Vehicles Agency Rental Online System

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***Abstract*— Vehicles Agency Rental Online System is a web application for lending or borrowing a vehicle for a period of time. This system offers 24-hours service and offered different types of cars with different costs. These systems can improve the efficiency and convenience of the car rental process for both the agency and the customer.**

Keywords—Vehicle, online booking, rewards program

I. INTRODUCTION

Customers can easily compare prices and options, and make reservations at any time, without having to visit a physical location. Online systems can reduce the workload of staff and potentially increase bookings by making it easier for customers to rent vehicles. Some online booking systems allow customers to manage their reservations, including modifying or cancelling them, through their online account. There are a variety of different vehicles car rental systems available, and agencies may choose a system based on factors such as cost, features, and integration with other systems.

It is worth noting that while online booking systems can offer many benefits, they may also present some challenges, such as the need to ensure the security of customer data and the potential for technical issues. Additionally, some customers may prefer to rent vehicle in person or over the phone, so it is important for agencies to offer multiple booking options.

One study published in 2020 (Lin et al., 2020) found that the global car rental market is expected to reach $93 billion by 2024, with online platforms playing a significant role in this growth. This trend is supported by another study published in 2018 (Wang et al., 2018), which found that online booking platforms for car rentals have seen a significant increase in usage, with a majority of respondents preferring to book their rentals online rather than through traditional methods.

Convenience factor, online vehicle rental systems also have the potential to streamline the rental process and reduce the time and effort required by both the renter and the rental company. For example, a study published in 2019 (Smith et al., 2019) found that an online system implemented by a major car rental company resulted in a 25% reduction in the time required to complete a rental transaction, as well as a 15% increase in revenue. A study published in 2017 (Jones et al., 2017) highlighted the need for these companies to implement robust security measures to protect against data breaches and other cyber threats. Socar is one of the most famous web applications in Malaysia for car rental.

Socar has more than 36 car models in more than 1000 zones picking up cars in different cities. (Car Rental Malaysia - SOCAR, 2022). Besides that, Go car is another service provider for the car rental service that was founded in 2015 with only 5 cars over Klang Valley. However, The Frost & Sullivan Best Practices Award named Go Car the Malaysian car-sharing company of the year 2022. (GoCar Malaysia: How It All Started, 2022).

The usage of AI in future would be more reliable as they would be able to use as a tool on analysing and detecting vulnerability and countermeasures that would be faced by the Vehicle Agency Rental Online System web (Elsallamy & Rahman, 2022).With this Vehicle Agency Rental Online System web, it would be a solution for traffic management as most of the vehicle can be used as a tracker to monitor the traffic. Data can be collected and being passed to agency for further interpretation and development of solution (Keat et al., 2021).

II. PROBLEM CONTEXT

One problem context related to vehicle rental systems is the potential for fraud and abuse. This can include issues such as customers providing false information or using stolen credit cards to make reservations, or renters using vehicles for illegal or unauthorized purposes. Additionally, rental companies may also face challenges related to managing insurance and liability in the event of accidents or damage to vehicles. Moreover, one of the big challenging is the management and maintenance of the fleet. This can include issues such as coordinating regular maintenance and repairs, ensuring compliance with safety regulations, and managing the replacement and retirement of older vehicles. Additionally, rental companies may also face challenges related to optimizing the utilization of their fleet and balancing supply and demand.

A recent survey has proved that In Malaysia, the number of automobiles has surpassed the number of people, with an increase of at least a million vehicles annually since 2019. (Zulkaflee, 2022) according to the National Statistical Office. Passenger cars per household reached 1.72 vehicles in 2019 in Malaysia. This is 0.812% more than in 2019. (CEICdata.com, 2020) which can proof that there is a high number of drivers own more than one vehicle. Besides that, most of the car agency shops only provide service during office hours which can lead to limited availability for customers who need to rent outside of regular business hours.

III. SCOPE & OBJECTIVES

A. *Aim*

The aim of this project is to develop a new system so that many users can increase their income and improve the experience of renting a vehicle online for both customers and investors. Also, to provide a convenient and efficient platform for customers to rent vehicles and for investors to monetize their vehicles, by renting them out to customers..

B. *Objectives*

- To develop a new online web application for vehicle-sharing
- To provide a user-friendly platform for customers to rent vehicles online.
- To improve customer service by providing real-time information and support.
- To improve the customers' experience of using an online system.

IV. SYSTEM DEVELOPMENT METHODOLOGY

A. *Selection of Methodology*

A. Waterfall Methodology

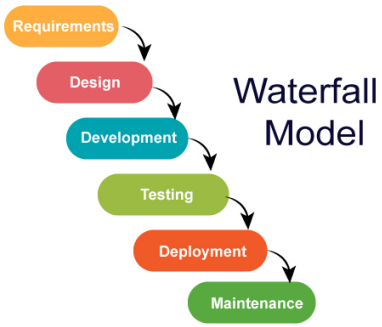


Fig 1: Waterfall model methodology

The Waterfall Methodology is a sequential and linear approach to software development that was first introduced in the 1970s and has since become one of the most widely used software development methodologies. It is based on the principle of a strict and controlled process that provides a clear direction and focuses on the development process. The methodology is structured in a series of phases, with each phase building upon the previous one, and no phase can start until the preceding one is completed. (Hoory, 2022).

The six phases of the Waterfall Methodology are: Requirements Gathering, Design, Implementation, Testing, and Deployment. Requirements Gathering: This is the first phase of the Waterfall Methodology, where the needs and requirements of the end-users are analysed and documented. The goal of this phase is to understand what the end-users want the software to do and how they want it to work. Design: In the Design phase, the software specification is used to create the technical specifications, architecture, and design of the software application. This includes developing a detailed design of the software application's user interface, database structure, and underlying architecture. Implementation: The Implementation phase involves the actual coding, testing, and debugging of the software application. This is the stage where the design and specifications are translated into a working software application.

Testing: The Testing phase involves thoroughly testing the software application to ensure that it meets the requirements of the end-users. This includes both functional testing, which verifies that the software functions as specified, and non-functional testing, which verifies that the software meets performance, reliability, and security requirements. Deployment:

The next phase is Deployment, where the software application is deployed to end-users. This may involve installing the software on end-user machines, configuring the software, and training end-users on how to use it. The maintenance phase is the final phase in the Waterfall model. Once the software has been tested and any issues have been resolved, it is deployed to the end-users or clients.

B. *Rapid Application Development (RAD) Methodology*

A software development paradigm called Rapid Application Development (RAD) puts an emphasis on productivity and speed. It was created in the 1980s as an alternative to the conventional Waterfall technique because it was thought to be slow and rigid. The RAD approach aims to produce high-quality software in a fraction of the time it would take using traditional methods. (OutSystems, 2021).

RAD is an iterative process, where the development team works closely with the client to understand their requirements and create a working prototype in a short period of time. This prototype is then refined and improved upon in subsequent iterations until the final product is delivered. The four stages of Rapid Application Development (RAD) are to establish the requirements, prototype, get feedback, and finish the product. (Kissflow, Inc, 2023). The first phase of RAD involves gathering the requirements from the client and understanding what they want to achieve with the software. This phase is critical as it sets the foundation for the rest of the development process.

The development team will work closely with the client to understand their needs, gather requirements, and create a high-level design of the software. (Kissflow, Inc, 2023). In prototype development phase, the development team creates a working prototype of the software. The prototype is designed to be functional, but not necessarily complete. The goal of this phase is to give the client a sense of what the final product will look and feel like, and to get feedback on the design. This feedback can then be used to refine the design and make any necessary changes. (Kissflow, Inc, 2023).

The next phase is absorbing feedback, RAD developers present their latest prototype to the client or end-users and gather feedback on all aspects of the product, from the interface to functionality. The client may have different perspectives or realize that some elements that worked well on paper are not practical in real life. Based on the feedback received, developers go back to refining the prototype, or if the client is satisfied, move on to the next phase. (Kissflow, Inc, 2023).

Lastly, Finalize the Product During this stage, developers work to optimize and refine their implementation for stability and maintainability. They also focus on connecting the back-end to production data, creating comprehensive documentation, and completing any necessary maintenance tasks before delivering the final product with confidence. (Kissflow, Inc, 2023)

C. Comparison of Methodologies

After comprehending the techniques, phases, and utilization of both methodologies, the project must determine which one is most appropriate for use in the current project. This will lead to a differentiation between the two methodologies based on their distinct features and attributes.

The table below is shown a comparison between The Waterfall Methodology and the Rapid Application Development (RAD) Methodology are two distinct approaches to software development that differ in several keyways..

TABLE I. COMPARISON BETWEEN THE WATERFALL METHODOLOGY AND THE RAPID APPLICATION DEVELOPMENT (RAD)

Areas	Waterfall Methodology	RAD Methodology
Structure	Structured and sequential	Flexible and iterative
Planning and Documentation	Emphasizes detailed planning and documentation	Prioritizes speed and efficiency
Requirements	Well-defined requirements	Requirements can be changed during development
Phases	Sequential phases	Overlapping and interdependent pha
End Product	Focuses on well-defined end product	Focuses on quick product delivery
Project Suitability	Suitable for projects with well-defined requirements	Suitable for projects with rapidly ch requirements or quick turnaround tir

The Waterfall Methodology is a sequential method for developing software, requiring that each stage be finished before moving on to the next. The stages involve gathering requirements, designing, carrying it out, testing, and deploying. The strategy is structured and linear, with an emphasis on thorough preparation and record-keeping. Projects with well-defined criteria and a clear concept of the finished product are a good fit for the waterfall methodology.

RAD, on the other hand, is an iterative approach to software development that prioritizes speed and efficiency. RAD involves a series of phases, including requirements gathering and analysis, prototype development, iterative refinement, testing, and deployment. The RAD methodology is flexible and allows for changes to be made to the requirements and design as the project progresses. The development team works closely with the client, seeking their feedback and incorporating their suggestions into the design. RAD is ideal for projects that require a quick turnaround time or where the requirements are not well understood.

D. Justification of Chosen Methodology

To start with, the waterfall methodology offers upfront requirements. For projects when the requirements are well-defined and explicit, the waterfall methodology is appropriate. rental system, the requirements and features can be defined in advance and followed in a structured manner. Furthermore, Linear Development Process. Waterfall methodology follows a linear development process that makes it easy to understand and follow for both the development team and stakeholders.

Moreover, The Waterfall methodology allows for thorough testing at each stage of the project, which is important for a web application for a vehicle rental system as it needs to be reliable and secure. Also, Clients can be involved in the early stages of the project, allowing for their feedback and requirements to be taken into consideration. Lastly, The Waterfall methodology emphasizes the importance of documentation, which can be helpful in maintaining and updating the vehicle rental system in the future.

E. Brief Explanation on the Phases of Chosen Methodology

The requirements collecting, design, implementation, testing, deployment, and maintenance phases are all seen as flowing steadily downwards in the sequential development methodology known as the waterfall. The model adopts a linear sequential approach, which means that phases do not overlap and that each one must be finished before the next one can start. Here's a detailed explanation of each phase in the Waterfall methodology:

Requirements Gathering: is the first step in the waterfall model. The project requirements are gathered and recorded at this phase. To assess the project's viability and develop a thorough project plan, the needs are examined. This phase is essential since the accuracy of the requirements acquired during this phase will determine if the overall project is successful.

Design: The second phase is Design, in which the system is designed based on the requirements gathered in the first phase. The design phase involves creating detailed specifications for the software, hardware, and any other components that are required for the project. This phase also involves the creation of a blueprint of the system, including a diagram of the system architecture, data structures, and algorithms.

Implementation: The system is built during the third phase of implementation, which is based on the design created in the first phase. It entails writing code, fixing bugs, and testing specific software parts. The Waterfall methodology's longest and most complicated stage is typically this one.

Testing: The system is thoroughly tested in the fourth step to make sure it complies with the specifications laid down in the first phase. Unit testing, integration testing, system testing, and user acceptability testing are all part of this step. Before the system is deployed, this step seeks to find and correct any flaws or issues.

Deployment: The fifth phase is Deployment, in which the system is deployed to the production environment and made available for use. This phase includes the installation of the software, hardware, and any other components required for the system to function. This phase also includes the training of end-users on how to use the system.

Maintenance: The final phase is Maintenance, in which the system is monitored and maintained to ensure that it continues to function as intended. This phase includes bug fixing, updating software and hardware components, and performing any other necessary maintenance tasks. The goal of this phase is to ensure that the system remains reliable and effective over time.

V. RESEARCH METHOD

A. Questionnaire

Questionnaire is a research instrument that is used to gather information from a large number of individuals. It

consists of a series of questions designed to collect data on a particular topic or issue. The questions can be in the form of multiple-choice or open-ended responses, and the questionnaire can be administered through various methods such as online, in person, or via mail.

Structured questionnaires have a fixed set of questions that must be answered in a specific manner, while unstructured questionnaires allow participants to provide their own responses. Structured questionnaires are commonly used in large-scale studies as they allow for easy data analysis and comparison, while unstructured questionnaires are typically used in qualitative research for in-depth insights.

Questionnaires can be an efficient method for collecting data as they allow for a significant amount of information to be obtained from a large number of people in a short period. However, it is crucial to design questionnaires carefully to ensure the quality of the data collected.

B. Questionnaire Design

The survey was conducted by promoting a link to the questionnaire with the aim of obtaining a substantial number of responses in return for a clear viewpoint on the proposed system. The survey was published using Google Forms. Participants will be provided with detailed information about the project and the survey research, including the objectives of the research, the participant's rights, and the terms and conditions, prior to the start of the survey. The researcher will seek the consent of the participants after they have fully understood the specifics of the project and the survey, and a checkbox will be provided for participants to indicate their consent to participate in the study. The collected data will be analysed and presented using pie charts.

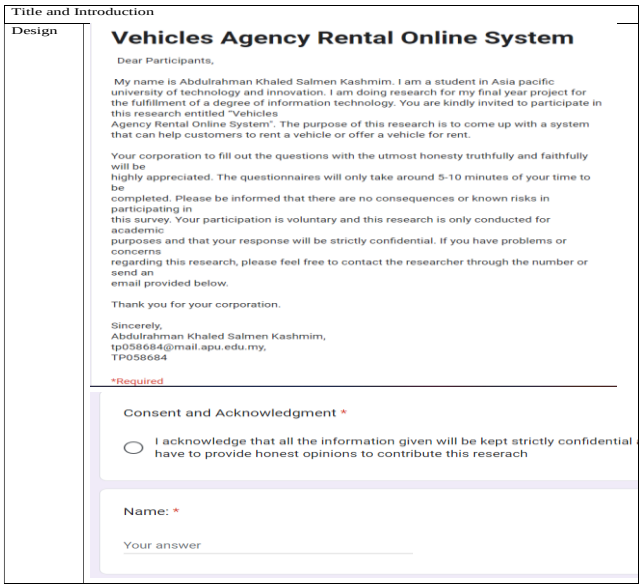


Fig 2: Questionnaire sample

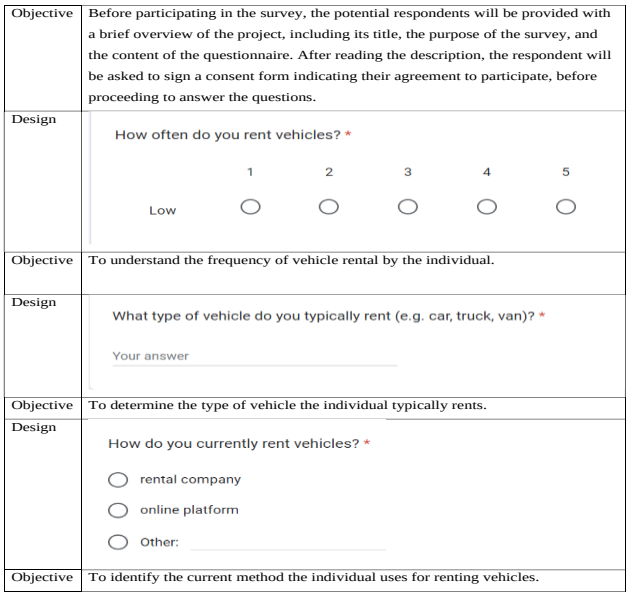


Fig 3: Questionnaire Sample

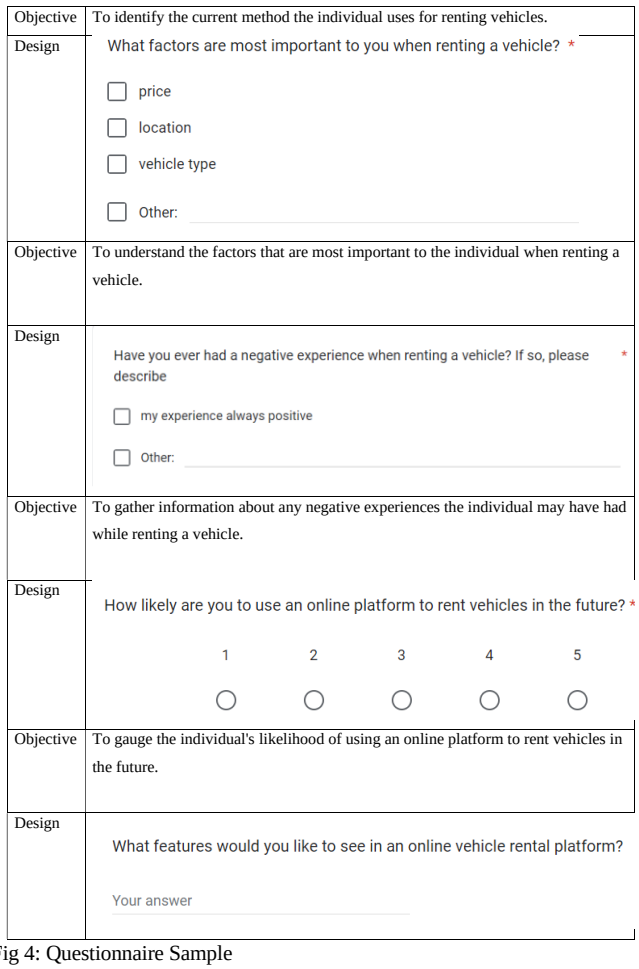
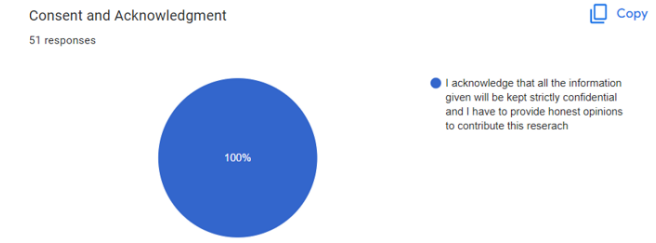


Fig 4: Questionnaire Sample

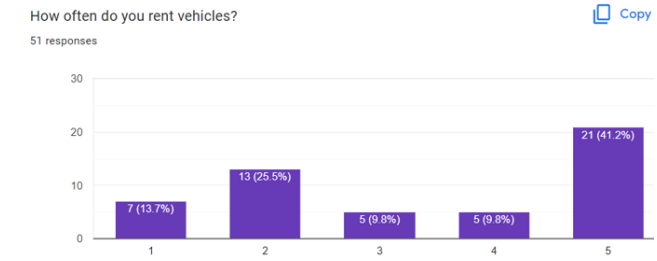
VI. DATA ANALYSIS

A. *Analysis of Data collected through questionnaire*



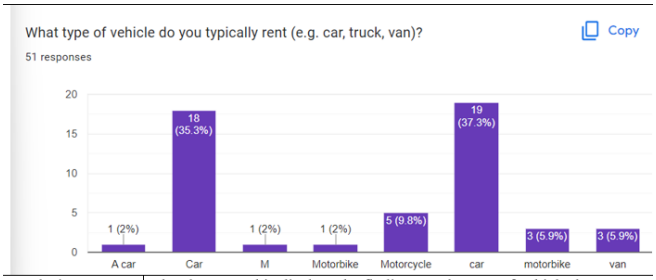
Analysis	The diagram shows that 100% of the respondent have agree and signed the consent and acknowledgement that their participation and information that they provide will be kept confidential.

Fig 5: Data Analysis for consent and acknowledgment



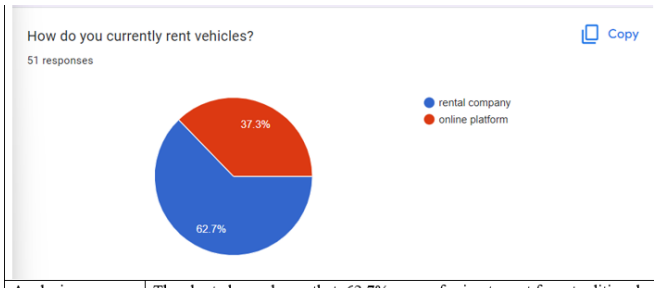
Analysis	As the result shown in the first question, around 40% of the responders are often rent a vehicle. While 45.1% of them has less percentage of renting a vehicle, and only 13.7% not tend to rent a vehicle.

Fig 6: Data Analysis for How often do you rent vehicle



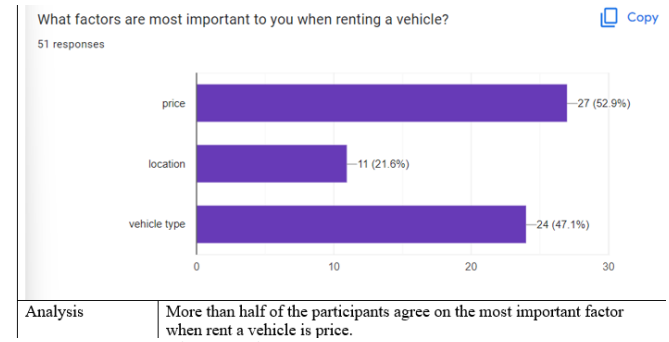
Analysis	The above graphic displays the findings on the type of vehicle that participants are most likely to rent; 38 respondents, or 74.6%, are likely to rent a car. In addition, about 17.7% of people rent motorcycles. In addition, three respondents frequently rent vans.

Fig 7: Data Analysis for What type of Vehicle do you typically rent.



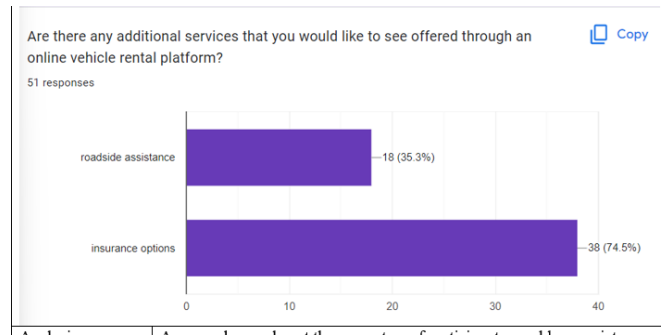
Analysis	The chart above shown that, 62.7% are preferring to rent from traditional rental company.

Fig 8: Data Analysis for How do you currently rent vehicle.



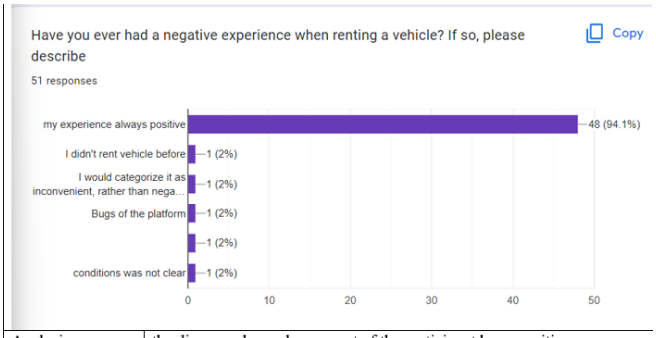
Analysis	More than half of the participants agree on the most important factor when rent a vehicle is price.

Fig 9: Data analysis for what factors are most important to you when renting a vehicle.



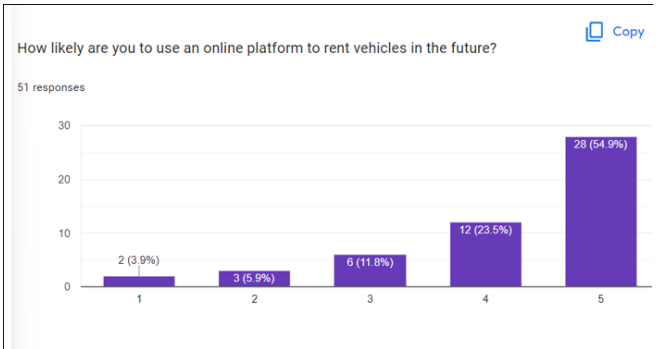
Analysis	As seen above, almost three-quarters of participants would appreciate insurance options via an online vehicle system.

Fig 10: Data Analysis for Are there any services that would like to see offered through an online vehicle rental platform.



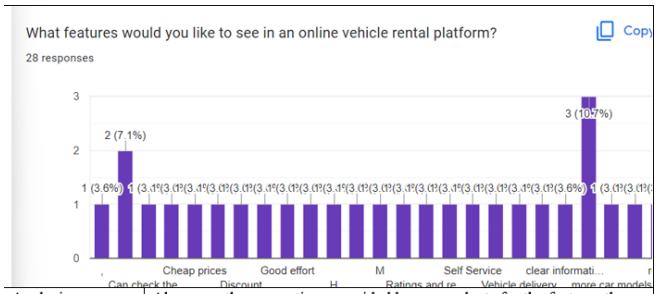
Analysis	the diagram above shows most of the participant has a positive experience when they rent a vehicle.

Fig 11: Data analysis for have you ever had a negative experience when renting a vehicle.



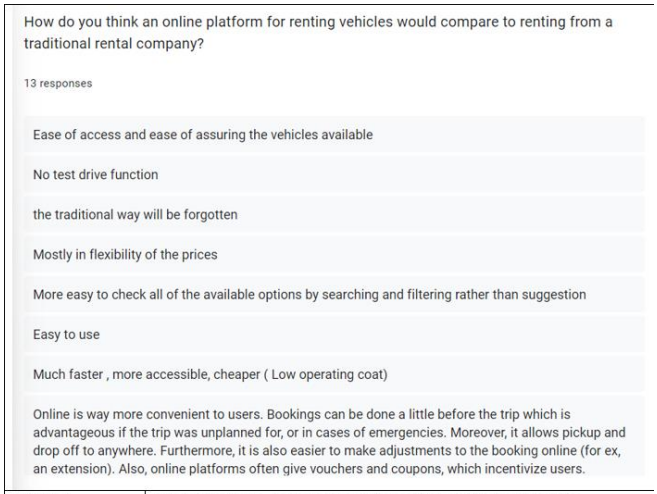
Analysis	The diagram above shows that about 55% of the participants tend to use an online platform to rent vehicles in the future.

Fig 12: data analysis for how likely are you to use an online platform to rent vehicle in the future.



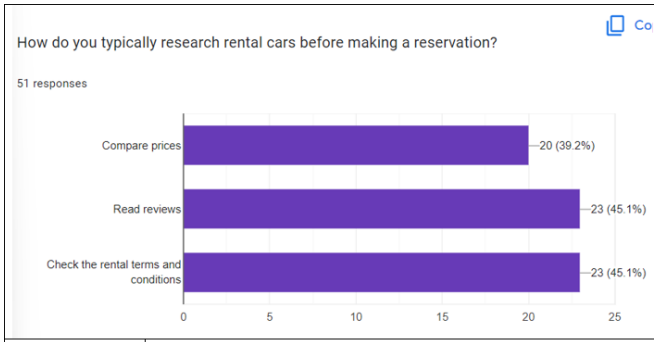
Analysis	Above are the suggestions provided by respondents for the features they like to see in online vehicle rental system.

Fig 13: Data analysis for what features would you like to see in an online vehicle rental platform.



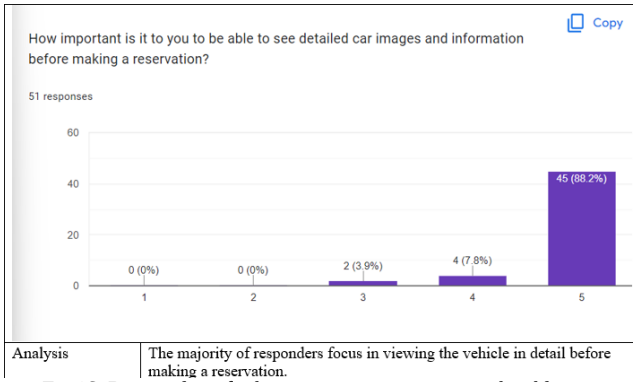
Analysis	As shown above, some point of view of the differences from the responses about the online rental and traditional rental.

Fig 14: Data analysis for how you think an online platform for renting vehicle would compare to renting from a traditional rental company.



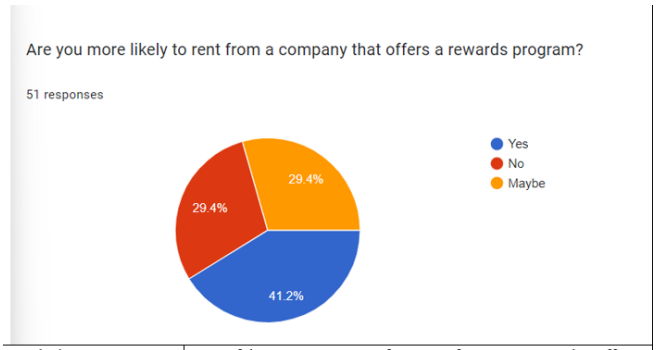
Analysis	45% of the responses read reviews and check the rental terms and conditions to research before rent a vehicle, While 39.2% are compare vehicle price before rent

Fig 15: Data Analysis How do you typically research rental cars before making a reservation.



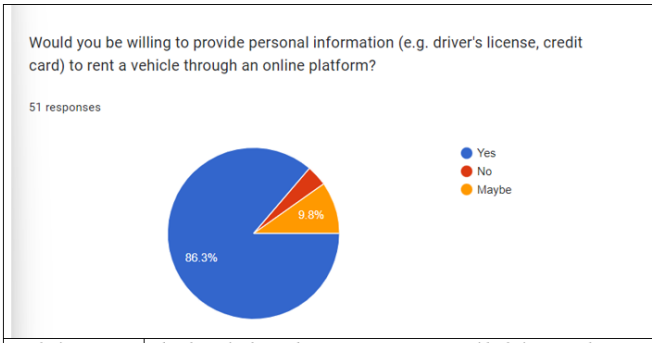
Analysis	The majority of responders focus in viewing the vehicle in detail before making a reservation.

Fig 16: Data analysis for how important is it to you to be able to see detailed car images and information before making a reservation.



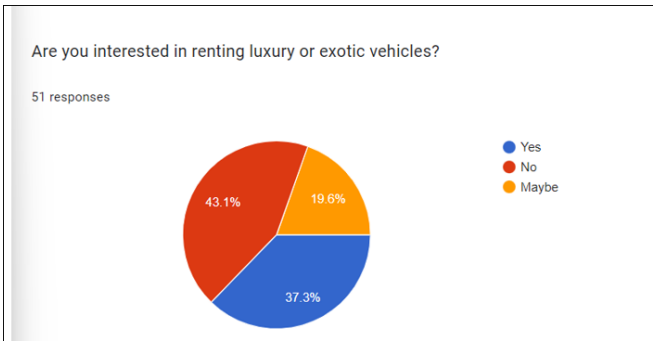
Analysis	41% of the responses are prefer to rent from a company that offers a reward program, whereas 58.8% the reward program not consider for them as a factor to rent.

Fig 17: Data analysis for are you more likely to rent from a company that offers a rewards program.



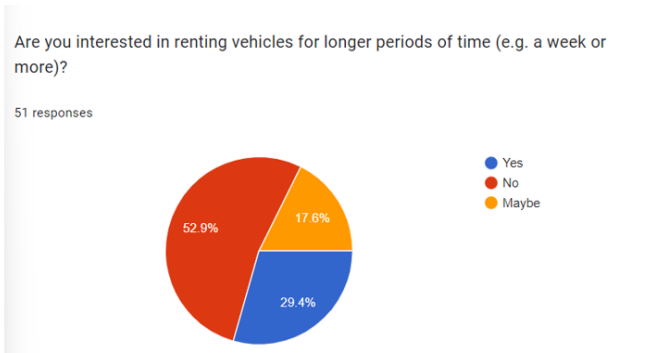
Analysis	The chart pie shown that 86.3% are open to provide their personal information online to rent a vehicle

Fig 18: Data analysis for would you be willing to provide personal information to rent a vehicle through an online platform.



Analysis	As shown in the pie chart, 43.1% of the response was not interested in renting luxury vehicle. While 37.3% are interested in renting luxury vehicle.

Fig 19: Data analysis for are you interested in renting luxury or exotic vehicle.



Analysis	More than half responses are rent a vehicle for short period of time.

Fig 20: Data analysis for are you interested in renting vehicle for longer periods of time.

VII. CONCLUSIONS

The researcher achieved various milestones during his research, including conducting domain and technical research, selecting a suitable methodology, and designing a proposed online system that meets the needs of its intended users. In order to construct the suggested system, the technical research entailed supplying enough details regarding programming languages, IDEs, database management systems, and operating systems.

In order to picking the ideal technology for the suggested online system easier, the researcher also offered a succinct comparison of the available technologies. The researcher also offered an appropriate software technique with adequate details, covering each methodology's positive and negative aspects, and a clear justification for the chosen methodology. The researcher also conducted primary research using a questionnaire-based method with 51 random participants to obtain clear user expectations based on the proposed online system.

Through this research, the researcher gathered responses and analysed the data to gain a deeper understanding of the participants' expectations. However, it is crucial to design questionnaires carefully to ensure the quality of the data collected.

Moreover, the researcher faced several challenges during his research, including time management, data collection, and analysis. However, he was able to overcome these challenges through careful planning and organization, seeking help and guidance from supervisors and colleagues, and implementing effective problem-solving strategies.

Finally, the researcher's work had a significant impact on the development of the proposed online system. Through his research, he was able to identify user expectations, select appropriate technologies and methodologies, and design a system that meets the needs of its intended users. The proposed online system could have significant implications for its users, such as improving efficiency, productivity, and user satisfaction.

In conclusion, the researcher's work represents a significant contribution to the field of online systems and software development. His achievements, challenges, and broader implications highlight the importance of conducting thorough research, being adaptable and flexible, and taking a user-centered approach to system development. By incorporating these principles into their work, researchers and practitioners can create innovative solutions that have a real impact on people's lives.

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