



Advancement in ICT: Exploring Innovative Solutions (AdICT)

Series 3/2025



Editors

Elin Eliana Abdul Rahim

Noor Azura Zakaria

Dini Oktarina Dwi Handayani

Ahmad Fatzilah Misman

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Preface

It is our great pleasure to present Advancement in ICT: Exploring Innovative Solutions (AdICT), Series 3/2025. This publication brings together diverse and forward-looking ideas in ICT, showcasing innovative approaches that not only address current challenges but also shape future opportunities. The contributions in this volume reflect the dedication, creativity and perseverance of KICT lecturers and students, whose hard work continues to push the boundaries of knowledge and application. Their commitment highlights the spirit of innovation that drives both academic inquiry and practical solutions in the ever-evolving field of ICT.

We would like to extend our sincere appreciation to all authors, reviewers, editors and the organising team for their invaluable efforts in making this series possible. It is our hope that this volume will serve as both an inspiration and a useful reference for scholars, students and professionals. By sharing these innovative perspectives and solutions, we aim to contribute meaningfully to the ongoing discourse in ICT, offering fresh insights and encouraging further exploration in advancing the discipline for the benefit of society.

Editors

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KiddieWheels: Safe, Smart and Simple School Runs

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Abstract—Managing student pick-ups and attendance in Selangor, Malaysia, is often challenging due to issues such as long waiting times, traffic congestion, safety concerns, and communication gaps. These problems lead to inefficiencies and stress for both parents and schools. To address this, KiddieWheels, a mobile application for Android and iOS, was developed with the objectives of enhancing safety, streamlining workflows, improving communication, and providing a secure system for managing student attendance and dismissal. Using the Rapid Prototyping methodology, the app was iteratively refined through user feedback. Developed with Flutter and Firebase, KiddieWheels offers real-time updates and customisable scheduling. The results demonstrate its effectiveness in resolving pick-up challenges, reducing waiting times, and improving coordination, making it a practical solution for schools in Selangor.

Keywords—student pick-up management, student attendance management, school dismissal system, mobile applications

I. INTRODUCTION

For every parent, guardian, and school administrator, ensuring children's safety and well-being has always been a top priority. However, coordinating school pick-ups can often be challenging in today's hectic society, particularly for busy parents. Parents with children attending private schools located within business premises in Selangor frequently face daily traffic congestion, especially during school dismissals. This congestion during peak hours raises safety concerns and leads to inefficiencies in the pick-up process.

Currently, there is no app in Malaysia explicitly designed to address the challenges faced by parents and schools during student pick-up and attendance management. Parents often encounter long waiting times, traffic congestion, and safety concerns, while schools struggle to manage large groups of children and ensure smooth dismissals. Communication gaps, lack of real-time updates, and inadequate attendance tracking further complicate the process. These challenges lead to stress, inefficiency, and logistical issues for both parents and schools.

The KiddieWheels app aims to achieve several outcomes. Firstly, it seeks to ensure the safety of students by enabling parents to provide daily attendance updates and notify schools of pick-up times in real-time. This app also aims to improve the efficiency of daily drop-off and pick-up processes by streamlining workflows, reducing waiting times, and ensuring timely communication of schedule changes. Additionally, KiddieWheels enhances communication and coordination between parents and schools through a user-friendly interface

that allows for scheduling pick-up times and receiving real-time updates.

Ultimately, the app offers a secure and reliable system to help schools manage student attendance and dismissal processes, saving time for both parents and school staff.

The scope of the KiddieWheels application focuses on addressing the needs of both parents and schools. For parents or guardians, the app provides a convenient way to alert teachers upon their arrival for pick-up and to plan daily pick-up schedules for their children. For schools, KiddieWheels functions as a comprehensive student management system, enabling the recording and storage of pick-up details, maintaining centralised student information along with their parents' details, and monitoring parents' arrival to ensure a smooth and efficient dismissal process. This dual functionality ensures that the app supports both key stakeholders effectively, streamlining the school pick-up system for all parties involved.

The targeted users of KiddieWheels include both parents and school staff. For parents and guardians, the app is designed to support busy individuals who require an efficient and reliable system to manage school pick-up schedules. It is particularly beneficial for parents of children attending private schools located in crowded urban areas. For school staff, including teachers and administrators, KiddieWheels provides tools to manage attendance and coordinate pick-ups efficiently, helping them address traffic congestion and logistical challenges commonly faced in busy school environments.

II. REVIEW OF PREVIOUS WORKS

Several existing mobile applications, such as PikMyKid [1], FetchKids [2], Kids Pick Up [3], and iSchoolRide [4], have been developed to address challenges related to school dismissal and pick-up. While these apps offer useful features, KiddieWheels stands out by providing a more tailored and comprehensive solution.

Based on Table I, both PikMyKid and FetchKids include a calendar feature for managing drop-offs and pick-ups, allowing parents to plan their schedules efficiently. However, Kids Pick Up and iSchoolRide lack this functionality, focusing more on carpooling and transportation. KiddieWheels includes this feature, ensuring parents can easily organise and adjust their schedules. Next, customisable pick-up scheduling is available in PikMyKid and FetchKids, offering parents the flexibility to update their pick-up plans at

any time. In contrast, Kids Pick Up and iSchoolRide provide more rigid systems. KiddieWheels improves this by allowing parents to make real-time adjustments and keep schools informed.

TABLE I. COMPARISON OF FEATURES BETWEEN PIKMYKID, FETCHKIDS, ISCHOOLRIDE AND KIDDIEWHEELS

Features	Pikmykid	Fetch Kids	Kids Pick Up	ISchool Ride	Kiddie Wheels
Calendar for drop-offs and pick-ups	✓	✓	✗	✗	✓
Customisable pick-up scheduling	✓	✓	✗	✗	✓
Real-time status on the school dashboard	✓	✗	✓	✗	✓
GPS-Based Feature	✓	✓	✗	✓	✓
Localised solution for Malaysian schools	✗	✗	✗	✗	✓
Cross-platform application	✓	✓	✓	✓	✓

Real-time status updates on a school dashboard are only offered by PikMyKid and KiddieWheels, enabling administrators to monitor dismissal processes effectively. Other platforms, such as FetchKids, Kids Pick Up, and iSchoolRide, lack this feature, making them less efficient for school coordination and management. Global Positioning System (GPS)-based features are supported by PikMyKid, FetchKids, and iSchoolRide, primarily for tracking locations. However, KiddieWheels takes this further by using GPS to enable the "Call" button only when a parent is near the school, ensuring precise notifications. Kids Pick Up does not include GPS features, limiting its functionality.

Finally, KiddieWheels is uniquely designed to address challenges faced by Malaysian schools, such as traffic congestion and limited parking. While other platforms are geared towards global markets, KiddieWheels focuses on providing a localised and user-friendly solution for parents and schools in Malaysia. Additionally, all platforms, including KiddieWheels, are cross-platform, supporting both iOS and Android devices.

III. METHODOLOGY

A. Rapid Prototyping Approach

The Rapid Prototyping methodology was chosen for the development of the KiddieWheels application to streamline the drop-off and pick-up process at schools. This methodology enables quick and easy adjustments, offering flexibility in the design process and allowing for the integration of new ideas based on user feedback. By iteratively refining the app's user experience, features, and functionalities, Rapid Prototyping ensures that the design evolves effectively through each iteration, driven by continuous feedback from target users. The steps involved in

this methodology include i. Prototype, ii. Review, iii. Refine and iterate, and finally iv. Deliver. As shown in Figure 1.

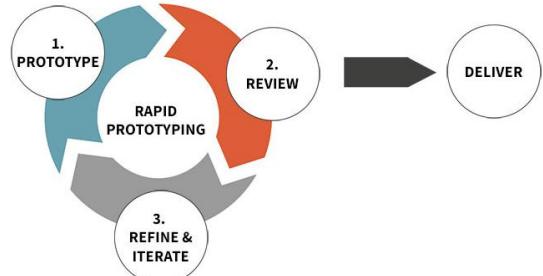


Fig. 1. Rapid Prototyping Model

To gather initial requirements for the KiddieWheels application, interviews were conducted with representatives of the target users, specifically a parent and the school principal. The interview questions, tailored to address key pain points such as traffic congestion, pickup inefficiencies, and communication gaps, are provided in Tables II and III. Insights from these interviews informed the development of features such as real-time attendance tracking, GPS-enabled parent arrival notifications, and a user-friendly scheduling interface, ensuring that the app closely aligns with user needs.

The Rapid Prototyping methodology enabled the development of high-fidelity prototypes that resembled the final product, allowing parents and school administrators to provide actionable feedback on the app's design and functionalities during the early stages. This iterative approach reduced the risk of developing features that did not meet user requirements, as potential flaws and enhancement opportunities were identified and resolved in real-time.

B. Requirements Specifications

KiddieWheels is a mobile application designed to address the challenges parents face during drop-off and pick-up processes at schools. This is especially critical for busy parents whose children attend integrated schools located in crowded business premises, as exemplified by a school in Seri Kembangan. To gather comprehensive data on these challenges, we interviewed a parent with children enrolled at the school and the school representative to gain in-depth insights into the specific issues, as well as any personal experiences related to school drop-offs and dismissals.

Based on Table II, the following key findings were identified:

1. Traffic congestion and limited parking: The area surrounding the school experiences significant traffic congestion, particularly during school dismissals between 4:30 and 5:00 pm. This congestion not only causes delays but also raises safety concerns for children navigating the parking lot amidst busy traffic. Due to the inefficiency of the current system, teachers are often required to manually notify children of their parents' arrival.

TABLE II . AN INTERVIEW WITH THE PARENT

Questions	Answers
May I know your name and your occupation?	They said their name and also mentioned their occupation.
How many children do you have that attended the school?	I have 2 children attending the same school.
Are you the only one involved in dropping off and picking up your children from school?	No, sometimes I will have my family members pick up my children from school.
Have you ever experienced challenges during the process of dropping off and picking-up your children to/from school?	Yes, it is quite challenging because I am not the only parent who wants to drop off and pick up my children at school.
How important are real-time notifications about your child's pick-up status?	I think it is very important to ensure that my children are picked up by authorised members at the right time.
Do you find it challenging to secure a parking spot in the school area during drop-off and pick-up times?	As it is located in a crowded business area, securing a parking spot is very challenging, so I will always be stuck in a traffic jam along with the other parents.
Do you often experience delays or inefficiencies during drop-off and pick-up times?	The current system is not very efficient. The teacher needs to check the car one by one to see which parents have arrived, as they have not been notified earlier. Hence, I will have to wait for a long time to pick up my children.
How do you typically manage to overcome the challenges during school drop-off and pick-up?	I would arrive early to avoid traffic jams. Sometimes, I adjust my work or other commitments to accommodate drop-off/pick-up times.
Do you agree that this technology can increase the safety rate and improve time management during school drop-offs and pick-ups?	I agree that this mobile application is safe for my children, and it will improve time management during school drop-offs and pick-ups.
If there were an app with those features, would it help you manage your children's school runs?	Yes, I think it will be very helpful in managing the school runs.

2. Long waiting times: Parents frequently spend an excessive amount of time waiting to pick up their children. This issue primarily stems from the manual process in which school staff must approach each parent's car individually to identify the student being picked up. This method is slow and inefficient, resulting in prolonged waiting times.

Based on Table III, the following key findings were identified:

1. Traffic congestion and limited parking: The school area frequently experiences heavy traffic due to the limited parking spaces, resulting in delays and raising safety concerns for children navigating the parking lot during dismissal times. The current system requires teachers to manually inform children of their parents' arrival, a process that is inefficient and time-consuming.
2. Attendance monitoring: The principal suggested implementing a system to track attendance, which would help the school maintain accurate records. A solution providing real-time updates and verified identities with instant status updates would streamline the attendance process.

TABLE III. AN INTERVIEW WITH THE SCHOOL REPRESENTATIVE

Questions	Answers
May I know your name and your position in this school?	She introduced herself and mentioned her position at the school.
Does the school frequently experience issues with traffic and time management during drop-off and pick-up?	Usually, the traffic was heavy during school arrivals and dismissals. Hence, it affects time management.
Is securing the parking spots in the school area during school drop-off and pick-up convenient for parents while they wait for their children?	Since our school is located in a crowded business area, parking spots are not available to accommodate all guardians while they wait for their children.
How useful are real-time notifications about the arrival of the parents at school?	I think real-time notifications of their arrivals will be very useful to assist the teacher in coordinating the students' preparation for school dismissals.
Is the current attendance tracking in this school systematic and flexible?	The current system does not automatically update when students arrive at school, which hinders the ability to monitor their attendance.
What do you think of the parents' acceptance of this project?	In my opinion, we should try to implement this app first because it is very convenient, especially for the teacher in charge of the students' safety. Moreover, the drop-off and pick-up processes are a daily issue for us. Some parents suggest creating a WhatsApp group specifically designated for the school-run process.
Do you agree that this technology can increase the safety rate and improve time management during school drop-offs and pick-ups?	Yes, this technology will benefit the parents and the school by increasing the safety rate and improving time management during drop-offs and pick-ups.
If there were an app with those features, would it help you manage the school runs for the students?	Yes, the application will help the school organisation manage the students effectively.

C. Platform and Tools

TABLE IV. SPECIFIC PLATFORM USED FOR KIDDIEWHEELS DEVELOPMENT

Requirements	Tools	Description
Mobile app development skills	Cross-platform framework (Flutter)	To develop a usable mobile app.
Streamlined code editor	Visual Studio Code	To provide developers with a quick code-build-debug cycle with various programming languages available.
Database management	Firebase	To store user data securely.
High-fidelity prototype design	Figma	To create an intuitive and visually appealing user interface.

Table IV describes the various platforms and tools used to create the KiddieWheels app, along with their specifications and associated features. The mobile app development skills requirement was addressed by a cross-platform framework (Flutter), which enabled the creation of a usable and satisfying mobile application. The developers were able to create, construct, debug, and test code in many programming languages using Visual Studio Code, a simplified code editor. Meanwhile, Firebase was chosen to satisfy the database management needs of securely storing all user data, synchronizing all activities in real-time, and offering

dependable backend functionality. Finally, Figma was used to build the UI interfaces for high-fidelity prototypes in a logical, user-friendly, and visually compelling manner, thereby improving the overall user experience and providing designers with a clearer idea of how the app will appear throughout the interface design stage. These tools cumulatively aided in the creation of a strong and user-centered mobile application.

D. System Design

1) Use case design

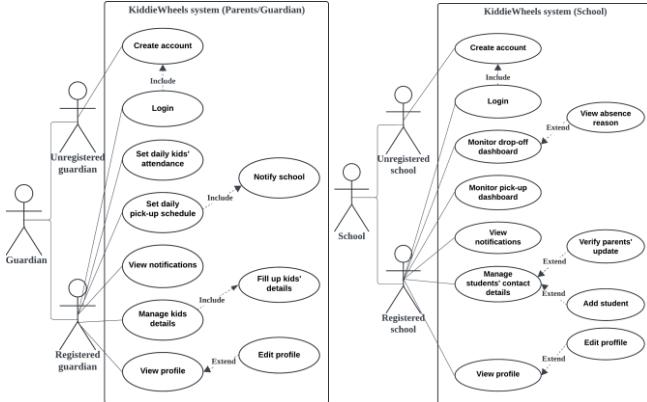


Fig. 2. Use case diagram for parents and school

The use case diagram, as shown in Figure 2, describes the primary features of the KiddieWheels system. Firstly, parents may register and log in as new members of the system. Once logged in, parents can record their child's daily attendance, schedule a pickup time, update their child's information, and modify their own profile. In terms of schools, new users can sign up and log in, while existing users can view dashboards that display drop-off and pick-up times, reasons for a child's absence, parent updates, add children, and update their profiles.

2) Database design

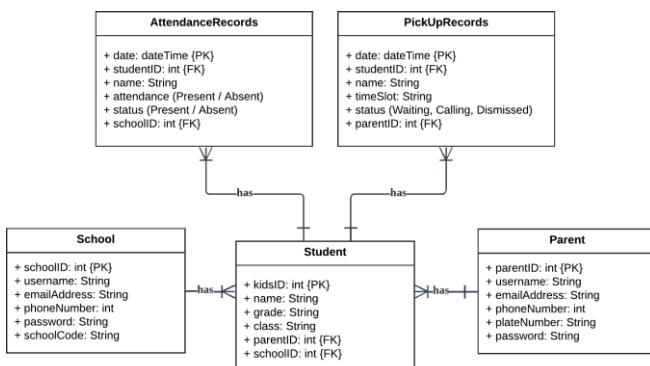


Fig. 3. ERD for KiddieWheels app

The Entity-Relationship Diagram (ERD), as shown in Figure 3, summarizes the main features of the KiddieWheels application, including DropOff, PickUpSchedule, School, Parent, and Student, as depicted in Figure 3. The DropOff entity contains information about the status and attendance of students on that specific day. In contrast, the PickUpSchedule entity stores information about the times and statuses at which students are picked up. Meanwhile, the School entity contains

the registered schools' information, which includes the school ID, username, email address, phone number, and password. Likewise, the parent entity provides information regarding the enrolled parents or guardians, including parent ID, username, email, phone number, and password. The Student entity serves as a middle ground between parents and schools. This is because it contains information such as the kid's ID, name, grade, and class, along with the foreign keys to the Parent and School entities. Hence, all these relationships contribute to effective data management and communication among parents, schools, and students.

3) High-fidelity prototype

Figure 4 showcases screenshots from the KiddieWheels app, highlighting key features designed for parents. The interface includes functionalities such as scheduling daily pick-up times, updating daily attendance, and registering their kids' details. The design emphasises user-friendliness, with a clean layout and intuitive navigation to ensure accessibility for all users.

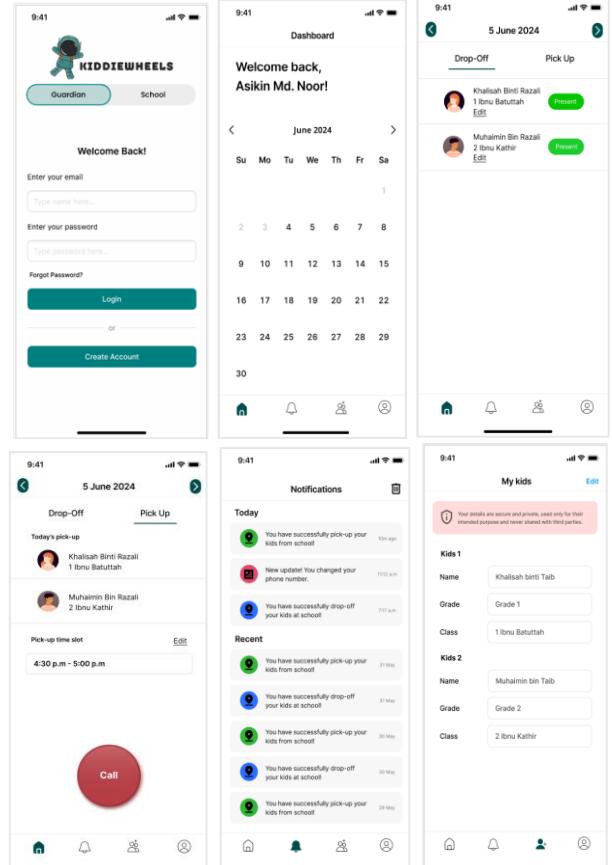


Fig. 4. Screenshots of KiddieWheels app (parent)

Figure 5 displays screenshots from the KiddieWheels app, showcasing features designed for school administrators and teachers. The key feature is the dashboard that enables teachers to monitor students' daily attendance and track real-time parent arrivals during school dismissal. This feature ensures a streamlined and organised pick-up process, enhancing both safety and efficiency.

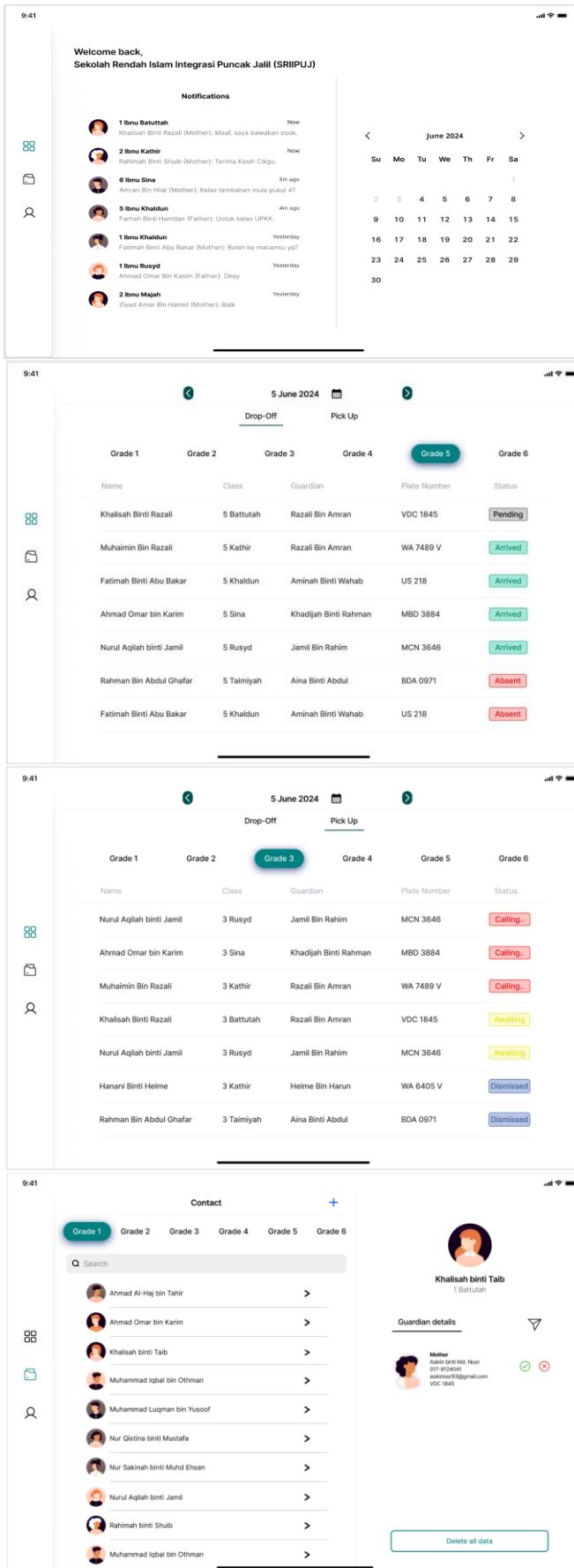


Fig. 5. Screenshots of KiddieWheels app (school)

IV. PROJECT DEVELOPMENT AND EVALUATION

A. Implementation

The implementation phase of the KiddieWheels project commenced with the development of backend components, followed by enhancements to the frontend interface based on the high-fidelity prototype.

Frontend Implementation

The frontend of KiddieWheels was developed using Flutter, a cross-platform framework, to provide a seamless and consistent experience across Android and iOS devices. The user interface (UI) was designed with simplicity and accessibility in mind, ensuring an intuitive experience for both parents and school administrators. Key features include a bottom navigation bar for easy access to core functionalities, such as scheduling pickups, updating attendance, and receiving notifications.

The design prioritises clarity, with real-time status updates such as "Waiting", "Calling", and "Dismissed" displayed prominently. Material Design principles were applied to ensure the UI is visually appealing and user-friendly. The user experience (UX) was further enhanced through responsive design, allowing smooth interaction across various device sizes. Dart was used for frontend logic, enabling the app to handle user actions efficiently and interact seamlessly with the backend.

1) Backend Implementation

The backend logic was implemented using Firebase, leveraging its scalability and real-time data capabilities. The system utilizes a Real-Time Database to manage updates for attendance and dismissal records, ensuring synchronized data for parents and administrators.

To enhance functionality, a GPS feature was integrated to improve location-based services. When a parent approaches or arrives at the school vicinity, the app detects their location using GPS data and enables the "Call" button. This ensures the feature is only available when the parent is physically near the school, preventing premature notifications. Firebase handles this logic by comparing the parent's current location with predefined geofencing coordinates of the school.

Authentication is managed via Firebase Authentication, ensuring secure role-based access for both parents and administrators. Business logic ensures accurate and secure handling of user data, while location data is processed efficiently to avoid performance issues.

2) Integration

The integration process of the KiddieWheels system combined the frontend, backend, and database to create a seamless and functional application. The front end, developed using Flutter, provided a user-friendly interface that allowed parents and schools to manage attendance, pick-up schedules, and student status in real-time. Through state management and real-time listeners, the front end dynamically reflected changes, ensuring a smooth user experience.

The backend, powered by Firebase, connected the frontend to the Firestore database, enabling secure and efficient data flow. Firebase Authentication ensured secure access for parents and schools, while Firestore's real-time capabilities allowed instant updates across the system. A well-structured database with parent-specific data under the 'Users' collection and a global 'AllKids' collection for schools ensured consistency and scalability. Features like the GPS-enabled Call button were integrated with backend logic to dynamically adjust button availability based on the parent's location.

By leveraging Firebase's capabilities and Flutter's responsive design, the integration enabled seamless communication between components. This ensured that changes in one part of the system, such as attendance updates or status changes, were instantly visible across the application, delivering a reliable and cohesive experience for all users.

B. System Testing

System Testing was performed to verify that the KiddieWheels platform functioned as intended and met all specified requirements. The testing took place in a controlled environment, ensuring all components were tested in an integrated manner. The system was tested in real-world scenarios, covering all features, including parent login, attendance updates, pick-up scheduling, and GPS-based functionality for the Call button.

Test Plan

The System Test Plan included the following components to ensure comprehensive testing of the platform. The test plan was based on various scenarios, which are described in Table V, and a real example of one of these scenarios is presented in Table VI.

1) Enhancements

During the system testing phase, several enhancements were identified and implemented to improve the performance of the KiddieWheels platform. These enhancements included:

a) Real-time system updates

The system was optimised to ensure instant updates for attendance and pick-up details, improving coordination and user experience on both parent and school dashboards.

b) GPS-Based Call Button Activation

A GPS-based feature was added to enable the Call button only when parents were near the school, ensuring appropriate functionality and enhancing usability.

c) Improved UI and Error Handling

Colour-coded status indicators and default "Pending" statuses were added for clarity, while performance improvements ensured smooth operation, even with large datasets.

TABLE V. SCENARIO DESCRIPTIONS

Pages	Each page of the platform (parent and school dashboards, attendance, and pick-up status) was systematically tested.				
Test Data	Specific test data, including mock user profiles, attendance records, and pick-up schedules, were used to simulate realistic interactions.				
Test Condition	Scenarios such as GPS availability, concurrent updates from multiple users, and network delays were simulated to test system resilience.				
Expected Result	Benchmarks were established for each scenario, detailing the expected outcomes for the system's functionalities.				
Actual Result	Observations were recorded to identify any discrepancies between expected and actual behaviours.				
Remarks	Notable issues, suggestions for improvement, or additional feature requirements were documented.				

TABLE VI. EXAMPLE SCENARIO

Pages	Test Data	Test Condition	Expected Result	Actual Result	Remarks
Attendance	User ID: Parent 1	The parent sets attendance for Kid A as "Absent" with a reason	Status updates to "Absent" and the reason is visible on the school dashboard	<input checked="" type="checkbox"/> Worked as expected	System updated in real-time

V. CONCLUSIONS

The KiddieWheels mobile application is a step forward in solving the everyday challenges faced by parents and schools during drop-off and pick-up times. With features like real-time attendance updates, a GPS-enabled "Call" button that activates only when parents are near the school, and customisable pick-up schedules, KiddieWheels provides a much-needed solution. By utilizing modern technologies like Flutter and Firebase, the app is reliable and scalable, ensuring smooth communication between parents and school administrators. The Rapid Prototyping methodology was crucial to its development, enabling us to adapt the design and functionality based on user feedback and ensure the app meets the needs of all parties involved.

Looking ahead, there is considerable potential for further improvement. Expanding user testing to include a broader and more diverse range of schools and parents would provide valuable insights to enhance the application's functionality. Additionally, incorporating features such as multilingual support, advanced analytics for school administrators, and integration with broader school management systems could greatly enhance the app's utility and scalability, making it suitable for a wider variety of educational institutions.

Furthermore, the development and implementation of KiddieWheels align closely with Sustainable Development Goal (SDG) 11: Sustainable Cities and Communities, particularly Target 11.2 [5], which emphasises the need for safe, accessible, and sustainable transport systems. By reducing traffic congestion, improving child safety during school dismissals, and streamlining communication between parents and schools, KiddieWheels contributes to the creation of more organised and sustainable urban communities.

In conclusion, KiddieWheels represents an innovative and impactful solution to the challenges of school transportation management. By prioritizing safety, efficiency, and user-friendliness, the application offers a practical approach to enhancing daily school operations while supporting global efforts to build sustainable and inclusive communities.

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