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RoadMate: A Substantial Development in Ride-Sharing and Carpooling

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ABSTRACT

E-hailing is acknowledged as ridesharing, ride-sourcing, automobile rental, paratransit, or on-demand transportation. A passenger may use a smartphone application to find a ride to their desired location. Due to the increasing acceptance and adoption of the services' demand, the number of e-hailing operators has expanded. Unfortunately, users' key motivations for using e-hailing services, which are dependability and cost, are frequently disregarded. Therefore, this research aims to develop a smartphone app that is focused on ridesharing and carpooling without the restrictions of the current ridesharing apps. Customers may potentially realize savings by dividing the expenses associated with gas, parking, or tolls. The app may allow users to add new passengers as they proceed to their destination, and more drivers might join carpooling if there are less stringent laws, saving money for both the drivers and the passengers. This study adopted the Agile methodology, which consists of five phases: 1) planning, 2) designing, 3) developing, 4) testing, and 5) maintaining and documenting. This app, which could make it easier to share rides and find carpools, is also developed in response to user requirements. The results of a user acceptance test conducted with potential users and e-hailing drivers indicate that the proposed concept and prototype are highly relevant to both parties (PEU=4.22, PU=4.3, ATT=4.38, BI=4.31). It is anticipated that future research will incorporate fresh elements and ground-breaking ideas into such prototypes based on the information acquired from this project and obligate an improvement. It is also recommended that this project be enhanced for a wider range of users and with enhanced technological components.

1. Introduction

E-hailing, also known as carpooling or carsharing, is a mode of alternative transportation [1]. E-hailing is a mode of transportation that traverses at least two passengers to a similar place [2]. According to [3], all e-hailing rides are either pre-arranged or customized to the needs of the passengers. E-hailing, also known as ridesharing, ride-sourcing, a car for hire, paratransit, or on-demand transport service, is an activity in which a passenger seeks a trip using mobile applications [4]. Individuals with fewer automobiles at home are more likely to utilize e-hailing services, according

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to [5] individuals who have little or no other options for transportation are more likely to use e-hailing services.

The number of e-hailing operators has increased in response to the growing acceptance and adoption of the services. According to [6], the notion of e-hailing initially appeared in Malaysia in late 2013, with Uber as the first operator. Grab (previously known as MyTeksi) came in second in 2014. With new entries into the sharing industry, the number of e-hailing services has risen since then. According to current statistics from the Land Public Transport Agency (APAD), there are 46 registered e-hailing businesses with APAD as of November 2019, with over 80% of the 46,000 respondents having used e-hailing services in Malaysia.

In recent years, customer experience has emerged as the most important brand differentiator. Literature [7] concluded that the sharing economy does not simply share physiological necessities for consumers such as housing and transportation. It does, however, give experience values that support utilitarian and hedonic worth. Hedonic value refers to feelings such as happiness and pleasure in the use of a service or product, whereas utilitarian value refers to the customers' appraisal of costs and major benefits after utilizing the service or product. When customers are happy with their experience, they will keep coming back to the platform to try new things. Because each asset provider's experience is unique, the sharing economy is more appealing and distinguishable from traditional service markets [7]. Most research concluded that the economic advantage provided by sharing economy services is the most important determinant of consumer happiness. As a result, customers' desires for property owners have shifted to wanting access, which is fulfilled in this economic model through property sharing [8].

However, the lack of understanding and experience with ridesharing applications might potentially hamper the industry's expansion [9]. The purpose of [1] research was to close the knowledge gap by addressing users' perspectives and opinions on e-hailing services while considering passengers' perspectives. The study found that knowledge of shared transportation operations can significantly facilitate the adoption of e-hailing services by larger populations. Therefore, the ridesharing app would no longer be foreign.

The proposed research seeks to develop a mobile app that focuses on carpooling and ridesharing and avoids restrictions in current ridesharing apps. This enables customers to possibly save money by dividing the cost of gasoline, parking, or tolls. The app can also add more passengers along the way to the desired location. Without heavy restrictions, there would be more drivers who could participate in carpooling, resulting in cost savings for the drivers and passengers. Immediately after that, it is hoped that the world could see a drastic change in air pollution due to reduced traffic capacity.

2. Literature Review

Initially perceived as disruptive in their early years of adoption, e-hailing applications are now embraced by the government, customers, and rivals alike and are seen as a supplement to the existing public transit system. The legalization of e-hailing services also introduces a new dimension that may be controlled to guarantee that all stakeholders benefit. Regulation of e-hailing firms and cheaper charges would also help the customer. Overregulation by the government, on the other hand, may have an impact on the business, particularly the drivers, stifling the expansion of e-hailing services. As a result, a new app to increase carpooling for improved traffic should be developed. As the sector remains competitive, with new markets and areas to explore, the developing tendencies of locally created e-hailing firms will help the e-hailing service thrive.

2.1 Carpooling

Carpooling (also known as car-sharing, ride-sharing, or lift-sharing) is the practice of sharing automobile trips so that more than one person may travel in the same vehicle and avoid the need for others to drive themselves to a destination. Carpooling permits us to divide the expenses for gas and parking, resulting in greater savings. The more people who carpool together, the more money could be saved. Carpooling is also cost-effective from a social standpoint. Users will not only save money, but they will also contribute to the reduction of expenses associated with the building of new roads, road maintenance, and health expenditures associated with air pollution due to heavy traffic [10].

2.2 Grab

Grab has the "first-mover advantage," as they first launched a ride-hailing service in the Southeast region. Grab provides flat-rate rides, lifts, and on-demand taxi services based on the car, the city, and waiting periods. Unlike local taxis, which may be unreliable in some locations, Grab allows users to instantly schedule a trip using the app, wait for it, and then pay via the app or cash. Grab thoroughly screens all its drivers, and users would not have to worry about getting overcharged with flat-rate payments [11]. Grab's app services now allow customers to book a cab up to seven days in advance. The user may specify the beginning location, drop-off place, and time of travel, as well as whether the trip is for personal or professional purposes. It can also leave notes for the driver indicating the exact location of the user. The app is available on both devices (Apple and Android), and users just need to sign up through Google, Facebook, or their mobile number and verify their mobile number.

2.3 Uber

Uber is a ride-hailing service that uses an app to allow customers to hail a trip and drivers to charge and get paid. Uber is a ridesharing service that employs independent contractors as drivers. It is one of many services that today pertain to the sharing economy by connecting existing resources rather than providing actual goods. [12]. Travis Kalanick and Garrett Camp launched the firm in 2009, and it is based in San Francisco. It is believed that the corporation has 110 million users globally. However, because of intense competition in the e-hailing industry, Uber (including its services Uber Eats and Uber for Business) suspended operations in Malaysia and Southeast Asia on April 8th, 2018 [13].

2.4 MyCar

MyCar Asia is a Malaysian-developed e-hailing ride app that offers on-demand passenger transportation services in 13 major Malaysian cities. MyCar now owns a 15% market share of e-hailing trips in Malaysia, serving over 1 million passengers every month. Platform Apps Sdn. Bhd., which owns MyCar, has been in the sector for almost two years. Today, the MyCar fleet has over 100,000 drivers in all major cities and towns, as well as over 2 million MyCar passengers [14]. The new MyCar SuperApp is available for Android users on Google Play and for iPhone users on the Apple App Store.

2.5 AirAsia Ride

AirAsia was predominantly recognized as a low-cost carrier that operated inside the Southeast Asian region. Nevertheless, it was claimed that they were expanding their service offerings to encompass a range of additional areas, including ride-hailing. AirAsia has introduced AirAsia Ride [15], a ride-hailing service that seeks to contend with well-established entities in the sector, including Grab. The strategic foray of AirAsia into the ride-hailing industry was motivated by the desire to capitalize on its established clientele and brand awareness. Through its entry into this market, AirAsia sought to offer its clientele a cohesive travel experience by merging ground transportation and air travel onto a unified platform.

2.6 Maxim

Since 2003, Maxim has developed cutting-edge technologies that enhance the convenience, affordability, and security of these services in the areas of travel reservations, freight transportation, retail and delivery, and roadside help. With the particularities of major metropolitan areas in mind, they propose a service that enables diverse users to effectively engage and reserve services with ease [16]. By improving the search process and decreasing mileage and downtime, reservations can be fulfilled. Their mission is to continuously enhance passenger interactions to assist individuals in achieving their objectives.

Concerning the total number of e-hailing operators, it is recommended to implement a new app that encourages carpooling to reduce traffic congestion. This is to address the issue of attempting to make the e-hailing service more reliable and affordable, as the demand for these services has expanded dramatically.

3. Methodology

To make this project significantly smooth sailing, this research adopted the Agile methodology as portrayed in Fig. 1. This approach is iterative, allowing adjustments to be made in response to customer satisfaction. Multiple iterations in the agile approach make it simple to add new features or refine products [17]. Plus, through agile methodology, evolution and a better version of the product could be achieved. The planning, requirement analysis, design, development, testing, maintenance, and documentation phases are all part of the software development life cycle (SDLC) [18].

Fig. 1. Agile methodology

3.1 Planning

During the planning phase, requirements are outlined to achieve the project's objective. The problem statement, objective, scope, and significance of the proposed project were all defined at this stage through a comprehensive investigation. The requirement analysis phase of the process

included the collection of all requirements, resources, and relevant data. This step entails conducting a survey and searching for articles and journals, mobile applications, and mobile cloud computing. By analyzing all gathered requirements and data, the problem, objectives, scope, and significance of the study are determined. Consequently, the initial research objective of identifying the project's requirements and development strategy has been met.

3.2 Design

Before developing the system, it is essential to prepare the design with a storyboard. In this phase, the features and functionalities of the system are discussed to ensure that the project's objectives are being met and the process is proceeding properly. The storyboard, which the researcher used to construct and design the project with the required scene sequences, outlines the fluidity and design of the mobile application. The storyboard's rough draught depicts the user interface. The proposed application's fundamentals are as follows:

3.2.1 Get Started

When the user first installs the mobile application, the "Get Started" page is displayed. On this page, users can register or log in.

3.2.2 Browse

Through a live map on this page, the user can select and locate any road companion (driver or passenger) displayed in the mobile application. There are numerous options available for both the driver and the vehicle. They can view the driver's profile and the feedback they have received. A search tool is available to facilitate the process of locating a driver. The services provided are geared toward passengers who, by default, are willing to carpool together.

3.2.3 Profile

The user (driver or passenger) can modify their personal information, such as their full name, email address, profile photo, and bio. However, the driver's profile contains an advanced menu. Every user could switch between driver and passenger roles.

3.3 Development

Following the identification of all requirements, the project process advances to the development phase. System development is the process that translates all design documents from the design phase into their actual implementation. In this step, Java program code is developed on the device with Android Studio loaded for the project. The proposed program additionally stores all mobile cloud computing data on the main server. This section displays the RoadMate sitemap and user interface (UI). Below is displayed a portion of the developed app's UI design.

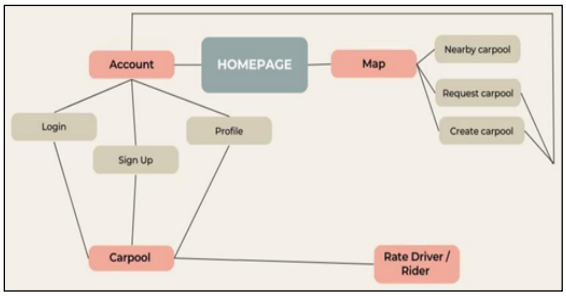

Fig. 2. Sitemap

A sitemap is a document that lists each page of an application as well as the relationships between them. A sitemap is a directory of an application's pages, media, and files. It is possible to have one sitemap for the application's login page and another for creating reports. Sitemaps, which are frequently created in XML or Java format, make it simpler to locate all of an application's pages in a single location. The sitemap for the RoadMate is depicted in Fig. 2.

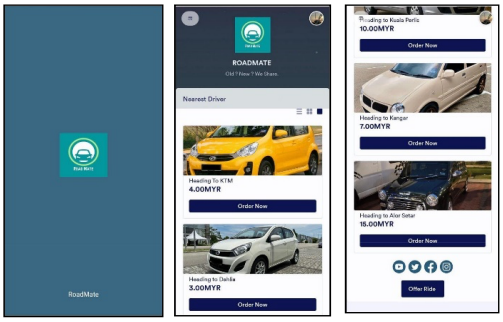

Fig 3. Splash Screen and Homepage of RoadMate

Once the user logs in and loads the mobile application, they will see the splash screen depicted in Fig. 3. The app's homepage will display the user's nearest driver based on their location. A login user may choose a ride to any desired location by offering the ride to be shared with other customers (Fig. 4). The app will receive the offer and pick up all customers along the predetermined route, with the agreement of both customers and drivers in the app.

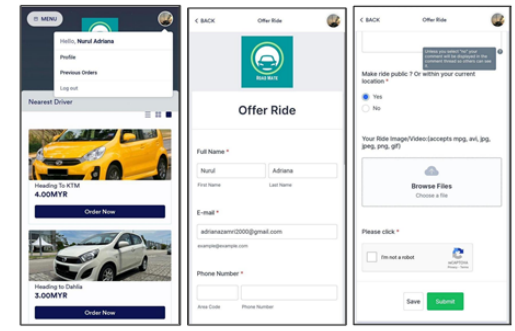

Fig. 4. Offer a Ride

The user could then confirm the ride and pay for e-hailing via the mobile application (Fig.5).

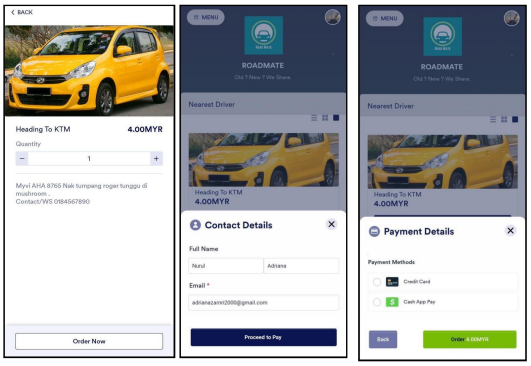

Fig. 5. Confirmation of Ordering the Ride and Payment

3.4 Testing

The software testing step was designed to ensure that the program meets the requirements of the project. This step includes unmoderated remote user testing to determine a user's level of satisfaction with the interface and usability of the product [19]. To enhance the functionality and performance of the program, every problem or flaw that arises during development is subsequently identified. The target audience consists of legal drivers and passengers. Based on the Technology Acceptance Model (TAM) [20] for this system, questions for user acceptance testing have been developed. The respondents are required to evaluate five sections of the questionnaire: demographic information, perceived ease of use (PEU), perceived usefulness (PU), intention to use (BI), and attitude (ATT). The respondents must first use the given mechanism before responding to the questionnaires. According to the scale that is related to the questionnaire, each question should be reviewed and scored by the respondents. The test was completed by the respondents in about 15 minutes. Details of the respondents are described in the Result and Discussion section.

3.5 Maintenance and Documentation

During the final phase of the SDLC, system maintenance and documentation are performed. Several maintenance operations, such as condition monitoring, bug patching, and error detection, are performed to ensure that the app meets user expectations and project objectives. Additionally, the documentation phase covered the entire project development process from start to finish. Using Ouriginal, the document is also checked for instances of plagiarism. To summarize, the planning, requirement analysis, system design, development phase, system testing, and documentation are the six phases of the Agile model used as the research methodology. Through the requirement analysis phase, objective number one, which was to identify and investigate the obstacles that discourage consumers from using e-hailing applications, was attained. Objective two of the system design phase was to create and construct a mobile application with carpooling features, whereas objective three of the system testing phase was to assess the application's effectiveness using unbiased testing, which is unmoderated remote user testing, and gather user feedback. All of the objectives were accomplished.

4. Result and Discussion

The test is based on the Technology Acceptance Model (TAM), which states that the perceived usefulness and usability of a new technology will impact a user's decision to accept it. These two

factors will govern the attitude of users toward technology. The perceived usefulness will influence the decision to use them in behaviour. The attitude directs behaviour, which in turn influences the level of acceptance. This test was conducted to determine how well the system functions for the users, who are primarily residents of Arau. The respondents were provided with the test and instructed to complete it using a Google form. The purpose of this test is to determine the system's usability and flaws. Questions for user acceptance tests have been developed based on the system's technology acceptance model.

In this test, respondents must evaluate five sections of the questionnaire: demographic information, perceived ease of use (PEU), perceived usefulness (PU), intention to use (BI), and attitude (ATT). Before completing the questionnaires, respondents must first utilize the provided mechanism. According to the scale associated with the questionnaire, respondents should review and score each question. In roughly 15 minutes, respondents completed the test; 34 individuals responded to this questionnaire. 54.9 percent of respondents had an average age between 24 and 30 years old, followed by those aged 18 to 23 (44.1 percent). There was a total of 21 female respondents who completed the questionnaire, making up 61.8% of the total respondents. Only 13 men participated in answering this questionnaire, making up only 38.2% of the total male responses. The survey was carried out in the Northern state of Malaysia.

4.1 Perceived Ease of Use (PEU)

There are five questions about perceived ease of use criteria. Using this system resulted in a mean score of 4.2 from respondents indicating that it was simple for users to explore the app, browse the rides, request rides, and post rides using RoadMate. With a mean score of 4.26, respondents believed that the app was straightforward to understand. In addition, respondents felt that using RoadMate did not require excessive mental effort, resulting in a mean score of 4.26. With a mean score of 4.12, respondents were also confident in their ability to operate the application independently. The respondents concluded, with a final mean score of 4.26, that the app would be simple to use for ridesharing. The overall response resulted in a mean score of 4.22 for perceived ease of use.

4.2 Perceived Usefulness (PU)

The respondents are required to evaluate three questions for this criterion. With a mean score of 4.29, respondents believed that the RoadMate could facilitate ridesharing and reduce traffic. With a mean score of 4.21, respondents believe the RoadMate will enhance their ability to effectively book rides. With a mean score of 4.41, respondents believed that RoadMate would be useful as a platform for reserving carpools or ridesharing. According to the input of respondents, the mean score for perceived usefulness is 4.3.

4.3 Attitude (ATT)

Three questions were posed to the respondents as part of the attitude criteria. With an average rating of 4.32, users viewed the RoadMate app as a valuable resource for ridesharing and carpooling. The respondents' attitudes toward adopting RoadMate were also positive, with a mean rating of 4.44. Respondents concluded, with a mean score of 4.38, that using the RoadMate app for carpooling would be a good idea. Given all responses, the mean overall score for attitude is 4.38.

4.4 Intention of Use (BI)

According to the criteria for intention of use, respondents were required to rate two questions. Users indicated, with a mean rating of 4.29, that if they had access to the RoadMate app, they would use it for ridesharing. According to respondents, it would also be one of the most popular ridesharing applications in Arau. The average use intention score is 4.31.

In conclusion, the perceived ease of use received the lowest mean score (4.22), whereas the attitude received the highest (4.38). The fact that this application received the highest mean scores for perceived usability and attitude demonstrates that it has the greatest impact on respondents. As depicted in Fig. 6, users are likely to utilize this program frequently because nearly all of the criteria are greater than 4.0.

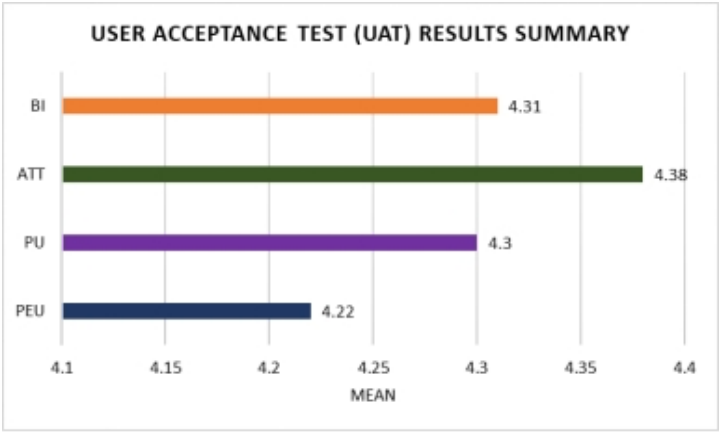

Fig. 6. UAT Results Summary

As a synopsis of the overall responses collected from respondents, it examined how people utilized and reacted to the mobile application through testing. The data indicate that the items evaluated received significantly higher than average scores. Most respondents believe that the mobile application for ridesharing and carpooling will benefit the Arau community, especially students.

5. Conclusion and Recommendation

The data obtained from this project lays a solid foundation for future research endeavors. Anticipating the evolving landscape of technology and transportation, future research should focus on incorporating new elements and innovative ideas into the prototypes. It's crucial to expand the project to cater to a broader range of users by tailoring the app to suit various commuting patterns, urban and rural contexts, and accommodating different socioeconomic groups. Furthermore, improving the project with more advanced technological components and integrating with smart city initiatives can enhance the efficiency and user experience. This data serves as a launchpad for future improvements, pushing for continuous innovation to meet the ever-changing needs of users and the technological landscape.

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