A Development of Mobile - Based Directory for UCSI University (UCSI Mobiletory)

L. C. Jing[1], A. S. Shibghatullah[2] and C. T. C. Ling

[1]Schoof of Information Technology, Faculty of Business & Information Science (FoBIS), UCSI University, Cheras, Kuala Lumpur, Malaysia

AbdulSamad@ucsiuniversity.edu.my

Abstract—**A directory can be known as the board of the organization or locations of certain departments, or certain shop in the context of a shopping mall. It is important to serves as a guide to people as it can provide locations and information of a mall, especially in the case of a large shopping mall, where people find difficulties to find the directory board. As the capital of Malaysia, Kuala Lumpur has been constructing many large-scale mall around the city, namely Sunway Pyramid and Pavillion mall. Without the implementation of a directory board, people could be lost or taking a lot of times to find their preferred shop. The purpose of this paper is to present a mobile application that was designed to be users search friendly and aware of the information provided at UCSI University (UCSI Mobiletory). The methodology used in the system development process is prototyping methodology. The languages involves in the development includes JAVA, PHP and SQL programming language. Based on the survey done, UCSI Mobiletory is able to help users in locating place and finding building at UCSI University.**

Keywords—shopping mall directory, indoor wayfinding, store locator, campus directory, indoor mapping system

I. INTRODUCTION

There are many ways to implement a mapping service in a complex area, for instance, an indoor navigation that uses technology such as WiFi access points, cell tower or beacons to receive wireless, magnetic, sound and light signals corresponded with the sensor-rich mobile device (Zeinalipour-Yazti, Laoudias, Georgiou, & Chatzimilioudis, 2017). However, to implement a navigation can be costly in terms of hardware installation and it can be less effective when it comes to indoor. Another way of implementing a mapping service is to provide a mobile directory service. Mobile application has become a must device nowadays (MCMC,2017). The objective of this research is to develop a mobile application that was designed for users search and for their awareness of the information provided at UCSI University that is called "UCSI Mobiletory". Table 1 below shows the comparison of UCSI existing directory with the proposed UCSI Mobiletory.

TABLE 1: COMPARISON OF UCSI EXISTING DIRECTORY AND UCSI MOBILETORY

	UCSI Directory Board	UCSI Mobile Directory
Conveniency	Only provided at certain spot around the campus. User have to find the directory board, less convenience.	User can access using mobile anywhere anytime, more convenience
Update information	Can be slow and costly to replace a directory board	Fast and easy by updating
		information on database
Easy to understand	User without sense of direction can be confused by static directory	User can understand the direction easier from dynamic directory

UCSI Mobiletory is a mobile-based directory that uses simple concept that aimed to bring convenience to the community of UCSI University. By putting partial dynamic floor plan in a mobile device, people can access through the application whenever they want as they ought to look for places in the UCSI

Article history: Manuscript received 07 February 2019; received in revised form 03 April 2019; Accepted 08 April 2019.

University campus. Mobiletory is an open access application and on-demand service that does not require user registration and authentication. This reduce the time for the searching process and provides quicker access to the floor plan. In this project, due to several constraints, it was decided that Mobiletory will focus on only Block G of the campus.

II. LITERATURE REVIEW

A university campus is an intricate facility, especially for freshman and visitors who will be having a difficult time to adapt the new facility and locate places. Like most of the mapping services such as Waze, Google Map, and Map by IOS used on a smart device, it rarely covers the indoor area. This is due to the limitation on GPS positioning as the signals is weak and it can only be utilised in an outdoor environment (Griffin, 2018). Therefore, other forms of positioning or wayfinding method in an indoor area is needed. This section shows conventional and unconventional ways that are available to solve the problem of indoor wayfinding (Islam et al.,2010; Uddin et al.,2013;).

A. Conventional wayfinding

Wayfinding, also known as navigating or searching for direction, is a problem-solving process or a structured system that provides guidance to people through physical environment and increase their understanding to the area (Kim, Wang, Han, & Wang, 2015). In other word, it involves in understanding where you are, knowing where you want to go, choosing the route to go and executing the decision. Before technologies, people tend to locate a place with several approaches, for instance, by their cognitive behaviour, their previous experiences or deduce a reasonable way from a combination of existing information, such as sign board. Sometimes, people would even go all the way around the facility if there exist misunderstanding of signboard. Therefore, information counter has been established in most of the organizations and buildings. In addition, some organization might add directory sign board at the entrance of each floor. However, the drawback of signboard is that it may be located at various point and people might not be able to find the sign board accurately.

B. Unconventional wayfinding

1.1 Directory system and application

Initially, directory is a board that contains of title and description of places. As time goes by, directory has evolved into many forms. For example, by adding of floor plan and categorized view. This can be found in complex buildings such as shopping mall or corporate area. Followed by implementing floor plan into websites or mobile application to provide easy access for visitors and lastly, emerged to become an indoor navigation system. The evolution of directory shows that it is important and crucial that people, especially visitors will depend on signboards, directory or navigation system to know where they are and to go places they wanted to go.

1.2 Wi-Fi based indoor positioning

Wi-Fi technology is a good substitution for GPS technology, as most of the smart devices are embedded with this technology, positioning in indoor is workable. However, the drawback of this method is that not every mobile device will support this services. According to ("Indoor navigation," 2018), IOS-based device that are running on IOS 4.3 and above can only support Wi-Fi positioning via the adding of iBeacons due to the restriction on the operating system itself. The cost of iBeacons is considered as more expensive due to its flexibility and accuracy of transmitting signals is higher.

The idea of implementing this method is to have multiple access points to behave as nearby anchors that could receive signals from Wi-Fi enabled devices within a level of the building. By doing so, there are several approaches need to be considered to work with the structure of buildings and access points, such as choosing from Time of arrival, Angle of arrival, Hybrid ToA/AoA and Received signal strength (RSS) and fingerprint (Yang & Shao, 2015).

1.3 Bluetooth Low Energy (BLE) Beacons

A Beacon is a small device that are running on long battery life and does not require an external energy source. In fact, a good beacon can be used

up to years with a single battery charge. With proper implementation, Beacon technology can be used in several scenarios to provide conveniency. For example, theft protection by attaching Beacons to valuable objects and when the object leaves the geofencing area, it will trigger a security notification; Emergency cases, it can be used to track people in the building that are equipped with Beacon technology in an ID card form, and determines the amount and the position of people during an evacuation plan; or it can be used in an inventory management system and indoor navigation system.

1.4 Magnetic positioning

Magnetic positioning uses the Earth's geomagnetic field that consist in the infrastructure of a building, such as steel, the main material that stand as the foundations of building. "The more steel the better", said by Janne Haverninen (Sterling, 2018). It improves the accuracy of receive and transmit signals around the building to provide more accuracy to locate user. This is a technology that can only work indoor as outdoor contains lesser steel than indoor buildings. Smart devices comes with magnetic sensors to provide compass function by measuring earth's magnetic field. The most significant benefit of magnetic positioning is that it requires no hardware installation and are compatible with IOS devices, unlike Beacons. However, it requires an API (Application Programming Interface) or a management system to manage the map. The drawback of this technology is that it only shows the pinpointed location without extra information of the places.

1.5 Augmented Reality

Augmented reality is another rising technology that provides interactive experience from the real world perspective by representing the real world objects with computer-generated perceptual information. Moreover, augmented reality also provides sensational experience such as auditory, haptic, somatosensory or even olfactory (Goyal, n.d), in other word, that would be the sense of hear, touch, pressure and pain, and smell and taste. In terms of positioning, augmented reality can provide navigation by immerge the information of surrounding into the smart device screen. It relies on gyroscope, digital compass, accelerometer and velocity meter from smart devices to provide data about the location. There are several possible ways to determine a user's location, by using Beacons and WiFi. This enabled another experience of navigating, by representing a world in the screen that is very close to the reality.

III. METHODOLOGY

Prototyping methodology is a system development approach whereby it reduces inherent project risk by breaking project into smaller segments and providing ease-of-changing during the development process. This approach is suitable for development of an online system for innovative, flexible designs that will accommodate future changes. There are 4 phases in this methodology, which are the Initial investigation, iterative phase, implementation phase and maintenance phase as shown in this section.

A Initial Investigation

This process is to have a series of research the requirement that are needed in this system and study the requirements. The followings are the activities that have been carried out:

1. By researching the information related to project title through Internet and collect more information from journal paper or relevant books.
2. Conduct research on the feasibility of Mobiletory by studying the existing system in the market, such as Pyramid and SouthPointe. Followed by collecting the concept and idea implemented in several shopping mall located in Kuala Lumpur.
3. Study the technologies and tools that can be used for develop the application, and understands how does different programming languages communicate with each other, for example, such as PHP and JAVA.

B Iterative Phase

This phase containes of overlapping of 3 phases, the Requirement Definition Phase, System Design Phase and Coding and Testing Phase. The followings are the activities that have been

carried out:

1. Observing on the current problem occurs to user using unstructured observation technique.
2. Perform data collection technique by distributing questionnaire to the community of UCSI to understand problem occurs in the community and thus, identify the requirements for the application
3. Conduct interview session with relevant parties.
4. Analyzation of responses from observation, questionnaires, and interview and provide statistical result with charts and tables.
5. Storyboarding and designing Mobiletory user interface that are understandable and easy to use.
6. Design the structure of database for the system and the layout of functions corresponding with the user interface.
7. Create UML disgrams for the system.
8. Perform unit testing and usability testing of the prototype.
9. Iteratively examining and discover problems of the prototype.

C Implementation Phase

Implementation phase occurs after all activities has been finalized in the previous phases. Activities to be conducted including error checking and bug fix of the system during installation on another mobile device. All bugs and error founded will be documented in the report. The objective is to provide a final and fully working system that are compatible to others mobile device.

D Maintenance Phase

Maintenance phase is an after-work phase whereby the application will be monitored in a structured timeframe. Activities to be conduct includes documenting system performance and records problem occur and make changes according to the expectations.

IV. RESULT AND DISCUSSION

This chapter discusses on the implementation of the proposed application. Including UML modelling diagram, design of models, diagrams and functionality of the system. UML (Unified Modelling Language) is a modelling language to display the functionality and the activity flow of the system. It contains rich graphical notation, and comprehensive set of diagrams and elements to provide a better understanding for implementation.

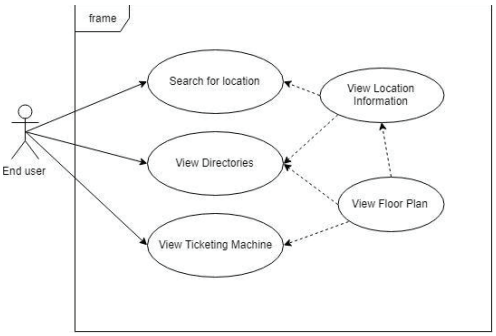

Fig. 1 Overall Usecase diagram of UCSI Mobiletory

End user is a role that includes the students, visitors, staff or everyone else that uses the system. The management of this application will be on the backend side since there will be no admin user for the system.

There are 5 main classes and a subclass, that is Location, Classroom, Facility, Ticketing Machine, Office and Faculty. An Office class contains of information such as officeID, officeName, locationID, desc, operatingHours, and contactNo. Faculty is the subclass of Office as each faculty may have its own administrative office to manage tasks in respective faculty.

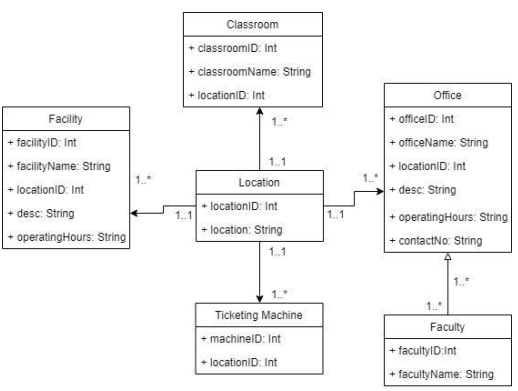

Fig. 2 UCSI Mobiletory class diagram

Each classes will inherit location information from the location classes using the locationID attribute. A Ticketing Machine class are used to store the location of each ticketing machine in the campus. A Facility class are used to store information related to facilities of the campus, such as badminton court, multipurpose hall, gym room, dance room and more.

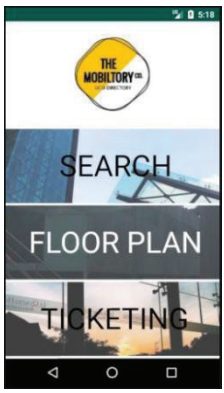

Fig. 3 Home page

In this case, it shows that the user are able to perform"Search for location ", "View Floor Plan", and "View Ticketing Machine" that leads to the subfunction within to view location information and view floor plan of the required place.

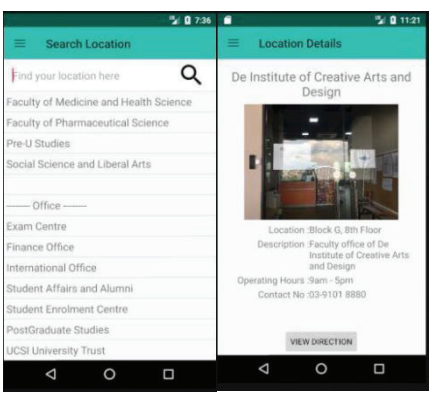

Fig. 4 Search page

User can search for a location by inserting keywords or select from the list. If the location is valid, the system will retrieve location information from the cloud database.

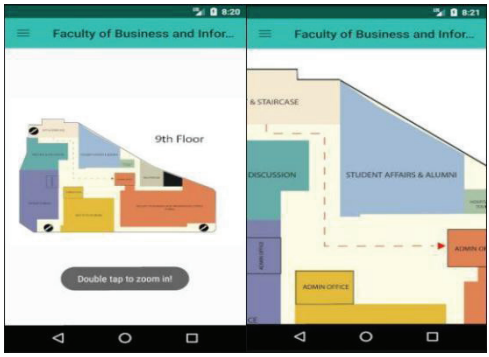

Fig. 5 View direction page.

User will be generate a floor plan with direction to the required location.

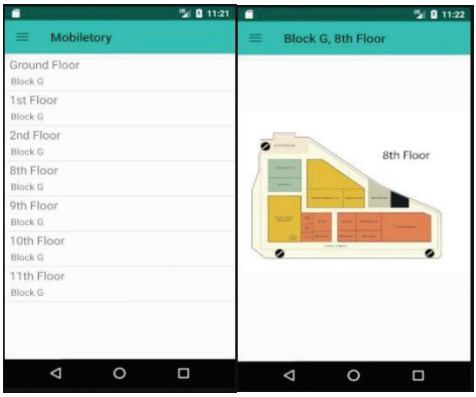

Fig. 6 Floor plan

User can view floor plan of a specific level from a block upon selection.

V. CONCLUSION

This paper explains about the requirement to implement a mobile-based directory in our everyday life. UCSI current directory system lies within physical static directory board that are located only at certain spot, that played as a guidance to provide an overview of the floor plan to students, staff and visitors that need this in UCSI University. Despite such continuous effort in improving the operations that brings benefits to the community of UCSI, it is discovered that the process of searching to a certain classroom, faculty or even an office needed to be done physically, specifically when to look for a directory board in order to be

directed to certain places required. Therefore, this project was aimed to act as a service that provides convenience to whoever that needs it in UCSI. As a conclusion, UCSI Mobiletory can be used as a guidance for the community of UCSI to accquire accurate information anywhere and anytime.

REFERENCES

[1] Goyal, A. Augmented Reality and Virtual Reality (n.d.). Retrieved from https://www.ps3g.com/wpcontent/uploads/2018/08/AV-VR.pdf

[2] Griffin, D. (2018). How does the Global Positioning System(GPS) work? Retrieved from https://www.pocketgpsworld.com/howgpsworks.php

[3] Indoor navigation using Wi-Fi – pros & cons. (2018). Retrieved from https://www.indoornavigation.com

/wikien/indoor-navigation-using-wi-fi-pros-cons

[4] Hendriana, Y., Pranolo, A., Sulaiman, S., & Fong, L. H. (2015, October). Generic shopping mall directory mobile application. In Science in Information Technology (ICSITech), 2015 International Conference on (pp. 363-368). IEEE.

[5] Kim, M. J., Wang, X., Han, S., & Wang, Y. (2015). Implementing an augmented realityenabled wayfinding system through studying user experience and requirements in complex environments. Visualization in Engineering, 3(1), 14.

[6] Malaysian Communications and Multimedia Commission, "Hand Phone User Survey 2017-Statistical Brief Number Twenty-Two.," pp. 1–61, 2017.

[7] M. P. Uddin, M. Z. Islam, M. Nadim, and M. I. Afjal, "GPS-based Location Tracking System via Android Device," Int. J. Res. Comput. Eng. Electron., 2013.

[8] R. Islam, R. Islam, and T. A. Mazumder, "Mobile application and its global impact," Int. J. Eng. Technol., vol. 10, no. 06, pp. 72–78, 2010.

[9] Sterling, G. (2018). Magnetic Positioning The Arrival of Indoor GPS. Retrieved from https://opusresearch.net/wordpress/pdfreports/MagneticPositioning_Opus_leadup.pdf

[10] Yang, C., & Shao, H. R. (2015). WiFi-based indoor positioning. IEEE Communications Magazine, 53(3), 150-157.

[11] Zeinalipour-Yazti, D., Laoudias, C., Georgiou, K., & Chatzimilioudis, G. (2017). Internet-based indoor navigation services. IEEE Internet Computing.