DriverSeekers – A mobile designated driver services system

Loh Giin Xiin, Abdul Samad Shibghatullah, Abdurrahman Jalil, Mohd Helmy Abd Wahab

Institute of Computer Science & Digital Innovation, UCSI University, Kuala Lumpur, Malaysia.
University Malaysia of Computer Science and Engineering (UNIMY), Cyberjaya, Selangor, Malaysia
Department of Computer Engineering, Faculty of Electrical and Electronic Engineering, Universiti Tun Hussein Onn Malaysia (UTHM), Malaysia.

Abstract. The intention of this project is to determine the limitations of the current market needs where the road injuries and fatalities are a growing concern in Malaysia. Without any hesitation, the resident’s driving pattern and behavior are highly correlated. Hence, the objective of this study is to develop a prototype mobile application DriverSeekers for pairing drivers with users who do not wish or do not have the ability to drive their own vehicles. An in-depth review of other research and literature is conducted to understand the benefits, impact, and features that similar programs are providing. Further, a qualitative survey has been given out to understand the potential users of the application and the feasibility of the proposed system which includes the user’s concern, preferences, and expectations, whereas the respondents are 10 students and 10 people who are employed. Once the data has been gathered and analyzed, the features of the application are build based on the collected data where the application is trying to meet the user requirement. Afterward, there are four testing phases consist of unit testing, integration testing, system testing, and user acceptance testing which are conducted to assure the system features and functions achieve what the users expect. Further, a UAT is conducted to ensure the users are joyed with the result which meets their requirements and expectation. Thus, the objectives of this study were all successfully fulfilled.

1. Introduction
In this day and age, mobility services have been developing rapidly in society and its provider not only offered customers heterogeneous services but also creating the concept of mobility-as-a-services (MaaS) (Xiao Qin, 2019; Vica et al., 2019; Jing and Shibghatullah, 2019). Besides, the location-based service is playing a vital role in the mobility service. This is due to the real-time geo-data will be constantly transferred location data to allocate the service better. Therefore, it is obvious that the e-hailing service is booming in the recent couple of years as well. However, this paper is proposed to develop a mobile designated driver services system – DriverSeekers which is another product in the field of mobile mobility service. Although it is similar to e-hailing but it’s actually different. Yet, the e-hailing is an indirect similar existing system as compared to the proposed system. The table below is showing the differences between e-hailing and DriverSeekers.
TABLE I. COMPARISON BETWEEN INDIRECT SYSTEM AND PROPOSED SYSTEM

|                       | E-hailing                          | DriverSeekers                      |
|-----------------------|------------------------------------|------------------------------------|
| Target Audience       | People with a car or without a car | People with car                     |
| Price                 | Cheaper than local traditional taxi| Cheaper than common chauffeur service|
| Payment Method        | Cash or e-wallet                   | Cash or card                        |
| Public Service Vehicle (PSV) License | Yes                               | Yes                                |
| Driver Vehicle Requirement | Yes                               | No                                 |
| Sitting with own car  | No                                 | Yes                                |
| Platform              | Websites, mobile app               | Mobile app                          |

Malaysia as a developing country, 93% of its resident owning a car vehicle and placing the third-highest rate of car ownership globally in 2014 (HANS, 2014). Meanwhile, as the rising number of people driving, the accident rate will rise as well if the people lack road safety consciousness. Malaysia has the third-highest rate for death caused by traffic accidents in Asia which second only to Thailand and South Africa (Lum, 2019). In Malaysia, the rate of fatalities maintains high due to the drivers’ behavior and pattern. For example, inattentive driving, drunk driving, inadequate sleep, and driving in unfamiliar road conditions are the causes of traffic fatality and injury.

Therefore, a new mobility service, DriverSeekers is a mobile app designed for people who own their car but need a temporary driver. It will be very helpful if the car owner is facing the following condition such as drunk driving, driving with inadequate sleep, inattentive driving, and driving in unfamiliar places. DriverSeekers provides people able to get their driver with a short while. When car owner cannot drive their own car to a destination, the certified driver who is from DriverSeekers will drive the owner’s car to the owner’s destination place and charge a certain fee. The benefit is once your personal driver in charge of your car, you just need to sit at the back and relax, let the driver do the rest of you. It is widely used in traveling, business corporations, or special occasions. In other words, it helps carry passengers that have different needs be it in business purpose or leisure (Md, 2012). The reason to develop DriverSeekers as a mobile app because the desktop internet usage is reducing while mobile share marked an increase (Haini et al., 2019; Hassan et al., 2017).

In short, the goal of this project is to propose a prototype mobile application DriverSeekers for pairing drivers with users who do not wish or do not have the ability to drive their own vehicles. As a result, the implementation of DriverSeekers will reduce the incident of a traffic accident because the temporary designated driver helps the car owner to handle the car owner’s vehicle, whereas the car owner would not need to force themselves to drive their car when they are unable or not suitable to drive. The objective is to study the problem of car owners who need a temporary driver because of car owner unable to drive or not wish to drive. In this study, it is necessary to collect the requirements for the problem solution (DriverSeekers) regarding the potential users, the driver requirements, the fee chargers, safety, and project feasibility.

2. Literature Review
2.1. Origin and Revolution
The designated driver is the combination string of designated and driver. Basically, designate means to appoint someone to a particular position and the driver is a person who drives a vehicle (Jay A. Winsten, 2001). The origin of the term designated driver is because of people who enjoy their
nightlife most likely to consume some alcohol, especially more and more nightlife appears in the cities. A group of friends usually hang out together at night, and they will decide early to pick one of them as a designated driver in order to send their friends to home safety after a fun (Jay A. Winsten, 2001). Thus, the one who is the appointed driver must never to touch a drop of alcohol and keep sober (Jay A. Winsten, 2001). When time goes by, many new “drivers” are appearing when this phenomenon is getting more in the cities, therefore it is expressed as designed drivers to provide driving service. Gradually, the meaning of driver is apt to be alcohol-related because the researcher tough the designated driver can be used to any drinking situation where people are drunk driving and more likely is to provide the drinkers a temporary driver to drive them home instead of drive-by themselves after drinking (Apsler, 1987). Moreover, the researchers think the designated driver is a good approach for reducing alcohol-related traffic incidents (Lange JE, 1998). The reason for this is the designated driver definitely needs to abstain from alcohol as the driver is responsible for driving (Watson, 2008).

However, this paper is proposed that the designated driver is not only used for solving the problem of alcohol-related crashes, but also provide a convenient way for people who have a need to get a temporary driver when the car owner is not in a good general condition such as feeling exhausted, sleepy, or abstracted by others. In addition, the latest definition of a designated driver can refer by hiring someone temporarily to drive a car owner’s car to the designated location and taking a certain fee when the driver not in a good condition to the destination by himself or herself in this project. Hence, DriverSeekers is intended to create a more comprehensive designated driver service system to expand the target audience, not just drinkers. In brief, the designated driver service system used to serve people who have the necessary to get a temporary personal driver for multiple uses such as business use, travel use, and entertainment use.

2.2. Cause of Traffic Fatality and Injury

In Malaysia, there is research proceeded in 2016 in order to study whether the drivers will choose to use a smartphone while driving. As a result of the research, 43.4% of drivers got mobile usage behavior while driving and 61.9% of them use smartphones when they stop by traffic light (Kamarudin, 2019). Mobile usage behavior is not allowed while driving, even though they have a desperate need for replying messages. However, people should have a proper mindset on the degree of danger if they got mobile usage behavior while driving because the attention will be distracting, and the consequence is serious. Basically, the driver is not allowed to drive if they consume any volume of alcohol according to section 43 of The Road Transport Act 1987, if they do so they will be punished and paid for penalties up to RM20,000 and a maximum period of imprisonment of 12 months (Bername, 2020). However, people still challenge to do so (LIM, 2020). A total of 3,992 number of drivers were arrested due to drunk driving from 2018 to May 2020 and there was a total of 70 traffic crashes cases were recorded (LIM, 2020).

Moreover, inadequate sleep can be understanding by somnolence which describes people who are lack of sleep and perform drowsiness (David, 2017). A study in New Zealand found that a higher chance of causing the accident fatality or injury due to drowsiness and sleeping time less than 5 hours in the past 24 hours (al., 2002). Driving with the not fully alert condition will increase in odds of injury crash was almost six-fold and this is undeniable facts (Josephine Herman, 2014). In 2016, a fatality has caused 2 female dead and 3 injuries due to unfamiliar road conditions (Shihua, 2016). It is reported that the car deviated from the lane and rammed into the big tree on the left side of the road when it suspected unfamiliar road conditions and dodged vehicles (Shihua, 2016). Thus, the traffic fatality accident or injury caused by driving under an unfamiliar road condition cannot be underestimated.

In sum, more than one study is reflected these factors are correlated for causing the accident fatalities or injuries no matter inattentive driving, drunk driving, driving under inadequate sleep, or unfamiliar road traffic conditions. Meanwhile, these factors can be considered as the driver is lack of
capability for driving. Hence the studies are focused on the accidents or fatalities caused by drivers’ behavior which might improve the situation by using DriverSeeker.

2.3. Research and Studies

One of the researches is to avoid impairing driving which prevents people who have consumed alcohol then operate with their car vehicle (James E Lange, 2015). However, some research is stated that the designated driver is often not executed well, therefore leading to reduce the effectiveness of risk reduction (James E Lange, 2015). In order to ensure the designated driver will less consumption of alcohol, this study was proposed the efficacy of six interventions designed (James E Lange, 2015). Subsequently, some designated driver is resulting in zero breath alcohol concentration (BrAC) to get the monetary rewards (James E Lange, 2015). Thus, these interventions help the designated driver abstain from alcohol and keep sober. In short, the implementation of the designated driver will reduce the accidents caused by drunk driving.

There is another study that said the implementation of a designated driver program is effectively reducing the consequences for drunk driving (James E, 2000). In the United States, car vehicle is necessary in order to get to commercial drinking establishments or friends’ homes which resulting in drunk driving is inevitable (James E, 2000). An experiment was done to determine the extent of the designated driver can reduce the incident of the traffic accident. As a result, 87.8% of the respondents were cued assigned the designated driver which they did not talk through about it, 10.2% of them only appoint one of their friends to be the designated driver after being cued, and only one group has determined a designated driver automatically. In brief, the experiment proved the implementation of a designated driver is reducing drunk driving, although it is insufficient to let the designated driver refrain from alcoholic beverages.

Other than that, in this study, it has used a television advertising campaign to call and encourage people to pick one of them as designated drivers and the one who is appointed needs to abstain from alcohol (Kevin Boots, 1999). Afterward, they are carried out an alcoholic beverage sale to seduce the designated driver consume alcohol (Kevin Boots, 1999). As a result, showing the mass media really works for encouraging the designated driver to abstain from alcohol, therefore it is proven this strategy reduces the incidence of drunk driving.

Now that these studies are providing strong evidence as to the implementation of a designated driver is a kind of a strategy to reduce the incidence of traffic crashes caused by drunk driving. However, the designated driver from these studies is picking one of their friends to be the designated driver. Yet, it has the possibility that the chosen one will consume alcohol (Lange JE, 2002). According to one of the researches, it indicated the designated driver did to consume alcoholic beverages in many instances (Mary A. Glascoff EdD, 2010). Meanwhile, the designated driver absolutely matters to prevent accident fatality or injury (DesignatedDriving, 2020). Hence, the designated driver should be temporarily hired instead of assigned from one of them and a mobile designated driver services system from this proposed project which fulfills the need for a temporary designated driver.

3. Methodology

This section presents the research methodology used to achieve the objectives of this study. The research methodology consists of two phases which are a literature review and a qualitative survey approach. Firstly, the literature reviews and reviewing the documentation help to find points and data regarding the proposed system that are authorized with legitimate proof. Through the literature review, it could sharpen the research focus (Snyder, 2019). In order to narrow down the search result, there are some string was used to search such as (“Designated Driver” OR “DD”) AND (“Campaign” OR “Benefits” OR “Impact” OR “Result” OR “Implementation* OR “Origin”).

Secondly, there is a qualitative survey conducted to gather the user’s expectations and underlying perspectives (AdrianChin et al.,2019; Mon et al.,2020; Vivilyana et al.,2020 ). Those interviewees are between the ages of 18 and 25. Throughout the interview, it is easier to examine the potential users,
user adoption, and user retention for the mobile designated driver service system. The collected data will be used to evaluate the necessity of the feature. The users will be asked a series of questions about their point of view for the proposed system. This qualitative survey is targeted to gather 20 responses from 10 students and 10 people who are being employed. Respondents were asked:

*Are you often drive your own vehicle instead of taking public transport? How many years have you been driving and how do you feel about that?*

People who often drive might because they got their own free space. With the steering wheel in hand, drivers can decide where they want to go, which music they want to listen to, and what speed they want to drive, all under control. Sometimes, driving is more flexible and comfortable compare to public transport.

The survey found that the respondents at least have a minimum one-year driving experience and the longest driving experience for up to 7 years. Even the respondents are enjoyed driving, but sometimes they feel tired of it.

*Have you ever thought about let the other people to drive you along with your vehicle? Can you give me a reason?*

Most of the respondents have thought about letting others drive their cars. However, even most of the respondents have the thought before but does not mean each and every one of them are willing to let the others handle their car. There are 60% of respondents directly indeed to let others drive their car vehicles. This is because they can take a break especially after a long day of study or work. Further, it is an obstacle to focus on the road while driving after a long day of work, therefore they would like to pay someone to drive them to their destination. The respondents said that they would like to let others drive them when they are very tired or sleepy.

*Based on the following situation stress over traffic congestion, unfamiliar locations, feeling uncomfortable/ feeling tired/ feeling not sober, do you feel convenient and if someone could help you to drive your vehicle and send you to your desired location? Please provide your reason to support your point of view?*

Most of the respondents are agree with it and 85% of the respondents feel convenient if someone could help them to drive their vehicle under those certain circumstances. If the driver has no platform or related contact, then it is difficult to get a temporary personal driver instantly when the driver is facing the situation above. Therefore, the respondents think that it is very good stuff that someone can help to drive the car owner’s car. However, 20% of the respondents are worrying about the security issue and personal safety issue. Even though it is convenient for them, but they do not know whether is appropriate to let a stranger drive their car because the respondents afraid that people will do something bad on them.

*Do you think the implementation of DriverSeekers affect the social environment? Please provide an example about how its affect?*

There are 90% of the respondents indeed the statement above. Firstly, the issues of drunk driving will be reduced. This is due to the other countries such as China which have implemented this kind of application and it does result in lesser drunk driving cases. Further, it is reducing drunk driving issues and reducing social problems. For example, recently a Chinese man killed a motorcyclist due to drunk driving at night. Besides that, it reduces the possibility of illegal driving such as people consumes alcohol or drugs, whereas it increases the lifestyle of the resident when they can get a designated driver instantly. Therefore, the accident rate in the city will definitely go down. In brief, the implementation of the proposed system affects the environment in a positive way that decreases drunk driving behavior, so people do not against the law.

4. Results and Discussion
4.1 System Design

This section focuses on the provided features that the users can perform with the proposed system, as well as the flow of the application by using UML Diagrams.

Throughout the use case diagram, it is easier to understand the system’s capability and flow. There is one actor who is using the system for common users. Further, the oval shape represents the functionalities that the users can perform which is known as a use case. Therefore, there are in total of 9 use cases within the system.
The flow of the application is shown in Fig. 2 and it will begin when the user is accessing the application. For the first time user, the user needs to do registration first. Afterward, the user will log in to the application and it is better to update the personal information. By making a request order to get the temporary designated driver, the user needs to enter the location and service type. The total fee for payment will be calculated and show to the user. If the user declines the following action, then the order will be canceled. Else, the user might proceed to the next activity where the user needs to wait for picking-up. After that, payment will be made when the designated driver is approached to the user and safely sent the user to the destination. Lastly, the user will rate the overall service experience.

Further, there is two important content need to point out which is the calculation for getting the nearest designated driver within 5km and the calculation for each service type. Throughout the searching, only the nearest designated driver within 5 km will show to users. The map will only show the designated driver who has last active < 30 secs AND distance < 5km.

Next, there are two calculations for charging by distance and charging by the hour. The unit price for charging by the hour is predefine in the database which is 20. In other words, it is RM20/ hour. Therefore, a is the value of duration as user input, and b is the defined value with 20. The two variable multiple together and the total number will be the amount that the users need to pay. The equation for charging by hourly, as in:

$$a \times b = \gamma$$ (1)

Next, the below description is going to explain about calculation for charging by distance. The same goes with charging by the hour, the unit price for distance by the hour is predefine in the database as well with unit price 15. In other words, it is RM15 for the first 10 kilometers (KM), and the remaining km will be calculated as an additional RM5 for every 5km. Unit price 15 will be representing as b, c is the distance between pick-up to drop-off, and \(\chi\) will be the total value calculates after the first 10km. The equation for charging by distance is:

$$\text{Math.ceil}(((c / 1000) - 10) / 5)) \times 5 = \chi$$ (2)
\[ b \times \chi = \gamma \] (3)

4.2 System Implementation

The mobile application is implemented by using Ionic where the programming language used is node.js and TypeScript. The user interfaces are shown in Fig. 3 until Fig. 6.

Fig. 3. Home Page and Service Option Selection Screen

Fig. 4. Duration Input and Alert Prompt Box Screen

Fig. 5. Finding Driver and Driver Found Screen
Fig. 3 shows the home page to the users when the users have login with their account. Meanwhile, the users are able to make the order request within the home screen. Users have the option to choose the service type whether the users want to purchase the service by the hour or distance. Fig.4 shows the input duration that required the user to insert if the user chooses the hourly service. The input cannot be smaller than 3, else it will have a pop-up dialog to alert the user. Further, Fig.5 shows how the driver is found. If there is a nearby designated driver the list will return by showing the name of the designated driver. If the driver is accepted the job request, then the users are able to see the driver’s information. Then, Fig. 6 shows the waiting page in which the user is able to track the designated driver’s location. The designated driver will be represented by an icon with a red car. Afterward, when the order has completed, users will go into the rating page to rate the designated driver.

4.3 Discussion
In the current market, the designated driver is just a form of people who use to ask their friends/family to safely deliver them to their home or hotel (Jay A. Winsten, 2001). The one who is assigned as a designated driver needs to keep sober and should not be consuming any alcohol. Meanwhile, it does not have an actual system to serve those potential consumers. In Malaysia, the competitors are minimal, the main competitors are Grab Car and Mycar which categorize as E-hailing service (Wang, 2019). Further, the E-hailing service cannot be compared directly to the designated driver, due to they provide different services, and it will most likely to consider as an indirect competitor. Therefore, there is no good implement, crowd-pleasing, and ease of use system to fulfill the needs in Malaysia (Jerrica, 2020).

4.4 Evaluation
Throughout the development of the system application, there will be four testing phases in order to assure the system is running well. The four testing phases are including unit testing, integration testing,
system testing, and user acceptance testing (UAT). The UAT has provided an actual full walkthrough of the application where it is conducted by two respondents, whereas one of them will be the user, and another one will be the designated driver. At the same time, they will examine whether the system is working well. Both the user and designated drivers are required to do the registration and information updates. Afterward, the user can select the service type (distance/hour) and insert the location, whereas the designated driver is waiting for the incoming job. When the user clicks the [BOOK] button, then the nearby designated driver will handle the job request and ready to pick-up the user. As a result, both users feel comfortable when using the platform. It does not show any bad impression to the users. They will most likely adapt to the platform easily. Additionally, the platform greatly meets the expectation of the user and fulfill the user’s requirement.

5. Conclusion

In sum, although most of the studies are stated the use of designated driver are highly correlated with alcohol, but the designated driver should be used for a wider purpose not just for drinker only. Factors that bring about traffic fatality or injury include inattentive driving, drunk driving, driving under inadequate sleep, and unfamiliar road traffic conditions and these can be considered as the driver's capability and state is performing poorly. As the goal for this project is to provide people who need a temporary personal driver to handle his/her car vehicle due to his/her, not in a good driving state, therefore if DriverSeekers can be fully used for sure the incidence of car accidents will be greatly reduced. According to one of the reports, it said the system of the designated driver yet to be invented in Malaysia, but few countries had to make use of such as a system which is South Korea and China (Jerrica, 2020). Therefore, the implementation of DriverSeekers might become a population platform for the people.

5.1 Limitation

In order to able to convert into the corresponding mobile platform, a specific device is required. For example, if the mobile application is going to deploy as an Android application, the Windows platform is required used to proceed with the software development and deployment, whereas iOS devices are needed which used to develop and deploy an iOS application. Yet, the current facilities are not complete and not able to compile or iOS platform. Therefore, the mobile application for this project will only be available for the Android platform. Other than that, the usage of firebase is limited as well. The free version for Firebase has quota restrictions. Thus, the prototype application cannot be stored too much accessible data and the data need to be constantly deleted.

5.2 Future Works

To make the proposed system fully develop, there are still plans to improve the application further to ensure the application is consistently on par with the competitor in the industry. It is advisable for the application to strive for enhancement to allow better user experience and built the most recognized platform for the designated driver service. Therefore, there are several enhancements that can be proceeded which include the application would embed better addressing function for returning a fully exact address instead of showing the area name. Next, making a real-time function for withdrawal which will go through the banking API. Besides that, the application would plan to embed the e-wallet features, develop actual functions for the admin role, and improve the user interface and user experience design which makes the application more significant.

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