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Advancement in ICT: Exploring Innovative Solutions (AdICT)

Series 2/2024

Editors
Ahmad Fatzilah Misman
Noor Azura Zakaria
Elin Eliana Abdul Rahim
Dini Oktarina Dwi Handayani

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Kulliyyah of Information and Communication Technology (KICT)

Preface

Advancement in ICT: Exploring Innovative Solutions (AdICT) Series 2/2024 is the sequel to the previous AdICT Series 1/2024 issue of April 2024. In similar tradition, this second collection of AdICT series 2/2024 disseminates the Final Year Project (FYP) undergraduate achievements in Kulliyyah of Information and Communication Technology (KICT) of December 2024. It publishes works of the later batch of the KICT Information technologists who are intricately engaged in the fabric of daily life at the forefront of innovative ideas and transformation in the field of Information Technology (IT).

This collection navigates through rapid advancements in software development, artificial intelligence, big data, cybersecurity, and the Internet of Things (IoT), it becomes increasingly essential to reflect on the ethical, social, and economic implications of these developments. This journal seeks to contribute to this discourse by publishing internal articles that delve into both theoretical frameworks and practical applications of ICT. We are dedicated to fostering interdisciplinary collaboration, as technology continues to transcend traditional boundaries and influence disciplines ranging from education to healthcare, finance, and beyond.

As we embark on this publication, we invite you to engage with the content, share your insights, and be part of a community that is passionate about exploring the limitless possibilities of information technology.

"…And when ye are told to rise up, rise up. Allah will raise up, to (suitable) ranks (and degrees), those of you who believe and who have been granted Knowledge. And Allah is well-acquainted with all ye do" [Quran, 58:11].

Editors

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ReLife: Habit Changing Application

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***Abstract*—This project focuses on developing a mobile application, ReLife, designed to help users break unwanted habits and establish healthier routines. Currently, habit-tracking systems often rely on manual processes, requiring users to use multiple applications for different activities. This fragmented approach can reduce motivation and hinder progress. Moreover, some applications encourage users to set unrealistic or overwhelming goals, leading to disappointment and frustration. ReLife aims to address these issues by providing a comprehensive, user-friendly solution that supports gradual and sustainable habit-building. The target audience for this system is the public, ensuring accessibility for users anytime and anywhere. The application offers a wide range of habits across categories such as productivity, fitness, and emotional well-being. Key features include reminders, progress tracking, and guided activities to enhance user engagement and increase the likelihood of success. ReLife will empower users to adopt positive habits that improve their physical, mental, and emotional health, ultimately leading to a healthier and more fulfilling life.**

Keywords—healthier routines, habit tracking, productivity, fitness, emotion

I. INTRODUCTION

Habits develop as individuals work towards their everyday goals [1]. Initially, people may act intentionally, aiming to fulfill a specific purpose. However, as these actions are repeated, contextual factors become associated with the behavior. Over time, the mere perception of these factors can automatically trigger the behavior, bypassing the need for a conscious goal [2]. In today's fast-paced and stressful world, cultivating and maintaining good habits is essential for leading a healthy and fulfilling life. However, breaking unwanted habits and establishing healthier routines can be challenging. Existing habit-tracking systems are often manual and require users to juggle multiple applications, which can be overwhelming and demotivating. To address this issue, ReLife, a habit-changing application, is proposed. It provides comprehensive solutions across various categories, including productivity, fitness, and emotional well-being, aiming to help users build better habits and lead more balanced lives.

The primary objective of ReLife is to help individuals break unwanted habits and establish healthier routines in a gradual and sustainable manner. The application includes features such as reminders, progress tracking, and personalized guidance to enhance user engagement and increase the likelihood of success. Designed as a user-friendly and convenient platform, ReLife addresses the challenges associated with manual habit-tracking systems while encouraging users to stay consistent in their progress. Additionally, the app provides tailored features for each category, making it easier for users to focus on changing one habit at a time. Ultimately, ReLife aims to empower individuals to take control of their habits and improve their overall well-being. With the right tools and support, anyone can overcome unwanted habits and establish positive routines that enhance their quality of life.

II. BACKGROUND OF STUDY

A study on existing habit-changing applications was conducted to explore and analyse the features they offer to users. The study focused on three categories of habit-changing applications which are productivity, fitness, and emotion. For productivity, the application Todoist was evaluated, offering general task management features. In the fitness category, two applications were studied which are My Water and MyFitnessPal, both of which support users in achieving fitness-related goals. In the emotion category, three applications were examined: Daylio, Motivation, and Headspace, each designed to enhance emotional well-being. Table 1 below presents a comparison of the features deduced from the study.

TABLE I. COMPARISON OF FEATURES WITH EXISTING APPLICATIONS

Existing Applications	Features	Description
Todoist	Task management	Todoist is a task management application that allows users to create tasks, specify due dates, and get reminders. It offers features such as sub-tasks, comments, collaboration on projects, and the ability to categorize and prioritize tasks. [3]
My Water: Daily Drink Tracker	Water intake	My Water is a mobile application that allows users to track daily water intake and set reminders to drink water throughout the day. User can see their progress visually and keep track of how much water they have consumed. It is designed to help users stay hydrated and reach their daily water intake goals. [4]
MyFitnessPal	Exercise routine, Calories tracking, Water intake	MyFitnessPal is a mobile application that allows user to track their daily exercise routine, calorie intake and water intake. It can calculate the calories for each food, including the total calories taken and the remaining calories. It also calculates the number of calories burned from each exercise. [5]
Daylio	Mood tracking, Emotions journaling	Daylio is a mobile application designed to help the user track and journal their daily moods, and activities. User can log in their moods and emotions throughout the day, along with the activities they did. Daylio enables the user to set reminders for their daily diary entry. It allows user to identify

Existing Applications	Features	Description
		patterns and trends in their emotional well-being. [6]
Motivation – Daily quotes	Daily motivational quotes	Motivation – Daily quotes is a mobile application which provides the user with a daily dosage of motivating and inspiring quotes. It includes a selection of carefully selected quotes from authors, celebrities, and other significant individuals. User may receive a new quote each day through the notification and reminder features, browse past quotes, save their favourites, and share them with others. This application is designed to encourage and motivate user in their daily life. [7]
Headspace	Mindfulness exercises	Headspace is a mobile application that guides the user to improve mental health and lessen stress by providing guided mindfulness and meditation exercises. Various guided meditation sessions, sleep sounds, and mindfulness exercises are available on the application. Headspace aims to help users develop a regular meditation practice for any life situation. [8]

III. METHODOLOGY

This project employs the Agile development model as illustrated in Fig. 1, beginning with requirements gathering through system studies and participant questionnaires. System design artifacts, such as a use case diagram for interaction representation and a flowchart for process illustration, were created. Development then proceeded through unit-wise coding, integration, testing, and deployment to users. To ensure continuous improvement, a review step is included after each iteration, allowing modifications based on user feedback. The use case diagram provides a visual representation of the system's functionalities, while the flowchart illustrates the sequential processes users follow.

A. Software Development Model

This project adopts the Agile process model as its development approach. The first phase involves defining the requirements. Two methods were used to gather requirements: conducting a study on existing systems and distributing questionnaires to various participants. The collected requirements were then analysed to design an effective solution.

The second phase focuses on system design, guided by the requirements identified in the first phase. In this project, a use case diagram was created to visualize interactions between system elements, and a flowchart was developed to illustrate the system's processes.

Both the requirements definition and system design phases were completed during Final Year Project 1. The third phase, system development, was carried out in Final Year Project 2. During this phase, the system was coded unit by unit based on the design from the second phase. The individual units were then integrated to form a fully functional system.

Following the coding completed in the third phase, the fourth phase of the Agile model is testing. This phase involves testing each completed unit individually as well as the fully integrated system to ensure functionality and reliability.

The fifth phase is deployment. In this project, deployment occurs upon the completion of the entire project, which includes all findings and final deliverables. The system will then be deployed to potential users to evaluate its effectiveness and ensure it provides meaningful benefits.

The final phase, the review phase, takes place after the project is completed. This phase focuses on refining the system and planning future iterations based on user feedback and insights gathered during deployment.

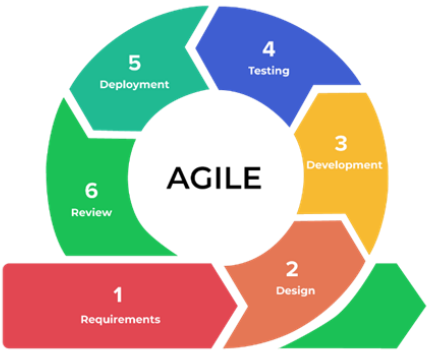

Fig. 1. Agile Model Process

B. Use Case Diagram

A use case diagram is modeled to illustrate the system's functionality. The diagram represents the interactions and workflows between the User and the System, highlighting the key functionalities within the system. The use case diagram for this project is portrayed in Fig. 2.

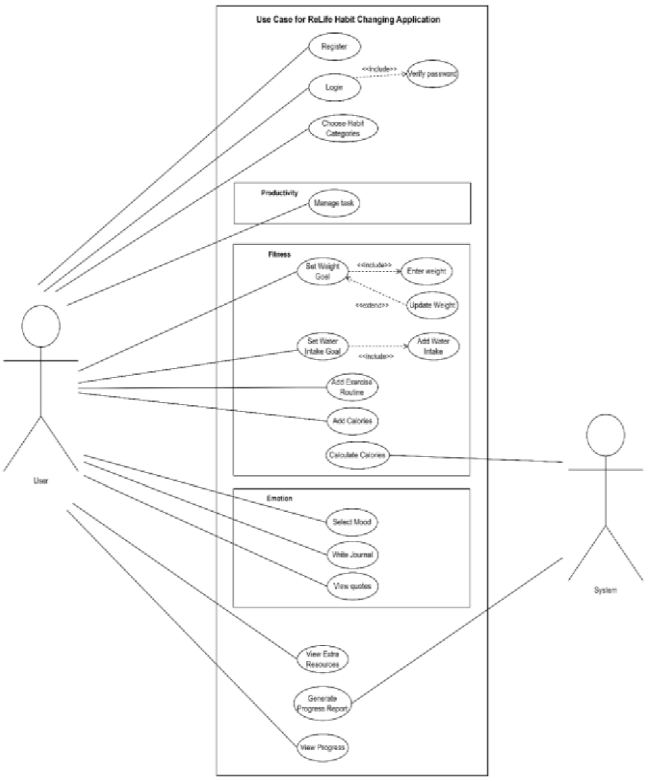

Fig. 2. Use Case Diagram

IV. Results

Highlighted below are key screens from the user interface, offering a detailed view of specific sections and features essential to the overall user experience.

A. *Productivity Page*

The Productivity Page as shown in Fig. 3 serves as a central hub for managing tasks and optimizing productivity. Featuring a customizable task list, a visual progress indicator, and a checkbox function, users can experience a sense of accomplishment as they complete tasks. This page offers a user-friendly interface that helps users stay on top of both personal and professional responsibilities, fostering improved focus and productivity.

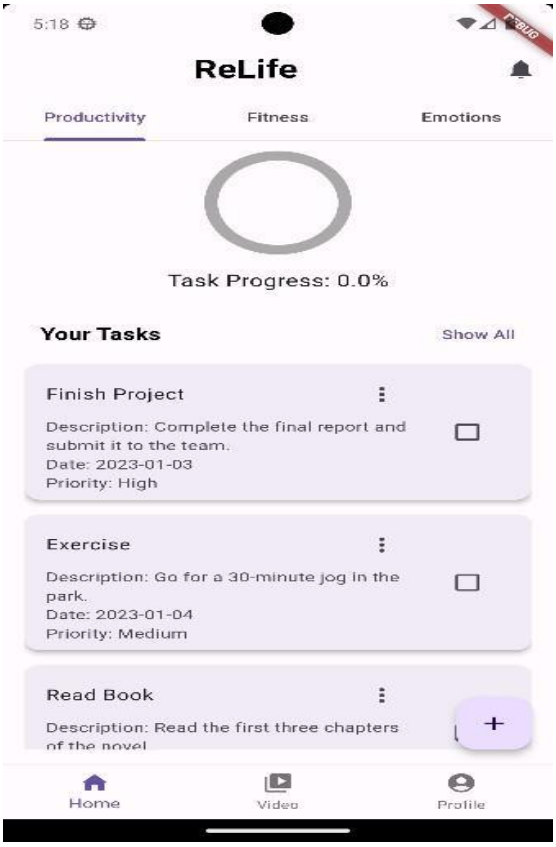

Fig. 3. Productivity Page

B. *Fitness Page*

The Fitness Page in Fig. 4 introduces features for comprehensive fitness tracking. It visualises fitness progress through weight tracking, allows users to set and adjust goals, and seamlessly monitors daily water and calorie intake. Additionally, the BMI calculator provides instant access to essential health data, offering a convenient way to track overall fitness levels.

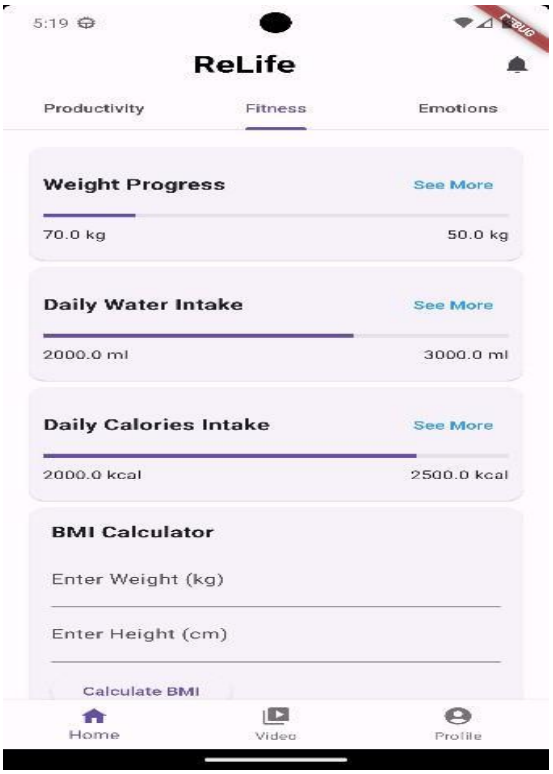

Fig. 4. Fitness Page

C. *Emotions Page*

Focused on emotional well-being, the Emotions Page illustrated in Fig. 5 combines organised emotion journaling with motivational quotes. It encourages constructive engagement and leverages technology to offer a comprehensive solution that helps individuals explore and build resilience in their daily lives.

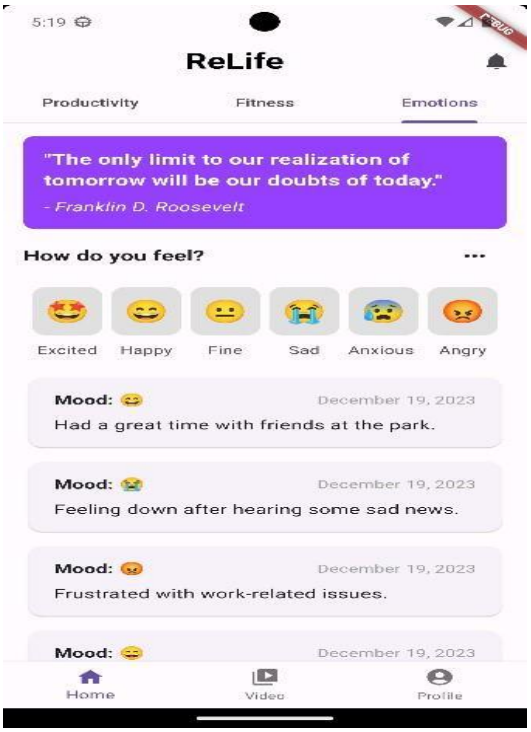

Fig. 5. Emotions Page

V. Conclusion

In conclusion, ReLife represents a transformative advancement in habit-changing applications. It offers a comprehensive and practical solution for individuals striving to overcome bad habits and establish healthy routines. Whether aimed at boosting productivity, enhancing fitness, or improving emotional well-being, this application provides a user-friendly platform for selecting and tracking habits aligned with personal goals and preferences.

What sets ReLife apart from existing habit-changing applications is its focus on addressing the limitations of manual methods. With a user-centric design, diverse habit categories, and features like progress tracking, ReLife encourages user engagement and motivation, supporting individuals on their journey toward positive change.

ReLife helps users make small but meaningful changes that accumulate over time. Its diverse features, including habit tracking, reminders, and progress monitoring, work together to support users in adopting habits that contribute to their overall well-being.

Ultimately, the adoption of these positive habits can lead to a healthier, more fulfilling life, as ReLife empowers users to break free from negative patterns and build a sustainable path towards self-improvement. By addressing the limitations of current habit-tracking systems and offering a more personalised, motivating experience, ReLife presents a holistic solution to habit formation. As users continue their journey with the app, they will not only improve individual aspects of their health but also enhance their quality of life, achieving greater balance and satisfaction in their daily routines.

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Earth Isn't Flat

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***Abstract*— Earth Isn't Flat is an informative website that implements a 3D interactive earth globe for travelers and tourists, aimed to provide them with a wonderful experience in learning and exploring countries around the world. This project also provides options for graphic modes to the user, a 3D earth model and an anaglyph/stereoscopic model to explore the website from different views. From this, users no longer need to visit different websites and pages anymore to gain information about their destination. Plus, they could experience amazing trip planning and avoid clashes of information, as well as inaccurate planning or cultural faux pas.**

Keywords—3D interactive globe, 3D Earth model, 3D anaglyph, tourism, interactive travel website

I. INTRODUCTION

"Earth Isn't Flat" is a web application designed to provide comprehensive geographical knowledge to travelers and tourists. The application features an 3D interactive globe interface for a dynamic and engaging experience [1], allowing users to explore countries worldwide by selecting their respective nations. Users can access detailed information such as tourist attractions, travel tips, and geographic insights.

The system architecture follows a Client-Server Model, ensuring that the front-end (client) is intuitive and user-friendly while the back end (server) efficiently manages data requests and 3D rendering. This separation enables a smooth user experience, as the client-side handles interactions like globe navigation, and the server processes data, ensuring responsiveness and performance.

In addition, the application adopts Microservices Architecture to ensure scalability and flexibility. Each core function, such as rendering the 3D globe, retrieving country data, and handling user requests, is developed as a separate, modular service. This architecture allows for independent updates and scaling of services without affecting the overall system. For example, if demand increases, the data retrieval service can be scaled up without changing the entire application structure.

By combining the Client-Server Model with Microservices Architecture, "Earth Isn't Flat" delivers a dynamic, scalable, and maintainable platform that enhances the user's travel research experience.

A. Problem Statement

When it comes to travelling, there are so many things that need to be considered and learned. Whether it is domestic travel or international travel, the traveler needs to do some research and suitable planning to make it enjoyable and memorable.

Before embarking on a journey, it is essential to gather pertinent information such as geography, climate, accommodations, dining options, and travel distances between various attractions. Proper research not only assists travelers in discovering hidden gems, but also aids in making informed decisions, avoiding unpleasant situations, and creating unforgettable experiences. Familiarizing oneself with cultural nuances also helps to prevent any inadvertent cultural missteps while exploring foreign lands.

However long it takes for a person to go through atlases, websites, and globes to visualize their destination wanderingly, they need to research various pages and make comparisons about the destinations so it will be a worthwhile travel plan. Furthermore, some pages may not advertise the place as it is and some of them might display outdated information, and users might find it heavy, dull and tedious. As such, there needs to be a website benefiting the tourism industry.

There are not many apps nowadays, specifically centered around travel that provide digestible information through interactive 3D spaces. As an alternative result, users often need to visit multiple websites and pages to gather information about their destination, such as weather, cultural practices, and travel tips. The fragmentation of travel-related information across various platforms can lead to inconsistencies and confusion among users, potentially resulting in wrong planning. Example, packing incorrectly for the destination's climate change and committing cultural faux due to lack of consolidated information. Additionally, research shows that travelers often struggle with information overload when visiting multiple websites for travel information, increasing the chances of overlooking critical details. For instance, a survey by What3words highlights that 3 out of 4 travelers struggle to find their destination accurately, underscoring the challenges associated with fragmented travel information [2].

B. Objectives

This project aims to develop a fully functional tourism web application that provides comprehensive geographical information for travelers and tourists. To accomplish this goal, there are several objectives to focus on:

1) To enhance user experience through an interactive 3D globe. This objective aims to improve the usability and engagement of users by providing geographical information via an interactive 3D globe. The globe will allow users to intuitively explore locations, offering a user-friendly interface that enhances spatial understanding compared to traditional 2D maps.

2) To offer multiple viewing options with 3D and stereoscopic modes. By providing two graphic modes, a 3D earth model and a stereoscopic model, this objective aims to improve the flexibility of the web application. Users can explore geographical data from different perspectives, catering to various preferences and devices. This feature also contributes to the overall ease of use, ensuring that tech-savvy and casual users can seamlessly navigate the application.

C. Project Scope

- User View: The user will be able to access the Earth Isn't Flat web application on their browser, explore the information through a 3D interactive Earth globe and view the normal and stereoscopic 3D Earth globe mode. This view includes the geographical knowledge consisting of countries around the earth globe. Additional information such as attractions, travel tips, accommodations, transportation, safety tips and airports will also be displayed in the web application.

- Interactive View: The user can interact with the website by rotating it using the cursor on the 3D interactive Earth globe while exploring the information. They can also click on a specific country to display additional information and view additional tabs such as Tourist, Travelers, First Timer, About Us, Information and Itinerary page.

D. Significance of the Project

The primary rationale for conducting this project stems from its potential to enhance the global tourism industry by presenting a diverse range of captivating attractions on a singular platform. This approach could improve the efficiency of the tourism industry and subsequently boost economic growth worldwide [3]. Furthermore, the project has the potential to cater the target audience who are the tourists and travelers who often encounter challenges in finding intriguing destinations to explore. By utilizing a user-friendly online application, they can easily access and discover new interests before embarking on their journeys, thereby enriching their learning experiences.

In alignment with the Sustainable Development Goals (SDGs), the sustainability of the tourism industry has been a persistent topic of discussion. The tourism industry holds great potential to contribute to several SDGs, particularly in sustainable economic growth, sustainable consumption and production (SCP), and sustaining the national oceans dan marine resources. The project, in turn, can serve as a critical starting point for realizing these goals by generating an interactive informational medium through an online platform that appeals to tourists and travelers, thereby facilitating the exploration of diverse destinations worldwide and ultimately benefiting the tourism industry, which can contribute to the SDGs.

II. Literature Review

Extensive evaluation was carried out before commencing the project, which involved initial investigation to finalize the project, as well as to make sure that the project stays up to date on the latest research and developments compared to the existing websites such as Google Earth, Crowdsourced Explorer.com and Travel End and Destinations.

Began at Keyhole Inc. by John Hanke, Brian McClendon and a small team of engineers, Google Earth has been made as a computer or mobile device-based virtual globe, map and geographical information system that allows users to explore and navigate the world [4]. Google Earth Interface shows a combination of satellite photos, aerial photography and 3D topography data to give viewers a complete perspective of the Earth's surface as well as information on individual locations, landmarks and features.

Crowdsourced Explorer.com on the other hand offers a platform that connects adventurers and travelers from all over the world to contribute their travel experiences and information [5]. Users can build and share trip guides, upload photos and videos and write blog posts about their travel experiences on the website. All in all, Crowdsourced Explorer's goal is to create a community-driven platform that connects travelers and adventurers while also providing them with useful travel information and resources.

The third review is related to another travelling website called Travel End and Destinations. This website offers travel advice and tools such as various attractions and destinations that can be viewed through the eyes of travel enthusiasts [6]. Travel and Destinations provides a variety of travel-related topics such as location recommendations, travel tips and photography. The website's goal is to inspire travelers to explore new places and to assist them in planning their trips by providing relevant information and insights.

Despite differences in individual features for each website, the concept and target audience are generally similar, providing interactive elements that benefit travelers and tourists. Earth Isn't Flat shares these objectives, aiming to assist travelers and tourists in gathering all relevant travel information. Each website typically offers a distinct set of information, which can be consolidated into a single platform.

Besides the travel information, to increase information processing, interactivity in a website has to be considered as well. A study by [7] showed that information processing increases as interactivity increases. This is also backed up by [8] where the authors stated that the interactivity in a website makes it easier for the users to search the website.

To make this website function as a one-stop service, we also looked at the importance of including a personal itinerary feature. As mentioned by [9], among advantages of having travel itineraries include 1) keeping track of your activities; 2) optimizing and saving time; and 3) prioritizing activities and travelling at your own pace.

TABLE I. COMPARISON OF FEATURES OF EXISTING SYSTEMS

Application	Compact Information	Personal Itinerary	Interactivity
Google Earth	No	No	Yes
Crowdsourced Explorer	Yes	No	Yes
Travel And Destinations	Yes	No	Yes

Table I shows the comparison of these three websites in terms of the information provided, interactivity and personalized itinerary. As can be seen from the table, all reviewed websites provide some form of interactivity but none on the personalized itinerary. This gap solidifies our reason to include this feature in our website.

III. ANALYSIS AND DESIGN

A. Development Approach

Earth Isn't Flat adopts Rapid Application Development (RAD) as its methodology, emphasizing swift prototyping, reduced timelines, and minimal investment. Unlike e-learning projects using ADDIE and ASSURE models, the RAD model's phases include business modelling, focusing on aligning the web application with organizational needs. Data modeling ensures an organized and consistent representation of web application features. Process modeling outlines workflows and activities, guiding development. Application generation creates prototypes, and testing and turnover involve various tests before user handover.

RAD enables the quick creation of interactive globe prototypes, facilitating user feedback from travelers and tourists. Iterative design based on feedback ensures a user-friendly interface, crucial for positive learning experiences. RAD allows continuous feature addition and development. For instance, user feedback can prompt the addition of historical or cultural information about countries, ensuring ongoing improvement. Overall, RAD proves effective for Earth Isn't Flat, delivering rapid prototypes, responsive design iterations, and continuous application development.

B. Requirement Specification

The project collects information through a Google Form questionnaire from frequent tourists and travelers of various ages. The questionnaire covers aspects like travel interests, planning, and information sources. Analyzing these responses helps identify project importance, user patterns, and required features. Utilizing a questionnaire for user requirements ensures the development of a user-friendly web application aligned with the target audience's needs.

Earth Isn’t Flat: The Significance of Trip Planning Google Form questionnaire has been distributed among the public. From the 35 respondents, the results revealed that 80% browse the internet when planning a trip. Notably, 60% seek cultural information, 77.1% check the weather, 54.3% explore geography, and 42.9% review laws. This data indicates a demand for a single platform providing comprehensive country information. Additionally, 45.7% find visiting multiple websites as challenging.

C. Needs Analysis

Need analysis guides problem and solution focus in Earth Isn't Flat, aiding developers in implementation aligned with project objectives. The project, delivered through an informative website featuring a 3D interactive globe, addresses traveler’s issues with trip planning, minimizing information clashes and lengthy browsing. The website offers comprehensive information on all countries worldwide, utilizing 3D interactive media as its primary feature. Advanced features, such as stereoscopic view mode, enhance engagement and user experience, reducing comparison time and concerns about information authenticity during trip planning.

D. Application Designs

The creation of the application design for an effective and engaging learning experience involves several key activities. The web application aims to empower travelers and tourists to enhance their geographical knowledge, accurately identify countries on the globe, and efficiently plan travel itineraries using an interactive Earth globe. The goal is to encourage users to engage with the globe actively, fostering a fun and immersive learning experience.

The learning objectives are structured logically, starting with orienting and navigating the website to attain the learning objectives. Proficiency in navigating the 3D interactive Earth globe and understanding its interface is a key skill users should develop. This involves familiarizing themselves with interacting with the globe and navigating its features before delving into country-specific information. The next learning objective is to enhance users' geographical knowledge by accurately identifying and locating countries on the interactive globe, providing a foundation for exploring different countries.

Users are then guided to utilize the interactive Earth globe to gather information about countries, encouraging them to find specific information of interest after locating a country on the interactive globe. Lastly, users are encouraged to actively engage with the interactive globe, taking control of their exploration to move beyond passive information consumption. This active learning approach has been shown to improve comprehension and retention of the subject matter.

The learning process incorporates 3D interaction simulations and multimedia components within the website as instructional strategies. To assess user progress and achievement of learning objectives, user feedback, including surveys, can be collected after users test the website. This feedback provides insights into usability, relevance, and overall impact on the learning experience. The web-based platform serves as the primary delivery strategy for delivering content to users.

E. Content Development

The content development process for the Earth Isn't Flat web application involves thorough research, data collection, and surveys to ensure the provision of comprehensive and accurate information. Geographical characteristics, cultural information, historical significance, and attractions of each country are extensively researched. Data is collected from various sources, including national tourism boards like Tourism Malaysia as a primary resource and travel blogs and

websites as secondary sources [10]. Careful selection is made to ensure the credibility and currency of the information.

Surveys play a crucial role in understanding users' preferences, interests, and needs as travelers, enabling the website to offer beneficial services and content. To continuously monitor and update geographic, cultural, and travel-related information, frequent reviews and revisions are conducted. User feedback, including survey responses, is instrumental in addressing any missing information and incorporating features to keep the website relevant.

A well-designed questionnaire captures users' travel preferences, desired information when exploring a new destination, valuable content types, and specific features or functionalities they would like to see on the web application. Analysis of the survey data helps identify patterns, trends, and shared preferences among respondents. This analysis guides decisions in prioritizing specific information, presenting it effectively, and determining which features to prioritize in the content development process based on user interests and demands.

The primary content that will be included in the web application is shown in Table II. It consists of several pages and content such as introduction text, main page, about us, register, login, tourist dropdown, travelers' dropdown, information dropdown, first timer and itinerary page. All these contents will be the main features that the user will make use of when accessing the website. Based on the data and information collected, the content outline of the project can be made as follows:

TABLE II. FUNCTIONAL REQUIREMENTS

Content	Content Outline
Introduction of the website	• Brief introduction about the purpose of the website • Option for the type of mode: Anaglyph mode
Register page	• First-time user to register
Login page	• To access the user's account
Main page	• Interactive globe • Mode of the globe • Normal mode • Anaglyph mode • Navigation bar
About Us page	• Background of the project • Team Members • Contact Form • Call-to-action (CTA)
Tourist Dropdown	Consist of: • Attractions page • Transportation page • Travel Agency page • Accommodations page
Traveler Dropdown	Consist of: • Backpacker page • Business page • Leisure page
First Timer page	• Content on what a first-timer traveler or tourist should consider
Information Dropdown	Consist of: • Wonders page • Continents page • Oceans page
About Us page	• Contact us form
Itinerary page	• Save the user's itinerary

F. *Navigation Flow of the Application*

Based on Figure 1, the dialog diagram illustrates the navigation flow of the Earth Isn't Flat website starting from the introduction page. Users need to choose the view modes, either the normal mode or the anaglyph mode. After that, the screen will display the main page of Earth Isn't Flat. On the main page, when the users click on the interactive globe by selecting a particular country, information will pop up. When users click on one of the page buttons in the navigation bar, it will lead them to the dropdown Tourist page, dropdown Traveler page, First Timer, dropdown Information page, About Us and Itinerary.

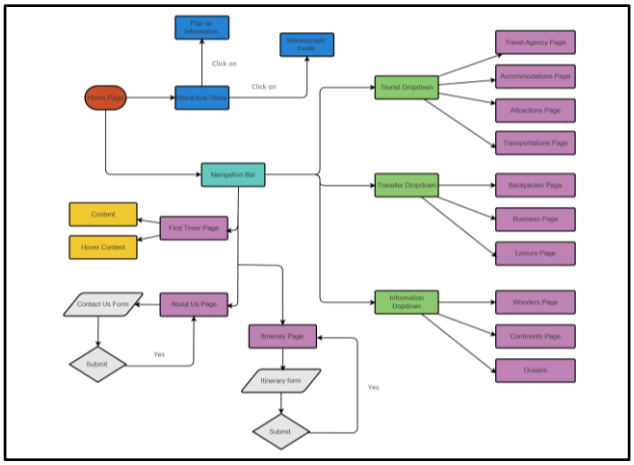

Fig. 1. Dialog map.

IV. DEVELOPMENT

Figures illustrating the evolved system have been included to enhance clarity and provide a visual aid to the Earth Isn't Flat website. These visuals serve to clarify key aspects such as integration, as well as the system's output for both administrators and users.

A. *System Integration*

System integration plays a pivotal role in ensuring the seamless functionality of the Earth Isn't Flat website. It entails a collaboration between system development and multimedia content, ensuring they work together cohesively to provide an efficient user experience. This integration includes content management systems, databases, and user authentication systems, increasing the website's ability to gather, process, and disseminate information.

Fig. 2. Main page.

Fig. 2 shows the integration system of Earth Isn't Flat with all pages interconnected through the navigation bar. The main page highlights the 3D interactive globe which is the main feature of the website.

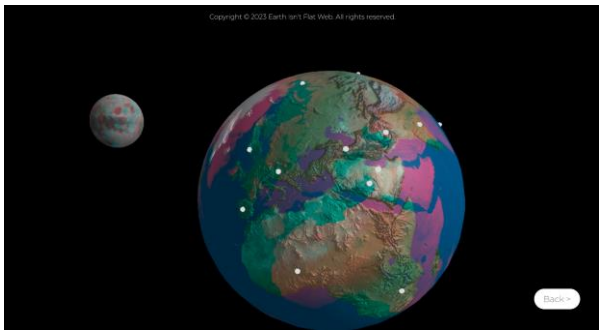

Fig. 3. Anaglyph page.

Fig. 3 shows the anaglyph mode of the Earth's globe. This additional mode has been created to enhance user experience and to make navigating through the website more fun.

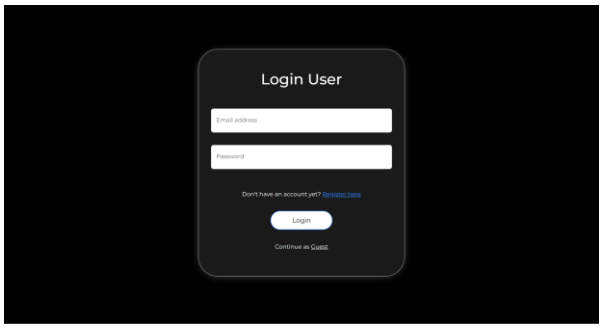

Fig. 4. Login page.

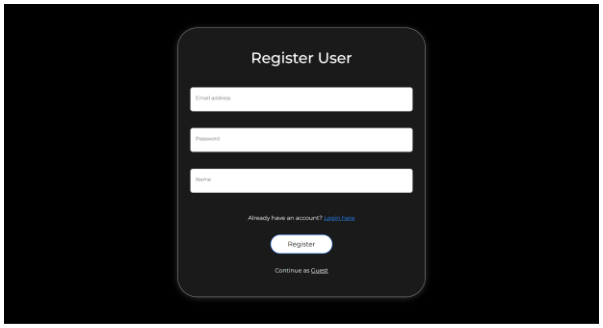

Fig. 5. Register page.

Fig. 4 and Fig. 5 show the login and register page which allows the user to use features like personal itinerary to record their data for later reference.

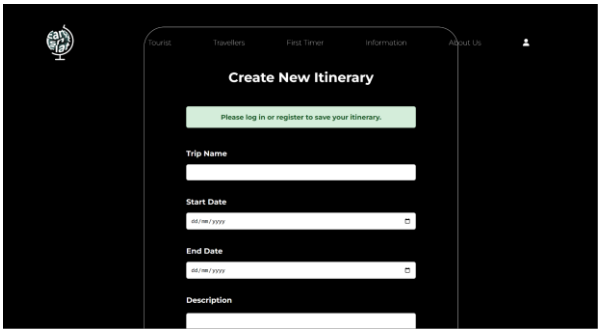

Fig. 6. Personal itinerary page.

The Personal Itinerary page in Fig. 6 displays a form which the logged-in user can save and which will be stored inside the database. Users can also delete the saved itinerary if they need to.

B. *System Output*

The administrator's function and modules make up the system output for this project. The database containing user data, including individual travel itineraries, was managed by the administrator. This website uses the Firebase database to store data, including user authentication during registration and login. The administrator can take steps, like wiping data, to make sure the website is safe and reliable.

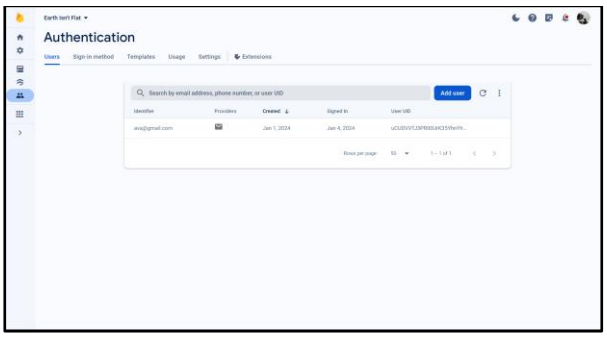

Fig. 7. Authentication Firebase.

Authentication in Firebase in Fig. 7 has been used for the website to ensure new users who registered and logged in will be stored correctly.

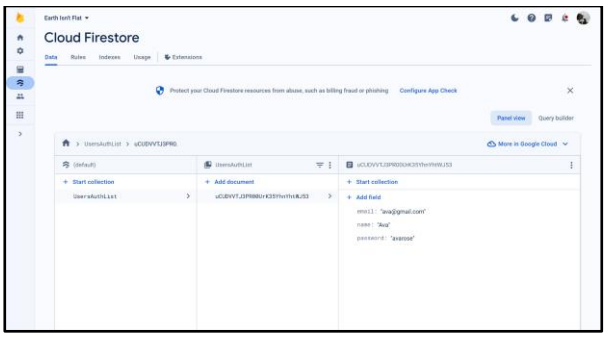

Fig. 8. Cloud Firestore Firebase.

Fig. 8 shows the Cloud Firestone which stores all the registered data of users including email, name and password.

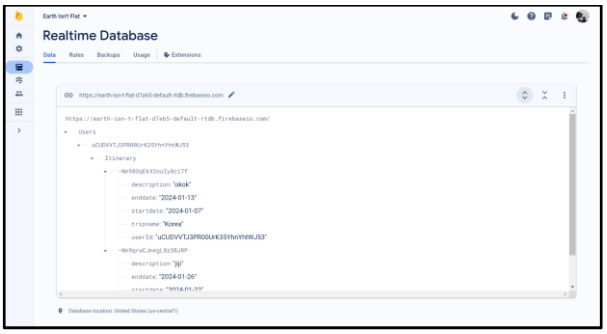

Fig. 9. Realtime database Firebase.

Whenever users save their itinerary, the pieces of information will be stored inside a real-time database in Fig. 9 under their respective unique ID.

V. Evaluation

To assess the success and effectiveness of Earth Isn't Flat, a comprehensive evaluation involving alpha and beta testing has been undertaken. This approach focuses on essential criteria, with a primary emphasis on user reactions during the User Acceptance Test (UAT). Earth Isn't Flat aims to create an engaging and user-friendly experience for information exploration, enhancing trip planning for users.

The evaluation also extends to a thorough analysis of storytelling objectives, ensuring alignment with the project's narrative goals, particularly in the context of global travel-related content. Beyond this, the assessment includes an examination of knowledge transfer effectiveness, aiming to measure the project's impact in providing information and fostering captivating exploration experiences.

Crucially, the evaluation process considers Earth Isn't Flat's impact on users, evaluating factors such as efficiency, workflow enhancement, and overall benefits. This multifaceted approach not only confirms the platform's success in meeting narrative goals and imparting knowledge but also offers developers valuable insights into Earth Isn't Flat's performance across diverse dimensions.

A. Test Plan

From January 2 to 4, 2024, three testers participated in the User Acceptance Test (UAT) for Earth Isn't Flat. Overall, positive feedback was received, highlighting the platform's captivating nature, particularly for tourists and travelers. The interactive 3D globe and appealing UI design were identified as notable strengths contributing to an engaging user experience. Testers unanimously agreed on Earth Isn't Flat effectiveness in providing valuable knowledge and comprehensive guidance for destination exploration.

However, some concerns were raised during the UAT. The submit button in the Contact Us form, intended for user inquiries, was found to be non-functional. Additionally, testers noted aesthetic issues with the Accommodation, Transportation, and Travel Agency buttons, causing them to disappear when hovered over. To address these issues and enhance user experience, testers recommended implementing a visible button during the hover function. Despite these identified issues, the unanimous agreement among testers underscores Earth Isn't Flat's status as an interesting and practically useful platform, with testers expressing a willingness to recommend it to others. The summary of comments made by all three testers is shown in Table III.

TABLE III. Comments From Testers During UAT

	Testers		
	Tester 1	***Tester 2***	***Tester 3***
Functional Requirements	• The button disappear whenever hover my mouse on it, but the button is working • Submit button not woring	• Not sure whether the submit button is working or not	• Submit button is not working
Overall comment	It is very interesting website with great designs and various multimedia elements, which make it more fun to explore. However, I hope you can make a slight change on the buttons background , so when user hover on it, it still visible.	It is a great alternative and beneficials, especially for tourist and travelers.	I found it very useful as a go-to informative website and fun to explore and I will definitely recommend it to others.

B. Enhancement

In response to valuable User Acceptance Test (UAT) feedback, we have made necessary adjustments to enhance the Earth Isn't Flat development process. The non-functional submit button in the Contact Us form has been fixed, ensuring prompt notification and proper handling of user feedback. Additionally, improvements to the hover design of Accommodation, Transportation, and Travel Agency buttons have been implemented, eliminating disruptions for users. These refinements show the team's commitment to improve functionality and user satisfaction based on testing insights.

VI. Conclusion

In conclusion, Earth Isn't Flat stands out as an exceptional interactive and informative website tailored for tourists and travelers. The incorporation of diverse multimedia elements aims to enrich the user's journey in trip planning. Despite the encountered limitations, the project developers successfully brought Earth Isn't Flat to fruition, aligning it closely with user requirements and needs.

Looking ahead, there is a steadfast commitment from the development team to continually enhance Earth Isn't Flat. The aspiration is to evolve and adapt, incorporating advanced multimedia implementations in tandem with the dynamic changes in the realm of IoT, including emerging technologies such as Virtual Reality (VR) and the Metaverse. With this forward-thinking approach, Earth Isn't Flat is poised to offer users an increasingly seamless and enriched knowledge exploration experience over time.

ACKNOWLEDGMENT

First and foremost, we would like to thank Allah the Exalted for His blessing that allowed us to complete this project. We pray that He accepts it as a work of sincerity and benefit. We would like to dedicate our special thanks to our supervisor, Dr. Nurazlin Zainal Azmi who was always there to guide us throughout the realization of the project.

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Interactive Space: Quranic Youth Club Manager

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***Abstract*— This project involves analysing and designing a prototyping system that automates the learning of program guidelines for clubs and societies at the International Islamic University Malaysia (IIUM). The main objective is to develop and assess the effectiveness of the system. The Quranic Youth Club Manager will be able to guide students in learning how to effectively organize programs at IIUM using a multimedia-based system that includes images, audio, and video. Additionally, the system streamlines the process of searching for program-related information, making it faster and more efficient. The system was developed using Adobe Animate, Adobe Photoshop, and Adobe Premiere Pro. It was then evaluated through a User Acceptance Test, and the results are presented at the end of the report.**

Keywords—design, multimedia, interactive, system

I. INTRODUCTION

Quranic Youth Club Manager is a multimedia-based project aimed at the society's mainboards and exco to run the society efficiently. It is specially designed for the use of the president, general secretary, financial controller, and head and assistant head of the bureaus in the club. It helps committee members of a program to gain information regarding documentation easily. It helps them in understanding the procedures and information regarding the activity or task that they need to perform.

A. Background Of The Problem

The mainboards and the exco of the club need plenty of guidance to run their responsibility in the club and programs held. The committees usually have many questions that they asked to the presidential bureau due to the lack of information, confusion, and uncertainty regarding their tasks. It gives pressure to the presidential bureau as they need to respond to a lot of questions and tasks from all bureaus in the club. Each bureau has one head of the bureau and one assistant head of the bureau. As such, there is a need to provide an automated and interactive application, replacing manual processes, hardcopy materials or verbal explanations, to ensure the smooth running of the clubs and to ease the tasks carried out by each bureau, organizing events.

B. Problem Statement

Due to lack of experience and information, all bureaus refer to the presidential bureau for explaining the task that they were unsure or unaware of. It is important to reduce the job scope of the presidential bureau as there are more prioritized tasks that need their attention. There are also unclear or misunderstanding of a job scope. Some committees even keep asking for explanation from someone. Especially the new students, they were left confused, due to their lack of experience. Thus, these problems may put a burden on the main committee. This issue needs to be resolved immediately as most of the tasks have a deadline.

II. PROJECT OBJECTIVES

- To develop a multimedia-based tool that automates the process of learning the job scope's information.
- To evaluate the effectiveness of the tool with the experienced committee in IIUM.
- To reduce the burden of the main committee.
- To guide new students who are involved in a program using multimedia elements.

III. PROJECT SCOPE

A. User View

The user will be able to use the application to retrieve information regarding their task and club related information interactively. There will be functions such as list of club's details that support with the guidelines in this project, the club's nature, and background. There will be also program organizer function where it contains proposal, tentative, budget, program report template, financial report template and guidelines.

B. Admin View

The admin will have the same function as the users, but the admin has special permission where they will be able to update, revise the content through feedback from the user.

C. Target Audience

Mainboards, exco members of clubs, and committees of programs in International Islamic University Malaysia ranging from 18 to 27 years old students.

D. Specific Platform

The application will be developed mainly using Adobe Animate. It runs on Windows 10 operating system. It is recommended for the user to have Windows 7 or higher. The software used in this project to achieve its objectives is as in Table 1 below.

TABLE I. SPECIFIC PLATFORM

Software	Description
Adobe Premiere Pro	Video Editing Software
Adobe Animate	Main Software Space
Adobe Photoshop	Image Editing Software
Microsoft Windows 10 Education	Operating System Environment
Microsoft Word	Writing Report
Microsoft PowerPoint	Presentation

IV. CONSTRAINTS

Restrictions that affect the project's quality, delivery, budget, time, and overall success are explained below.

A. *Scope*

The developer may add features to the software if there is plenty of time and budget but for now the focus is on detailing, refining, and polishing the features that was planned such as report program guidelines.

B. *Time*

The developer needs to learn a few software such as Adobe Animate, and complete the tasks which are designing, editing in a short period of time and needs to be done before the deadline.

C. *Budget*

The software used is mostly paid software such as Adobe Premiere Pro, and Adobe Photoshop which are expensive, so the budget is quite high but manageable.

D. *Quality*

Taking scope, time, and budget factors, the quality of the final product would be beautifully designed, no error in the coding, and the users satisfied with the multimedia-based guidelines of the program in the application.

V. SIGNIFICANCE OF THE PROJECT

The project is to ensure efficiency and effectiveness of programs organized by IIUM clubs, particularly the Quranic Youth Club. This aligns with the Sustainable Development Goal (SDG) 4 which is Quality Education. Application of a better system to achieve excellent outcome from a program aligns with SDG 9, Industry Innovation and Infrastructure. This reduces the number of possible arising matters that usually exist due to inefficiency and lack of experience in program or event handling.

VI. PROJECT SUMMARY

There is no efficient way for the exco members to retrieve information regarding the procedures and tasks of the club as the committee members will change every cohort. This results in the presidential bureau getting a lot of questions thus they need to show them the details on how to complete. This process usually takes time as the procedures and tasks are usually complicated and need extensive explanation. There are also unclear or misunderstanding of a job scope.

It is hoped that the system may help the exco members to guide them through and ease the process of the task. The easy-to-understand user interface makes the process effective and efficient. It provides plenty of benefits to the user and the presidential bureau as the systems help them to ease their task in the club. This project is going to be designed using Visual Studio Codd and Adobe Photoshop targeting the mobile users in the mainboards and exco of the club.

There are a few challenges faced by the developer. With the limited budget and time, this project puts pressure to the developer as it needs to be done in a short period of time such as learning and practicing on how to design and create the system in Adobe Animate. The developer also needs to gain respondents of target group to get data so it will be challenging to find willing respondents to answer the questionnaire.

VII. LITERATURE VIEW

Literature review would improve the developer's understanding on Quranic Youth Club Manager by analysing current projects or apps that is available in the market and identify the strength and weaknesses of the projects or apps.

VIII. SIMILAR PROJECT OR APP

A. *ClubManager*

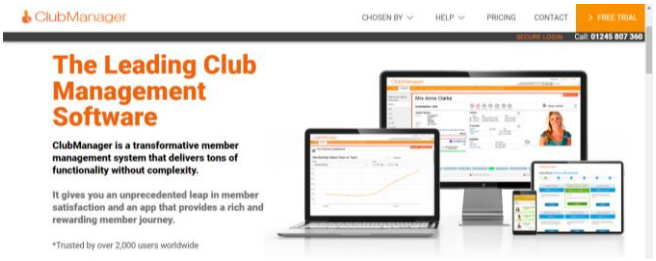

Fig. 1. Screenshot of ClubManager website.

1) *Software Details*

ClubManager is a multiplatform based software and application that manages club membership. The screenshot of the website is shown in Fig.1. ClubManager was established in United Kingdom. The users of the software will be charged monthly according to the number of members registered in the software. The more members, the higher the subscription fees. The software could broadcast messages through email, SMS, and application to an individual or groups in the club. They provide training and IT support for troubleshooting and assistance for the customers. Link of website: https://www.clubmanagercentral.com/uk/

2) *Main Function*

The main function of this software is to ease access to the organization's membership and information details such as full name, id number, phone number where it can be accessed by the members and the admin on phone and PC.

3) *Target Audience*

The target audience for this application is for clubs, associations, charity, and business who are interested in membership management system.

4) *Pros*

- Can access on multiple device.
- Provides free training.
- No additional costs.

5) Cons

- Took hours to set up
- Personal data being stored in other company

6) Functions that I want to apply

For my FYP, I would like to implement some functions and elements into my very own multimedia system. From ClubManager, I would like to infuse the functionality of using well designed interface for the user to easily navigate throughout the membership system. The functionality of assisting the user by a system helps the system to be better in terms of handling the club, managing the information, and everything is placed and arranged accordingly. Therefore, I would like to take this element and put it into my project because it can help with the user experience.

IX. Analysis And Design

A survey on clubs' job scope awareness in IIUM have been made for the past few weeks. The objective of this questionnaire is to investigate the issues and problems faced by the club committee members in getting the right information and knowledge. The target audience are students who have joined in programs and clubs in IIUM. The respondents are given a Google Form link to answer and complete the questionnaire survey. There are a total of 132 respondents to this survey.

The survey was divided into 3 sections:

- Section A: Respondent's demographics.
- Section B: Awareness of committee members' job scope in IIUM clubs.
- Section C: User preferences on the features for Quranic Youth Club.

A. *Section A: Respondent's demographics*

The survey findings are divided into males and females who are full time or part time students, aged between 18 years old and below, 19 years old to 20 years old, 21 years old to 22 years old, 23 years old to 24 years old, and 25 years old and above.

1) Gender

Table II and Fig. 2 below show the number and the percentage respondent's demographics according to gender.

TABLE II. Demographics Based On Gender

Gender	Respondents	Percentage (%)
Male	35	26.5
Female	97	73.5
Total	132	100

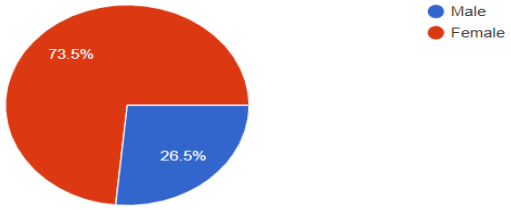

Fig. 2. Demographics based on gender.

It shows the demographics of respondents based on gender. From 132 respondents, a total of 35 respondents are male which is equivalent to 26.5% while the remaining 97 respondents are female which is equivalent to 73.5%. This shows that female respondents are larger than male respondents. It is common for females to outnumber males in most places.

2) Full time or part time

Table III and Fig. 3 show the number and the percentage respondent's demographics according to full time or part time students.

TABLE III. Demographics Based On Full Time Or Part Time Students.

Student	Respondents	Percentage (%)
Full time	130	98.5
Part time	2	1.5
Total	132	100

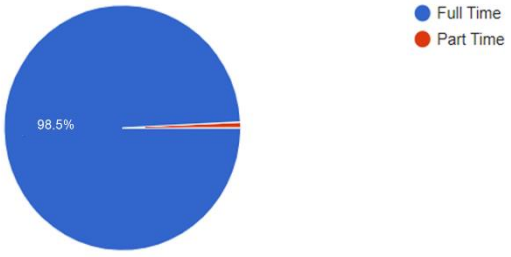

Fig. 3. Demographics based on full time or part time students.

It shows the demographics of respondents based on full time or part time students. From 132 respondents, a total of 130 respondents are full time students which is equivalent to 98.5% while the remaining 2 respondents are part time students which is equivalent to 1.5%. This shows that most respondents are full-time students thus could fully commit to their studies and clubs' activities in IIUM.

B. *Section B: Awareness of committee members' job scope in IIUM clubs*

The purpose of this section is to analyse the awareness of committee members' job scope in IIUM clubs. The survey findings obtained in this section are rated by the Likert scale

as in Fig. 4 below. From left, 1-Strongly Disagree, 2-Disagree, 3-Neutral, 4-Agree and 5-Strongly Agree.

Fig. 4. Likert Scale.

1) Item B1: It is easy to find and refer information regarding your job scope in the club.

Table IV and graph illustrated in Fig. 5 show analysis on the questionnaire for item B1. From 132 respondents, 2 respondents strongly disagree, 9 respondents disagree, 22 respondents are neutral, 71 respondents agree, and 26 respondents strongly agree that it is easy to find and refer information regarding their job scope in the club.

TABLE IV. TABLE OF RESULTS ON ITEM B1

QUESTIONNAIRE	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It is easy to find and refer information regarding your job scope in the club	2	9	22	71	28

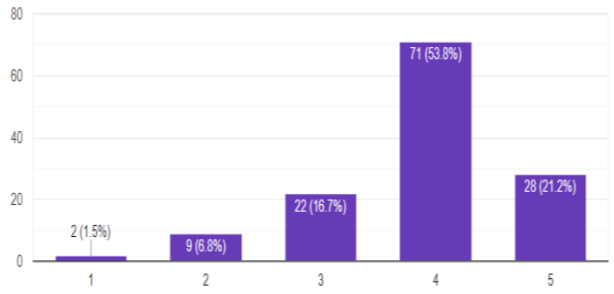

Fig. 5. Results Graph on Item B1

2) Item 2: It is easy to find and refer information regarding your job scope in a program conducted by the IIUM club.

Table V and graph illustrated in Fig. 6 show analysis on the questionnaire for item B2. From 132 respondents, 1 respondent strongly disagree, 10 respondents disagree, 28 respondents are neutral, 65 respondents agree, and 28 respondents strongly agree that it is easy to find and refer information regarding your job scope in a program conducted by the IIUM club.

TABLE V. TABLE OF RESULTS ON ITEM B2

QUESTIONNAIRE	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It is easy to find and refer information regarding your job scope in a program conducted by the IIUM club	1	10	28	65	28

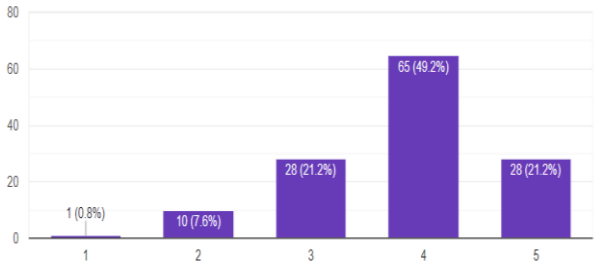

Fig. 6. Results Graph on Item B2

C. Section C: User preferences on the features for Quranic Youth Club Manager

The purpose of this section is to analyse user preferences on the features for Quranic Youth Club Manager.

1) Item C1: It will be helpful if there's a system that can help with my understanding of job scope in a program or in the club?.

Table VI and graph in Fig. 7 show analysis of the questionnaire for item C1. From 132 respondents, 1 respondent strongly disagree, 0 respondents disagree, 10 respondents are neutral, 38 respondents agree, and 83 respondents strongly agree that it will be helpful if there's a system that can help with their understanding of job scope in a program or in the club.

TABLE VI. TABLE ON QUESTIONNAIRE ABOVE

QUESTIONNAIRE	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
-	1	0	10	38	83

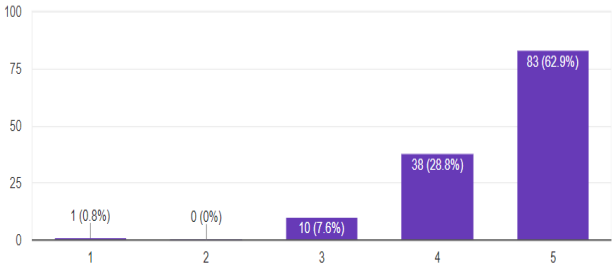

Fig. 7. Results Graph On Item C1

2) Based on your answer above, why do you think so?.

According to the respondent's answer, they mostly agree because they think that we need to be clear with our job scope. One brief meeting doesn't mean everyone gets to know their job scope so we need a system that can be accessible whenever we need, especially during the period of working on a particular task. So, it will help to understand what to do in a short period of time efficiently, no need to keep asking someone for further understanding.

Lastly, they believe each job scope will be different according to the programme's mission and niche, or the target that organizer wants to achieve. So, it is better if the higher up can provide detailed job scope according to the programme.

3) The system will contain all the information needed to organize a program and perform your task in the club. What do you want to be included in the system?.

Based on the respondent's answer, they want the following features:

- Poster editing resources and guidelines (if have specific theme for it feed)
- Proposal guidelines, Program Tentative, Report template, Program Timeline, Recruitment Forms
- Complete and clear job scope guidelines, person in charge and examples
- Organisational chart and contact number

X. PROTOTYPE

The prototypes for the project are explained in this section.

Fig. 8. Start screen

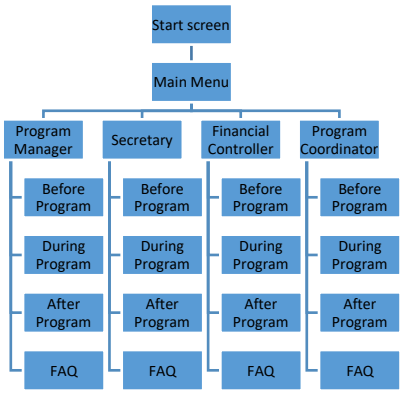

Fig. 9. Flow of program

A. Project Development

After getting some feedback and suggestions from both the supervisor, examiner, and users, on the early concepts for the system, the developer started to work on completing the hi-fidelity prototype for it as well as conducting a user acceptance testing to ensure that the project is running as intended.

In this section, the developer explains in detail the development of the hi-fidelity prototype and preparation for final release. This includes both the asset designs in the system. As the early asset designs were already made, it was time to design it in detail using Adobe Photoshop and Adobe Animate. However, the supervisor suggested making the background more detailed and making the interface look more professional and match the design concept for all elements in the project.

B. Background

The background (in Fig. 10) is a gradient of navy blue with gold frames inspired by Islamic design and architecture at all corners of the interface. It symbolizes classic Islamic design with a fusion of modern interface. Figure below shows the background of the project.

Fig. 10. Background of project

C. Lower Buttons

Lower buttons are gradient gold-colored rectangles (shown in Fig.11). It is placed at the lower part of the interface. The buttons by default have a white shadow behind the buttons. When the user hovers the mouse at the button, there will be blue bar at the bottom of the button. When the user hits the button, there will be a red bar at the bottom of the button indicating the button has been hit. Lower buttons are divided into two types which are Navigational and Sub-page.

Fig. 11. Lower Buttons Interactivity

D. Navigational Lower Buttons

Navigational lower buttons will direct the user to the next or previous frame in the project. Fig. 12 shows navigational lower buttons.

Fig. 12. Start Button

E. Sub-page Lower Buttons

Sub-page lower buttons will direct user to a specific frame in the project. Fig. 13 shows sub-page lower buttons.

Fig. 13. Before Program Button

F. Upper Buttons

Upper buttons are simple line-based icons. It is placed at the upper part of the interface. The buttons are by default are white. The buttons will appear grey when the user hover their mouse and red when the user successfully clicked the button. Upper buttons are divided into two types which are Navigational and Audio Control.

Fig. 14. Upper Buttons Interactivity.

G. Navigational Upper Buttons

Navigational upper buttons will direct user to the previous frame, home and sub-home menu in the project.

H. Audio Control

Audio control buttons will allow user to stop and play the audio.

I. Timeline Navigation

The function of timeline navigation is to indicate the user the position of the pages. Dark blue with yellow-bordered circle indicates the user is on the current page while grey with yellow-bordered circle indicates the other pages in the system (as shown in Fig. 15).

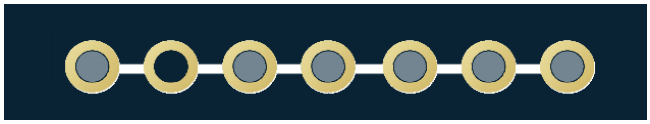

Fig. 15. Timeline Navigation.

J. Logo

The logo of the system is visible on all pages of the system. It was created with minimalist design concept to attract user attention and convey the message (Quranic Youth Club Manager) as clear as possible as shown in Fig. 16.

Fig. 16. Logo

K. Images

The center part of the system was designed both in Photoshop and Animate to produce graphics that makes user interested to learn the topics. Fig. 17 shows the example of graphics in the Program Manager – Before Program first page.

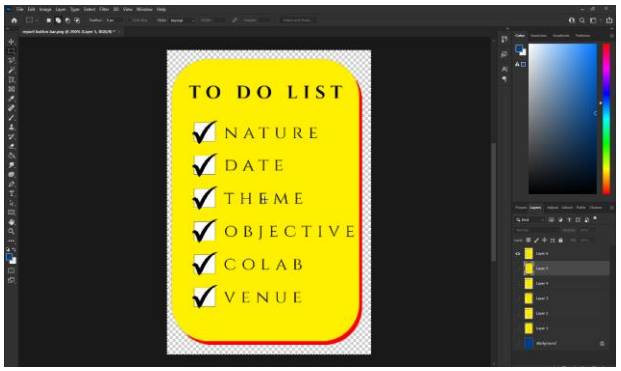

Fig. 17. Project Snapshot in Adobe Photoshop

L. Audio

One of the multimedia elements in this project is audio. The snapshot of the audio files are shown in Fig. 18. In this project, audio is divided into two types which are Voice and Sound Effects.

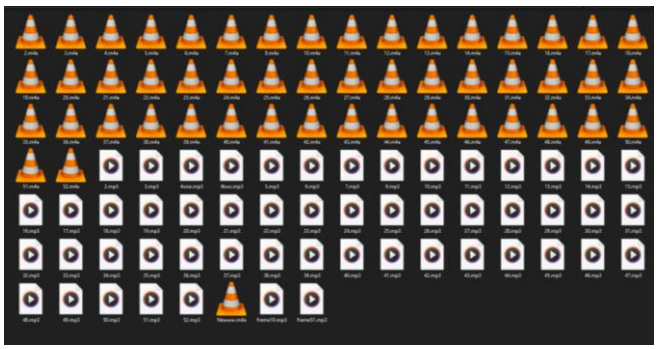

Fig. 18. Audio Files

M. Voice

The user will be able to listen the voice by clicking the play button and stop the voice by clicking the stop button. The voice is recorded in a quiet place using a recorder. Unfortunately, Adobe Animate does not support the format. So the developers have to convert the audio one by one in Adobe Premiere Pro from .m4a to .mp3 format. Snapshot in Fig. 19 shows the conversion of audio format from .m4a to .mp3 format.

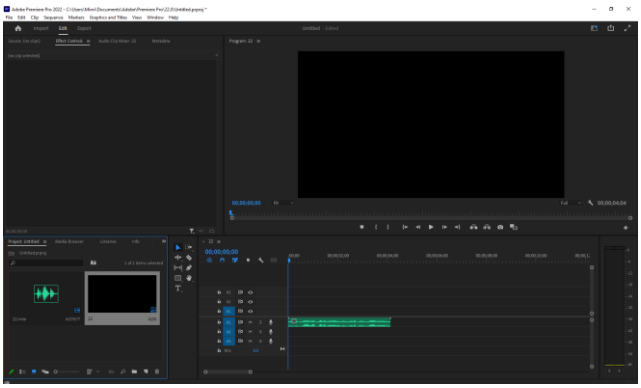

Fig. 19. Audio Files Format Conversion

N. Sound Effects

The sound effects could be heard when the user clicked on a button. There are two different sounds in the system. One is for the buttons at the top and the other is for the gold buttons at the bottom of the interface. The sound was created by source it from an audio library and manipulate the audio tuning levels in Adobe Premiere Pro. Fig. 20 shows the developer manipulate the audio by adding and altering the Effects.

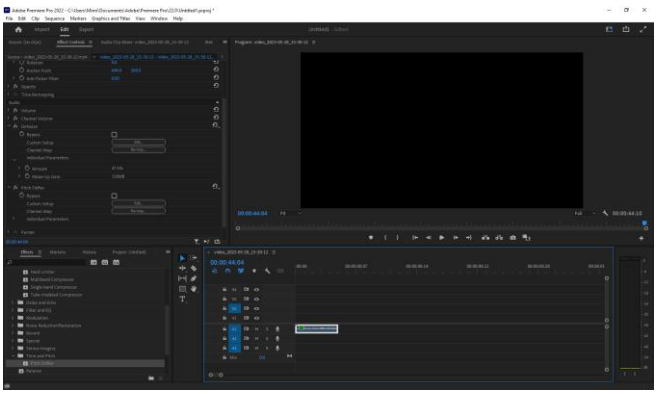

Fig. 20. Sound Effects Manipulation

O. Video

Experienced students for handling programs for each job scope are instructed to share and record their experience in Frequently Asked Questions regarding their assigned job scope. The recorded videos were edited in Adobe Premiere Pro. The subtitles were added to all the videos in the project. Fig.21 below shows a video being edited.

Fig. 21. Editing A Video

P. Online Guidelines

The online guidelines was designed in Adobe Photoshop. It is designed to make the user understand clearly how to navigate throughout the system. It is posted in Instagram because the target user are youth, where most of the youth spent time in social media such as Instagram. By uploading the guidelines to Instagram, the user able to view the guidelines easily as the platform was often visited by the target user. Fig.22 shows examples of guidelines posted in the page. The user has an option to learn the system in detailed by visiting the Instagram page @qycmanager.

Fig. 22. Snapshot of Guidelines

XI. IMPLEMENTATION

After finalizing the product, the developers export the Adobe Animate project file and save it as .swf file. The file then distributed to the club members for user testing and evaluation. They could open the file with Adobe Animate in their personal computer or by using the Chrome web browser. There are a total of 18 club members that benefit from this system. It helps to guide them handle a program with interesting multimedia-based elements in the system.

XII. USER TESTING AND EVALUATION

User testing and evaluation are important to make sure the system fulfils the user requirements. User results are evaluated and will be used to improve the project. Evaluation process occurred during the KICT Final Year Project (FYP) Showcase. During this process, two examiners were assigned to evaluate the functionality of the system, as well as other aspects of the project such as documentations, design details, and improvements. Feedback received from the examiners: the project requires more detail to improve user navigation and ensure a clearer understanding of the program's flow, as noted by the examiner. Additionally, the developers need a better grasp of the multimedia concept, and the examiner

emphasized the importance of clearly defining the project objectives. Besides feedback from the examiner, the evaluation process included feedback from the project supervisor during Beta testing to help refine the system.

A. Testing Plan

The developer planned out some user testing plans for the club members to gain feedback. Table VII until Table IX are the user testing and evaluation. It is divided into three parts which are Main Function, Audio and Navigation.

TABLE VII. TESTING THE MAIN FUNCTION

Scenario	Status	Expected Result
Click start and go to the main menu using mouse cursor	Pass	User can hover and click all button without any issue
Click the sub-menu button to go to the sub-menu	Pass	Sub-menu will appear after clicking the button

TABLE VIII. TESTING THE AUDIO

Scenario	Status	Expected Result
Click on the play icon to play the audio	Pass	Audio will be played

TABLE IX. TESTING THE NAVIGATION

Scenario	Status	Expected Result
Click the upper back button	Pass	The system will go to the previous page

B. Improvement

Based on the evaluation and feedback from the supervisor, examiner, and user testing sessions, several improvements can be made to the Quranic Youth Club Manager. One key area for improvement is the interface. While the interface is easy to navigate, the "back" button needs to be more visually appealing. Some users initially struggled to understand the interface but eventually became accustomed to it. To enhance usability, the system should provide clearer guidance on navigation and use color differentiation to distinguish between different job scopes. Additionally, the timeline navigation should be functional, allowing users to easily jump from one page to another. Finally, the font used should be more eye-catching and less generic to improve the overall user experience.

XIII. CONCLUSION

In conclusion, the Quranic Youth Club Manager has the potential to be a valuable tool for club members, making the learning process more engaging and enjoyable. Despite facing several challenges during development, such as platform limitations and unfamiliarity with coding functions, the developer is proud to have completed this project. Looking ahead, the developer is excited about the prospect of creating a mobile version of the system to enhance its accessibility, as well as adding new features and more detailed graphics to further improve the user experience.

A. Project Requirement

Overall, it is safe to say that the base requirement of the project, which is to make a general guideline for Quranic Youth Club using multimedia elements, is completed. As agreed by the developer, supervisor and target user, the developer managed to deliver the system as intended, where it was made to teach club members their job scopes in a program. However, the developer could not manage to design the interface in detail with animations as the original planning because the developer focuses mainly to make sure the core functionality was working correctly. Fortunately, to counter the issue, the developer has made an Instagram page guideline to help the target users navigate throughout the interface.

B. Project Constraint

The constraint that the developers encountered while developing the system was that Adobe Animate does not support a wide variety of images and audio formats. The original file needs to be converted into supported files. The tools used to convert the files are Adobe Photoshop and Adobe Premiere Pro. It took quite some time to convert the files, so it made the development progress longer.

Errors that arose in the programming component of the project were another challenge for the developer to overcome. Before using them in the system, various coding elements needed to be well understood. Not only does it result in syntax errors for a frame, but it also has an impact on other frames that make use of the same references. To get the preceding scripts to function properly in the same file, it required some effort to find out the solutions and make the necessary corrections.

XIV. FUTURE ENHANCEMENT

A future enhancement that may be added to this system is the mobile application port. This will make the project more accessible for club members as they can access the system anywhere and anytime, they want from their own Android or iOS devices. Another enhancement that may be added to this system is detailed animations and videos. It makes the system more professional and looks more complete. Finally, the system must be future proofed by easily editing or updating the guidelines in the system.

ACKNOWLEDGMENT

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Stockmail: Stock Dashboard Website

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***Abstract*— As the economy of Malaysia is not stable and in growth stage overall, the 2023 growth for the Malaysian economy normalised to 3.7%, following a strong growth registered in the previous year (2022: 8.7%). Growth moderated amid a challenging external environment. Stockmail is a web dashboard built to be useful for traders in providing stock data, predictions and news to help them decide on future trading. The features that will be provided for the app are stock data, the latest stock news data on the stock, expected earnings and currency exchange with real-time currency rates. These features will allow users or traders, especially new traders, to learn useful data and trading skills to gain better profits.**

***Keywords*— System Development, Stock Trading, Economy, Stock data.**

I. INTRODUCTION

Stockmail is a web dashboard built by traders to provide stock data, predictions and news. The project's main objective is to help them make the best decisions on future trading. To achieve this, developing the Stockmail web application will be a vital tool to assist their trading. The web application will provide features such as displaying stock data, the top and bottom five of stock prices and volume, the latest stock news data on the stock and stock forecast data. These features will allow users or traders, especially new traders, to learn useful data and trading skills to gain better profits. Moreover, it will be equipped with a currency exchange with real-time currency rates for users to convert their selected currency to help them calculate the true and exact amount of money at their latest rates.

A. Background of the Problem

Stock trading requires a lot of time commitment because of the rapid changes in market sales. However, traders usually have a primary job they must attend to, and they do not have the time and space to observe the market all the time, learn past historical data, and update news reports on the current state of companies. Traders should carefully consider their specific needs and requirements when choosing a platform that is easy to understand, stay informed, and make trading decisions. So, there needs to be a program/system that can help them overcome these challenges.

B. Problem Statement

In the fast-moving era of financial markets, traders are grappling with the significant issue of finding a user-friendly and information-friendly app that gives them easy access to reliable stock data, updated latest stock news and stock forecasting. Current solutions are scattered and not very user-friendly, making it tough for traders to make smart decisions and get the most out of their investment strategies. There's a clear need for a fresh application that smoothly combines historical stock data, updated stock news, and AI stock forecasting all in one place. This web application should be all about making things easy to understand, accurate, and simple to use so traders can have the tools they need to succeed in the fast-paced world of financial trading.

C. Objective

By the end of this project, we should be able to provide at least a complete website that everyone can access on their desktop web browser. The system should help beginner and new stock traders get updated and rapid news on the stock market so they can make lively and intelligent decisions about trading stocks and gaining profit.

D. Project Scope

1) Views

The visitors will be able to view all the pages available on the website, including the home page, Stockmail page, and forecast page. In addition, the user will be able to convert the currency of their choice, view the top and bottom five of stock prices and volume, get historical data and the latest news on stock companies and also get the forecast data of their stock preferences.

2) Target User

New traders, People new in stock trading.

3) Platform Used

Python, Streamlit, VS Code.

II. LITERATURE REVIEW

The main objective of this literature review is to explore the most user-friendly options that are also packed with useful information regarding stock trading, especially for beginner stock traders. Stockmail website aims for everything data- and information-wise and is sufficient for new traders to make the right decisions and be profitable. By examining the advantages and disadvantages of these systems, potential opportunities can be explored, and pitfalls can be avoided while developing this system.

Three websites were selected for the literature review: TradingView, MarketWatch and Thinkorswim by TD Ameritrade. By comparing these websites, we can identify the fundamental aspects of stock trading websites, such as the informational data, the easy-to-understand design, and more. The results are summarized and presented in Table 1.

TABLE I: COMPARISON OF SIMILAR SYSTEMS

	Advantages	Disadvantages
TradingView	• Users can set up notifications and price alerts to keep track of changes in the market and trading possibilities. • TradingView covers a broad spectrum of financial markets, including stocks, cryptocurrencies, forex, commodities, and more. • Provided latest updated news • TradingView also provide expected earnings of stock	• For active traders, a premium subscription is necessary for access to additional features and data, which can be expensive. • Users need to subscribe in order to access real-time market data. • Stock data pages are too complicated. • No currency exchange with uptodate rate.
Thinkorswim by TD Ameritrade	• Provides a wide range of educational resources and research tools. • The platform allows users to trade futures and forex markets with real-time data	• Advanced features require a subscription that come with a fee. • Possibly not function properly on older or less capable computers. • No news on stock • No currency exchange with uptodate rate.
MarketWatch	• It's a valuable resource for staying informed about financial markets. • Offers real-time stock quotes, charts, and market data • Provided latest updated news	• Some content and features on MarketWatch may require a subscription or payment. • Free content on MarketWatch features advertising, which can be distracting or affect the user experience. • No currency exchange with uptodate rate.

Many systems and applications nowadays are already on real-time updates, which is very important, as the immediate and continuous provision of information allows users to access the most recent information. This function is helpful in many kinds of fields where timely information might be important, especially in the stock market. However, many systems that use real-time updates often come with a price. In other words, customers must subscribe or pay to use these current and up-to-date functions. This could be an obstacle for new users or those on a tight budget, like beginner traders, as they have just started and have to begin using premium services.

There are several improvements and changes that our project will adopt to make it more user-friendly and easier for investors and traders in this stock market. Firstly, the proposed system will list company earnings expected in the next 1 to 5 years. This feature provides useful information for traders and investors by enabling users to stay updated about the financial potential of different organizations in the near future. This becomes an invaluable resource for anyone wishing to make well-informed investing decisions by providing this forward-looking view on earnings. Users can strategically plan their financial actions for long-term and short-term investing plans based on expected company performances.

Secondly, the proposed system will provide the latest news alerts regarding the stock. The website's real-time stock news alerts are a game-changer for users eager to stay current on market movements. This feature ensures that users are instantly informed about the most recent events affecting stocks, making it a useful and educational user experience. The system will surely become an essential tool for traders and investors looking to make wise decisions in a volatile market with timely news alerts. Users can respond quickly to breaking news, modify their plans, and take advantage of opportunities or mitigate risks as they arise. Users will no longer have to search numerous sites to find relevant news about stocks.

Moreover, the proposed system will also provide stock data from past months. This feature will be useful to users seeking in-depth market analysis and trend spotting in stock data. It also gives users an insightful look back, enabling them to review and evaluate the stock's performance over previous months. With the help of this function, users can perform in-depth analysis, spot trends, and learn how particular stocks have performed in different market situations. Past stock data allows users to plan strategic investments, do technical analysis, or conduct studies by providing a thorough picture of a stock's behaviour over time.

III. METHODOLOGY

A. *Development Approach*

This chapter provides an overview of the development approach, requirements specification, and logical design of the Stockmail app project. It plays a significant role in understanding the purpose and significance of the project's analysis and design activities.

For the development of Stockmail, Agile development is ideal for developing a stock trading dashboard due to its iterative and adaptable nature. In the dynamic and quickly changing scene of monetary business sectors, coordinated considers nonstop variation to developing necessities and economic situations. Agile's incremental development cycles allow stakeholders to provide regular feedback, ensuring that the dashboard meets user needs and effectively adapts to changes in the market.

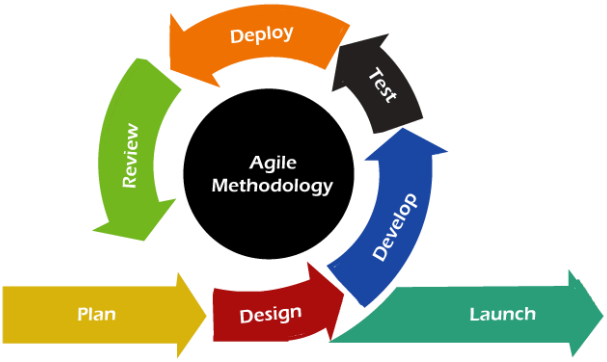

Fig. 1 Agile Methodology

This approach additionally works with speedy acclimations to consolidate new elements or alter existing ones because of changing administrative structures or mechanical headways. By underscoring coordinated effort, flexibility, and client input, Lithe improvement guarantees the opportune conveyance of a stock cautioning application that isn't simply receptive to current market requests but is additionally equipped for development to address future difficulties.

B. *System Design*

This section involves analysing the requirements and the system architecture to help developers better understand them.

Microservices Architecture is a design pattern that breaks down an application into small, loosely coupled services, each responsible for specific business

functionalities. In the case of Stockmail, adopting a microservices architecture would enable independent services to handle different features, such as real-time stock data retrieval, stock forecasting, currency conversion, and news updates. These services can be independently developed, deployed, and scaled, allowing for greater flexibility and faster response to changes in the financial markets. By isolating functionalities, any update or failure in one service does not affect the entire system. This architecture also facilitates integration with external APIs and enhances the overall resilience and performance of the web application, particularly under heavy user demand or during volatile market conditions.

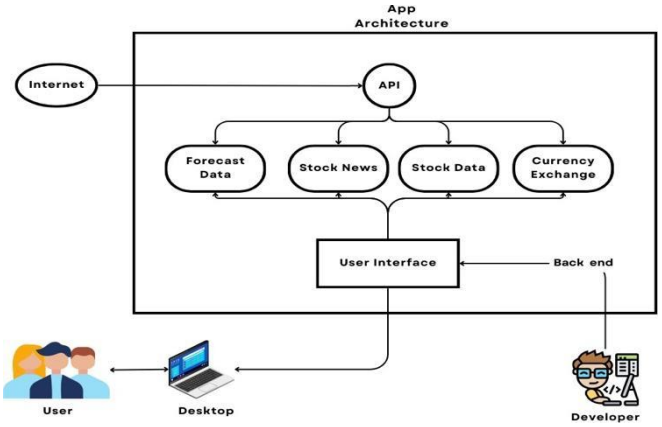

Fig. 2 System Architecture

Fig.2 shows the system architecture of Stockmail. The "User" basically interacts with the webpage and gets dynamic data from API, such as stock prices, news and the currency rate. The data is then organized, and the user can obtain it. The dashboard is separate from three pages: the homepage or welcome page, stock pages and the forecast page.

While user-friendliness is a core focus of Stockmail's design, the system's objectives extend beyond ease of use. The system's architecture also prioritizes scalability, ensuring the platform can handle many users and data sources without compromising performance. Additionally, security is integrated into the design, with data encryption and secure API connections to protect sensitive financial information. Performance optimization is another key objective, particularly for real-time data retrieval and forecasting functions, ensuring users receive the latest information with minimal latency. Furthermore, modularity in design allows for future enhancements and the integration of new features without disrupting the existing system. These objectives ensure that Stockmail is not only user-friendly but also robust, secure, and adaptable to the evolving needs of its users.

The Stockmail dashboard is designed with a streamlined user experience in mind, featuring three distinct pages to navigate through its comprehensive functionalities. The homepage or welcome page serves as the introduction to the Stockmail dashboard, providing users with an overview of its features and capabilities. This page is designed to be user-friendly and informative, ensuring that new and returning users can easily understand how to utilize the dashboard to its fullest potential. The welcome page outlines the core functionalities of Stockmail, such as accessing real-time stock data, viewing graphical representations of stock trends, and leveraging advanced forecasting tools. Additionally, it may include quick links to the other key pages, recent updates, or tutorials to help users get started.

The stock pages are the heart of the Stockmail dashboard, allowing users to search for and obtain detailed stock data. Users can input the name or ticker symbol of the stocks they are interested in and receive up-to-date information, including current prices, historical data, and graphical representations of stock performance over time. Furthermore, these pages integrate the latest news related to the searched stocks, providing users with a comprehensive view of factors influencing stock movements.

The forecast page complements the stock pages by offering AI-powered predictive analytics. This feature provides users with data-driven forecasts on the future performance of the searched stocks, helping investors make informed decisions. The AI-based predictions consider many variables and historical data to generate accurate forecasts, making the Stockmail dashboard an invaluable tool for novice and experienced investors.

IV. Results

A. *User(s)*

This section presents the users' views of Stockmail, encompassing the Homepage, Stockmail Pages and Stock Forecast Page. The screenshot examples below show the user's views.

Fig. 3 Homepage

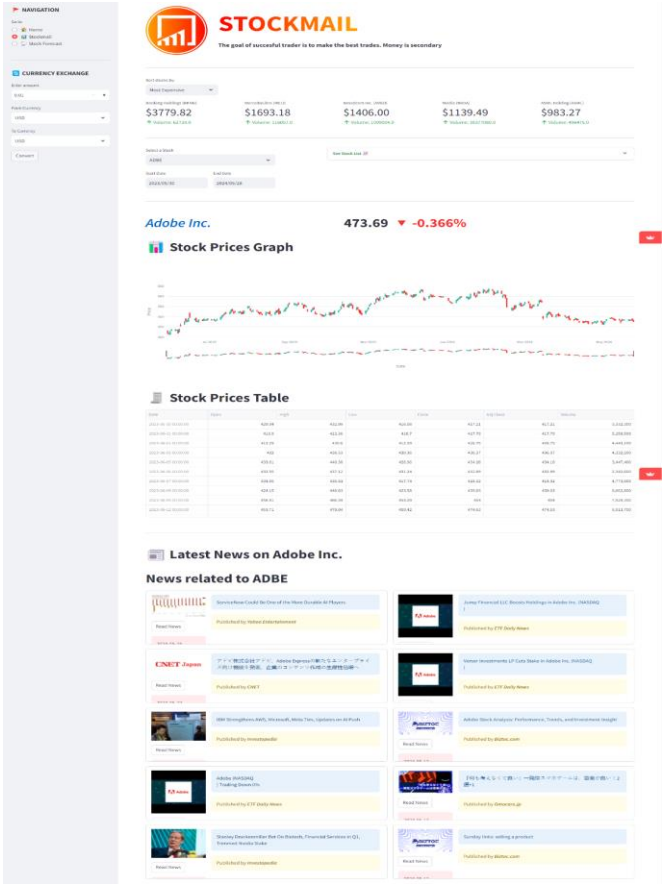

Fig. 4 Stockmail Page

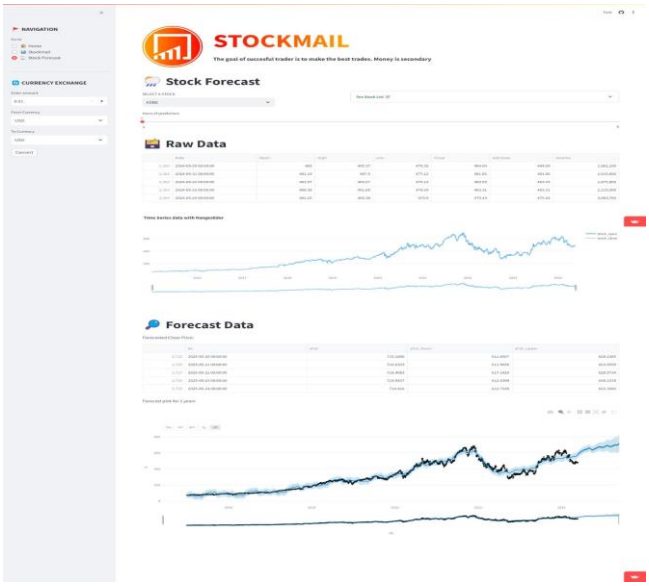

Fig. 5 Stock Forecast Page

V. User Acceptance Testing

The testing phase will involve a comprehensive User Acceptance Testing (UAT) plan tailored to the Stockmail system. This plan will primarily focus on evaluations conducted by general Users. By systematically examining the system's functionality and performance from the perspective of Users, the test aims to ensure that StockMail meets the expectations and requirements of this key user role

User

- Change pages through the navigation bar.
- Convert currencies
- Sort stocks by most, least expensive and active.
- Select a stock to view its price graph, price table and news related to the stock.
- Clicking read news to navigate to the desired content.
- Select a stock and year range for its forecast data.

VI. Constraints

In terms of project constraints, there are several noteworthy challenges. One of the primary obstacles encountered in developing the Stockmail project revolves around the team's limited proficiency in Python programming. Working on the project will be a challenge for us as a beginner in the language. There is a huge library and framework ecosystem for Python. As a self-learner who relies on online resources, communities and discussion, choosing the appropriate tools for the project will require plenty of effort and time, and the early stages of the project may not be as perfect as it is. Despite these constraints, the team is committed to overcoming this obstacle by dedicating substantial effort to learning Python during the project's initial phase, leveraging available internet resources, and seeking guidance from the supervisor.

Another significant constraint relates to API connectivity issues when attempting to establish connections with the server. These problems hinder seamless integration with external data sources and services critical for Stockmail's functionality. Addressing these API challenges requires plenty of troubleshooting to resolve them. These obstacles may delay project progress and require additional time and resources to implement a robust and reliable API. Despite these challenges, the team remains determined to overcome API connectivity constraints to ensure the successful development and deployment of Stockmail.

VII. Significance of the Project

The Stockmail project offers significant benefits for both the individual and the user base. On a personal level, this final-year project provides an opportunity to expand my knowledge of stock market dynamics and refine my technical skills in web application development and data analysis. Additionally, the project helps enhance soft skills such as effective communication and teamwork, which are essential for discussing ideas and progress with the supervisor.

For users, the Stockmail Dashboard is a valuable resource for making informed trading decisions. By offering comprehensive tools such as graphical stock data representations, real-time news updates, and a stock forecasting feature, the application empowers users to analyze market trends and metrics thoroughly. This enables traders to anticipate market movements and make strategic decisions, improving their trading performance. In conclusion, the Stockmail Dashboard project delivers meaningful benefits, aiding individual personal growth and providing traders with essential resources.

VIII. CONCLUSIONS

In conclusion, the development of Stockmail represents a significant milestone in providing traders with a powerful tool for informed decision-making in the stock market. The team encountered various challenges throughout the development process, including initial proficiency barriers in Python programming and API connectivity issues. However, through dedication and collaboration, these obstacles were successfully navigated, creating a robust and user-friendly system. Stockmail offers a comprehensive suite of features, including graphical representations of stock data, real-time news updates, and a sophisticated stock forecasting tool. These functionalities empower Users to analyze market trends, make strategic decisions, and confidently anticipate future market movements.

Moving forward, the team will continue to refine and enhance Stockmail based on feedback received during User Acceptance Testing (UAT). This iterative approach ensures that the system remains aligned with Users' evolving needs and preferences, providing a valuable resource for traders of all levels of expertise. To end, StockMail stands as a testament to the team's dedication, innovation, and commitment to delivering a high-quality solution that empowers traders to navigate the complexities of the stock market effectively.

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SejahteraCare: A Comprehensive Clinic Management System for International Islamic University Malaysia

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Abstract—This paper outlines the development of SejahteraCare, an internet-based platform for patients, doctors, employees, and administrators of the International Islamic University Malaysia's (IIUM) Health Centre. The primary goal of SejahteraCare is to enhance the patient's experience, optimize operational efficiency, and improve the overall quality of healthcare services. The platform is specifically customized to cater to the unique requirements of the university community. The absence of an internet-based system for organizing medical appointments results in inefficiencies, which causes students to miss classes, encounter delays in receiving healthcare, and be denied access to medical facilities due to lengthy waiting periods and administrative complexities. SejahteraCare prioritises user-friendliness and secure data management, including features such as appointment booking, patient records, profile maintenance, doctor reports, and clinic staff management. Despite limited internet and resource availability, the User Acceptance Test (UAT) resulted in UI enhancements, and SejahteraCare met its deadlines. This study highlights how digitising clinic operations at IIUM may increase efficiency and user experience with future additions, such as insurance integration planned to streamline procedures further.

Keywords— **System development, SejahteraCare, clinic management system, clinic, web application, digital health**

I. INTRODUCTION

SejahteraCare's primary goal is to develop and implement an advanced Clinic Management System (CMS) for IIUM Health Centre to enhance patient experience, raise operational effectiveness, and improve the quality of healthcare services through the delivery of an efficient and cutting-edge healthcare management system that is specifically designed to meet the demands of IIUM Health Centre. The project seeks to enhance the overall healthcare experience for the university community. The accomplishment of the project's primary goal of enhancing health and well-being, in line with SDG-3 and SDG-9 goals, is meant to develop resilient infrastructure, encourage sustainable industrialisation, and foster innovation-will, thus guaranteeing a smooth, contemporary healthcare management solution, improving the university community's overall healthcare experience. This introduction outlines the project's importance, goals, reach, and the fundamental issues it aims to solve.

A. Background of the Problem

This project is dedicated to offering a digital solution specifically tailored to IIUM's needs. However, the current operation structure, with manual appointment scheduling, paper-based record-keeping, and fragmented data management, resulted in inefficiencies in delivering optimal healthcare while managing the diverse student body on campus, which numbers around 14,000 students. This situation highlighted the limitations of traditional methods in a growing healthcare environment. As a result, a new user-centred clinic management system was needed to streamline appointment booking for patients and elevate work management for staff and doctors.

B. Problem Statement

The main problem is that an online tool needs to be created to assist students in effectively scheduling their medical appointments. This shortfall is presented in several ways, the most common of which is reliance on manual procedures for tasks like scheduling direct walk-in appointments for medical care. These manual procedures sometimes result in students missing classes, experiencing delays in receiving appropriate healthcare services, and even facing rejection from the clinic due to extensive line-ups and administrative inefficiencies. Another difficulty relates to the inability to conduct efficient data analysis due to the frequent use of manual data recording methods. Thus, to overcome these challenges, it is necessary to create a centralised and user-friendly platform that includes a comprehensive management system for patients booking appointments. By enhancing access to this critical information, patients can have a more comfortable and enjoyable experience, while staff and doctors can provide high-quality healthcare services on campus.

C. Objective

With the development of this system, the developer aims to modernise and streamline clinic processes while offering a better experience for patients and clinic staff. This objective can be achieved by developing an effective and user-friendly system when scheduling and booking online appointments with doctors, as well as a secure and simple system so patients can access their medical records and histories from anywhere, ensuring easy access to their health information. Furthermore, the system should include a user-friendly interface that allows users to smoothly navigate the system and provide a comprehensive picture of available doctors, allowing patients to choose the most convenient time frame

and online access to test results, prescription history, and treatment suggestions.

D. Project Scope

1) *Views:*
SejahteraCare will have diverse features and functionalities, including online appointment and scheduling, active administration monitoring, digitised medical records, online report accessibility, and patient self-service elements. The CMS aims to offer a comprehensive solution for modernising clinic operations.

General visitors can view only the pages available on the website: the home page, about, doctors, FAQ, contact us and login. Users can log in to the system. Patients must register, and after approval by staff, they log in to their own account. Doctor and staff users can log in to their accounts using their credentials and act by editing, viewing, and deleting information.

2) *Target Users:* Patients, Doctors, and Administration, IIUM Community.

3) *Platforms Used:*
Software specification-HTML, CSS, JavaScript, BootStrap, PHP, Laravel, MySQL, and Ajax.
Hardware specification-Apple MacBook Air M1 8 GB RAM, 256 GB SSD.

II. Literature Review

The primary goal of this literature review is to determine the most appropriate characteristics for the SejahteraCare website, which aims to digitise healthcare services at IIUM Health Centre. This study will focus on analysing and assessing existing systems similar to the one that will be formed. By investigating the benefits and drawbacks of existing systems, we seek to find potential possibilities and risks to avoid when creating the system.

Three websites were selected for the literature review: Visit Universiti Malaya [1], University of Sydney [2], and Visit International Islamic University Malaysia [3]. By comparing these websites, we may determine the key characteristics of clinic management websites. Furthermore, a few components of the websites were outstanding, revealing prospective new features that could help the SejahteraCare website grow. The findings are summarised and given in Table 1.

TABLE I: Comparison of Existing Systems

Features	Student Health Clinic University Malaya	Health Services University of Sydney	Medical Specialist Centre International Islamic University Malaysia	SejahteraCare
User-Friendly Interface	✓	✓	✓	✓
Comprehensive Health Services Information	✓	✓	✓	✓
Online Appointment Booking and Contact Information	✓	✓	✓	✓
Health Tips and Resources	✓	✓		
Mobile Responsiveness	✓			✓
Health Packages, Promotions and Resources			✓	
Integration with Student Portals		✓		
Patient Testimonials and Success Stories			✓	

In modifying the project, we looked at similar systems in Table 1 and chose which features to incorporate on the SejahteraCare website. These include sections for "Online Booking" and "Comprehensive Health Services Information," organised content, an appealing design, doctor data and contact information integrated with Google Maps, a Login option, and the dashboard panel and FAQ dropdown box. The dropdown box in the FAQ section is an extra feature that lets users explore information on the website without getting overwhelmed visually.

III. Methodology

A. Development Approach

System development techniques provide an organised way to develop systems. These approaches are critical for overseeing system development, from planning to implementation and maintenance. Various solutions are available, including the Waterfall model, System Development Life Cycle, Agile methodology, Rapid Application Development, Scrum, Spiral model, and more. Choosing the appropriate approach for a particular project is critical to achieving the project's objectives within the expected timeframe and budget. Following extensive research and assessment of the project's unique needs, goals, and available resources, the following methodology was selected for the system development.

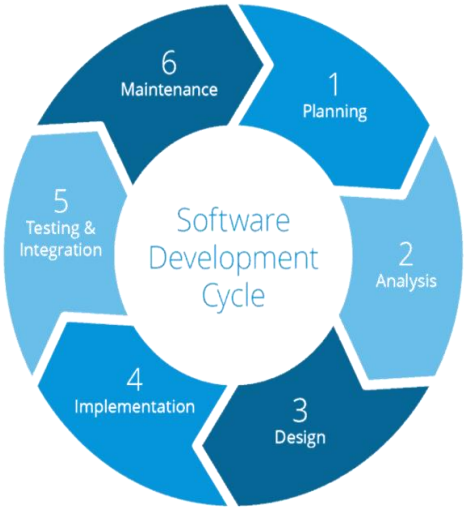

Figure 1. SDLC (System Development Life Cycle)

Pinheiro (2018) and Figure 1 above outline the 6 processes that must be incorporated into the System Development Life Cycle [4]. These steps are:

1) *Planning*: Planning is the first stage of the Software Development Life Cycle (SDLC) process. The developers collaborate with the client to identify and record the user requirements and organise a survey questionnaire to obtain specifications from end users. In this stage, the developer establishes the system's aims and objectives, identifies the users and their requirements, and specifies the functional and non-functional criteria.
2) *Analysis:* During this phase, the developer examines the requirements and sets up a comprehensive plan for the system using diagrams. They will also assess the project's technical viability, verify the necessary hardware and software prerequisites, and identify any possible dangers or limitations.
3) *Design*: The Design phase comprises System Design, Database Design, and Interface Design. The System Design will utilise a use case diagram, sequence diagram, and activity diagram to represent the system's progression visually. A prototype must be developed to determine the practicality of the web application. The design should be sufficiently detailed to guide the developer during the coding process, ensuring that the user's needs are effectively translated into software design.
4) *Implementation (Coding):* This phase involves the actual construction of the system. The coding phase entails creating code for the various system components, following the design documentation. PHP and Laravel are the programming languages chosen for this system. Developers are required to secure the completion of all features within this phase.
5) *Testing & Integration:* This step of the SDLC process is crucial since it involves the developer conducting tests to verify that the system meets the user requirements and operates correctly. The testing process encompasses the execution of the User Acceptance Test, which verifies that the system fulfils the requirements of end users and is prepared for deployment.
6) *Maintenance:* After Testing, we can obtain helpful suggestions from end users and the client. This feedback will be evaluated, and the system will be updated to fix any issues that may develop. This phase is essential to guaranteeing the system's long-term effectiveness and efficiency.

B. *System Design*

This stage involves evaluating the requirements and producing a use case diagram to help developers comprehend them.

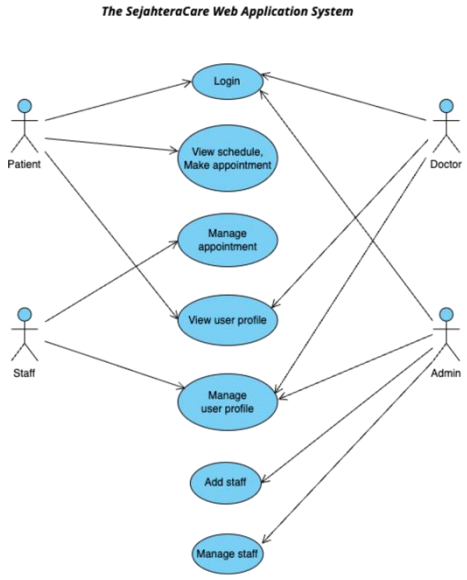

Figure 2. Use Case Diagram

Figure 2 is a use-case diagram presenting a comprehensive list of essential actors and their duties. The role of the "Admin" or "Website Master" is to add staff members. In contrast, the "Staff" is responsible for adding doctors, updating information in the system, and evaluating the overall booking performance of patients. At the same time, the term "Patient" describes those who visit the website and interact with its features.

The "Log In" use case enables users to access their registered accounts. Patients can create new accounts by clicking on the "Register" option. "View schedule" enables patients to view an available schedule of time with a listed doctor's list, which they can choose, and the "Book Appointment" feature lets patients book available slots for doctor's visits. Additionally, the "Manage appointment" use case enables staff to manage and approve booking registrations. While all roles have to view their profile page, only staff and admin can update the content. The "Manage User Profile" feature enables doctors to access and post prescriptions and reports to the student profile. Staff members can alter the reports, while students may only see and download them. Finally, the "Add Staff" and "Manage Staff" cases enable administrators to add new staff members to the system and ensure that user profile information is kept

accurate. These needs shape the functionality and user experience of the SejahteraCare website.

C. Database Design

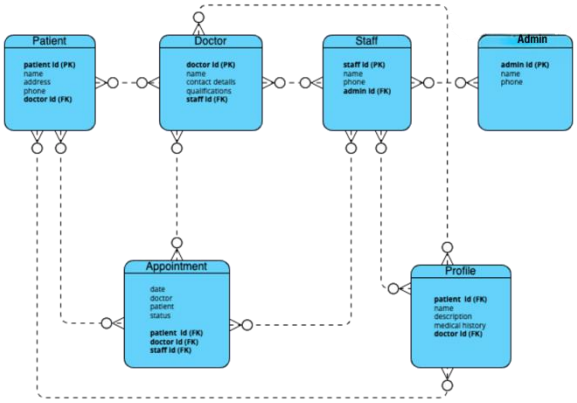

Figure 3. ERD (Entity Relationship Diagram)

Figure 3 depicts the Entity Relationship Diagram (ERD) for the SejahteraCare website, consisting of 6 entities.

1) *Patient:* The "Patient" table stores data about the system users, including a distinct user ID, an authentication password, and the user's name, address, and phone number.
2) *Doctor:* The "Doctor" table contains data pertaining to bookings and report documents that need to be uploaded to the system. The staff assigns doctors a distinct doctor ID and a password to ensure secure access.
3) *Staff*: The "Staff" table holds details about various profiles, attributing a unique ID, its name, a description, and contacts.
4) *Admin*: The "Admin" table records information about the staff, who are given a unique ID, name, and contact information.
5) *Appointment:* The "Appointment" table manages mainly bookings on the system, storing information with a unique ID, a date and time for when it was scheduled, the reason for booking, choice of doctor, and an attachment file associated with it.
6) *Profile:* The "Profile" table facilitates the users' access to their own information stored in the database. It holds a unique ID, names, addresses, contact numbers, matric for patients and specialist categories for doctors.

IV. Results

A. Patient

This section presents the general user's and patients views of SejahteraCare, encompassing the Homepage, About Page, Doctors Page, Frequently Asked Questions Page, Contact Us Page, Login Page, Registration Page, and Dashboard page of patient user with Screenshot examples of views are shown in figures below.

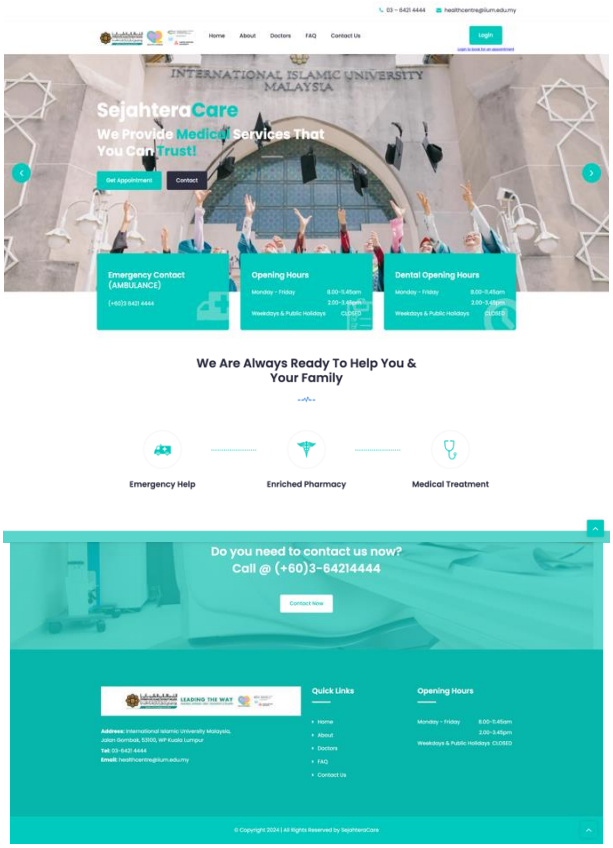

Figure 4. Home Page

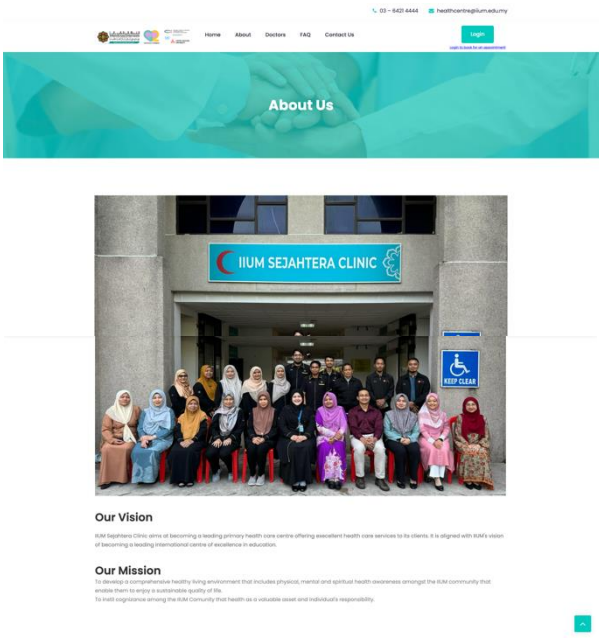

Figure 5. About Page

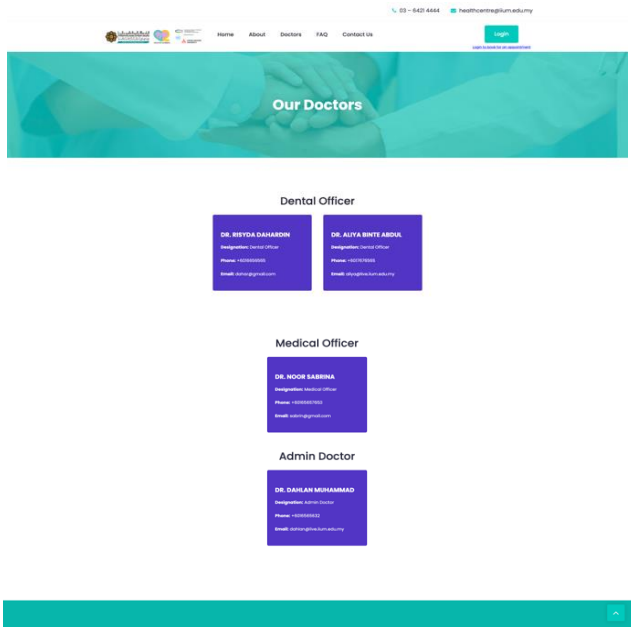

Figure 6. Doctors Page

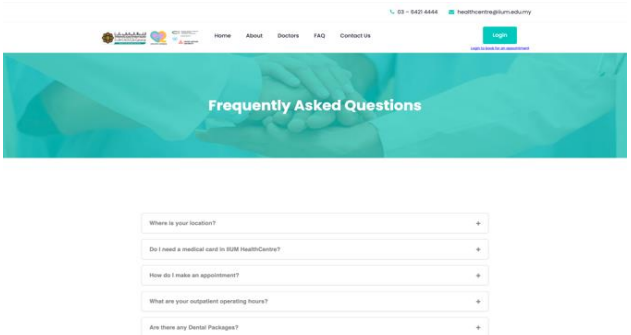

Figure 7. Frequently Asked Questions Page

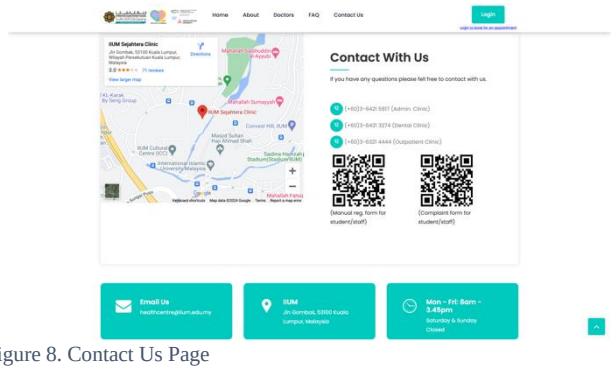

Figure 8. Contact Us Page

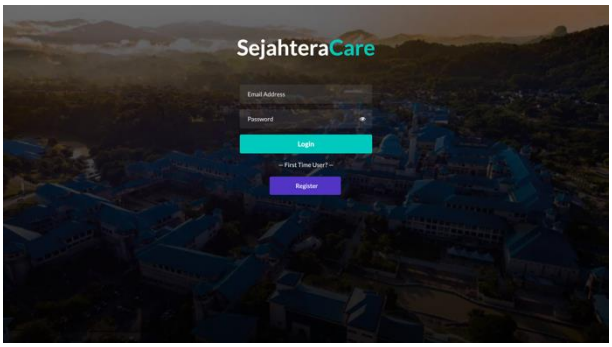

Figure 9. Login Page

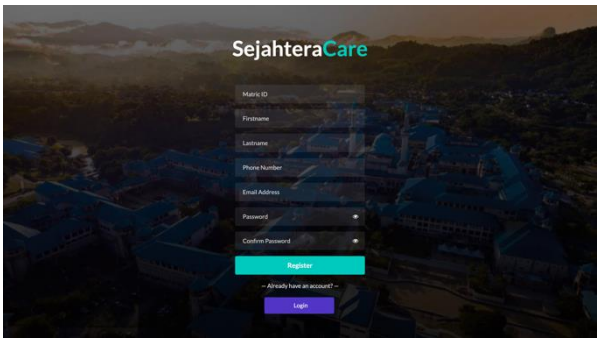

Figure 10. Registration Page

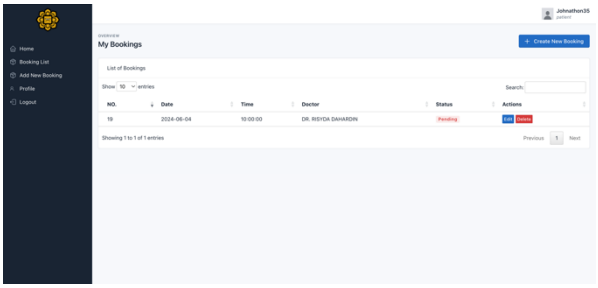

Figure 11. Patient Dashboard

B. Doctor, Staff and Admin

This section displays the staff's view of SejahteraCare, which consists of their Dashboard panel and Profile. The screenshot examples of Staff views are shown in the figures below.

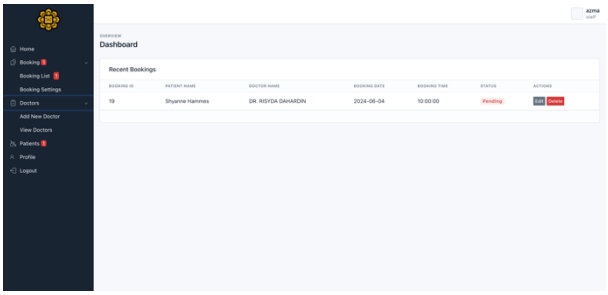

Figure 12. Staff Dashboard

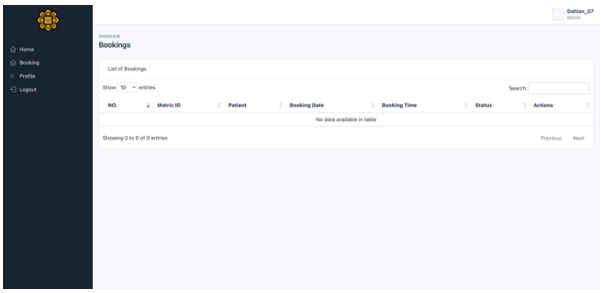

Figure 13. Doctor Dashboard

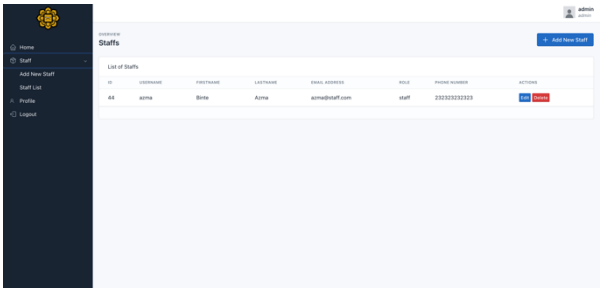

Figure 14. Admin Dashboard

V. User Acceptance Testing

The testing phase was executed through a comprehensive User Acceptance Testing (UAT) plan. This approach included evaluations on three major user categories: staff, doctor, and general users-patients. By systematically examining the system's functionality and performance from the perspectives of both Staff and Patients, the test sought to ensure that SejahteraCare met the expectations and needs of these major user roles.

A. Patient

- Log in until you Log out
- Book Appointments
- View and download medical history
- View profile

B. Staff

- Update patients' information and status
- View, Edit and Delete bookings
- Add and Update staff information
- Update calendar and timing
- View profile

C. Doctor

- Log in until you Log out
- View scheduled appointments
- Add, View, and Delete the reports
- View profile

Results:

The User Acceptance Test involved three participants from different user groups: students, staff, and doctors. The test was conducted in real-time and followed by questions for future enhancements. Overall, users found the UI professional and neat, providing a clear view of the system's functionality. Participants actively suggested improvements, including design corrections, bug fixes, and the addition of an FAQ dropdown menu. These changes aimed to enhance user comfort with the system.

VI. Constraints

This project encountered several noteworthy challenges. The primary constraint during the development was the need for more participants to gather comprehensive user feedback, which limited the project's ability to fully capture diverse perspectives and identify potential user needs across a broad range of users. Additionally, the developer's knowledge base presented a hurdle, potentially slowing development progress.

Despite those limitations, the project successfully progressed by being resourceful and adaptable. To gather user feedback, the study employed participants from a relative field to simulate real-world user interactions with the system. Furthermore, the developer enrolled in related courses throughout the semester to address the knowledge gap. Finally, the supervisor's comprehensive guidelines proved helpful in ensuring timely project progress.

VII. Significance of the Project

This project benefits both patients and the clinic. From a personal perspective, it offers patients a comfortable, user-friendly platform that is easy to use, which results in decreased waiting periods, enhanced convenience, and more autonomy over their healthcare encounters.

The project creates a valuable alternative for the clinic to optimise the processes for clinic staff and doctors. Such implementations improve the clinic's online presence, greatly lessen administrative tasks, and boost operational effectiveness. This web application helps the health centre allocate additional time to patient care and allows doctors to concentrate on providing high-quality medical services. Ultimately, this research has substantial beneficial effects for patients and clinics.

VIII. Conclusions

To summarise, SejahteraCare is a dynamic system development project that aims to digitise and enhance the patient experience in the IIUM clinic. The project addresses patients' challenges while manually registering, offering a user-friendly web application for streamlined healthcare services and an improved data management system for the clinic's operation. The project follows a System Development Life Cycle (SDLC) strategy, incorporating customer requirements to guide the web application's design, database construction, and user interface. The comprehensive User Acceptance Testing (UAT) plan, involving evaluations from staff and general users, such as patients and Doctors, ensures that SejahteraCare meets the expectations and requirements of major user roles. The results showcase the successful integration of required features into the system. Despite the constraints and challenges, the project holds significance in expanding knowledge, acquiring new skills, and providing a valuable alternative for a clinic to access information on IIUM's health centre. Overall, SejahteraCare emerges as a

promising tool to reshape and enrich the patient's experience in the clinic, contributing positively to individual growth and organisational objectives.

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IIUM Bus Tracker Website

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***Abstract*— The International Islamic University Malaysia Campus (IIUM) has a vast campus area and complex transportation needs. Buses play an important role in providing convenience and speed to students, allowing them to use their time more efficiently and move quickly from one location to another. Students of IIUM expect to catch or take the bus on time when needed. However, many students cannot get the bus's real-time location, making them miss the bus, unnecessary waits, and other problems. To address this, we propose the "IIUM Bus Tracker'', a bus monitor for IIUM students. The system integrates the API of two maps and calls the driver's mobile phone GPS positioning information, allowing students to check bus locations, driving routes, and bus schedules through the web page to shorten their waiting time, which will help them plan their time efficiently. Additionally, students can provide their feedback through our webpage. At the same time, it can also provide data support for the management department to plan the university bus schedule and optimise the bus service.**

Keywords*— *Real-time Location, Transportation Needs, Bus Location, Webpage, Maps API, Mobile Phone GPS

I. INTRODUCTION

The "IIUM Bus Tracker" web application is a university bus monitoring tool designed to assist IIUM students. Students can view bus locations, driving routes, and schedules through the web page to shorten their waiting time, which will help them plan their time better. At the same time, it can also provide data support for the management department to plan the university bus schedule.

A. Background of the problem

The International Islamic University Malaysia Campus (IIUM) has a vast campus area and complex transportation needs. Students of IIUM are expected to catch or take the bus on time when needed. However, students cannot get the bus's actual status, which makes them miss the bus, unnecessary waits, and other problems. To solve these problems, the "IIUM Bus Tracker" web application needs to be developed.

B. Problem Statement

(i) Long waiting time—Due to the lack of real-time information, students often wait a long time for the bus and are unsure when to wait efficiently.

(ii) The bus is not announced. Students miss or waste time because of temporary bus changes.

(iii) There is no specific platform for Bus schedules. Students often rely on a variety of inefficient methods to obtain bus schedules, including printed schedules, posted routes, and word-of-mouth information. They often feel confused when trying to find the bus schedules.

C. Objectives

(i) Develop a Web-based bus tracker to track buses for IIUM students in real-time. Integrate with location API for the web application to accurately track the position so that students and drivers benefit.

(ii) Place an announcement board in our web application where students can easily check some information and the occurrence of emergencies on the bus. It can reduce their time waste as well as help them make other choices in advance.

(iii) The bus schedules should be placed on the IIUM Bus Tracker web application so that students can find them easily. The user feedback should also be placed on the web application so that students can give feedback.

D. Project Scope

Views:

(i) Users will be able to use any of their smart devices to open our web pages and track the bus.
(ii) Our web application will allow users to accurately determine the bus's real-time location.
(iii) Users will be able to use our web to view the buses' related announcements and schedules.
(iv) Users will be able to provide and upload feedback to bus services and related content through the Web.
(v) Administrators will be able to update the announcement and the bus schedules in time.
(vi) Administrators will be able to check user feedback through our web applications accurately.
(vii) Drivers will be able to turn on and off the GPS for different routes on mobile applications.

Target audience:

All students of IIUM, IIUM Bus Administrators, and IIUM Bus drivers.Platform Used:

GPS (via the driver's cell phone), Web server, HTML, CSS, VUE.js, UniSpp, Axios(For request interface), PHP, and FastAdmin.

II. LITERATURE REVIEW

The literature review is an essential component of our system development, as it ensures that the design and implementation of the system are based on sufficient theoretical foundations and practical experience. Furthermore, the respected literature review will focus on every detail, some of which will help us analyze systems being developed in real-time and provide the best possible results. In addition, this analysis will enable us to gain insight into the advantages and problems of developing such systems

and understand the importance of building them with detailed information about their shortcomings so that they are not repeated in upcoming systems. Therefore, it will assist us in providing a better system.

The transportation system is a fundamental issue that needs attention on a large campus. According to a study, “An effective transportation system has an effective movement of goods and people, which leads to a better quality of life and better social and economic growth of the society. The transportation system forms the heart of the system. With the population boom, the vehicle population is also rapidly increasing, which is further leading to heavy traffic [3].”

Several similar systems may emphasise comparable mechanisms to the "IIUM Bus Tracker." This analysis has identified some existing systems worth learning from and highlighted certain problems we need to avoid. These diverse perspectives, both positive and negative, assist us in brainstorming ideas and hopefully achieving outstanding results for the completion and development of the "IIUM Bus Tracker."

Five websites were selected for the literature review: Moovit [4], Sydney.com [5], Bus Tracker for Rice University [6], Bus Tracker for the University of Greenwich [7], and Bus Tracker for Stony Brook University [8]. “By comparing these websites, we can identify the fundamental aspects of bus tracker websites. There is no standard application for vehicle tracking. The applications are written to suit the existing scenario’s needs.” [2]. Moreover, these websites were particularly impressive, highlighting potential additional features that could enhance the IIUM Bus Tracker website. Figure 1 below clearly and intuitively shows the differences between similar web pages or applications, providing support and inspiration to make our own web pages.

TABLE I. TYPES OF FACIAL RECOGNITION SYSTEM

Existing	**Moovit**	**Bus tracker for the University of St. Thomas**	**Bus tracker for Rice University**	**Bus tracker for University of Greenwich**	**Bus tracker for Stony Brook University**
Platform (online)	✓	✓	✓	✓	✓
Login	✓	✗	✗	✗	✗
Simplicity	✗	✓	✓	✓	✓
Navigation	✓	✓	✗	✗	✗
Home Page	✓	✓	✗	✗	✗
Bus real-time location	✓	✗	✗	✓	✓
Bus Routes	✓	✓	✓	✗	✗
Announcement	✗	✗	✗	✓	✓
Overview	✓	✗	✗	✗	✓
Schedule	✓	✗	✗	✗	✗
User Feedback	✓	✓	✗	✗	✗

According to our research, “The way people move around their communities’ public transportation systems is the main problem which plays an increasingly important role.[1]” So, when adapting the project, we studied similar systems in Table 1 and decided on the features to include in the IIUM bus tracker website. These include a Bus Map, Real-time location, Timely Announcement, Schedule, User Feedback, Update functionality, GPS access, Simple Navigation, Attractive Design, integration with Google Maps, and a way for administrators to log in. User Feedback is an additional feature that allows users to get in touch with bus management and leave feedback, allowing them to contribute to optimising the bus service.

III. METHODOLOGY

A. Development Approach

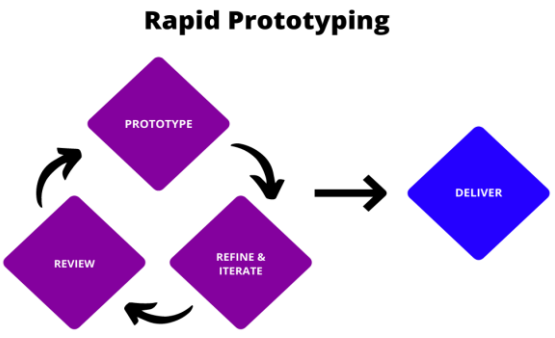

Fig. 1. Rapid prototyping

Rapid prototyping [9] is crucial for the IIUM Bus Tracker project. It involves swiftly creating preliminary system versions to test functionality, design, and usability. This iterative approach allows for quick modifications based on user feedback, ensuring the system aligns with end-user preferences. It also helps visualise system capabilities early on, aiding in user understanding and participation in the design process. Additionally, rapid prototyping ensures flexibility in adapting to changing user needs and seamlessly incorporates new features. This dynamic process facilitates quick adjustments and refinements based on user feedback, validating design decisions early and addressing usability issues effectively.

B. Requirement Specification

Functional requirements of "IIUM Bus Tracker":

- Allowing users (students, staff, and visitors) to view the buses' live location, announcements, and schedules.
- Get the real-time location of the bus through the drivers turning on the GPS.
- Allowing system administrators to add and modify announcement information with all necessary details and update the bus schedule.
- Allow users to submit feedback.

Non-functional requirements for "IIUM bus tracker":

- User-friendly and easy to navigate for all users.
- Responsive and accessible on laptops and mobile phones.
- Reliable, ensuring the real-time location of the bus, schedule, and announcement is accurate.
- Clear and concise instructions so users understand how to use it.
- Security and easy user access.

C. System Design

Use case diagram

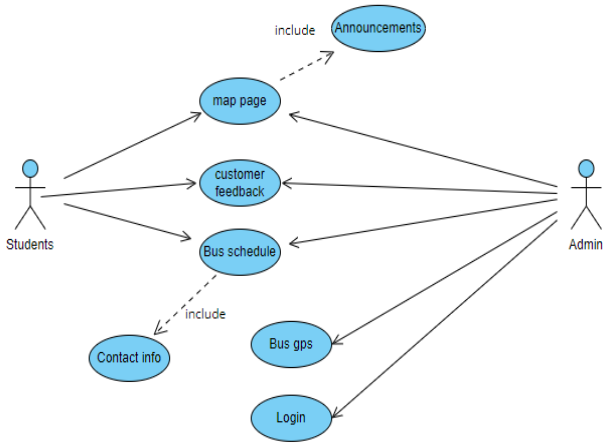

Fig. 2. Use case diagram

Sequence diagram

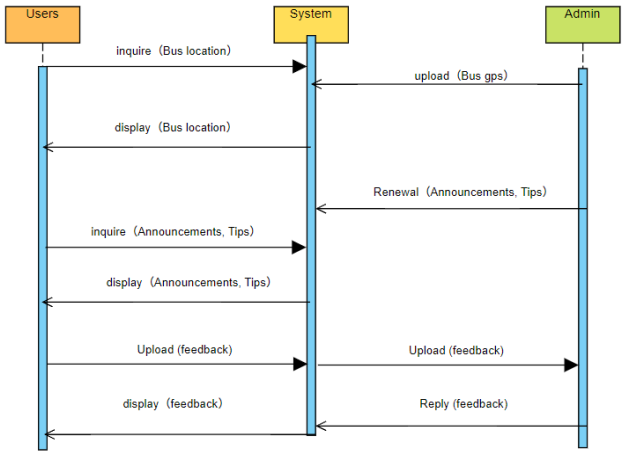

Fig. 3. Sequence diagram

D. Database Design

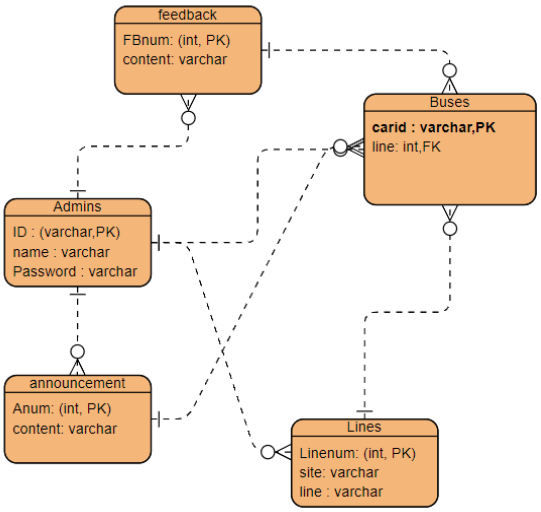

Fig. 4. Database design

IV. RESULT

A. Users

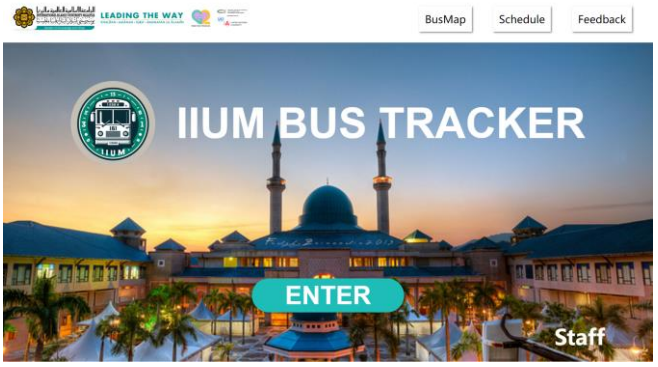

Fig. 5. Home page

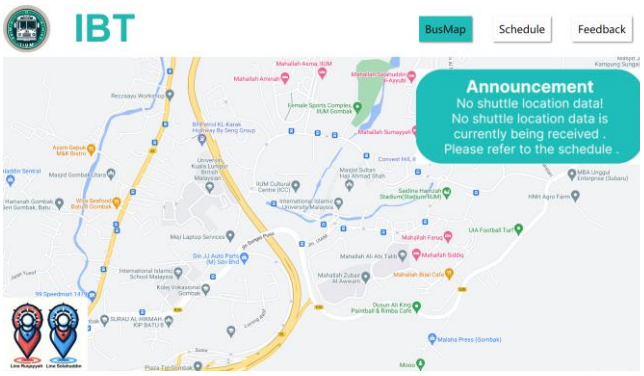

Fig. 6. Bus map page

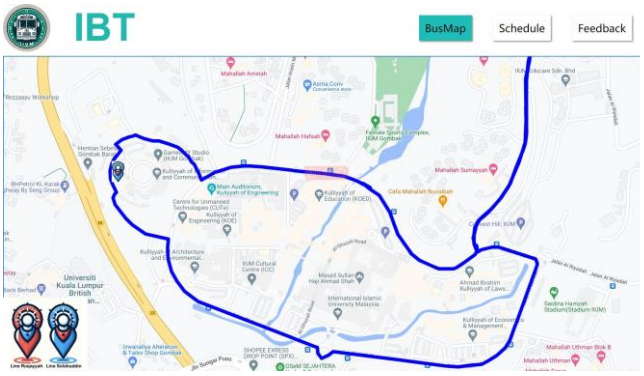

Fig. 7. Bus map page - Salahuddin Line

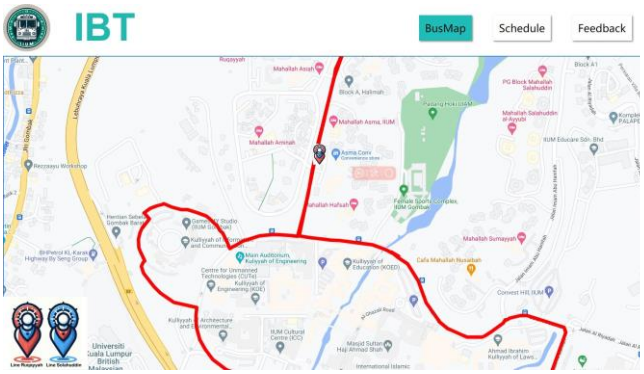

Fig. 8. Bus map page - Ruqayyah Line

Fig. 9. Schedule page

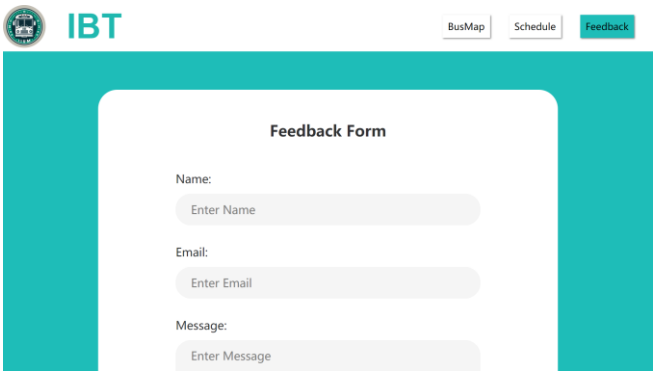

Fig. 10. Feedback page

B. Driver

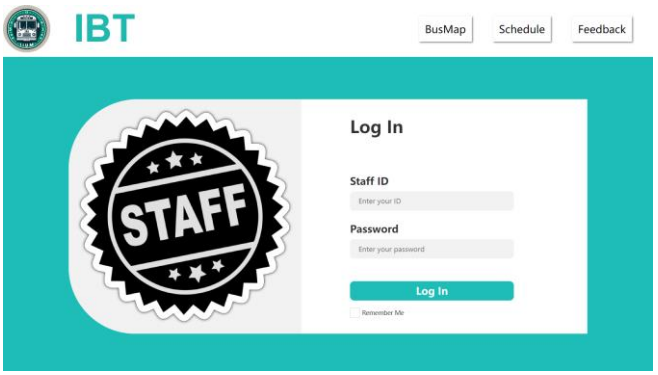

Fig. 11. Staff login page

Fig. 12. Driver GPS mobile application page

C. Admin

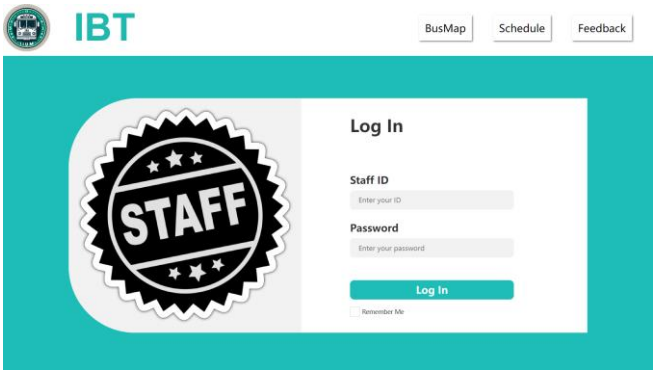

Fig. 13. Staff login page

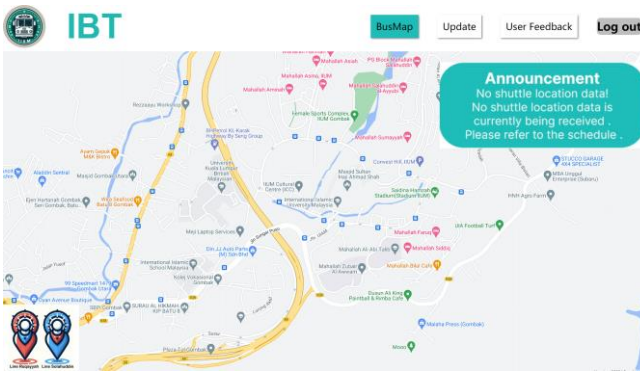

Fig. 14. Admin bus map page

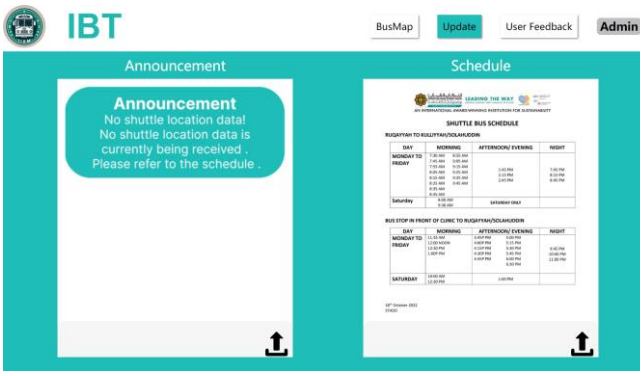

Fig. 15. Update page

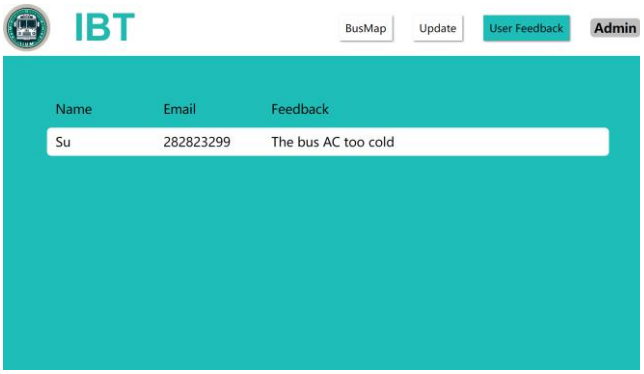

Fig. 16. Admin User Feedback Page

D. User Acceptance Test

The test plan involves User Acceptance Testing, where developers will interview users to evaluate if the application fulfils all the functions and performances. The developers interviewed three KICT students from IIUM who are always waiting for the bus. The selected users played different roles while testing the "IIUM Bus Tracker" system. The roles assumed by the users during the testing were those of students, admin, and drivers. During the UAT, the respective testers tested and explored each feature and function. Their diverse perspective, participation, and valuable feedback play an important role in fulfilling the "IIUM Bus Tracker" system. They provided some remarks to clarify their understanding of the system.

UAT Remarks as follows-

- Beautiful Home Page
- Easy to check bus map page
- Easy to find bus schedule
- Easy to fill the form for feedback
- Convenient to return to home page by clicking the logo
- Easy to turn on GPS in mobile application
- Easy to login
- Simple update operation
- Clear feedback page

V. CONSTRAINTS

Our project has certain limitations, but we have tried our best during development to avoid them or find other alternatives.

1. We initially planned to use Arduino boards for our web page to call bus location information. Still, considering the hardware cost and the simulation comparison of the effects after implementation, we chose to use GPS. The reason is that the hardware needs to be installed, and regular maintenance will bring unnecessary costs. The main feature of Arduino boards is that we can customise the development. For example, we can use this method later when we need to obtain the temperature, humidity and other information on the bus. Overall, using mobile phones GPS is an optimal solution that reduces costs and eliminates the need to install and maintain equipment.

2. API cost issue: Currently, our bus location uses Google Map API and Gaode Map API. They will have certain restrictions on individual users, such as positioning accuracy, request limit, API route planning, etc. We need to purchase subscriptions to unlock these features later, and these issues can be implemented after the project receives financial support.

3. Server problem: Because of the access restrictions of Google Map API, we chose to use Gaode Map API to obtain longitude and latitude information for the website. Because of the particularity of our web pages, we need to consider both working together when selecting a server. We deployed our web page and tested it to give users a better experience when displaying it. This problem can also be solved after receiving financial support from the API.

VI. SIGNIFICANCE OF THE PROJECT

The IIUM Bus Tracker web app significantly enhances the overall campus experience for students, drivers, and administration. Its importance can be described in several key ways:

1. Enhanced Convenience: By providing real-time bus location information, driving routes, and schedules, the web app significantly reduces the uncertainty and inconvenience of campus bus commuting. Students can accurately plan their trips, minimise waiting times, and optimise their schedules.

2. Improved Time Management: With timely and accurate bus location data, users can effectively manage their time, ensuring on-time attendance for classes, meetings, and other activities. This promotes a more efficient and productive academic and professional environment.

3. Enhanced User Experience: The web app's intuitive interface ensures a seamless and user-friendly experience for all users. Users can easily access important information about bus services, enabling them to navigate the campus with ease and confidence.

4. Feedback Mechanism: The inclusion of a feedback feature enables users to voice their opinions and concerns about bus services directly through the web application. This fosters a culture of transparency and responsiveness, enabling administrators to resolve issues in a timely manner and adjust services to meet user needs better.

5. Environmental sustainability: By promoting public transportation and minimising unnecessary waiting time, the IIUM Bus Tracker web application contributes to the university's sustainable development goals by reducing carbon emissions associated with private vehicle usage.

In summary, the IIUM Bus Tracker web application marks a transformative advancement in campus transportation management, providing tangible benefits regarding convenience, efficiency, user experience, and sustainability.

VII. CONCLUSIONS

We successfully developed three main stations serving users, drivers, and administrators in this project. Users can access the webpage through any smart device to obtain campus bus location information in real-time and view real-time announcements and the bus schedule of the current semester. Besides, drivers can share GPS positioning information through the mobile application, provide real-time location information of the bus to the web page, and change the route displayed on different routes through the mobile application to achieve flexible changes. Additionally, administrators can log in to the Admin page by using their staff ID; they are able to detect the operating status of each bus through the bus map page and update bus schedules and announcement information through the update page, as well as check user feedback to improve the bus service quality. Although the project has some limitations, such as hardware selection, API cost issues, and server issues, we have worked hard to find solutions. We plan to further optimise the website based on user feedback, including selecting better servers, considering other hardware solutions, and providing disability-friendly pages.

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Pendekar Siber Portal: Empowering Malaysian Youth Through Cybersecurity Education

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***Abstract*— The rise of digitalization and interconnected environment has made cyber threats more prevalent today. To address these threats, organizations need cybersecurity experts to defend their information systems from cyber-attacks. Hence, Malaysia is in need of 30,000 cybersecurity knowledge workers by 2030. To address this critical need, the Pendekar Siber initiative was created to build Malaysia's cybersecurity capability by educating and recruiting youth to become a *pendekar siber* (cyber warrior, defender of the cyber realm). The program utilizes a sustainable train-the-trainer model, ensuring that trained individuals can further train their peers, thus expanding the reach and impact of cybersecurity education. The initiative includes the development of a comprehensive online platform designed to not only enhance cybersecurity awareness among young people but also to spark their passion for cybersecurity and inspire them to pursue a career in the field. This portal features cybersecurity training modules, discussion forums, personality tests, and cybersecurity career information. It was developed using Agile software development principles and used vxjs, visual studio, node.js and mongodb to develop the web portal.**

Keywords*— Cybersecurity, cyber safety, education, online safety, youth

I. INTRODUCTION

As dependency on the Internet grows, cyber-attacks are on the rise. Organizations need experts to defend their information systems but it is difficult to get the right ones. This is because there is a gap in cybersecurity capacity in Malaysia and the world. [1] reports that Malaysia needs 30,000 cybersecurity experts by 2030. Nevertheless, the cybersecurity skill shortage continues to rise despite the lucrative salary offered by companies. In 2023, it was reported that Malaysia is short of 12,000 cybersecurity knowledge workers [2]. At the same time, cyber safety and security stand at the intersection of education and youth awareness, and it has become increasingly critical in today's digital landscape. The youth today is our future generation that is going to defend the cyber space. However, according to [3], students, teachers and parents are not familiar with the existence of job professions in cybersecurity.

Realizing the cybersecurity capacity challenges described above, this study introduces the Pendekar Siber Portal which embodies a proactive response to the escalating cyber threats, with a focus on fostering cybersecurity awareness and engagement among Malaysian students, educators, and parents. By showcasing cybersecurity as a viable career path, the program addresses skills gap in this field both locally and globally. The Pendekar Siber Portal aims to equip young individuals with essential knowledge and skills for safe navigation in cyber space through engaging and interactive methods. It integrates comprehensive modules, quizzes, and discussion forums to provide a holistic approach to cybersecurity awareness. By offering career opportunities and personality tests, the portal does not only enhance online safety but also opens avenues for young learners to explore and pursue cybersecurity-related professions. This approach helps bridge the cybersecurity knowledge gap among Malaysian youth and meets the rising demand for cybersecurity expertise in both public and private sectors. Through targeted advocacy efforts and awareness campaigns, Pendekar Siber empowers individuals and contributes to the development of a skilled workforce urgently needed in the field of cybersecurity [3].

II. BACKGROUND

In this study, the term cyber safety and security is referred to as the protection of user's "infrastructure from cyber threats and attacks, and protecting people's physical, mental, and emotional health from any harm through the Internet use" [3, p.2].

With the increasing prevalence of cyber threats such as cyberbullying [4], gaming disorder [5], and online sexual exploitation [6], there is a critical need to educate and equip young individuals with the necessary knowledge and skills to stay safe in the digital landscape. While there are existing cyber safety websites, they often contain outdated information and do not include a personalized experience for youths to find out more about cybersecurity career path. This leads to cybersecurity knowledge skills gap and increased vulnerability among youth.

Cases of these top three cyber threats: (1) cyberbullying, (2) gaming disorder, and (3) online grooming or sexual exploitation that are increasing day by day highlight the importance of educating youth about cyber safety and security [3]. The high demand for cybersecurity professionals underscores the need to spark youth's interest in this field. However, existing web resources in this area are often offer uninteresting teaching content, without personality tests that can match the suitable cybersecurity profession and quizzes to test user's knowledge, making it difficult to effectively teach digital safety and engage youth in cybersecurity careers.

A. Objectives

Therefore, the Pendekar Siber Portal aims to revolutionize cybersecurity education, training and awareness by crafting an innovative and user-centric online platform. Geared

towards Malaysian youths aged 15 to 24 (the age range for youth based on [7]), the platform endeavors to offer an immersive and interactive environment complete with the latest cybersecurity information, practical resources, and engaging learning experiences. By instilling a culture of cybersecurity empowerment, the goal is to equip young individuals with the pre-requisite knowledge, skills, and tools to secure the digital realm with confidence. Moreover, the project aspires to forge strategic partnerships, initiate community engagement endeavors, and implement robust user feedback mechanisms to continually refine and enhance the Pendekar Siber Portal, ensuring its sustained relevance and impact amidst the ever-evolving cybersecurity landscape. Through these concerted efforts, Pendekar Siber is envisioned as a dynamic force driving positive change and resilience in the cybersecurity education.

B. Project Scope

The scope of the project covers two users: (1) Administrator (admin) of the system and (2) User. Below are the functionalities for each users.

1) System Functionality

a) Admin

An administrator of the system can perform the following functionalities:

Log in to the admin dashboard

Create, read, update, and delete posts for cybersecurity articles, career information, and events

Monitor the forum page for any inappropriate content

b) Target Users

The portal is targeted to youths from 15-24 years of age. They can perform the following functionalities:

- Access all pages including homepage, cybersecurity articles, career information, forum, events, and about us
- Participate in discussions by writing posts and replying (if logged into their account)
- Attempt quizzes
- Perform personality test

III. SYSTEM REVIEW

In system review, an in-depth examination of five existing cybersecurity education platforms was conducted and they are as follows: (1) Pendekar Siber Prototype 2020 [8], (2) Cybervengers [9], (3) CyberSafe [10], (4) Be Internet Awesome [11], and (5) Childnet [12]. These platforms represent a diverse range of approaches to cybersecurity education, each with its own set of features, content offerings, and user interfaces. By thoroughly evaluating these systems, we aimed to gain insights into their effectiveness in engaging and educating users, particularly young individuals to learn about cyber safety and security.

Based on the evaluation of the above existing platforms, important factors such as user experience, interactivity, content relevance, and gamification elements were missing from the existing platforms. By comparing and contrasting these platforms, common trends and best practices were identified, and the improvement of cybersecurity education was delineated. This comprehensive review laid the groundwork for the development of the Pendekar Siber Portal. Below are the features that are deemed to be beneficial for users to learn better about cyber safety and security, and at the same time can spark their interest to choose this field as a profession.

Profile:
Users can showcase their professional details, including a profile picture, education, achievements, and interests.

Cyber Safety Module:
Three modules cover cyberbullying, sexual exploitation, and gaming disorder, offering information, tips for protection, and quizzes to test knowledge.

Discussion Forum:
A space for users to ask questions, share information, and discuss cybersecurity topics, with options to report inappropriate content.

About Us:
Describes Pendekar Siber's mission and activities, with links to social media and multimedia content showcasing past events.

Personality Test:
Uses the Holland Code to match users' personality types with cybersecurity careers, helping identify suitable career paths.

Cybersecurity Career Content:
Provides resources on cybersecurity careers, including industry insights, job descriptions, and certification guides.

These features were adopted in our Pendekar Siber Portal. Thus, the table below shows the mapping of these features across the five existing platforms.

TABLE 1. CMPARISON OF SIMILAR SYSTEMS

Functionality of system	Pendekar Siber Prototype 2020	Cyber Vengers	Cyber Safe	Be Internet Awesome	Childnet	Pendekar Siber Portal
Profile	×	×	×	×	×	✓
CyberSafety Module	✓	✓	✓	✓	✓	✓
Discussion forum	×	×	×	×	×	✓
About us	✓	✓	✓	✓	✓	✓
Personality test	×	×	×	×	×	✓
Cybersecurity career content	×	×	×	×	×	✓

Based on Table 1, all platforms provide Cyber Safety Modules and About Us features. However, profile, discussion forum, personality test and career path are not provided. Therefore, the proposed web portal covers the entire six features to offer a personalized experience to learn more about cyber safety and security, and how to become a cybersecurity professional. This strategy creates a dynamic and effective online platform for cyber safety and security education, training and awareness. It aims to equip young

individuals with the necessary knowledge to address cyber threats and secure the cyber space.

IV. METHODOLOGY

Fig.1. Agile Methodology [13]

The system development of the Pendekar Siber Portal followed the Agile methodology [13] as shown in Fig. 1, which emphasizes flexibility, user feedback, and iterative progress through sprints. This approach enabled the team to continuously refine the platform based on user needs and evolving requirements. Key phases of this method are: (1) planning and requirements gathering, (2) designing, (3) developing, (4) testing, (5) deploying and (6) reviewing. This framework ensures that each phase is adaptable, allowing for ongoing adjustments to improve user engagement and platform effectiveness. Regular stand-up meetings and sprint reviews kept the team aligned and focused, while continuous integration and testing ensured stability and reliability throughout the development cycle.

The following subsections show the system development of the Pendekar Siber Portal:

A. Planning and User Requirements

To address the specific needs and challenges identified, user requirements were gathered through a survey. The questionnaires of the survey were developed based on existing surveys developed by the research team for different projects. Data on demographics, Internet usage, cyber threat experiences, and desired features in a cyber safety application were collected. The insights gained from this survey informed the development of a solution tailored to effectively meet the needs of the target audience.

1) Survey Analysis and Findings

Understanding of the cyber threats faced by youth was captured through a detailed online survey. This survey, conducted with 50 respondents in Malaysia aged 15-24, utilized Google Forms and was segmented into four key areas: General Information, Cyber Safety Awareness, Cybersecurity Career Interest, and Solution Preferences. The data collected from this survey provided valuable insights into demographics, internet usage patterns, experiences with cyber threats, and preferences for features in a cyber safety application. This was instrumental in defining the user requirements for the development of the Pendekar Siber Portal.

a) Demographics

23 males and 27 females responded to the survey, displaying an almost balanced gender representation. Internet usage varied as follows: (1) 23 respondents spent 7 to 9 hours online daily, indicating significant time spent on digital activities, (2) 9 respondents spent 4 to 6 hours and (3) 9 respondents spent 10 to 12 hours online, (4) 2 respondents used the internet for 1 to 3 hours, and (5) 7 used it for 12 hours or more. Fig. 2 illustrates the graph for such findings.

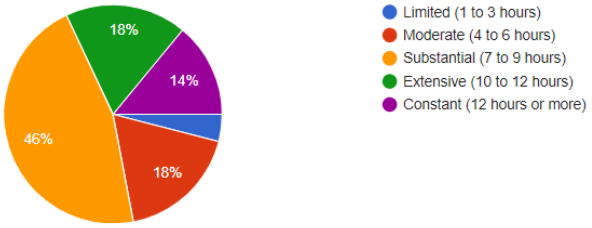

Fig.2. Hours of internet usage

These results highlight the diverse internet usage habits and the importance of digital connections in daily lives.

b) Encountered Cyber Threats

Findings revealed diverse cyber threats faced by the respondents, with the highest threat being Gaming Disorder in which 62% of respondents admitted of doing so. Second highest is Cyberbullying with 58% of respondents encountered this threat. Thirdly, 40% reported to have experienced Sexual Exploitation. Other threats include identity theft, phishing, and online scams with 2% of respondents. These findings align with the focus of Pendekar Siber Portal on cyber threats, highlighting the prevalence of the stated cyber threats in [3][4][5][6]. Fig. 3 depicts the summary of these findings.

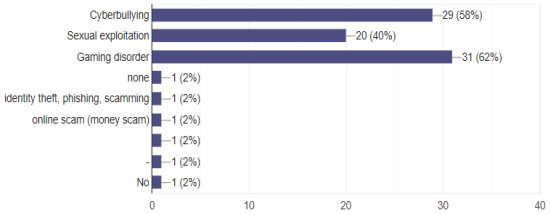

Fig.3.Types of cyber threats encountered by respondents

c) Cybersecurity Career Interest

The results show that a significant portion of respondents were interested in pursuing cybersecurity as their career, indicating their awareness of the high demand for cybersecurity experts in various industries. Out of the total respondents, 66% of respondents were interested in cybersecurity. On the other hand, only 2 respondents answered negatively, indicating they were not interested. The remaining 15 respondents (30%) chose the option "Maybe," suggesting uncertainty or partial awareness of cybersecurity as a profession. Overall, most participants seem to recognize the prevailing demand for cybersecurity experts, emphasising the perceived importance and relevance of cybersecurity skills across different industries [1][2][3]. Fig. 4 illustrates these findings.

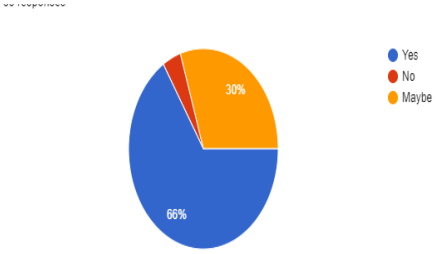

Fig.4. Interest in pursuing cybersecurity as a career

d) Familiarity of Job Opportunities in Cybersecurity

These results reveal a diverse range of familiarity of job opportunities in cybersecurity. The highest number of respondents, 16 individuals (32%), rated their familiarity as a 3, indicating a moderate level of familiarity. This is followed by 13 respondents (26%) rated their familiarity as a 4, suggesting a relatively higher familiarity level. Ten respondents (20%) rated their familiarity as a 2, indicating a lower level of awareness, while six respondents (12%) provided the highest rating of 5, signifying a strong familiarity with the job opportunities in cybersecurity. Lastly, 10% admitted that they had low familiarity (rated themselves 1). The distribution of responses across the rating scale highlights varying degrees of familiarity of job opportunities in this field among participants, with a notable concentration in the moderate to high familiarity range. Fig. 5 summarizes these findings.

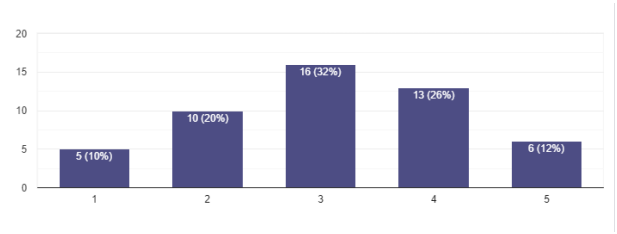

Fig.5.Distribution of familiarity of job opportunities in cybersecurity

Overall, according to the survey findings, it can be concluded that the development of the Pendekar Siber Portal web application is imperative in educating the youth of cyber safety and gauge interest in cybersecurity field. The fact that they were interested in pursuing cybersecurity as their career path, majority of respondents only possessed moderate familiarity of job opportunities in this area. These findings also confirmed the top three cyber threats that are prevalent among youth are in line with findings by [3].

B. System Development Approach

Agile methodology, known for its flexibility and iterative approach, is assumed to be ideal for the Pendekar Siber project. By breaking the development process into smaller iterations, or sprints, Agile allows for adaptability to changing requirements and user feedback. This user-centric approach ensures that the platform meets the needs of Malaysian youth seeking cybersecurity education, training and awareness programs. Additionally, Agile's incremental delivery promotes tangible progress and early stakeholder feedback, facilitating collaboration among cross-functional teams involved in the project. Overall, Agile provides a framework that aligns with Pendekar Siber's objectives by emphasizing flexibility, user-centricity, incremental delivery, and collaboration [13].

C. System Analysis

During the system analysis phase, findings from the user survey were analyzed to understand the user requirements. Based on the survey results, the system was designed accordingly. Since the top three threats were cyberbullying, gaming disorder and online grooming, the training modules are focused on these three threats.

E. System Design

The system design meticulously considers user interaction and prioritizes seamless navigation throughout the Pendekar Siber Portal. Notably, the design emphasizes the creation of a personalized profile page, where users can showcase their achievements and interests in cybersecurity. Additionally, a dynamic homepage serves as the central hub, offering updates and highlighted topics to keep users engaged. Educational modules on the top three cyber threats, coupled with interactive quizzes, enhance user learning and preparedness in combating online risks.

Furthermore, the inclusion of a discussion forum fosters community engagement, allowing users to exchange insights, seek advice, and contribute to cybersecurity conversations. Overall, the design centers on delivering an immersive and informative user experience that empowers individuals to navigate the digital landscape securely.

Fig. 6 below shows the use case diagram of this system.

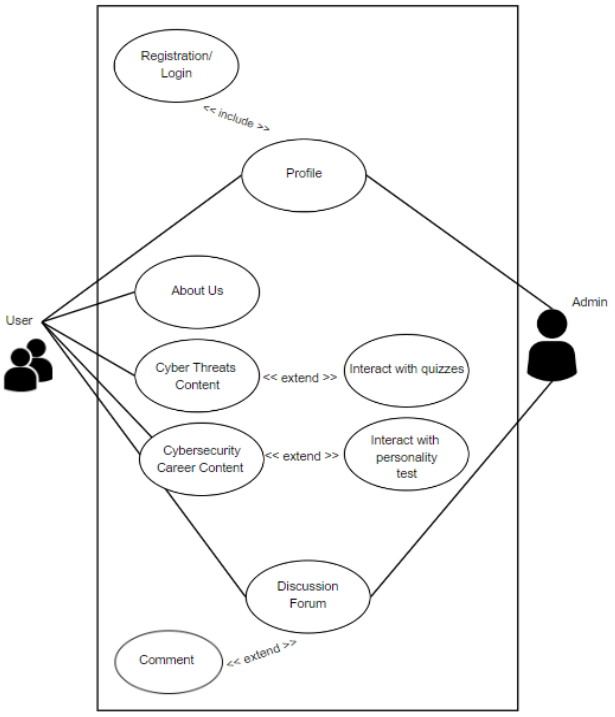

Fig.6.Use Case Design Diagram

The use case diagram shows that a user can create his or her profile, access the About Us page, learn about cyber safety and security from the Cyber Threats Content, learn more about Cybersecurity Career and participate in Discussion Forums. Through the Cyber Threat Content, users can take quizzes to test their knowledge in the area. Additionally, through the Cybersecurity Career, users can take the Personality Test, in order to know which areas in cybersecurity are suitable for their personality.

F. Database Design

The database is designed using MongoDB, supporting efficient data storage and retrieval for user information, educational content, quizzes, and forum posts.

In this database schema, there are three main entities: User, Post, and Comment. Users can create posts, which consist of content and other details. Comments can be made on posts, and each comment is associated with a specific post and user. Additionally, administrators, identified by the "isAdmin" flag in the User entity, possess elevated access rights. They can view a dashboard, providing insights or administrative tools for managing user activity, content, or system settings. This structure facilitates user engagement, content creation, and interaction while enabling administrators to oversee and maintain the platform effectively. The User entity stores data such as usernames, emails, passwords, profile pictures, educational backgrounds, accomplishments, interests, personality types, quiz scores, and registration status. The Post entity includes data like user IDs, post content, titles, images, categories, and slugs. Finally, the Comment entity contains data regarding comment content, post IDs, user IDs, likes, and like counts. Fig. 7 depicts the Entity Relationship Diagram for this system.

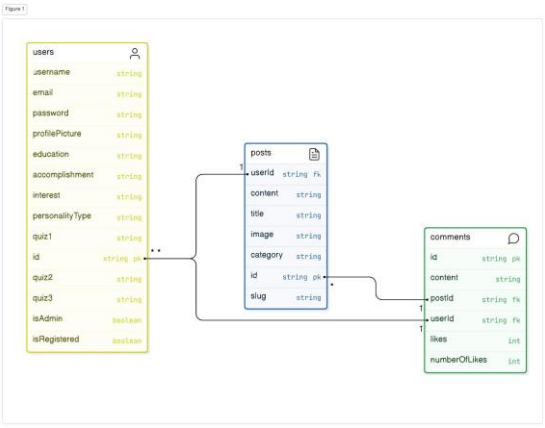

Fig.7.Entity Relationship Diagram

II. The Pendekar Siber Portal

E. Features for Users

This section presents the user's views of the Pendekar Siber Portal, encompassing the Homepage, About Us, CyberSafety Modules with Quizzes, Personality Tests, Cybersecurity Career, Discussion Forum, and Profile Page. Screenshots of each view are shown in the figures below.

The homepage of the Pendekar Siber Portal (Fig. 8) features an engaging layout, highlighting the portal's mission and providing quick access to key sections like CyberSafety Modules, Discussion Forums, and Cybersecurity Career resources. It serves as the main entry point for users, showcasing the latest updates and featured content.

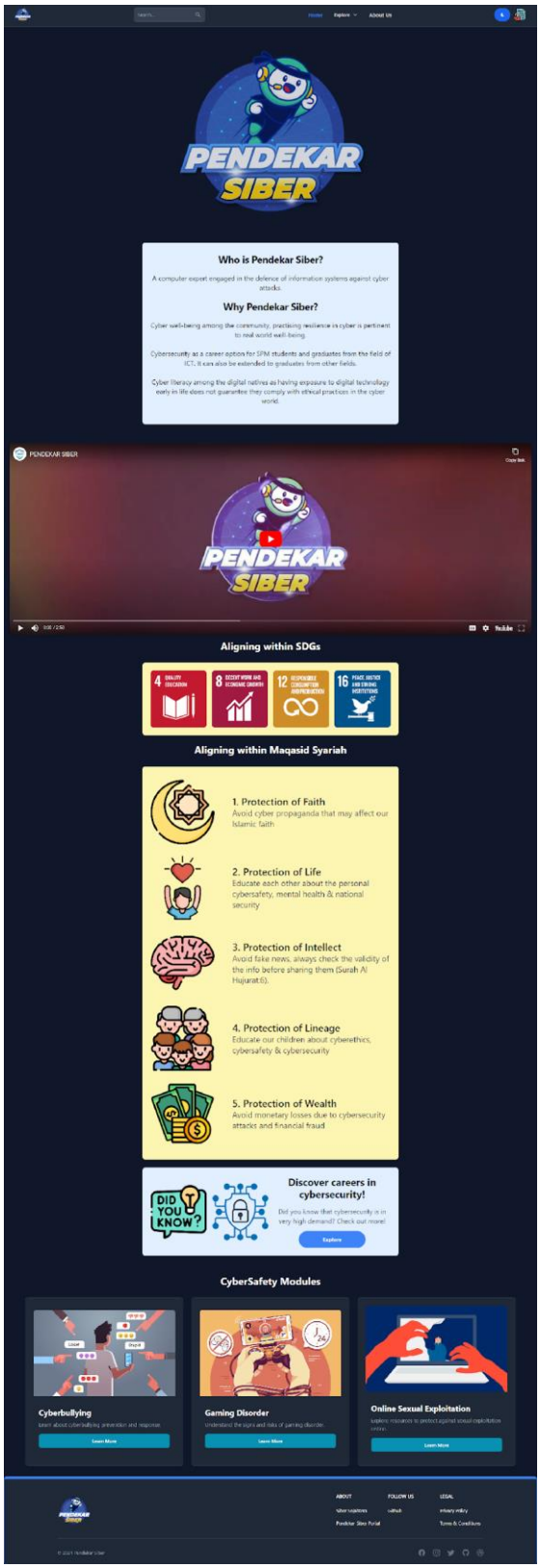

Fig.8.Pendekar Siber Homepage

The About Us page (Fig. 9) offers a detailed overview of the Pendekar Siber past initiatives and events. It encapsulates the details of each events with description and pictures.

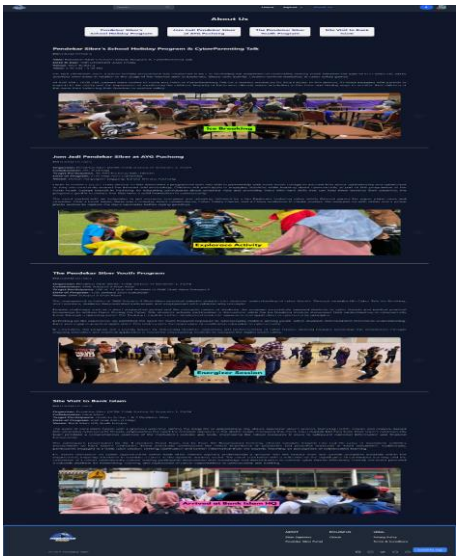

Fig.9.About Us Page

The CyberSafety Modules page (Fig. 10) contains interactive educational content on various cybersecurity topics such as cyberbullying, gaming addiction , and online sexual exploitation. Each module includes information, tips, and quizzes designed to enhance the user's understanding of cyber threats and safe online practices.

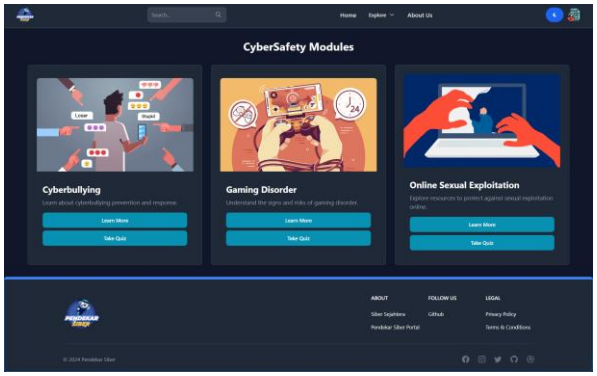

Fig.10.Cybersafety Modules Page

This page allows users to test their knowledge after completing the CyberSafety Modules. It features multiple quizzes (Fig. 11) that cover the topics of cyberbullying, gaming disorder, and online sexual exploitation, providing instant feedback and scores to encourage learning and retention.

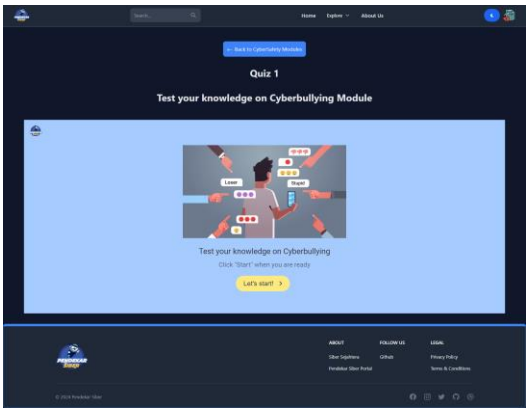

Fig.11.Cyberbullying Quiz Page

The Cyberbullying Module (Fig. 12) page offers in-depth information on cyberbullying, including definitions, examples, prevention strategies, and advice for victims. This module aims to raise awareness and equip users with the tools to recognize and respond to cyberbullying incidents. This layout is synchronized for the two other modules: gaming disorder and online sexual exploitation.

Fig.12.Cyberbullying Module Page

The Personality Test page (Fig. 13) utilizes the Holland Code model to help users identify their personality types and match them with suitable careers in cybersecurity. The test provides insights into personal strengths and how they align with various roles in the cybersecurity field.

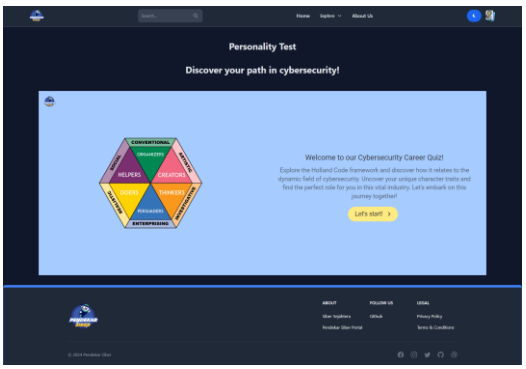

Fig.13.Personality Test Page

The Cybersecurity Career page (Fig. 14) provides comprehensive information on various cybersecurity professions. It includes job descriptions, industry insights, and certification guides to help users explore and pursue career opportunities in cybersecurity.

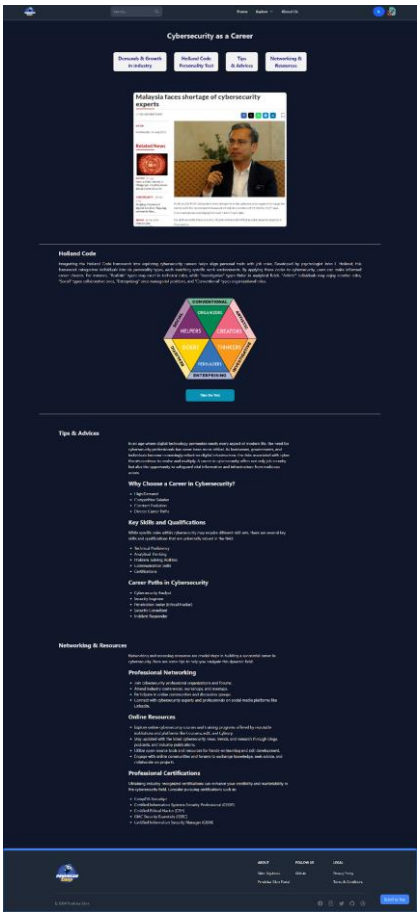

Fig.14.Cybersecurity Career Page

The Discussion Forum page (Fig. 15) is a community space where users can ask questions, share information, and discuss cybersecurity topics. It encourages interaction and knowledge sharing among users, with options to report inappropriate content to maintain a safe environment.

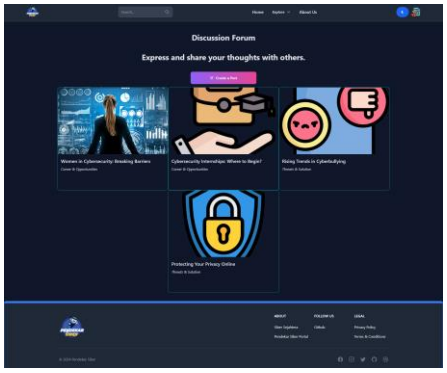

Fig.15.Discussion Forum Page

This page (Fig. 16) shows an individual post within the Discussion Forum, including user contributions, replies, and discussions. It allows users to engage more deeply by commenting on specific topics, sharing experiences, and contributing to ongoing conversations.

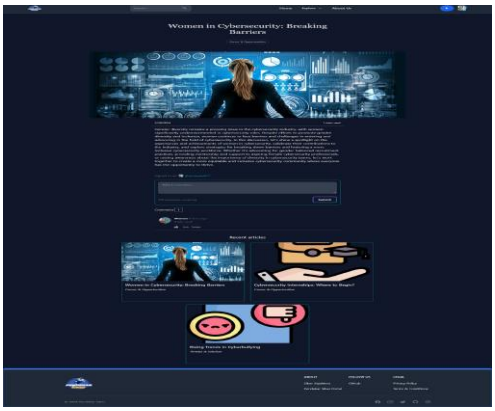

Fig.16.Post in Discussion Forum Page

The User Profile page (Fig. 17) displays individual user information, including profile picture, education, achievements, interests, and personality test results. It serves as a personalized space where users can update their details, track progress, and showcase their involvement in cybersecurity activities.

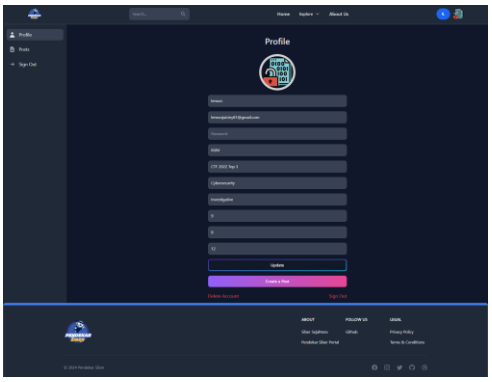

Fig.17.User Profile Page

F. Features for Administrator

This section presents the admin's views of the Pendekar Siber Portal, encompassing the Dashboard, Content Management System, User Management, and Analytics Dashboard. Screenshots examples of admin's views are shown in Fig. 18 and Fig. 19 below.

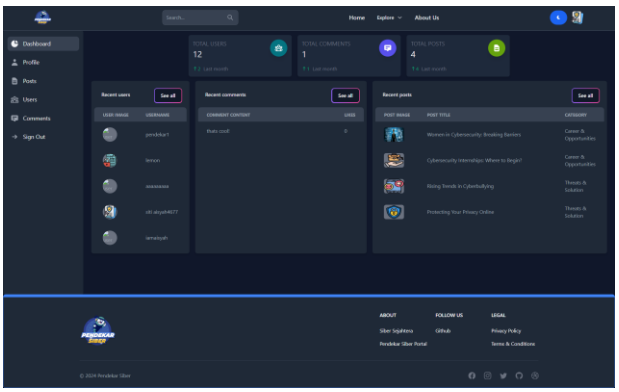

Fig.18.Admin Dashboard

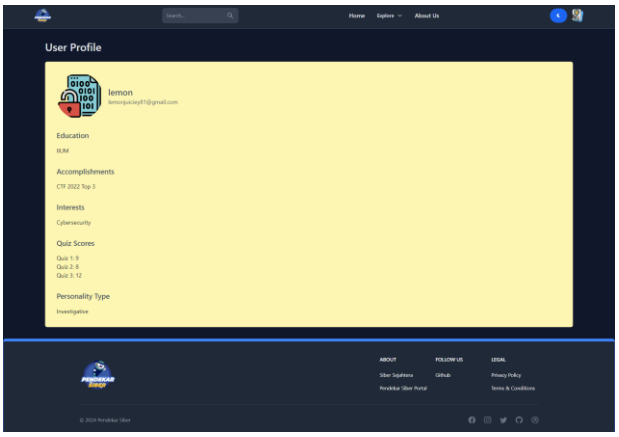

Fig.19.Admin view on registered users

III. USER ACCEPTANCE TESTING

The testing phase was executed through a comprehensive User Acceptance Testing (UAT) plan. This plan encompasses evaluations conducted on two distinct user categories: Administrators and general Users. By systematically examining the system's functionality and performance from the perspectives of both Administrators and Users, the test aims to ensure that the Pendekar Siber Portal meets the expectations and requirements of these key user roles.

For users:

- Log in and Log out.
- View cyber safety modules with quizzes, personality tests with career opportunities, discussion forum, and profile page.
- Engage with quizzes and personality tests to assess cybersecurity knowledge and explore career opportunities.
- Participate actively in the discussion forum by posting new topics, replying to existing discussions, and engaging with other users.

For administrator:

- Update Homepage information.
- Create, Update, and Delete cyber safety modules, quizzes, discussion forum topics, and profile page content.
- Monitor Forum Activity.

IV. FUTURE RESEARCH

To further improve the user experience and effectiveness of the portal, future enhancements could include integrating a certification or badge system for module completion, which would offer tangible recognition of learning achievements and encourage continued engagement. Additionally, incorporating data analytics to analyze user personality types and preferences could provide personalized learning experiences, enhancing both engagement and knowledge retention. Introducing gamification elements such as leaderboards and rewards would make the learning process more interactive and enjoyable, fostering a sense of accomplishment and motivating active participation. These proposed features will help the portal evolve into a comprehensive hub for cybersecurity education, empowering Malaysian youth to navigate the digital landscape safely and confidently. By maintaining a user-centric design and continually updating its features, the Pendekar Siber Portal will address the growing challenges of cyber threats and contribute to creating a safer online environment.

V. CONCLUSION

In conclusion, the Pendekar Siber Portal marks a significant step forward in enhancing cybersecurity education, training and awareness among Malaysian youth. It does not only provide cyber safety and security education, training and awareness to the youth but aims to spark the interest in cybersecurity as a career of choice. This study is important considering the current attention on cyber safety and security phenomenon in the development of cybersecurity capacity building.

ACKNOWLEDGEMENT

The Pendekar Siber program is registered and protected under the Copyright Act 1987. Pendekar Siber has won Gold Awards at PECIPTA 2022 & MTE 2022 and was among the finalists for MyHackathon 2020 and International Green Gown Award 2024.

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I-SAFETY: Personal Safety System for Emergency Situations

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***Abstract*—This paper focuses on the development of I-Safety, a hybrid mobile app designed to prioritize safety and protect travelers and adults. The design of the I-SAFETY app is grounded in Human-Computer Interaction (HCI) principles, focusing on accessibility, usability, and real-time feedback to ensure that users can activate emergency features intuitively and effectively under pressure. The app incorporates essential features such as incident sharing, SOS alerts, emergency help information, and preventive tips. Users will create an account and input contact members' as well as have access to emergency contact numbers through the app. In case of feeling unsafe or in danger, users can activate SOS alerts within the app. The system will then notify the user's contact by sharing the user's live location. The paper aims to enhance personal safety and provide timely assistance through technological means.**

Keywords—Personal Safety, Security, Emergency, Self-defense, Safety Measures

I. INTRODUCTION

Talking about safety is a major problem nowadays. Although the students and people are taking all the necessary precautions needed to be taken for their safety, however as technology is rising, people tend to use their phone as the safety measure, with the increased use of technology and smart devices which creates an opportunity for a simple and low-cost safety measure that will assist people to overcome any threat. Thus I-SAFETY, which is a personal safety mobile application designed to assist people overcome when they are in dangerous situations by considering user-centred design (UCD) for enhancing user experience in interactive systems. To ensure that their needs, preferences, and goals are met, users are involved in the design process at every level of UCD. Iterative design, usability testing, and user research can all teach designers about how users behave. In response to user feedback, they can then iterate enhance their designs. UCD works to create software that is easy to use, intuitive, and straightforward to comprehend [10].

The app provides a wide range of features that can help users to connect with emergencies and notify their designated contact members if they are in danger. For instance, it enables users to have real-time tracking on their location as well their friend’s location allowing them to notify contact members about their whereabouts for emergency assistance. The identified problems of increasing crime rates and the lack of immediate support during emergencies highlight the critical need for innovative safety measures.

The primary objectives of I-SAFETY App include providing users with a reliable and accessible tool to enhance their sense of security in potentially dangerous situations, empowering them to take control of their safety, and furnishing them with a platform that not only aids in alerting their contacts but also provides their location.

The I-SAFETY app incorporates HCI principles to reduce cognitive load so that users can find and use the emergency features quickly, even in stressful situations. User-centered design is used throughout the interface, which is crucial in high-stress safety scenarios.

A. Research Scope and Limitations

I-SAFETY is committed to offering safety precautions to IIUM students and others, especially travelers who are unaware of their surroundings while going about their daily lives. It is secure and has a long-term goal such as improving the app's features and functionality for increased user engagement. One of the services this system offers to users is the ability to track their friends' locations and receive notifications when they are still nearby, informing them about emergency contacts information such as fire station, ambulance and police station contact numbers to dial while in an emergency situation.

There are a few limitations with the application. For example, because the system is compatible with Android platforms, there is a potential that it will not work on iOS platforms because their systems have several requirements for app installation and launch.

Another limitation is the ability to track users' locations and return detailed information such as whether they are still active in that area while friends are tracking their location without connecting it to the internet, as we are aware that not all users will be able to have internet connection at all times while in an emergency, so this will be difficult to determine the usage of the app without internet connection and making it easy for the users to use it.

II. LITERATURE REVIEW

Insufficiency in mechanisms for feedback and usefulness were found in an examination of current safety applications, especially while under pressure. The I-SAFETY app seeks to overcome these shortcomings by focusing on simplicity of use and real-time feedback in its design, which integrates HCI principles.

At the moment there are six applications which have been reviewed that relate to the proposed system. These applications include: bSafe, SafeNow, UrSafe , I'M Ok Locator, Life 360 and Find My Friend [1].

bSafe is a mobile application that provides various features such as allowing users to broadcast their location so that friends can virtually track them. It also has a voice activation feature that enables users to activate the SOS alarm by speaking, and when the SOS alarm is activated, video and audio are instantly captured. Furthermore, it has a live streaming feature that enables guardians to watch the incident directly, which aids the emergency response team in taking swift action. Additionally, fake call features are offered to help users deal with potentially dangerous or suspicious situations by calling their phone numbers to make it appear if someone else actually called [2].

SafeNow is a mobile application that has numerous features that help users in a variety of ways when they are in a difficult situation. For example, pressing the alarm when feeling uneasy sends messages to the designated emergency contacts. Furthermore, the alarm is only sent to the saved contacts. It also sounds an alarm if the phone is silent, ensuring that users obtain immediate assistance from their friends and family [3].

UrSafe is a personal safety app that has numerous features such as the ability to update friends about the users' whereabouts, voice activation features to send SOS messages and the capacity to detect if there is a nearby car crash to take precautions while driving. Furthermore, the system can be used without being connected to the internet, but it can only send SOS messages while using it offline [4].

I'M Okay Locator is a platform to provide family and friends peace of mind by allowing them to track the location of their kids or anyone who could be in danger or harm. The app is designed to provide users with an extra level of protection and safety, especially when they are traveling alone or in situations that could be dangerous by allowing users to create a network of emergency contacts who will receive notifications when the user checks in or sends an SOS alert. In addition to location tracking, the app also has a panic button that users may click in case of an emergency. This will immediately alert their emergency contacts and provide them the user's location. The app also has a function called (Safe Zone) that enables users to create a virtual wall border around a specific area such as their home,school, or office. When a user enters or exits the safe zone, their emergency contacts will receive a notification [5].

Life360 is a popular family location tracking and communication app that is designed to keep families in touch and safe. The app provides users with real-time location sharing, which means that family members can see each other's whereabouts on a map, receive notifications when someone arrives or leaves a specific location, and communicate with each other through group messaging and even make phone calls [6].

Locate My Friend is an application that enables individuals to share their current location with their friends and family in real-time. It is available for free download on both iOS and Android devices. Once you have downloaded the app, you can invite your friends to join your network, and request to join theirs as well. When you're connected with someone on the app, you can see their location in real-time on a map, and they can see yours as well. Additionally, the app allows you to set up alerts based on your location, so you'll be notified when your friend arrives at or departs from a specific location, such as their home or office. You can also select to share your location for a specific duration, such as a day or a few hours, before it stops sharing automatically [7].

Each of the existing apps has its pros and cons. Still, the common thread among them is the focus on emergency features. Hence, the I-Safety Application Project shares a similar concept, aiming to offer real-time location sharing.

Table 1 provides a summary of key features in various safety and emergency-related applications, offering a quick comparison of their functionalities.

TABLE I. LITERATURE REVIEW SUMMARY

Application	**Features**			
	SOS Alert	***Share Location***	***Incident Sharing***	***Emergency Help***
bSafe	Yes	Yes	Yes	Yes
SafeNow	Yes	Yes	Not Available	No
UrSafe	Yes	Not Available	Not Available	yes
I'M Ok Locator	Not Available	Yes	Not Available	Yes
Life 360	Yes	Yes	Not Available	Not Available
Locate My Friend	Yes	Yes	Not Available	Not Available

III. METHODOLOGY

A. Requirement Engineering

Various methods can be used to collect user requirements for system functionalities. However, in the case of the I-Safety mobile application, a survey questionnaire was utilized as one of the strategies for gathering user requirements and measuring their perspectives and preferences on the features and functionality of the proposed system. The questionnaire contained questions that were relevant to the proposed system.

The survey conducted for the I-Safety mobile app received approximately 78 responses from various people, including students, travelers, and others. It aimed to study how users from various backgrounds perceive the app's features and how it should function. Furthermore, based on the data collected from users regarding the desired features to be included in the system, the system's mission was to be developed in alignment with this gathered information.

The development approach utilized for I-Safety application was Extreme Programming (XP). This methodology aims to deliver software quickly while maintaining flexibility. There were four stages involved in the XP approach which are planning, designing, coding, and testing. Additionally, it includes short iterations and continuous testing to identify and fix bugs early, ensuring stability and reliability.

The development of the I-Safety mobile application followed a user-centered approach in line with Human-Computer Interaction (HCI) principles, using a survey to gather insights from 78 respondents, including students and travelers, to design an intuitive and accessible system. Extreme Programming (XP) was utilized to maintain flexibility and deliver the app in rapid iterations, incorporating usability testing at every stage. This allowed continuous feedback from users to shape the interface, ensuring ease of use, minimized cognitive load, and reliability, particularly in emergency situations. By integrating HCI practices, the app's design and functionality were refined to meet the diverse needs of its user base.

The development of the I-Safety mobile application followed a user-centered approach in line with Human-Computer Interaction (HCI) principles like flexibility, ease of use, usability testing, and minimizing cognitive load. By integrating HCI practices, the app's design and functionality were continuously refined based on user feedback to ensure accessibility, reliability, and effectiveness in emergency situations.

B. Development Requirement

- Development environment: Visual Studio IDE with flutter extensions and plugins installed in windows OS
- Flutter Software Development Kit (SDK) installed in windows OS for developing flutter apps [9].
- Android Studio: In developing flutter apps android SDK is required to run the application.

C. Functionality Requirement

Fig. 1 shows the user case diagram for actors in this system which are users, emergency services and the admin. In Fig. 2, the class diagram is shown. Fig. 3 illustrates a sequence diagram that indicates the interaction between the user and the system. Lastly, Fig. 4 displays the activity diagram, providing a clear knowledge of how a process should be carried out.

- Use Case Diagram

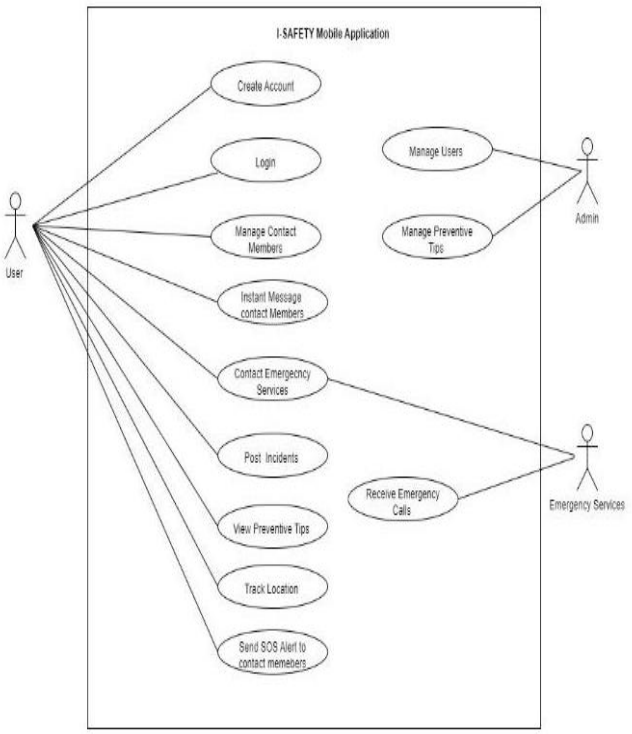

Fig. 1. Use Case Diagram.

- **Class Diagram**

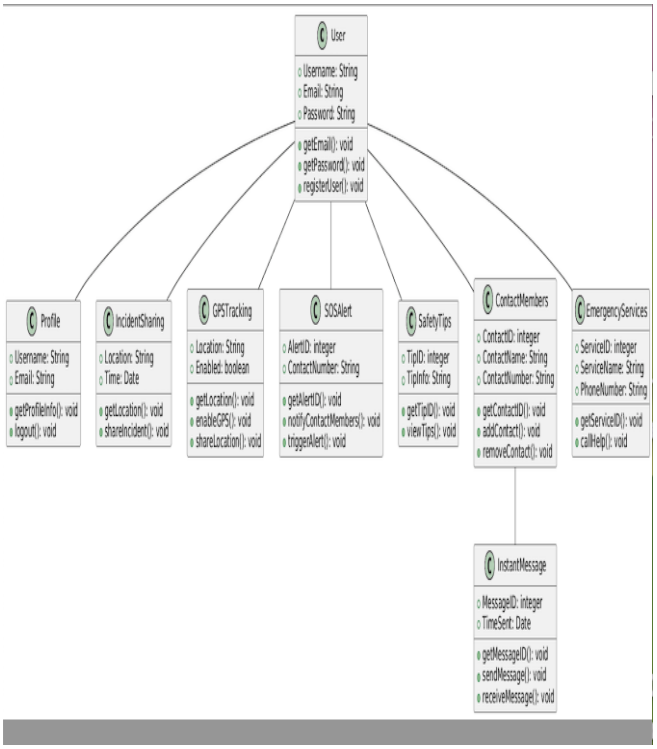

Fig. 2. I-SAFETY Class Diagram.

- **Sequence Diagram**

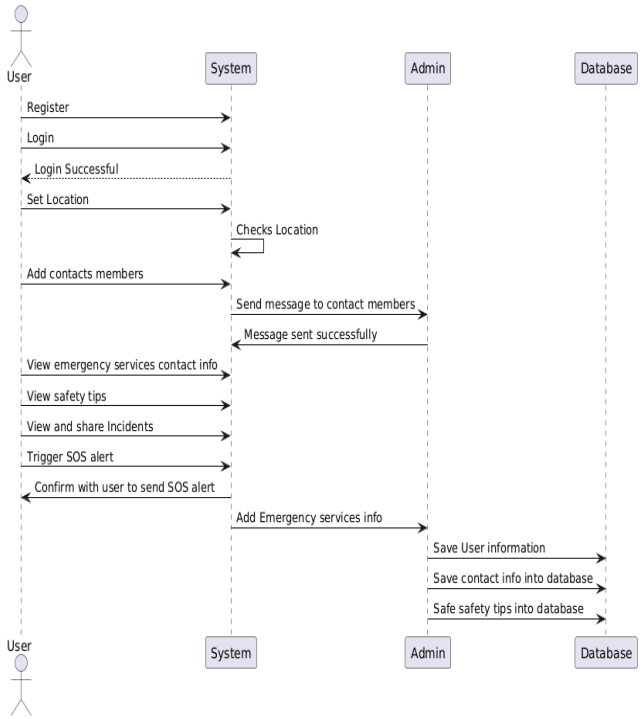

Fig. 3. Sequence Diagram.

- **Activity Diagram**

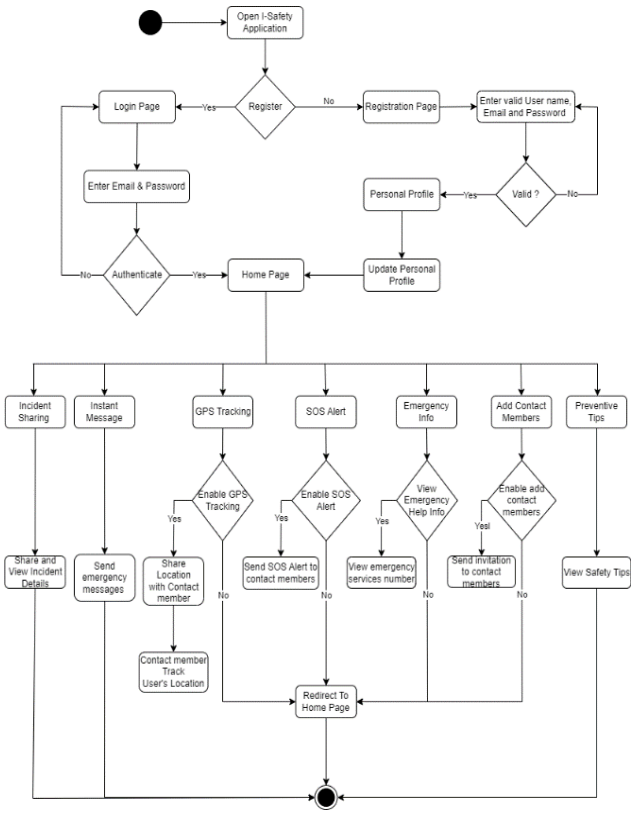

Fig. 4. Activity Diagram.

IV. RESULTS

Fig. 5 indicates the splash screen that users will see when they access the app. User proceeds with the signup page to create an account. Once users create an account, they will proceed to the login screen displayed under Fig. 5.

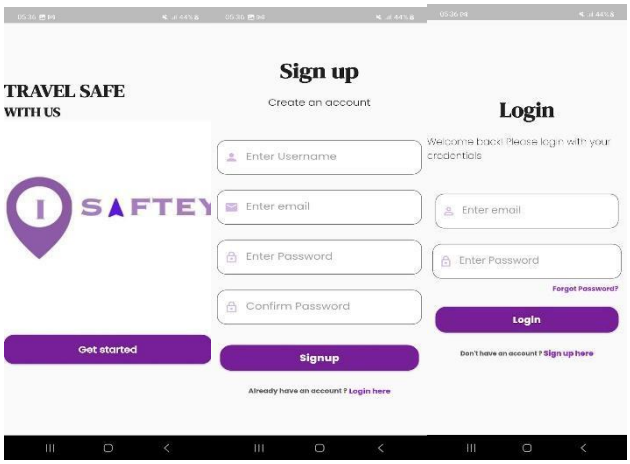

Fig. 5. Splash Screen, Registration Screen and Login Screen.

Meanwhile, Fig. 6 shows the home screen which includes the live location tracking, contact screen of which users are required to add contacts from their phone device and SOS alert feature.

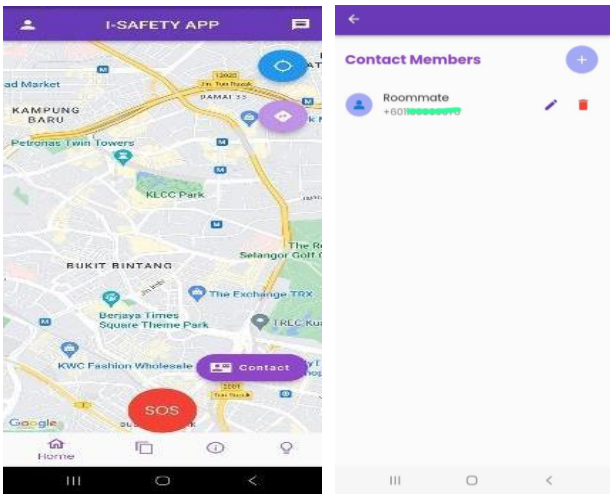

Fig. 6. Home Screen.

Additionally, Fig. 7 illustrates the message screen where users can chat with any user using the system or their contacts and share their live location with them, users also receive notification when they receive a new message.

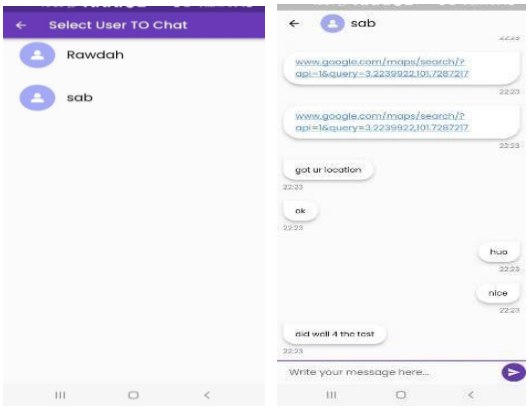

Fig. 7. Message Screen.

Fig. 8, 9 and 10 illustrate the emergency, incident sharing and safety tips screen.

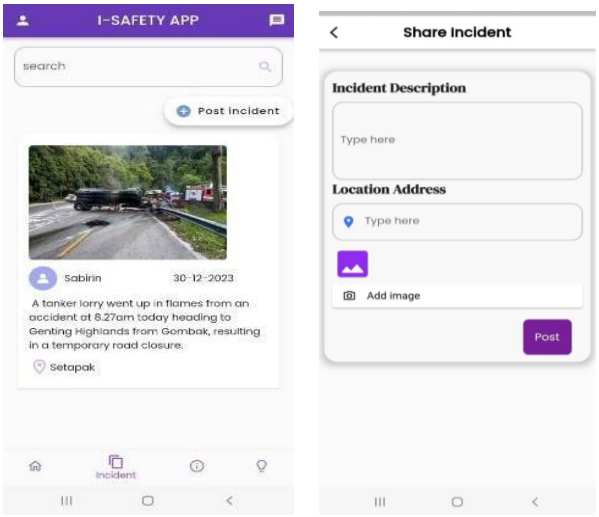

Fig. 8. Incident Screen

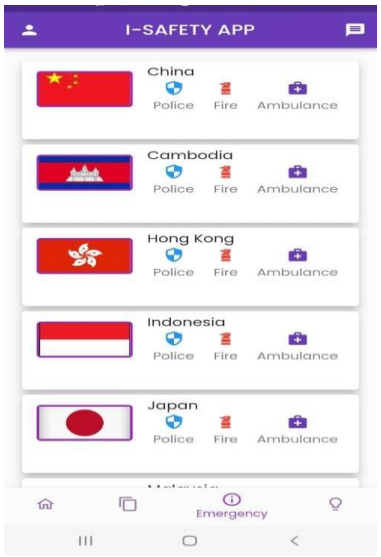

Fig. 9. Emergency Screen

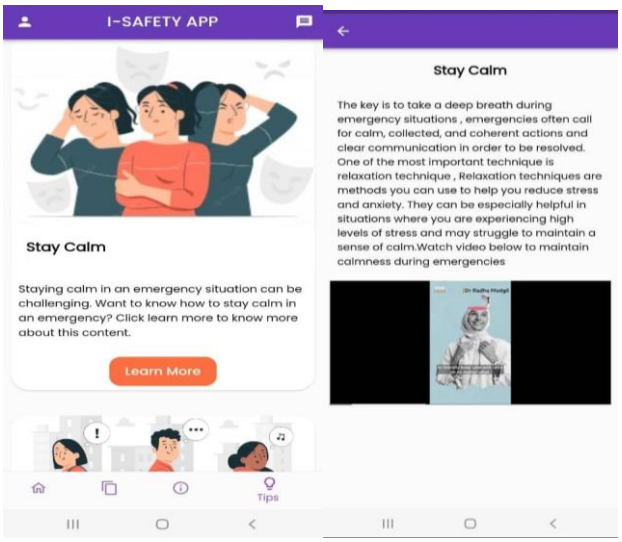

Fig. 10. Safety Tips Screen

V. Discussion

Choosing Extreme Programming (XP) for the I-Safety application brings a crucial advantage to this research. XP's collaborative approach ensures active involvement of users, aligning the app closely with their safety needs, while also adhering to Human-Computer Interaction (HCI) principles by placing users at the center of the design process. The flexibility of XP is invaluable, allowing us to adapt swiftly to evolving safety requirements and user preferences, as well as addressing usability and cognitive load concerns typical of HCI. Continuous testing in short cycles not only guarantees the reliability of real-time alerts and emergency features but also ensures that the user interface remains intuitive and easy to navigate. Pair programming enhances the security and quality of our code, essential for a safety application, while also focusing on error prevention and feedback mechanisms, core HCI considerations. XP's focus on rapid delivery ensures timely releases of safety features, providing users with a quick and effective safety tool that aligns with ease of use and accessibility, vital in emergency contexts. Overall, XP's user-centric design and adaptability, in conjunction with HCI principles, make it the ideal choice for creating a reliable and responsive I-Safety application.

Gathering feedback is vital for making the I-Safety app even better. The survey results highlight areas to focus on, such as addressing privacy concerns about sharing live locations and boosting user confidence in safety features, both key considerations in HCI's focus on user trust and data security. Users really care about real-time alerts and easy access to emergency services, so these aspects will be a priority as they affect usability and responsiveness. The interest in preventive safety tips shows that educational content could add value, contributing to user empowerment, a core HCI goal. Following the principles of Extreme Programming (XP), we will continue to gather user feedback regularly to make ongoing improvements, ensuring that the I-Safety app adheres to HCI's iterative design process. This helps ensure the app becomes even more user-friendly, effective, and aligned with user experience (UX) goals in keeping people safe.

VI. Future work

In future enhancement, there is a strategy to improve the system's services, further strengthening the development of this application. Future enhancements include ensuring the application's compatibility with both Android and iOS platforms, as the current version is only compatible with the Android platform. Additionally, there will be a focus on meeting the needs of people with disabilities, with plans to implement AI assistance. The application aims to provide specific AI assistance for individuals with visual impairments to aid in system navigation, aiming for a seamless and user-friendly experience. Furthermore, voice activation features will be added to enable users to send live location and SOS messages in emergency situations when they are unable to access their smartphones. Additionally, the implementation of a geo-fencing feature will also be included to alert users about the safety of their environment by analyzing their location and providing information on the number of incidents reported from that specific area.

VII. Conclusion

In conclusion, while this research has made significant progress, it is essential to recognize the areas that require further development. By addressing the identified constraints and implementing the proposed future enhancements, this research will be able to create a safer and more efficient system that effectively meets the needs of its users. Through continuous improvement and innovation, the research can strive towards its goal of providing a reliable and user-friendly application for personal safety.

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Digital Inventory Hub

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***Abstract*—Efficient warehouse management is essential for businesses, but traditional manual processes often lead to errors and inefficiencies. Introducing the Digital Inventory Hub, a mobile application designed to revolutionize warehouse management through technology integration. By leveraging QR code technology, the application streamlines inventory tracking, expedites product identification, and minimizes errors in data entry. Advanced analytics features provide valuable insights into product trends, facilitating informed decision-making and optimizing stocking levels. Automated reporting capabilities alleviate the burden of manual report generation, ensuring accuracy and timeliness in inventory documentation. With user-friendly interfaces and intuitive functionalities, the Digital Inventory Hub enhances operational efficiency and productivity. Embracing technological innovations in warehouse management is crucial for businesses to adapt to evolving digital landscapes. By leveraging the Digital Inventory Hub, organizations transcend the limitations of traditional inventory control methods, fostering resilience and competitiveness in dynamic market environments.**

Keywords—Warehouse Management, Efficiency, Inventory Control, Technology Integration, Mobile Application

I. INTRODUCTION

A. Preamble

This Warehouse management is a crucial aspect of any business that deals with inventory management. Warehouses are typically large buildings designed for storing a variety of products. They play a vital role in the supply chain management system, serving as an intermediate point between the manufacturer and the end consumer. Fortunately, technology has made it easier than ever to streamline this process and optimize inventory management. Digital Inventory Hub can help businesses manage their inventory, implementing technology into the process will help the workers more easily manage their products. Furthermore, in the absence of a good management system, the warehouse can encounter problems such as human error, which can lead to a cascade of other issues including data integrity. The researchers believe that by using Digital Inventory Hub, these issues can be minimized. The features that the application offers such as QR Scanning, analytics, and automated reports that can be downloaded make managing a lot of items in the warehouse more effective. Overall, the Digital Inventory Hub Mobile Application can improve warehouse management, and effectivity, and ensure data integrity.

B. Problem Description

Managing items through traditional ways such as a paper-based report, or manual analytics process, is no longer suitable for warehouses nowadays. Thus, the researchers are trying to give an innovative solution by developing the Digital Inventory Hub application.

a) Background of The Problem

Based on the information that the researchers received, there are several problems that can happen while managing items. One of the samples is from K.S.E. Mart at Mahallah Faruq. The workers mentioned about time consuming for a small task like checking stock supply and also inspecting the expiry dates of food items. The workers have had to look over every single food product and they admitted that often made mistakes. Moreover, they also have difficulty making reports about their products, so sometimes there is a lot of wrong and inappropriate data. Managing a large amounts of products manually, that is undoubtedly time-consuming and inefficient. One worker even complained that she spent 3 to 4 hours to report on stock that needed to be added or that didn't need to be added. Hence, when the researchers asked about how they write their report, the answer was written on the paper and after that, they just took a picture of that paper. To conclude, the researchers believe that, if they use the Digital Inventory Hub Application these kinds of problems can be solved easily with the feature provided inside the application.

[4] The warehouse needs to implement this barcode technology in its warehouse management system to achieve efficiency in the warehouse. It is related to the Digital Inventory Hub Application developed, as it aims to streamline and optimize warehouse process, providing a solution that prioritizes efficiency and integrity. The traditional method that researchers explained above, it has inherent limitations and it is no longer suitable for this modern era, where technology can turn it to be more efficient. Therefore, by addressing these challenges, the application provides a valuable feature for warehouse managers to improve the overall effectiveness of warehouse operations.

b) Problem Statement

The problem with current manual systems is verified such as with report writing is still on paper-based systems. That invites human error often can cause the integrity of the data

to suffer. Therefore, the traditional methods of managing inventory, such as manual records, are not only time-consuming but also prone to errors and inaccuracies. [1] The main purpose of automating the warehouse management system is to secure the movement and storage of the products. The newly created software upgraded the capabilities of the warehouse management system to be more efficient and save time-consuming.

It is related to the problem; innovative solutions are needed to enhance warehouse management. Based on the problem the researcher concluded that the workers faced 3 main problems, which are analytics, reports, and information on product details. Therefore, one such solution is the development of a Digital Inventory Hub application that provides modern approaches to managing warehouse inventory. By utilizing QR code scanning technology, the warehouse can significantly improve their inventory management process, reducing the risk of errors and increasing overall efficiency.

C. Project Objectives

Therefore, our innovative application is created to minimize the adverse impact of human errors during data input. The impact of this error can be detrimental to both the product owner and distributor. In today's digital era, researchers believe that technology can be used to increase operational efficiency. Our Digital Inventory Hub app makes it easy for warehouse workers to quickly record data using QR codes.

[4] The implementation of the barcode or QR code in a warehouse management system has many benefits such as speeding up goods in and out of the warehouse, identifying goods in order to simplify racking and picking, improving data accuracy, reduce the possibility of stock out, reduce handling costs in warehouses, and reduce human errors that occur due to manual handling, these things can increase efficiency in the warehouse. This simplifies the data input process, ensures product data accuracy, and facilitates overall operational efficiency.

The aim of this project is to develop a mobile application for inventory management. This aims to streamline inventory handling, increase efficiency, and reduce errors through the application of QR code technology. Thus, not only QR Scan, but there are also analytical features available that help in seeing product developments. This project answers the important need for improving warehouse operations in today's digital era.

D. Project Scope

The Digital Inventory Hub application provides some features such as QR Code scanner, analytics, auto report generator that will be based on the data from the analytics feature and reduce the risk of human error.

1) Scope

- Inventory Manager
- Material Handler

2) Target Audience

Inventory Manager:

- Implementing inventory management systems.
- Conducting regular stock checks and audits.
- Analyzing inventory data to optimize stocking levels and reduce carrying costs.
- Identifying slow-moving or obsolete stock and implementing strategies to address them.
- Coordinating with procurement and sales teams to manage stock levels effectively.

Material Handler:

- Operating forklifts and other material handling equipment safely.
- Loading and unloading trucks.
- Moving and organizing goods within the warehouse.
- Assisting in inventory counts and audits.

3) Specific Platform

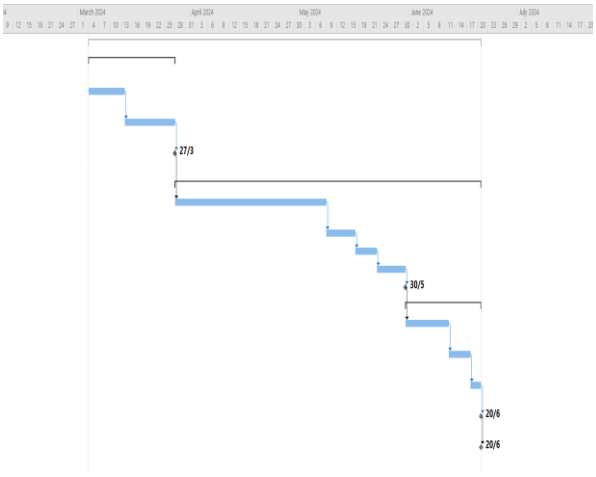
Digital Inventory Hub is a mobile application that runs on Android operating system using Dart as the programming language with Flutter framework.

E. Constraints

For the constraints or project limitation:

- Coding skill limitation.

F. Project Stages



G. Project Significance

- Improved Inventory Management: The application helps users streamline their inventory management processes, ensuring better organization and control over their products.

- Efficiency and Productivity: With features like QR scanning, analytics, and automated reports, users can work more efficiently and accomplish tasks in less time.

- Reduced Human Error: By implementing technology, the application minimizes the risk of human error in tasks related to inventory management, leading to more accurate data and fewer costly mistakes.

- Resource Optimization: By efficiently managing inventory, businesses can reduce waste and optimize the use of resources, contributing to more sustainable and eco-friendly practices.
- Job Creation and Economic Growth: The adoption of technology in warehouse management can lead to the creation of new jobs in areas such as technology support, software development, and data analysis, contributing to economic growth and employment opportunities.
- Fostering Technological Advancement: The project promotes the use of digital technology in traditional industries, driving innovation and progress in warehouse management practices.
- Efficiency and Resourcefulness (Islamic Perspective): In an Islamic context, efficient resource management and avoiding waste are highly valued principles. The application aligns with these principles by helping businesses make the most of their resources.

H. Summary

In conclusion, the Digital Inventory Hub project provides a comprehensive overview of the challenges faced in traditional warehouse management. It establishes the significance of technology in addressing these challenges and introduces the Digital Inventory Hub Application as an innovative solution. Also, outlines the specific problems that the application aims to tackle and defines its objectives and scope. Overall, this chapter provides a solid foundation for the subsequent sections of the project.

II. LITERATURE REVIEW

A. Introduction

Establishing connections among different inventories within a dynamic network chain relies on the effective management of several parameters. The internal structure of storage can be viewed as a layered management system, while its external framework encompasses customers, additional warehouses, and various other elements, creating a dynamic network chain [5]. Another study introduces a QR code-driven automated inventory management system, wherein comprehensive details are stored on mobile devices [1][2]. While [7] QR can store large amounts of data, its quick scanning ability speeds up the process of maintaining an accurate inventory and cuts down the time spent on manual data entry and enhances the accuracy of the records in question.

B. System Review

The following are comparisons with existing applications, made with the sole purpose of optimizing Digital Inventory Hub.

1) Existing Product

a) Agiliron Warehouse Management

Fig. 1 Agiliron Warehouse Management Application

In Fig. 1, Agiliron Warehouse, developed by Agiliron Inc. in 2022, stands as a robust app designed to streamline warehouse management and inventory tasks. With its intuitive interface, businesses can swiftly set up the app for multiple warehouses, adapting seamlessly to their evolving needs. One notable feature is its offline functionality, allowing uninterrupted warehouse operations even without an internet connection. The 2-way sync ensures data consistency when reconnecting Agiliron Inc. (2022).

b) Its Warehouse Management

Fig. 2 Its Warehouse Management Application

In Fig. 2, The Its Here Warehouse Management app, exemplifies a robust solution for modern warehousing challenges. Providing real-time inventory visibility and control, the system adeptly manages inbound and outbound product logistics across diverse packaging formats, including units, boxes, and pallets. Its commitment to detail is evident in the maintenance of a comprehensive product history and the delivery of insightful analytics, empowering users to make informed decisions. With its user-friendly interface and powerful functionalities, "It's here warehouse management" emerges as an asset for businesses navigating the complexities of warehouse operations (It's here delivery, 2023).

c) IKEA Shopping

Fig. 3 IKEA Shopping Application

In Fig. 3, Launched by the developer IKEA System B.V., the IKEA Shopping mobile app serves as a digital platform created by IKEA Group, the well-known Swedish multinational recognized for its ready-to-assemble furniture, kitchen appliances, and home accessories. The primary objective of this app is to elevate the overall shopping experience for IKEA customers by offering a user-friendly platform to explore products, plan purchases, and utilize various features that streamline the shopping process.

2) Advantages

a) Agiliron Warehouse Management

Agiliron Warehouse Management (AWS) focuses on automating the warehouse management system, hence there are a lot of features such as adding new products, stock transfer, stock adjustment, adding pictures, and others that can help to make the warehouse management system more efficient. These features play an important role in making sure that the data of the product is correct. There is one feature that the researchers observe that is the 2-way sync that ensures data consistency when reconnecting. Therefore, when products come when the internet has difficulties, the product can still be added and later, when the internet is fine, this app can make sure that the data will synchronize.

b) Its Warehouse Management

It can be seen in Fig. 2, that this application offers a very clean and very friendly interface making it very easy to understand for the users. The choice of color and font size used is very suitable, and easy to read without having to enlarge or enlarge the text. Furthermore, the feature that the researchers think is interesting is the receiving feature which combines several features into one, namely edit, add, delete, and read. Users can even directly download reports from the product. So, this is closely related to User Experience (UX) which is the attitude, behavior, and emotions of users when using a product, system, or service which involves individual perceptions related to the perceived benefits and convenience obtained.

c) IKEA Shopping

From Fig. 3, the IKEA Shopping application has some features that help users to find the product that they need. The app includes a categories list feature, facilitating efficient browsing by allowing users to navigate through specific product categories and streamlining the search for items based on their preferences and needs. Also, the ability to filter products based on specific features, allows users to narrow down their search, making it easier to find items that meet their criteria and preferences.

3) Disadvantages

a) Agiliron Warehouse Management

Agililorn Warehouse Management provides various features that can help automate warehouse management systems. Otherwise, there are still some disadvantages that the researchers can see from the app itself such as there is no Scanning feature in this app, while nowadays this feature is crucial. Then, dependency on internet connectivity may limit some features, and users heavily reliant on real-time data may find this aspect challenging. Lastly, user interface is important in applications because; Almost all applications have a user interface, a bad interface can be frustrating for users and affect productivity, and competitors may have a more user-friendly user interface system.

b) Its Warehouse Management

The researchers found several things that could be improved from this application, which in our opinion as researchers is a weakness. The weakness is in the features provided in this application, there are only 3 features offered, including receiving, placing, and shipping out. Compared to the application that we will develop, we provide analytical features and a QR scanner, which will be more efficient in helping to collect data on all products in the warehouse. [7] QR Codes can store large amounts of data. Its quick scanning ability speeds up the process of maintaining an accurate inventory and cuts down the time spent on manual data entry and enhances the accuracy of the records in question.

c) IKEA Shopping

One notable disadvantage of the IKEA Shopping app is the absence of alternative sign-up methods. Unlike some other apps that allow users to register using their existing Google, Facebook, or other third-party accounts, the IKEA Shopping application currently requires users to create a unique account specifically for the app. This means that users do not have the option to expedite the registration process by leveraging their credentials from other platforms.

4) Comparison Table

TABLE I. COMPARISON TABLE

Application	**Features**			
	QR Scan	***Document Report***	***Analysis***	***Target Market***
Digital Inventory Hub	Yes	Yes	Yes	Company, Individual
Agiliron Warehouse	No	Yes	Yes	Company
Its Warehouse	No	Yes	No	Company
IKEA Shopping	Yes	Yes	Yes	Company, Individual

This table briefly shows the differences between the 3 apps we reviewed previously. Based on the results of this review, this table was created.

C. System Adaptation

The primary objective of this project is to design and implement a mobile inventory management application, focusing on optimizing inventory processes, enhancing efficiency, and minimizing errors by leveraging QR code technology. Beyond the core QR scanning functionality, the application incorporates analytical features to provide insights into product developments. This initiative addresses a critical requirement for advancing inventory operations in the contemporary digital era, aiming to streamline the handling of goods, boost overall efficiency, and contribute to error reduction within the inventory management environment.

III. METHODOLOGY

A. Introduction

This chapter provides an introductory exploration of the reasons behind developing a mobile application for Digital Inventory Hub. It highlights the challenges faced in traditional inventory management, particularly emphasizing the negative impact of human errors during data input. The main goal is to introduce an innovative solution that utilizes QR code technology to simplify inventory processes and enhance overall operational efficiency in warehouse management. This chapter is crucial in the analysis and design phases because it identifies the significant challenges, emphasizes the importance of integrating technology, and validates the project's objectives through a comprehensive literature review. Furthermore, [4] it implicitly introduces the application's functional requirements by outlining features such as QR scanning, analytics capabilities, and higher data accuracy.

In addition, the chapter broadens the project's perspective by considering economic and ethical aspects, highlighting potential outcomes such as economic growth and alignment with Islamic principles of resource efficiency. In essence, this chapter lays the groundwork for the following project phases, providing a cohesive understanding of the challenges at hand, the proposed technological solutions, and the broader implications of the project from economic and ethical standpoints.

B. Development Approach

The Agile development approach is a software development methodology that prioritizes flexibility, collaboration, and customer satisfaction. It emphasizes iterative and incremental development, where projects are divided into small, manageable units called iterations or sprints. Agile is characterized by its responsiveness to customer feedback, regular reassessment of priorities, and a focus on delivering high- quality, working software in a timely and efficient manner. The Agile approach encourages open communication, transparency, and a mindset that values individuals and interactions, working solutions, and customer collaboration over rigid processes and documentation. This methodology has gained widespread adoption in the software industry due to its ability to enhance adaptability and foster a more customer-centric development process.

The Agile Model was chosen for several reasons:

- Iterative Development: Agile allows for iterative development, meaning that you can release the application in small increments or sprints. This aligns with the project's focus on providing features like QR scanning, analytics, and automated reports. Users can benefit from these functionalities as they are developed and refined over time.
- Flexibility and Adaptability: Given the dynamic nature of technology and the need for quick responses to changing requirements, Agile provides flexibility. This is crucial for a project aiming to address challenges in traditional warehouse management and respond to emerging needs efficiently.
- Efficiency and Productivity: Agile's focus on delivering a minimum viable product (MVP) quickly allows users to start benefiting from efficiency-focused features sooner. This supports the project's goal of improving efficiency and productivity in inventory management.
- Relation to the Project: Agile's principles align well with the objectives of the Digital Inventory Hub project. The project aims to address challenges in traditional warehouse management through the adoption of technology. Agile's iterative and collaborative nature allows the development team to respond effectively to the project's evolving needs, ensuring the application meets its stated objectives.

In summary, the choice of Agile as the development approach for the Digital Inventory Hub project is grounded in its suitability for iterative development, adaptability to changing requirements, and emphasis on customer collaboration, all of which are crucial for the success of the application addressing the challenges outlined in the project description.

C. Requirement Specification

To gather user requirements for the Digital Inventory Hub, we utilized a multi-pronged approach that included reviewing existing systems, applications, or databases, research and site visits, observation, and prototyping. Each of these methods played a crucial role in understanding the needs and expectations of the potential users.

- Existing System, Application, or Database: A comprehensive review of existing warehouse management tools and databases was carried out to understand the current offerings in the market. This helped identify common features, strengths, and limitations of existing systems, which informed the design of our apps.
- Research and Apps Review: We conducted research into the needs and preferences of several applications, including site visits to their websites. These application reviews and visits allowed us to observe their current type of warehouse management practices.
- Prototyping: Early prototypes of the Digital Inventory Hub were shared with potential users for feedback. Their inputs helped refine the tool's design and features, ensuring it would be user-friendly and effectively meet their needs.

From requirement gathering, these were the non-technical requirements needed for the project: Development of a Digital Inventory Hub

- User registration and login functionality: The system includes user registration and login functionality with authentication to allow users to create user accounts and securely access the Digital Inventory Hub.
- Input forms for product data: The system provides user-friendly input forms where the user can input their product data, such as product name and product code.
- Generate QR Code of the product: The system generates a QR code for the product, providing users with an easy way to find the product.
- Generation of reports based on the listed product: The system automatically generates comprehensive reports that present the list of products in a clear and understandable format.
- Advanced data analysis features: The system offers advanced data analysis functionalities, such as graph

analysis, to provide users with deeper insights into their product data and assist in forecasting future performance.

D. Logical Design

1) System Analysis and Design Diagram

a) System Architecture

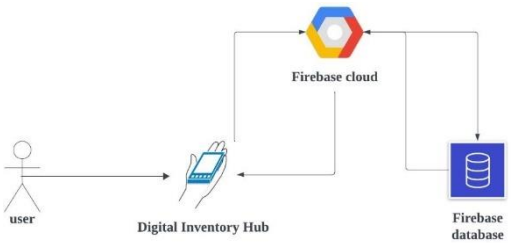


Fig. 4 System Architecture

Fig 4 shows the system architecture for this project. It defines the structure, behaviour, and views of the system. Our project platform uses a mobile application with a cloud database which is Firebase cloud and database.

b) Use Case Diagram

Fig. 5 Use Case Diagram

Fig 5 presents the use case diagram of the project. A graphical depiction of a user's possible interactions with a system. It shows that the user can choose the interaction or features that are available on our application, which are add products and product list, delete product, scan QR code, view statistic or analytics, and print the file or catalogue.

c) Use Case Narrative

TABLE II. COMPARISON TABLE

Use Case: Login	
Actors	User
Objectives	The user wants to log into the system
Preconditions	User already have an account
Basic Flow	1. User opens the system's login page. 2. User enter their username and password. 3. User clicks on the login button. 4. System verifies the credentials. 5. System grants access and redirects the user to the main page.
Alternative Flow	1a. User enters incorrect credentials. 1a.1. System displays an error message. 1a.2.Users can retry entering the correct credentials. 1a.3. User can request a password reset.
Postconditions	User is logged into the system and can access their account.

In Table 2, the use case narrative for login is outlined. It shows the detail of the actors, objectives, preconditions, basic flow, alternative flow, and postconditions.

TABLE III. COMPARISON TABLE

Use Case: Registration	
Actors	User
Objectives	Creating new product and generate new productQR code
Preconditions	None
Basic Flow	1. User opens the system's registration page. 2. User fills in the required information (name, email, password, etc.). 3. User submits the registration form. 4. System validates the information. 5. System creates a new user account. 6. System redirects the user to the login page.
Alternative Flow	2a. User enters an email address that is already registered. 2a.1. System displays an error message. 2a.2. User can try again with a different email address.
Postconditions	User successfully registers an account and can proceed with login.

In Table 3, the use case narrative for registration is laid out. It shows the detail of the actors, objectives, preconditions, basic flow, alternative flow, and postconditions.

TABLE IV. COMPARISON TABLE

Use Case: Add Product	
Actors	User
Objectives	Creating new product and generate new productQR code
Preconditions	User already have an account
Basic Flow	1. User choose New Product button. 2. Fill all the data into the form. 3. Submit the form.
Alternative Flow	None
Postconditions	New product is added into List Products

Table 4 details the use case narrative for add product is. It shows the detail of the actors, objectives, preconditions, basic flow, alternative flow, and postconditions.

TABLE V. COMPARISON TABLE

Use Case: Edit Product	
Actors	User.
Objectives	Edit existing product.
Preconditions	User already have an account and product already exist.
Basic Flow	1. User choose List Products button. 2. Choose the product. 3. Edit the product. 4. Press update button.
Alternative Flow	None
Postconditions	The product is updated.

In Table 5, the use case narrative for edit product is shown. It shows the detail of the actors, objectives, preconditions, basic flow, alternative flow, and postconditions.

TABLE VI. COMPARISON TABLE

Use Case: Delete Product	
Actors	User.
Objectives	Edit existing product.
Preconditions	User already have an account and product already exist.
Basic Flow	1. User choose List Products button. 2. Choose the product. 3. Press delete button.
Alternative Flow	None
Postconditions	The product is deleted.

Table 6 shows the use case narrative for deleting product. It shows the detail of the actors, objectives, preconditions, basic flow, alternative flow, and postconditions.

TABLE VII. COMPARISON TABLE

Use Case: Scan Product QR Code	
Actors	User.
Objectives	Scan the product QR code.
Preconditions	User already have an account and product already exist.
Basic Flow	1. User choose Scan QR button. 2. Scan the product.
Alternative Flow	3a. QR code is not correct. 3a.1. users need to create new QR code.
Postconditions	The product QR code is scanned.

Table 7 shows the use case narrative for scan product QR code. It shows the detail of the actors, objectives, preconditions, basic flow, alternative flow, and postconditions.

TABLE VIII. COMPARISON TABLE

Use Case: Print List of Product	
Actors	User.
Objectives	Print list of products.
Preconditions	User already have an account and products already exist.
Basic Flow	1. User choose Statistic button. 2. Choose catalogue. 3. Press save button. 4. Print the list of products.
Alternative Flow	None
Postconditions	The product is printed.

Table 8 shows the use case narrative for print list of products. It shows the detail of the actors, objectives, preconditions, basic flow, alternative flow, and postconditions.

d) Activity Diagram

Fig. 6 Activity Diagram

Fig. 6 is the activity diagram for the project. It visually presents a series of actions or flow of control which covers all the decision and action in the system.

e) Sequence Diagram

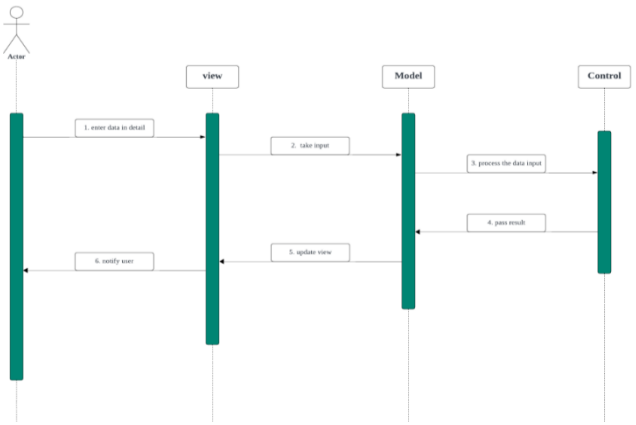


Fig. 7 Sequence Diagram

In Fig 7, it presents the sequence diagram of the project. It shows the process interactions arranged in a time sequence.

E. Database Design

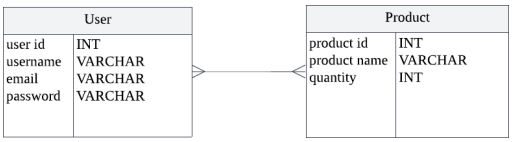


Fig. 8 Database Design

In Fig. 8, the database table presents retrieval and storage of data. There are two entities which are the User table and Product table. Each entity consists of various data with their data type. Furthermore, the t is entity-relationship which is many to many.

```
CREATE TABLE Users (
    user_id INT PRIMARY KEY,
    username VARCHAR(255) NOT NULL,
    email VARCHAR(255) NOT NULL,
    password VARCHAR(255) NOT NULL
);

CREATE TABLE Products (
    product_id INT PRIMARY KEY,
    product_name VARCHAR(255) NOT NULL,
    quantity INT NOT NULL,
    user_id INT,
    FOREIGN KEY (user_id) REFERENCES
Users(user_id)
```

Fig. 9 Database Code

Fig 9 is the visual of the database table code for our project.

F. Interface/Prototype Design

1) Login View

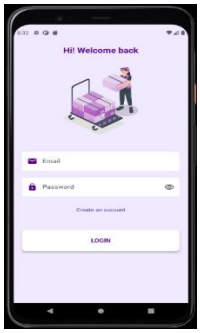


Fig. 10 Login View

Fig 10 presents a straightforward login screen. The placement of the signup text button is designed to be intuitive, accompanied by a brief description to enhance user understanding.

2) Signup View

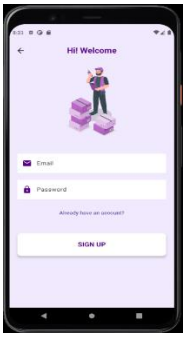


Fig. 11 Signup View

In Fig 11, the signup screen, we ensure that users easily comprehend the signup page. Additionally, those who already possess an account can seamlessly navigate to the login functionality by clicking on the provided text button.

3) Home View

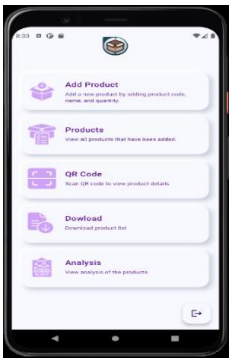


Fig. 12 Home View

In Fig 12, on the home screen, we offer various sub-menus such as Add Product, Product List, QR Code, Analytics, and Report.

4) Add Product View

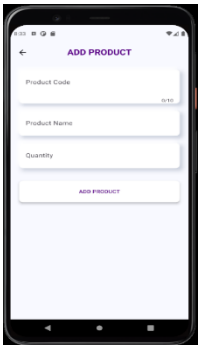


Fig. 13 Add Product View

In Fig 13, within the Add Product page, we have implemented a simple form with clear labels, ensuring user-friendliness. Each form element is appropriately labelled to facilitate user understanding of the required information.

5) Product List View

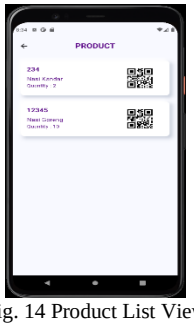


Fig. 14 Product List View

In Fig 14, all information entered by users in the Add Product section is displayed within the Product List page. The system automatically generates QR codes for each product, enhancing efficiency.

6) Product Details

Fig. 15 Product Details

In Fig 15, in the event of inaccuracies or incomplete details, users can edit information by accessing the product details through a click on the product within the Product List page.

7) Product Statistic

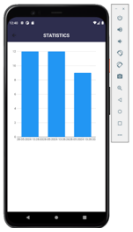


Fig. 16 Product Statistic View

IV. PROJECT DEVELOPMENT

A. Introduction

This chapter provides a comprehensive overview of the project development, implementation, and evaluation of the financial ratio calculator. It details the final product achieved through the development process, with a focus on ensuring the system's functionality, usability, and reliability. The implementation phase involved integrating various components and modules to create a cohesive and user-friendly interface. Subsequent sections will delve into the system integration, system output, system testing, and enhancements devised based on user feedback.

B. System Integration

The Digital Inventory Hub system has been developed utilizing the advanced capabilities and features offered by the Flutter framework. Flutter's hot reload functionality has allowed the developers to see immediate changes during the development process, which has led to faster development cycles. Additionally, the Flutter framework provides high-performance capabilities by using its own rendering technology, resulting in consistent performance across a variety of platforms. The flexibility of the Flutter framework allows for easy integration of various packages such as QR Code, Database (in this case, Flutterfire), and report download, thus streamlining the development process.

The seamless integration of Dart programming language and packages using Flutter has led to the creation of a cohesive and comprehensive system, where data flow, user interactions, and system responses are seamlessly connected. This integration has significantly improved the efficiency of communication between system components, enabling smooth data transfer and processing.

C. System Output

a) Login View

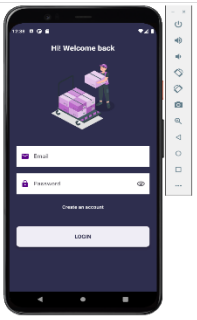


Fig. 16 Login view

b) Home View

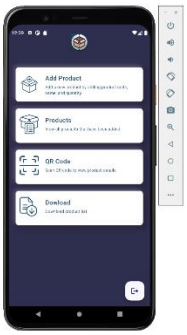


Fig. 17 Home view

c) Product List

Fig. 19 Product list

d) Product Statistic

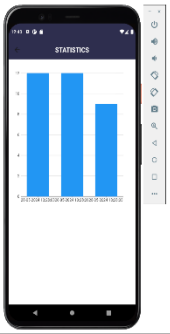


Fig. 18 Product statistic

D. System Testing

1) Test Plan

The test plan for Digital Inventory Hub's User Acceptance Test (UAT) is a vital document that outlines the methodology and approach to gather user feedback and insights through a comprehensive survey. The primary objective of this User Acceptance Test (UAT) is to ensure that the application meets the expectations and requirements of its target users while identifying potential problems or areas that require improvement. By using a survey-based approach, the testing plan allows for the collection of valuable data that will inform decision-making and improve the overall user experience of the managing inventory application. This report introduces the UAT testing plan, detailing its purpose, survey design, and expected results, highlighting the importance of user feedback in optimizing application functionality and effectiveness.

a) User Acceptance Test

Fig. 19 User Acceptance Survey

Based on the findings above, it can be concluded that Digital Inventory Hub is relevant and helpful for small businesses and the overall user experience for the application is satisfactory to their needs. Other results include:

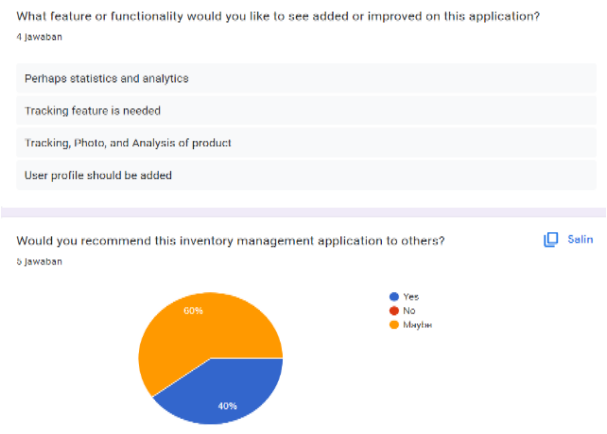


Fig. 22 Survey Short Answer

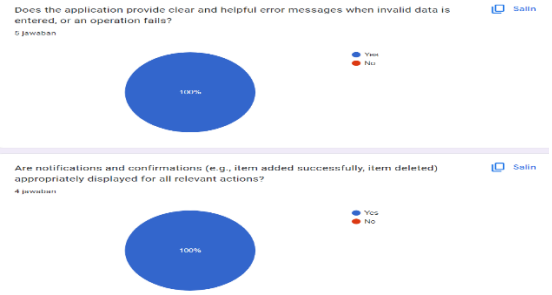


Fig. 23 Survey Result

Based on the UAT, all functionalities worked as intended and no major issues were encountered upon user testing. Suggestions mostly point towards extra features such as extending the feature that can tracking product, user profile amendments, and more detailed analysis. Therefore, the UAT can be concluded upon all remarks stated above.

2) Enhancement

There are many features that, if added, could make it easier to collect warehouse/business owner product data more comprehensively. Leveraging technology in managing products is our desired target. The true essence of a knowledge-based system is its ability to deliver messages that can be understood by users from all demographic ranges. Therefore, if the Digital Inventory Hub has shortcomings in this sector, it must provide compensation. To further enhance the system, the following features can be added to increase functionality:

- Increased advanced forms for the product.
- Amendment of user profile.
- The inventory management system is embedded in the web application.
- Advanced product analysis.

V. CONCLUSION

A. Project Requirements

In Methodology in chapter 3, the project requirements were outlined. This section highlights the completed and uncompleted requirements and explains any unfinished aspects.

Completed Requirements:

- Development of an inventory management application.
- User registration and login functionality.
- Input forms for product data.
- Create, update, delete, read, and generate the QR code of the product.
- Scanning QR code.
- Dashboard for product analysis.
- Download the product report.

Uncompleted Requirements:

- Advanced data analysis features: The project focused on providing basic financial ratio calculations, and advanced data analysis features, such as predictive modelling or trend analysis, were not included due to scope limitations.

The purpose of this project is to create an application that simplifies inventory management. However, it does not encompass complex data analysis capabilities like predictive modelling or trend analysis. The rationale behind this is to keep the project within its defined scope and available resources. Developing these advanced features would require a longer timeline and additional resources.

B. Project Constraint

The project has certain limitations that impact on its functionality or scope. These limitations are outlined below, along with explanations for each:

- **Advanced data analysis features**: The scope of the project did not encompass the implementation of advanced data analysis features, such as machine learning algorithms or complex statistical models. These features require specialized expertise and significant time and resources for development and testing, which were not available within the project's scope.
- **Scalability and performance**: The project focused on meeting the specific needs of small-medium businesses. As such, the system's scalability and performance might not be optimized for handling large-scale operations or accommodating a significantly larger user base. This limitation arises from resource constraints and the project's scope, which prioritized the targeted audience.

C. Future Enhancement

Future enhancements for the financial ratio calculator system could include:

- **Advanced data analysis capabilities**: Implementing advanced data analysis features, such as predictive modelling, trend analysis, or industry benchmarking, would provide users with more valuable insights for their business decision-making.
- **Customizable reporting options**: Allowing users to customize the format and content of generated reports would enhance the system's flexibility and meet individual user preferences.
- **Website development**: Creating a website version of the inventory management would provide users with on-the-go access to their product data without necessarily downloading the application.

D. Conclusion

The inventory management application project has effectively achieved its primary objectives, encompassing user registration, input forms for product data, QR code generation, and basic analytics. However, it was unable to incorporate advanced data analysis features and scalability optimizations due to defined scope limitations and resource constraints. The project's success in meeting its initial goals now paves the way for future enhancements that could prioritize the integration of advanced data analysis capabilities, customizable reporting options, and website development, all of which would serve to significantly augment the system's functionality and accessibility. Additionally, considering the evolving nature of technology and business needs, the project team may also need to consider the integration of machine learning algorithms and real-time data processing to ensure the system remains at the forefront of inventory management technology.

ACKNOWLEDGMENT

We would like to express our heartfelt gratitude to our Creator, Allah (SWT), for His boundless blessings and for bestowing upon us the knowledge, strength, and perseverance necessary to complete this project. We humbly pray that He accepts this sincere effort and grants us the rewards and benefits of our hard work, guiding us to use this knowledge for the betterment of ourselves and society.

Our journey through this project has been one of growth and learning, made possible through the divine wisdom granted to us. We are deeply aware that without Allah's (SWT) mercy and guidance, our efforts would not have borne fruit. Therefore, we extend our sincerest thanks to Him, acknowledging that every success comes from Him alone.

Additionally, we extend our deepest appreciation to our esteemed supervisor, Ts. Dr. Noor Hayani Abd Rahim, whose invaluable guidance and unwavering support have been instrumental throughout this project. Her profound expertise, insightful feedback, and constant encouragement have significantly contributed to the depth and quality of our work. Her dedication to mentoring us has not only helped us complete this project to the best of our abilities but has also inspired us to strive for excellence in all our future endeavors.

In conclusion, we are thankful for the opportunity to embark on this project, and we hope that the knowledge and experience gained will serve as a foundation for future successes.

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Applying Human-Computer Interaction (HCI) Principles to Enhance User Experience in the BookLub Mobile Application

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***Abstract*— Nowadays, the number of people who read has been decreasing. The new generation is so used to social media and visual content, but no one is giving importance to books. Now with COVID-19, everyone is trying out new hobbies at home and what better could be done than reading books. This paper explores the application of Human-Computer Interaction (HCI) principles to optimize both the usability and accessibility of BookLub. Key HCI principles such as usability, learnability, and accessibility have been integrated into the design process to create an intuitive interface that fosters seamless interaction. As a result of that, the idea of developing a mobile application where people can buy used books for reasonable prices came. Also, the users can chat and have discussions about books. Users may also list the books they have for free. The main objective of BookLub application is to ease the process for people to learn and spread knowledge by finding affordable and good-quality books easily through this application. Also, this application allows the users to create a chat room where they can chat and discuss their favorite books with the same interest.**

Keywords—Mobile application, used books, Books App, Knowledge Management,

I. INTRODUCTION

Nowadays, the number of people who read has been decreasing. The new generation is so used to social media and other things, but no one is giving importance to books. Now with COVID-19, everyone is trying out new hobbies at home and what better could be done than reading books. As a result of that, the idea of developing a mobile application where people can buy used books for reasonable prices came. Also, the users can chat and have discussions about books. Users may also list the books they have for free; users may also exchange books with other users.

Recently, many people have books they do not want to read anymore, and they don't have the right platform to sell them or give them away to the right people. Reaching out to the right people who are in need of these books is not an easy task. Also, another issue is the price of the new books. The issue of the expensive books is one of the reasons for developing this application where the users will be able to see books at reasonable prices.

Books trading is an issue nowadays, it is difficult to find used books with affordable prices. Moreover, it is rare to find a platform that can allow people to talk and discuss books and their interests. Hence, this application is providing a platform for book lovers where it provides efficient services such as the ability of selling, buy, and exchange used books. Also allowing the users to have small chat rooms for the users to talk about their interests in books in order to grow the knowledge within the community which is targeted. Social media becomes an important part of young people's lives nowadays. It plays an important role in all walks of life and changes teenagers' ways of receiving information and even their reading habits.

The value of books has decreased with the rise of social media and digital distractions [1]. The BookLub Mobile Application is based on human-computer engagement (HCI) concepts and aims to improve user engagement and accessibility, encourage book trading, and rekindle interest in reading. This strategy guarantees that the program is user-friendly, captivating, and available to a broad spectrum of users.

The main objective of BookLub application is to ease the process for people to learn and spread knowledge by finding affordable and good-quality books easily through this application. Also, this application allows the users to create a chat room where they can chat and discuss their favourite books with the same interest. The objective of this application is to reach out to the book lovers community and gather them in the application where they can have post their ideas and have the ability to share books with each other and invite others to BookLub application.

II. LITERATURE REVIEW

Currently as a developer for any new system, before the developing phase of any application or system, it is important to search and get an insight into various similar existing projects. Literature Review is conducted to determine potential solutions and overcome the drawbacks of existing applications. It is considered the first step to understanding and studying these existing applications and websites and comparing them to produce more good ideas. Comparing the websites and applications is important in understanding how

these platforms could fulfil the user's requirements and identify the project's advantages and disadvantages. Mobile applications have the potential to play an essential part in creating an application for trading books. The concept of creating an e-commerce application in order to reach the greatest number of users is effective and it can be performed through a mobile application. The application represents a unique opportunity to expand the quality and availability of new/used books and affordable books. As a result of the literature review, it can develop an e-commerce application for trading books, that can be unique from other existing applications by adding new features and solving existing problems

It is important that the developers and researchers do the procedures to develop an application in terms of the functionalities and design the interfaces that should be user-friendly. Moreover, they should gather some information on existing similar applications to understand and identify each application's advantages and disadvantages to bring about ideas to develop the application better. The developers and researchers have gathered a few applications and websites to identify their pros and cons. The review could enable them to add, modify or enhance the application that will be built.

A. *Existing Applications*

The template is used to format your paper and style the text. All margins, column widths, line spaces, and text fonts are prescribed; please do not alter them. You may note peculiarities. For example, the head margin in this template measures proportionately more than is customary. This measurement and others are deliberate, using specifications that anticipate your paper as one part of the entire proceedings, and not as an independent document. Please do not revise any of the current designations.

a) BookScouter

BookScouter is a go-to solution for users who want to sell and buy used or new textbooks at a competitive price. The buyback site compares prices on 30+ vendors and finds the best deals on books. Whether you are a college student or a graduate, want to get rid of used books stocked in your closet, or buy titles at a low price, BookScouter is here to help you buy back and sell back textbooks. The book price comparison site is an easy-to-use tool that helps you sell and buy textbooks quickly and at the best price, firstly scan the textbook's ISBN barcode or type the ISBN in manually then compare real-time price quotes from over 30 vendors for textbooks. BookScouter LLC. The developer has been active since 2012 and has two sites (BookScouter - sell & buy used books & textbooks, and CampusBooks.com). With more than 100 thousand visits, BookScouter - sell & buy used books & textbooks is among the more popular sites [2]. Fig. 1 and Fig. 2 illustrate the screenshot from the BookScouter website.

Fig. 1. Screenshot of BookScouter

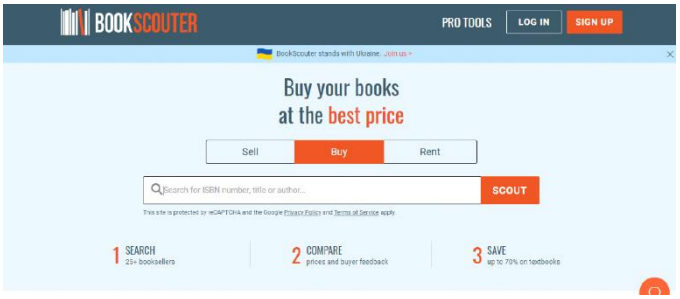

Fig. 2. Screenshot of BookScouter

b) ThriftBooks

ThriftBooks is a large web-based used bookseller headquartered near Seattle, Washington. ThriftBooks sells used books, DVDs, CDs, VHS tapes, video games, and audio cassettes. The ThriftBooks app lets book lovers quickly and easily search, browse, get book details, and buy millions of books, textbooks, and graphic novels. Scan barcodes to compare prices and check availability to make sure you get the best book prices. See personalized recommendations based on your interests and get an instant email notification when we receive an item on your wish list. Thrift Books Global, LLC, and was founded by Daryl Butcher and Jason Meyer in 2003. In 2004, they started to partner with libraries to provide more unsorted books. With more than 500 thousand installs on Google Play, ThriftBooks is popular among book lovers and known as one of few western online bookselling platforms [3]. Fig. 3 shows the screenshot of ThriftBooks.

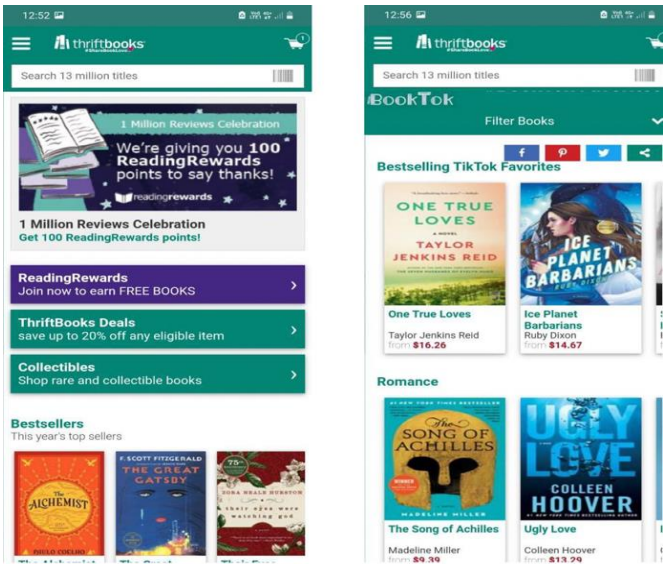

Fig. 3. Screenshot of ThriftBooks

c) Ziffit.com

Ziffit.com [4] can both identify and price your books quickly and easily by using the barcode scanning feature. Once it's identified the book, the site will assign a price to it and add it to your trading basket. However, if you don't think the site is offering a fair price, you can always edit your basket to remove books. Keep in mind that the site doesn't allow you to make trades under 10 items, or trades under fifteen dollars, so make sure you have enough books in order to make a trade. Once you've got enough books in your trading basket, and you've confirmed your trade, Ziffit.com will provide you with

a free postage label so that you can ship off your items. Ziffit.com was founded by Stephen Boobyer, and it is a member of the World of Books Group. It has been active since 2013. The current site portfolio contains 3 sites as shown in Fig. 4 and Fig. 5.

Fig. 4. Screenshot of Ziffit.com

Fig. 5. Screenshot of Ziffit.com

d) PangoBooks:

PangoBooks is a social marketplace for readers to buy and sell books and connect with one another [5]. The app for iPhone and Android devices makes it super easy for anyone to list books for sale, and the process for shipping and getting paid is as simple as can be. It's like opening your own little bookshop. When buying books on PangoBooks, you'll find a vast landscape of excellent titles at excellent prices. Every book listed comes from the shelf of a reader just like you, and every picture you see is a picture of the actual copy you will receive. When you purchase a book, the seller will ship it straight from their house to yours, and if there is any sort of issue, we will refund the entire amount. PangoBooks tech support offer complete customer support for every seller and buyer on the platform, and 100% back for every book that's sold. The app offers full refunds or returns if you are at all unsatisfied with a book you receive. Fig.6 illustrates the screenshot of PangoBooks.

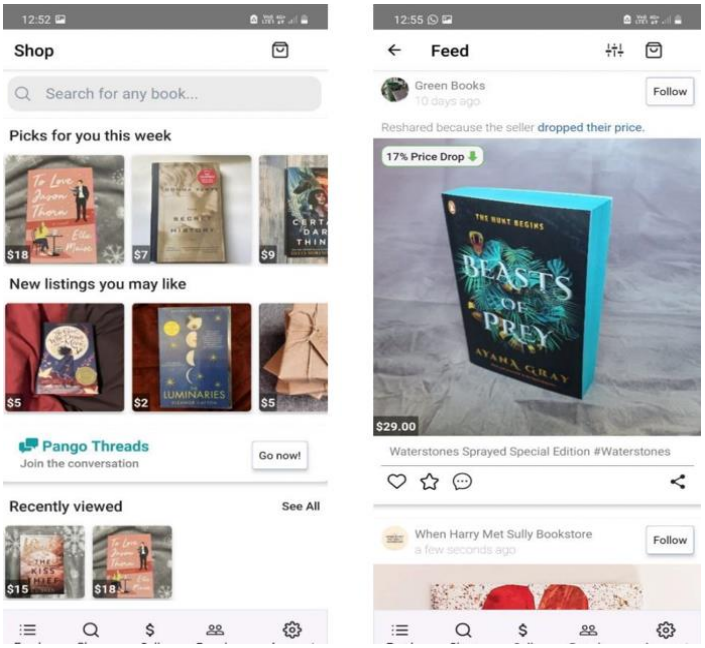

Fig. 6. Screenshot of PangoBooks

B. Features found in existing mobile applications

Table 1 compares the features of mobile applications meanwhile Table 2 is list of features from the websites.

TABLE I. FEATURES OF MOBILE APPLICATIONS

	BookChor	PangoBooks	ThriftBooks
Sell	√	√	X
Buy	√	√	√
Rent	X	X	X
Book donate	X	X	X
Review	√	√	√
Chat room	X	X	X
Private chat	X	√	X

C. *Features found in existing websites*

TABLE II. FEATURES OF WEBSITES

Sell	✓	✓
Buy	✓	×
Rent	✓	×
Book donate	×	×
Review	×	×
Chat room	×	×
Private chat	×	×

III. METHODOLOGY

The developers chose an Agile approach for this project, which refers to frameworks that help in the structuring, planning, and control of the system as it is being built [6]. The main reason for choosing this approach is that it is responsive and flexible. As a result, it is appropriate that the project's requirements are likely to change during the process. Other advantages of the agile methodology include the simplicity at which problems or distractions can be identified and early changes in the development process can be made [7]. It is also beneficial to the project because the process can be repeated during production. It will save time because the developers would not have to start from scratch. Agile also allows for a quick turnaround time and a reduction in complexity.

A. *Requirement Specification*

The researchers conducted surveys, questionnaires, and observations of current systems. The developers took note of the different advantages and disadvantages of the existing systems from the literature review and found that the applications and frameworks that provide BookLub with similar services do not simplify user objectives. The main goal of BookLub is to provide one platform with all features that the students and book lovers may need. Based on the advantages and disadvantages, the researchers decided on the number of features needed for the proposed system.

The user interface of the BookLub Mobile Application emphasizes accessibility, simplicity, and usefulness. The app's minimalistic layout, which lowers cognitive load and makes it easier for users to navigate through functions like book browsing, user chat, and book listing, is made possible by adhering to HCI principles. To improve learnability, the design includes recognizable icons and movements. It also provides feedback systems, such as visual cues, to let users know when they've done something well.

- Background on the issue: The students suffer from the high prices of textbooks and books, and users need a place where they can share their opinions on different books and share their favourite books. Users wish to contact the seller before buying to ask about the condition, delivery method, and so on.
- The objective of the survey: The main objective of the survey is to collect data on the users and how they wish to use the application if they want to buy or sell or rent or even donate books using the application. Furthermore, the survey aims to gather information on users' preferences using the app.
- Methods of questionnaires: We conducted a survey through Google survey and distributed the survey to students with different social media sites such as WhatsApp, Telegram, and Facebook.

B. *Functional Requirements*

a) *Use Case Diagram*

Fig. 7. Use case diagram-BookLub

b) *Sequence Diagram*

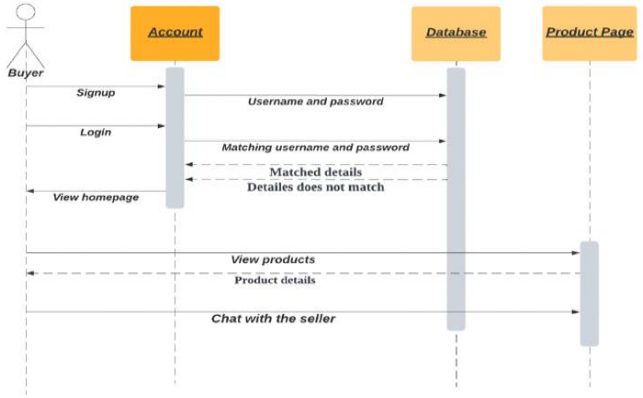

Fig. 8. Sequence diagram

c) *Database*

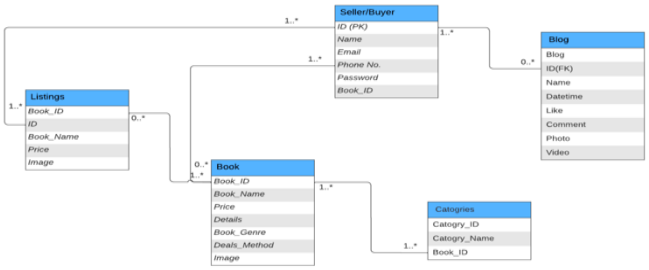

Fig. 9. Database

IV. RESULTS

After logging into the BookLub Mobile Application, users are taken to the homepage (as shown in Fig. 10), where they can easily explore the app's key features. The homepage is designed based on HCI principles, offering a clean and intuitive interface. A search bar at the top helps users quickly finds books by title, author, or genre, with predictive search functionality to improve ease of use and navigation.

The app also provides clearly categorized book genres (as shown in Fig.11), reducing cognitive load and helping users efficiently find books that interest them. The consistent design across the application ensures familiar actions, like tapping on book covers or genre icons, result in expected outcomes, improving the app's overall usability.

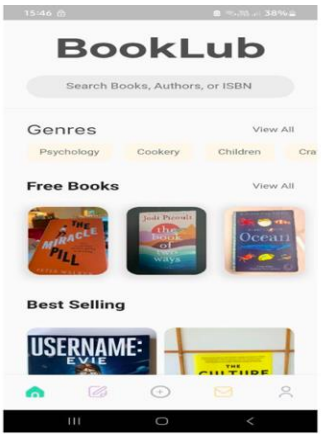

Fig. 10. Homepage interface

Fig.11. Genre Interface

Fig. 12 and Fig. 13 show the user profile and edit profile interface. In the profile page, users can update their personal information, manage their book listings, and view reviews left by other users. The interface is equipped with real-time feedback, providing visual confirmations, such as pop-ups, when a profile update is successful, or a new book is listed. This instant feedback boosts user engagement and confidence in the app's functionality.

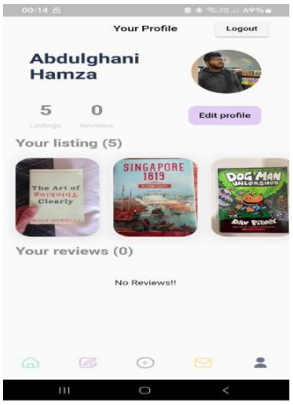

Fig.12. User Profile Interface

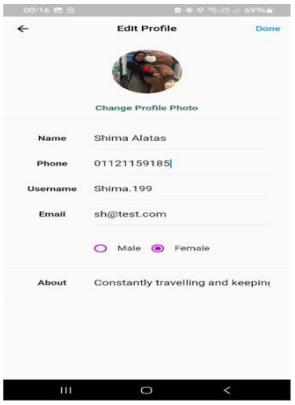

Fig.13. Edit Profile Interface

The add book page (as shown in Fig. 14) streamlines the process of listing new books, with a simple form and image upload feature. Fig. 15 illustrates the book details interface. Error prevention and feedback mechanisms notify users if required fields are incomplete and suggest corrections (e.g., automatically filling in ISBN information). This contributes to improved usability and efficiency in book uploads.

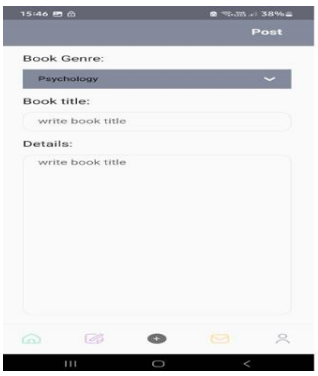

Fig.14. Add book interface

Fig.15.Book details interface

The messaging page (as shown in Fig. 16) facilitates smooth communication between buyers and sellers through a real-time chat interface. The design utilizes clear buttons and distinct message threads to reduce user confusion. Users can also leave and view reviews about interactions or books, fostering trustworthiness in the app's community (as shown in Fig. 17).

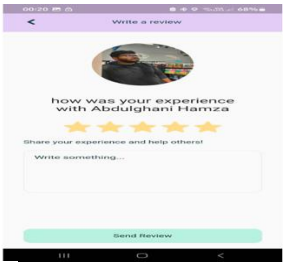

Fig.16. Message interface

The posting function (Fig. 18 until Fig. 20) promotes social interaction by allowing users to share their thoughts, reviews, and discussions about books. Aligned with user-cantered design principles, users can engage with posts by commenting, liking, or sharing, while receiving instant feedback through notifications. Additionally, the app ensures accessibility with adjustable text sizes and buttons, making it easier for visually impaired users to navigate.

Fig.18 Add Post Interface

Fig.19. Post Interface

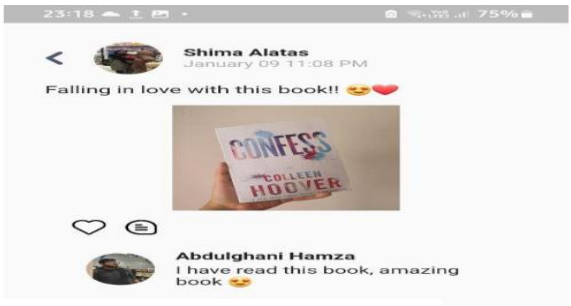

Fig.20. Comment Interface

Lastly, the app is optimized for responsiveness, ensuring it works smoothly on slower connections or older devices. By focusing on flexibility, personalization, and real-time feedback, the BookLub Mobile Application delivers a user-friendly platform that supports both social interaction and knowledge sharing.

V. Conclusion and Future Enhancement

The BookLub Mobile Application will keep developing in the years to come by implementing suggestions from user testing. Based on HCI principles, this strategy will guarantee that the application stays user-friendly, intuitive, and flexible enough to meet the demands of its expanding user base.

The target of this project was to create an interactive platform that works for those people who love to read books but cannot afford them, for people who have books that they do not read them anymore and are taking place at the shelves, and lastly, for books lovers to discuss their interests together. All the targets were accomplished successfully. There is no limit to the enhancement of the application. In the future, a proper payment system can be implemented in the mobile application. Furthermore, the participants of the UAT suggested implementing a rating system to rate the chats between the seller and buyer. Also, the participants of the UAT suggested implementing different languages besides English. Moreover, push notifications could be one of the future enhancements. Also, the developers are planning to collaborate with small libraries to offer more books for book lovers.

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UniHive: Centralized University Events Platform

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***Abstract*— This paper introduces a web application, UniHive, designed to address the challenges faced by students in discovering and participating in university events. The platform facilitates centralized event listing and registration for both students and organizers. Furthermore, it incorporates a virtual marketplace that incentivizes student engagement through a reward system with local business partnerships. A System Development Life Cycle (SDLC) approach guided the development process. User feedback was gathered through surveys and interviews, informing the system design, database structure, and user interface. This integrated approach ensures a user-friendly platform that streamlines event discovery, management, and participation, fostering a more vibrant university event ecosystem through UniHive.**

***Keywords*—University Events, Event Discovery, Virtual Marketplace, Student Engagement, Reward System, Web Application, UniHive**

I. INTRODUCTION

UniHive is a an application and database designed to keep track of university and on-campus viral event. This platform is uniquely created and implemented to give the students a single environment to post and search for new events that will take place in the university. While adopting the feature of virtual marketplace in our project, every student will be provided certain rewards every time he/she utilizes our platform to post and participate in specific events. Such points could be converted into a rebate or a discount voucher from our major business partners including Mowla, Soft Cremez, and Mosha, most of which are university-based businesses. These business partners in exchange would get business exposure from our website through the web advertisement slot provided.

A. BACKGROUND OF THE PROBLEM

The vast majority of IIUM students alert themselves to university events through the spread of viral messages around social media—WhatsApp, Instagram, Telegram, etc. This situation puts into question the problem of limited outreach to the targeted audience due to the fact that students are not necessarily within a certain channel, group, or community. For example, Student A is a BIT student taking the Business Intelligence and Information Sciences specialization. Last semester, she just finished taking a data warehousing course where she was exposed to the usage of Microsoft Power BI software but was just a brief lecture on simple basic knowledge. Later, she found out that a close friend of hers recently joined a 3-day training workshop to get a Microsoft Data Analyst Certification which was worth RM 3,000 and was subsidized by the government. She had missed the opportunity to join the said workshop by knowing the existence of the workshop way too late when it was already finished.

B. PROBLEM STATEMENT

As of now, there is still no standardized platform that encapsulates all the existing university events that students can refer to and go to. We have also taken into consideration the reception of the students towards this project once it has entered its deployment phase. This is due to the nature of the human capability to adapt to new changes and environments. The reason that persuades students or the IIUM community to blast viral messages through outside the traditional common social media platform

C. OBJECTIVE

The objective of the UniHive project is to design and introduce a one-stop university events website and application, where students can access a centralized platform to publish and search for upcoming university events. The goals of the project are specific: to develop a platform for it and add features to its blasting strategies in order to motivate the student's engagement. The nature of the project allows for measurement of progress through the number of events posted and students participating. The project is considered feasibly overviewing the capacity of the team members in web development and the resources. It is relevant because it addresses the need to digitize program discovery and enhance student engagement.

D. PROJECT SCOPE

1. Views: Participants or students will be able to view and register for any events listed within the website application and receive reward points; where they could exchange them into discount or rebate vouchers of our business partners (Local University Business such as Mowla, SoftCremez and Mosha). Event organizer(s) can publish and edit the details of the event they organized within the website. The admin would be handling the advertisement slots and managing the reward point system within the UniHive web system.
2. Target User: All undergraduate and postgraduate students of IIUM.

3. Platform Used: Microsoft Word 2021, Microsoft Project, Canva, Draw.io, Figma, Bootstrap, Visual Studio Code, Laravel 11, PHPMyAdmin, and XAMPP.

II. LITERATURE REVIEW

The primary goal of this literature review is to determine the ideal features for the UniHive website, which is intended to make it easier for students to discover and register for university events. This section analyzes existing university program management and event discovery platforms to identify strengths and weaknesses relevant to UniHive's development. The goal is to understand how UniHive positions itself within the current landscape and how it can leverage existing functionalities while offering unique value propositions.

Three mobile applications and one web-based application were selected for the literature review namely: Corq [1], EventBrite [2], CampusGroups [3], and StudentSphere [4]. Comparing these applications allows us to determine the key characteristics of event discovery websites. The results are summarized and presented in Table 1.

TABLE I : COMPARISON OF SIMILAR SYSTEMS

Features	Corq	EventBrite	StudentSphere	CampusGroups
Discover events	/	/	/	/
RSVP for events	/	/	/	/
Encourage community involvement	/	/	/	/
Student engagement	/	/	/	/
Attendee management	/			
Managing registrations		/		/
Advertisement slots				
Selling tickets		/		/
Local business focus			/	
Loyalty system				

In developing the project, we examined comparable platforms in Table 1 and determined which characteristics to incorporate in the UniHive website. While Corq can provide rich features for complex events, which are out of the scope of UniHive, Eventbrite inspires a seamless user experience when it comes to user-friendly interfaces for program publishing and discovery. StudentSphere has an integral concept of student discount, but UniHive extends this to an integrated virtual marketplace with local business partnerships, providing broader incentives for program participation—a feature not available in platforms like Campus Groups. Other platforms, such as Eventbrite, have much more functionality focused on ticketing and little to no functionality related to student publishing of events, while Campus Groups does not have any comprehensive program discovery. UniHive will thus bridge the gaps through the offering of a centralized platform both for the university organized events and for initiatives driven by students.

III. METHODOLOGY

A. DEVELOPMENT APPROACH

System development approaches provide a structured manner for designing systems. A development approach will be used in the management of system development, from design to implementation and maintenance. There are a good number of them to select from, including but not limited to Scrum, Rapid Application Development (RAD), Agile approach, System Development Life Cycle (SDLC), Waterfall model, and Spiral model. The choice of approach in the accomplishment of any given project determines the realization of the project goals within the estimated budget and time. The system development approach that will be used for this project is explained below, considering the specific requirements, aims, and resources of the project.

Fig. 1 System Development Life Cycle

According to Gupta and Fig. 1 illustrated above, there are 6 steps to be included in the System Development Life Cycle [5] which are:

1) *Planning:* The developers coordinate with different stakeholders and conduct a survey among IIUM students to gather requirements for UniHive. In this stage, goals, objectives, user needs, and system requirements are defined. The project scope, timeline, and resources are outlined.

2) *Analysis:* The developers go through the requirements and come up with a detailed plan. They evaluate the technical feasibility, required hardware and software, and possible risks. Data requirements, system architecture, and interaction between the components are defined.

3) *Design:* Design involves System Design, Database Design, and Interface Design. Use case diagrams, sequence diagrams and activity diagrams are drawn to represent the system flow. Database tables are designed to hold the data for each use case. User friendly interfaces are developed for publishing events, exploring events, redeeming points, and for displaying advertisements.

4) *Coding:* Actual development of UniHive with PHP using Laravel; for the website template, Bootstrap is used for

responsiveness and a modern look. The developers will implement the features from the design and integrate the front-end and back-end parts for a seamless user experience.

5) *Testing:* UniHive platform is tested for unit, integration and system testing to find and rectify any issues. UAT (User Acceptance Testing) is performed to ensure the delivered functionality meets the user requirements. Any feedback from clients is incorporated and utilized during final preparation before going live.

6) *Maintenance:* After the UniHive platform is launched, it will be constantly monitored for any issues and other performance parameters. Any bugs or issues will be rectified after analysis of user feedback and complaints. Constant maintenance is done to keep the platform updated and relevant.

B. System Design

This section involves analysing the requirements and creating a use case diagram to aid in understanding for developers. Fig.2 shows the use case diagram which illustrates a list of key business actors, and their roles. In UniHive, both organizers and participants perform their respective activities through user interface interactions. The common actions between the organizers and the participants include registering an account, logging in, choosing a role, updating profiles, checking points balance, and redeeming rewards. These features ensure the smooth flow of activities and effective management of their dealings within the platform. For the organizer, the important use case is event management. Organizers can create events by entering necessary details and then be able to post them on the platform. Organizers can also change event details as needed, and they are able to remove events if those events are no longer applicable or active. It also makes the organizing part versatile to ensure events are constantly updated.

On the other hand, the participants use UniHive as a means of discovering and engaging in the events. Using the "filter event" feature while browsing the website, the participants will be able to delve into all the events by using keywords or applying the different filters available, such as event level, type, or category. This increases accessibility and allows participants to seek out events that suit their interests and tastes. After an event is found, the participant can get the details of the event, register attendance, and share his or her feedback after the event. The administrative functionalities of the platform focus on system administrators to manage advertisements with ease. They will be able to add, modify, or delete advertisements in an effort to keep promotional content fresh and relevant. In doing so, the administrator is able to optimize the advertising ecosystem of the platform and enhance engagement.

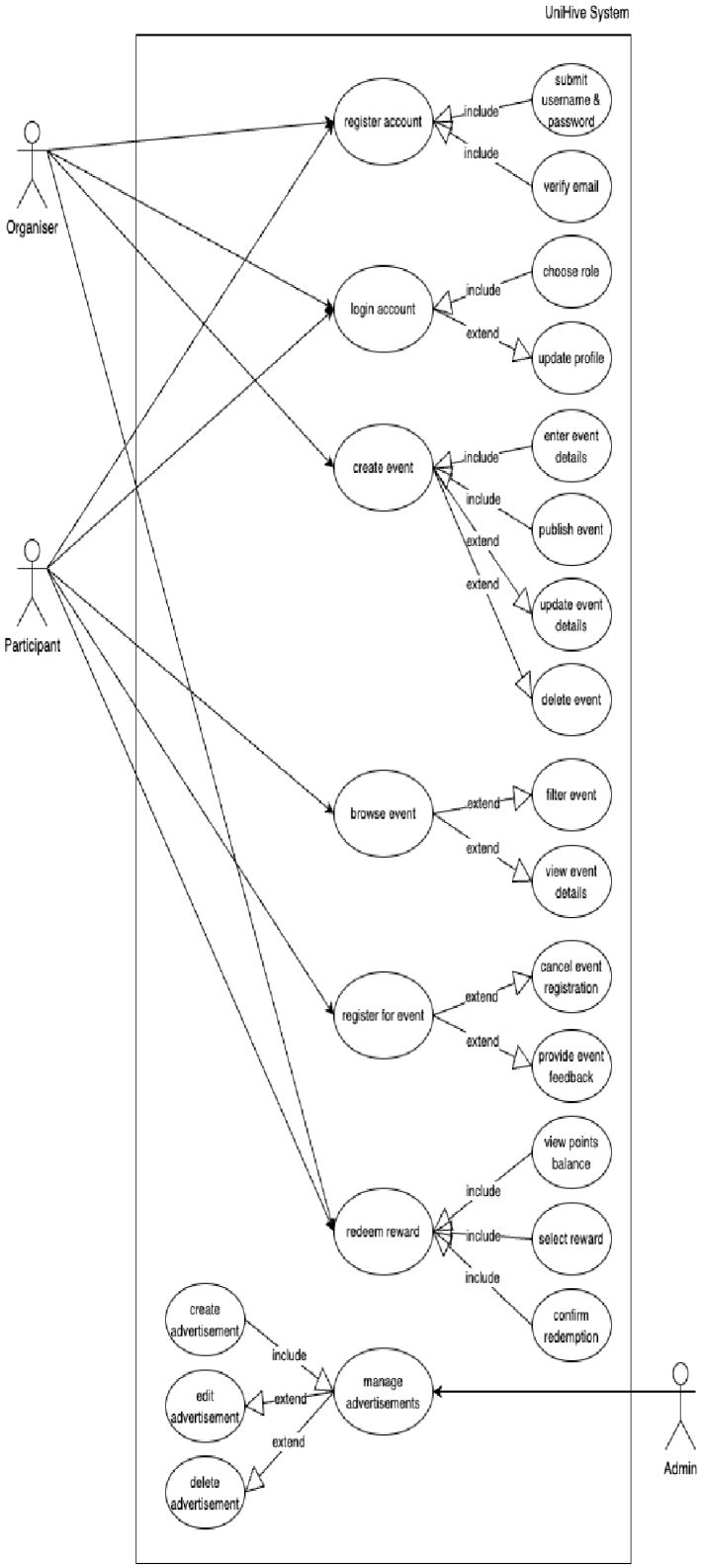

Fig. 2 Use Case Diagram

C. DATABASE DESIGN

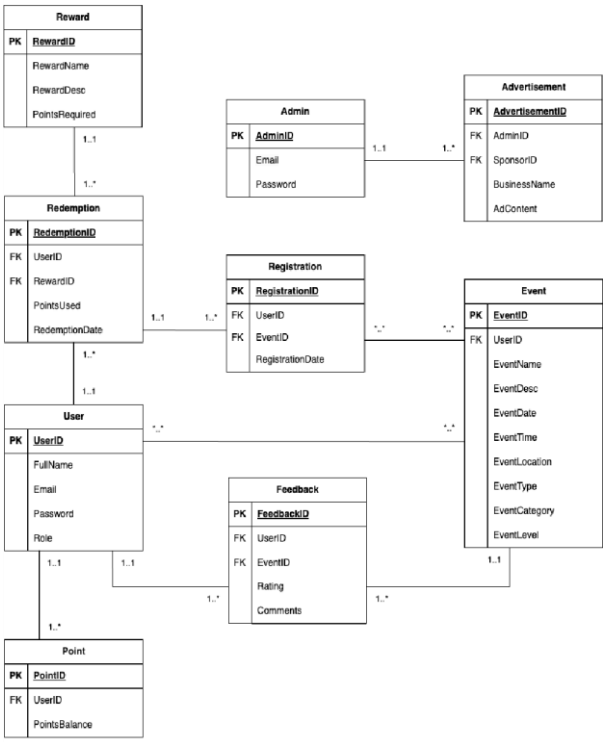

Fig. 3 Entity Relationship Diagram

Fig. 3 displays the Entity Relationship Diagram (ERD) for UniHive website which involves 9 entities.

1) User: The "User" table stores information about users of the platform, with attributes including a unique user ID, a password for authentication, the user's full name, their email address, and their role within the platform.

2) Admin: The "Admin" table stores data related to administrators of UniHive system, including a unique admin ID, email address, and an admin secured password.

3) Event: The "Event" table holds information about all the ongoing events within the university, attributing a unique event ID, its name, the level of event, category that characterize the event, the type of event; paid or free admission, their description, its scheduled date and time, and also the location.

4) Registration: The "Registration" table records information about user registrations for events, featuring a unique registration ID, their registration date, and references to both UserID and EventID from the User and Event table, indicating the user who registered and the event the user registered for.

5) Feedback: The "Feedback" table stores user feedback about events, storing a unique feedback ID, their rating of the event including their personal comment, and references to both UserID and EventID from the User and Event table, indicating the event the feedback is about and the user who provided feedback.

6) Point: The "Point" table tracks points earned by users through the platform's reward system, including a unique point ID, current number of points accumulated by the user, and references the UserID from the User table, indicating the user who has the points.

7) Reward: The "Reward" table directly stores the type of reward redeemed, with attributes such as a unique reward ID, name of the reward, details about the reward and its benefits, and number of points required to redeem the reward.

8) Redemption: The "Redemption" table stores information about user redemptions of points for rewards, featuring unique redemption ID, number of points redeemed in one transaction, date of the redemption, and references the UserID from the User table, indicating the user who redeemed the points.

9) Advertisement: The "Advertisement" table stores information about advertisements displayed on the platform, holding a unique advertisement ID, content of the advertisement, and references the SponsorID from the Sponsor table, indicating the sponsor who placed the advertisement.

IV. PROTOTYPE

A. USER(S)

This section presents the user's view of UniHive web application, as shown in Figure 4 until Figure 6.

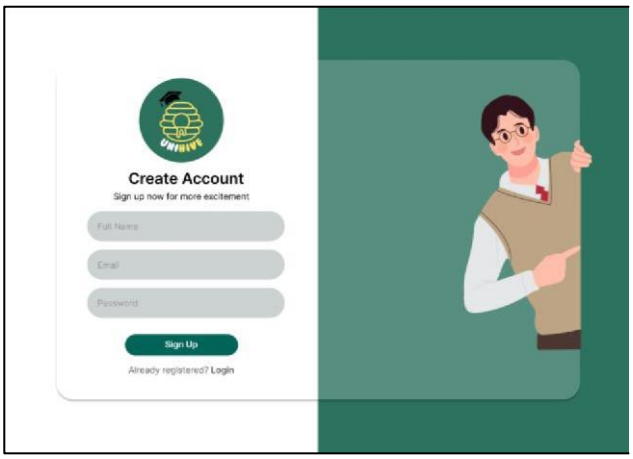

Fig.4.Create Account Page

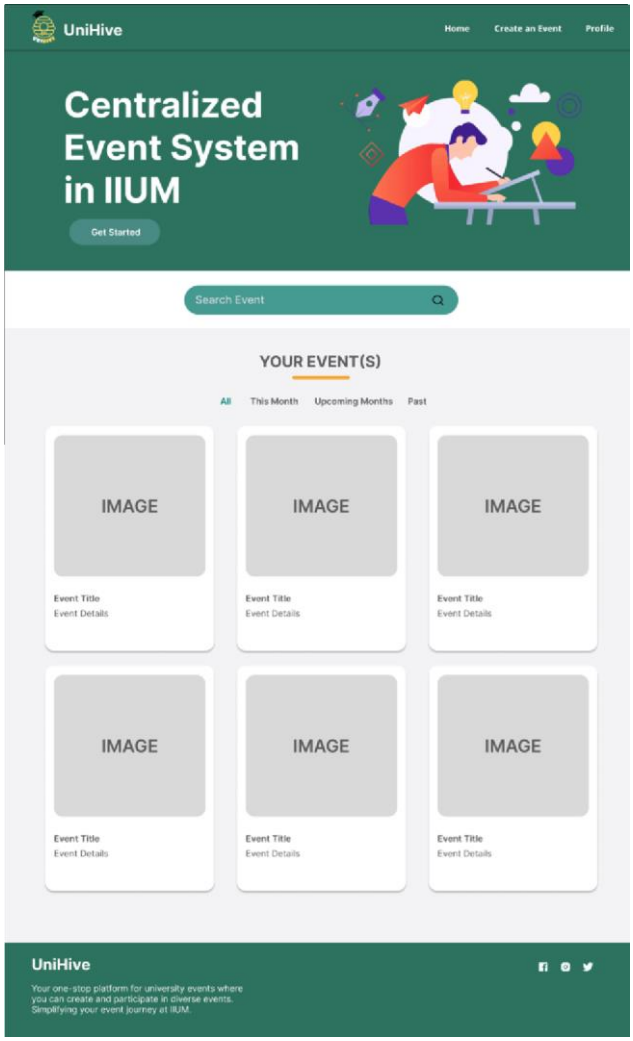

Fig.5. Organizer's Homepage

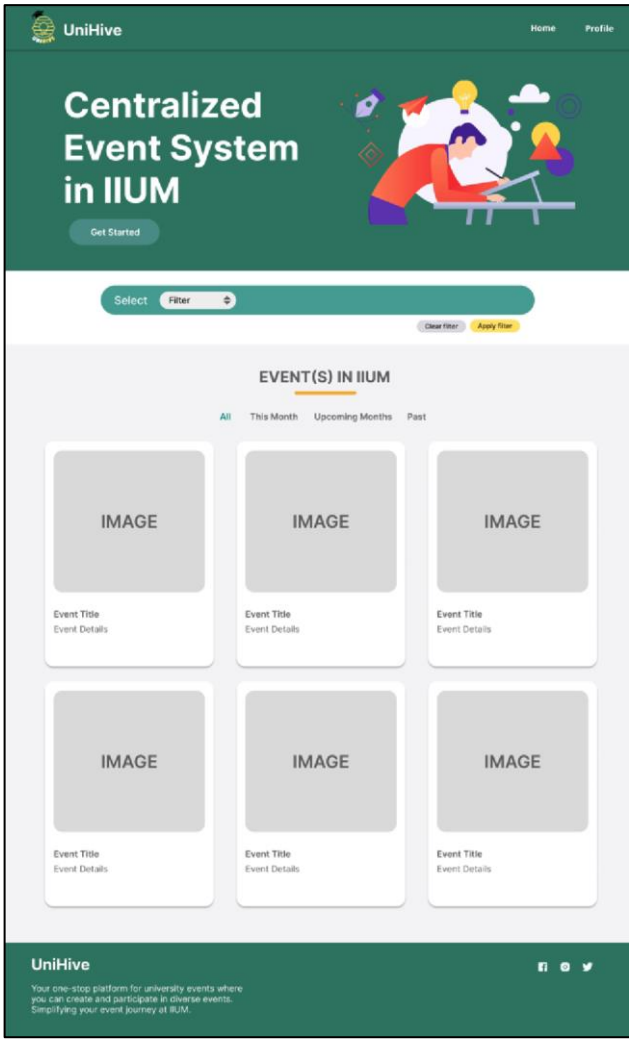

Fig.6. Participant's Homepage

V. CONCLUSIONS

In summary, UniHive seeks to revolutionize the way university events are discovered and engaged with by providing a consolidated database specifically designed for the students. The system addresses the current limitations of the social media approach for event dissemination by providing a more centralized and standardized environment for the posting and discovering events. Beyond just incentivizing student participation through a virtual marketplace and reward system, UniHive promotes partnerships with local university-based businesses for an improved student experience. By using the SDLC approach, the project ensures a structured and effective development process from planning and analysis to design, implementation, and maintenance. Therefore, UniHive will fill up the gaps identified in existing platforms by offering a unique, comprehensive solution that supports both university organized events and student-driven initiatives.

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SecurityJourney: Online Information Security Learning System

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***Abstract* - SecurityJourney is a unified platform designed to encompass all learning materials and exercise modules across four learning methods: kinesthetic, visual, auditory, and reading or writing. The purpose of this project is to provide a comprehensive and adaptable information security learning system. This project is specifically tailored for the IIUM community, particularly students and staff interested in deepening their knowledge of information security. SecurityJourney will be developed on a desktop platform utilizing Laravel for the web application framework, phpMyAdmin for MySQL database administration, XAMPP for a local server environment, and Visual Studio Code (VS Code) as the primary code editor.**

Keywords—SecurityJourney, learning system, learning method, IAS

I. INTRODUCTION

In the ever-evolving digital landscape, the imperative for comprehensive information on security knowledge has become increasingly apparent. In response to this expanding need, the ground-breaking SecurityJourney: Online Information Security Learning System is created, which is set to reinvent cybersecurity education within the IIUM community. Users in the IIUM community, especially students in Information Assurance and Security (IAS) specialization, face significant obstacles when trying to obtain complete and logical learning resources of the related specialization's courses. The current environment is characterized by fragmented materials, which makes it difficult for users to navigate and comprehend important ideas. Furthermore, users are unable to interact with the content in a meaningful way or gain a comprehensive understanding of cybersecurity principles due to the fragmented nature of the resources that are available. SecurityJourney seeks to address these problems by providing a unified platform that slickly integrates many resources into a user-friendly interface, enabling users to improve their understanding of information security and securely traverse the digital world.

A. Problem Statement

- Users, especially from IIUM community, struggle to obtain revision notes and resources due to overlap with other courses' topics on websites.
- When users learn theoretically, the materials they find are a little difficult for them to comprehend.
- Some websites' lack of interactive features like quizzes that would test audiences' understanding and help them absorb the content better.

B. Project Objective

- Design and develop a working web application learning system for information security.
- Enhance users' understanding in information security through the features and functionality offered by the system.
- Provide a user-friendly, interactive, and responsive learning system.
- Encourage the IIUM community to learn about information security through various learning methods in a simple and comprehensible way.

C. Project Scope

The project is to give the IIUM community access to a consolidated information technology security learning system, with a focus on Information Assurance and Security (IAS) specialized students from Kulliyyah of Information and Communication Technology (KICT). With the integration of materials onto a single platform, this approach seeks to streamline and accelerate information security education. Limitations to the project include:

- Technical limitations: Developers need to enhance their skills for optimal system effectiveness.
- Creating engaging learning materials: Balancing enjoyment and relevance while adhering to course guidelines poses challenges.
- Adaptability to changing technology and educational goals: Developing a scalable system capable of evolving with technological and educational changes is challenging.
- Copyright issues: Careful assessment of copyright restrictions is necessary when obtaining lecture notes and materials for IAS specialist courses to maintain resource quality.

II. LITERATURE REVIEW

The purpose of this literature review section is to provide a comprehensive examination of existing systems relevant to the development of the project. This review aims to explore and analyze five key systems, focusing on their features and functionalities to gather insights and best practices that can

inform and enhance the system design. The current landscape can be better understood by looking at these established learning management systems. Strengths and weaknesses can then be recognized, and this information can be used to develop a more robust and successful solution. This section will highlight the five prominent systems that have been studied in detail.

Firstly, Ita'leem,[1] the Learning Management System (LMS) for the IIUM community, supports students and faculty members by providing access to registered courses, sharing course materials, and monitoring student engagement. Its secure, password-based authentication ensures safe access to the users. The user-friendly dashboard displays current semester courses, with a continuous scroll page for further convenience. Ita'leem also keeps lecturers informed about student submissions and progress, facilitating effective communication and course management, thereby enhancing learning efficiency and security.

Secondly, Hank and John Green's Crash Course YouTube series features interesting and concise instructional films covering a variety of topics including science, history, literature, and philosophy [2]. The videos condense difficult subjects into brief, enjoyable chunks that include comedy, lively graphics, and animations. The colorful user interface draws in users and improves understanding, which makes learning fun and efficient. The themes are easy to navigate, with each one leading to a pertinent video. Crash Course makes learning engaging and effective by utilizing the special features of online platforms.

Thirdly, a well-known website that provides extensive resources for web development, including HTML, CSS, JavaScript, and other languages, is W3Schools. It offers interactive examples, tutorials that are suitable for beginners, real-world activities, and tests to make web development topics simple for users to understand and use [3]. On top of that, in an Integrated Development Environment (IDE), users can experiment with topics such as database management and web design through practical coding techniques. W3Schools offers interactive and hands-on learning resources to improve students' web development skills.

Next, Education.com [4] is an extensive website that provides educational information for kids in preschool through fifth grade, catering to parents, educators, and homeschoolers. It includes more than 25,000 coloring pages, worksheets, and educational activities along with math, spelling, and time conversion tasks. The portal features morality tales, instructional films covering a range of subjects, and music videos for both visual and aural learning. Hover-over descriptions of the interactive exercises and stories provide information about grade levels and learning objectives. The goal of Education.com is to promote children's learning and development by offering a variety of interesting, dynamic, and engaging tools.

Lastly, the Government Chief Information Officer of Hong Kong manages the Information Security (InfoSec) website [5], which provides the public with a wealth of information security resources, including best practices, empirical data, and proactive steps to avert cybercrimes. It contains advisories about phishing attacks, interactive instructions made for different user groups, and malware alerts. Promoting best practices for information security and educating the public about cybersecurity concerns are the main goals of infosec functions.

III. METHODOLOGY

SecurityJourney was developed via rapid prototyping. This method is effective in gathering information, engaging users for feedback, and utilizing suggestions for improvement. It helps to avoid unnecessary resource allocation and ensures early evaluation of system concepts, user interfaces, and overall operation. Effective communication and constructive feedback are critical for ensuring that the end product satisfies user expectations. Moreover, rapid prototyping provides flexibility, allowing for continual modification based on user input while minimizing the waste of key development resources.

A. Requirement Collection

Understanding the user requirements is important in developing this project. To develop a user-friendly learning system, user requirements are essential to this project as they center on what the system must accomplish. Therefore, an online survey was carried out using Google Forms to collect the data. The online survey was distributed over two weeks to a targeted group of respondents, which included staff and students of IIUM. Respondents need to answer a set of questions about the proposed system. The survey included 47 participants, including 21.3% staff and 78.7% students. It was separated into two sections: one for IIUM students studying Information Assurance and Security (IAS), and another for IIUM staff and non-IAS students. The first section intended to identify IAS students' preferences and challenges, while the second section gathered information from non-IAS respondents on their exposure to and interest in IT security.

The collected responses were then analyzed to gain a better understanding of the project scope in terms of respondents learning preference and feature suggestions. Most IAS respondents are in their third year and have moderate IT security skills. They prefer visual, kinesthetic, and read-and-write methods, emphasizing theoretical explanations and practical exercises. Non-IAS respondents adhere to increasing their knowledge of IT security. However, they struggle with time and resources. They prefer visual learning methods like mind maps. As a result, both parties underline the importance of implementing an engaging learning process within SecurityJourney.

B. Development Requirement

- Visual Studio Code is a development environment code editor designed to support debugging, task running, and version control for efficient development of the SecurityJourney system.
- Laravel PHP and PHPMyAdmin: Laravel is the framework for developing the SecurityJourney system and PHPMyAdmin is to handle the administration of MySQL over the Web for this system.
- XAMPP was used to set up the local server for testing and deploying the SecurityJourney system.

C. Functional Requirement

The survey requirement analysis outlines the processes, functionality and features of the system that will meet project

objectives and user's needs. These requirements are the foundation for designing, creating, testing, and delivering a system that provides the needed functionality. Moreover, analysis and design are important stages in which users are included to ensure that the system fits their expectations while still being delivered on time and within budget.

Fig. 1 shows the SecurityJourney system use case. Registered users will inherit non-registered user tasks, but non-registered users need to register first before they can have the same access as register users. The admin will manage the user, course contents, and review the feedback that the user submits. Authorized users can view the dashboard, profile and article page in the system.

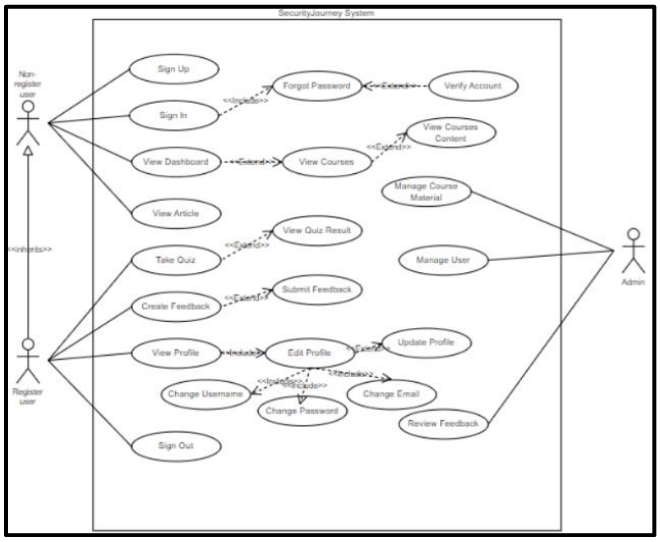

Fig. 1 SecurityJourney Use Case Diagram

Fig. 2 explains the activity for users within the system. In the dashboard, the user can view courses, articles, and profile. After a session, the user can sign out of the system. When viewing a course, the user can also select their preferred learning method. The user is also allowed to retake the quiz after completion.

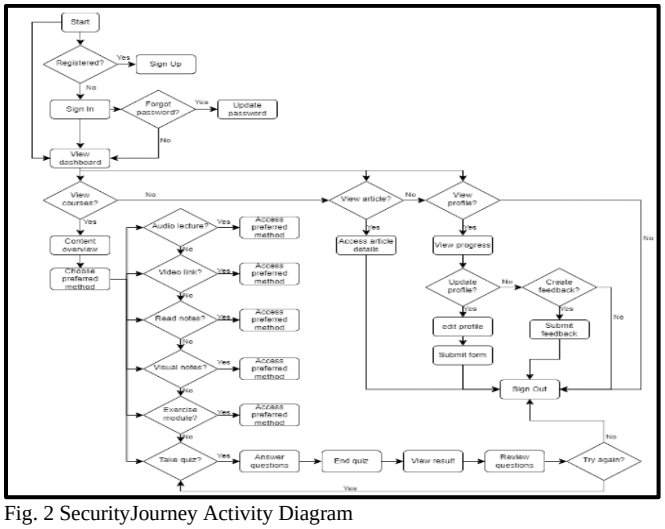

Fig. 2 SecurityJourney Activity Diagram

IV. RESULT

The SecurityJourney Online Information Security Learning System's implementation stage comprises developing and implementing the requirements and design to produce an operational platform. During this stage, the programming language, framework, and associated functionalities that meet project requirements must be specified. The SecurityJourney system's evaluation step then evaluates how well it performs, functions, and delivers goals. Determining the system's performance in general, user-friendliness, efficiency, and dependability depends significantly on this evaluation. The system may be optimized to improve the IIUM community's information security learning experience through an extensive evaluation.

A. Examples of Interface Screenshots

1) Admin and Users Interface:

Figure 3 shows the landing page as the starting page of SecurityJourney learning system. Figure 4 shows the register page while Figure 5 shows the login page for users and administrators.

Fig.3 Landing Page

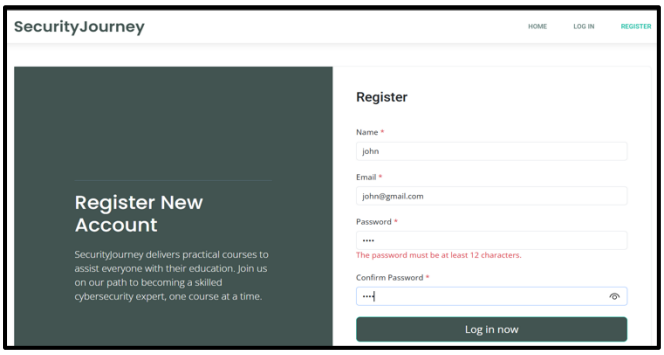

Fig.4 Register Page

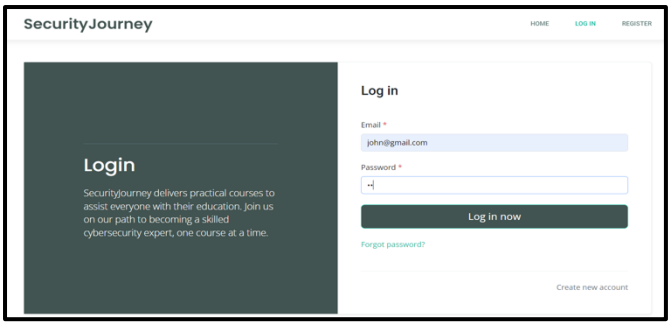

Fig. 5 Login Page

2) Admin Interfaces:

For administrative features, Figure 6 shows the administrators dashboard which has the options of functions that will be managed by administrators. Figure 7 portrays the content's files management where they can upload content's file according to category reading notes, visual notes, or

exercises module. Figures 8 depicts the list of feedback submitted by users that can be seen by administrators and Figure 9 shows the quiz management page where they will upload the quiz for each course.

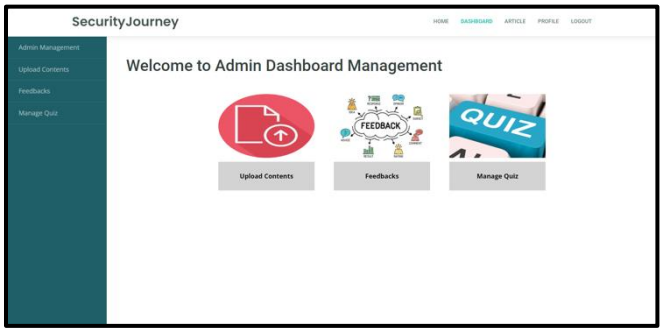

Fig. 6 Admin Dashboard

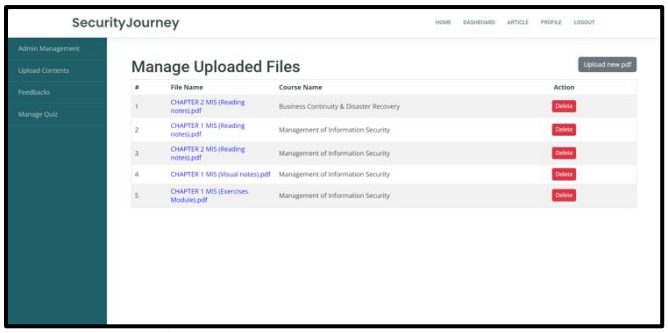

Fig. 7 Content's File Management Page

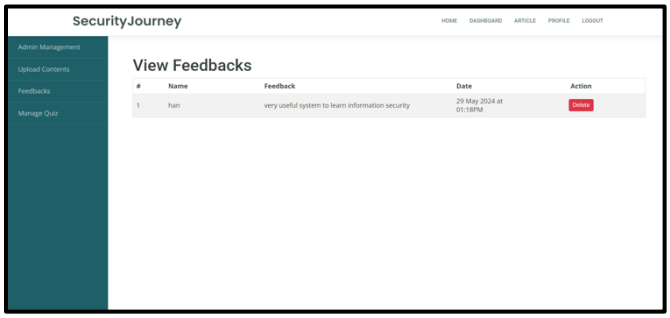

Fig. 8 View Feedback Page

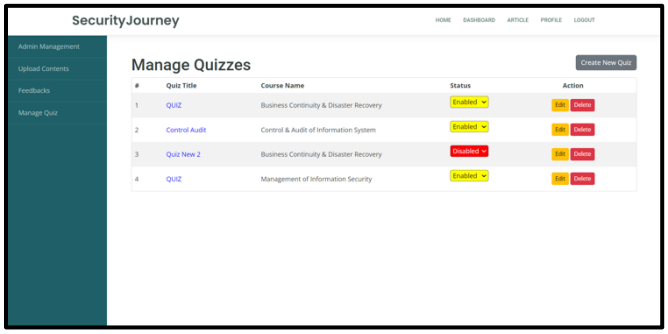

Fig. 9 Quiz Management Page

3) User Interfaces:

Apart from that, for user features, Figure 10 shows the user dashboard that has the options of available courses that will be chosen by users. Figure 11 shows the course page which has the overview of the course chosen along with a list of 5 chapters and quizzes for the course. Figure 12 illustrates the chapter page that has a list of learning method content including videos, reading notes, visual notes, and exercises module. Moreover, Figure 13 shows the article page with a list of available articles related to cyber-attacks. Figure 14 shows the user's profile page where users can see their browsing history throughout SecurityJourney's learning system from their last session. Figure 15 shows the feedback page where users can submit their feedback about their experience using SecurityJourney's learning system.

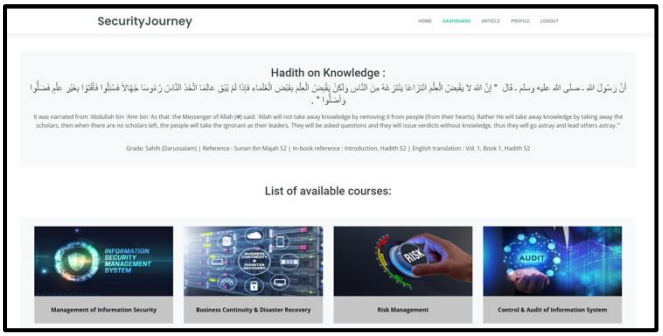

Fig. 10 Users Dashboard

Fig. 11 Course Page

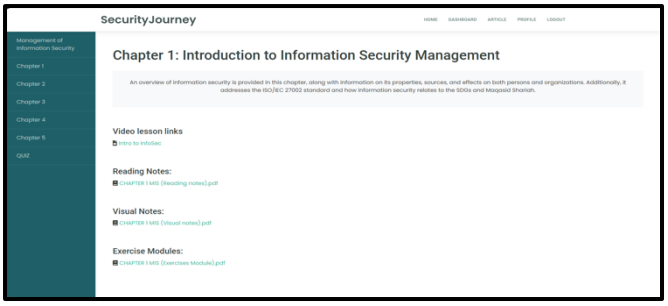

Fig. 12 Chapter Page

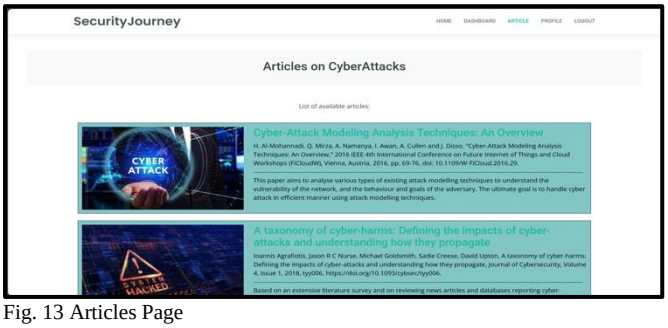

Fig. 13 Articles Page

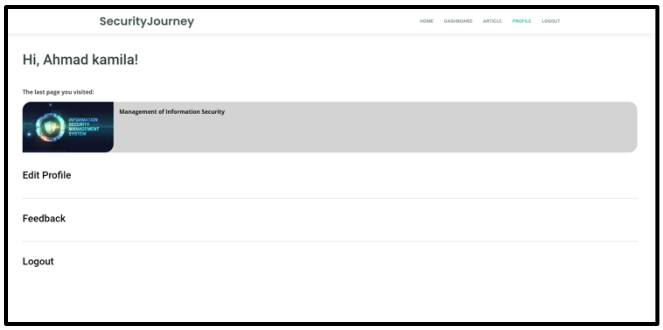

Fig. 14 User's Profile Page

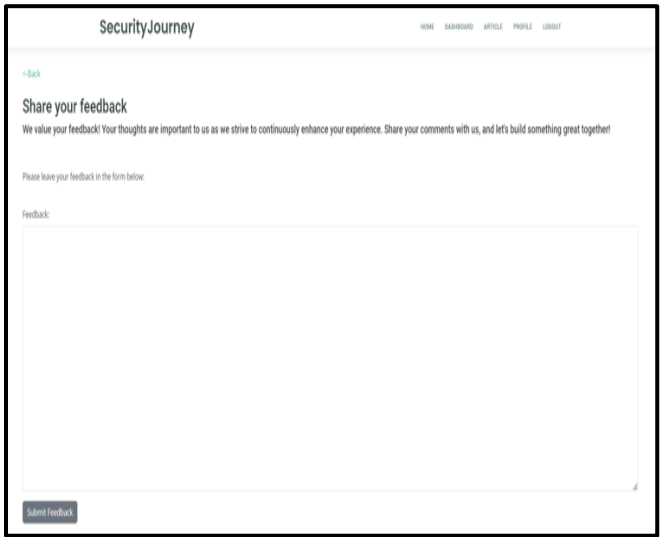

Fig. 15 Feedback Page

V. Discussion

Implementing rapid prototyping in this project allowed developers to detect and rectify faults throughout the process efficiently. This development approach offers flexibility as it allows ongoing adjustments based on user requirements. Additionally, it facilitates rapid feedback for developers by minimizing the waste of valuable system development resources. Given that SecurityJourney is an educational platform, rapid prototyping aligns well with its iterative nature and user-oriented focus. The feedback gathered during beta testing enabled developers to address any concerns before moving on to user acceptability testing (UAT). User acceptance testing (UAT) was carried out after the finished system was ready for launch. The goal of UAT was to test all functionalities of the final product properly. The developers attempted to confirm that the system matched all planned criteria defined during prototyping before closing the project.

For this SecurityJourney system, the testing is done through beta testing. This system had been tested by 4 users, two from non-IAS students, one IAS student and one staff. They were required to register accounts and access all features available. For the admin side, the developer monitored users' activities from time to time to make sure no error occurred. Finally, all interfaces were evaluated for system reliability and performance purpose to ensure the system met the objective of the project.

VI. Conclusion And Future Works

SecurityJourney's system was designed for the IIUM community, especially students specialized in IAS. This system focuses on easing the community learning journey by including different learning methods. In each chapter, the developers provided video, visual and reading notes as well as exercise modules for users to test their level of knowledge in that topic. Therefore, SecurityJourney managed to achieve the objectives set out. However, the developers also acknowledge the limitations and challenges that may arise if were to implement further enhancements. This system should incorporate a chapter selection option and expand the number of courses available to IAS students. From the administrator's perspective, the system might be improved further by allowing users to track their progress.

VII. Acknowledgment

Our first gratitude goes to Allah the Exalted for providing the favor that enabled us to complete this work. Our lecturers, final-year project coordinator, and supervisor's extensive knowledge and experience were essential to our ability to COMPLETE this project. Additionally, we would like to thank our family for their support and encouragement during the system development phase of the final year project. Finally, we thank our classmates for their HELP and emotional support throughout the late-night feedback sessions.

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A Data-Driven Approach to Unveiling Mental Health Realities Among Undergraduate Students at the International Islamic University Malaysia (IIUM) Using Machine Learning: A Case Study

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***Abstract*— This study investigated the mental health of Generation Z undergraduate students at the International Islamic University of Malaysia (IIUM), focusing on the impact of academic pressures and societal expectations. Generation Z, defined as those born between 1997 and 2012, represents a unique cohort navigating the challenges of modern education and societal norms. Data was collected from IIUM students via a Google survey for the analysis. The study compared Random Forest, Support Vector Machine, and Feed Forward Deep Learning models for predicting mental health outcomes. Random Forest achieved the highest accuracy at 0.71. Key factors influencing mental health were daily meal intake, extracurricular activities, social support, and financial stability. The results highlight the importance of effective data balancing techniques, like SMOTE, in improving model performance. These findings provide valuable insights into the mental health challenges faced by Generation Z students and emphasize the need for targeted interventions to support their well-being.**

Keywords— mental health, generation Z, undergraduate, machine learning, SMOTE

I. INTRODUCTION

This final year project is about a data-driven approach to uncover the realities of mental health among undergraduate students in Malaysia, utilizing machine learning techniques. The project aims to use acquired data to provide significant benefits to individuals or groups. Motivated by the challenges faced by undergraduate students, particularly those belonging to Generation Z, in managing their mental health, the project seeks to delve into the minds of this generation and understand the underlying mental effects. The primary objective is to conduct a thorough analysis of the mental well-being of college students in Malaysia, enabling the prediction of trends for early intervention measures. The methodology involves a meticulous data collection process, utilizing surveys and interviews. Subsequently, machine learning algorithms will be applied to comprehensively analyse this data. Through machine learning models, the project aims to identify patterns, risk factors, and potential early indicators of mental health issues among undergraduates in Malaysia. By integrating traditional data collection methods with advanced machine learning techniques, this project aspires to provide a holistic understanding of the mental health landscape among undergraduates in Malaysia.

Rapid digital technology development and the widespread use of electronic gadgets have created a new "digital environment" that has become a key factor in forming Generation Z. Authors of this research claimed that Generation Z children exhibit certain psychological and personal traits, including socio-psychological de-adaptation, higher anxiety, lower sociometric status, and decreased psychometric parameters of physical development [1]. The prevalence of overweightness in Generation Z may be influenced by factors such as sedentary lifestyles and changes in dietary habits. The researchers underscore that those prior investigations into bipolar and mental health primarily relied on traditional methods for data analysis, hence they wanted to improve upon them. Consequently, in this research, deep learning is employed to uncover hidden patterns within the responses, which the researchers claim is challenging to distinguish using traditional approaches [2].

To achieve high-accuracy prediction of mental health problems, multiple machine learning algorithms were applied to datasets, including, Logistic Regression, SVM, Random Forest, and K-Neighbors. To ensure the best possible working of the machine learning algorithms, the model's parameters were fine-tuned for increasing its utility and accuracy [3]. The implementation of several machine learning in this research is based on previous research and future work recommendation. This paper utilizes OSMI datasets to analyse the relationship between work parameters and mental health, employing machine learning for predictive modeling. It addresses imbalanced instances using techniques like SMOTE [4]. In this research, one of the highlights is the use of the SMOTE technique to address data imbalance, ensuring more accurate results.

II. PROPOSED MODEL

This section explains the entire research process, starting from data collection and machine learning implementation to the analysis using PowerBI. It outlines the steps taken,

beginning with data collection, followed by the application of machine learning algorithms to comprehensively analyze the data. The goal is to identify patterns, risk factors, and potential early indicators of mental health issues among undergraduates in Malaysia. By integrating traditional data collection methods with advanced machine learning techniques, the project aims to provide a holistic understanding of the mental health landscape among undergraduates in Malaysia. This section will also discuss in detail the importance of each procedure undertaken in this study, concluding with an introduction to methods for handling data imbalance.

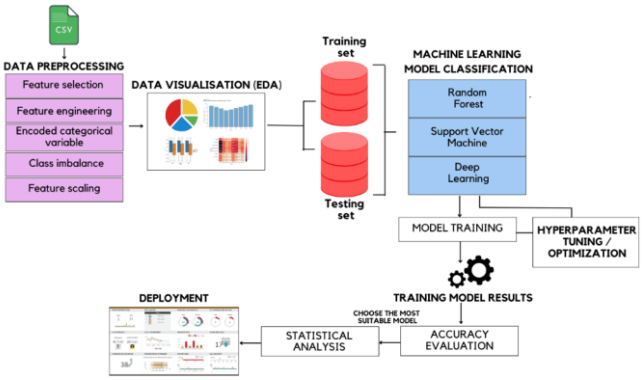


Fig. 1. Summary of Methodology

The entire methodology process, based on the figure, is explained below, part by part.

A. *Data collection*

The data was collected using a Google Form, which was distributed through social media platforms. The form consisted of 11 sections that asked respondents about themselves and included a mental health assessment. Responses were received from 150 participants, primarily students from the International Islamic University Malaysia.

TABLE 1. LIST OF QUESTIONS IN GOOGLE FORM

No.	Questions
	Demographics
1.	What is your age?
2.	What is your gender?
3.	Are you a local or international student?
4.	Where are you from?
5.	Which university are you studying in?
6.	What academic year are you currently in?
7.	What is the name of your bachelor program?
8.	Do you live on or off-campus?
	Academic and Workload Factors
9.	On average, how many hours per day do you dedicate to studying?
10.	How would you rate your academic performance?
11.	How would you rate your overall level of stress related to academic responsibilities?
12.	Which of the following academic stressors have you experienced in the past month?
13.	Have academic stressors impacted your sleep or overall well-being?
	Health and Lifestyle
14.	On average, how many hours of sleep do you get per night?
15.	Do you have difficulty falling asleep or staying asleep?
16.	How many days per week do you engage in moderate to vigorous physical activity (e.g., brisk walking, jogging, cycling)?
17.	Are there any barriers preventing you from exercising regularly?
18.	How would you describe your typical daily diet?
19.	How many meals do you typically eat in a day?
20.	Do you smoke/vape?
	Stressors and Life Events
21.	Is/are there any recent life changing event that you experienced?
22.	How would you rate the overall stress level associated with these recent life changes?
23.	How would you rate your current financial situation?
24.	Do you feel stressed about managing your finances?
25.	Have you ever had to skip meals or limit your food intake due to financial constraints?
26.	Are you currently employed or engaged in any work-related activities (part-time job, internships, etc.) while studying?
27.	Do you find it challenging to balance your work commitments with your academic responsibilities?
28.	Have work-related obligations caused you to miss classes or academic deadlines?
	Mental Health Assessment
29.	Using a scale from 1 to 5 (1 being the lowest and 5 being the highest), how would you rate your overall mental well-being?
30.	On a scale from 1 to 10 (1 being the lowest and 10 being the highest), how would you rate your current stress levels?
31.	Have you experienced symptoms of depression or anxiety? If yes, please describe.
	Coping Mechanism
32.	How important is social support from friends, family, and peers to your mental well-being?
33.	Are you aware of and have you ever utilized available counseling services?
	Technology Use
34.	How often do you use social media?
35.	Do you believe your use of social media affects your mental health?
36.	On average, how many hours per day do you spend on screens (including smartphones, tablets, computers, and TVs)?
37.	What time do you usually spend on screens (including smartphones, tablets, computers, and TVs)?
38.	Do you believe your screen time impacts your overall well-being?
	Impact of External Factors
39.	How does the economic concerns impact your mental health? For example, concerns about job security, financial stability, and the rising cost of living may contribute to feelings of stress and anxiety.
	Future Concerns and Expectations
40.	What are your post-graduation aspirations or plans?
41.	Do you believe these plans may impact your mental health? For instance, the anticipation of entering a competitive job market, the necessity of reskilling and upskilling to align with job market demands, or the pressure to adhere to and emulate the lifestyle expectations of peers could all be factors influencing your mental well-being.
42.	How do your career expectations relate to your mental health outlook? For example, anticipating a fulfilling and rewarding career may positively impact mental well-being, whereas uncertainty about job prospects or dissatisfaction with career choices might contribute to stress and anxiety.

B. *Data Cleaning*

The data was loaded into Google Colab, consisting of 120 rows and 44 columns. Some columns were dropped because they were not used and did not impact the analysis.

```
#Drop columns
columns_to_drop = ['Timestamp','Age','Origin', 'Live_Campus', 'Study_hours',
                   'PhysicalAct_barriers', 'Smoke', 'Life_event',
                   'Life_event_stress', 'Employed', 'Work_balance',
                   'Work_academic_miss','Social_media_mental',
                   'Screen_time_AMPM','Screen_time_wellbeing']
data.drop(columns=columns_to_drop, inplace=True)
```

Fig. 2. Code of droping the columns

Some standardizing has alsobeen made to both ‘States’ and ‘Course’ variables to make the data in variables consistent with the formating.

```
#Change course name into a standard course name

#Engineering
data['Course'].replace({'mechanical-automotive engineering ( honours)': 'Engineering' ,
                        'Bachelor in Communication Engineering ':'Engineering',
                        'Chemical Engineering' : 'Engineering',
                        'Bachelor of Materials Engineering with Honours':'Engineering',
                        'Mechatronics ':'Engineering', 'Mechatronics':'Engineering',
                        'Bachelor in Communication Engineering':'Engineering',
                        'MCT':'Engineering' , 'Beee' : 'Engineering',
                        'Mechatronics engineering ':'Engineering',
                        'بنجينيرنغ' : 'Engineering',
                        'Bachelor of Engineering (Communication)(Hons.)' :'Engineering'
                        } , inplace = True)
```

Fig. 3. Snippet of Standardizing Process

Categorical variables were encoded to facilitate machine learning. Two of the variables, 'States' and 'Course,' were one-hot encoded to avoid ordinality in both variables.

```
# Convert categorical columns to numerical values
data.replace({"Gender":{'Male':0,'Female':1},
              "Year":{'First year':1,'Second year':2, 'Third year':3, 'Fourth year':4},
              "Cgpa":{'High (GPA between 3.50 and 4.00)':3,
                      'Average (GPA between 3.00 and 3.49)':2,
                      'Low (GPA below 3.00)':1,
                      'I prefer not to disclose or assess my academic performance.':1},
```

```
[ ]  # One-Hot Encode the 'Course' feature
     course_dummies = pd.get_dummies(data['Course'], prefix='Course')

     data = pd.concat([data, region_dummies, course_dummies], axis=1)
```

Fig. 4. Snippet code of encoding variables

Next, features engineering is implemented to ‘States’ variables where it groups the states into their respective area. In other words, it is the process of selecting, extracting, and transforming the most relevant features from the available data to build more accurate and efficient machine learning models [5].

```
region_groups = {
    'Northern Region': ['Kedah', 'Perak', 'Penang', 'Pulau Pinang'],
    'Central Region': ['Selangor', 'Wilayah Persekutuan', 'Negeri Sembilan', 'Melaka'],
    'Southern Region': ['Johor'],
    'Eastern Region': ['Terengganu', 'Kelantan', 'Pahang'],
    'East Malaysia': ['Sarawak', 'Sabah']
}

# Create a new feature 'Region' based on the grouping
data['Region'] = data['States'].apply(lambda x: next((region for region, states in region_groups.items() if x in states), 'Unknown'))
```

Fig. 5. Snippet of Feature Engineering code

The data was analyzed to detect null values. Five variables were identified with some nulls, and steps were taken to address this using the `replace.na` technique.

```
missing_data = missing_to_df(data)
missing_data[missing_data['Total']>0]
```

	Total	Percent
DaysFor_PhysicalAct	34	34.343434
Depression_anxiety	10	10.101010
Ac_stressor	4	4.040404
PostGrad_plans	1	1.010101
Economic_concern	1	1.010101

```
# Replace "None" with "No factor"
data['Ac_stressor'].replace('None', 'No factor', inplace=True)

# Fill NaN values with "0 days"
data['Ac_stressor'].fillna('No factor', inplace=True)
```

Fig. 6. Process of Handling Nulls

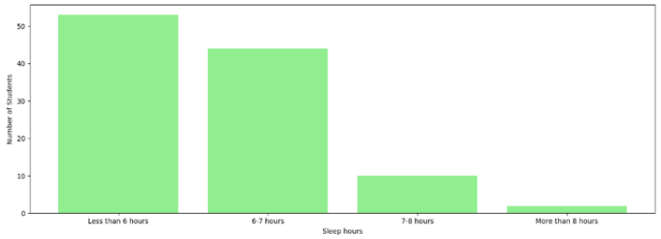
Last but not least, feature scaling is applied because it standardizes the range of independent variables, ensuring that each feature contributes equally to the model's performance and helps improve the accuracy and efficiency of machine learning algorithms.

```
scaler = StandardScaler()
X[columns_to_scale] = scaler.fit_transform(X[columns_to_scale])
```

Fig. 7. Snippet Code of Feature Scaling

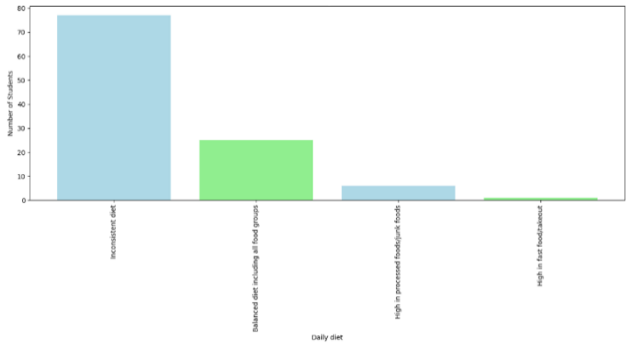
C. *Data Visualisation*

For data visualization, a variety of plots are used to show the trends and relations between the variables.



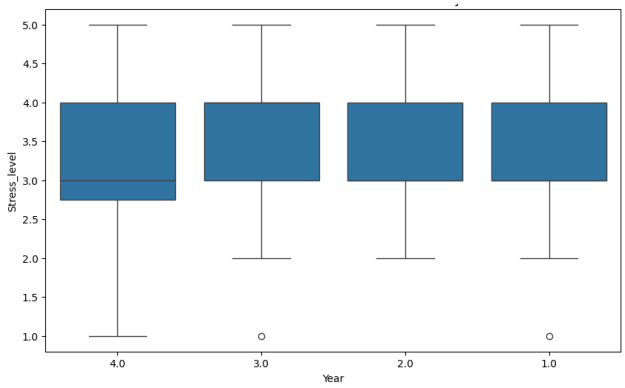
Bar Graph 1. Sleep Hours Among Students

The bar plot clearly illustrates that a majority of students sleep for less than six hours, indicating a prevalent pattern of insufficient sleep among the student population.



Bar Graph 2. Daily Diet Among Students

The bar plot indicates a significant number of students following an inconsistent diet, primarily consuming whatever is readily available to them.



Boxplot 1. Academic Stress Levels Across Different Study Year

The box plot illustrates how academic stress levels are distributed across different study years, providing insights into how stress levels may fluctuate throughout a student's academic journey.

D. NLP Processing

Some of the questions in the form were open-ended, requiring respondents to answer based on their creativity. The data received from these responses were in raw text form. Various NLP techniques, such as the use of word clouds, were applied to analyse this data. Below are the questions that require NLP implementations along with their corresponding results.

i. Have you experienced symptoms of depression or anxiety? If yes, please describe.

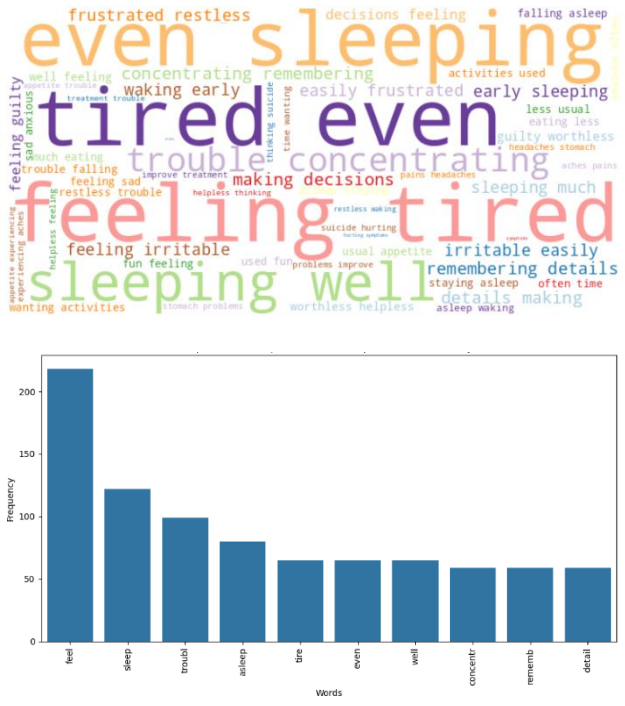


Fig. 8. Word Cloud and Bar Chart of the Symptoms of Depression or Anxiety

The bar chart indicates that the most common symptoms reported by respondents are sleepiness, difficulty, and fatigue.

ii. Which of the following academic stressors have you experienced in the past month? (Check all that apply)

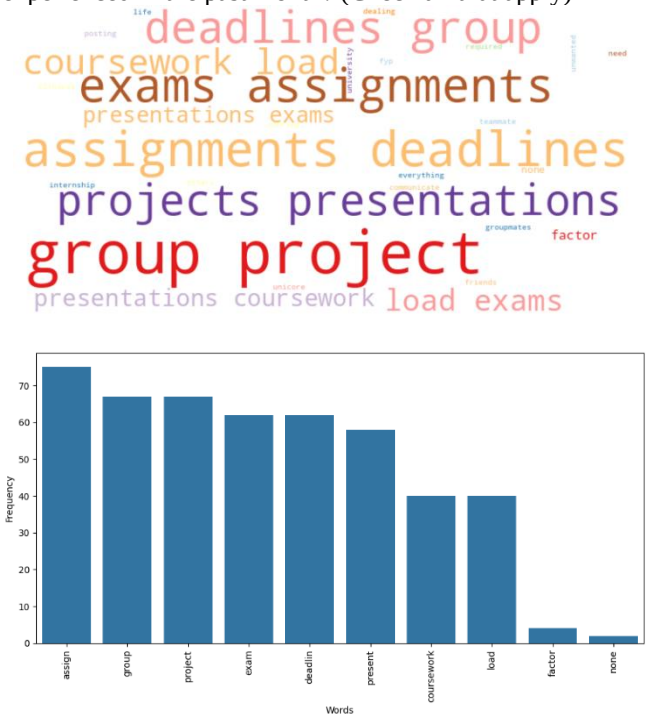


Fig. 9. Word Cloud and Bar Chart of Academic Stressors

Analyzing the Word Cloud and bar chart reveals that the primary stressors in the academic field are often linked to assignments, group projects, and examinations. This clearly illustrates the factors that weigh heavily on students' minds.

iii. How does the economic concerns impact your mental health?

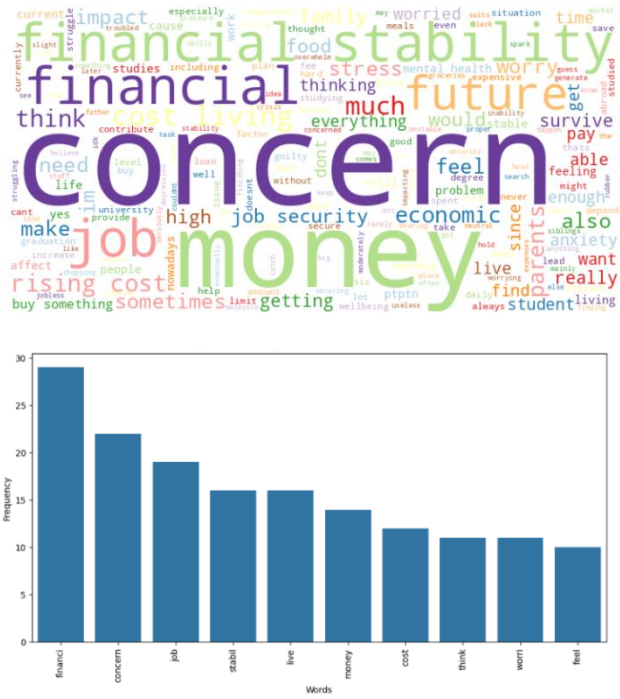


Fig. 10. Word Cloud and Bar Chart of Economic Concern

The word cloud and bar chart highlight the top three economic concerns faced by students: financial stability in

adulthood, job prospects post-graduation, and maintaining a stable life after graduating. This clearly reflects the students' primary worries about their future.

iv. What are your post-graduation aspirations or plans?

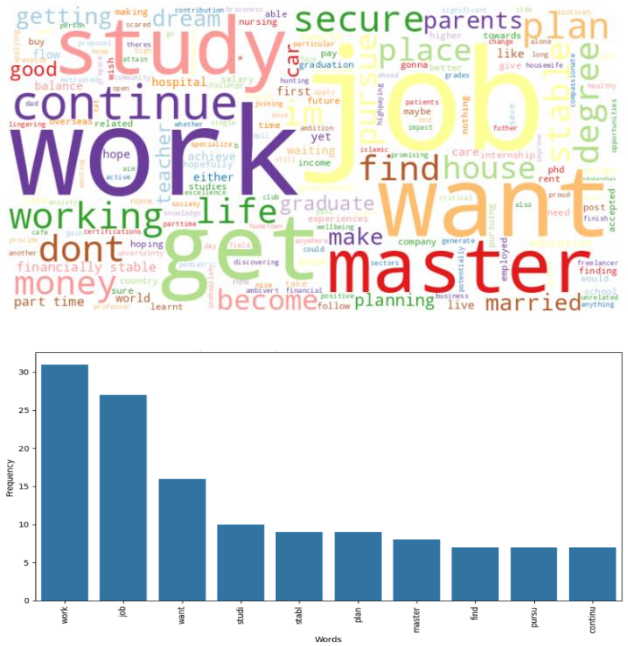


Fig. 11. Word Cloud and Bar Chart of Post-Graduation Plans

The Word Cloud and bar chart illustrate that the majority of students plan to work after graduation, with some aiming to find a job and others intending to pursue Master's-level studies as their post-graduation plan.

E. Machine Learning Implementation

The machine learning techniques implemented in this research are based on a literature review conducted in FYP1. These techniques are used to predict mental health status outcomes. The three machine learning models utilized in this research are Random Forest, Support Vector Machine, and Feed Forward Deep Learning. All three models have been used in previous studies and are recommended for future use.

The first machine learning type is Random Forest. Random Forest (RF) is an ensemble learning algorithm based on decision trees. It combines bagging with a random subspace method to reduce variance and increase diversity between trees [6].

```
# Initialize the model
rf_before = RandomForestClassifier(random_state=42)
```

Fig. 12. Code of Random Forest Utilization

Hyperparameter tuning Grid Search CV is also applied so that by testing different combinations of hyperparameters, it can find the best set that maximizes your model's performance, resulting in more accurate predictions.

```
# Hyperparameter tuning
param_grid = {
    'n_estimators': [100, 200, 300],
    'max_depth': [10, 20, 30],
    'min_samples_split': [2, 5, 10],
    'min_samples_leaf': [1, 2, 4],
    'bootstrap': [True, False]
}

grid_search_before = GridSearchCV(estimator=rf_before, param_grid=param_grid, cv=3, n_jobs=-1, verbose=2)
grid_search_before.fit(X_train_before, y_train_before)
```

Fig. 13. Code of Hyperparameter Tuning

Secondly, the Support Vector Machine algorithm is applied to the data. SVM stands for Support Vector Machine, which is a widely used machine learning method for predicting active compounds and molecular properties in cheminformatics and drug discovery [7].

```
[ ]  # Initialize the SVM model
     svm_before = SVC(random_state=42)
```

Fig. 14. Code of SVM Utilization

Hyperparameter tuning for the SVM (Support Vector Machine) using Grid Search involves testing different combinations of the parameters `C`, `gamma`, and `kernel` to find the best configuration that improves the model's performance. This process automates the search for optimal parameters, ensuring the SVM model is both accurate and efficient.

```
# Hyperparameter tuning for SVM (before SMOTE)
param_grid_before = {
    'C': [0.1, 1, 10],
    'gamma': ['scale', 'auto'],
    'kernel': ['linear', 'rbf', 'poly']
}

grid_search_before = GridSearchCV(estimator=svm_before, param_grid=param_grid_before, cv=3, n_jobs=-1, verbose=2)
grid_search_before.fit(X_train_before, y_train_before)
```

Fig. 15. Code of Hyperparamater Tuning

Lastly, the deep learning using Feed Forward is because the data used in this research are more suitable. The ANN solution is continuous and differentiable in the computational domain; the rounding errors do not affect the convergence of the method based on the neural networks [8].

```
def _build_model(self):
    model = Sequential()
    model.add(Dense(64, input_dim=self.input_dim, activation='relu'))
    model.add(Dense(32, activation='relu'))
    model.add(Dense(1, activation='sigmoid'))
    if self.optimizer == 'adam':
        optimizer = Adam()
```

Fig. 16. Snippet Code of ANN declaration

In this code snippet, the Adam optimizer is used in the context of building a neural network model. Adam (short for Adaptive Moment Estimation) is an optimization algorithm used to update the weights and biases of a neural network during training. Adam adjusts the learning rate dynamically for each parameter based on the magnitudes of the gradients and past gradients.

F. Smote Technique Implementation

The imbalance in the data, with a significantly higher number of female respondents compared to male respondents, can greatly impact prediction accuracy. To address this issue, the SMOTE technique is applied to the data to improve accuracy. For that reason, we proposed a prediction model for multiclass that helps to remove the problem of overfitting and misclassification of the factors, which gives outcomes developed by an unbalanced multi-

classification technique based on oversampling which is SMOTE i.e., Synthetic Minority Oversampling [9].

The SMOTE technique is applied to all three machine learning models to enhance their performance and improve the overall model accuracy.

```
# Handle class imbalance using SMOTE
smote = SMOTE(random_state=42)
X_resampled, y_resampled = smote.fit_resample(X, y)
```

Fig. 17. Snippet Code of SMOTE application

G. *Features correlation*

Several factors influencing mental well-being and stress levels among students were identified. Regular meals, financial stability, social support, and extracurricular activities were all positively correlated with better mental health. The study also highlighted the strong link between academic stress and sleep quality with stress levels. While extracurricular activities were beneficial for mental health, they also showed a positive correlation with stress, suggesting the importance of balancing workload with these activities.

```
[ ] # Get the correlation of each feature with the target variable 'Mental_status'
    correlation_with_target = correlation_matrix["Mental_status"].sort_values(ascending=False)
    correlation_with_target = correlation_with_target[correlation_with_target.index != "Mental_status"]

    # Filter positive correlations for the correlation matrix
    positive_correlation_matrix = correlation_matrix.copy()
    positive_correlation_matrix[positive_correlation_matrix < 0] = 0

    # Get positive correlations with the target variable 'Mental_status'
    positive_correlation_with_target = correlation_with_target[correlation_with_target > 0]
```

Fig. 18. Code of features positively correlated with mental status

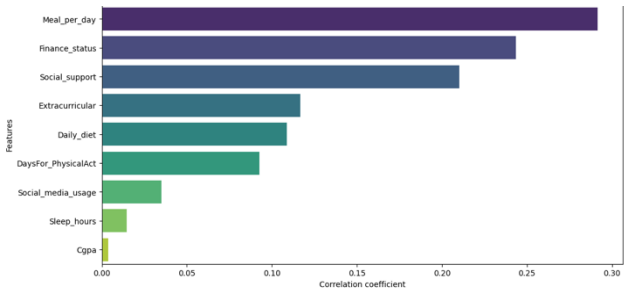


Fig. 19. Features positively correlated with mental status

```
[ ] # Get the correlation of each feature with the target variable 'Mental_status'
    correlation_with_target = correlation_matrix["Stress_level"].sort_values(ascending=False)
    correlation_with_target = correlation_with_target[correlation_with_target.index != "Stress_level"]

    # Filter positive correlations for the correlation matrix
    positive_correlation_matrix = correlation_matrix.copy()
    positive_correlation_matrix[positive_correlation_matrix < 0] = 0

    # Get positive correlations with the target variable 'Stress_level'
    positive_correlation_with_target = correlation_with_target[correlation_with_target > 0]
```

Fig. 20. Features positively correlated with stress level

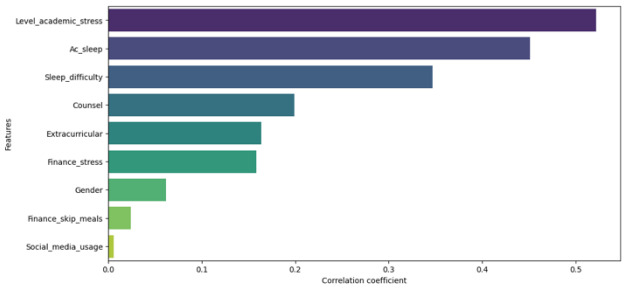


Fig. 21. Features positively correlated with stress level

III. Results and Discussion

The result will be divided into two categories which are before SMOTE and after SMOTE. The results of the performance mode are as follows:

i. Before SMOTE

1. Random Forest

Accuracy before SMOTE: 0.41935483870967744

	precision	recall	f1-score	support
1.0	0.00	0.00	0.00	3
2.0	0.50	0.17	0.25	6
3.0	0.47	0.75	0.58	12
4.0	0.30	0.43	0.35	7
5.0	0.00	0.00	0.00	3
accuracy			0.42	31
macro avg	0.25	0.27	0.24	31
weighted avg	0.35	0.42	0.35	31

Fig. 22. Classification Report for Random Forest

The classification report broke down the performance of a machine learning model across different classes. The model was particularly effective at predicting class 3, achieving a precision of 0.47, recall of 0.75, and an F1-score of 0.58. However, it struggled significantly with classes 1 and 5, showing zero precision and recall for these categories. For class 2, the model performed moderately with a precision of 0.50, recall of 0.17, and an F1-score of 0.25. Class 4 showed balanced performance with a precision of 0.30, recall of 0.43, and an F1-score of 0.35.2. Support Vector Machine

Accuracy before SMOTE: 0.3870967741935484

	precision	recall	f1-score	support
1.0	0.00	0.00	0.00	3
2.0	0.00	0.00	0.00	6
3.0	0.39	1.00	0.56	12
4.0	0.00	0.00	0.00	7
5.0	0.00	0.00	0.00	3
accuracy			0.39	31
macro avg	0.08	0.20	0.11	31
weighted avg	0.15	0.39	0.22	31

Fig. 23. Classification report of SVM

The classification report summarized the performance of an SVM model in predicting different classes. The model struggled significantly across all classes, with low precision, recall, and F1-scores. For instance, it failed to predict any instances correctly for classes 1.0, 2.0, 4.0, and 5.0, with all

metrics at 0.00. Class 3.0 showed the best performance, with a precision of 0.39, perfect recall of 1.00, and an F1-score of 0.56. However, even this indicated that while the model identified all instances of class 3.0, many of its predictions were incorrect.3. Feed Forward Deep Learning

Accuracy before SMOTE: 0.3870967741935484

	precision	recall	f1-score	support
1.0	0.00	0.00	0.00	3
2.0	0.33	0.17	0.22	6
3.0	0.50	0.67	0.57	12
4.0	0.25	0.43	0.32	7
5.0	0.00	0.00	0.00	3
accuracy			0.39	31
macro avg	0.22	0.25	0.22	31
weighted avg	0.31	0.39	0.34	31

Fig. 24. Classification Report of Feed Forward Deep Learning

The classification report revealed the performance of a model in predicting different classes, showing mixed results. For class 1.0, the model performed poorly, with precision, recall, and F1-score all at 0.00, indicating a failure to predict any instances correctly. Class 2.0 fared slightly better, with a precision of 0.33, recall of 0.17, and an F1-score of 0.22, suggesting limited prediction capability. Class 3.0 demonstrated the highest performance, achieving a precision of 0.50, recall of 0.67, and an F1-score of 0.57, indicating that the model was relatively better at predicting this class. Class 4.0 showed moderate performance, with a precision of 0.25, recall of 0.43, and an F1-score of 0.32. Similar to class 1.0, class 5.0 had precision, recall, and F1-score all at 0.00, reflecting poor prediction accuracy.

ii. After SMOTE

1. Random Forest

Accuracy after SMOTE: 0.711864406779661

	precision	recall	f1-score	support
1.0	1.00	0.81	0.90	16
2.0	0.75	0.86	0.80	14
3.0	0.60	0.50	0.55	12
4.0	0.31	0.44	0.36	9
5.0	1.00	0.88	0.93	8
accuracy			0.71	59
macro avg	0.73	0.70	0.71	59
weighted avg	0.75	0.71	0.73	59

Fig. 25. Classification Report of Random Forest After SMOTE

The application of SMOTE significantly improved the model's predictive capabilities, particularly for classes with fewer instances. The model showed strong precision and recall for classes 1.0 and 5.0, indicating robust performance in identifying these classes. However, there remained room for improvement, especially for class 4.0, where the model's performance was still lower. These results underscored the effectiveness of SMOTE in addressing class imbalance and highlighted opportunities for further optimization to enhance the model's accuracy across all classes.

2. Support Vector Machine

Accuracy after SMOTE: 0.6949152542372882

	precision	recall	f1-score	support
1.0	0.81	0.81	0.81	16
2.0	0.63	0.86	0.73	14
3.0	0.50	0.42	0.45	12
4.0	0.57	0.44	0.50	9
5.0	1.00	0.88	0.93	8
accuracy			0.69	59
macro avg	0.70	0.68	0.69	59
weighted avg	0.69	0.69	0.69	59

Fig. 26. Classification Report of SVM After SMOTE

The SVM model, after applying SMOTE, demonstrated robust performance across most classes, particularly excelling in classes 1.0 and 5.0 with high precision and recall. Classes 2.0, 3.0, and 4.0 also showed reasonable performance, though with varying degrees of precision and recall. Overall, the results indicated that SMOTE effectively improved the model's ability to predict all classes more accurately, while leaving room for further optimization to enhance precision and recall for certain classes.

3. Feed Forward Deep Learning

Accuracy after SMOTE: 0.5423728813559322

	precision	recall	f1-score	support
1.0	0.80	0.50	0.62	16
2.0	0.48	0.93	0.63	14
3.0	0.50	0.25	0.33	12
4.0	0.33	0.22	0.27	9
5.0	0.60	0.75	0.67	8
accuracy			0.54	59
macro avg	0.54	0.53	0.50	59
weighted avg	0.57	0.54	0.52	59

Fig. 27. Classification Report of Feed Forward After SMOTE

The Deep Learning model, while showing strengths in predicting classes 2.0 and 5.0 with higher precision and recall, struggled with consistency across all classes. Classes 1.0, 3.0, and 4.0 exhibited lower precision and recall, indicating challenges in accurately predicting these classes. Overall, the model's performance after applying SMOTE suggested room for improvement, particularly in enhancing its ability to predict less frequent classes effectively. Further optimization and possibly additional data balancing techniques could improve its overall accuracy and reliability in classifying mental health outcomes. A comparison across all machine learning models is provided in Table 2.

TABLE 2. MACHINE LEARNING RESULTS

Classifier	Accuracy	Precision	Recall	F1-Score	Support
Random Forest	0.42	0.35	0.42	0.35	31
Random Forest + SMOTE	0.71	0.75	0.71	0.75	59
SVM	0.39	0.15	0.39	0.22	31

SVM + SMOTE	0.69	0.69	0.69	0.69	59
Deep Learning	0.35	0.21	0.35	0.26	31
Deep Learning + SMOTE	0.54	0.55	0.54	0.54	59

Next, to comprehensively evaluate the effectiveness of SMOTE in our machine learning approach for predicting mental health status, we employed a multi-pronged statistical analysis. Firstly, we gathered key performance metrics, including accuracy, precision, recall, and F1-score, for each model trained both with and without SMOTE. Secondly, bootstrapping was utilized to calculate confidence intervals around these metrics, providing a measure of generalizability and uncertainty in the model's performance. Thirdly, we conducted statistical tests, such as paired t-tests or Wilcoxon signed-rank tests, to assess the statistical significance of any observed differences in performance between models with and without SMOTE. Finally, the results of these analyses, including performance metrics, confidence intervals, and statistical test p-values, will be presented in tables or plots within the report, providing a clear and concise overview of the model's effectiveness with and without the class imbalance mitigation technique.

i. *Random Forest*: The confidence intervals and T-test/Wilcoxon test p-values indicated significant improvements in accuracy, precision, recall, and F1 scores post-SMOTE. The confidence intervals showed tighter bounds after SMOTE, suggesting increased reliability in the model's performance.

ii. *SVM*: The confidence intervals and statistical tests also revealed significant improvements across all metrics after SMOTE.

iii. *Deep Learning*: The metrics remained unchanged, and statistical tests confirmed no significant differences, highlighting potential issues with how SMOTE was applied or the model's capacity to effectively manage such data adjustments.

IV. Discussion

The application of SMOTE resulted in a significant improvement in the performance of all machine-learning classifier. The accuracy for Random Forest increased by 30 percentage points, indicating that the classifier's overall prediction capability enhanced. The improvements in precision, recall, and F1-Score suggest that the model became more balanced in identifying true positives across classes. The accuracy of SVM increased from 39% to 69%, and the precision rose significantly to 0.69, indicating a notable reduction in false positives. The improvement in recall also led to a balanced F1-Score of 0.69, reflecting better overall performance after SMOTE. For the Deep Learning model, the accuracy improved from 35% to 54%, but the precision, recall, and F1-Score remained relatively low. These results suggest that while SMOTE helped, the Deep Learning model still struggles to make accurate predictions and balance the classes effectively.

V. Conclusion and Future Works

This research investigated the mental health of Generation Z students at the International Islamic University Malaysia (IIUM), focusing on the impact of academic pressures and societal expectations. Machine learning models, including Random Forest, Support Vector Machine, and Feed Forward Deep Learning, were used to predict mental health status based on factors like economic concerns, academic stress, and sleep quality. SMOTE substantially improved the performance of Random Forest and SVM models, with SVM showing the highest accuracy gain. However, Deep Learning did not benefit from SMOTE and may require alternative techniques or further tuning to handle imbalanced data effectively. Besides, the findings revealed that the main factors influencing mental health in IIUM students were daily meal intake, extracurricular activities, social support, and financial stability. These findings highlight the challenges faced by Gen Z students and emphasize the need for targeted interventions and holistic approaches to address mental health among Malaysian undergraduates.

Future work should focus on expanding the sample size and diversity to enhance generalizability. Exploring additional machine learning techniques and alternative data balancing methods could improve prediction accuracy, especially for Deep Learning models. Longitudinal studies could provide insights into mental health trends over time. Including a broader range of psychological factors and developing targeted interventions based on identified key factors would address specific needs. Improving model interpretability and integrating multimodal data sources could offer a more comprehensive understanding of mental health outcomes.

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Bubbles O2 Factory: A Digital Solution for Batch Data Excellence

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***Abstract* — This document proposes a web-based batch data management system to address Bubbles O2's current struggles with manual data entry, limited real-time monitoring, and inefficient data retrieval. These shortcomings prevent them from tracking production, analyzing trends, and making data-driven decisions. The proposed solution, built using the Laravel framework, tackles these issues by allowing bulk data import, facilitating real-time visualization of key metrics on a centralized dashboard, and enabling users to easily search, filter, and export data through user-friendly interfaces. These improvements are expected to yield significant benefits, including enhanced data accuracy, improved real-time analysis capabilities, increased operational efficiency, and better reporting and compliance, ultimately granting Bubbles O2 a competitive edge through the power of real-time data and streamlined operations.**

Keywords— Batch data management, Bubbles O2, real-time data, data accuracy, reporting, user-friendly, web application, Laravel

I. INTRODUCTION

This introductory chapter serves as a gateway to our exploration of an essential project to revolutionise manufacturing data management for Bubbles O2. In it, we embark on an exploration of the company's challenges, presenting a contextual background that underscores the necessity for change. Subsequently, we articulate the specific problems we intend to address.

Proceeding with clarity, we outline our specific goals in the project goals section. The project scope outlines the bounds and parameters of our project, including the platform of choice, anticipated features and functionalities, and target users. We identify probable obstacles and provide limitations within this scope.

We provide a methodical road map for our efforts by explaining the successive steps in the project stages and anticipating the project's evolution. In the final section, we highlight the project's importance and highlight how it has the potential to significantly improve Bubbles O2's operational effectiveness, data correctness, and overall productivity. This introductory chapter lays a solid foundation for the comprehensive project that follows.

A. Project Description

Bubbles O2 is a reputable manufacturer specializing in the production of high-quality products. The company's commitment to quality and efficiency has been at the forefront of its success in the industry. However, like many manufacturing enterprises, Bubbles O2 encounters significant challenges in efficiently managing the batches of manufacturing materials data within their factory.

The current batch data management system at Bubbles O2 relies on manual processes and outdated record-keeping methods. Operators responsible for recording material batch data, particularly related to raw materials, face several issues, including:

Data Entry Errors: Manual data entry is prone to human errors, leading to inaccuracies in recording batch details, such as raw material quantities, production times, and quality control parameters. For example, typos, misinterpretation of information, or oversight during the recording process. These inaccuracies compromise the integrity of batch details and hinder decision-making processes and the ability to track and optimize manufacturing processes effectively.

Lack of Real-Time Monitoring: The system lacks real-time data collection and analysis capabilities. This deficiency inhibits timely decision-making and hinders the ability to respond promptly to production issues or deviations.

Inefficiency in Data Retrieval: Retrieving historical batch data is a time-consuming and labour-intensive process. This inefficiency affects tracking raw material usage, analysing production trends, and optimising manufacturing processes.

Operational Inefficiencies: The absence of a streamlined batch data management system has resulted in operational inefficiencies and increased production costs, particularly in the context of raw material utilization.

Quality Control Challenges: Inaccurate and delayed data reporting can impact the quality control processes, leading to potential product quality issues.

Given the critical role that accurate material batch data management plays in ensuring product quality, operational efficiency, and cost-effectiveness, Bubbles O2 recognizes the need for a modernized and systematic solution to address these challenges.

The proposed Final Year Project (FYP) aims to develop a user-friendly batch data management system tailored to Bubbles O2's requirements. This system will address the aforementioned issues and enable real-time data collection and analysis, leading to improved production processes, accurate reporting, and enhanced decision-making capabilities.

B. Project Objective

1. **Develop a User-Friendly Batch Data Management System:** Design and create an intuitive and user-friendly batch data management system tailored to the specific needs and workflows of Bubbles O2's manufacturing processes.
2. **Enable Real-Time Data Collection and Analysis:** Implement features that allow for the real-time collection of batch data and provide tools for immediate analysis, giving Bubbles O2 the capability to monitor production processes in real-time. This means their users can key in data on the spot with automated date and time input.
3. **Improve Data Accuracy and Reporting:** Automate data capture processes and generate accurate and timely reports on batch details, production times, and quality control parameters to minimize data entry errors and inaccuracies.
4. **Enhance Batch Data Retrieval Efficiency:** Develop a system that enables efficient retrieval of historical batch data, facilitating trend analysis and providing insights for process optimization.

C. Project Scope

1. **Development of a System for Managing Manufacturing Data:** The project will encompass the design, creation, and implementation of a data management system tailored to Bubbles O2's manufacturing processes.
2. **Real-Time Data Collection and Analysis:** The system will enable the real-time collection of batch data, including raw material quantities, production times, and quality control parameters, and provide tools for immediate analysis.
3. **Data Accuracy and Reporting:** Efforts will be made to minimize data entry errors and inaccuracies through automation, resulting in accurate and timely reporting of batch details.
4. **Batch Data Retrieval:** The system will facilitate efficient retrieval of historical batch data for trend analysis, reporting, and process optimization.
5. **Data Security and Integrity**: The system will incorporate robust data security measures to ensure the integrity and confidentiality of sensitive production data. This includes secure access controls, administered by designated

II. LITERATURE REVIEW

This document explores three inventory management systems tailored for businesses of various sizes and needs. SAP ERP, a robust system favoured by large corporations, integrates diverse operations like supply chain and finance, offering real-time data and streamlined workflows. Still, it comes with complexity and high costs. inFlow Inventory, ideal for smaller businesses, provides user-friendly interfaces for core functionalities like inventory tracking and basic manufacturing. However, it may lack features for intricate production processes and struggle to adapt to significant business growth. Zoho Inventory, a cloud-based solution, offers real-time updates, automated reordering, and customizable reports but relies on internet connectivity and may incur additional costs for advanced features. Ultimately, the optimal choice depends on the company's size, operational complexity, and budget.

There are advantages to each of the three inventory management systems explored here. SAP ERP stands out for its comprehensiveness, integrating various departments to foster seamless communication and data consistency. This scalability caters to businesses of all sizes, while real-time analytics empower data-driven decision-making. Additionally, quality management modules ensure consistent product quality. inFlow Inventory is user-friendly, boasting an intuitive interface for core functionalities like inventory tracking, order management, and basic manufacturing. Zoho Inventory takes a cloud-based approach, providing real-time inventory updates, automated reordering, and customizable reports to facilitate informed decision-making.

However, there are also some considerations for each system. While SAP ERP boasts comprehensiveness, scalability, and real-time data analysis, its implementation can be complex and expensive due to customization needs and consultant fees. Additionally, user training can be resource intensive. inFlow Inventory excels in user-friendliness for core functionalities, but it may lack advanced features required by complex manufacturing operations and struggle to adapt to significant business growth. Zoho Inventory offers a user-friendly cloud-based solution with real-time data and customizable reports. Still, it relies on stable internet connectivity and might incur additional costs for advanced features. Ultimately, the best choice depends on your specific needs; consider your company's size, budget, and operational complexity to identify the system that best balances advantages and considerations.

TABLE I. SUMMARY OF THREE EXISTING INVENTORY SYSTEM

Features	Zoho Inventory	SAP ERP	inFlow Inventory
Multi-Channel Selling	/ - Seamless integration with multiple sales channels	X- May require additional modules or customization	X-Limited multichannel intergration
Automated Reorder points	/-Alerts and automatic reorder suggestions based on inventory levels	X-Possible through inventory planning tools	X-Might not have automated reorder points
Shipping Intergration	/-Intergrates with shipping carriers for streamlined shipping process	/-Extensive logistics and shipping intergrations	X-Limited shipping intergration

Features	Zoho Inventory	SAP ERP	inFlow Inventory
Batch and Expiry Tracking	/-Tracks batches and expiration dates for perishable items	/-Comprehensive batch and expiration tracking	X- Might not have batch and expiry tracking capabilities
Bundle and Composite Items	/-Capability to create bundled or composite items from multiple products	X-Possible through product configurations or adds-on	X-May not support bundled or composite item creation
Intergration Capabilities	/-Intergration with Zoho Suite Apps	/-Extensive integration capabilities	X-Limited third-party intergrations
Warehouse Management	/-Supports multiple warehouse	/-Advanced warehouse management	/-Supports multiple locations and warehouse
Reporting and Analytics	/-Customizable reports and analytics	/-Sophisticated reporting tools with advanced analytics	/-Customizable reports for tailored insights
Financial Intergration	X-Limited financial intergration	/-Seamless integration with financial modules	X-Limited financial integration capabilities
Supply Chain Management	X-Limited supply chain management capabilities	/-Complete supply chain management functionalities	x-Might lack comprehensive supply chain management
Manufacturing Resorce Planning	X-Limited MRP functionalities	/-Advanced planning tools for production and resource management	X-Might not have extensive MRP capabilities

III. METHODOLOGY

A. Development Approach

Our Final Year Project, titled 'Bubbles O2 Factory: A Digital Solution for Batch Data Excellence, is centred around creating an advanced digital solution resembling an inventory system, emphasising maintaining batch data accuracy. To accomplish this, we have adopted the Agile software development methodology. This approach underscores continuous collaboration between the development team and user test participants, focusing on iterative software development and adaptability over extensive documentation. The flexibility inherent in Agile methodology enables us to respond to evolving requirements and user feedback swiftly, ensuring the quality and effectiveness of our 'Bubbles O2 Factory' system. Our commitment to maintaining open communication with users aims to refine the system's features based on their satisfaction. This approach proves pivotal for our inventory system and is essential for precisely tracking and managing inventory items.

B. Specific Platform

We deployed the web application based on the Laravel framework and utilising its database handler. The server infrastructure will be considered to run on a local host or set up dedicated servers and utilize cloud-based hosting services. The servers will run on the Windows 10 operating system to support the Laravel framework.

C. Features and Functionalities

The project envisions a web application that offers user registration and authentication capabilities. Users can create accounts, and a secure authentication system will protect user credentials through password hashing. Different user roles will be implemented, primarily Admin and User, each with distinct permissions to manage system functionality.

A dashboard will give users a centralized view of pertinent information and data about their roles and responsibilities. This dashboard will be a hub for navigation and interaction within the application.

The key to the application's functionality is data management. The system will offer an interface for raw material batch data entry, allowing the recording of crucial details like raw material quantities, production times, and quality control parameters. This includes validation checks to minimize data entry errors and ensure data accuracy. Users can perform Create, Read, Update, and Delete (CRUD) operations for essential data entities, allowing them to interact with and manage data within the system effectively. Advanced search and filtering options will enhance the user experience, enabling them to locate specific information swiftly.

Efficient data retrieval mechanisms will be implemented to facilitate quick and easy access to historical batch data. This feature will be invaluable for data analysis, trend identification, and reporting. Role-based access control will ensure that users only have access to the data and functionality relevant to their roles. This extends to administrative controls for user management and access permissions.

D. Requirement Specification

In the pursuit of designing a robust and tailored batch data management system for Bubbles O2, the initial phase involved a comprehensive interview with key stakeholders. This collaborative session aimed to extract essential insights from the Head of Research and the Warehouse Operator, ensuring a thorough understanding of their operational needs and expectations. The interview revolved around key aspects crucial for system development, and the subsequent requirement specifications were derived from these insightful discussions.

The most recent interview took place on December 18th, 2023, in a Google Meet. Below are the insights and requirements mentioned by the client.

Features and Functionalities: Track raw material entry and usage, record raw materials used in bottle production, and track the distribution of produced batches.

Data Entry and User Experience: Minimize the number of data fields required for manual entry and prioritize ease of data checking and user-friendliness

Efficiency Enhancements: Implement features that automate data entry. The system should provide real-time dashboards and reports and implement robust search functionality.

User Interface Design: The system should have a clean and uncluttered dashboard with a production volume, such as charts and graphs, visualization of raw materials consumption trends and charts depicting the progress of batch distribution.

Visual Design: The primary user interface colour should be corporate cyan blue (#00b4bc) and incorporate subtle bottle iconography or other relevant imagery that complements the overall design and reinforces brand identity.

User Access Control: Warehouse personnel have full access to all system features, while the executive teams have access to a dashboard displaying key production metrics with limited functionality.

Reporting and Data Retrieval: Track specifics for each batch, including Batch ID, raw materials used, production details, distribution information and quality control parameters and outcomes. Analyze overall production performance through reports on volume trends over time, efficiency metrics and resource utilization.

The client also needs the quality control reports to monitor and analyze quality control data.

IV. RESULTS

In Fig. 1, it shows the whole flow of activities of all functions and features of the system from login until logout as a warehouse or production staff. Figure 2 shows the whole. flow of activities of all functions and features of the system from login until logout as an executive staff. A use case diagram is illustrated in Fig. 3.

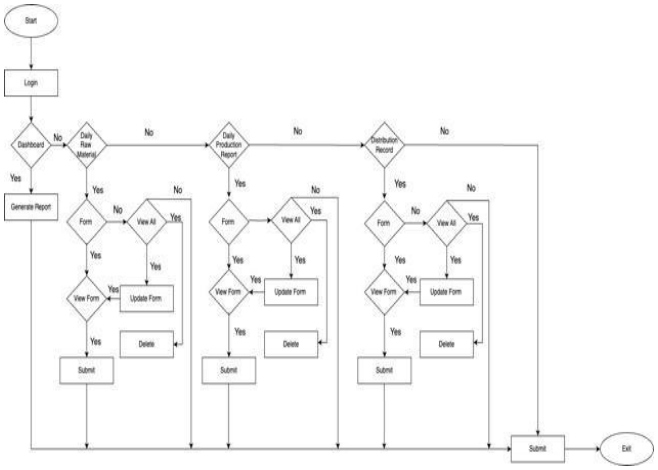

Fig.3. Activity Diagram as warehouse or production staff

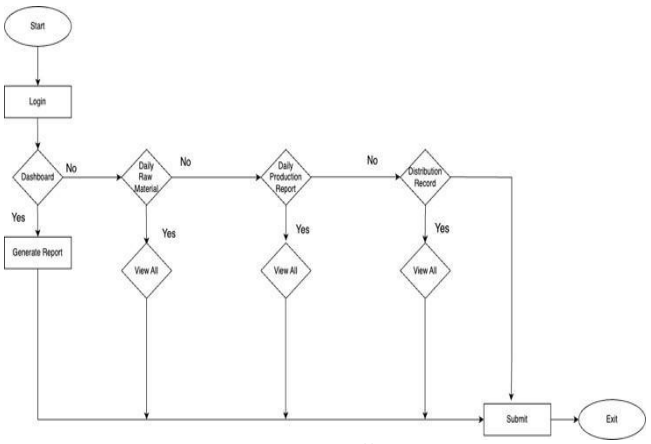

Fig. 2. Activity Diagram as executive staff

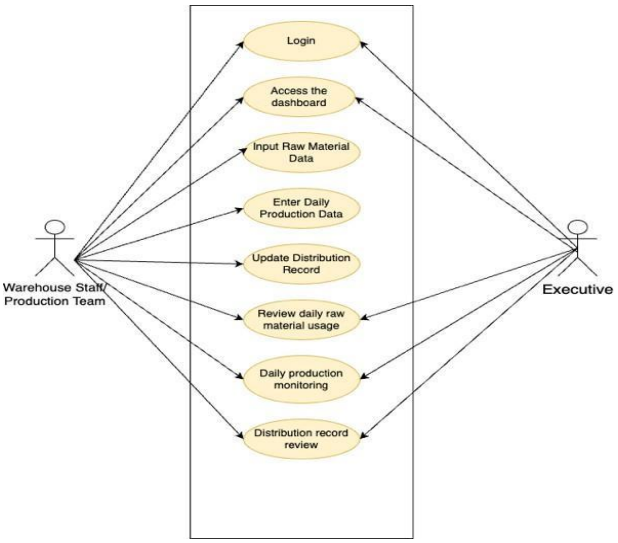

Fig.3 Use Case Diagram

Fig. 4 is a database designed for the Batch Data Management System, which aims to efficiently manage Bubbles O2's manufacturing processes. Key entities include users, daily raw material records, daily production reports, distribution records, and a centralized dashboard. The schema establishes foreign key connections for data integrity.

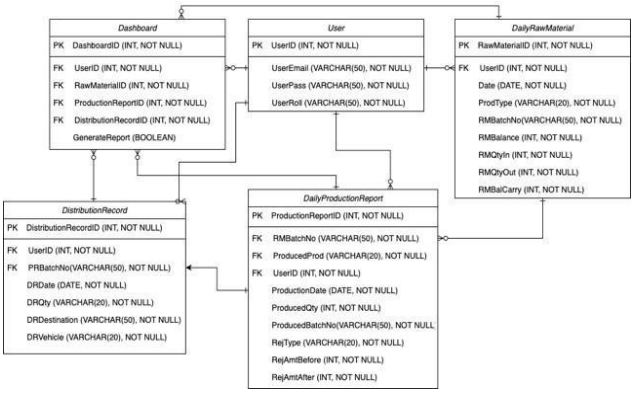

Fig. 4. Database design of the web application

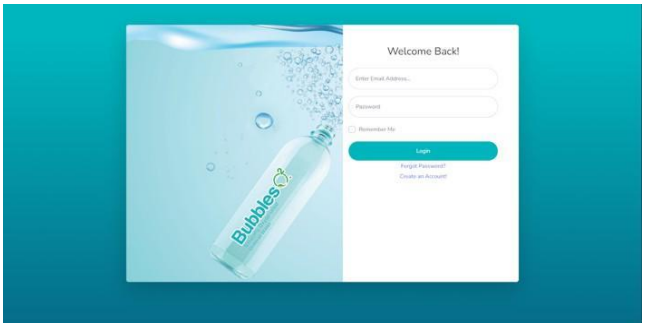

Fig. 5. Login page

Fig. 5 shows a login page where users can enter their username and password to log in to the system. Fig. 7 displays a dashboard page. This dashboard provides a bar chart that visualizes the stock levels of raw materials compared to the number of raw materials used on the current date.

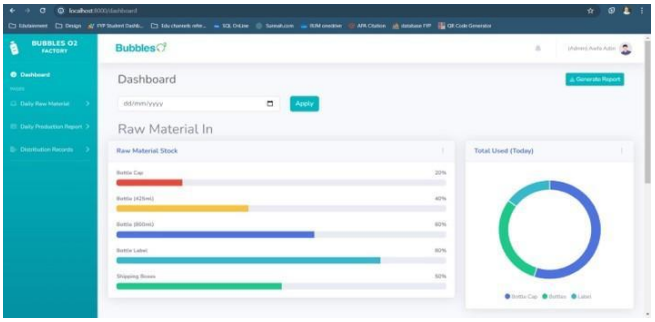

Fig. 7. Dashboard page

Figure 8 is the daily raw material form. This page allows users to input daily raw material data. It includes fields for selecting the date and product type (e.g., bottle, cap, box) and scanning the batch number from the raw materials barcode. Additionally, the form displays the current stock balance in the warehouse and allows users to enter the quantity received (stock in) and quantity used (stock out). It also automatically calculates the remaining balance, which is carried forward.

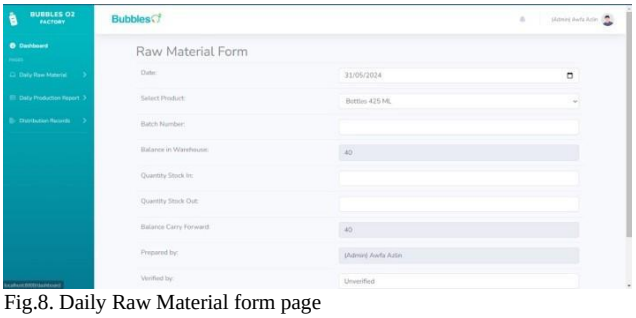

Fig.8. Daily Raw Material form page

Fig. 9 is the daily production report form. This form focuses on daily production data. Users can choose the product type, which is a scrollable list, including a cap, box and bottle, and are able to scan the barcodes of the raw materials used. The system automatically generates a production batch number for the current date. Fig. 10 is a daily raw material view of all table pages. This page provides a comprehensive view of all daily raw material data. It displays information such as date, product type, batch number, stock balance, quantity received (stock in), quantity used (stock out), and remaining balance (carry forward) in a tabular format.

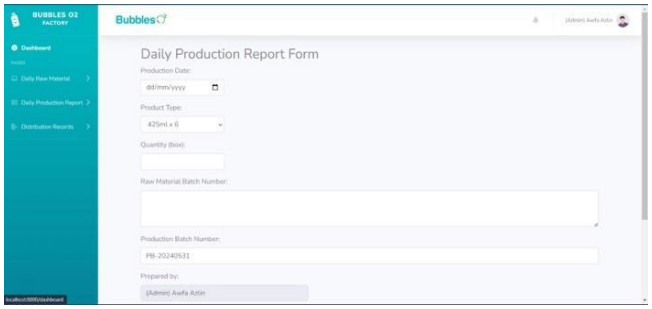

Fig. 9. Daily Production Report form page

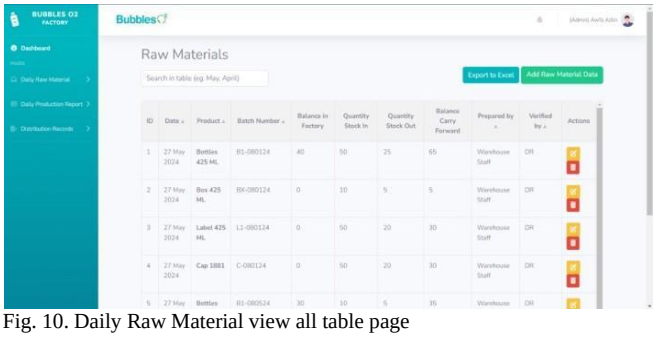

Fig. 10. Daily Raw Material view all table page

Fig. 11 is a distribution record form that allows users to choose the type of product being distributed from a selection of checkboxes. There is also a designated field that allows users to enter the exact quantity of products being distributed easily. This form also provides a scannable field for the production batch number and is user-friendly, facilitating the selection of the distribution destination. For example, typing ‘Melaka’ would automatically display ‘Melaka’ as the chosen destination.

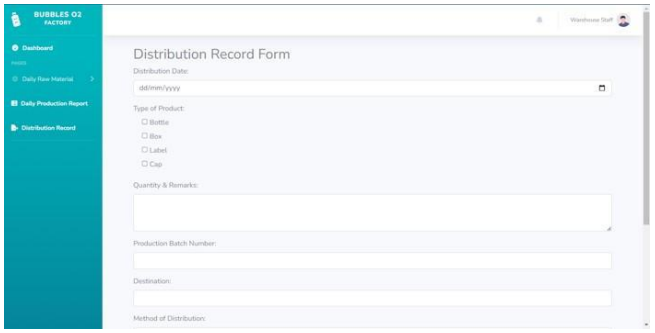

Fig.11. Distribution Records form page

Fig. 12 is the distribution record view of all pages. Like the raw materials view page, this page offers a consolidated view of all distribution records. It likely displays information such as date, product type, quantity distributed, production batch number, destination, and any remarks in a tabular format. Fig. 13 is a production report view of all pages. This page provides a comprehensive view of all production reports. It displays data related to daily production activities, potentially including fields like date, product type, production

batch number, and other relevant production details in a tabular format.

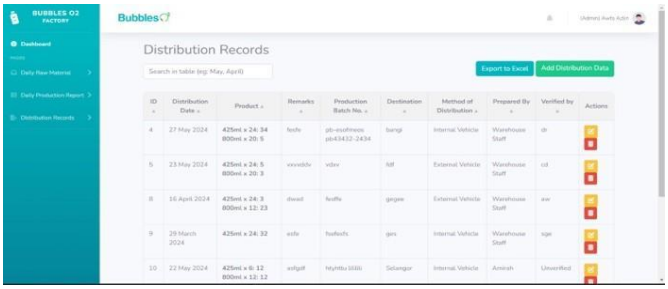

Fig.12. Distribution Records view all page

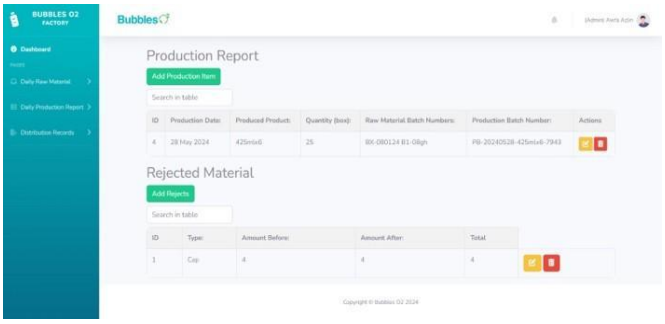

Fig.13. Production Report view all page

VII. Conclusion

Bubbles O2's commitment to delivering high-oxygen mineral water with consistent quality requires a robust and efficient production process. A game-changer will be implementing a new batch data management system with the features and functionalities discussed. Streamlined data entry for warehouse and production personnel, combined with real-time dashboards and reports, will empower Bubbles O2 to gain valuable production insights at every stage. This newfound visibility will enable proactive decision-making regarding resource allocation and production optimization. By monitoring trends in raw material usage, production efficiency, and quality control data, Bubbles O2 can identify areas for improvement and implement preventative measures. This translates to a more streamlined production process, minimized waste, and consistent quality in their high-oxygen mineral water. Ultimately, the new system can potentially give Bubbles O2 a competitive edge. By leveraging data-driven insights to optimize production and ensure consistent quality, Bubbles O2 can solidify its position as a leader in the high-oxygen mineral water market, delivering a superior product that exceeds customer expectations.

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Investigating the Relationship Between Social Media Usage Duration and Academic Success Among Muslim Students Using Data Science Process Cyber Security Awareness Training (SecurityGuts)

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***Abstract*— This study explores the relationship between social media use and academic success among Muslim students. By analyzing social media usage patterns and potential correlations with academic performance, the research addresses key questions on how social media impacts this student group. A survey distributed to 222 Muslim students reveals a modest negative correlation between prolonged social media usage and academic performance, particularly for those spending over five hours daily on social media. The study concludes that social media can be a significant distraction, but its impact varies, highlighting the need for tailored strategies to mitigate potential negative effects on academic success.**

Keywords—social media, academic success, Muslim students, relationship, data science process, GPA, SDG.

I. INTRODUCTION

Social media has become an integral part of modern society, significantly impacting various aspects of individuals' lives. According to recent statistics, the global average time spent on social media platforms per day has reached 151 minutes [1]. Similarly, studies have found that undergraduate students spend an average of about three to four hours per day using social media platforms [2], indicating a substantial and pervasive presence in their daily routines. Concurrently, academic success, as measured by overall GPA, remains a fundamental indicator of students' achievements and capabilities in educational settings.

In alignment with Sustainable Development Goal 4.7—Education for Sustainable Development and Global Citizenship [33]—this study explores the intricate relationship between social media usage duration and the academic success of Muslim students. 'Social media usage duration' refers to the amount of time individuals spend engaging with various social media platforms, while 'academic success' pertains to the overall Grade Point Average (GPA) achieved by students and the time spent studying. By employing a data science process that encompasses systematic approaches to data collection, preprocessing, analysis, and interpretation [3], this investigation seeks to shed light on the potential influence of social media engagement on students' academic performance, with a focus on the Muslim student population.

Despite the extensive research on social media's impact on various demographics, a significant gap remains in understanding its specific effects on Muslim students' academic success. This study aims to fill that gap by providing insights into how social media usage influences the academic achievements of this understudied group.

II. PROBLEM STATEMENT

The pervasive influence of social media on the academic journey of Muslim students presents a complex and multifaceted challenge. As these students navigate the digital realm, understanding the intricate relationship between social media usage, time management, and academic success becomes paramount. Social media's influence on nearly every aspect of life underscores its potential impact on academic performance [4]. While social media can have a positive impact by connecting individuals and sharing information, it can also lead to behaviours that negatively affect students' academic performance [5]. Through analyzing survey data, we aim to identify specific patterns in social media use and share recommendations for effective time management strategies that maximize the positive potential of these platforms while mitigating negative impacts on academic performance.

III. PROJECT OBJECTIVE

- To determine whether a correlation exists between social media usage and academic performance among Muslim students.
- To identify the most popular social media platforms used by Muslim students, as well as their motivations for using them.
- To assess the presence and nature of social media policies within universities and institutions regarding student usage.

IV. Research Questions

- What is the relationship between social media usage duration and academic success among Muslim students?
- What are the most frequently used social media apps/platforms by Muslim students, and what purposes do they serve for these students?
- Do institutions/universities have policies in place pertaining to social media usage at study places?

V. Project Significances

- Enhanced Awareness: The project will increase awareness among Muslim students.
- Bridging the knowledge gap: Little research exists specifically examining the social media habits and academic performance of Muslim students. This study helps address this gap, offering unique insights into this understudied segment.
- Informing educational practices: Understanding the impact of social media on Muslim students' academic performance can inform educators and institutions in developing strategies to support social media use in a balanced and productive manner.

VI. Project Scope

A. Scope:

The population for this research project will focus on Muslim students who use social media platforms. This targeted population will consist of students from diverse backgrounds, ages, and educational levels who are actively using social media for various purposes, including communication, entertainment, and academic activities.

B. Targeted User:

This research targets 200 Muslim students from the population of social media users who identify as Muslims.

VII. Previous Works

A. Social Media in the Current Situation

The pervasive impact of social media, intensified by the COVID-19 pandemic, has driven extensive research into its effects across various areas. Studies show a significant positive link between social media use—academic, social, entertainment, and informational—and mental well-being among young adults [6]. Additionally, social media has been crucial for health promotion during the pandemic, aiding in the spread of health information and influencing preventive behaviours [7]. In healthcare, it has been used for community engagement, health promotion, patient education, and outreach [8]. However, the ethical implications of social media, including its effects on public opinion and societal manipulation, require careful regulation [9]. As research progresses, a nuanced understanding of social media's complex impact is essential for developing strategies to maximize its benefits while minimizing potential harm.

B. Academic Success for Muslims

Scholarly exploration into the academic success of Muslim individuals reveals diverse perspectives on the challenges and facilitators within this context. Academic performance and psychological distress of Muslim adolescents of immigrant origin were studied, emphasizing the positive correlation between supportive teacher relations and academic achievement [10]. The impact of Islamophobia on post-secondary Muslim students was investigated, emphasizing the need for inclusive educational environments [11]. The importance of collaboration and knowledge exchange for academic success among Muslim academics in Malaysian institutions was highlighted [12]. A positive relationship between religiosity and academic achievement among Muslim students in Indonesia was found [13]. Examining leadership challenges, obstacles faced by Muslim women leaders in academia were addressed, calling for initiatives to promote gender equity [14]. Factors contributing to the success of Muslim-owned businesses were explored, emphasizing the role of innovation and proactive elements [15]. The psychological impact of the pandemic on students, including those from Muslim communities, was studied, emphasizing the need for support during crises [16]. In sum, understanding the multifaceted factors influencing the academic success of Muslim individuals is crucial for fostering inclusive and supportive educational environments.

C. Data Science Process

The data science process spans diverse topics such as risk management, visualization, and machine learning. Educational implications of data science were explored, emphasizing its role in developing innovative strategies [17]. The focus on risk management gaps in data science projects highlighted the need for deeper understanding [18]. Insights into the people and process of data science projects were provided [19]. Best practices to accelerate data science using Python were discussed [20]. The role of cloud-based processing in data science for visualization was investigated [21]. Innovative methods for biomedical data analysis were highlighted [22]. The impact of student motivation on science process skills was explored [23]. Visualization techniques were applied to Sichuan opera data [24]. In summary, the data science process encompasses risk management, visualization, and diverse applications, offering valuable insights across domains.

D. Relationship Between Social Media Usage Duration and Academic Success

Extensive research has explored the nuanced relationship between social media usage duration and academic success. Gender variations in this connection among university students were highlighted [23]. The moderating role of innovation characteristics of social media was delved into [24]. A significant relationship between the purpose of social media usage and academic performance, particularly for personal purposes, was found [25]. The moderating role of social media self-control failure was emphasized [26]. Investigation into teenage social media usage and academic success was stressed [27]. A survey on the relationship between social media usage and overall academic performance was conducted [28]. Excessive non-academic social media usage, especially in multitasking, could negatively impact academic performance [29]. The complex interplay of social media usage, multitasking, and students' academic self-efficacy was examined [30]. A significant relationship between time spent on social media and academic performance was revealed [31]. In conclusion, understanding the multifaceted relationship between social

media usage duration and academic success requires consideration of gender, innovation, self-control, multitasking, and temporal aspects.

VIII. METHODOLOGY

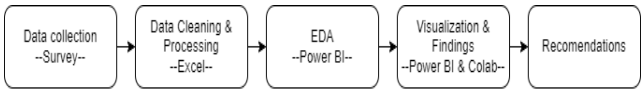

Fig. 1. Data Science Process

This research project adopts a structured approach, guided by the data science process in Fig. 1, to methodically progress through key stages. The initial phase involves data collection, utilizing Google Forms to create customized surveys aligned with research objectives. Following the initial data collection, a thorough data refinement process is undertaken with Microsoft Excel. This includes addressing missing or inconsistent data, removing duplicates, and structuring the dataset for effective analysis. Subsequently, the third stage involves Exploratory Data Analysis (EDA), where statistical methods and visualizations are employed to uncover patterns and relationships within the dataset. This step lays the groundwork for further analysis. In the implementation phase, a combination of Microsoft PowerBI, Google Colab, and statistical calculations is utilized for a comprehensive analysis, extracting valuable insights from the refined dataset. The findings from this stage are then simplified and communicated through visualization, leveraging the visualization capabilities of Microsoft PowerBI. The conclusive stage incorporates the formulation of recommendations within the conclusion section, offering insights and suggestions for future actions based on the analysis conducted. Throughout the research project, the tools employed predominantly include Microsoft PowerBI, Excel and Google Colab for analysis, cleaning, and visualization, ensuring a comprehensive and rigorous approach to data processing. Google Forms facilitates efficient data collection aligned with research objectives. The recommendation stage seamlessly integrates into the conclusion, while other key stages are expounded upon in the results section, providing a clear and structured presentation of the research methodology.

IX. RESULT AND DISCUSSION

A. Stage 1: Data Collection

The first step in the research project involved the collection of data through the utilization of an online service, specifically Google Forms. The form was published on October 20, 2023, and was accessible for responses until November 2, 2023. The target was to obtain 200 responses by the end of October 2023, and the form successfully received 222 responses. To maximize the reach of the survey, it was shared across various social media platforms, with a particular focus on WhatsApp, Instagram, and Facebook. Additionally, the survey was also disseminated within educational settings, specifically in classes. However, several challenges were encountered during the data collection process. Initially, the response rate was slow, and respondents expressed concerns about the length of the form. Furthermore, as the survey targeted Muslim students in universities across Arab countries, language comprehension issues were reported. Additionally, the requirement for respondents to provide their name and email posed a barrier, as some individuals were hesitant to disclose this information due to privacy concerns. Moreover, difficulties were encountered when attempting to share the survey on university pages, as administrative rejections were frequently encountered. To address these challenges, the decision was made to make the provision of name and email optional, a modification that was approved by the supervisor.

Survey Questions: The survey encompassed a series of questions designed to gather comprehensive insights into the social media usage patterns and academic experiences of the respondents. The questions included inquiries about demographic information such as age, country of origin, and current educational institution. Additionally, the survey delved into the respondents' social media habits, academic engagement, and perceptions regarding the impact of social media on their academic performance. Furthermore, the survey sought to ascertain the strategies employed by respondents to reduce social media usage and their awareness of institutional policies or guidelines related to social media usage within their educational institutions.

B. Stages 2 & 3: Data Processing and Cleaning

Upon the acquisition of 222 responses through the online survey, the subsequent phase of the research endeavour necessitated meticulous data processing and cleaning to ensure the integrity and reliability of the dataset. This critical phase involved addressing several challenges encountered during the data collection process, with a focus on the conversion of GPA scales, standardization of categorical responses, and simplification of multiple-choice questions.

The first challenge pertained to accommodating the diverse GPA scales utilized by respondents, particularly those from educational institutions in Egypt, where both 4.0 and 5.0 GPA scales are prevalent. To address this, the survey was structured into two distinct sections, each tailored to the specific GPA scale. Subsequently, the responses were consolidated, and a conversion process was undertaken to align the 5.0 GPA scale data with its approximate equivalents on the 4.0 scale. An alternative approach was also considered, involving the sole inquiry about GPA on a 4.0 scale, accompanied by the provision of a conversion formula for respondents utilizing the 5.0 scale, thereby streamlining the data processing and cleaning process. Furthermore, the standardization of categorical responses emerged as a significant endeavour, particularly in instances where varied spellings and formats were observed for categorical variables such as country, educational institution, and program. This necessitated meticulous efforts to ensure uniformity and consistency in the dataset. Notably, responses referring to the same educational institution were harmonized to eliminate inconsistencies, thereby enhancing the accuracy and reliability of the dataset. Additionally, personalized follow-up was conducted to address instances where respondents left certain categorical questions unanswered, ensuring comprehensive and complete data. Moreover, the simplification of multi-choice questions, such as those pertaining to the main purposes for using social media, was undertaken to facilitate streamlined analysis and interpretation. This involved the transformation of complex multi-choice responses into a format conducive to rigorous analysis, thereby enhancing the utility of the dataset for

subsequent research endeavors. The execution of these data processing and cleaning tasks was facilitated by the utilization of advanced data manipulation tools, including Excel, Power Pivot, and Power Query. These tools provided the necessary functionalities for seamless data transformation, standardization, and cleaning, ultimately contributing to the quality and reliability of the dataset for rigorous analysis.

C. Stage 4: EDA

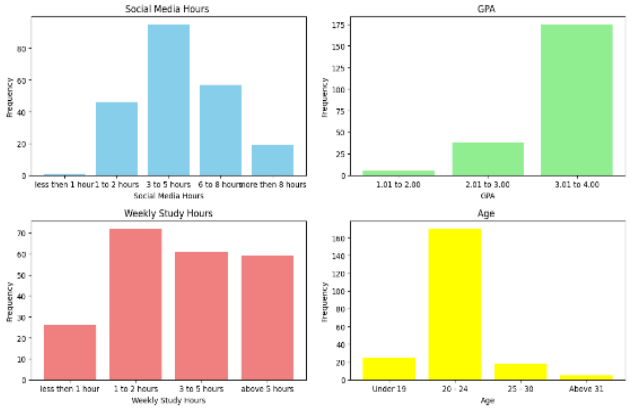

Fig. 2. Histogram Distribution

In this comprehensive exploration of the research methodology, PowerBI and Google Colab was leveraged to visually dissect the dataset and uncovering diverse insights. The dataset, consisting of 222 responses from 32 countries and 27 universities, disclosed a wide range of academic backgrounds. Notably, 74.30% pursued bachelor's degrees, with the 20–24 age group spanning over 40 academic fields. Malaysia emerged as a focal point, housing 110 respondents, predominantly from the International Islamic University Malaysia (IIUM). Fig. *2* Transitioning to the data-driven revelations, the study unveils a spectrum of social media engagement (mean of 4.54 hours) and academic excellence (GPA range: 1.5–3.5, mean: 3.2). Varied study habits (average weekly study hours: 3.57) and broad age distribution (15–50 years) further accentuate the study's complexity. Intriguing trends, such as a social media usage concentration of around 4 hours, consistently high GPAs, and a clustering of study hours at 1.5 per week, beckon deeper exploration. These findings fortify the groundwork for subsequent research stages, guiding nuanced interpretation and recognizing the profound implications of sample characteristics on the study's outcomes.

D. Stage 5: Analysis & Findings

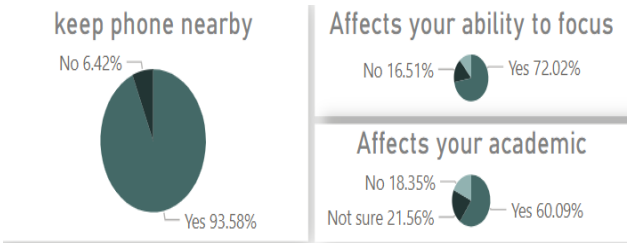

Fig. 3. Effectiveness of Mobile Phone Usage on Academic Focus

In the analysis of the data collected, it is evident that the use of mobile phones and social media platforms among students has a significant impact on their academic performance and focus. The findings indicate that 93% of students keep their phones nearby while studying, with 70% acknowledging that it affects their ability to focus. Furthermore, 60% of students believe that the use of mobile phones and social media platforms has a detrimental effect on their academic performance Fig. 3. These statistics highlight the pervasive nature of mobile phone usage and its potential impact on students' academic endeavors.

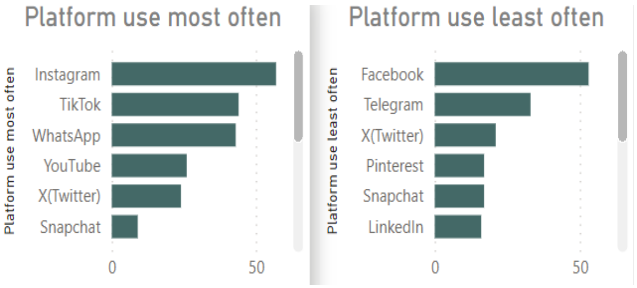

Fig. 4. Social Media Platforms Used by Students

In terms of social media platform usage Fig. 4, the study reveals that Instagram is the most popular platform among students, followed by TikTok and WhatsApp, which collectively account for 66% of the usage compared to other platforms. Notably, almost every student has an account on WhatsApp, indicating its widespread adoption among the student population. Conversely, Facebook is the least used platform, 24% of students reporting Facebook as the least used platform. These findings shed light on the preferences and habits of students in relation to social media platforms and address the first part of the second research question: What are the most frequently used social media apps/platforms by Muslim students, and what purposes do they serve?

The purposes of using social media platforms among students were also examined, with the majority of respondents indicating that they use social media for purposes such as connecting with friends, staying updated with current news, and seeking entertainment. These purposes collectively represent more than 50% of the total responses, while only 13% of students reported using social media for educational purposes. This disparity underscores the predominance of social and recreational uses of social media among students, as opposed to its potential educational utility.

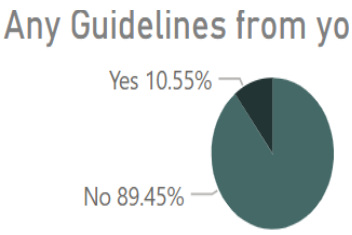

Fig. 5. Institutional Guidelines on Social Media Usage

Furthermore, Fig. 5 the study investigated the existence of guidelines for social media usage within the university context. It was found that 90% of students reported the absence of specific guidelines for social media usage, indicating a lack of institutional regulation in this area. However, the remaining 10% mentioned a few guidelines that

were in place, including promoting accountability and responsibility in social media use, preventing the spread of false information, restricting access to certain applications under university Wi-Fi, organizing programs to help students manage their social media time, and prohibiting the use of phones during class time. These guidelines reflect the efforts of some institutions to address the challenges associated with social media usage among students. This answers the third data science question which is whether or not institutions/universities have policies in place pertaining to social media usage at study places.

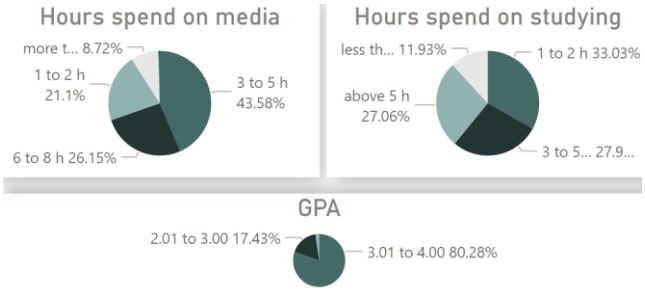

Fig. 6. GPA & Hours Spent on Social Media and Studying

The initial analysis suggests a relationship between social media usage and academic success among Muslim students. Students who have difficulties focusing on their studies experience a negative impact on their academic performance. There is a positive correlation between students who keep their phones nearby and their ability to focus. Specifically, the category of students spending 3-5 hours studying increased from 26.96% to 42.84% among those who keep their phones nearby compared to those who do not. This suggests that students who keep their phones nearby spend less time studying, and the hours spent on studying is a significant factor in measuring the academic success of Muslim students. The proximity of the phone and social media usage are also related. The percentage of students who do not keep their phones nearby and use social media for more than 8 hours is 0%, while for those who keep their phones nearby, the percentage for the same category is 9.34%. This finding indicates that the duration of social media usage increases when the phone is kept nearby Fig. 5 and Fig. 6.

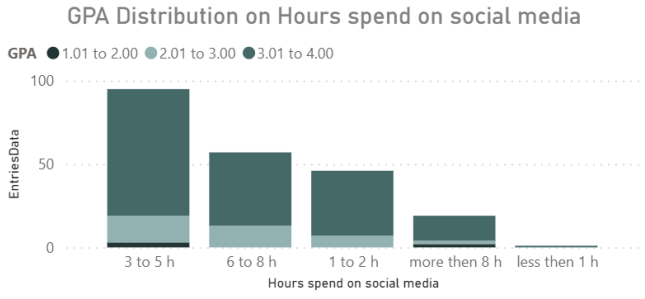

Fig. 7. GPA Distribution

In examining the relationship between social media usage duration and academic success among Muslim students, the analysis reveals noteworthy insights. Specifically, the data indicates that there is a discernible association between social media usage duration and students' GPA. The percentage of students using social media for 1-5 hours and achieving a GPA of 3.01 – 4.00 is 81.56%. However, when the usage exceeds 5 hours, the percentage decreases to 77.62%. This observation suggests a modest relationship between social media usage duration and GPA for Muslim students Fig. 7.

X. Future Work

To further advance the research project, several key areas can be addressed to enhance the depth and scope of the investigation. Firstly, expanding the sample size by obtaining a larger number of responses from diverse demographics and geographical locations would significantly strengthen the statistical power and generalizability of the findings. This would enable a more comprehensive analysis of the relationship between social media usage duration and academic success among Muslim students, allowing for a more nuanced understanding of potential variations and trends within the data. Additionally, incorporating a broader range of factors to measure academic success beyond GPA and study period, such as student engagement, mental well-being, and extracurricular involvement, would provide a more holistic assessment of students' educational achievements and overall experiences. This multifaceted approach would offer a more comprehensive understanding of the complex interplay between social media usage and academic success, contributing to the development of targeted interventions and support mechanisms for students. Furthermore, future research could explore the longitudinal effects of social media engagement on academic outcomes, considering the dynamic nature of social media platforms and their evolving impact on students' educational journeys.

XI. Conclusion

This study provides a comprehensive review and exploration of key areas, including the current state of social media usage, academic success among Muslim students, the data science process, and the relationship between social media usage duration and academic performance. Employing the data science process—from data collection and cleaning to exploratory data analysis and findings— revealed that drawing a definitive conclusion on the impact of social media usage on academic success is challenging. However, it is evident that students are aware of the potential influence of social media on their academic performance.

The final stage of the data science process includes simulations and recommendations, which are purposefully presented in this conclusion. Survey responses highlighted strategies such as setting time limits, disabling notifications, engaging in hobbies, and practising mindfulness as effective ways to manage social media usage. Some participants even suggested the complete removal of social media from their lives, aligning with Islamic teachings on time management, as emphasized in the Hadith: 'Man's feet will not move on the Day of Resurrection before he is asked about his life, how he spent it; his knowledge, how he used it; his wealth, how he earned and spent it; and his body, how he used it' [32]. Therefore, effective time management is crucial for Muslim students to maximize their free time.

In summary, this study sheds light on students' mobile phone and social media usage, exploring its prevalence and potential effects on focus and academic performance. While

the results were inconclusive, it underscores the complexity of the issue and the need for further research into specific platforms and usage patterns. A deeper understanding of this relationship can help develop better support strategies for students and improve their academic outcomes.

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Facial Recognition Technology: AI-Driven Classroom Attendance System

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***Abstract*—Our AI-driven Classroom Attendance System, developed at International Islamic University Malaysia, employs state-of-the-art facial recognition technology to modernize and enhance the way attendance is recorded in educational settings. Unlike traditional methods, such as manually calling names or signing sheets, our innovative system uses a webcam to immediately recognize and register students as they enter the classroom. This automation not only accelerates the process but also minimizes human errors, ensuring that attendance records are precise and dependable.**

Keywords—Facial recognition technology, classroom attendance, real-time updates, educational technology

I. INTRODUCTION

A. Problem Statement

In traditional educational settings, the process of manually recording attendance is fraught with inefficiencies and inaccuracies, often leading to significant administrative burdens and potential errors. Such methods can consume valuable instructional time and are susceptible to manipulation and human error. The AI-Driven Classroom Attendance System aims to resolve these challenges by implementing an automated system utilizing advanced facial recognition technology.

This system not only improves the precision and speed of recording attendances but also significantly minimizes the likelihood of common errors associated with manual entry, thereby enhancing overall academic productivity and accountability.

B. Objectives

The primary objective of this project is to develop and deploy a fully functional AI-based attendance system designed to:

1. Automate the entire attendance tracking process using state-of-the-art facial recognition technology, thus minimizing manual intervention.
2. Reduce the administrative burdens traditionally associated with attendance management, allowing educators more time to focus on teaching.
3. Provide real-time attendance updates and historical data analytics to educators and administrative staff, facilitating better student management and academic planning.
4. Increase the security and integrity of the attendance recording process, preventing fraudulent activities and ensuring compliance with institutional policies.

C. Significance of Project

The AI-Driven Classroom Attendance System represents a transformative leap forward in the management of attendance within educational institutions. By leveraging advanced facial recognition technology, the system not only automates but also significantly enhances the accuracy and reliability of the attendance tracking process. Below are key aspects of its significance:

Efficiency in Attendance Management

The system reduces the time required for traditional roll calls, which typically consume a significant portion of class time. By automating attendance through facial recognition, students can be instantly recognized as they enter the classroom, thereby allowing classes to start on time and maximizing educational delivery. This efficiency is particularly crucial in large universities where managing the attendance of hundreds of students per lecture can be daunting.

Enhanced Security and Integrity

With the implementation of real-time facial recognition technology, the system substantially mitigates the risks associated with conventional attendance methods such as proxy attendance. Each student's presence is authenticated through biometric data, which significantly reduces fraudulent activities and enhances the integrity of attendance records. This feature is vital in maintaining rigorous academic standards and fairness.

Real-Time Updates and Accessibility

Faculty members receive real-time updates on attendance, enabling immediate responses and interventions if necessary. Additionally, the system provides an accessible interface for both students and faculty, where attendance records can be reviewed and managed effortlessly. This accessibility ensures that all stakeholders are informed and can make timely decisions based on accurate attendance data.

Alignment with Digital Transformation in Education

The deployment of this system aligns with the broader digital transformation initiatives within the educational sector. As institutions seek to modernize their infrastructure and embrace digital solutions, the AI-Driven Classroom Attendance System serves as a benchmark for how technology can be effectively utilized to enhance educational processes and administrative efficiency.

D. Features and Functionalties

The AI-Driven Classroom Attendance System showcases a myriad of advanced features and functionalities specifically tailored to enhance the educational experience by streamlining attendance processes. Central to its design is the integration of facial recognition technology, which allows for the rapid identification and logging of student attendance as they enter the classroom. This is facilitated through a high-definition webcam and sophisticated image processing software that can accurately recognize faces in varied lighting and orientations, ensuring reliability and efficiency.

Further enhancing its utility, the system features real-time data synchronization with a Firebase database, enabling immediate updates and access to attendance records. This integration ensures that data is consistently updated and available to educators and administrators via a user-friendly web interface developed using Flask, HTML, and CSS. This interface not only allows for the viewing of attendance records but also includes administrative tools for managing student profiles and generating detailed attendance reports, which are crucial for academic management.

Security features are also paramount, with the system employing advanced encryption protocols to safeguard sensitive data and privacy controls to ensure that information access is restricted to authorized personnel only. Additionally, administrators can access these features through a secure, intuitive web interface, which allows for quick modifications and updates without the need for direct interaction with the database or technical intervention.

The interface is designed to be user-friendly, ensuring that administrators can easily navigate through different functionalities, from entering new student records to updating existing ones. This is complemented by a permission-based access system, which ensures that only authorized personnel can make changes, thus safeguarding student data integrity and privacy.

E. Summary

The AI-Driven Classroom Attendance System changes the way attendance is managed within educational institutions by incorporating advanced facial recognition technology. This innovation addresses the major flaws associated with traditional attendance methods, which are generally slow, error-prone, and vulnerable to manipulation. Traditional methods often lead to substantial losses in instructional time and pose significant administrative challenges. By implementing this automated system, not only is the accuracy and speed of recording attendance significantly enhanced, but the likelihood of errors commonly associated with manual processes is also drastically reduced, thereby improving overall academic efficiency and accountability.

This project is designed with several critical objectives in mind. Firstly, it aims to minimize manual intervention by automating the entire attendance tracking process using cutting-edge facial recognition technology. This reduces the time educators spend on manual attendance tasks, thereby allowing them more time to focus on instructional duties. Secondly, the system is engineered to provide real-time attendance updates and detailed historical data analytics to educators and administrative staff, which facilitates more informed student management and better academic planning. Additionally, it enhances the security and integrity of the attendance recording process by preventing fraudulent activities and ensuring strict compliance with institutional policies.

The system's significance is particularly noted in its ability to transform attendance management from a time-consuming task into a seamless, efficient process. By automating attendance with facial recognition, students are instantly recognized as they enter the classroom, which allows for a prompt start to classes and maximizes educational delivery. This is especially valuable in large university settings were managing the attendance of hundreds of students per lecture can otherwise be an overwhelming task.

Moreover, real-time facial recognition technology significantly mitigates risks associated with traditional methods, such as proxy attendance. This not only reduces fraudulent activities, but also strengthens the integrity and fairness of academic records. Faculty members benefit from immediate updates on attendance, enabling swift responses and necessary interventions when attendance issues arise. The system also provides a highly accessible interface for both students and faculty, making it easy to review and manage attendance records efficiently.

Aligning with the broader initiatives of digital transformation in the educational sector, the AI-Driven Classroom Attendance System sets a new standard for integrating technology to improve educational processes and administrative efficiency. It features a suite of user-friendly tools including real-time data synchronization with Firebase, an admin dashboard for efficient data management, and robust security protocols to protect sensitive information, ensuring that the system not only simplifies attendance management but also upholds a high standard of data accuracy and reliability.

II. Literature Review

A. Introduction

Taking attendance is a critical task in university. Traditionally, it involved calling names or marking papers, which could be slow and error prone. With advancements in technology, digital tools have started replacing manual methods, making the process faster and more reliable. Tools like Firebase, an online database, along with HTML and CSS for designing web-based interfaces, are now being used to create more efficient attendance systems.

This section will review research, industry reports, and real-world applications that integrate artificial intelligence (AI), especially facial recognition, into attendance management systems. AI offers promising enhancements, enabling faster and more accurate tracking of student attendance. We will explore how systems built on Firebase with interfaces designed in HTML and CSS are being implemented in educational settings. The review will address the operational benefits, technical challenges, and privacy concerns these technologies face.

Additionally, we'll discuss how AI can leverage data beyond mere attendance tracking to enhance student engagement and learning outcomes. By examining existing AI-driven systems, this review aims to gather insights into best practices and innovative solutions that can inform the

development of a new, user-friendly AI-based attendance system.

The aim is to create a foundation of understanding that will guide the development of an attendance system that not only automates the process, but is also intuitive to use and adaptable to various educational environments. This exploration will ensure that the proposed system improves on traditional methods and aligns with modern educational technology standards.

B. Issues and Problems

While the deployment of facial recognition for classroom attendance offers distinct advantages such as enhanced speed and accuracy, it is not without its challenges. Privacy concerns are at the forefront, with stakeholders wary about the handling and security of biometric data. The potential for misuse and the implications for personal privacy demand stringent data protection protocols and clear transparency about data usage.

Accuracy of the system also poses a significant challenge. Variables such as inconsistent lighting, various angles, and changes in students' appearances (like new hairstyles, glasses, or facial hair) can impact the system's ability to correctly recognize individuals, leading to possible misidentifications or false absences. Such technical limitations highlight the need for high-quality hardware and sophisticated image processing software, which can be cost-prohibitive for some institutions.

Resistance to technological change is another hurdle. Both students and faculty might be skeptical about the effectiveness and privacy implications of facial recognition systems. Overcoming this resistance requires robust communication strategies, emphasizing the benefits and safety features of the system.

C. Definition of Facial Recognition Technology

Facial recognition technology is a form of biometric software that can identify or verify a person's identity using their face. This technology captures, analyzes, and compares patterns based on the person's facial details. The process involves several key steps: first, the software identifies human faces in digital images, whether in a photo or video. It then measures various aspects of the face, such as the distance between the eyes, the width of the nose, the depth of the eye sockets, and the shape of the cheekbones. These measurements are used to create a facial signature, a mathematical formula that uniquely identifies one individual's face.

This facial signature is then compared to a database of known faces to find potential matches. In the context of classroom attendance, this technology automatically verifies the identities of students as they enter the classroom and records their presence, thereby eliminating the need for manual roll-calling. This system not only speeds up the attendance process but also enhances its accuracy, as it reduces the human error that can occur with traditional methods.

Facial recognition systems can vary in complexity and capability but generally rely on sophisticated algorithms and deep learning models to improve accuracy over time. Despite its benefits, the technology raises significant privacy and security concerns, necessitating careful implementation and adherence to stringent data protection standards to protect individuals' rights and personal information.

D. Types of Facial Recognition System

TABLE I. TYPES OF FACIAL RECOGNITION SYSTEM

Type	Description and Use Case
2D Recognition	Analyzes 2D images for feature distances; sensitive to lighting and angles. Used in consumer apps and smartphones.
3D Recognition	Captures facial contours using 3D sensors, less affected by light/angles. Ideal for high-security areas needing precision.
Thermal Recognition	Detects temperature patterns, effective in darkness. Suitable for nighttime surveillance.
Multimodal Systems	Combines multiple biometrics for enhanced security. Used in critical security areas.
Active Systems	Requires user interaction (e.g., blinking) to capture data. Used for controlled access with interaction.
Passive Systems	Captures data without user interaction from normal images or videos. Common in general surveillance and public spaces.

E. Existing Systems

Amazon Rekognition

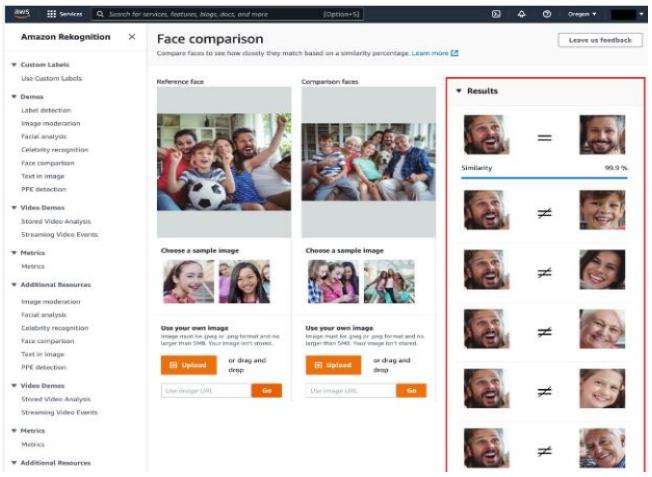

Fig.1. Amazon Rekognition

As a part of the comprehensive Amazon Web Services (AWS) suite, Amazon Rekognition is more than just a tool – it's a powerhouse of image and video analysis capabilities, driven by advanced deep learning technology. Its ability to accurately recognize faces in a variety of media formats makes it a versatile and powerful component for classroom attendance systems. The strength of Amazon Rekognition lies in its adaptability and scalability, allowing it to handle large volumes of data with ease. This makes it not only

suitable but highly effective for educational institutions that require a robust, reliable system capable of managing the attendance of numerous students across multiple classrooms. Furthermore, its integration capabilities with other AWS services make it a part of a larger ecosystem, offering a comprehensive solution for schools and colleges looking to leverage the latest in technology to enhance their administrative processes.

Microsoft Azure Face

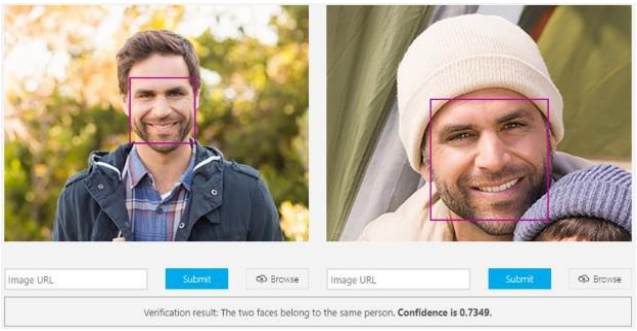

Fig.2.Microsoft Azure Face

The Azure Face API, a key component of Microsoft Cognitive Services, offers an array of features that go beyond basic face detection. Its advanced recognition and identification capabilities are pivotal in various applications, including attendance systems. What sets the Azure Face API apart is its continuous improvement and evolution, powered by the latest advancements in AI and machine learning. This not only ensures enhanced accuracy over time, but provides a level of reliability and trustworthiness crucial for educational institutions. The Azure Face API's capacity to integrate into existing systems makes it a versatile choice for schools and colleges aiming to upgrade their technological infrastructure. Its robust cloud infrastructure support further ensures a reliable and seamless experience, positioning it as a top choice for educational settings seeking a comprehensive, future-proof solution for attendance and beyond.

AttendLab

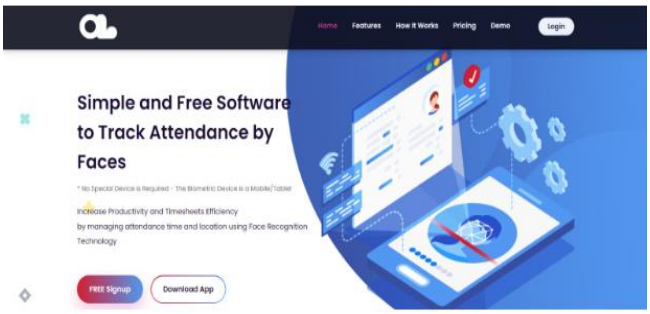

Fig.3.AttendLab

AttendLab stands out in the realm of educational technology as a highly accessible and user-friendly platform for attendance tracking through facial recognition. Operating seamlessly on standard devices like mobiles and tablets, AttendLab is not just about simplicity; it's about bringing efficiency to the forefront of the educational experience. This platform addresses a key need in modern educational settings – streamlining the attendance process without the need for specialized equipment or extensive training. Its design prioritizes ease of use, making it an ideal solution for educational institutions looking to modernize their attendance systems while maintaining a focus on user accessibility and convenience.

F. Advantages and disadvantages

Amazon Rekognition

Advantages: Amazon Rekognition showcases exceptional facial recognition accuracy, thanks to its use of advanced deep learning technologies. This high level of precision is crucial for accurately verifying student identities in real-time, ensuring that attendance records are reliable and free of errors. Furthermore, Amazon Rekognition integrates seamlessly with other Amazon Web Services, creating a comprehensive tech ecosystem that simplifies management across various school administrative functions. This integration enhances the efficiency of school operations, allowing for the centralized handling of tasks ranging from attendance to security management. Additionally, Amazon Rekognition is highly scalable, making it an ideal solution for large educational institutions. It effortlessly handles the increasing data demands of growing student populations and can scale across multiple campuses, ensuring consistent performance as school districts expand. This scalability, combined with the robust accuracy and integration capabilities, makes Amazon Rekognition a powerful tool for schools looking to modernize and streamline their attendance tracking systems.

Disadvantages: While Amazon Rekognition offers significant benefits, there are notable disadvantages that schools must consider. The service operates on a usage-based cost structure, which can become financially burdensome for educational institutions, especially those with large numbers of students or those that require frequent system access. This pricing model can lead to unexpectedly high costs as the scale of use increases, making budgeting challenging for schools. Additionally, there are serious privacy concerns associated with the handling of facial data on cloud-based platforms like Amazon Rekognition. Storing sensitive biometric information in the cloud poses risks of data breaches, unauthorized access, and potential misuse of personal data. Schools must ensure strict compliance with data protection laws and might need to invest in additional security measures to safeguard student information. These privacy issues can also raise ethical questions and concerns from parents and stakeholders about the security and confidentiality of student data, impacting the acceptance and implementation of such technology in educational environments.

Microsoft Azure Face

Advantages: Microsoft Azure Face API offers continuous improvements that enhance recognition accuracy over time, ensuring that the technology adapts to evolving needs and conditions. This dynamic improvement in capability guarantees that the system remains effective as facial recognition technology advances. In addition to its accuracy, Azure Face API boasts advanced recognition capabilities, such as emotion detection, which can provide additional

layers of interaction and analysis for educational purposes. For instance, emotion detection can help teachers understand student engagement and emotional responses in real-time, offering a unique insight into classroom dynamics. Moreover, the service is backed by Microsoft's robust cloud infrastructure, which ensures reliable performance even under heavy loads. This reliability is crucial for schools that depend on consistent and uninterrupted access to attendance systems to maintain daily operations smoothly.

Disadvantages: While the Microsoft Azure Face API offers robust capabilities for facial recognition, it comes with notable disadvantages, particularly in contexts involving minors. Privacy and ethical issues are major concerns, as the use of facial recognition technology involves handling sensitive personal data. Navigating the regulatory landscape to ensure compliance with privacy laws, which often require explicit consent for processing data from minors, can be complex. Additionally, the Azure Face API uses a complex pricing structure that can lead to unexpected costs. This model, based on the volume of data processed and the number of API calls made, may result in financial unpredictability, posing a challenge for organizations operating on fixed budgets.

AttendLab

Advantages: AttendLab offers several compelling advantages for its users, particularly in educational environments. It features an intuitive interface that simplifies adaptation and use, allowing educators and students to quickly become proficient in managing and recording attendance without a steep learning curve. This ease of use is particularly valuable in settings where time and ease of access are crucial. Additionally, AttendLab is freely accessible which is highly appealing to budget-conscious institutions looking to maximize their resources without incurring additional software costs. Moreover, the platform boasts flexible device compatibility, functioning efficiently across various devices including mobiles and tablets. This flexibility ensures that users can access the system conveniently from anywhere, enhancing the overall usability and effectiveness of the attendance management process.

Disadvantages: While AttendLab offers several benefits, it also has some limitations that can impact its effectiveness in certain situations. One major disadvantage is its limited functionality in offline environments or areas with low connectivity. This dependency on a stable internet connection can restrict its use in rural or underdeveloped areas where internet service may be unreliable or unavailable, potentially leading to interruptions in attendance tracking. Additionally, AttendLab's performance heavily relies on the quality of the device camera used for facial recognition. If the device has a poor-quality camera, it can compromise the accuracy of student identification, affecting the reliability of the attendance data collected. These factors can pose significant challenges in ensuring consistent and accurate attendance tracking across all settings.

III. METHODOLOGY

In developing the AI-Driven Classroom Attendance System, a strategic and structured approach is crucial. This project employs the Agile System Development Life Cycle (SDLC) methodology, specifically chosen for its adaptability and efficiency. The Agile SDLC is well-suited for projects like ours, where user feedback and evolving requirements are key.

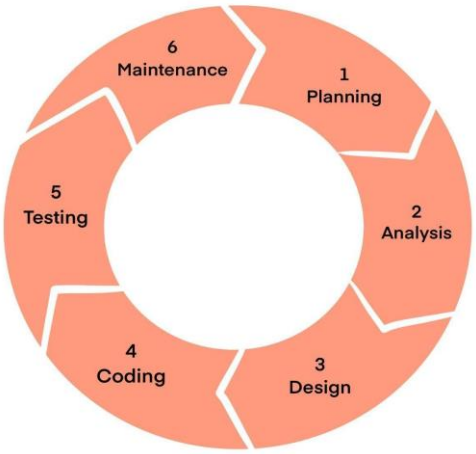

Fig.4.System Development Life Cycle

A. Implementation of SDLC

TABLE II. IMPLEMENTATION OF SDLC

Phase	Description
Planning and Ideation	Define objectives and scope; assess current attendance methods and potential for facial recognition.
Requirement Gathering	Collect requirements via surveys from IIUM students and faculty to understand specific system needs.
Analyzing System Needs	Translate user needs into system requirements, focusing on functionality and privacy.
Design	Create initial designs and prototypes; focus on user interface and facial recognition efficiency.
Development	Code the system using Python, integrate OpenCV, and configure hardware like Raspberry Pi.
Testing	Test facial recognition accuracy, interface usability, and system performance at IIUM.
Deployment	Deploy the system at IIUM, monitor its use, and gather feedback to evaluate effectiveness.

B. Logical Design

TABLE III. ACTORS TABLE

Actor	Role at IIUM	Description
Students	IIUM Students	Use the system for automated and accurate attendance.
IIUM Lecturers	IIUM Academic Staff	Monitor and verify student attendance; access detailed reports.
Administrators	University Administrative Staff	Manage the system, ensuring functionality, data integrity, and alignment with university standards.

TABLE IV. USE CASE TABLE

Use Case Name	Description	Actors
Mark Attendance	Students log attendance upon class entry.	Students
Review Attendance	Lecturers verify and approve attendance records.	IIUM Lecturers
Manage User Accounts	Admins set up and manage user profiles.	Administrators
System Maintenance	Routine updates and fixes to ensure system reliability.	Administrators
Register New Account	New university members are registered on the system.	Students, IIUM Lecturers

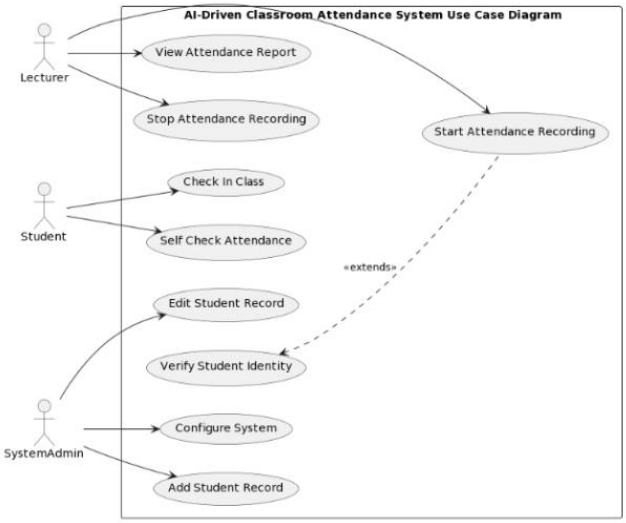

Fig.5.Use Case Diagram

The "AI-Driven Classroom Attendance System Use Case Diagram" from Fig. 5 illustrates how Lecturers, Students, and System Administrators interact with the system, each with distinct roles. Lecturers can view, start, and stop attendance records, managing class sessions effectively. Students mark their attendance upon arrival, verify their records, and can request edits for inaccuracies. System Administrators handle system configurations and update student records, ensuring the system operates smoothly and aligns with educational requirements. This diagram succinctly encapsulates user-system interactions, demonstrating essential functionalities for automated and secure attendance tracking within the educational environment.

The sequence diagram for the AI-Driven Classroom Attendance System from Fig. 6 outlines a streamlined process for managing attendance through facial recognition technology. The process initiates when a Lecturer or Administrator starts the system, which activates the camera to capture images of the students. These images are then processed by the Facial Recognition Module to identify students based on their facial features.

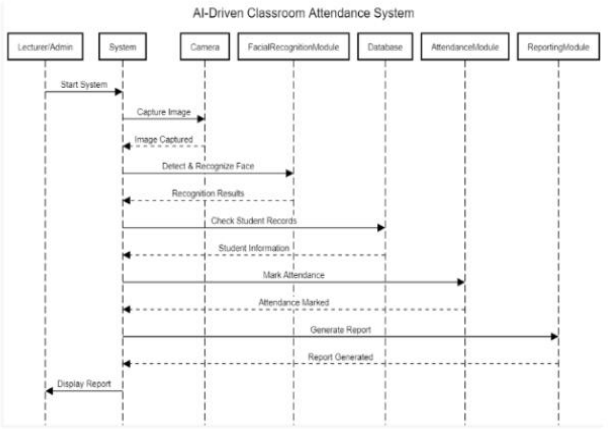

Fig. 6. Sequence Diagram

Once identities are confirmed, the system cross-references these with the student records in the database to verify class enrolment. Attendance is then automatically marked for each recognized student. Subsequently, the system generates a report that details the attendance for the session, which is displayed to the Lecturer or Administrator. This diagram also showcases the efficient integration of technology to automate and simplify attendance management in educational settings.

C. Data Collection

The primary goal of this questionnaire is to explore the perceptions, concerns, and potential advantages perceived by students and educators regarding the use of an AI-driven classroom attendance system. This questionnaire aims to gather detailed feedback on the effectiveness of facial recognition technology for attendance tracking, its ease of use, and any privacy concerns participants might have. Additionally, it seeks to understand the overall acceptance of such technology in educational settings and how it could potentially improve administrative efficiency and student accountability.

IV. IMPLEMENTATION

This semester marked the initiation of the AI-driven Classroom Attendance System project, designed for attendance taking through facial recognition technology at the International Islamic University Malaysia. The project began by identifying key user groups and their needs, which guided the development of targeted survey questions aimed at understanding the unique challenges and requirements of our educational environment. Building on the survey insights, we documented detailed system requirements and initiated iterative design processes to develop a user-friendly interface. Throughout the project's implementation, our team honed their soft skills, significantly enhancing our ability to communicate effectively with potential users and stakeholders. This engagement was crucial for refining our data collection strategies and further developing our system requirements. Notably, the focus on user-centered design has not only improved our team's technical skills in interface design but also ensured that the system is intuitive and meets the actual needs of users.

A. *Data Collection*

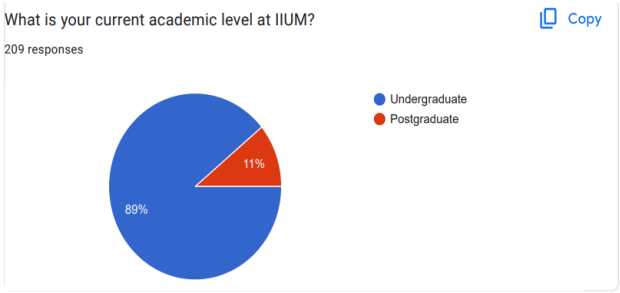

Fig.7.Academic level

The pie chart in Fig. 7 shows the academic levels of 209 respondents at IIUM: 89% are undergraduates and 11% are postgraduates.

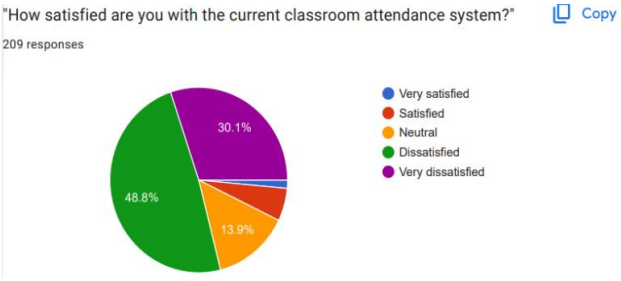

Fig.8.Satisfaction level

Around 48.8% of participants were satisfied with the existing attendance system, suggesting a level of acceptance of current methods.

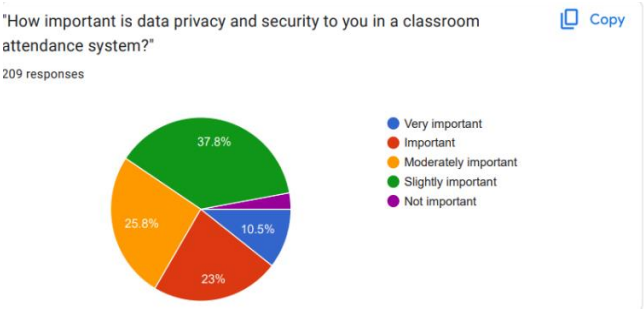

Fig.9.Data privacy concerns

Data privacy and security were significant concerns, with 37.8% of respondents rating them as very important, emphasizing the need for secure handling of biometric data in the new system.

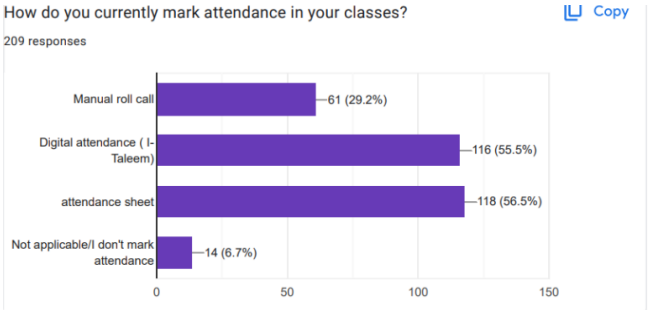

Fig.10.Methods of taking attendance

Among the respondents, 55.5% reported using digital attendance methods like I-Taleem, and 29.2% relied on manual roll calls, indicating the current split in attendance practices.

V. RESULTS

A. *Admin Interface*

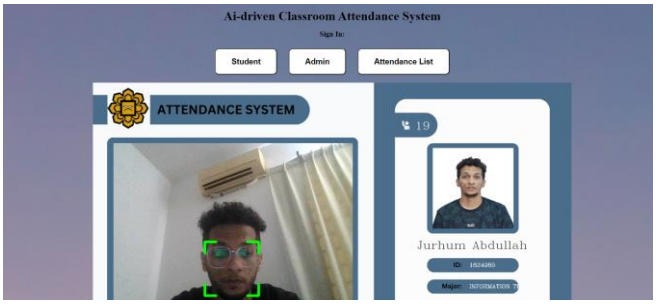

Fig.11. Home page

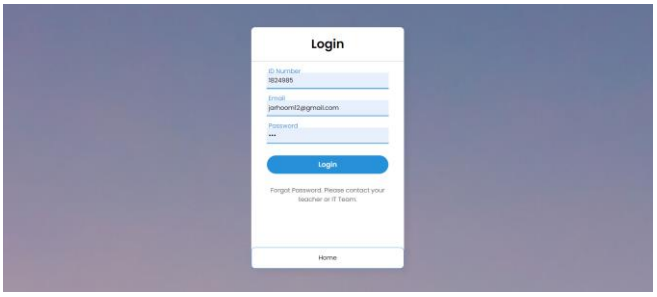

Fig.12. Admin login

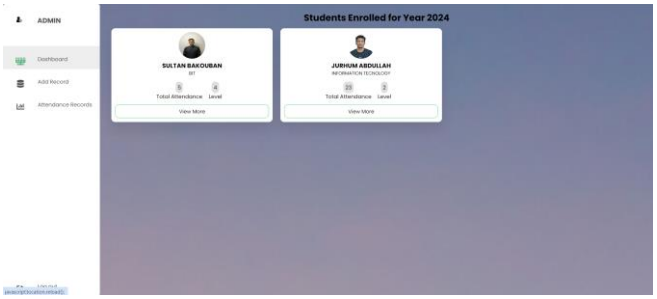

Fig.13.Admin dashboard

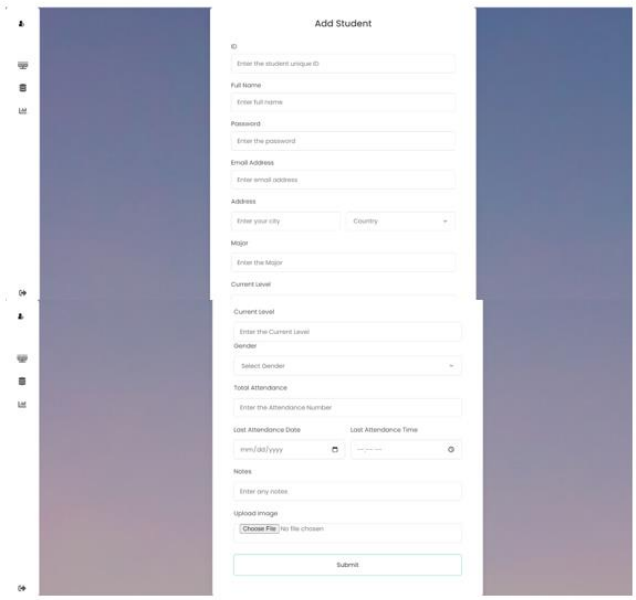

Fig.14. Add new student

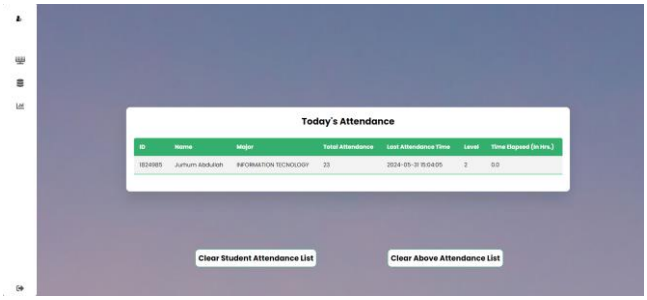

Fig.15. Record for attendance

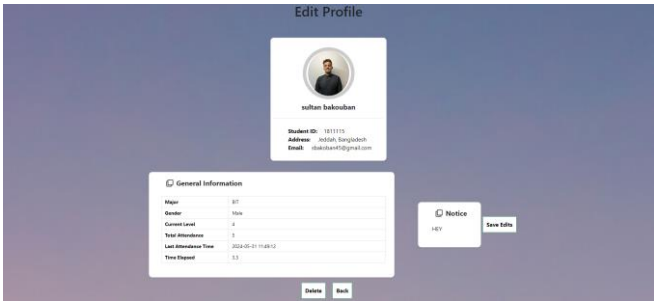

Fig.16. Edit, delete student

B. *User's Interface*

Fig.17.User's interface

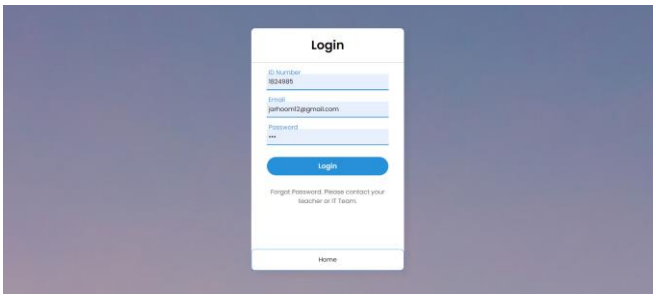

Fig.18. User login

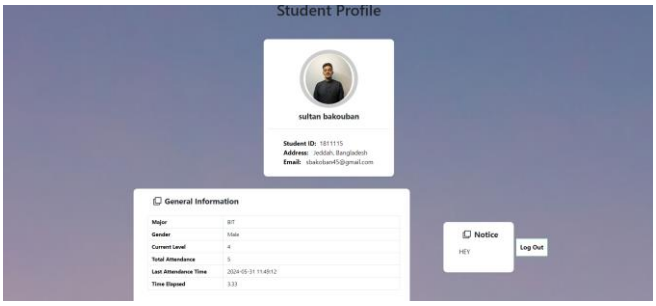

Fig.19. Student's profile

VI. SIGNIFICANCE OF THE PROJECT

The AI-Driven Classroom Attendance System significantly enhances educational efficiency by automating attendance tracking, which reduces the time spent on manual roll calls and ensures classes start on time. Utilizing advanced facial recognition technology, it minimizes errors and increases the accuracy and reliability of attendance records. The system incorporates robust security measures to protect student data and ensure privacy compliance, while real-time updates and analytics provide immediate access to attendance data for better student management and academic planning.

Aligned with digital transformation goals in education, this system integrates cutting-edge technology to streamline administrative tasks, enhancing the educational experience. It offers an intuitive user interface for easy access and management of attendance data, empowering both students and faculty. Scalable and adaptable, it suits various educational settings, helping educators focus more on teaching and engagement, thereby supporting improved educational outcomes. Overall, the AI-Driven Classroom Attendance System modernizes educational practices, making them more efficient, secure, and focused on quality learning experiences.

VII. FUTURE WORK

As we look towards future enhancements of the AI-Driven Classroom Attendance System, several key areas have been identified for development to further increase the system's efficiency and accuracy.

Firstly, investing in high-quality cameras is essential. Enhanced camera technology will improve the system's ability to accurately capture images, even in varied lighting conditions and angles, which is crucial for effective facial recognition. This upgrade will reduce errors and enhance the reliability of the attendance data captured.

Secondly, integrating the system more deeply with university databases to automatically retrieve student information and photographs will streamline the setup process and ensure the system has up-to-date data. This integration will facilitate easier management of student profiles and improve the system's overall efficiency.

Additionally, allocating a higher budget for advanced facial recognition libraries is crucial. By utilizing state-of-the-art facial recognition technologies, the system can achieve higher accuracy rates, better performance, and more robust security features. This investment will also support continuous improvement of the system through access to the latest updates and features available in the market.

These future developments will not only refine the system’s functionalities but also enhance user satisfaction and trust in the technology, ultimately leading to a more seamless, secure, and efficient attendance management process within educational institutions.

VIII. CONCLUSIONS

The AI-Driven Classroom Attendance System has effectively transformed traditional attendance tracking methods within educational settings by integrating advanced facial recognition technology. This integration has streamlined the attendance process, significantly reducing time spent on manual procedures and enhancing both accuracy and reliability. By minimizing common errors associated with human involvement, the system allows classes to commence promptly, thereby optimizing instructional time and improving the overall educational experience.

Looking forward, the system will benefit from further enhancements such as the use of higher quality cameras, deeper integration with university databases, and investments in advanced facial recognition technologies. These improvements will refine the user experience, enhance security measures, and ensure that the system remains at the forefront of educational technology. Ultimately, the AI-Driven Classroom Attendance System exemplifies the profound impact of digital innovation in education, promoting more efficient, secure, and data-driven academic environments.

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