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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

KICT Publishing

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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

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

TABLE OF CONTENTS

Pendekar Siber Portal: Empowering Malaysian Youth Through Cybersecurity Education

Nur Syafini Ismail
Department of Information Systems
International Islamic University Malaysia,
Selangor, Malaysia
nursyafni81@gmail.com

Siti Aisyah Ismail
Department of Information Systems
International Islamic University Malaysia,
Selangor, Malaysia
aisyahisml13@gmail.com

Nurul Nuha Abdul Molok
Department of Information Systems
International Islamic University Malaysia,
Selangor, Malaysia
nurulnuha@iium.edu.my

***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.

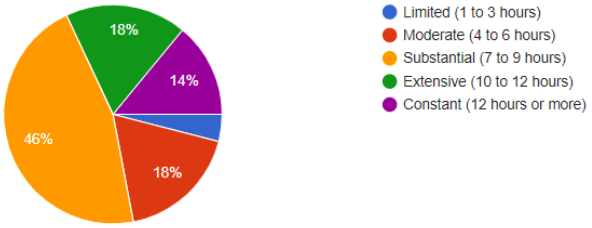

Fig.2. Hours of internet usage

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.

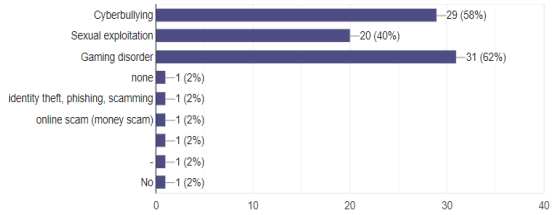

Fig.3.Types of cyber threats encountered by respondents

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.

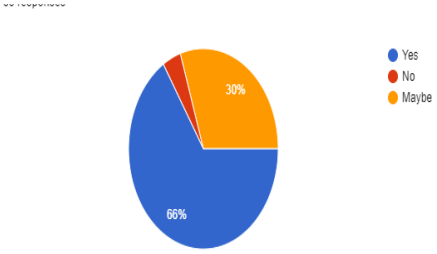

Fig.4. Interest in pursuing cybersecurity as a career

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.

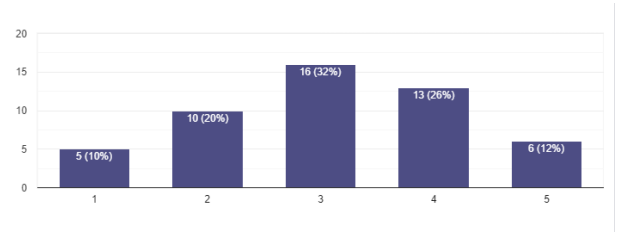

Fig.5.Distribution of familiarity of job opportunities in cybersecurity

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.

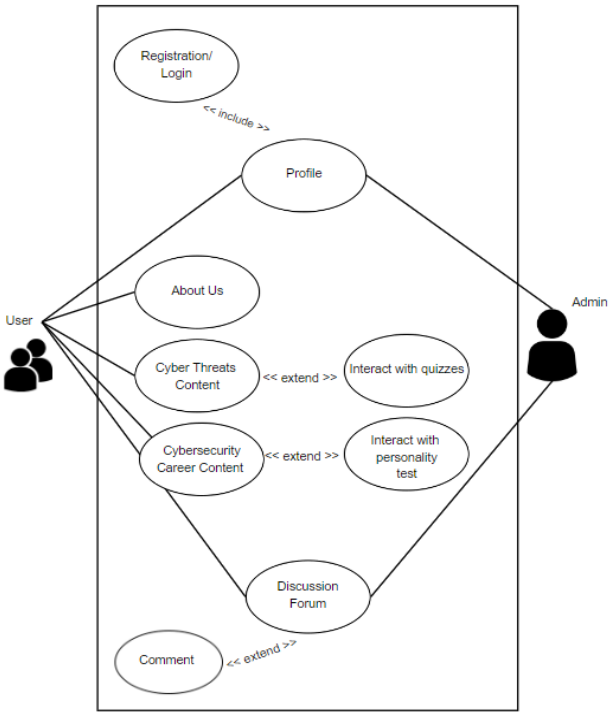

Fig.6.Use Case Design Diagram

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.

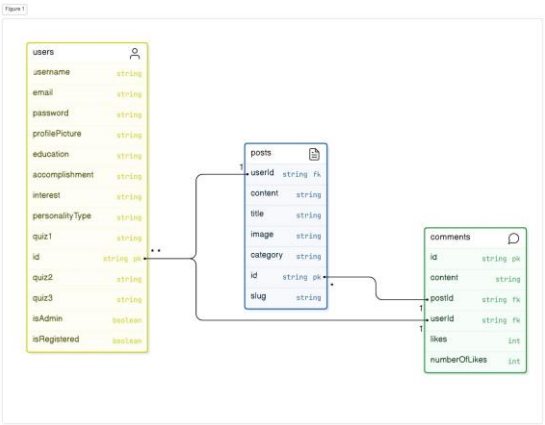

Fig.7.Entity Relationship Diagram

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.

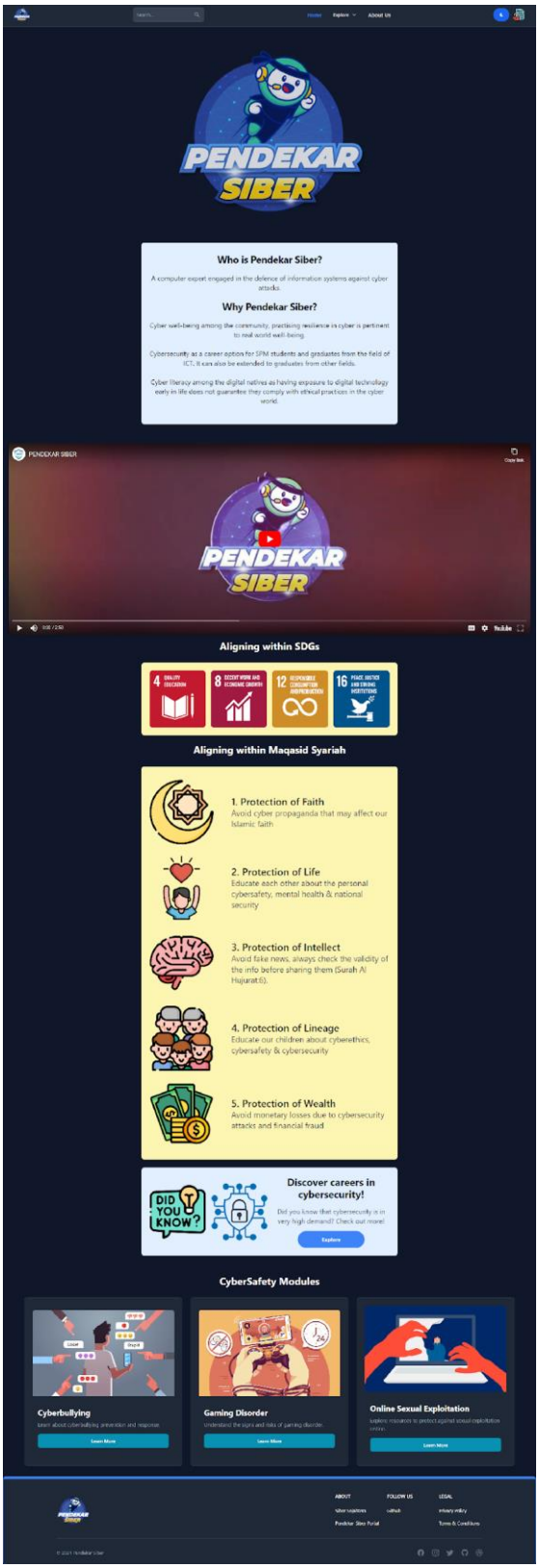

Fig.8.Pendekar Siber Homepage

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.

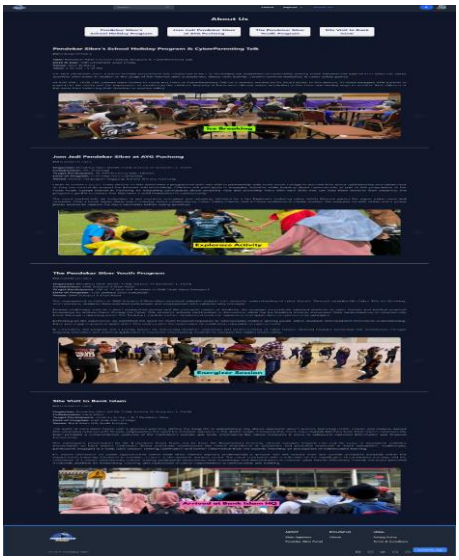

Fig.9.About Us Page

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.

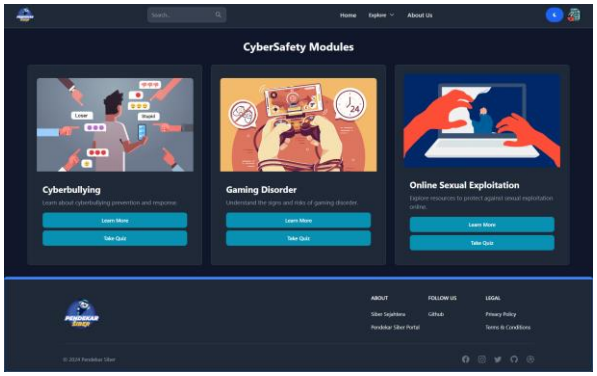

Fig.10.Cybersafety Modules Page

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.

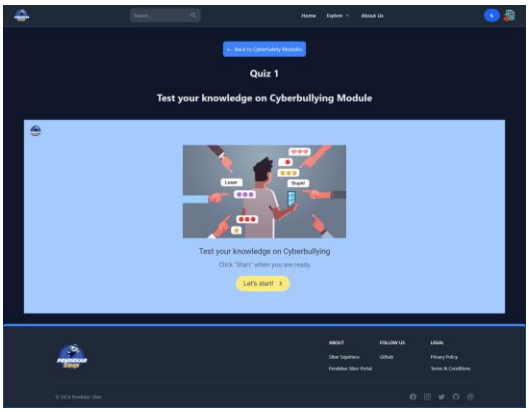

Fig.11.Cyberbullying Quiz Page

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.

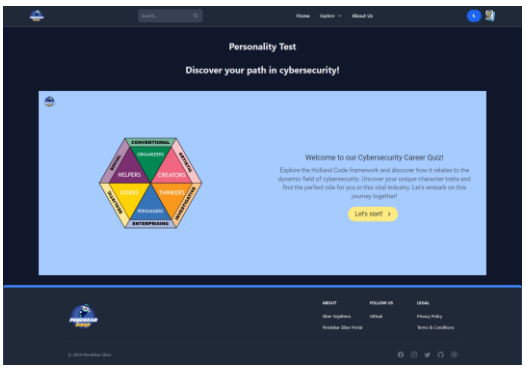

Fig.13.Personality Test Page

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.

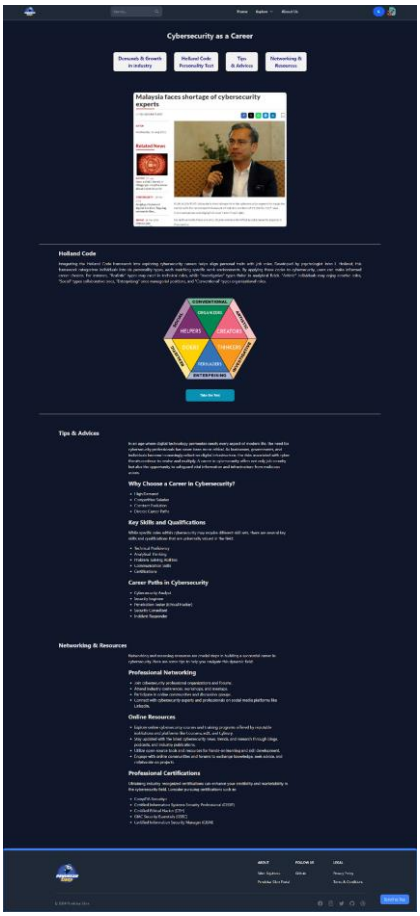

Fig.14.Cybersecurity Career Page

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.

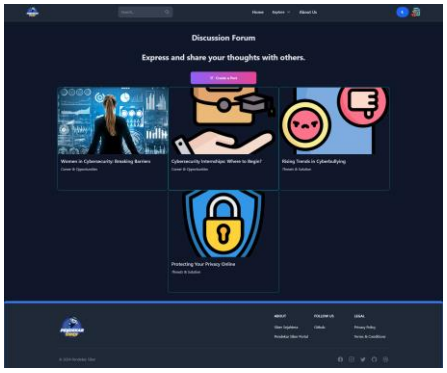

Fig.15.Discussion Forum Page

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.

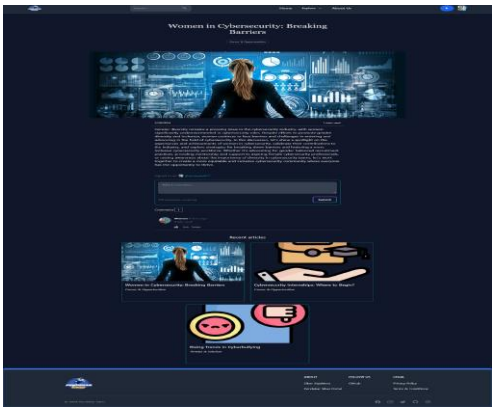

Fig.16.Post in Discussion Forum Page

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.

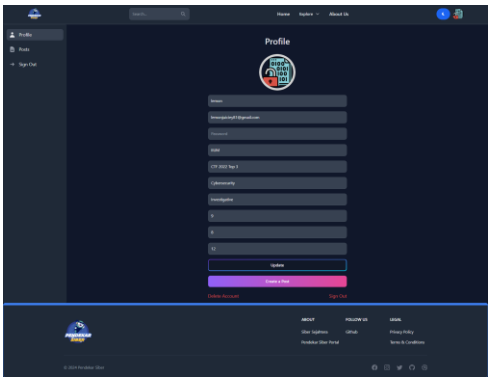

Fig.17.User Profile Page

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.

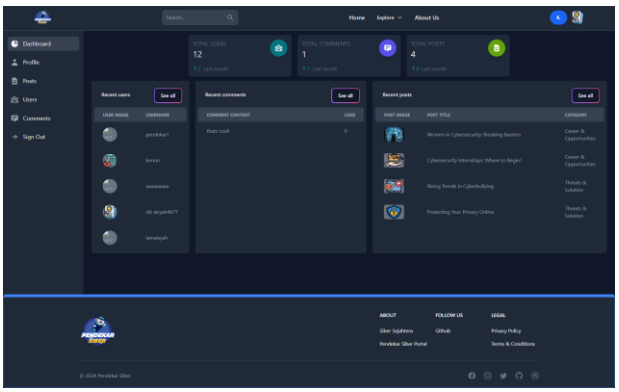

Fig.18.Admin Dashboard

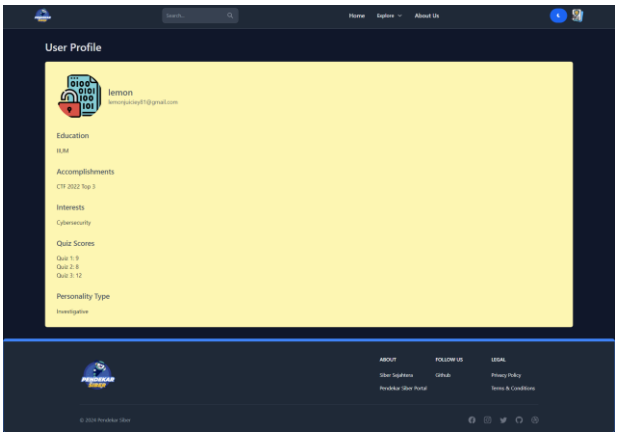

Fig.19.Admin view on registered users

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.

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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.

REFERENCES

[1] R. Ahmad, “Negara perlukan 30,000 tenaga mahir keselamatan siber” [Online]. Available: https://www.bharian.com.my/rencana/komentar/2024/03/1225693/negara-perlukan-30000-tenaga-mahir-keselamatan-siber 2024.

[2] T. A. Yusof, "Malaysia faces a shortage of cybersecurity experts. The Star.," [Online]. Available: https://www.thestar.com.my/news/nation/2023/08/16/malaysia-faces-shortage-of-cybersecurity-experts.

[3] N.N. Abdul Molok, Z. Zulkifli & M.R. Wahiddin, “Pendekar Siber: Empowering young people to combat cyber threats”. International Conference on Cyber Resilience (ICCR), Dubai, United Arab Emirates, 2022.

[4] S.A. Mohd Fadhli, S.Y. Liew, A.S. Ab Halim, A. Ab Razak, A. Ab Rahman. “Finding the link between cyberbullying and suicidal behaviour among adolescents in Peninsular Malaysia”. Healthcare, 2022.

[5] V. Nehru, "Experts: Too much video game time detrimental", 2023. [Online]. Available: https://thesun.my/local_news/experts-too-much-video-game-time-detrimental-AI10900725

[6] Z. Morden, "Study estimates up to 100,000 kids may be victims of online sexual exploitation, abuse last year. Malay Mail.," September 2022. [Online]. Available: https://www.malaymail.com/news/malaysia/2022/09/28/study-estimates-up-to-100000-kids-may-be-victims-of-online-sexual-exploitation-abuse-last-year/30581.

[7] U. Nations, "Youth Population Trends and Sustainable Development.," 2015. [Online]. Available: https://www.un.org/esa/socdev/documents/youth/fact-sheets/YouthPOP.pdf.

[8] "Pendekar Siber Prototype 2020," [Online]. Available: https://syaz5898.wixsite.com/pendekarsiber/

[9] “Cybervengers,” [Online]. Available: https://cybervengers.club/en/

[10] “CyberSafe,” [Online]. Available: https://www.cybersafe.my/en/

[11] “Be Internet Awesome,” [Online]. Available: https://beinternetawesome.withgoogle.com/en_us

[12] “Childnet,” [Online]. Available: https://www.childnet.com/

[13] C. Sanghani, T. P. M. “Introduction to Agile Development: Principles and Practices.” [Online] Available: https://www.linkedin.com/pulse/introduction-agile-development-principles-practices-chetan-sanghani--3iqjc/ .

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