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An Application For Vehicle Rental Service Advertising Using Geofence With Content-Based Filtering (ReadyVehicle)

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***Abstract*— Vehicle rentals have been a popular practice for many years. Some individuals prefer renting vehicles for their flexibility and affordability, especially in areas with limited public transportation options. However, finding rental services on the internet can be a cumbersome task. Therefore, this project aims to create a mobile application for advertising vehicle rental services in Jasin and Merlimau, Melaka, using geofencing and content-based filtering. The solution used will allow rental providers to create advertisements in specific areas, notifying potential renters as they enter these designated areas. This project has been tested using functionality testing to evaluate the mobile application functionality.**

Keywords*— *Vehicle Rental Service, Geolocation, Dynamic Geofence, Content-based Filtering, Rental Service App, Geo-targeted Marketing, Vehicle Advertising, Personalized Promotions, Android Application

I. INTRODUCTION

Rent is defined as a form of agreement that includes a payment to rent out services, goods, or property from the owner temporarily. Alongside, one of the main reasons people chose renting over owning is due to affordability. For instance, maintaining a car involves high maintenance expenses which not many people are able to afford, and this has attracted the entrepreneurs to invest in car rental business as it is a huge business opportunity for them [3].

Accompanied by the rapid growth of technologies, the usage of the internet is increasing over time. Almost everyone has access to the internet. As reported by the Department of Statistics Malaysia in a survey on ICT use by individuals and households, 95.5% of them have access to the internet along with 99.6% have access to mobiles phones [4]. This indicates how people in this age favours the internet, and it is now considered a necessity. Besides, one of other reasons people today are fond of their mobile phone is due to the access of retrievable information for quick activities due to the simplicity and tiny screen size [7]. Associated with the increasing numbers of internet and mobile phone users, it is believed that advertising through mobile devices can be an effective way in promoting a service. This is due to high construal, convenience and context congruency offered by mobiles phones that makes mobile commercials more relevant [10].

Making use of today's technology, geofence is an application of location-based service (LBS) that could help in sending advertising messages across devices in a certain area. Oxford defined geofence as a virtual geographic boundary that uses Global Positioning System (GPS that can detect mobile devices that enters or leaves a particular area. Geofence involves giving alerts or sending targeted messages of information to mobile devices through a notification or email. Nowadays, the use of geofence is often implemented in an application for business purposes like delivering in-store promotions to customers.

For this project, the use of geofence and content-based Filtering techniques in the vehicle rental system offer multiple advantages to both the rental providers and renters. By combining these two techniques, the system can provide users with a more informed and efficient search process. Geofencing involves creating a virtual boundary around a specific location and is used to alert the user when they are entering designated area. Content-based Filtering, on the other hand, is a technique that uses information about an individual's browsing history and behaviour to make recommendations.

II. LITERATURE REVIEW

A. Vehicle Rental

Generally, vehicle rental serves people to use a vehicle for periods of time, the vehicle is provided by either an agency or a person (vehicle's owner) under an agreement that comes with payment. One of the many reasons why people choose renting over owning is because is it economically more stable. A study revealed that some people often to find another way of consuming a product for the experience as well, the desire of getting hand with up-to-date products being one of the reasons why some chose to rent rather than owning [13]. For instance, one may rent out a luxury car for the sake of experience and enjoyment as experience and excitement of consumption is said to have a great significance.

B. Advertising

Today, we find ourselves inundated with an overwhelming influx of commercial content. Our physical spaces are invaded by advertisements vying for our attention, engaging in a competitive battle to persuade us to purchase and consume a diverse selection of goods and services [11]. The art of advertising necessitates creating content that is profoundly persuasive, capable of influencing individuals towards embracing a particular product or service—a concept commonly referred to as advertising appeal [6]. This persuasion is realized through creative endeavors that captivate customers' buying instincts and impact the perception of the given offering [6]. The efficacy of an advertisement hinges on the contextual elements and the precise delivery of messages within it [5]. Achieving an advertisement that enables consumers to swiftly grasp and resonate with the conveyed idea is a critical characteristic, ensuring its effectiveness in both captivating and persuading the target audience [6].

C. Geofencing

Nowadays, Geofence technology has gained significant traction, finding extensive application in various platforms such as FoodPanda and Grab. As revealed by Rahate and Shaikh, Geofence represents a feature within programs or applications that leverages Radio Frequency Identification (RFID) and the Global Positioning System (GPS) [14]. Upon a user's entry into a defined geographical boundary, the geofence can swiftly ascertain the consumer's real-time [8], enabling effective tracking and notifications within this virtual perimeter. Beyond tracking and notification capabilities, a geofence holds potential for applications in home automation and law enforcement [1]. Consequently, integrating Geofence into this project is envisioned to enhance the dissemination of advertisements pertaining to nearby vehicle rental services within the proximity of users. Salem and Deva, affirm that Geofence facilitates the establishment of a virtual fence for targeted message delivery, thus amplifying the reach and impact of advertising efforts [9].

D. Related Work

One of the applications, FenceBook is an application that utilizes geofencing for advertising purposes. It is explicitly designed for shop retailers to create advertisements within a desired area [12]. The application requires retailers to set a radius for their targeted area, automatically generating a tag name related to the specified area. On the other hand, EventAware personalizes event agendas for Android users. This project employs a context-aware, tag-based recommendation system and geofencing to locate users near events [2]. EventAware's recommender system requires users to customize their congress agenda or interests, and based on their details, the algorithm will recommend exhibitors and seminars. These projects provide valuable insights and features that inform the development of the ReadyVehicle application, enhancing its functionality and effectiveness in addressing its context to advertise vehicle rental services.

III. METHODS

In this part, we delve into the stages of the Waterfall approach, outlining the necessary actions and results essential for achieving the project's objectives. The initial three stages encompass requirement analysis, application design, and development. Within this methodology, the outcomes of each phase frequently serve as the starting point for the subsequent step in a linear sequence.

A. Phase 1: Requirement Analysis

The use case diagram shows how two types of users, rental providers, and renters, interact with the project. Both have similar basic actions, such as signing up, logging in, logging out, and managing their profiles. Rental providers can handle their vehicles, make ads, and place them in specific spots. Renters can browse available vehicles, receive suggestions based on their browsing habits, find nearby rental providers, and get alerts by notification if they enter an area where a rental provider has placed an ad.

B. Phase 2: Application Design

Creating the program's design involved making storyboards, flowcharts, system architecture, an entity-relationship diagram (ERD), and an algorithm. The storyboard was essential for guiding the development of a storyline and structure that fits the intended audience. This thorough storyboard served as an initial guide during the project planning phase.

C. Phase 3: Development

The application utilized the latest technology during development, referring to code from other mobile applications for guidance. The product code was constructed in accordance with the specifications outlined in the design document. Thorough planning and outlining earlier on helped streamline the actual development process. This included planning the project's programming language, database, and other high-level technical components. A key aspect of this project was implementing geofencing, ensuring that renters receive notifications upon entering the designated boundaries set by rental providers. Additionally, content-based filtering was implemented, considering renters' vehicle viewing behavior. The objective remains to create advertisements for rental providers, enhancing awareness of their services among potential renters.

IV. RESULTS AND FINDINGS

The entire application needs testing to make sure it can solve the problem and meet user needs. This testing will display how the ReadyVehicle Application looks and works for users. The interface design is the part users see and use to operate the app, making their experience better. ReadyVehicle is fully developed, and all interface design is done, with the figures showing the initial user interface when the app is installed.

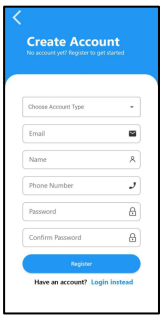

Fig. 1 Registration page

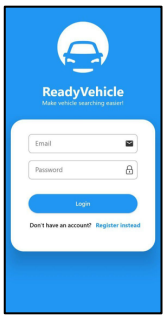

Fig. 2 Login page

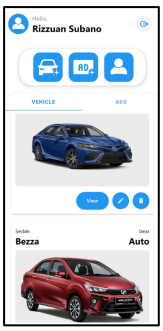

Fig. 3 Home page rental provider

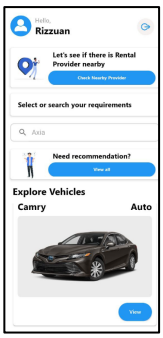

Fig. 4 Home page renter

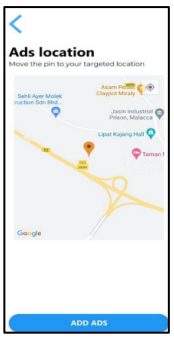

Fig. 5 Create ads page rental provider (draggable marker)

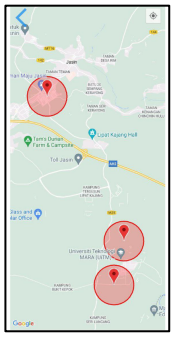

Fig. 6 View nearby rental provider from created ads (multiple geofence view)

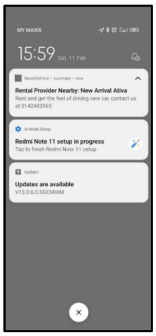

Fig. 7 Receive notification when entering ads boundary (renter)

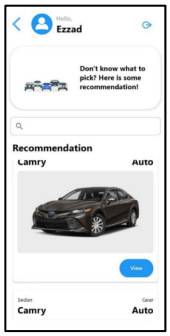

Fig. 8 Recommendation page (renter)

V. CONCLUSIONS

The ReadyVehicle mobile application does not entirely solve the problem in advertising available vehicle rental services to the local. However, the application still can help the user by providing a platform to advertise their services through the advertisement feature which utilizes the use of geofence technology to notify other user (renter) about their service offering. Additionally, the recommendation using content-based filtering helps the user who is unsure about which vehicle rental to choose. But the weakness of ReadyVehicle app is that the geofencing functions in the application really depends on the user phone's as if there is a hardware problem, the application will have trouble in determining the current position of the user hence affecting the accuracy of advertisement notification. To summarize, ReadyVehicle is believed to all the target users in providing a platform to neither advertise their vehicle rental services nor search for available vehicle rental services.

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