Mobile Navigation Application for the University: A Case Study

Afnan Amirruddin and Mohd Hilmi Hasan,

Centre for Research in Data Science, Computer and Information Sciences Department, Universiti Teknologi PETRONAS, 32610 Seri Iskandar, Perak, Malaysia

Summary
Human being uses mapping system as their mean of navigation such as physical map and stars in the sky. Since the advance of technology, we saw the thrive of Global Positioning System (GPS) like PAPAGO! which produces GPS hardware just for navigation. Nowadays, the advancement of navigation technology is rapidly growing as seen from the immense number of users using mobile apps like Google Maps and Waze. In this research, we propose the use of this technology to resolve the navigation problem in a confined place such as university. We focus the study on our university, where most of the buildings are named alphabetically such as N, L or P block. This naming system is quite confusing as compared to using the department name for the building. The department name cannot be used to identify buildings because there are buildings that contain several departments. This problem does not only affect new students, new staff or visitors, but also the existing students and staff. Hence, we develop a university mobile navigation system to resolve the issue. The system is developed as a mobile app and as for this research it runs on Android platform only. The results show that the system can provide customized navigation for the university.

Key words:
Android mobile app, navigation app, mobile navigation app, navigation system

1. Introduction

The development of information technology and the massive acceptance of mobile devices have led to the introduction of various mobile navigation apps. An example of the apps is NavToPref, which can recommend and guide users to the nearest locations where their most preferred products are available [1]. Another example is a mobile app that combines augmented reality, QR code and cloud computing technologies. These three technologies serve different tasks in ensuring a good and lively scene and information delivery for users' navigation [2]. Mobile navigation app is also used for marketing and advertising local foods to visitors as shown in [3]. Many other mobile navigation apps have also shown that they offer significant benefits such as efficient routing/navigation as well as information-based navigation. Mobile navigation apps can also provide best experience to users in universities. An example is the mobile app used for navigation in California State University, which intends to provide best user experience to the users [4]. The similar app is also used in several other universities such as Massachusetts Institute of Technology, Texas A&M University, and University of North Carolina, Chapel Hill [5].

This research is conducted to study and develop a mobile navigation app to our university. Our preliminary survey showed that the app is required to guide students, staff and visitors in touring around the campus. The problem arises due to the naming of the buildings, whereby most buildings are not named after department's/unit's names. Instead, the naming uses alphabetical identification such as N, L or P block. This naming system does not define where the location is, instead it just provides some generic names.

Hence, this research aims at conducting a study on mobile navigation app and developing it, as a feasible and efficient solution to the navigation system throughout the campus. The objectives of this paper are to discuss the results of the study conducted in UTP regarding the mobile navigation app, and to present the developed app and its performance. This paper is organized as follows. The next section presents the literature review on the existing works, followed by the methodology section. Next, results and discussion section are presented, and lastly the conclusion section summarizes the research and outlines some future works.

2. Survey and Related Works

Navigation is defined as the demonstration or routine with regards to exploring [6]. In addition, the act of coordinating a ship, air ship etc. starting with one place then onto the next, or the exploration of finding a path starting with one place then onto the next [7]. Furthermore, navigation is described as the way of getting objects or individual from one place to another [8]. Nowadays, people associate the word navigation with Global Positioning System (GPS). GPS can also be defined as the provider of constant timing and positioning information in real-time without any restrictions regarding the weather [9]. GPS comprises typically, of a group of stars of 24 operational satellites. This star grouping, known as the underlying operational capacity (IOC), was finished in July 1993 [10]. However, the 24 satellites that keep GPS administrations running in the US aren't particularly

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secure; they're defenseless against screw-ups, or assaults of the digital or bodily kind [11].

In relation to GPS and navigation, individuals regularly become mixed up in structures, including libraries, doctor's facilities, conference centers, and malls. There are three contributing variables; the spatial structure of the building, the intellectual maps that users develop as they explore, and the methodologies and spatial capacities of the users of the buildings. Therefore, these variables are some factors that explained how the personnel can be lost or cannot found specific venues throughout a certain building [12].

For some people, using GPS is not their necessities. But technologies nowadays are utilizing the GPS as a part of daily life. Such example is social media. From Facebook to WhatsApp, they are implementing the GPS in their features. For example, if you want to meet a person, you could just send location via WhatsApp and the person could go there at ease. Not to forget also the existence of Google Maps on the smartphones. Moreover, people lose all sense of direction to some extent since we don't focus and have lost old methods for perusing the earth to explore [13].

From the article written by Ghose, the human sense of navigation is not a superior thing, thus by having GPS, it filled the void of the human weakness. In addition, GPS are widely used from land navigation, aviation and space guidance for space explorations. Thus, the need of GPS is significant not for just daily use, but also for military, air transportation and technology in space exploration [8].

A specific guidance or navigation system would really help our university's staff and students in saving times and energy for navigating from a place to another. Thus, we gathered some information and conducted a survey to our staff as well as current and former university's students. There were 148 respondents participated in the survey where the results are described in the following paragraphs. From the total number of respondents, 89.9% are students (133), 2.7% are staff (4) and 7.4% are alumni (11).

There are 77 respondents who have been in the university (UTP) around 3-4 years, followed by 32 respondents has been in UTP for 1-2 years. The third is respondents that has been more than 5 years (29 respondents) and followed by the least respondents (10 respondents) that has been in UTP for less than a year. This is shown in Figure 1.

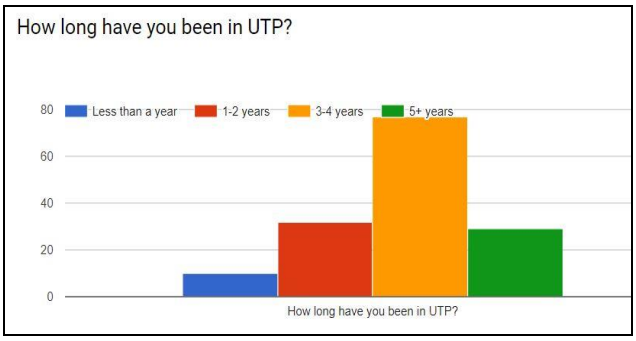

Fig. 1 Number of years respondent has been in UTP

As in Figure 2, the survey results also show that majority of the respondents have had experience being lost when finding building, classroom or venue in UTP (125 respondents) and 23 respondents finding it otherwise. Figure 3, meanwhile, show that 119 respondents have had experience being late to certain venue due to lack of precise location of the venue.

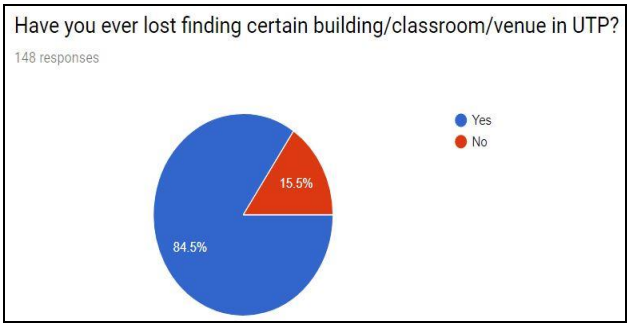

Fig. 2 Number of respondents have experienced being lost in UTP

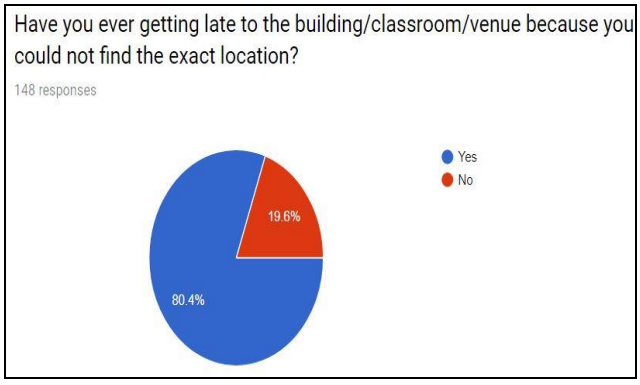

Fig. 3 Relevancy of tour and easiness to remember the locations throughout UTP

There is an initiative to guide new students about venues and places around the campus through campus tour program during students' orientation week. However, this initiative is conducted during their first week at the

university, which may not be helpful to guide them in later years at the university. Figure 4 shows the survey results about students' opinion on the campus tour program. It shows that 50% of the respondents (74 respondents) answered "maybe" as an answer as they also quite unsure whether the tours helped them to remember all the locations or not. The are 58 responded disagree with the statement that the tour helped them to navigate through UTP and the least is the respondents with "yes" as the answer to the question (16 respondents).

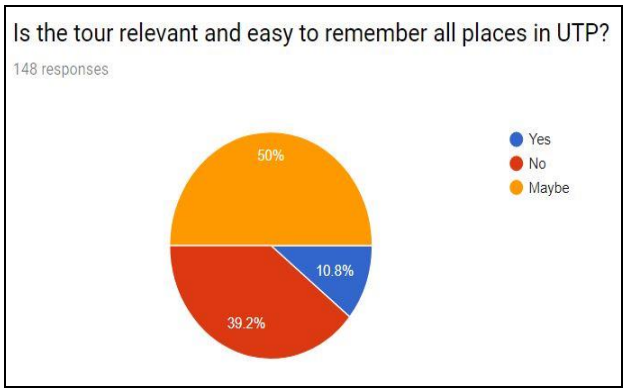

Fig. 4 Relevancy of tour and easiness to remember the locations throughout UTP

Therefore, in this research, we proposed the university navigation through mobile app. To support the need for this kind of app, we surveyed on the keenness of the respondents to looking at the phone while walking or on the way to venue has been conducted. 73 respondents looking at their phones sometimes, followed by 46 respondents with often looking at their phones. This followed by 23 respondents and 6 respondents on rarely and never looking at their phone while going to venues. This is shown in Figure 5. This is supported with the next survey which is on opinion poll whether the respondents think that having a navigation system to find all building, classroom or venue within their smartphones is sophisticated, relevant and efficient or not. As shown in Figure 6, 73% agrees on thoughts that having an application to help to go to venues is sophisticated, relevant and efficient (108 respondents). Followed by 21.6% of respondents with in the middle (32 respondents) and the rest with "no" as the choice (8 respondents).

The final survey, which is whether the respondents agree if other universities could take initiative to have navigation system for every building, classroom and venue in their respective campus also giving the almost consistent data received from the previous question. 83.1% of the respondents agree for other universities to have the similar fashion for navigating throughout the campus (123 respondents) followed by 14.2% that are in the middle (21 respondents). There are also 4 respondents that are disagree with the suggestion. This survey is shown in Figure 7.

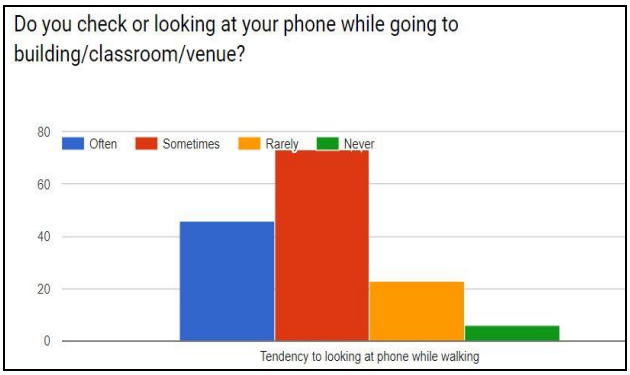

Fig. 5 Keenness of respondents to look on phone while going to venues

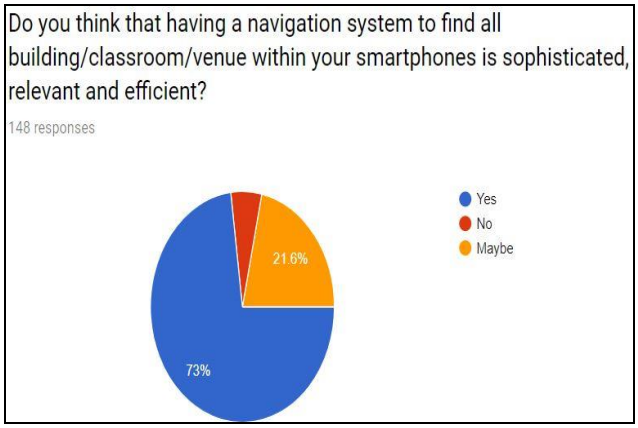

Fig. 6 Opinion on whether navigation system sophisticated, relevant and efficient

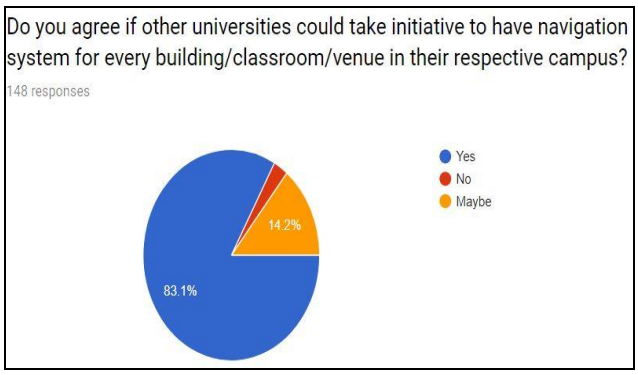

Fig. 7 Does respondents agree if other campus could take initiative having a navigation system

There are numerous GPS related mobile apps; Google Maps and Waze, just to name a few. Figure 8 shows that just interest Point of View (POI) places that are displayed

in the map rather than every blocks and section that are available in our university. Table 1 shows the comparison between our proposed apps, UTP Navigation System (UTPNS), and the existing apps.

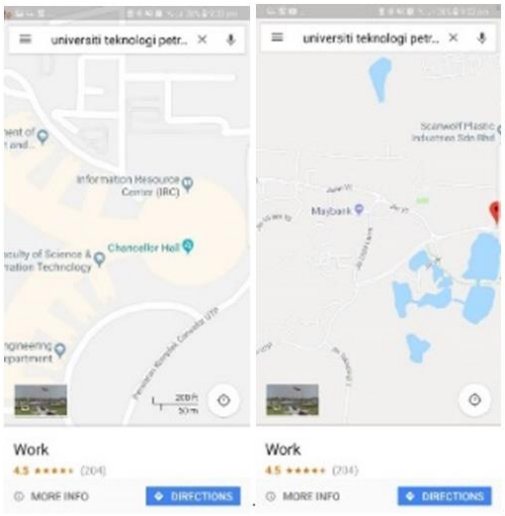

Fig. 8 Google Maps interface

Table 1: Comparison Between UTPNS and Existing Apps

Criteria	UTPNS	Google Maps	Waze
Navigation	Yes	Yes	Yes
Specific POI details in UTP	Yes	No	No
Detail of each block in a building	Yes	No	No

Our literature survey found that a navigation should have the following basic features [14]:

1. Continuous Tracking

Most GPS Tracking gadgets are empowered with continuous tracking. Location of the mobile phone/user is being traced on the guide as it moves from point to point. The GPS location of user is shown on a guide alongside vehicle speed if the vehicle is moving. The present condition of the vehicle like moving, stopped since or sit out of gear is demonstrated utilizing map markers.

2. History tracking

User can track every past location made by him on the map. From travelled POI and history of location travelled should be able to be assessed by the user. This helps the user to have easier and faster way to assess the POI rather than retyping the location name as such.

3. Simple to utilize, easy to understand interface.

A basic and natural UI gives intense highlights like gathering great access without the requirement for numerous records, bird's eye perspective of the map and the capacity to report on ongoing information in real-time. A basic yet all around created instinctive UI enables simple access to the easy access and navigation.

Our literature survey found that a GPS-based app has shortcomings, such as it requires heavy battery consumption, and the signal could not go through strong structures so can't work inside, underground, under the water, or under a thick overhang of trees. It also can be influenced by vast structures and is normally problematic in CBD zones. Lastly, GPS-based app's accuracy is identified with the nature of flag gathering; the bigger the radio wire the better the flag – so supreme scaling down isn't conceivable while keeping up great situating exactness [15]. The proposed UTPNS is a derived and inspired by the Google Maps but specifically to be done to the UTP staff and students. This includes the building details for students, lectures and any related entities.

3. Methods

Figure 9 shows the general process system flowchart of UTPNS.

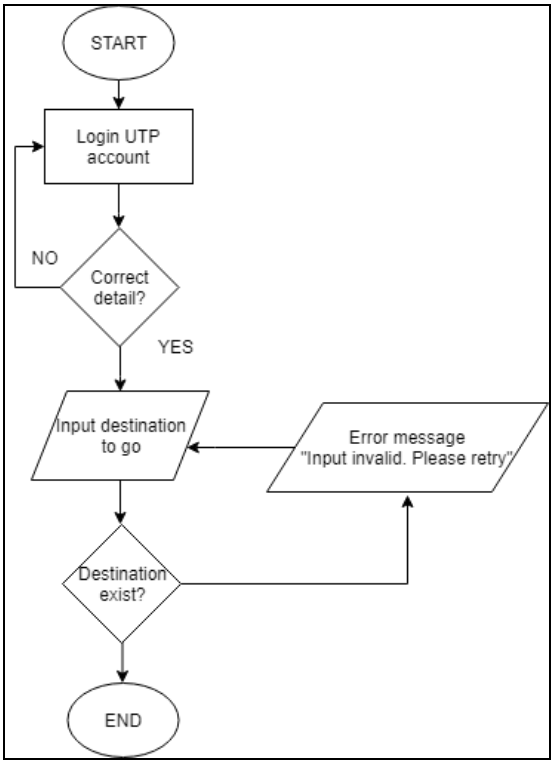

Fig. 9 General Process System Flowchart

In the development of UTPNS, the following tools and software were used:

1. Android studio
   - A software for developing mobile applications for android platform that is suitable to use for the development of the system.
   - More user friendly mobile application to be used and straightforward.
2. MIT App Inventor
   - A software as alternative to android studio for the development of the mobile application.
   - Easier to integrate to fulfil the functional requirements.
3. Test smartphone
   - A smartphone to be used as a test platform for the mobile application.
   - Can be tested through desktop PC, but more suitable to use a real smartphone to simulate the user experience
4. Test server
   - The test server is used to storage etc.
5. JustInMind
   - For the development of prototype
   - Easy to use and less time consuming
6. Computer
   - For programming and execution

Meanwhile, Figure 10 shows the Use Case Diagram of the proposed UTPNS.

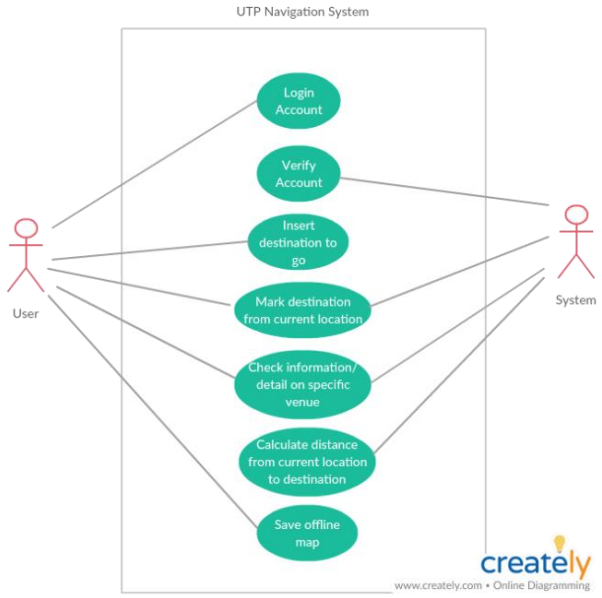

Fig. 10 Use Case Diagram

4. Results and Discussion

Figure 11 shows the main page of UTPNS app. The user ID and password are linked to the university login ID that is used to login to university-wide applications such as email and e-learning system. There are buttons for choosing to input for directions, directions, about point of interest (POI), history and logout if necessary. To start navigation, user needs to click on "Directions" link.

Fig. 11 Main Page

Figure 12 shows an example when user chooses the "IRC UTP".

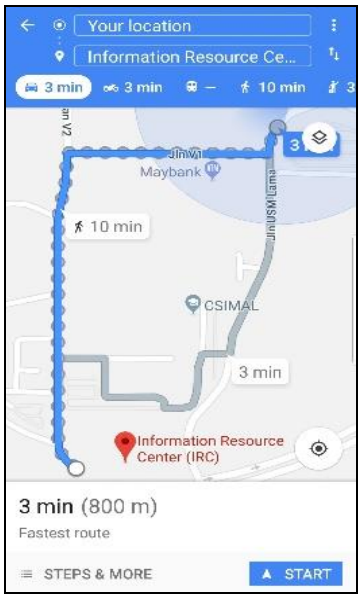

Fig. 12 Direction to input location

Figure 13 shows some of the POI in our university. We take Information Resource Center (IRC) for example. IRC has their specific timing on opening hours and sometimes students went there to find out that it closed. Therefore, this provide information on that as well as contact information if necessary, as shown in Figure 14.

Fig. 13 About POI

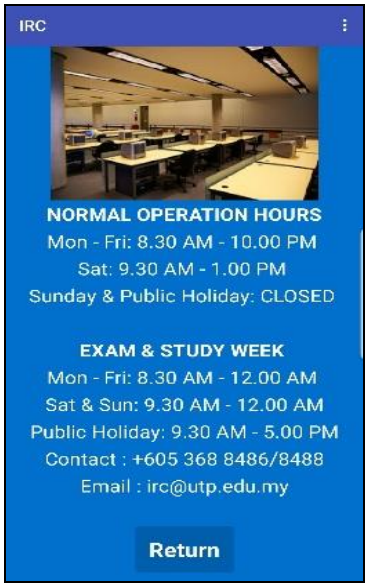

Fig. 14 Information on POI after button being pressed

5. Conclusion

The survey conducted to our university's staff, students, and alumni as well the literature survey, it shows that the problem arises in campus navigation due to less information available and the naming of the venues and buildings. This had motivated this research because it gave opportunity to introduce a mobile navigation app that is able to specify the locations in the campus. In this paper, the developed mobile navigation app for our campus is presented. The result shows that the app is working according to the planned features; in providing directions to the users.

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Afnan Amirruddin graduates from Universiti Tekknologi PETRONAS (UTP) with Bachelor of Information Technology in 2018. He is currently pursuing Master's Degree in Information Technology at UTP.

Mohd Hilmi Hasan is a senior lecturer at Universiti Teknologi PETRONAS (UTP), Malaysia. He obtained his Ph.D in Information Technology from UTP in 2017 with a research in the area of artificial intelligence, specifically Interval Type-2 fuzzy. He also graduated with Master of Information Technology (eScience) from The Australian National University in 2004 and Bachelor of Technology (Hons.) Information Technology from UTP in 2002. He has been teaching and being an active researcher at UTP since 2004, in which his research interest covers areas of artificial intelligence, data analytics, and networking and communication systems.