APLIKASI MUDAH ALIH UNTUK PENGURUSAN PENGANGKUTAN PELAJAR SEKOLAH (MySchoolCommute)

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Abstrak

Kecekapan dan kebolehpercayaan pengangkutan pelajar sangat bergantung kepada penyelarasan, komunikasi, dan perancangan yang berkesan antara pemandu pengangkutan sekolah dan ibu bapa. Di kawasan luar bandar atau kawasan yang baru dibangunkan, pemandu sering menghadapi kesukaran untuk menentukan keutamaan lokasi semasa merancang laluan, menetapkan waktu pengambilan, dan berkomunikasi dengan ibu bapa. Proses manual yang tidak berpusat ini menjejaskan kecekapan kerana ibu bapa terpaksa menghubungi beberapa orang pemandu secara individu untuk menyemak ketersediaan, yang mengakibatkan kelewatan, salah komunikasi, dan cabaran logistik. Komplikasi-komplikasi ini mewujudkan pengalaman yang tidak tersusun dan memakan masa, sekali gus menjejaskan ketepatan masa dan kepercayaan kedua-dua pihak. Oleh itu, bagi menangani isu ini, satu aplikasi telefon pintar yang dinamakan *MySchoolCommute* dicadangkan sebagai platform berpusat untuk memudahkan pemandu menggunakan alat penjadualan dan komunikasi bersama ibu bapa. Melalui platform ini, ibu bapa boleh berbincang dengan pemandu untuk menetapkan waktu pengambilan, berinteraksi secara dua hala, dan menguruskan pembayaran. Dengan memusatkan fungsi-fungsi ini, aplikasi ini bertujuan untuk meningkatkan penyelarasan antara semua pihak berkepentingan serta memperbaiki keberkesanan keseluruhan sistem pengangkutan pelajar, sekaligus menawarkan penyelesaian yang lebih tersusun, boleh dipercayai, dan mesra pengguna. Aplikasi ini akan dibangunkan menggunakan *Android Studio, Flutter, dan MySQL*, dengan objektif untuk mengoptimumkan operasi dan meningkatkan pengalaman semasa pengangkutan, mengurangkan masa menunggu, serta menambah baik kecekapan pengurusan pengangkutan untuk ibu bapa dan juga pemandu bas sekolah, kereta, dan van.

Abstract

The efficiency and reliability of student transportation are heavily dependent on effective coordination, communication and planning between school transportation drivers and parents. in rural or newly developed areas, drivers often encounter difficulties in prioritising where to go to during route planning, determining pickup times and communicating with the parents. This fragmented manual process dismantles efficiencies, requiring parents to contact multiple drivers individually to inquire availability, resulting in delays, miscommunication and logistical challenges. These complications create a disorganised and time-consuming experience that affects the punctuality and disrupts trust for both parties. Thus, addressing this issue, the proposed solution is a smartphone application, MySchoolCommute, that streamlines a centralised platform for drivers to use scheduling tools and communication between parents and drivers. Through this platform, parents can negotiate with the drivers in calibrating pickup times, interact with drivers in a two-way engagement, and manage payments. By centralising these functions, the application aims in enhancing coordination between the stakeholders and improving the overall effectiveness of student transportation, offering a more reliable, structured, and reliable solution for all users. The application will be developed using Android Studio, Flutter, and MySQL, aiming to optimise operations and enhancing experience during transportation, reduce waiting times, and increase overall efficiency in transport management for parents and for school bus, car, and van drivers.

1.0 INTRODUCTION

School transportation in Malaysia continues to face complex logistical, financial, coordination and safety challenges, especially in rural and newly developed areas, causing a major dent in efficiency. Due to the scattered layout of residential compounds in randomised areas and high operational costs of maintenance and fuel for conventional school transportation to navigate in scattered residential areas, providing consistency in transport services remains difficult to achieve due to affordability discussed in a study done by Ariffin, Zahari, and Tumin (2015). Parents, particularly where both are working, often struggle to manage timely pickups and drop-offs for their children to get to school and home, leading to a growth in concerns about reliability, efficiency and safety. As a result, many parents personally opted in using private vehicles, managed by a self-appointed driver or family member, to transport their children to school, which in turn contributes to worsening traffic congestion and urban pollution, especially during peak hours (Drive in Malaysia, 2022).

According to the Malaysian Institute of Road Safety Search (MIROS, 2020), 60% of urban parents transport their children using private vehicles due to the lack of trust in available transport services. Challenges such as unlicensed operators, driver shortages, poor coordination, unpredictable schedules, limited transportation availability, further complicates school transport logistics (Drive in Malaysia,

2022). Additionally, geographic and infrastructural limitations within suburban and rural areas exacerbate the difficulty of providing equitable and consistent school transport access (Mohamed & Karim, 2016; Ahmad, 2018).

In addressing these multiple layered issues, it necessitates the need for a modern, efficient and reliable transportation system in micromanaging the aforementioned issues. The proposed solution catered to school transportation management is a mobile application called *MySchoolCommute*, designed to centralise communication and scheduling between two stakeholders, the parents and school transport drivers, in real time. This app will aid in monitoring, scheduling and arranging pickup times, access transport-related safety information, communicate with drivers and includes safety features such as emergency alerts and driver credentials consisting their full name and licensed plate number. Drivers, in turn, can efficiently manage their schedule with clients, respond and accept or reject to requests, and reduce idle capacity and increase clientele networking through better demand visibility within household vicinities.

This mobile-based application aim to resolve inefficiencies caused by fragmented communication, reduce pollution and traffic congestion by improving centralised utilisation from multiple clients, and ultimately offering a safer, well-structured school commute experience for involving stakeholders. Features such as driver background checks, licensed vehicle verification, and emergency alarm functions will be included in ensuring enhanced safety.

The application will be built using *Flutter*, *Android Studio* and will be supported by *MyPHPAdmin* for purposes such as backend data storage and primary functions. This application will target Android users (version 5.0 and above) and includes a readable, user-friendly interface that is accessible to groups of all ages and backgrounds. Through this platform, the application will not only enhance efficiency during operations but also augmenting better informed policymaking in the future by enabling centralised data tracking on school mobility patterns.

2.0 LITERATURE REVIEW

The development of the *MySchoolCommute* application is based on a comprehensive investigation conducted in assessing the challenges of school transportation management in Malaysia. Addressing issues such as poor scheduling, limited rural coverage, and safety concerns requires the integration of mobile applications, GPS, and real-time scheduling — technologies that have proven effective in optimizing stakeholder communication and route efficiency (Chen & Wang, 2020).

One critical concern in Malaysia, as a developing country, is the increasing presence of illegal operators and unlicensed school transport vehicles, which lack insurance, proper maintenance, and adherence to safety laws and policies by the government. This has raised significant alarm among families and authorities, with government figures highlighting the threat these operators may pose to student safety (The New Straits Times, 2017; Sinar Daily, 2023). To overcome such risks, centralized databases and scheduling systems implemented in this application can improve service reliability and reduce administrative burdens (Roslan & Ismail, 2018). Moreover, real-time tracking and computerised scheduling help minimize delays and enhance communication among parents, drivers, and school administration (Ahmad & Arshad, 2019).

Vehicle maintenance also plays a key role in ensuring operational safety. Preventive measures such as regular inspections and repairs prove to be essential to avoid sudden breakdowns (overhaul) and malfunctions (Spanco, 2020). Thus, when the clientele networking are centralised, it will aid in easing the management of maintenance and cost measures.

The system's database architecture will follow a client-server model, enabling efficient data storage, access, and updates for multiple users simultaneously (Azman, 2018). Key data such as student records, transport schedules, and maintenance logs will be managed centrally to improve decision-making and real-time availability for parents, drivers, and administrators.

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The platform will be built on the Android operating system, chosen for its open-source flexibility and widespread use. Efficient scheduling algorithms tailored to Malaysia's unique traffic patterns and geography are vital to reduce environmental impact and improve operational reliability (Ibrahim et al., 2017; Lee & Tan, 2018).

3.0 METHODOLOGY

This study adopts the *Waterfall Model*, a sequential approach using five phases to software development, as described by Smith (2019) in *"The Application of the Waterfall Model in Software Development: A Case Study"*. The Waterfall Model was selected due to its linear process flow, as well as a sequential phase that ensures completion before proceeding, ensuring that each phase is fully completed before moving on to the next. The key phases implemented during the development are requirements analysis, system design, implementation, testing and deployment and maintenance.

3.1 Needs Analaysis

Within the development phase of the application, user requirements are essential to guide the development of the *MySchoolCommute* mobile application. The analysis will also underline both functional and non-functional specifications, ensuring the application meets the operational needs required from parents and drivers.

The functional requirements define the expected behavior of the system based on actions performed, such as user authentication, in-app emergency notifications, digital wallet functionality and parent-driver communication. On the other hand, the non-functional requirements focus on the quality aspects of the system, including reliability, responsiveness, readability, usability, and availability. These ensure the app responds quickly to user actions, performs smoothly, and provides a stable, always-accessible experience.

The prototyping was conducted to obtain user requirements by designing the application's prototype, which is front-end based. This technique was utilised to provide the needs that users and parents require for the application to operate at a minimum necessity.

Furthermore, the analysis identifies the hardware and software requirements essential for both development and deployment. The application will be compatible with Android 5.0 and above, and developed using Android Studio, Flutter, and a client-server database system, namely MyPHP to store user and other necessary data.

3.2 Conceptual Model Design

The conceptual design of the *MySchoolCommute* mobile application outlines the interaction between key components that facilitate real-time school transport coordination. It will also outline the measures that are taken during the early phases of development. The system integrates core functionalities such as user authentication, emergency alert systems, digital wallet system, messaging communication, and schedule management. Despite of different educational backgrounds, ages and gender, each component is designed with an intuitive interface to ensure accessibility and usability for all stakeholders, including parents and drivers.

In early production stage, prior to the development of the application’s front-end design, a prototype rough design will be created to picture and engulf of the expected outcome of the application design. Using *Adobe Photoshop*, the early designs will be used as a mock design for reference during later phases.

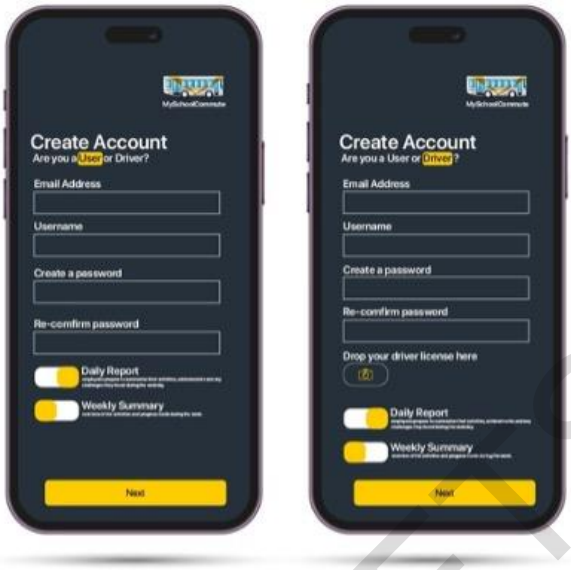

Figure 1: Protoype Design for Registration Page

Based on Figure 1, which illustrates the Registration Page, the interaction type is categorized as "command". Users are required to input their credentials, such as username and password into a form interface. Since there exists two type of users, the registration page will differ in terms of which type of stakeholder they are registering as. As a user, namely parents, they will be asked to submit their username, email and create a password. On the other hand, as a driver, similar fields will be required but they will have to additionally submit their driver's driver license and licensed gerund of their vehicle.

Figure 2: Prototype Design for Looking for Driver Page

Figure 2 represents the Looking for Driver Page, where the user interface offers multiple navigational options. The interaction type here is "instructions", as the system displays to the users available drivers through a list oriented data display, where the user will be able to select the driver available within a specified vicinity of the area and once selected, the user will be able to engage in a two-way communication messaging interface with the driver. The messaging system enables two-way communication between parents and drivers, categorized under "dialogue" interaction.

Figure 3: Prototype Design for Log Out Page

Other features of the application will include a digital wallet feature accessible from the homepage of the application for both users, as well as an emergency feature that encompasses within the safety measures embedded into the application, enabling the user or driver to directly call the parents or the authorities without having to exit the application using a forwarding call method. Lastly, as shown above in figure 3, the application will consist of a log out button that allows the user to log out of the application system.

The app is developed using Flutter for the front-end interface and MySQL as the backend database. Android Studio is used as the main integrated development environment (IDE), and the system is optimized for Android 5.0 and above. To allow visibility of previous records and transactions, data such as user credentials, trip schedules, and transport logs are stored in a centralized database to ensure real-time access, scalability, and data reliability across the system.

4.0 RESULTS

4.1 Application Development

During the development phase of the application *MySchoolCommute*, several software and tools were utilised to streamline the processes involved from design to deployment phase. Adobe Photoshop was utilised for the creation of the prototype, enabling a clearer visualisation of the interface layout from pages homepage, login, registration, digital wallet, emergency alert, choosing a driver, pickup logs, payment logs, messaging with driver/user and logout pages. These designs aid in guiding the development process as well as ensuring an interface that is user-friendly.

The application was developed using *Flutter*, a UI toolkit by *Google*, alongside *Dart* programming language that proved difficult at first due to very basic prior knowledge. *Flutter* was chosen due to its cross-platform capabilities and has an important feature that helps in smooth UI rendering, which is essential for this application which targets *Android 5.0* and above. The backend system employs the *MySQL* software as the database management system platform, integrated through *PHPMyAdmin*. This acting central database will be connected to *Flutter* through the integration of Android Studio that stores user credentials, schedules, digital transactions, past pickup locations, and emergency contacts.

Android Studio, on the other hand, served as the integrated development environment (IDE) for writing and compiling code associated in development, managing dependencies, and running emulators for testing which displays a virtual Android device. *Firebase Authentication* was integrated into the login process to ensure secure and reliable user access control across two roles: parents, and drivers.

Figure 4: Front Page of *MySchoolCommute*

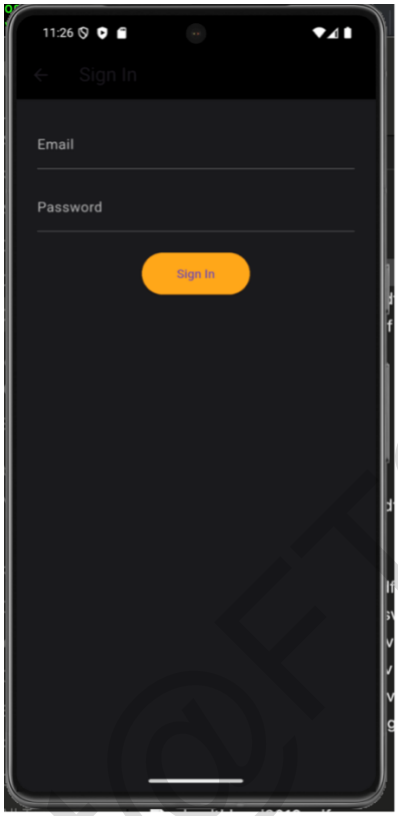

Figure 5: Login Page of *MySchoolCommute*

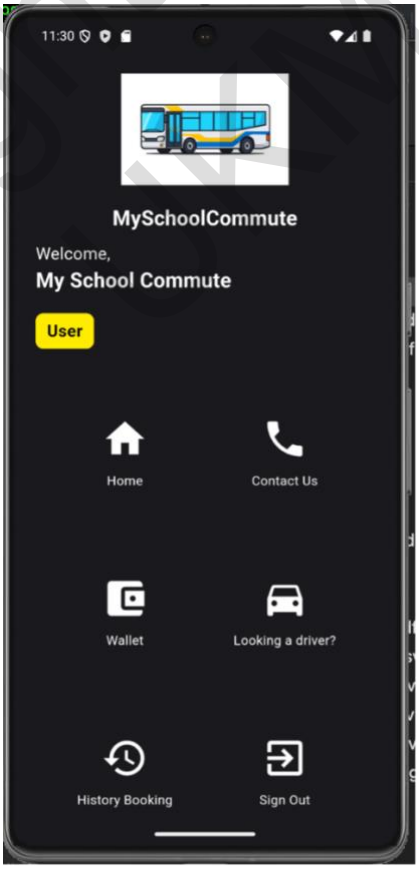

Figure 6: Home Page of *MySchoolCommute*

Figures 4, 5 and 6 illustrate the Front Page, Registration Page and Home Page respectively. The login interface requires users to enter their credentials (username and password), which has to be registered prior, which are then place through a verification process against stored data; upon match, the system will allow the user to access the application, if not, the user will be unable to access. Upon successful login, the home screen presents several key buttons displayed in large icons such as Home, Contact Us (emergency alert), Wallet (digital wallet), Looking for a Driver?, Booking History and Log Out.

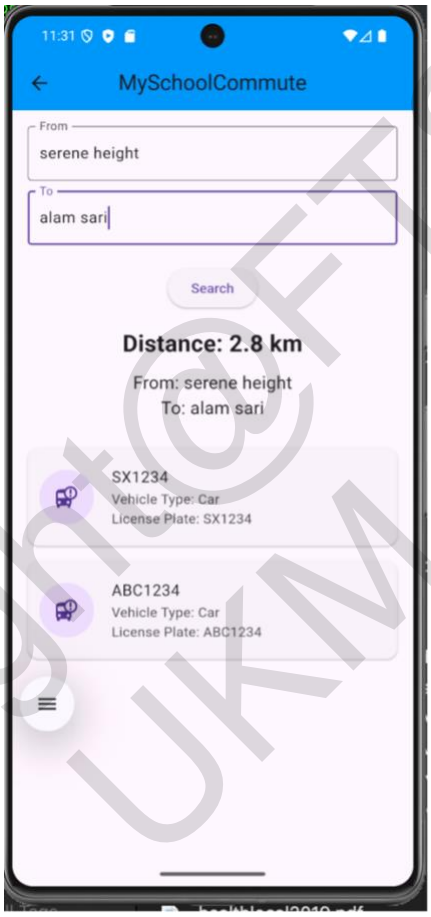

Figure 7: Looking for a Driver Page of *MySchoolCommute*

The application implements *Google Maps API*; this allows parents to be able to look for a driver when specifying their whereabouts, as shown above in Figure 7, to the school's whereabouts, and the application will display the distance calculated as well as the drivers that are available within the specified area. Another critical feature of the application is the emergency button, as shown in Figure 8, which when pressed, sends immediate alerts through emergency call forwarding to either the parents/drivers or the authorities, improving student safety on the road.

Once development phase has been completed, the application underwent several phases of internal testing, including unit testing, system integration testing, and user acceptance testing (UAT), which is done through the form of online survey. Test cases were created to ensure all functions—such as login, two-way communication system, driver assignment, and emergency alerts—operated as what the

testing phase documentation depicts as expected. The final version was reviewed and validated based on user feedback and test reports to ensure full or partial alignment to a certain extent with the project objectives and user requirements.

4.2 Application Evaluation

The evaluation phase, as part of the Waterfall Model, is crucial to ensure that the *MySchoolCommute* mobile application operates and functions effectively so that it meets the user's expectations. This phase consists of functional testing and usability testing, which are essential for verifying both technical performance and user satisfaction. From this, the strengths and weaknesses will be evaluated, observed and documented.

i. Functional Testing

The usability testing that was utilised in the MySchoolCommute will be carried out by users within a specified targeted social parameter, involving whether the parents are both working or they are one of the school transport drivers. From these social parameters selected, the software will be tested before releasing to the real-world environment and ensuring that its key functions are able to achieve development's objectives. The application underwent "Black-Box testing" to validate its functions without needing internal system knowledge and internal structure, allowing the testers to focus on user inputs and system outputs. Functional testing will include six core functions, as shown in Table 1.

Table 1: Tested Functions

Phase	Functions	Results
1	User registration	Passed
2	User login and verification	Passed
3	Parent-driver communication	Passed
4	Looking for driver feature	Passed
5	Digital wallet transactions	Passed
6	Driver’s past bookings log	Passed
7	Emergency call	Not passed
8	User log out	Passed

Before initiating functional testing, the MySchoolCommute application was installed on an Android smartphone device, which has Android 5.0 Operating Software, that met the minimum operating requirements. The goal was to ensure each main feature that operated in the application

worked according to its intended user-facing functions. Each page will have its own designated button to direct the user with what they need to do in specific phases.

In Phase 1, users tested the User Registration process. The application displayed a clean and guided registration form that allowed parents, or drivers, to register with unique credentials that will be uploaded to the backend of the system once completed. Prior to registering, the user will have to ensure that they are registering under the correct user role (parent or driver). This form included essential fields such as full name, email address, and password. The registration data was successfully stored in the backend database, and users received confirmation prompts, indicating that the process was working correctly.

Phase 2 focused on the User Login and Verification process. Once successfully registered, users were able to log in securely using their credentials that will ensure that it matches their registered credentials; to test this process, the user must first enter the incorrect password to validate the security. The login system included error handling for incorrect credentials and provided feedback for failed attempts, enhancing usability and user guidance. Login verification ensured that only authenticated users could access the app's core features.

In Phase 3, the application tested the Parent-Driver Communication, which is done once the user selects a driver. This process involved an internal messaging or notification system and allowing a two-way communication interface in sending text messages between each other. Parents were able to contact their selected drivers to request on pickup, confirm pickup schedules or discuss any changes in plans. The communication module passed the test by sending and receiving real-time text messages and updates, confirming that this key feature operated as intended.

Phase 4 tested the Looking for Driver Feature, where parents could browse available school transport drivers in their vicinity that has to be specified from the page at the top section. The app successfully displayed a list of verified drivers along with their full name, vehicle type and licensed plate number. The filter and selection process worked smoothly, allowing parents to request services directly from within the app.

Phase 5 covered Digital Wallet Transactions, where users could simulate adding balance and making payments to the drivers. The digital payment process was tested using mock transaction flows, and it passed by correctly updating wallet balances and generating transaction logs. Though, receipts were not successfully issued for each transaction as this was not implemented into the application.

In Phase 6, the Driver's Past Bookings Log was evaluated. Drivers were able to access their booking history, which listed completed and cancelled jobs, including timestamps and parent details such as their residency address. This allowed for easy tracking and future reference, and the feature passed all performance checks.

Phase 7, however, tested the Emergency Call Function and did not pass. During testing, the emergency button failed to initiate a call or trigger an alert as intended, which would direct a forwarded call to the stakeholder intended to call. This issue was attributed to either insufficient permission settings

on the app or a lack of backend integration with device dialer or emergency response protocols. Further debugging and integration work are required to make this function operational. Though, the user is able to call the driver only from their past booking records, which would allow them to access the driver's detail and make a call from that page.

Finally, Phase 8 involved testing the User Logout Function. The feature performed as expected, allowing users to log out safely and securely, and clearing their session data upon exit and directing them back to the homepage of the application.

Based on the functional testing across all eight phases, seven out of eight core features passed, and only the emergency call function required further improvement before the application could be considered deployment-ready for public use.

ii. Usability Testing

Usability testing was then conducted to assess the application's operational usability, such as its ease of use, user satisfaction, readability, and interface design. This phase involved a selected sample of 15 participants, which includes parents and school drivers, that are aged in between 20 to 60 years old. From these user feedbacks gained, the application development objectives will be tested to determine whether product produced has achieved the user's criteria and study's objectives.

To attain the user feedbacks, a questionnaire will be utilised and distributed via *Google Forms*, and the android device with the application installed will be given to them prior to answering the questionnaire so that the participants will be able to assess the application. The questionnaire will adapt from Lund (2001), where it covers the ease of use, interface quality, and satisfaction. The questions given, following Lund's study, are also divided into three parts: the demography of the respondents, the user-friendliness of the application interface, and the overall user satisfaction.

The reliability of the questionnaire will be determined and confirmed with a *Cronbach's Alpha* value above 0.85, including high consistency. Respondents were also given the will to rated statements on a five-point *Likert* scale (1 = Strongly Disagree to 5 = Strongly Agree). Then, the data were analysed through a series of mean scores, following Jamie's (2002) interpretation scale. Table 2 shows the interpretation scale table of the mean score (Jamil, 2002).

Table 2: Mean Interpretation Scale

Mean Score	Interpretation
1.00 – 2.32	Low
2.33 – 3.65	Medium
3.66 – 5.00	High

Table 3: User Satisfaction Rating

No.	Items	Mean
1	Overall satisfaction with the MySchoolCommute application.	4.13
	Overall mean	4.13

Table 3 shows the findings obtained based on the respondents' overall evaluation when using the mobile application. The data obtained was that, 1 respondent showed a 3 star rating, and 3 showed a 5 star rating, while the rest of the respondents, at 11 respondents, displayed an approval rating of 4 stars. The overall mean gave a high score of 4.13, which meant that the overall mean of satisfactory impression of most users illustrated a relatively strong approval ratings. This signifies that the mobile application has good usability characteristics.

Table 4: Application Interface Evaluation

No.	Items	Mean
1	The app interface is easy to understand and use.	3.67
2	The information layout is clear and well-organized.	3.80
	Overall mean	3.74

Table 4 shows the findings obtained regarding on the user's satisfaction on the evaluations made from observing the application interface. The overall average displayed at 3.74, which illustrates a high score level of user satisfaction. The mean for each items listed also shows a high score level (Mean > 3.66), showing that the respondents were satisfied with the mobile application and placing the application interface in a high percentage range.

Table 5: Most Liked and Disliked Features

No.	Items	Percentage	Interpretation
Most Liked			
1	Ease of use	60%	Most favoured
2	Features provided	40%	
Most Disliked			
1	Interface Design	33.3%	Needs improvement
2	Content	33.3%	Needs improvement
3	Features	13.3%	Slight Concern
4	Nothing Disliked	20%	Generally Satisfied

Table 5 shows the findings on what the respondents answered regarding what was the most liked and most disliked features in the *MySchoolCommute* application. A majority of 60% of respondents cited the application was easy to use, notifying that the ease of use as the most attractive element. Meanwhile, the remaining 40% of the respondents selected the functional features provided. Notably, none of the users marked interface design, content, or responded "nothing liked," as the remaining elements presented as options in the survey, indicating that the application successfully delivered its core value proposition. On the other hand, on the lower part of the table, it outlines user concerns or least favourite elements. Equal portions from the group of respondents answered that 33.3% of them expressed dissatisfaction with either the interface design or the application content. A smaller portion, marking at 13.3%, mentioned the available features available on the application, while 20% responded that they had no negative feedback. These findings suggest that although the application is generally well-received, enhancements to the visual layout to increase its readability, aesthetics, design, and visualisations and the depth of content could further improve user satisfaction.

5.0 CONCLUSION

The findings from this study demonstrated that the *MySchoolCommute* mobile application proved to successfully address the initial core challenges that exist between both parents and school transport drivers in managing and communicating school commute schedules for students. The application was developed to aid in bridging communication gaps, streamline coordination with scheduling and increasing clientele communication, and introduce safety features as well as efficient features such as real-time communication, in-app digital transactions, driver-finder tool and an emergency call forwarding feature. Through rigorous usability and functional testing, in overall, the application illustrated to be reliable, functional and responsive through most of the components featured, except for emergency call forwarding feature, which required further refinement.

Feedback from the usability survey involving 15 respondents done through *Google Forms* online survey, which consisted of parents and drivers as the data sample parameters, revealed mostly positive satisfactory levels, particularly in the interface navigation, ease of use and clarity of information layout. Users also rated the app highly for its ability in enhancing communication between both parties, improving student safety and simplifying daily routines. Moreover, a majority of the respondents expressed interest in suggesting and recommending the application to others, which reflects strong confidentiality in the solution's practicality and relevance in adapting to modern solutions. Also, the historical booking log and the built-in digital wallet proved to added valuable features promoting a sense of accountability as well as control, especially for both working parents.

The application's user-centered design's approach is clearly evident in the satisfaction and qualitative feedbacks received. A major portion of the respondents appreciated the convenience of not having to solely rely on conventional calls or messages between both parties, as the application centralises all communication into a single cohesive system. Although minor improvements and augmentations were required, particularly in the visual interface and presentation priority in content, the application's functionality aligns closely with the user needs and the challenges met in transportation management.

In conclusion, *MySchoolCommute* serves asa digital innovation enhancing school transportation management and processes daily by introducing real-time coordination in terms of communication and financial transparency through an intuitive application on mobile platform. The results obtained from this study reinforces the importance of technology in modernising conventional and traditional solutions, such as manual or outdated systems, into in integrated digital tools that is flexible in response and scalability as well as being user-friendly to the realities of suburbanised and urbanised accommodations. Future augmentations to suit to the application will be heavily lean towards improving the user interface, optimising emergency features, and enhancing content prioritisation in ensuring a better user experience with a broader adoption.

6.0 APPRECIATION

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