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Research Article

Implementation of an Android Mobile Location-Based Service Application for General Auto Repair Shops

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ABSTRACT

The need of a location-based service more specifically as a mobile application sparked the interest of this paper to develop an Android Mobile Application using Location-based services. Yelp and Zomato are one of the few examples. The application created is specific to locating the nearest auto repair shops used via smartphones that detect the location of the user in order to perform the task. This application will not only benefit the customers in need for a nearby auto shop but as well as the providers of the service. The application was developed using Android Studio and was tested by using five (5) nearest auto shops around the vicinity. The results showed the directions getting to the shops as well as the type of services being provided to customers. An acceptability survey was conducted to validate the applicability of the mobile application. The survey was conducted using a controlled group consisting of the nearest auto shops and thirty (30) automobile enthusiasts. The survey presents an applicable and engaging application in assisting possible customers in case of emergency instances arise. Using the survey as basis, an enhancement of the application was completed. Finally, it was suggested that the application will reach its full potential once additional functions are implemented. Registration or Google verification of shop owners is key as it will add to the service provider directory to enable a broad listing.

Keywords: Mobile Application, Location-based Service, Auto Repair Shops, Android, Prototyping

Introduction

The use of mobile Internet and mobile applications is on the rise and growing rapidly, today more are looking for information on the go. People on two or more mobile devices, each of which contains pre-installed or installed applications. A mobile application is a software application designed to run on smartphone, tablets, and other mobile devices. Mobile applications can be downloaded from app stores/

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markets that are our distribution platforms for every operating system (OS).

Location is a critical component for customizing particular applications in a diversity of fields inclusive of internet searching, mining of data, contextual suggestions or recommendations, or mobile gaming. Presently because of the rapid increase and extensive availability of positioning methods and connectivity, location is easily reachable and considerably improves the applications that make use of the user's context. The use of graphical location of users has become progressively accepted in recent times largely due to the growing accessibility of GPS-enabled mobile devices, and the continuous fall in the prices of such gadgets. Moreover, additional position-determining methods such as Wi-Fi and cellular network positioning, make it easier for users to access specific locations. Consequently and interestingly, commercial and academic projects have an increasing interest in location-based services work over the past few years.

A location-based service is an integration of the user's location in addition to providing information on a particular place and geographical position. Location-based services can be accessed mobile devices connected to a network using the information of the location supplied by the particular device.

Needs Analysis

Online directories like Yelp, Trip Advisor, Zomato, and FourSquare have become extremely popular. Search apps help tourists to find specific places. Apps like Yelp utilizes geolocation to show the rundown of organizations close by. Clients can channel the list items or characterize a particular business classification as business sectors, shops, and bistros. At that point, the application permits the arranging of the indexed lists by distance, cost, etc. Then, show business address, phone number, working hours, visitors' reviews etc. Visitors can leave reviews and comments about the business if registered in the app. Even if someone is good at driving, incidents may come along. Getting a flat tire or a simple dent that needs to done right away, there are times where occurrences happen in places one is not familiar with. Therefore, creating an application that locates the nearest auto repair shops in cases of curiosity or in cases of emergency would benefit many users.

People nowadays want everything to be quick and accessible. Typing and having to look through different options online would take up too much time. If an accident occurs wherein the user is not familiar with the area that currently in or need to find the nearest gas station it would take time to look and can cause people to feel anxious during the situation.

When searching online, not all companies would share what services are being offered and how much these services would cost. Also, if searched online, perhaps the information of the searched auto shops have not been updated like the address, phone number, business hours or have closed. If users were in a tight budget situation, one will have a hard time to fix the issue right away and to find the most budget friendly.

The information in the web can be very vague and not be accurate for users. Information on the auto shops can be outdated. The information of the shop may not even be controlled by the shop owner. Having to search for the nearest, budget-friendly, and highly recommended all at the same time in a simple web search server can give many inaccurate options or may not even find the right auto shop for the users where time and effort of users can be wasted. Instead of searching and scrolling through each option, the users using the application will already have it as soon as they open the application.

During instances that a user asks for a certain service or product, web searches would take too much time and users would have to rummage through a lot of options to look for the best one. This process may be stressful for users and will make users just pick a random place that later will be regretful. With the current system, services may be inaccurate; users will take time in searching for the details about a certain service and product.

Creating a mobile application that helps users find the nearest auto shops who may or may not be familiar with the area especially in cases of emergency will be the best way of dealing

with the current dilemma. The application will be featuring a user-friendly interface which will search for auto shops located within the vicinity current location of the user. Preference of auto shops will be possible as selection from a list will be provided. Also, a selection of a service will be added for specific needs.

Related Literature

The Impact of Mobile Phones

From the get-go in 2013, smartphones overwhelmed mobile phones by garnering more prominent portion in gadget sales. This demonstrates a complete move towards more figuring power embraced in the possession of actors (Svensson, 2013). Mobile devices especially phones were at once an obvious status symbol, but recently many believe that gadgets without abilities to convey information were to be from the stone age era (Geser, 2014). Expanding omnipresence of smartphones calls for examination into swaying innovation to having on both miniature and full-scale levels and from a sociological standpoint on social qualities and normal practices.

Defining Location Based Services

Access to the Internet utilizing a mobile phone has made location-based services (LBS) an exceptionally well-known piece of the Web, from informal community area sharing, to driving bearings or to discovering interest focuses (B. Pejić, 2010). In light of Kölmel and Alexakis, location-based services are administrations that exploit the information about where a mobile phone client is found. The innovation to pinpoint the area of a mobile phone is accessible today and is of significant business incentive to the market that needs to target more clients by means of mobile phones and versatile applications (Kölmel and Alexakis, 2002). These services are regularly utilized in location based versatile applications which can be created differently.

More on MLBS

Using the location of a handheld digital device in delivering applications, manipulating important geospatial information on the actual position of the user, and the proximity of different entities (e.g., people, places, future destinations) forms the wireless services being provided by mobile location-based services (Stefkanis, 2006). MLBS can be operated on different devices and divided into several categories. An example of which is that for navigation service using a GPS device or smartphone, a specific user can operate a related application. MLBS can be defined through either the following categories: emergency and emergency alert services, person or pet tracking, navigation, roadside assistance, traffic congestion reporting, fleet management, nearest commercial enterprise routing, or localized advertisement (Ververidis, 2002).

Traffic Services/ Point of Interest Look-up or Navigation

Traffic services assist clients/users in checking specific services, locations, or products. H. J. Tsai (2006) stated that tagging (e.g., nearby restaurants information, timetable of public transport and other related information, weather report, finding stores or parking spaces, local news, sending advertisements, etc), tracing (e.g., specific stores directions, navigation, latest traffic information, etc), tracking (e.g., tracking assets, family, friends or pets, emergency calls positioning, etc), and m-commerce technology (e.g., mobile transactions, exact location billing, coupon distribution) were possible and maximized using mobile location-based services.

Open and Closed Systems

Open and closed frameworks are the two kinds of location-based services. Capacity to communicate information is a limitation in a closed LBS framework. An illustration of a closed LBS framework is a GPS device where it obtains data from a satellite using the GIS framework while an open LBS system is performing the opposite (Shahra, 2017). Specifically, devices relate to platforms to get specific services. For instance, Google My Location services renders interactive functions by linking the Google Map system to identify the user's location. Once the location was determined, the information related to location of the user can be downloaded or viewed. The open LBS demonstrates more advantages by working with platforms (Liang et al. 2008) as in contrast

with the closed LBS framework. Furthermore, the value-added service in terms of feasibility in a closed system LBS is not high.

As the term proposes, location assumes a basic part in LBS as it decides the services and data the client may anticipate. In any case, there is something else entirely to setting than area. Depending just on the area occasionally may prompt superfluous outcomes, as two people utilizing an LBS at a similar area, or even a similar individual at a similar area however inside an alternate setting (e.g., time, seasons, with whom), may anticipate various answers. For viably supporting the client, LBS ought to give data and services adjusted not exclusively to the client's area, yet additionally user's other setting. In the previous years, a great deal of examination progresses has been made to empower context-awareness in LBS, especially on the parts of context acquisition, representation, and adaptation.

Framework

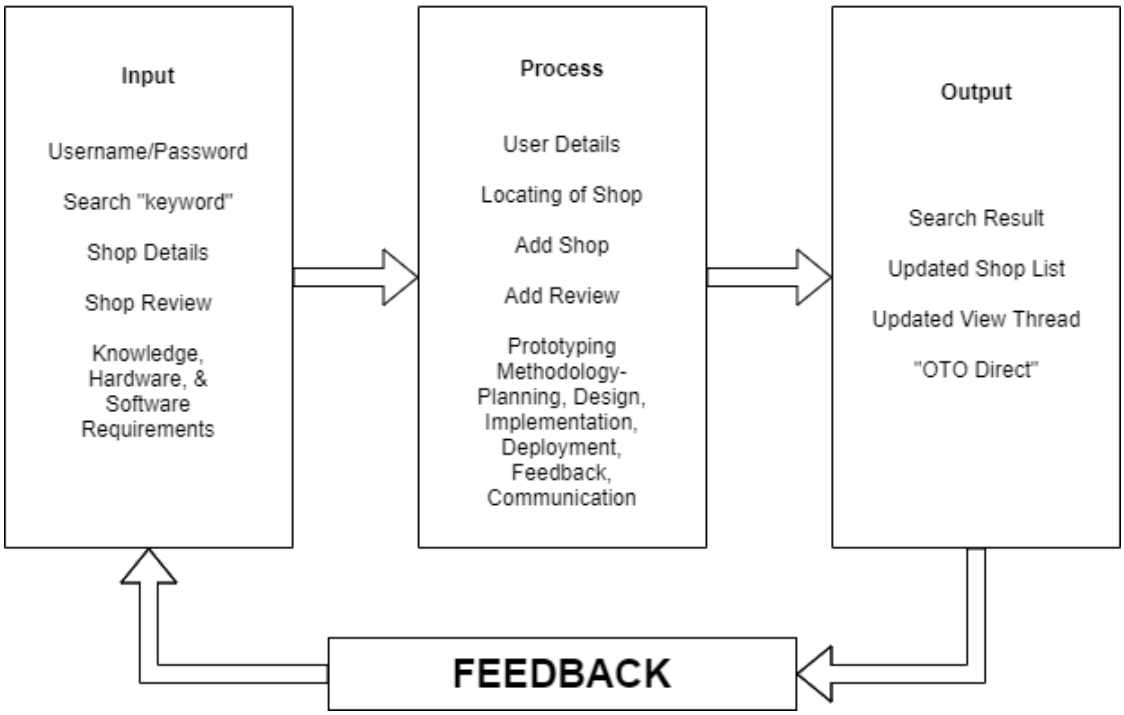


Figure 1. Input Process Output (IPO) Framework of the Implementation of a Mobile-Based Location Application for Auto Repair Shops

Figure 1 illustrated the input-process-output (IPO) of the Implementation of a Mobile-Based Location Application for Auto Repair Shops. The input section indicates the variables that the application will be receiving from either the users or the owners of the auto shops. The process section of the diagram that shows the functions that will be utilizing the inputs to the application. Obviously, the output section features the produced results from the processed of the inputs into the application.

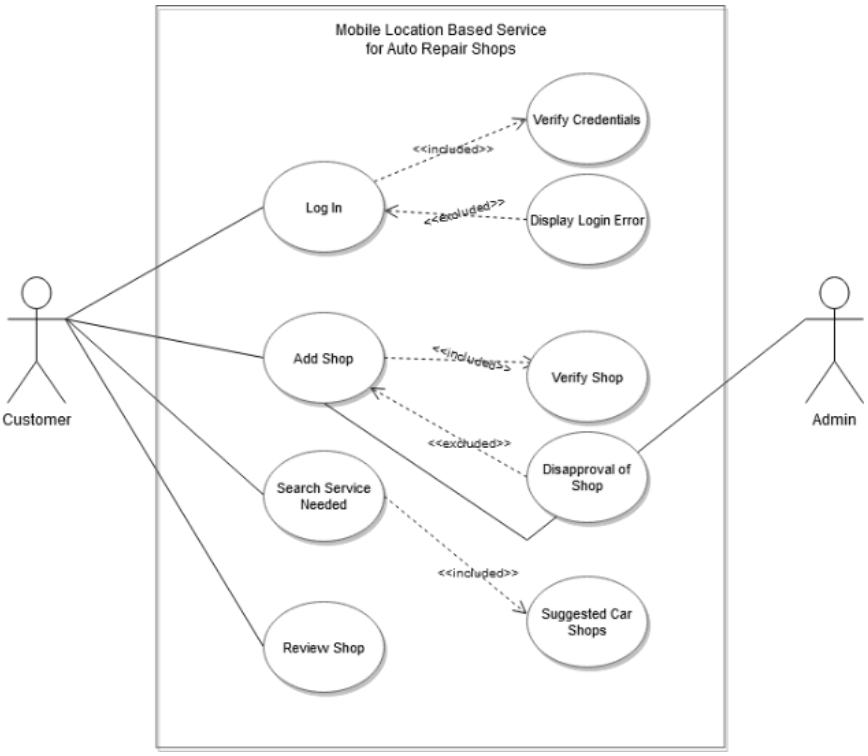


Figure 2. Use Case Diagram for the Implementation of a Mobile-Based Location Application for Auto Repair Shops

Figure 2 shows the interaction between the actors (customer and admin) to the actual mobile application.

Methods

Prototyping is the software development methodology that was used in creating the mobile application. Prototyping is a methodology where a prototype is built, then tested, and revised until an acceptable working model is achieved. It also demonstrates a basis for reference to generate the final application specifically mobile ones. It works best in scenarios where requirements are not obtained in detail such as in an experimental project. The model is a trial and error and iterative method which occurs usually between the developer(s) and the prospective client.

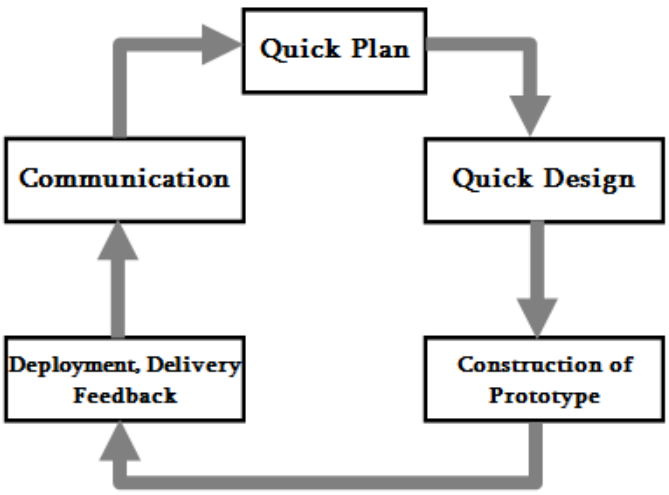


Figure 3. Prototyping Model

Stages within the development of the application followed the six-step model of prototyping namely requirements gathering and analysis, preliminary design of application, prototype building, initial user evaluation, refining of the prototype and finally, implementation of the application.

Requirements gathering and analysis phase details the requirements definition, expectations, and possible resources before proceeding with the application design. The preliminary design is a swift draft of the architecture deriving the diagrams needed for the prototype to follow in the actual implementation which was developed using Android Studio.

The prototype development conformed using a sequence and activity diagrams as illustrated in figures 4, 5, 6, 7 and 8.

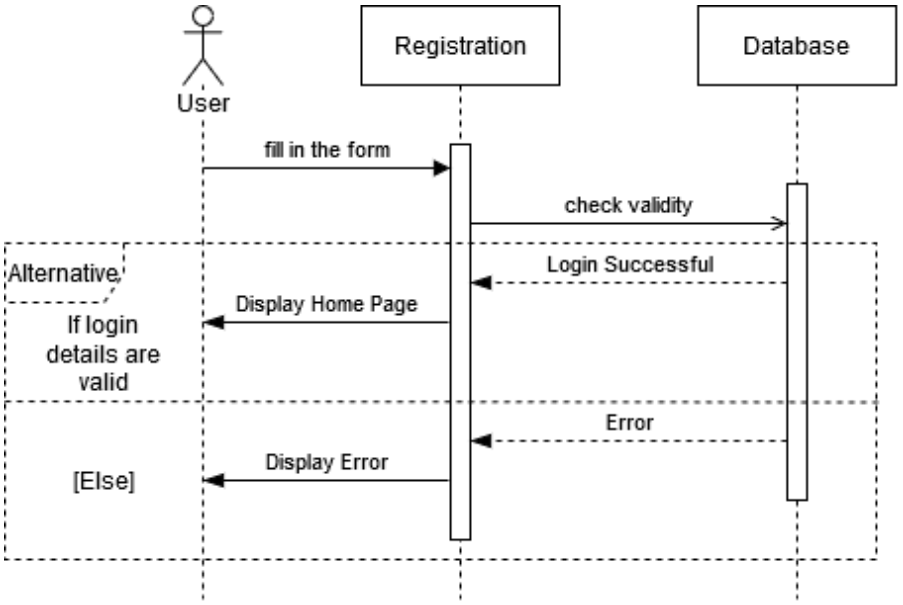


Figure 4. Sequence Diagram for Logging in the Application

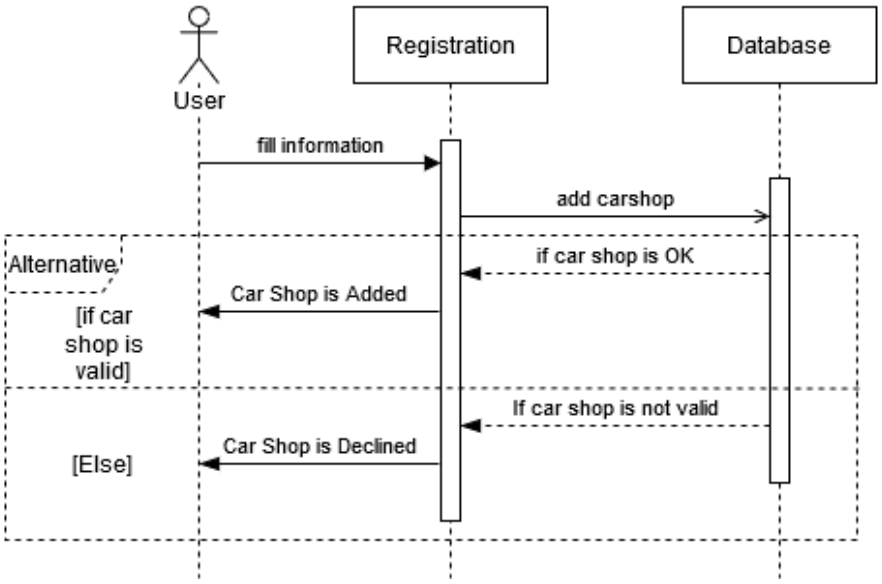


Figure 5. Sequence Diagram for Adding a New Shop in the Application

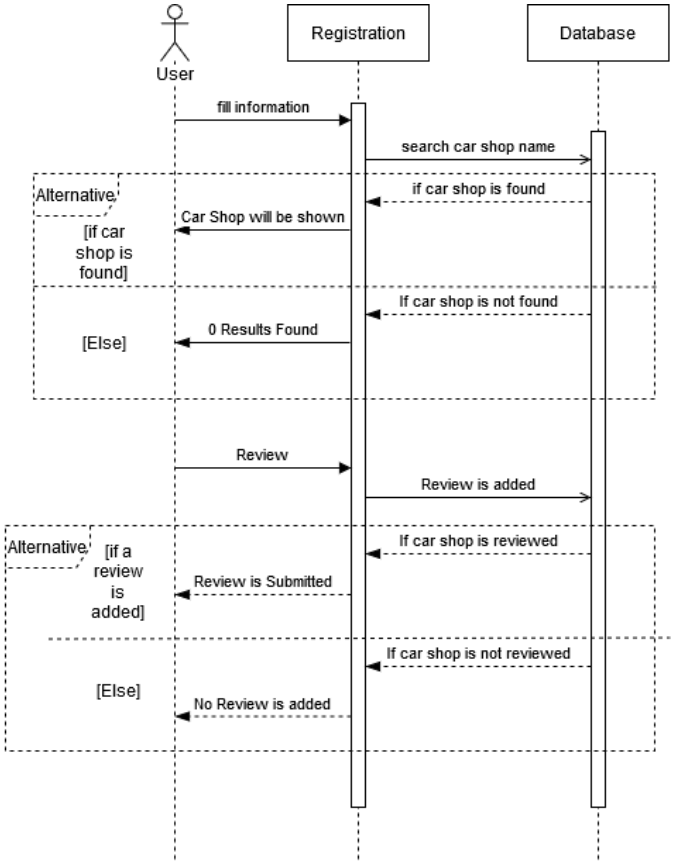


Figure 6. Sequence Diagram for Search and Review in the Application

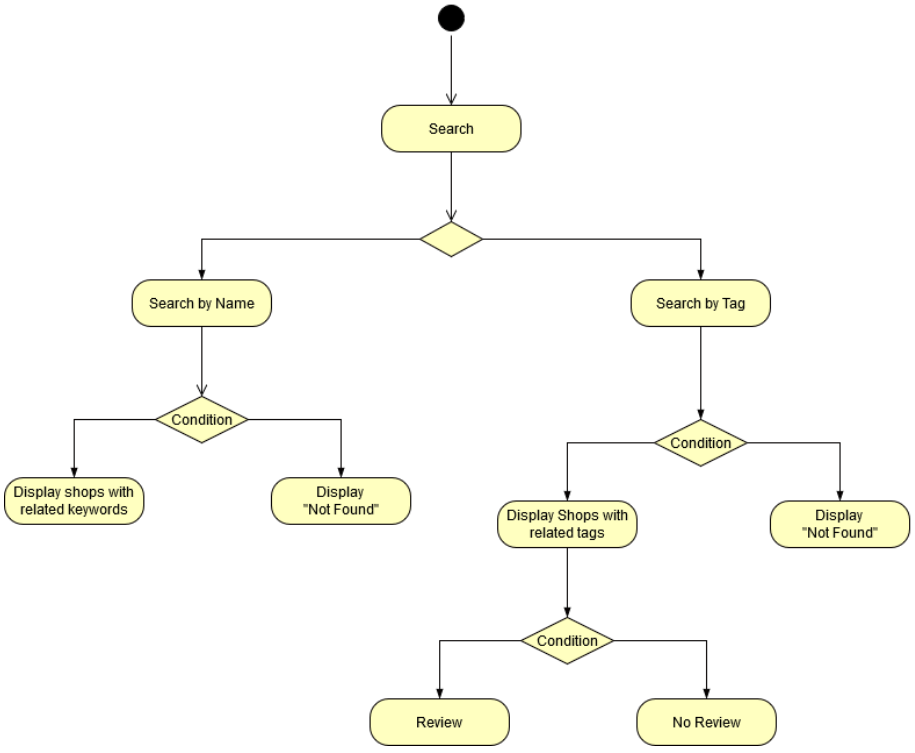


Figure 7. Activity Diagram for Searching a Specific Service in the Application

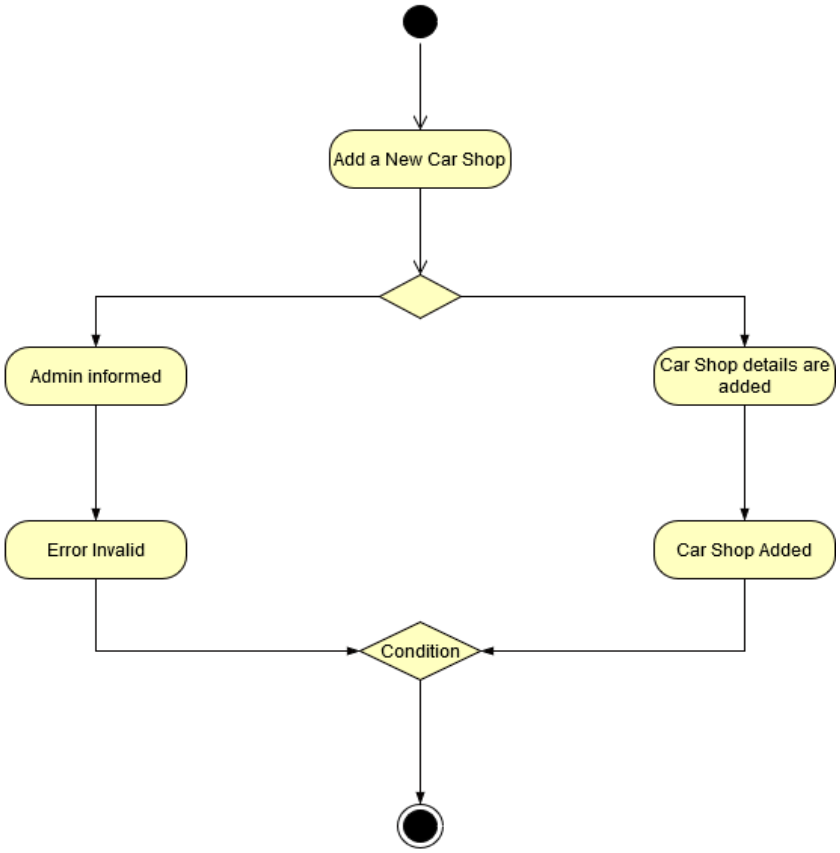


Figure 8. Activity Diagram for Adding a New Auto Shop in the Application

Further advancement of the framework requires transformation of the application to more up to date forms of the Android OS and, if necessary, this ought to likewise incorporate the past one that was not covered by the development. Since the application is a prototype, testing with a bigger number of clients and diverse cell phones has not been performed however is expected soon. Considering the obtained information, it will be anything but difficult to characterize extra rules for future development. In the development of the prototype, an initial test featuring the nearest five (5) auto shops that were located around the vicinity.

As an initial user evaluation, a survey was conducted to determine the acceptability of the prototype. The survey questionnaire was validated in two stages and it was designed through a series of categories namely: user interface design, system performance, system integrity, and security. The categories contain criteria in determining the acceptance of the mobile application.

User Interface Design

1.1. The design of the application is appealing to the eyes
1.2. The design of the application is suitable to the purpose
1.3. The design provides easy navigation and is intuitive

System Performance

2.1. The application provides an easy way to search for auto shops
2.2. The system quickly provides results through searching

System Integrity

3.1. The application shows exact location of the shops
3.2. Search results indicate proper auto shop and its services

Security

4.1. The system provides the security needed for accounts
4.2. Data stored cannot be tampered

Respondents of the survey were composed of the five owners of the nearest auto shops available within the vicinity. An additional thirty (30) respondents, who will act as customers, were selected randomly. These respondents are owners, users and enthusiasts of automobiles. The random sampling technique was used in conducting the survey.

The acceptability of the system was determined using a scaling system as a technique to examine the interpretation of the respondents. A five-point Likert scale was exercised to interpret the entries in the survey questionnaire. Ranges and interpretations were stated in the table below:

Table 1. Five-point Likert Scale

Scale	Range	Interpretation
5	4.6 – 5.0	Excellent
4	3.7 – 4.5	Very Good
3	2.8 – 3.6	Good
2	1.9 – 2.7	Fair
1	1.0 – 1.8	Poor

The weighted mean was utilized to quantify the overarching response to the survey. The weighted mean can be determined using the formula stated below:

Where:

$\bar{X}$ - Mean
f - Weight given to each respondent
X - Number of respondents
n - Total number of respondents

Mean

$$\bar{X} = \frac{\sum fX}{n}$$

Percentage

$$P = \frac{X}{n} x\ 100$$

After gathering the results of the survey, adjustments to the application were done to further enhance the final version of the prototype.

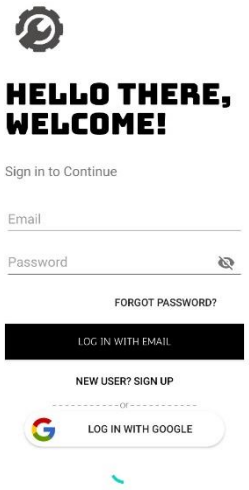
Results and Discussion

The prototype that was developed through the initial design with the enhancements obtained from the results of the conducted survey. The application is named "OTO Direct" which depicts giving of directions to automobiles and the like.

1

Splash Screen

2

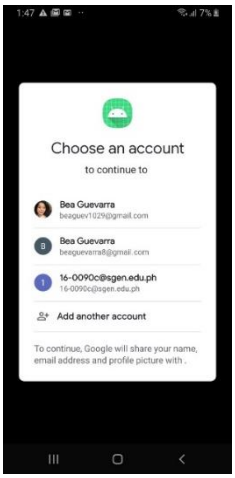


Login Screen

3

Registration Screen

4

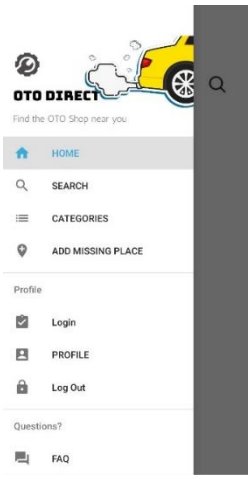


Login Using Google Button Screen

5

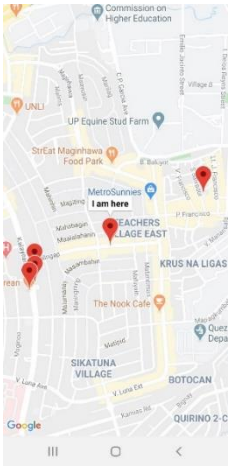
Home Screen

6



Navigation Side Drawer Screen

7

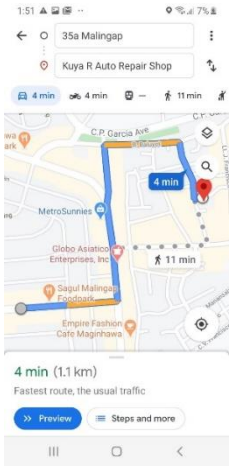


Search Page

8

Example Store

9

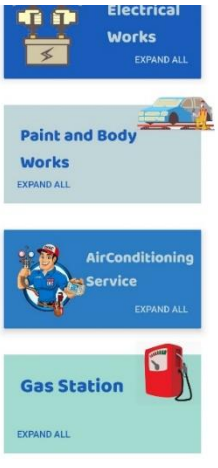


Maps Page

10

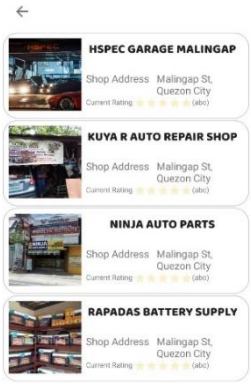
Categories Page - Part 1

11



Categories Page - Part 2

12

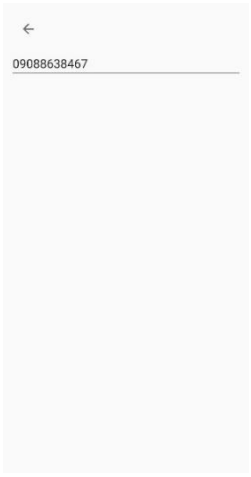


Expand All for Electrical Works Category

13

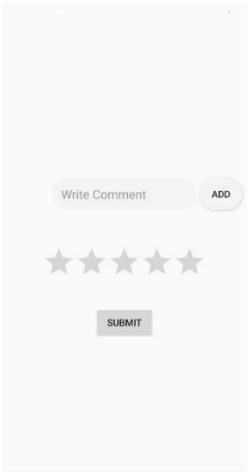
HSPEC Garage

14



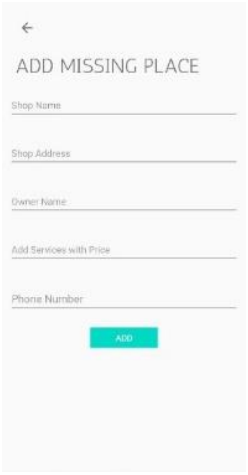
HSPEC Contact Number

15



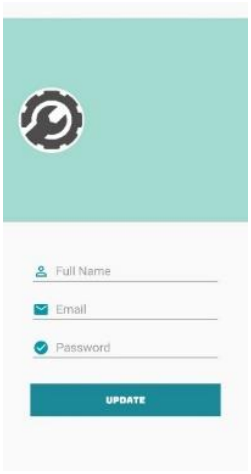
HSPEC Review

16



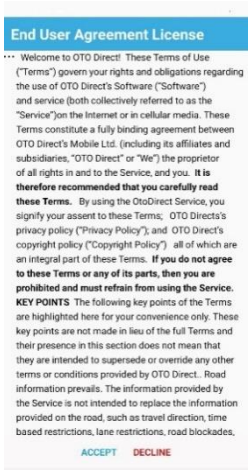
Add Store Page

17



Profile Page

18



End User Agreement Page

Figure 9. User Interface for the Android Mobile Location-Based Service Application for General Auto Repair Shops (OTO Direct)

The splash screen shows the applications' first screen with the app logo, app name, and app slogan. Upon entering, it will proceed to the login screen with an option to use a Google account. Once the Google button has been clicked, the logged in accounts in the phone will appear for the user to choose which account will be utilized.

Home and Navigation screens were also provided along with other user interfaces that were viable in the manipulation of the application prototype. Adding additional shops and searching for service centers deemed to be the most vital functions as it serves as the core tasks of the application.

Table 2. Category 1: User Interface Design

Category 1: User Interface Design	f = 5	4	3	2	1	Total (n)	$\bar{X}$
1.1	35	0	0	0	0	35	5.00
1.2	35	0	0	0	0	35	5.00
1.3	32	1	2	0	0	35	4.86
						Average Mean	4.95

Category 1 user interface design shows that majority of the respondents indicated an excellent rating. In question 1.1 and 1.2, all the 35 respondents have indicated a rating of '5" or interpreted as "Excellent" in the five-point Likert scale. Question 1.3 shows that 32 of the 35 respondents have indicated a '5" rating which corresponds to 91 percent from the total. The other one and two remaining respondents indicated "4" and "3" rating that leads to an average mean of 4.86.

The average mean for category 1 user interface design of the application resulted at 4.95 which is according to the five-point scale is interpreted as "Excellent".

Table 3. Category 2: System Performance

Category 2: System Performance	f = 5	4	3	2	1	Total (n)	$\bar{X}$
2.1	30	2	3	0	0	35	4.77
2.2	28	5	2	0	0	35	4.74
						Average Mean	4.76

Category 2 system performance shows that majority of the respondents indicated an excellent rating. In question 2.1 where out of the 35 respondents, 30 have indicated an excellent rating which corresponds to 86 percent from the total. The other remaining two and three respondents indicated a rating of "4" and "3" respectively leading to an average mean of 4.77.

Question 2.2 presents an excellent rating with 28 respondents indicating "5" which corresponds to 80% from the total. The other five respondents indicated a "4" which was "Very Good" as stated in the rating of the five-point scale. The final two respondents indicated a "3" rating which was still "Good". The average mean as indicated in the table was at 4.74.

The average mean for category 2 system performance of the application resulted at 4.76 which is according to the five-point scale is interpreted as "Excellent".

Table 4. Category 3: System Integrity

Category 3: System Integrity	f = 5	4	3	2	1	Total (n)	$\bar{X}$
3.1	33	2	0	0	0	35	4.94
3.2	29	5	1	0	0	35	4.80
						Average Mean	4.87

In category 3 for system integrity based in the table, it shows again that most of the respondents have indicated an excellent rating for all the questions. In question 3.1, 33 of the 35 respondents indicated a "5" rating. This corresponds to 94 percent of the total responses obtained. The other two respondents indicated a "4" rating leading to an average mean of 4.94 for the question.

29 of the respondents, or 83% from the total, for question 3.2 indicated a "5" rating. The other five respondents indicated a "4" rating while one indicated a "3" rating resulting an average mean of 4.80.

The average mean for category 3 system integrity of the application resulted at 4.87 with an interpretation of "Excellent".

Table 5. Category 4: Security

Category 4: Security	f = 5	4	3	2	1	Total (n)	$\bar{X}$
4.1	10	18	5	2	0	35	4.03
4.2	31	4	0	0	0	35	4.89
						Average Mean	4.46

Finally, for category 4 which measures security of the application, question 4.1 presented that most of the respondents, 18 from the total of 35, have indicated a "4" rating. 10 respondents have indicated a rating of "5" while five indicated "3" and the remaining two indicated a rating of "2". This leads to the average mean to 4.03 for the question, which is according to the five-point Likert scale is interpreted as "Very Good".

Question 4.2 shows a direct contrast to the previous question where 31 respondents or 89% from the total indicated a "5" rating. The other four respondents indicated a "4" rating resulting an average mean of 4.89.

Category 4 security of the application resulted an average mean of 4.46 with an interpretation of "Very Good".

Overall, obtaining all results from each category, the total average mean for the mobile application is 4.56 with an acceptability interpretation of "Excellent" based to the five-point Likert scale.

Conclusion

Creating an application like "OTO Direct", allows an easier way for users to locate the nearest auto shops that contain the services that the customer needs. This also becomes a great marketing tool for auto shops being featured in an application that is can be widely used by mobile device users.

The application is better than the traditional searching, since it saves time for users. By automatically getting the user's current location, the application provides results in an easier and more efficient manner. It is a great application in case of emergencies for users who are not familiar with the location currently in or people who need a fix as soon as possible.

Based on the conducted initial acceptance survey, enhancement in the security category of the application was done to produce an updated version of the system. An enhancement on the account management was completed complying to the result of the survey.

The user interface design, system performance, and system integrity showed a superior acceptability rating leading to an "Excellent" interpretation according to the five-point Likert scale. This indicated that the design, overall performance, and integrity of results were highly accepted and supported by the respondents of the survey.

Further recommendations were suggested in making the application more viable for prospective customers and auto shop owners and/or operators. Since the current application is limited to searching nearby auto shop and respective services, it is recommended that transactions (bookings, reservations, payment) be

included part a major function for the application. Auto shops are suggested to undergo Google verification for the application to obtain information from the aforementioned facility. Also, having a feedback page, will allow users to mention insights and share reviews about the application. Polls will be another great way to receive feedback from users. The input and insights of users are key for continuous improvement and success for the application.

Acknowledgement

The researchers would like to extend their appreciation to all who participated in the data gathering procedure and to the institution for their undying support in giving opportunities including this research. Without their valuable inputs and treasured assistance on the information of the study and the design and development of the application, this study would not be possible.

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