CONCEPTUAL DESIGN OF UNIVERSAL WIRELESS NAVIGATION SYSTEM IN PUBLIC AMENITIES (INTERNAL FACILITY) FOR PHYSICALLY BLIND PEOPLE (DISABLED)

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ABSTRACT

There are many people want to live with happiness without obstacles and burden due to physical disabilities. Since earlier the accumulation of the number of physical vision loss has been increasing around 2 million in Malaysia. Majority of them did not take care of their vision when their eye sight started to decrease. This has affected their vision as it started to become dim daily. This has obtained an eminent of interest of the researcher on an assistive technology research for public amenities in this country. It has been proven in various studies, that there is a correlation between a numbers of navigating autonomous mobility assistant for physically blinded. Therefore, this study aimed to construct a conceptual design together with cost-effective prototype design for disabled. The new product introduce of a universal wireless navigation system device with an equipped voice synthesis raspberry device to improve the quality of life for physically blinded and visually impaired. This design integrated with hardware and software tools to help the physically blinded and special group together for those who have lost their vision along their life journey due to an undesirable event. Therefore, researcher decided to develop a Universal wireless navigation system by taking into consideration the safety factors, ergonomics and accuracy of information to be provided for the physically blind people to accomplish their daily routines without any personal assistance. It will take around 2 seconds only for the participants to detect their desired location through the designated device. At the same time, participants able to obtain latest multiple features which can be used be all over Malaysia and even world. The physically blind will be obtained benefit once the government of Malaysia approved including, Ministry of welfare and World Blind Organization approval to sell in the market.

ABSTRAK

Terdapat ramai orang hendak kehidupan yang penuh dengan kebahagiaan tanpa halangan dan bebanan dari segi keupayan fizikal. Sejak awal angka kekerapaan terhadap keupaayan penglihatan fizikal meningkat secara mendadak ke 2juta orang di Malaysia. Kebanyakan terdiri daripada mereka yang tidak menjaga penglihatan mereka semasa penglihatan mula pudar di peringkat awal. Ini telah menjejaskan tahap penglihatan dan kabur pada setiap hari. Fenomena ini telah mendorong minat kepada penyelidik dalam penyelidikan bidang teknologi yang sedia ada pada setiap kemudahan awam di negara ini.Terbuktinya dalam pelbagai penyelidikan, bahawa terdapat kolerasi dianatara pembantu yang sanggup membantu mobility autonomi terhadap orang keupayaan fizikal. Oleh sebab itu, penyelidikan ini bertujuan bagi membenuk konsep yang canggih dengan satu alat prototaip peralatan ujian kepada orang keupayaan fizikal dan ini akan memberi harga yang efektif kepada mereka. Pembuatan alat tanpa peranti system navigasi ini dilengkapi dengan alat sintesis suara yang bernama Raspberry bagi meningkatkan kualiti kehidupan golongan orang keupayaan buta fizikal dan kecacatan penglihatan.Penciptaan alat peranti ini disepadukan dengan perkakasan dan perisian untuk membantu orang buta dan orang yang istimewa mempunyai kecacatan fizikal , apabila kehilangan pengilihatan disebabkan oleh kejadian yang tidak diingini semasa kehidupan mereka. Justeru itu, penyelidik meneliti pekara yang telah dialami oleh orang keupayaan fizikal dan mengambil keputusan untuk mencipta peralatan sistem navigasi tanpa wayar sejagat bagi mereka mengatasi keselamatan, ergonomik dan ketepatan maklumat yang disediakan untuk tugas rutin harian.Peralatan ini boleh digunakan dengan tanpa bantuan peribadi oleh sesiapa. Produk ini juga mencipta dengan ciri –ciri yag baru iaitu meliputi pelbagai lokasi dan identiti yang sama pada kemudahan awam di seluruh malaysia termasuk luar negera.Golongan keupayaan fizikal mata akan mendapat manfaat daripada peranti apabila

dishakan oleh persatuan buta dunia (World Blind Assosiciation) dan kerajaan Malaysia iaitu Kementerian Kebajikanuntuk menjual di negara.

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First I would like to express the humble and graceful with gratitude and appreciation to my supervisor, Associate Professor Ir Dr. Siti Zawiah Binti Md Dawal faculty Engineering in the past from semester two and three 2017/2018. Her contribution on my research prototype design and demonstrate on blind people are gave more encouraging to make this design successful. I also thankful to my co-software team acknowledgment and support that provided for this successful project.

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LIST OF SYMBOLS AND ABBREVIATIONS

WHO	:	World Health Organization
ATM	:	Auto Teller machine
R&D	:	Research and Development
GPS	:	Global Positioning System
NGO	:	Non -Governmental Agency
TPD	:	Total Permanent Disability
PPD	:	Partial Permanent Disability
GIS	:	Geographical Information System
RFID	:	Radio Frequency Infra Detection
POI	:	Point Of Interest
LCD	:	Liquid Crystal Display
AC	:	Alternative Current
DC	:	Direct Current
WIFI	:	Wireless Fidelity Alliance Inc
QR	:	Quick Response

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CHAPTER 1

INTRODUCTION

1.1 Research Background

Physical blindness is becoming a worldwide problem which affect the personal lifestyle and behaviour of the blind person as well the social economic status. The blind people's lifestyle has a deep impact on social economy and as well to their family members too. This visually impaired and physically blind people has to lean on others' assistance to perform their routines without any obstacle. Though this disabled people has learnt sign language in special school, yet they are facing difficulties in leading a normal life fulfilling all their daily needs and necessities.

There is a fast development of infrastructure within the world particularly on civil building, reminiscent of searching complexes, recreation centers, interlink railroad station that is connected to the bus terminals for daily use of individuals. The development shows that by the design of infrastructure on a building with varieties of design pattern may impress native population and additionally foreigners. However, people' are looking for latest accessible technology which will be helpful for publics. (Kadir & Jamaludin, 2012).

World Health Organization (WHO) declared that 253 million people live with visual impairment and 36 million are blind. This is a huge number in the world when compared with the current population that has reached to 7.6 billion in year 2018. Severe visual impairment has affected around 217 million people refer to figure 1.1 The 81% people are blind or have moderate or severe impairment because they are above 50 years old. All around the world, chronic eye diseases are becoming the main root cause for vision loss. Most of the people are affected vision loss and they are scared to do operation for cataract to rectify their refractive errors. Un-operated cataract leads to blindness especially in the third world country due to low income. The third world countries need

to face awareness of disease to reach to the people. The government also less focus on health promotion to blindness. This happen due to improper allocation of the funds by the responsible department in federal constitution.

During childhood blind and visually impaired people's put a lot effort to learn their special education. They're facing this just to reinforce a much better quality of life. This might return back the consequence that happens in their life. The world is keep on circulating on its orbit and new generations are coming up and at every single point of life, there are many new ideas and new technologies has been established.

At the early stage of blindness, one can study using braille machine to learn about their signs language (Tekli, Issa, & Chbeir, 2018). Much earlier, the braille machine was in typewriter model and it has been used till now. Then, touchpad gesture which has touchscreen manipulation system in a computerized solution was invented which allows data accessibility for the blind users. Moreover, blind people also learning sign language for communicating with ordinary people because some of the blind people are unable to understand those who are speaking to them because of their deafness. A common practice for blind people when they learned from schooling and rehabilitation center is on braille machines and sign languages. This is very common learning which can be understand by blind people to get benefits and lead their life style more easily. If blind people are not deaf they can speak out with others and can make others easily understood of their request. Blind population without deaf might face controversies in visualizing their sign language but they are able to communicate to get their request being fulfilled.

In certain situations, blind people are so often visiting to public amenities in their daily routines. Design of facilities at public amenities keep on improvising by the infrastructure developer management in order for an easy access by this disabled group.

Accessibility to these facilities are systematically accommodated in public amenities yet there have limited accessibility for blind people to access them.

In urban areas, blind people are so keen to use public amenities and their desired locations such as bus terminals and KL Sentral areas just by using walking stick or walking cane. Commonly, they are accessibility is more towards public amenities such as washroom (Disabled lavatory), Automatic Teller Machine (ATM), Ticketing counter, lift, and escalator for their needs. For an example, in order for blind people to access ATM and disabled toilets in the shopping mall, they may require assistance from security or surveillance that are around the place to reach these places.

Even though the sign of ATM and disabled lavatory area unit are shown clearly on-screen synthesizer, yet the physically blind people are using their walking canes to get supported and sense of the special pedestrian route that they had practised through blind awareness educational program. In some of the places, the pedestrian route is not fully completed and in some cases, it could possibly lead this people to undesirable places. To avoid this kind of problems, blind people have to be more independent in recognising the signs that are mounted on the doors using their own hands or by feeling it. This could assign confidence level for blind people to access lavatories without being lost(Mamee & Sahachaisaeree, 2010).

People those are physically blind needs an ergonomic design technology that should are suitable for them. The design must fulfil the additional requirement to enter and exit from the place that they do access. Basically, blind people use to look for easy way enter and exit from the places they wish to go.

An ergonomic can cause the long-term impact on blind people's health caused by risks and accidents whenever they access crowded place or place that they have not visited before. Since technology has grown very widely especially on telecommunication field, there are multiple devices had been invented with new features such as GPS (Global Positioning System), Bluetooth, 3G data for the fast network operation and to search application through telecommunication. This has been developed by the software infrastructure experts from Research and Development (R&D) all over the world(Serrão, Rodrigues, Rodrigues, & du Buf, 2012). Blind people are also a part of using the telecommunication network through cellular phones and uses network system to listen to the voice synthesis, songs, but rather than this most important and particular usage is to communicate with their friends and relatives including their children except viewing or watching anything. System also can help to find the solution for the obstacle faced by the blind people during walking in the complexes.

Comprehensible building development on public amenities are installed with wireless network (WIFI) meanwhile individual premises who runs their own business has installed with latest technology wireless network system for customers' usage to abstain from the search application of the network for non-customers(Ren et al., 2017). Unfortunately, this network is only used for their application purpose but the building structure and layout that designated with GPS had not progress due to some restricted network constraint in their development. Their GPS is unable to penetrate in the indoor building.

Moreover, ergonomic is playing a serious role in this development for the mobility of the blind people. Ergonomic ministry focuses more concentration on the blind group. Ministry had established professional task force and develop strategic plan to provide training and awareness program for blind people. The related department also develops fillip ideas to encourage blind people to learn more on future facilities that could be

introduced in the country development(Hussein & Yaacob, 2012). The Ministry has collaboration with Social Welfare Department Malaysia to enhance blind knowledge to become an ordinary citizen of Malaysia and to excel in several skills. Besides that, the government engages with Professional Bodies such as NGO (Non-Government Organization) and arrange ergonomic awareness programmes at public amenities in order to exposure on latest development for blind people in Malaysia.

Currently, most of the blind people are using walking stick to find the obstacle that are on their way during walking. This could be manual mode sticks or costly walking canes from latest development which could help them to detect and reach the desired destination without facing any difficulties(Costa, Fernandes, Martins, Barroso, & Hadjileontiadis, 2012).

Moreover, blind people are looking for advance and trustworthy communication device that can help them to reach their desired places. Since a lot invention using navigation system on new technology is introduced in the market yet invention for blind group still in small number in market. Blind people want to use modern technology tools which has navigation with voice synthesis for mobilizing in public amenities which can easily define their desired destination without interrupting their daily task. This will reduce surveillance assistance during mobilization. In summary, there is a need to design a device that can assist blind population for mobilizing without any assistant for their daily activities.

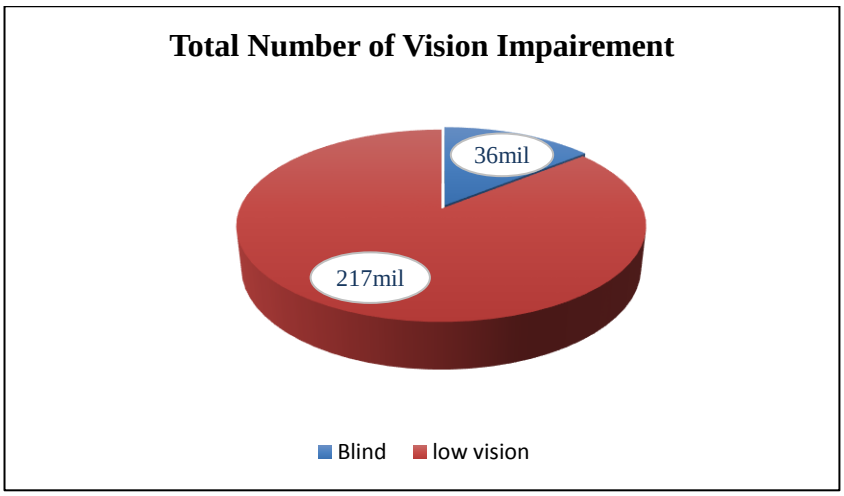

Figure 1.1 World Number of Physical Blind population

1.2 Significance of Research

Physical blindness pedestrian route detection with accurate location is the master key task for computerized technology which is to interact with machine, language, location, and human. A system is used to detect and analyze designated location with parameter in real time studies. A developed wireless navigation system can be used in many places and finding ways such as pedestrian routes towards ATM, washroom ticketing office, restaurant and other related to human business places.

Nowadays, one of the major problem faced by physically blind people is unable to mobile independently because they are lacking with intelligent device. Therefore, a wireless navigation system with android application device is important for the blind people to live a comfortable lifestyle. The Wireless Navigation Bluetooth device can detect the route for the public amenities and some complex environment. It will trigger alert and assign information of the designate place before the physically blind people has enter the route therein. The research able to bring advantages to all the blind people.

1.3 Problem Statement

The facilities in public amenities is a real-life environment such as change of location and various distances depends on the building architecture development are currently one of the most challenging tasks for vision impaired people. Generally, location is designated with certain specification using certain applications for ordinary people. Physically blind people are unable to find the location precisely. Therefore, a fast and intelligence navigation system is needed for this group of people to detect the specific location. (Costa et al., 2012).

1.4 Research Aim and Objective

The aim of this research project is to propose a Conceptual Design of Wireless Navigation System for the Ergonomics of the Physically Blind people. In order to complete and accomplish the aim, there are several objectives need to be achieved which are as below:

1. To identify the difficulties faced by blind people to detect the desired destination.
2. To design a prototype Universal Wireless Navigation system for physically Blind people.
3. To validate the prototype application for the blind group of people.

1.5 Scope of Research

A preliminary observation and study on wireless navigation system design for blind people in Malaysia was conducted in Kuala Lumpur Sentral. With a current economic growth and endeavors developments by various millennium projects, no such studies have been taken into consideration and done in Malaysia. This research was to gain systematic effort to gain a new knowledge and with a proper investigation and studies mainly to

determine the route of a facility at public amenities for physically blind group especially in Malaysia. This research is conducted with significant studies and development and can further provide other researchers to use as a benchmark for future research with new improvisation for physically blind people in Malaysia and overseas.

1.6 Research Outline

This research consists of five chapters. The brief review about the content of each chapter is as below:

1.6.1 Chapter 1: Introduction

The first chapter of this thesis began with a structural background of the study which is about the physically blind people's characters and their behaviour together with Wireless Navigation System for them. It also includes the problem statement, aim and objective of the research, scope of study and project outline.

1.6.2 Chapter 2: Literature Review

This chapter elaborates on the literature reviews of the related subjects with particular design modules and foundation for this research project. The main part of this literature review is based on articles from journals, books, article, and internet. Basically, the review of the scope of this project is covered with characteristics and behaviors of the blind and visually impaired people, the impacts including the pros and cons for the navigation system. The scope also reviews existing designs and some of the researches does not match to the blind users and also lacking of understanding regarding blindness.

1.6.3 Chapter 3: Methodology

Above chapter describes and concentrates on the methodologies used to design the wireless navigation system for blind group. The development of the facility of the design and the significant data collection at public amenities are evaluated.

1.6.4 Chapter 4: Result and Discussion

This chapter focuses on the result of the proposed wireless navigation system design by using Bluetooth 4.3 version with the Android navigation system which can be used for physically blind people.

1.6.5 Chapter 5: Conclusion

This chapter consists of elaboration of the significances and pros outcomes of the research project study to the public amenities facility. At the same time, it also assigns recommendations for further improvisation with the current expectation by physically blind people.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A literature review is discussed about the physically blind people's mobility at public amenities and aspects to prevent difficulties and contribution of other organization in previous studies. The researcher using mechanism of gathering data widely and relevance specification details and some useful information which is able to generate and support the research report's discussion and finally concluded with the conclusion of the research study. The process is inclusive of collection and analyses of articles from journal's, reviews from documentation and relevant resources from a network database. Moreover, feedbacks from physically blind people and their messages also had been gone through for the purpose of this research. This research report also highlighting briefly on building site environment, location designation, NGO activities, Blind People's Safety, Health training and awareness programs for physically blind people and risk while using pedestrian route.

In buildings, the special pedestrian route for blind group is not designated completely and are still incomplete even in shopping complexes (Costa et al., 2012). Researcher has developed a device known as Blavigator and in other word called Smart Vision which is a mobile navigation system that helps to provide information about obstacles for blind and visually impaired people wherein they can find ways to move to their desired location(Plant, 2016).This device is specifically developed for Zebra crossing and building entrance. It has two-way communication module and the device receives the input signals to make logic decision and the user will get the information from the system that is hold by the blind people. The technology that use by researcher is Geographical Interface System (GIS) in order to activate the GIS system at the indoor environment

building, it needs WIFI connection to make communication between the system and blind people's device. The result of this research shows that the usage of this navigation device is significant(Bousbia-Salah, Fezari, & Hamdi, 2005). It is also advised in the research that this development can also be used as an electronic travel aid which can assist the mobility of the blind people. It also described in the research that this GIS system is also enhanced with microcontroller kit and software programming on navigation using coordination of certain locations as required. It shows a significant result whereby it can be useful for the blind people but they need to wear this portable equipment and the sensor point known as footswitch at their feet. It could be heavy and could cause back pain if they are walking continuously for a long period and can become a chronic disease for the blind. Rather than this it can affect the stem cell of the blind people's bodies if they continually wearing this electronic part.

2.2 Physical Blind Essence

Disabled are very unique person in this whole world compared with ordinary human beings. The interaction by the disabled with ordinary human being is quite different due to the activities they perform and their communications. In disabilities divided into four categories such as mentally disable, hearing impaired, visually impaired and speech impaired. Besides, that, Total Permanent Disability (TPD) and Partial Permanent Disability (TPD) also a part of disability.

Physical blindness is considered to be the hardest disability. They can communicate with others but they are unable to see the nature that is around them including the latest technology growth such as high tech buildings and public amenities. Moreover, they are unable to visualize the beauty of human being and other living creatures. Visually impaired who has low vision are able to see but not with clear vision or they are unable to see as the result of the mother nature. This the reason they find difficulties in improving

fundamental relation between people and this affects social relationship due to the interruptions while communicating or comprehend openly with others.

In early stage, the information design and education for blind people results in a successful interaction such as good and fluent communication with their parents since childhood. Compare to ordinary people, the blind and visually impaired people need to enhance their personal competency skills. In terms of socializing with people around, they are looking for suitable relations in their social environment in order to have friendship because they should be someone who can understand their disabilities. Feeling of lack of self-confidence can bring negative thoughts when they are meeting new friends at the same social environment. Thus, the findings of the study must be taken into consideration and an environment that are able to support, enhance and satisfy the physically blind people should be created. According to Dursin (2012), disabled person should have positive thoughts and expected behaviours such as having healthy communication, get active role in communication and make friends with other people having high level of confidence.

2.3 Public Amenities in Malaysia

Malaysia is focusing on the development and improvisation of various sector through the Malaysian Eleventh Plan (MP 11). One of the sector is building infrastructure for the country development such as Kuala Lumpur NU Sentral , Kuala Lumpur Tower , Berjaya complex and etc. The research and development industry is a part of nation's backbone to develop infrastructures that are involves in developing building environment for blind and visually impaired at the public amenities. According to Malaysia Standard, it has designated from representative which is producer, consumer user and stake holder for the development. This standard was adapted from World International Standard which consists of standard of regulation for disabled population used that the (MS 1184) 2002.

This is more creditable to focus on building good facilities for disable people in Malaysia. The Local Agenda 21 (LA21) also a part of council that gives master plan for the building development. Based on this standard, the guideline has been established to be followed accordingly (Hashim et al., 2012). Unfortunately, the system of design has been derived to create a special pedestrian route described as tactile paving design for physically blind people. The tactile paving is a shape that can assist to a particular route by using the shod feet to detect and distinguish guidance for blind. It has various types of braille paving used in construction road, building and road sidewalk (Nasir, Lim, Nahavandi, & Creighton, 2014). The name of the braille paving pedestrian used by physical blind are as below:

I. Blister paving is used for pedestrian crossing. Figure 2.3(a) shows the design generated as flat rows with top blister in square pattern.

II. Offset blister paving is design at train station and tube platform to educate warning sign for the visually impaired. Figure 2.3(b) shows the design consists a flat top domes (blister) tile that are used to indicate potential hazardous or junction area.

III. Corduroy paving is a design which comprises of round bars running along the way across the direction of pedestrian walking route. This type of surface warns the specific hazardous.

IV. Blindness detection of the junction of the tactile for their turn of direction to which location to prefer it. Figure 2.3(c) the dome has installed in the middle of blister paving tactile.

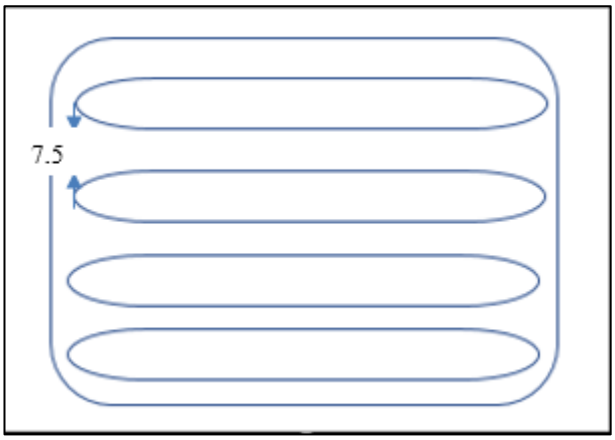

Figure 2.3(a): Pathway tiles

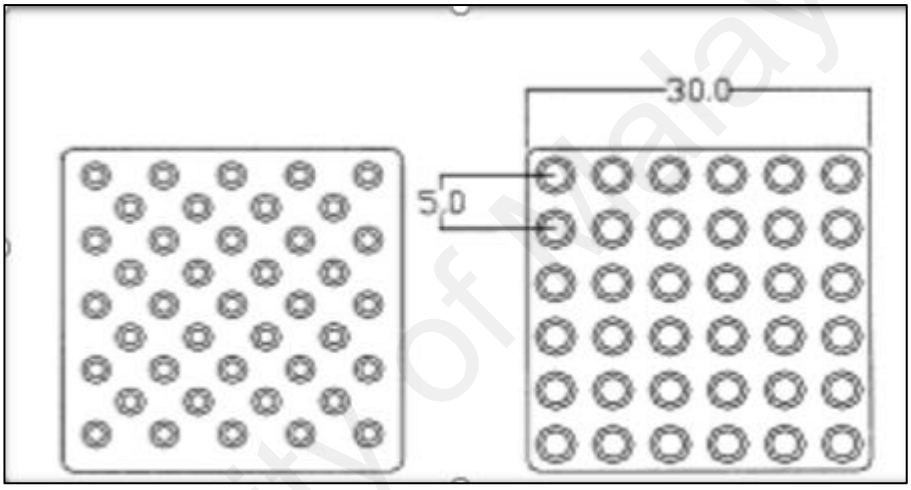

Figure 2.3(b): Two type of Dome tiles

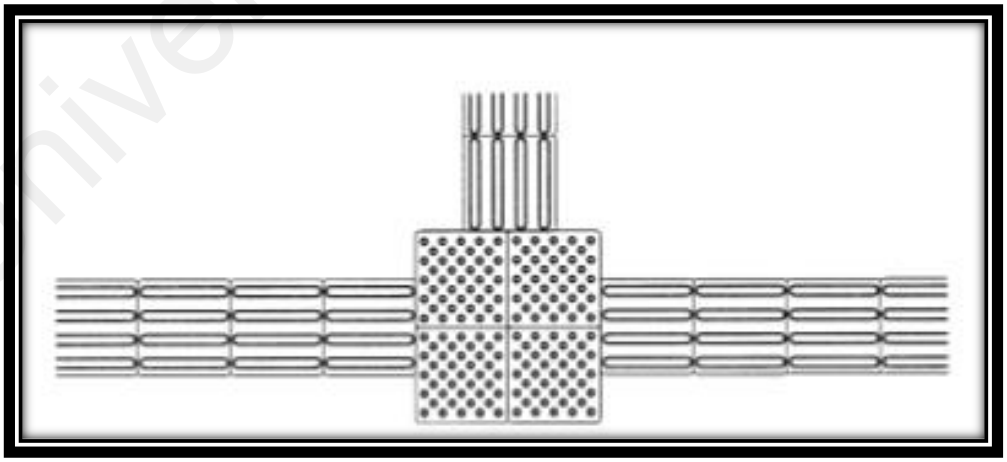

Figure 2.3(c): Setting of a junction of existing design

2.4 Design of Public Amenities for Physical Blind

Sometimes, multiple mismatch public amenities facility design is developed by developers. This sort of public amenities could not be useful for the blind people because it has some problems such as incomplete tactile pedestrian route in certain location or might be tactile pedestrian pavement which are not suitable at the location. Other than that, the desired location is too far for them to reach at the expected time. As an opinion, developers of building environment should have to prepare questionnaire to get the public advice to know the feedbacks especially the physically blind people's responses as per their requirement. The responses might be positive or negative but it gives room for improvement on the particular development of public amenities in the building environment. In the report, the researcher advised that accessibility to the terminal from the public amenities led to inconvenience and prohibits them from moving around freely for the disabled people. Normally it is stated as intercity for another destination (Soltani, Sham, Awang, & Yaman, 2012).

2.5 Design Of Public Amenities Architecture

A public amenity is designed with certain criteria and structures. Most of the public amenities is structured in higher level which is certainly an obstacle for physically blind people to attain therein. Some location was designated within ground floor, first floor and staircase and escalator areas which are normally far away from walking distance. This causes laziness to the ordinary user. Physically blind people are uncertain about this location yet they need to attain those places in order to fulfil their needs. Mostly, physically blind people's mobility relies on moving from one building to another for survival of their own selves and also their family members. Therefore, the system design should be compatible to be use by the blind group.

2.6 Difficulty of Indoor Public Amenities

Basically, if there is an involvement of environment found in a public amenity, then, information pertaining to the location, route and angle of positions must be prepared in the indoor amenity. This to avoid difficulty for the accessibility of the disabled people. Mobilizing is moving or shifting from one environment to another. While mobilizing, there are various types of obstacles such as staircases, escalators and blocking rails on their way which can bring complications to blind people. This causing difficulties to blind people as they are moving to offices in indoor buildings. Sometimes, these offices might change to new locations. This could cause uncomfortable situation for this blind group because they might face difficulties in finding the new location again. Sometimes, their safety also will be in risk and they might have lost to other places.

The major concern of physically blind people is, being uncomfortable regarding their safety when they are mobilizing independently around the public amenities. A blind person can face many complications in self navigation and also, they are not familiar with outdoor public amenities environment. They are using multiple skills and aids that designated by professional bodies such as NGO's, Blind association training centre those who are experts in the field of mobility awareness to help them to move around safely at outdoors. Basically, from the professional training they have started to use the canes and try to mobilize independently. However, their practise is not fully applicable for all sort of blindness.

In the world, designing aids for blind and visually impaired is not quite new for anyone. An integrated computer technology has been improving globally. Various product with high technology devices are invented to aid the blind people and it is getting more and more advance to find solution for the problem and this is not applicable for the developing countries due to expensive cost. (Mehta, Alim, & Kumar, 2017). Many

professional development team came out with various type of the studies on outdoor and indoor issues with varieties of problem-solving techniques in order to attain a safe navigation system for the blind population. Multiple advanced technology also considered for blind people's mobility such as Global Positioning System (GPS), Navigation device (NAVIG), remove sighted guidance, Infrared Detection system but the blind mobility performance has improved through the mobility training which has been conducted by professional trainers.(Riazi, Riazi, Yoosfi, & Bahmeei, 2016). The researcher has done survey internationally on typical design and the ability of blind people to access in the building independently (Sánchez & Sáenz, 2010). Researcher has developed metro navigation GPS device to be used by blind population but the device is unable to penetrate into underground locations. Therefore, researcher has decided to develop Nintendo WIFI system as virtual environment to be used (Hahn, Bolles, Fränzle, Fröschle, & Hyoung Park, 2016).This device applicable with WIFI system and it was uploaded with software to navigate through any kind of environment.

GPS system is used widely for all the application, however the blind and visually impaired population face difficulties in identifying the routes for their mobilizing. Many of them using different strategies based on calculating visited location and they keep the record of pass data. The places they had visited such as bus station, slopes and staircase had been counted and kept into the memory disabled people. From the author (Riazi et al., 2016) majority of blind people never used GPS technology device because it consist of a little information embedded into the device. Normally this GPS device is very useful for driver who is driving cars and public transport that searching for their desired destination. GPS is user-friendly for outdoor environment because the range of receiving signal is wide but when they use it for public amenities, the system will face trouble on receiving reception and unable to get the network to detect the destination exactly.

2.7 Risk on Inappropriate Canes

Major argument of all blind and visually impaired population is using a quality design of walking canes. They believe walking canes are reliable because it's locally manufactured products and also very fragile. Some walking cane can be bend if necessary and but is not strong enough against obstacles detection (Plant, 2016).The design of walking canes made with a sharp at end notch that can cause them to be stuck in small holes on the ground and at the same time can be broken.

This kind of incidents could bring difficulties for the blind people to move around in public amenities. Import design of walking canes is very useful for them because it is designated with warning system which help them to detect the obstacles.(Riazi et al., 2016). There is an improvement that can be made on this walking cane. A new development design known as control steering angle robot can be used as a path guidance in this walking cane. In this design, a handy mobile device is developed with software for blind people. Researcher advises that the electronic gadgets are suitable to navigate an independent mobility through the vibration and audio warning synthesis through continuous audible beep signal. The electronic smart cane design that was proposed by the author is sophisticated and incur low cost according to the ability of the blind user. However, the user will face some difficulties in detecting the distance of the object and distinguishing the obstacle while they are mobilizing (Mehta et al., 2017). Generally, the design contributed results in lower evaluation from the blind user because it could not detect obstacles that are found after certain length.

2.8 Way Finding Application System

Many research and development in the provision of navigation system aids that has been developed to create easy way of finding path for blind population. The interface design has been introduced with Smart phone technology device to assist

blind and visually impaired users. The users of an interface on the display can adapt the requirement and preferences from a various group with different particular development. In this screen has designed base on the android reading software with blind Apps launcher. Based on the rules proposed by (Rodriguez-Sanchez, Moreno-Alvarez, Martin, Borromeo, & Hernandez-Tamames, 2014) the system is performed with a series of flick and clicks command cursor in the device by selecting and double tapping the menu. It can open the selection menu as required by the blind people. It has several features that combine and diverse an interaction technique based on the menu browsing. In the application had gesture and fixed regionalisation software together with optional vertical and horizontal movements for selection. It has full screen of version application appears on the screen. Users need to select by tapping the application as required. For an example, information such as "where you want to go", "Help" and "Where am I" application applicable in this device. Since smartphone gadget application assigns a lot of changes in people life style, blind users are able to access this application for their daily use but had limitation as well for this device due to ON and OFF screen. (Rodriguez-Sanchez et al., 2014).

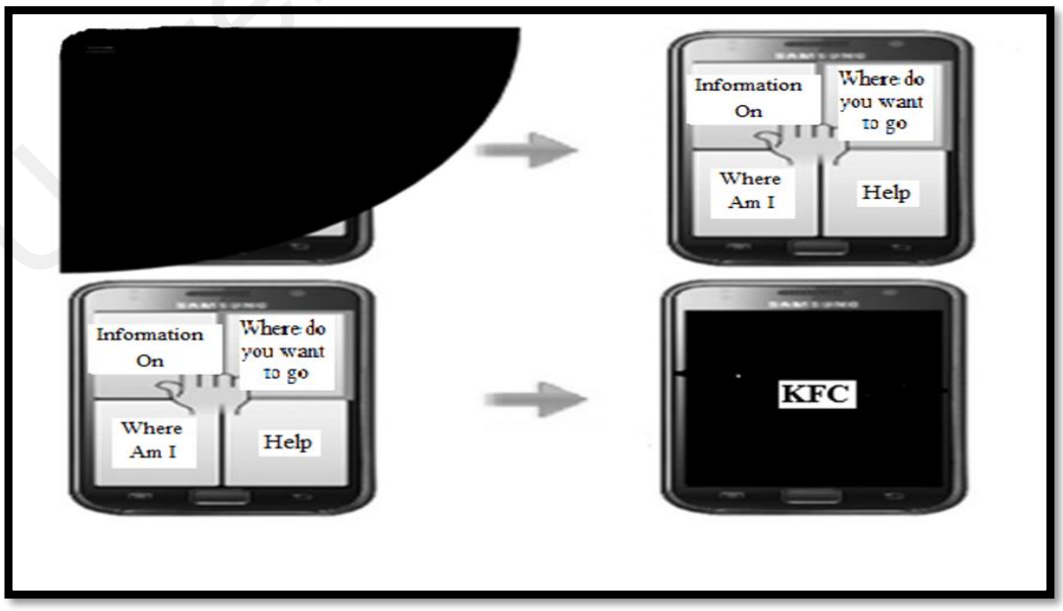

Figure 2.8: Blind-App Launcher using fixed region in the way to find application

Practically, detection of obstacle will occur if there are any obstacles while they are walking with this device being fixed at foot. This method is applicable in many electronic products such as foot device, accelerator and gadgets for blind used. The device is designed with audible recording feature and also attached with map to the desired point of interest which were calculated through distance that travelled by the user at end of destination. User need to decide which location route to response, then they will use their own interest of selection and performed it to the keys. The application keys designated according to their decision. The information is stored in the device and function depends on the knowledge of the users(Rodriguez-Sanchez et al., 2014).

2.8.1 Android Way of Finding Software

Many software engineers are developing various type of software. Example by using Radio frequency identification (RFID), Wireless Personal Area Network (WPAN) centred on a smartphone or Personal Digital Assistant (PDA) included with GPS applications devices for blind users. However, the system should be compatible and comparable to a device that developed specifically for physically blind population. One of the popular device to finding way for blind people is using the QR (Quick Response) code system. This system is used by the serial barcode. The design of this system used through the goggle glass which they are wearing as a spectacle is an inclusive of camera, microphone, speaker and numerous other sensors. This system is generated by using coding processing system by the android application software to transmit the constructed layout of the destination chosen. If blind people start to pursue the android application, they must be inside the location as much before pursues the application. This is to detect the QR code and if the QR code is peeled off or damage, then the android application will be unable to send the signal to QR coding. QR code sign were pasted based on the map and building layout. An android application system has its own library to deal with speech voice synthesis. This device is able to convert the speech to other languages such as

Arabic, Malay or Chinese. Language is definitely not a barrier to setup this android application. First of all, the implementation need to be done by sighting the construction of the building map, edit location information ,linearized and uploaded it to web server to operate the android application to be accessible for the physically blind user's (Al-Khalifa & Al-Razgan, 2016).

2.9 Summary

In conclusion for the literature review, existing technology helps a lot for physical blind population. They obtain better living and work performance. Unfortunately, the current technology does not fully organize with advance function thus they are unable to utilize it. The imperative statement is supported to blind and visually impaired people by the orientation, mobility instruction, reliable electronic device that provide a good solution for blind population.

CHAPTER 3

METHODOLOGY

3.1 Introduction

The research study was conducted in qualitative standard methods to study through observation, including context of events and circumstances. The major purpose of this methodology is to understand the difficulties on mobility faced by the physically blind people at the public amenities. The researcher intended to design and develop a new device known as universal navigation technology. This device will be user friendly and can assist the mobility of physically blind amenities. This study was conducted at several public amenities such as in KL Sentral and Commuter Station. Participants were physically blind people and they gave very good contribution to this research project plan. The physically blind users between the age of 35- 60 were involved in this project. The elderly man was around 65 years old and was participating and gave dedicated contribution in this evaluation because he lost his vision recently and he needs assistance to perform his daily tasks. The research has been conducted from March to April 2018 to test the device that was developed for future endeavours. Findings drawn from research assessment worksheet was analysed and interpreting data gave a better understanding on this research to higher advanced level.

The Figure 3.1 below is the flow chart on the process and analyses that are conducted systematically on public amenities and physically blind in Kuala Lumpur Sentral.

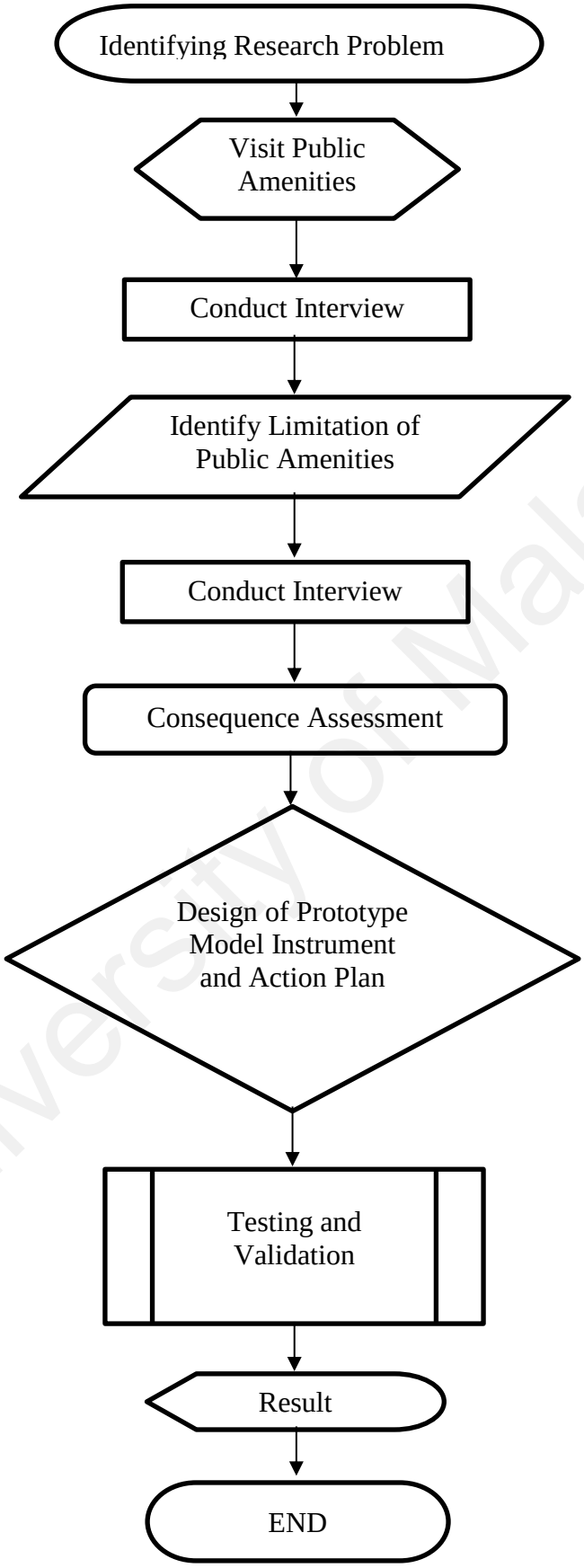

Figure 3.1: Flow chart of process

3.2 Research Method

This research project report has been designated with multiple stages which consist of five stages of development. There is on the interview session, survey, critical solution electronic device, software development and testing and validation thus an approach with a quite new combination of design and studies of the literature review guided for this development. This is a new design in this generation which consist of a universal application whereby the device can detect any location for the blind population to easily and independently move without any personal assistance in indoor environment. The development of the gadget comprises of hardware and software. The hardware circuit design is developed through the printed circuit board that will communicate with software which is developed in the gadget using Bluetooth application. The critical part for this design is the communication of interface between hardware and software. Interface communication is the communication of the device's software with human being which assist them to detect and get signal via voice synthesis. Thus, this device can be known as a device which has value added with latest technology for the blind population to perform their daily tasks without any assistance.

The first phase is, conducting the survey with a number of blind and visually impaired people at KL Sentral. From the feedback and elaboration that were given by visually impaired people, it is a serious issue that was facing by them do perform their daily task without proper assistance from the high technology device. The observation method was chosen and practiced in this research project because it can obtain reliable direct sources, fast, facile and versatile. The assessment tool was included by the background of the physically blind people's age, gender and percentage of usage of public amenities. Evaluation of usage public amenities also considered for this resign design.

3.3 Face to Face Interview with Blind People.

An interview has been conducted as non-metrical whereby nominal ordinal data on blind users in Kuala Lumpur pertaining to their mobility at public amenities. Five blind and visually impaired users was interviewed. This was a tool for self-reported directly to the person and interviewer. This interview session was done with several questionnaires to the respective person to get big picture of the public amenities structure in spite of their mobility in indoor areas. An interview has been carried out about the facility and easiness of using public amenities for their daily activity such as lavatory, ATM, ticketing machine and so on. From the feedback of the questionnaire that was done, 90% of the blind people responded that they need assistance to mobility an independently. They also feel grieved on the public amenities development that are related to these departments which needed to be improve in the sense of the structure of the design. Participants were advised on the problem that they were facing based on my questionnaire to them. In the interview session, particular destination was chosen and thus it leads to more ideas for further development on devices. Main hostile incident that was faced by blind people is the direction and relocation of some indoor facility in certain places.

Table 1 below presents the survey questionnaire that has conducted to blind people. This survey has been validated with an ergonomic expertise from Mechanical Department University Malaya. The key question has answered depend on their difficulties that faced against on the current public amenities architecture.

Table 1: Survey questionnaire

Number	Survey Questionnaire
i.	How are the toilet facilities in public amenities?
ii.	Is it easy and manage to find the Public Toilet amenities?
iii.	What kind of feedback you facing from people surrounding?
iv.	Does surveillance provide help without requesting?
v.	Any support provide from helpers?
vi.	Separate washroom or toilet is compatible?
vii.	How get in to ATM or Bank ticketing counter
viii.	Do you manage find easily the restaurant
ix.	Can operate hand phone (cellular)
x.	How about the Ergonomic issue during using the public amenities
xi.	If we give apps system with gadget device for your use to find desire destination. Are you agree to use it?

3.4 Survey on Tactile Pedestrian Route in Public Amenities

The survey was distributed to the blind participants that frequently use pedestrian route for it is safe to access, convenient, and comfortable. A study of systematic approach was conducted for the pedestrian route usage at public amenities. Design of survey had come out with multiple data analysis for the special pedestrian route walk. Details of data is consisting of the frequency of tactile pedestrian walk usage in a day, week, and month. The same goes for other public amenities usage such as ATM, disabled lavatory, lift, escalator and restaurant.

Figure 3.4(a) presents an incomplete tactile pedestrian route walk for the blind people. Sometimes, when the blind people are walking, they found out that the tactile pedestrian route is missing in halfway. Thus, it made them to walk on ordinary pavement

which is definitely a big problem for them. They had experienced this situation several times during their journey. Regularly, blind people tend to miss the path due to this kind of continual disconnected pedestrian route. Besides that, there also some renovation made on the peel of the tactile pavement and then replaced with new ordinary pavement without tactile correct design. Figure 3.4 (b) shows that the feedback from physically blind interview session whereby disabled people always confused when they are heading towards disabled lavatory due to missing of tactile pavement. Sometimes they walk via braille pedestrian route and all of sudden the tactile divert to lift location the continuation to the disabled toilet has discontinue. These are the major problems raised that has been design by the infrastructure development stakeholder. Refer to Appendix B

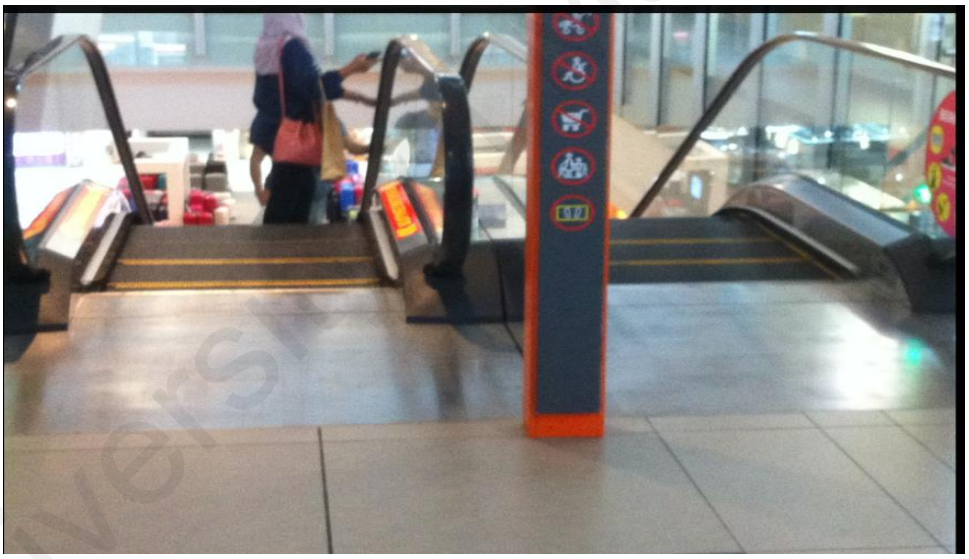

Figure 3.4(a) Incomplete escalator pedestrian route

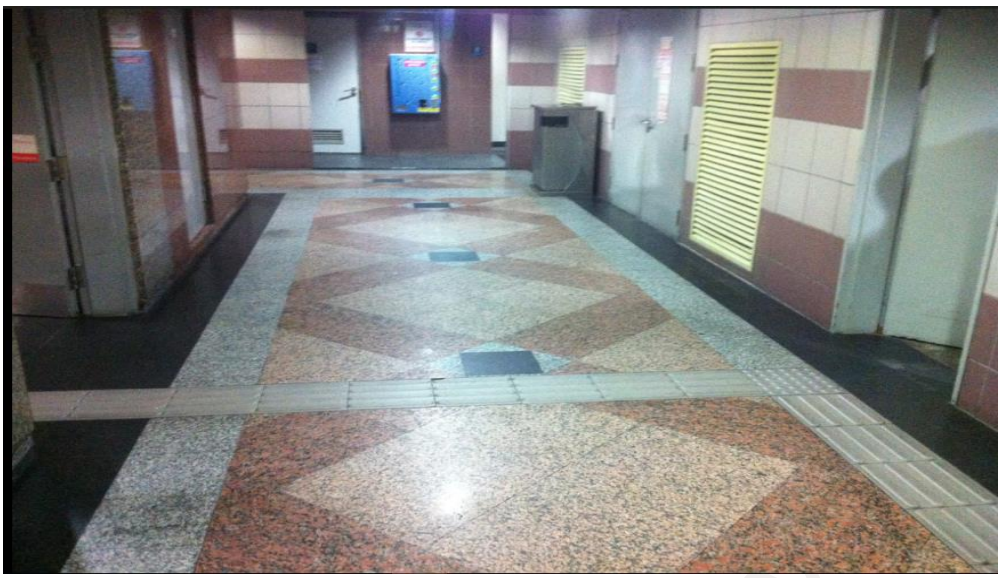

Figure 3.4(b) incomplete disabled Lavatory (toilet) pedestrian route.

3.5 Research Investigation and Direction

Based on further investigation, a conclusion was made based on the complaints of physically blind people. They complained that developers and agencies those who are designing public amenities are not giving serious concern, attention and importance towards the needs and demands of this disabled group. Though it was made very sophisticated and very standard and full of quality, yet it brings many obstacles and difficulty for the mobility of the disabled people. The most common issue that was faced by the physically blind people is the accessibility to the disabled lavatory independently. In some cases, the disabled lavatory for disabled people are designed and developed at the corners of building according to the advice of the infrastructure developers. However, some designs were developed on the personal perspective of the architecture. This cause in difficulties for the physically disabled people to find the disabled lavatory. Thus, they may need to use their hand to find the sign of disabled symbol. Not only for this desired destination, there are other locations that also has the same issue such bank, ATM and outdoor public amenities such as public transport as well.

In additional, most of disabled people use bank teller to withdraw cash. Physically blind people tend to use their experience of braille knowledge that they had learnt from special disabled schools to perform the deposit or withdraw cash. Yet, they need assistance from a guide or other people in order to reach ATM and also to click in their pin numbers as well. Sometimes, they tend to get help from bank securities to reach to the teller. Sometimes, this can be dangerous for their safety whereby the people whom have helped them in the beginning also can cause problems such as stealing their money, kidnapping or even hurt them.

3.5.1 Risk Factor Usage Public Amenities

Disabled people also concern about the risk they are facing in the current design. Sometimes, the floor could be slippery and can cause risks and accidents to them because they are unable to see the floor's condition. Sometimes, the tiles might be damaged and this could hit them to fall or even get injured in their legs while walking through it. They could not feel it thus unable to escape those accidents. They could also be lost whereby they might miss locations and ending up being in different areas and also might get hit to other objects or wall on their pathway. The disabled people tend to keep the frequent places they use to visit in their memory because they use to move around the places a lot of times. When the desired location has been renovated or relocated, they tend to face risks and difficulties on attaining the place.

3.5.2 Ergonomic Factor for Physical Blind People

In the feedback of survey, highlighted about an ergonomic issue for the disabled. This ergonomic structure playing an important role for physically blind people in the public amenities areas. A blind person usually walks using walking stick in order to find the places. While doing like this, they have to bend their neck down to find the pedestrian route with correct indication tactile location and path. Bending neck can cause chronic

cervical spondylosis disease or they can face neck pain and spinal disease if it continues for long period. (Jordan & Escobales, 2015). Disabled people to abstain from the risky situations and accidental incidents that happened due to the ergonomics problem are very common(Jordan & Escobales, 2015).So that an ergonomic is part of disabled activity for this design.

3.6 Guideline and Procedure

All the observation and communication has conducted by the same person to eliminate the confusion faced by the disabled people. Before the data collection, physically blind people had visited some Public with Disabilities (PWD) places that are accessible to understand about the research studies that on physical barrier faced by disabled(Bashiti & Rahim, 2016). The particular researcher had done the questionnaires and distance studies for the public amenities location to test the future device. Simultaneously, the validation of the questionnaires was done and examined by others to ensure the consistency of each specification.

3.7 Wireless Features

The gadget is designated using wireless features which comprises Bluetooth application. This Bluetooth application is a very common application in all android gadgets in the market. It will not face any interruptions from external signal because the device is designated with the built-in application in the gadgets. Therefore, the detection of signals will be wider and can past through the indoor environment without any interruptions. Compare to other wireless system, Bluetooth application is much easier and best for an indoor and outdoor environment.

3.8 Prototype Design

The Prototype design has 3 constructed sections known as Layout of the Schematic Circuit diagram, Software development and Programming with Universal destination coding.

3.8.1 Schematic Circuit

i) Design schematic of circuit which consist of BLE (Bluetooth Version 4.0) Model with signal circuit to the main microprocessor board.

ii) Design of schematic layout for the circuit board of incoming and outgoing voltage of microprocessor, Crystal oscillator and LCD (Liquid Crystal Display)

3.8.2 Software Development

Android software application is selected for this development due to the compatibility of the gadgets. This will be the common software which is much easier to write source code for various application. Modification of code in the source is not difficult in this development. Any modification which is required to change or establish new features can be developed in the android software.

3.8.3 Programming

The programming of Android software into the gadget is through the upload of the encrypted source file into the gadget in order to activate the application. From the programming of source code file run the application the source code to generate the icon BLE to search and detecting the desire location as require.

3.8.4 Testing and Validation

The complete design of the circuitry and software application will perform a validation test to identify the presence of Software bugs, synchronising testing, timing

test for detecting the desired location and circuitry validation to test the input and output signal in order to prevent the overload voltage for signal. Then, final validation of the product will be done with a blind person in order to assure that the device is functioning as per specified requirement and bring advantage to the blind people.

3.9 Summary

The blind and visual impaired people's pedestrian route is very important. Based on the study, many of the place need to refine and design new systematic approach system with optimum device for the disabled people. We had done a number of survey questionnaire for disabled people's in several places. The systematic wireless design will be discussed in the chapter 4.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Introduction

This chapter presents the result and research method that is universal wireless navigation device required for physically blinded group while using the public amenities. This research project chapter is referred to the methodology requirement that has been conducted for physically blind people that has been listed in chapter 3.

4.2 Data Collection

During the observation, the number of the blind users of public amenities are recorded. Hence, detailed data on the accessibility of male and female participants at public amenities was collected. Table 2 shows a tremendous increase of physically blinded male people at public amenities. Based on the observation that was conducted for a month, some of the male followed their visually impaired wives. There is a less mobility of female blind people at public amenities. They only follow their spouse to desired location and sometime, follow their children.

Table 2: Percentage of Mobility at Public Amenities by Gender

Frequency	Daily (%)		Weekly (%)		Monthly (%)	
Gender	Male	Female	Male	Female	Male	Female
Ticketing office	68.8	31.3	76.79	23.21	68.12	31.87
Lavatory	71.4	28.6	85.71	14.29	77.5	22.5
ATM	100	0	90.48	9.52	90	10
Lift	61.5	23.1	83.52	16.48	90	10

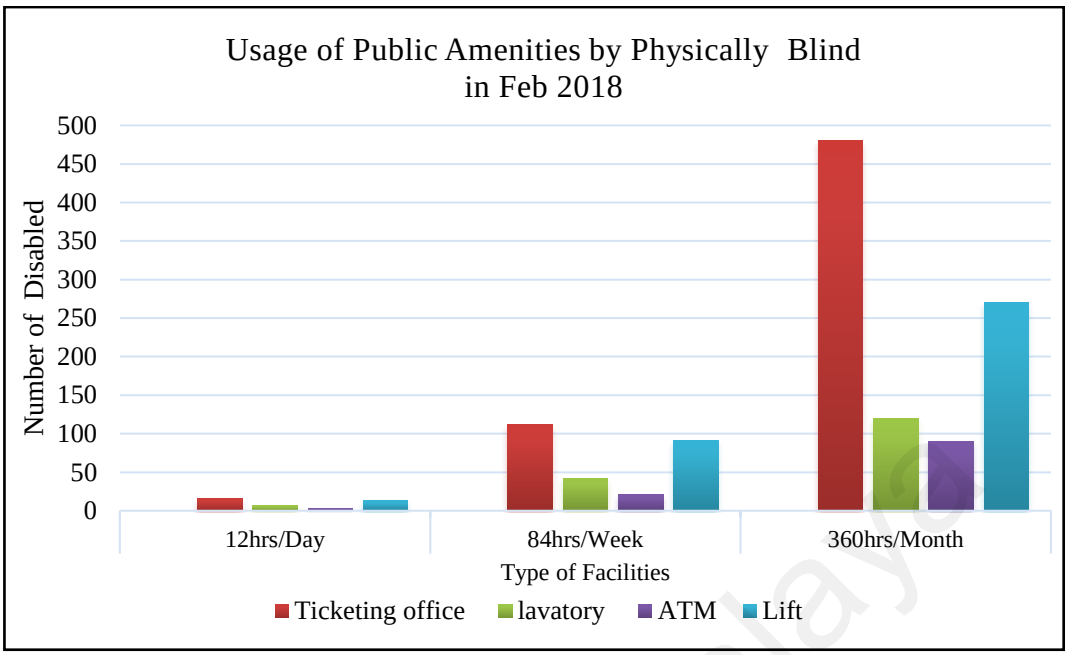

Figure 4.2 (a): Number of blind population mobility at public amenities

Figure 4.2 (a) presents the details of the analysis that has been collected from Kuala Lumpur Sentral. The data was tabulated based on one month of observation done at the desired location used by the blind population. From the observation, huge number of blind people are using public transport and most of them are looking for ticketing office to purchase the tickets to travel back to their home. At the entrance of the train station, they face difficulties to look for the turnstile doors. Thus, they look for assistance from ticketing counter officers to help them to access to the door.

At the disabled lavatory, it is noticeable that many blind people are looking for tactile pedestrian route. In some places, the tactile was incomplete, and they need to get more attention and Point of Interest (POI) in order to access the lavatory. The research was done at Kuala Lumpur Sentral during the peak hours. The observation was done from early morning till the closing hours of the KL Sentral.

4.2.1 Feedback from Blind People

Based on the survey questionnaire feedback many of physically blind expressed their feeling that facing during their mobility in public amenities. They provide a lot comments according to the questionnaire that has been ask question by verbally. The survey feedback from physically bind reflect as below.

Table 2: Survey questionnaires and Feedback

Number	Survey Questionnaire	Feedback from Blind
i.	How is the toilet facilities in public amenities?	• blind pedestrian route incomplete • Found Slippery floor and blind can slip on floor
ii.	Is it easy and manage to find the Public Toilet in amenities?	No, we need assistance from surveillance, sometime we manage using our hand by feeling at wall then enter to OKU toilet.
iii.	What kind of feedback you facing from surrounding people?	They ask us to follow with Children and Sibling if go out from home
iv.	Do surveillance provide help without requesting?	Most of the time they help us without request, but we get shy because always looking for their help.
v.	Any support provide from helpers?	Sometime follow us till to embark from complexes, helping to get cab for us.
vi.	Separate washroom or toilet is compatible?	Yes, but still needs assistance to reach the destination.
vii.	How get in to ATM or Bank ticketing counter	We obtained help from bank security person. sometime we get help from surveillance and bank officers to help withdraw cash
viii.	Do you manage find easily the restaurant	Sometime yes, some need assistance to guide us to the stalls.
ix.	Can operate hand phone (cellular)	Can but using normal phone without touchscreen version
x.	How about the Ergonomic issue during using public amenities	Ergonomic is always we follow sometime we slippery during waking slippery tiles that installed at public amenities. The shoe or sandal we use must be proper and compatible for walking in public amenities
xi.	If we give apps system with gadget device for your use to find desire destination. Are you agreeing to use it?	Yes agree, we can try this unit .If it is works good and we can use that to get reach to desire destination without assistance. It must be a user friendly

4.3 Prototype Design of Ergonomic Universal Wireless Navigation Device

An analysis which was conducted in chapter 3 shows various obstacle that were faced by physically blind people. Therefore, figure 4.3 shows a new technology gadget was introduced with multiple features to assist these blind people to move independently without requiring any assistance from guidance or family members. This device is included with coding application to convey voice message to the person who is using that. The device is applicable for novice as well because there are no difficult features and no need to provide any training for them (Morales, Arnay, Toledo, Morell, & Acosta, 2016).

Figure 4.3: Raspberry FI Zero device

Figure 4.3 shows the Raspberry gadget that was modified with android programming. These gadgets are produced much smaller than normal model for easy carry and portability. Once the framework is power ON, it will demonstrate that the device is in the running mode. There is no necessity of pressing any peripheral or additional buttons or numbers to activate the system. This gadget is used as a measuring tool for the physically blind people to move wherever they wish to go for it can show the distant to their desired location.

This gadget is designed in a simple manner and straight cut which can be easy to use by the visually impaired people. This wireless gadget is assigned appropriately with different application, for example, OS (Operating System) especially for iPhone which is not applicable for Android program. This will be helpful on programming establishment. Thus, raspberry is chosen as a reasonable gadget for this application.

4.4 Observation on the Prototype Device

Perception and testing of the gadget's highlights was done on various individuals who are utilizing the public amenities in KL Sentral ATM. Ten physically blinded individuals were picked as participants and showed interest in this research on testing the gadget. 8 of them are adults including an elderly man and two are students who are under 15 years old.

In specific circumstances, blind individuals are strolling using walking cane on their own and some others were not using stick yet they walk very carefully heading towards ATM machine. In middle of walking to desire location, suddenly they lost their immediate pathway to ATM machine. Basically the lost their way ready and looking for assistance to get their place. Therefore, an improvement of universal wireless system comprises of android programming software, microcontroller coding, and controller hardware with Liquid Crystal Diode (LCD) and Bluetooth 4.3 version. This remote wireless navigation is designed to identify the destination even before they reach within the timeframe using Bluetooth 4.3 version detection. Figure 4.4 is the complete of prototype hardware design that works as in software to give instruction to the physically blind. More attachment can refer to Appendix H.

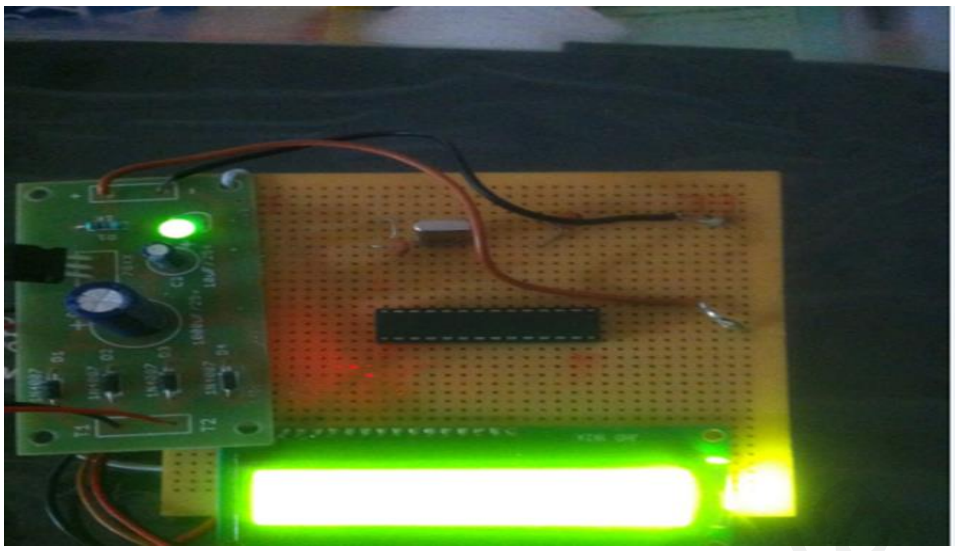

Figure 4.4: Complete of Prototype Hardware Design

4.5 Design of Hardware and Technical Solution

A gadget called Raspberry PI Zero and microprocessor with Bluetooth 4.3 pack has been presented for physically blind individuals. The gadget Raspberry is transferred with android programming software to create triggering of voice synthesis to give alertness to blind individuals. A few situations have been tried with a recording of video to distinguish the route of the desired destination of this blind people. This research project's development, that is the universal wireless navigation system can recognize the desired destination utilizing the voice synthesis when the blind and visually impaired individuals walking along their special tactile pedestrian route.(Neto & Fonseca, 2014). This universal wireless navigation gadget is built for all public amenities and wherever these open public amenities are found, this gadget can work without any breakdown. Through this research it is considered that human geometric coordination is computed by gadget itself when they are reaching closer to the desired destination

A gadget hardware circuitry board is designated and programmed for a particular area and it is operating as a universal device. For example, in KL Sentral ATM, it is assigned as L1A. This specific gadget pack is introduced also for Johor or Malacca Sentral

ATM and furthermore it is assigned as L1A as well. The gadget application works as indicated by their byte as programmed in the microcontroller. A microchip is the fundamental piece of this gadget pack. Binary code in microcontroller gadget is to create and it send the signal pulse to Bluetooth each and every second. Inside the chip, there is byte that was customized for every single area. It's a programmable controller unit and it has details, for example, programmed with compatible crystal gadget. The voice Speech (synthesis) recorded and programmed as a single entry to the Android software programming. There will be no interruption or changes will happen to the gadget or android programming if the installation has been occurred.(Castillo-Cara et al., 2016). Refer to Appendix D.

Table 2 shows designated location that was assigned for universal wireless navigation mobility. To detect distinct location using universal wireless navigation, it is expected to include the command in android programming to create a similar voice combination (voice synthesis). Devices that was assigned with Android Bluetooth programming, when it is taken into different urban areas or other states' public amenities, it will be activated immediately as how it is programmed. In this way, physically blind individuals can move to any place without any assistance and ready to walk autonomously.

Table 3: Location identification with designated coding

DESIGNATED IDENTIFICATION	LOCATION
L1A	ATM
L2D	DISABLED LAVATORY (TOILET)
L3T	TICKETING COUNTER
L4R	RESTAURANT
L5B	BUS STATION

4.5.1 Design of Circuit Regulator

A regulator is considered as semiconductor rectifier circuit. This circuit to regulate the incoming voltage and gives expected voltage to the circuit to functioning. Distribution of voltage is applied to an integrated microcontroller in order to turn on the AT Mega (Atmel Mega) 328 through using the pin 7 and 8. To acquire a correct signal to functioning the circuits need enough voltage to supply to the conduct the circuit. Normally it's called as an input voltage. Principle period of input voltage is Alternative Current (AC) which can be sent to a circuit, but for this AC need to have the power supply to regulate the AC voltage. Since the Bluetooth gadget and microcontroller required 9 volts or 12 volts Direct Current (DC) within the range circuitry can be led to the circuit functioning. For this circuit used 9volts.The minimum of output voltage is 7volts can be applied through the regulator with less the 1 ampere to the circuit. Perhaps if an applied excess of 7 volts and is connected to the circuit it must increase to 1 Ampere. By practically the ampere should increment rely upon the voltage applied to the circuit, because if apply more voltage need to have extra precaution to get the correct voltage rectifier to be applied. If it applied more that expected the microcontroller can be spoilt. Appendix I explain about the microcontroller coding.

4.5.2 Crystal Oscillator

In a circuit, Crystal 7805(16 MHz) is using with two capacitor range of 22pf (PICO Farad) to oscillate the oscillator circuit with mechanical resonance to generate an electrical signal with a precise frequency that produce continuous signal to the microcontroller. The function is to control the speed of the pulse. Every second, the crystal oscillator oscillates pulse consistently and give exact input of pulse signal to the microcontroller via Bluetooth. Refer to Appendix G.

4.5.3 Basic function of Schematic Diagram

Circuit works as to generate signal according to pulse generation from the crystal oscillator. Pulse signal is generated and send to the microcontroller device via signal transmitting and thence to Bluetooth device. Once the signal is received from android BLE Bluetooth, the signal generation from Bluetooth device will be triggered. (Castillo-Cara et al., 2016). The device of Raspberry Bluetooth immediately receives the signal after being activated by the Raspberry device.

Below figure 4.5.3 is the schematic layout for the universal wireless navigation system device which consist of multiple inter communication between Bluetooth devices, rectifier circuit with microcontroller. Here added with LCD display to generate the indicated direction status in the display. This is to avoid the mix device with other circuit board. For example, for ATM, it will show indicator as “ATM Near to You” and for the inter junction it will display as “Turn Right To ATM”. For further details of the schematic component that used for development, refer to Appendix B

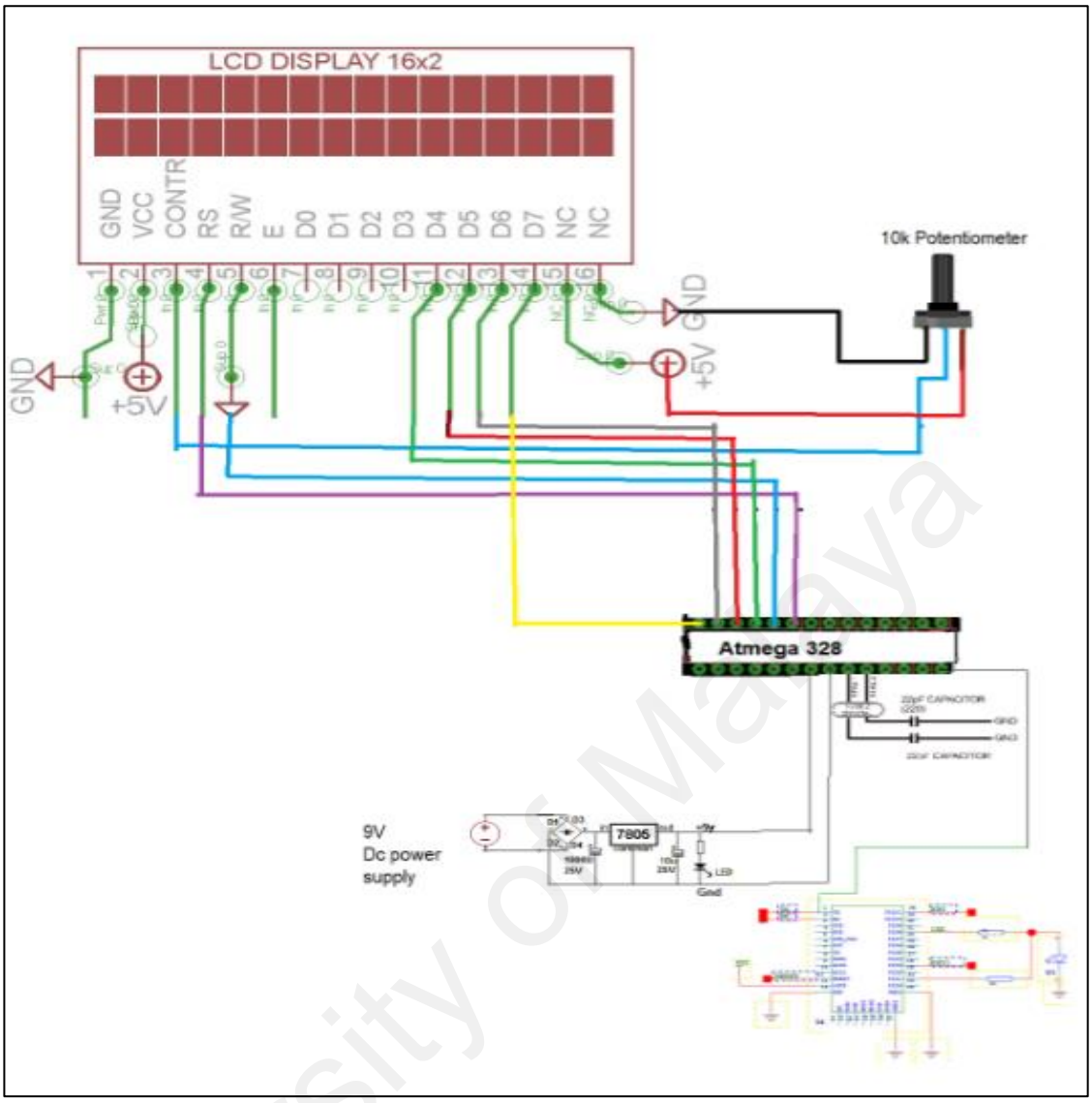

Figure 4.5.3: Schematic Layout of the BLE device

4.5.4 Bluetooth and Significant Distance Measurement

The distance for universal wireless navigation system to detect signal is considered when designing the Bluetooth device. This device is designed by taking into consideration the factor of recognizing and receiving signal from gadgets or portable mobile. This Bluetooth 4.3 version device is able to receive a signal from 20meter distance. This device can receive signal from the minimum distance of 5cm as recommended by the manufacture. This device is able to detect and be tried with distance for the detection of a signal from the circuit with Bluetooth prototype module.

4.5.5 Procedure of BLE Device Operation

A physically blinded person can hold this Raspberry PI Zero gadget uploaded with android wireless Bluetooth device software. Figure 4.5.5(c) shows the Bluetooth device icon. Once the application icon which indicates as **"BLE"** a known as **Bluetooth Legatt** is initiated, the application will start to run continuously as **"BLE Device Scan"** coherently until it receives signal**.** Figure 4.5.5(d) shows the device's BLE scanning function. This application will be running online until switch off the gadget device. If the Bluetooth application is in ON condition the tool's scanning keeps continue without any interruption. Once person reached the inter-junction of the pedestrian route, the first microcontroller device starts to detect send the signal through Bluetooth 4.3 version to gadget scan device. Than then device starts to make decision whether the desired location on right hand or left-hand side. If the location is at the right-hand side, immediately the portable gadget gives voice synthesis direction to the location. For example, if the ATM is at the right-hand side, the command will be as below:

Designated voice synthesis is applied as:

"TURN RIGHT TO ATM"

Blindness was continued to walk through the pedestrian route before they reach to the ATM and the device start to detect and generate second device voice synthesis sounds as:

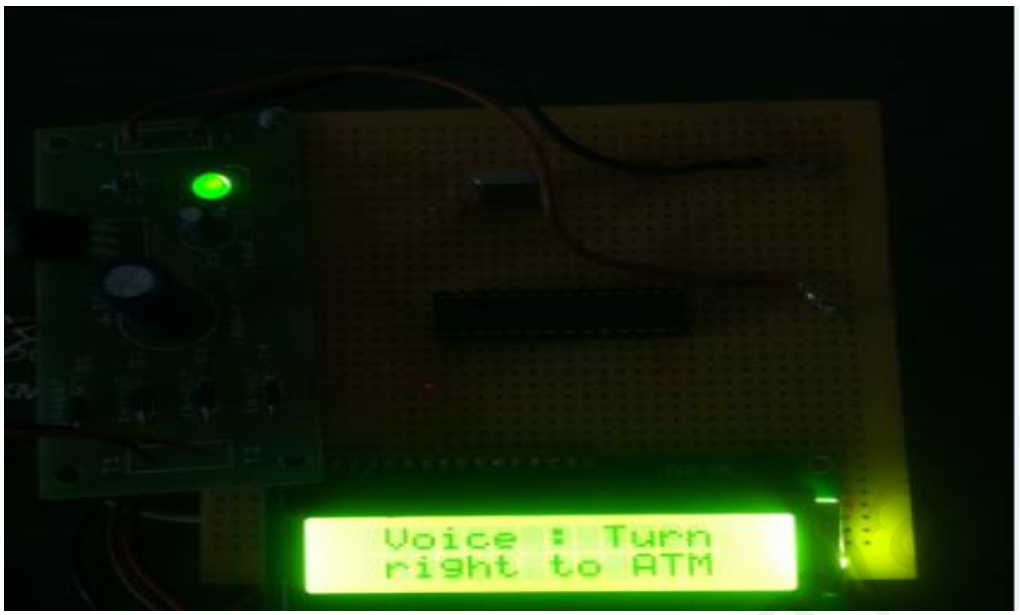

Figure 4.5.5 (a): Right to ATM LCD Display

“ATM NEARER TO YOU”

Figure 4.5.5(b): ATM Nearer to you LCD Display

For other locations, it is depending on the voice that has been recorded in the android software.

For example, designated voice for disabled lavatory are as below:

“GO STRAIGHT FOR TOILET”

“TURN RIGHT FOR TOILET”

“TOILET NEARER TO YOU”

Figure 4.5.5 (c): BLE Application

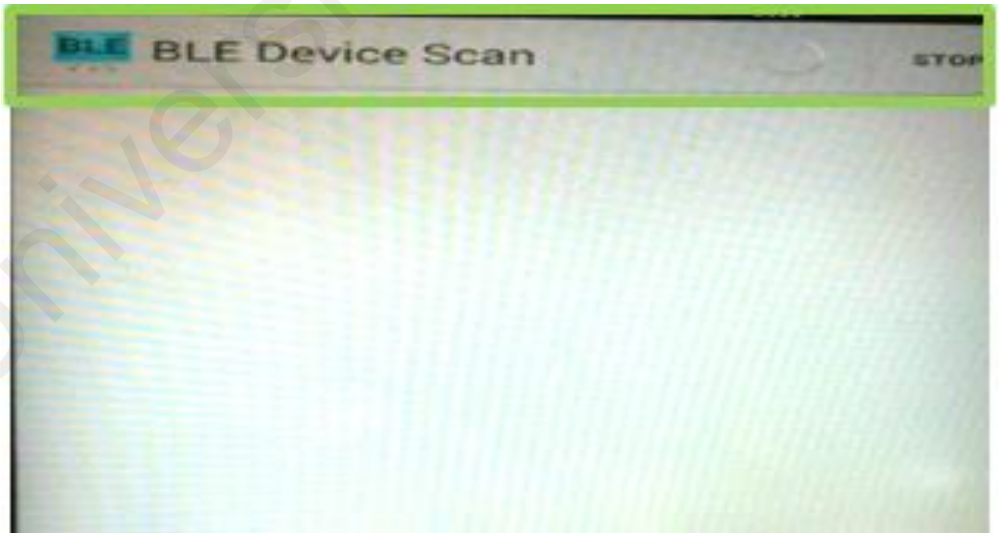

Figure 4.5.5 (d): Bluetooth BLE Scanning Function

4.5.6 Operation of Gadget Device

Figure 4.5.6 presents the operation of gadget during mobilization to an indoor environment. The operation will be easier for blindness population to recognise from the voice synthesis to reach the desire destination.

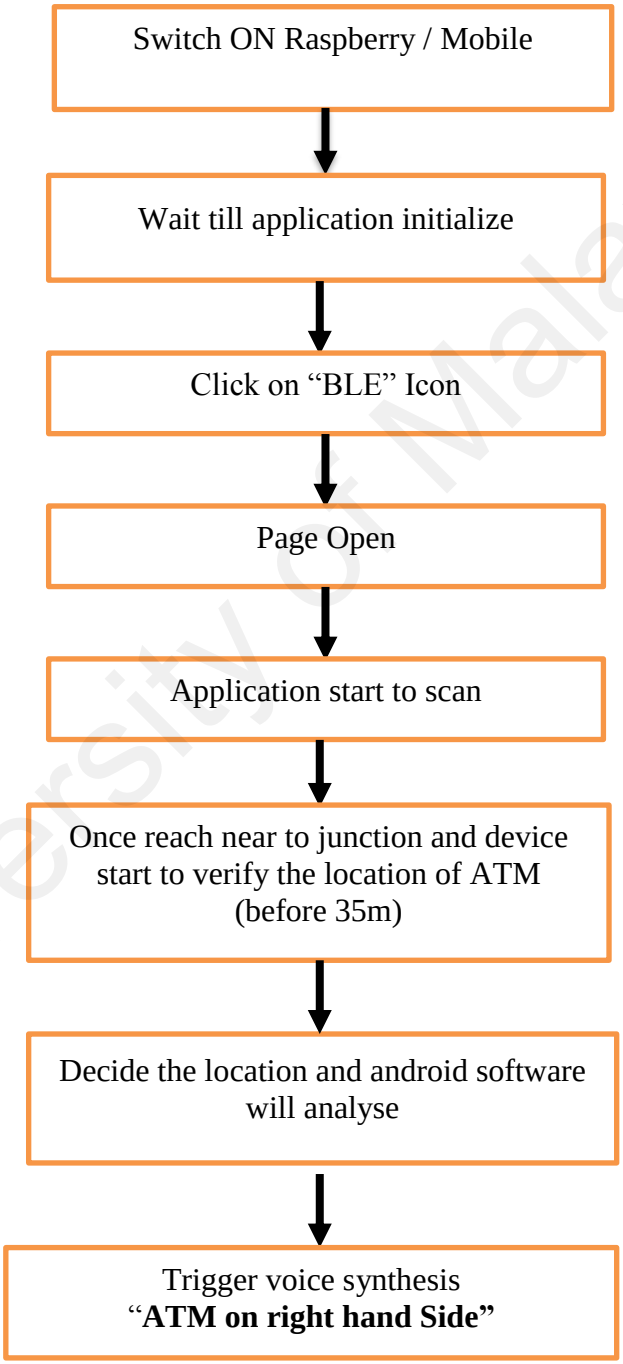

Figure 4.5.6: Operation Flow Chart of BLE application

4.5.7 Software Development

Android software is used very common in order to develop for programming and easy to determine the resource required to function. In this topic, BLE is our Icon application gadget used for universal wireless navigation system. BLE application can be downloaded in raspberry gadget. Once BLE is turned ON, the BLE icon will appear on the screen and the device started to scan to get detection from Bluetooth device to generate voice synthesis. The programme will start coding for immediate action to read the signal coding without delaying.

When Running BLE application, the Android software code appeared as below:

I. **MLT -BT05-42**

II. **OC: B2:BT:7F:CC:5F**

When the voice synthesis triggers the value of 42, it will begin to increase to a certain value, for example, 52. It means the detection signal keep on moving and gives signal continuously. There counting of value to 10 seconds also will be going on together with android coding immediately after the Bluetooth voice location began. Coding II is represented from microcontroller and send through Bluetooth to android programming as to acknowledge and generate the voice audible sound.

4.5.8 Software Source Code

Below is the android software that was developed for prototype device. The voice synthesis for the desired location is derived in the source code (Bold Font). In this development, it is able to add new features for the required command. For the full source code, refer to appendix J.

```
/*
 * Copyright (C) 2013 The Android Open Source Project
      }
      if (requestCode == MY_DATA_CHECK_CODE) {
         if (resultCode == TextToSpeech.Engine.CHECK_VOICE_DATA_PASS) {
            //the user has the necessary data - create the TTS
            myTTS = new TextToSpeech(this, this);
         }
            viewHolder.deviceName = (TextView) view.findViewById(R.id.device_name);
            view.setTag(viewHolder);
         } else {
            viewHolder = (ViewHolder) view.getTag();
         }
         BluetoothDevice device = mLeDevices.get(i);
         final String deviceName = device.getName();
         if (deviceName != null && deviceName.length() > 0) {
            viewHolder.deviceName.setText(deviceName + Integer.toString(signalStrength));
           if(deviceName.equals("ROBO")) {
               if (signalStrength > -150 && spoke1 == false) {
```

```
            speakWords("ATM NEARER TO YOU");
            spoke1 = true;
        } else {
            spoke1 = false;
        }
    }
    if (deviceName.equals("MLT-BT05")){
        if (signalStrength > -150 && spoke2 == false) {
            speakWords("TURN RIGHT TO ATM");
            spoke2 = true;
        } else {
spoke2 = false;
        }
```

4.6 Location for Installing the Device

The location for the installation of prototype design are chosen based on the desired destination of the physically impaired group. Figure 4.6(a) shows that a device kit was located near to ATM and another device kit was attached at the junction of the pedestrian route in other condition. This device is also applicable in public amenities at other location as shown in figure 4.6(a) such as restaurants and washroom which are frequently used by physically blind people. Figure 4.6(b) shows physically blinded person brought with the device is getting closer to ATM(Khalifa, Kamel, & Barfety, 2010).

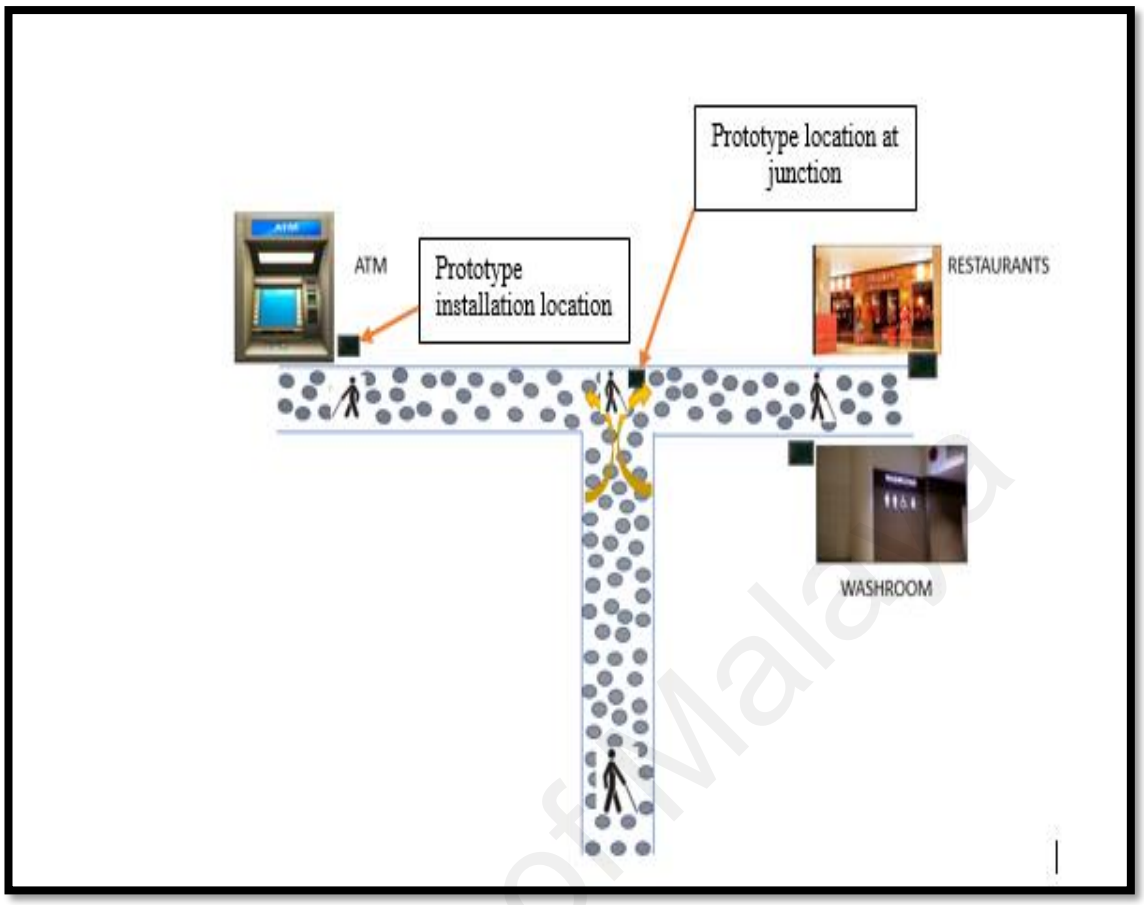

Figure 4.6(a): Route for Blind people at the pedestrian with Microcontroller device

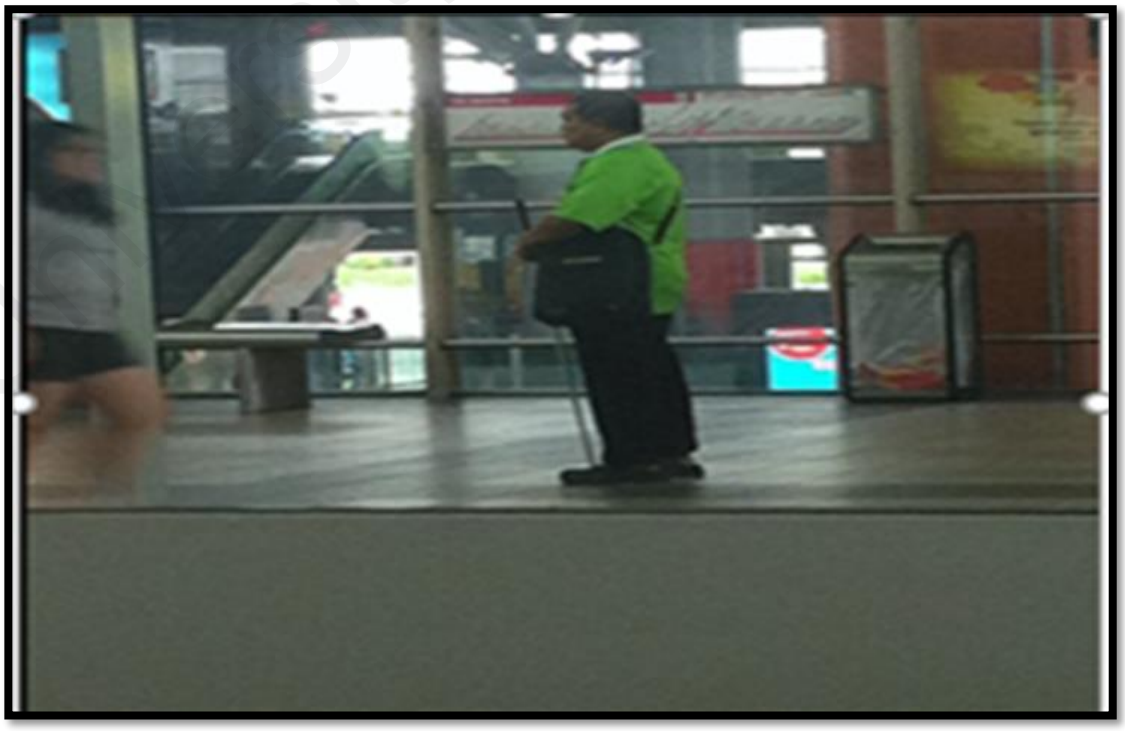

Figure 4.6(b): Blind person with prototype device to reach at ATM

4.7 Future Improvement

In general, most of the development that deployed by researcher, it's either software or hardware, can be discontinuous during their evaluation. Therefore, this project need to must be enhanced in future to obtain compatible instrument and component to design the prototype. We had done a lot of empirical solution technically for the development. However, the device that was selected for this development encountered multiple issues during testing. Figure 4.7 shows various type of Bluetooth device and Radio Frequency (RF) are tested with multiple frequency in order to get correct detection. This is to ensure the selection of the Bluetooth device must be compatible with android signal detection for the distance required in upcoming future design. Finally, we had obtained Bluetooth 4.3 version which had necessary specification for prototype model and it was successfully tested and installed in the circuitry to run the entire hardware circuitry without abnormalities and useful for blind people's.

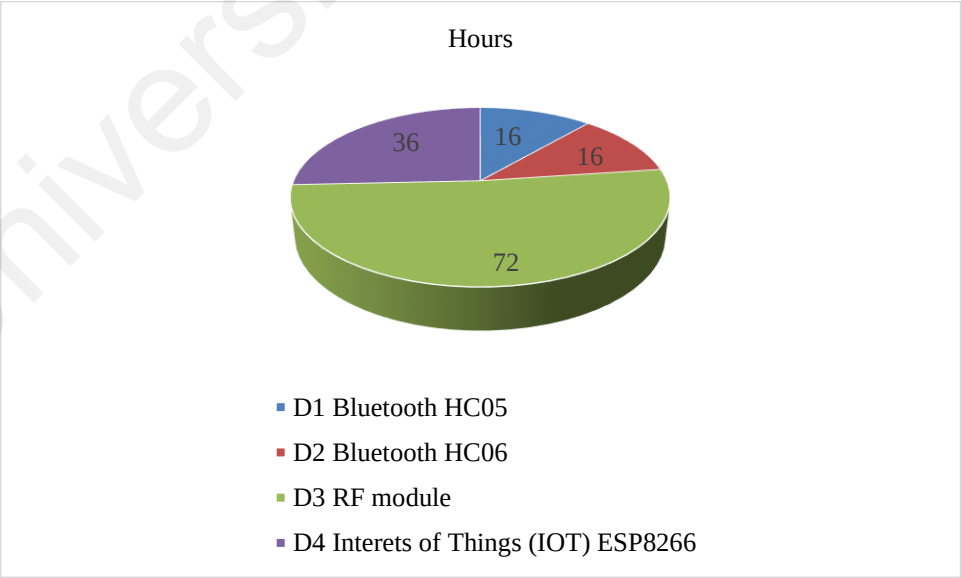

Figure 4.7: Evaluation on Various devices

4.8 Advantages of the Research

This device can be utilized using any gadgets, such as, cell phone which is updated with advanced android programming development. Physically impaired individuals can utilize this gadget since it is user-friendly which can empower them to move autonomously, because there are no complicated commands are set in this application. Based on the literature review in chapter 2, researcher advises to use GPS system but the GPS can require high chargers to be used via mobile. This design is costing less charge for development and the design kit is cheaper. Less component is utilized for internal build-in of the Bluetooth device. Currently, in telecommunication field, Bluetooth device is already upgraded to built-in Bluetooth device, therefore it is not a limitation for using this prototype. This device can be used by those who have lost their vision during their life journey due to accidents and also can be utilized by elderly people as well. It might help continuously to change their dimmed life style to become brighter. This gadget can be useful for the individuals who are misfortunate because they might have lost their vision in eyes due to accident.

4.9 Summary

In conclusion, utilization of vital software programming in developing an electronic component instrument demonstrates the result of ergonomics prototype universal wireless navigation design configuration. It is an entire unit for the physical visually impaired people. Discussion has decided that the utilization of the hardware and electronic component is incorporated into this prototype model. Consequently, all the significant elements and attributes that are identified with the safety and ergonomics has been actualized in this prototype design.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The initial objective of this thesis report is to identify the difficulties encountered by the physically blind people while they are mobilizing independently. The existing designs are playing an important role in the life of visually impaired people. Yet, there are some lacking found in those designs which become an obstacle for the mobility of this physically blind group. This is true when it comes to real time situation for elderly people when they are looking for assistance. Therefore, the aim of this project is to develop a prototype design known as Universal Wireless Navigation System which includes voice synthesis and latest design configuration with universal coding for different location which proves to be reliable for physically blind people to access to those places without any assistance. This device is able to determine a specified location from within 35meter and able to detect and process the signal within 2 seconds. Raspberry gadget can automatically open the Bluetooth application once it is power on. Android cellular too can be used yet there is some limitation whereby they have to power on the phone and open BLE Bluetooth application separately by pressing any certain number. These two devices have audible voice application and are much cheaper compare to other devices. Thus, it is available for the physically blind group to purchase them due to low cost and easy for their access too. It is a user-friendly device for all level of physical blindness. The limitation faced during the development phase of the device and also the benefits therein are discussed further below.

5.2 Limitation of Research

There are several limitations have been occurred during this research. During data collection, some of the physically blinded are not using disabled lavatory and ATM. In order to collect the frequency of public amenities usage obtained mismatching result but manage to get it reliable data.

Henceforth limitation of the prototype design can cause: -

1) The drop out of gadget or mobile phone's battery charge may confuse the physically blinded to look for their path. They will be unable to reach to their point of destination and they have to rely on own assistance.
2) ATM being closed down can cause prototype design to lose its input signal from equipment input voltage. As a fundamental, there will be a backup battery installed in their design which can works continuously for a short period and it might last even a week.
3) The gadget is available to any mobile as well but there is limitation for iPhone users because the design of iPhone software is not compatible with android software but they can use raspberry device for usage.

5.3 Recommendation for Future Research

In summary, this thesis evaluates the process of ergonomic of universal intervention for Blind Mobility. There were gaps in this study that have been conducted based on the Universal Wireless Navigation System. The recommendations for future research are as below:

i) To obtain further enhancement of the continuous triggering signal or repeated audible voice synthesis when physically blinded getting closer to their destination.

ii) Upgrading of the software in android gadgets with new version time to time with new features which can contribute advantages to physically blinded.

iii) Enhance wireless detection Bluetooth device to the extent of maximum distance to wider range in the complexes to get easy detection to physically blind people's.

iv) Recommendation to bank management to install this device in their ATM for the physically blinded to move independently and reduce load for bank officers.

v) Provide awareness training to bank officers about the development on new technology.

vi) Gives recommendation to Non-Government Agency (NGO) and government department Social Welfare Department Malaysia, National Blind association in Malaysia on the deployment of the device in market and also to get more data collection for further improvement.

vii) Obtain grant from government to develop this device to get benefit for all blind people's.

viii) Promote to World Health Organization about this new prototype to get grants.

ix) This device can be utilised by non-physical blinded or ordinary human being in order find places faster within shorter period. It is applicable for tourist from other states and countries who came for vacation.

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