"I hereby declare that I have read through this report entitle "DESIGN AND DEVELOPMENT OF TACTILE DETECTION BY USING RFID METHOD" and found that it has comply the partial fulfilment for awarding the degree of Bachelor of

Mechatronic Engineering".

Signature : .....

Supervisor's Name : .....

Date : .....

DESIGN AND EVALUATE THE PERFORMANCE TACTILE DETECTION BY USING RFID METHOD

ANG SOON CHANG

A report submitted in partial fulfilment of the requirements for the degree of Bachelor of Mechatronic Engineering

Faculty of Electrical Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

YEAR 2013

I declare that this report entitle "DESIGN AND DEVELOPMENT OF TACTILE DETECTION BY USING RFID METHOD" is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : .....

Name : .....

Date : .....

I dedicate this research work to my supervisor, Mr. Anuar bin Mohamed Kassim who teach and guide me, to my family who supports me in everything and to my friends who helped me finished this project.

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First of all, I would like to give my upmost thanks to my supervisor En. Anuar Bin Mohamed Kassim for guiding and assisting me through the completion of this project. I am very thankful for his advice and guidance until the successfulness of this project.

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ABSTRACT

Over the past few decades, for visually impaired people, orientation and mobility are very difficult especially in unknown environment or a place which not design with assistive purpose. In this modern era, independent mobility for blind and partially sighted people is an important objective to achieve. There are many assistive way to help visually impaired people namely, Guide Dog, White Cane as well as the tactile paving which is a very common assistive tool throughout the world, support the visually disable person walk in the correct path from one place to another. Moreover, RFID technology is introduced in this project to support the visual disable people more efficiently in outdoor activities. The system has been developed based on the integration of RFID wireless technology and voice system which assembled on the normal white cane in order to help the visual impairment to identify the surrounding landmark via verbal notification. The tactile detection by RFID system composed by RFID system integrated on normal white cane and RFID TAG which installed on the tactile paving where the TAG stored unique information uses to navigate/notify the user once they scan/tap the tactile paving by the designed white cane. Furthermore, four experiments were carried out to analyses the performance of the system such as the reading range where the readable distance and position of the embedded TAG can be detected. The analysis also included the finding of the performance of the system when obstacle is introduced between the RFID antenna and TAG. Result showing that the antenna installed 1.7cm apart from the floor level is within the optimum range and light obstacle such as paper will not affect the reading performance although the reading range is slightly reduced. Due to no vision support, visual impairment unable to get the landmark information around them, thus the mobility aid by voice will brings benefits for them.

ABSTRAK

Pada masa kini, pegerakan dan mobiliti bagi orang kurang upaya terutamanya yang mengalami masalah penglihatan adalah susah dan jarang dibantu. Isu ini harus diambil hati oleh masyarakat. Terdapat beberapa rekaan dan alat telah dicipta untuk membantu golongan ini seperti White Cane, tongkat digunakan untuk mengesan keadaan jalan dan Guide Dog, melatih anjing untuk memberi arah kepada pengguna. Lebih-lebih lagi, teknologi RFID telah diperkenalkan untuk membantu orang buta supaya dapat bergerak dan mampu untuk menyertai aktiviti luar dengan selamt. Sistem RFID ini telah diimplimentasikan dengan mengabungkan teknologi wayarless dan sistem suara di atas White Cane, tongkat membantu orang buta dengan membekalkan fungsi mengesan keadaan jalan dan memberi isyarat kepada pengguna melalui suara. Sistem RFID berfungsi melalui sentuhan antara RFID TAG yang dipasang di tongkat dan cip-cip yang dipasang di atas jalan atau laluan yang disediakan. Cip-cip ini mempunyai maklumat yang khas dan isyarat akan diberikan kepada pengguna apabila sentuhan berlaku. Dalam projek ini, empat eksperiment telah dijalankan untuk menganalisis prestasi sistem RFID yang diimplementasikan seperti jarak signal dan posisi cip-cip yang dapat dibaca oleh RFID TAG. Melalui kajian-kajian ini, jarak optimum antara RFID TAG dan cip-cip adalah 1.7cm dan halangan-halangan ringan seperti kertas tidak akan menjejaskan prestasi sistem ini. Dengan menggunakan RFID, golongan mengalami masalah penglihatan boleh bergerak dalam keadaan yang lebih selamt.

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RFID	-	Radio Frequency IDentification

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CHAPTER 1

INTRODUCTION

1.1 Project Background

Moving from point to point for a normal human being is not a problem but, in the other hand, it is a very challenging task for the people who involved in eye disease, the visually impaired or the blind. White cane is a tool where the blind use it to sense or detect the obstacle or path in front of them, however, the blind sometimes will facing difficulties to move independently from one point to another by using the conventional white cane especially in the environment which not designed for assistive purpose. Moreover, another navigation aid such as guide dog provide a little assistance for the visual disable with macro-navigation, e.g. navigate the blind to a fixed point of interest. The guide dog cannot help in the situation where point of interest is being relocated without notice. Nowadays, in a society where sophisticated technology is available especially in advanced and developed country, the visually disable or the blind should be given priority and support in order for them to live conveniently in their daily life. Many state of the art assistive tools are developed by engineer or scientist, which provide optional and flexible help for the visually disable people. Radio Frequency Identification (RFID) technology is become a common technology in many field around the world such as wireless security system, agriculture, retail, wireless-payment system and etc. In this project, RFID white cane is introduced based on the integration of RFID technology and sound system which help the visual impairment to identify landmark or point of interest (POI) surrounding them verbally. Voice navigation greatly bring benefits for the blind.

1.2 Problem Statement

According to the visual impaired and blindness statistical report released by the World Health Organization, new estimates has been made in the few years back, year 2010, the visual impaired and blindness in the globe, where overall population involved in prevalence of visual impaired is 285 million,246 million having low vision whereas 39 million are blind [1]. The data of eye prevalence stated above shows that the large amount of eye disease patient throughout the world cannot be just ignored. In Malaysia, there is a number of visual impaired or the blind in the nationwide which cannot be abandoned yet needed to support in terms of assistive facilities and etc.

The white cane is a tool which helps the visually impaired people, for example, to detect or sense the path in front of them in order to walk in the correct direction. Moreover, the function of tactile paving is to helps the visually disable people to distinguish direction, location and potential hazardous places. However, the blind unable to identify the landmark or location surrounding them without the help of vision. Moreover, they also facing difficulties to finding way, or taking a bus while walking on the street.

Thus, this project is to design a voice notification system by using RFID technology where the system become a kind of indicator that help the visual impairment to identify important spots such as warning sign or hazardous point in front of them, additionally giving important information about a particular spot, for example the location of surrounding environment/building, train station, bus stop and etc via voice system.

1.3 Project Objective

1 To design, develop and evaluate the RFID tactile detection on white cane to help the visual impairment or the blind identify the landmark surrounding them.

2 To design and fabricate the electronic white cane implemented with sound system to navigate the visual impairment verbally.

1.4 Project Scope

1 The aid tool will be install on the white cane only.

2 The electronic white cane only have notification function, obstacle detection is not cover in this project.

3 The RFID Tag will be install on and within the area of tactile paving.

4 The system notify specific landmark or point of interest only.

CHAPTER 2

LITERATURE REVIEW

In this modern society, there are many types of assistive equipment, tools or robot which developed by the motivated engineer or scientist worldwide which share the same goal, to help the visually disable people in terms of improve their quality of life as well as bring convenient into their daily life in terms of independency. The assistive equipment and tools developed are GuideCane[2], NavBelt[3], Echolocation[4], vOICe[5] and etc. Besides that, one of the developed assistive robot for the blind is RoboCart[6], [7] which designed to help the blind in shopping mall. Without the state of the art assistive technology, the visual impaired or the blind commonly rely on the normal white cane to detect the surrounding obstacle and sense the path in front of them. On the other hand, the most common assistive technology which has been widely used throughout the world is the tactile paving. Tactile paving is a kind of texture ground surface which install on the floor to help the visual disable people to distinguish direction, location, and potential hazardous environment. However, the visually disable people not able to identify the surrounding landmark around them by using their traditional white cane although they walk on the tactile paving. In this situation, they only able to identify the surrounding area by asking stranger around them, otherwise they will never get to the landmark that they looking for without vision support. Thus, voice navigation system may bring benefits for the blind where the navigation system assist the blind in point-to-point navigation by giving verbal notification, additionally the surrounding area or point of interest can be identify by a preset voice. By integrated wireless technology system in the normal white cane, it will greatly help the visual disable people, bring convenient into their outdoor activities. In the present research, blind navigation is developed to assist the visual disable for indoor and outdoor environment. Moreover, several wireless navigation for outdoor environment have been proposed or

already exist in the market but the characteristic are similar with indoor navigation system yet, integrated with different technologies[8]. One of the major wireless technologies is Radio Frequency Identification (RFID) technology. The research application which related to RFID technology will be discuss next.

2.1 Case Study 1: A Blind Navigation System Using RFID

This paper research about the assisting navigation system using RFID technology. Basically the system composed by three main subsystems, which is designed assistive path, communication unit and navigation server. [9] From the system, the designed assistive path consists of RFID TAG which embedded on the footpath where the RFID TAG stored the information uses to navigate the user.

Moreover, the communication unit consist of RFID reader which the function of read is to activate and extract the information stored inside the RFID TAG. Each TAG contained the information of TAG ID as well as the location information of where the TAG installed. The communication unit is controlled by a microcontroller which is PIC18LF4620 in this case, where the extracted information by the RFID reader module sends the data to the microcontroller through serial communication for further processing.

Furthermore, GPRS module is embedded into the system as a bridge connection between the client which is the communication unit and the navigation server. The uses of navigation server is to calculate the path from the current position to the desired destination. The process start by communication unit sense the TAG and transfer the extracted information from the TAG to the navigation server via GPRS module, the information received by the server calculate the routes and send the calculated information back to the communication unit for navigation.

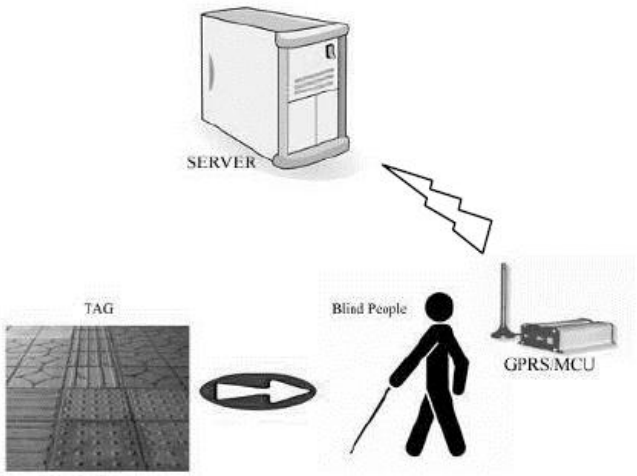

Figure 2.1: Navigation system in case study 1

2.2 Case Study 2: RFID and Bluetooth enabled automated space for the blind and visually impaired (INSIGHT)

This paper research about the assisting navigation system using both Bluetooth and RFID technology, a combination of RFID and Bluetooth in a control system installed on the white cane. [10] Basically the system composed of control unit which consist of microcontroller, RFID and Bluetooth module, client software and server software.

The RFID TAG will be install on the designed assistive location where the TAG stored the information of a particular point of interest. The RFID reader reads the TAG to get the information of the point where the user scanned the place by the white cane. Moreover, the Bluetooth receiver receive the zone coordinate of the location where the user standing on within the covered area through the Bluetooth-Track/dongle.

Both RFID and Bluetooth data received by the modules are converted into voice by the voice controller circuit embedded in the control board in order to produce voice output purpose to navigate the user verbally. The designed assistive area is as shown in figure 2.1 below;

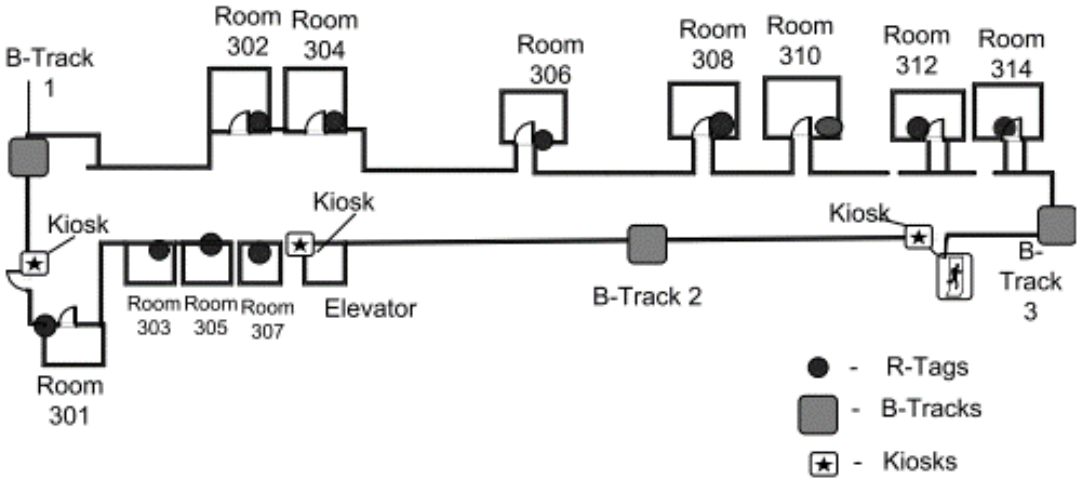

Figure 2.2 Covered area in case study 2

Moreover, the system is connected to a PDA in order to communicate with the server via existing WIFI which covered the designed area. Instead of communicate with the server, the PDA will also feature in converting text sent from the server into voice form through text-to-speech engine which is a designed application integrated in the PDA. When RFID TAG is detected, the code inside the TAG will be send to the server to generate the information of that point, PDA will notify the user through text-to-speech engine. A button is installed on the white cane which the purpose is to help the user generate their current location within the Bluetooth zone.

2.2 Case Study 3: The Research on Blind Navigation System Based on RFID

In this paper, University of Science and Technology of China proposed a system to navigate the blind by providing navigation service based on wireless technology, radio frequency identification system as well as communication system. [8] The system composed of mobile phone, remote server, centre information server, RFID Tag as well as RFID Tag reader. In the study, the RFID Tags has been categorized into several types which Information Tag stored the road condition or information of current location while Cue Tag stored specific location (e.g. shop and etc) whereas guidance tag stored information of hazardous condition (e.g junction, railway, etc). The RFID Tag reader

installed on the white cane and connects wirelessly to mobile phone through Bluetooth interface [8].

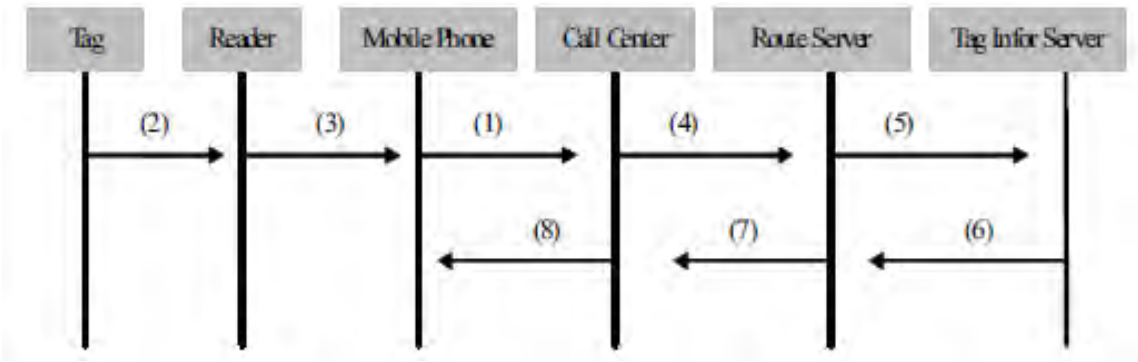

Figure 2.3: Process flow for blind navigation system in case study 3

In order to navigate the user, the system read the RFID Tag embedded on the designed footpath and sends the information to the remote server through the call centre. Each RFID Tag stored the unique information of the particular point providing navigation to the user.

2.4 Case study comparison

From the case study discussed above, all the discussed projects are uses RFID technology which share the same goal to assist the visually impaired or the blind move conveniently from one place to another. All of the case study are uses passive RFID Tags with different frequency specification because of lower implementation cost. Project in case study 1 used low frequency RFID Tags installed along the designed footpath which the low frequency RFID Tag provide shorter reading range yet sufficient in the case study. While project in case study 2 and 3 are using high frequency RFID Tags where high frequency Tag giving better reading range and the RFID Tag in both case studies are installed on a specific location only to provide the information of that point.

Moreover, the data uses to associate with the RFID Tags are stored in the same way for all case studies discussed. Due to the system that has been designed with point to point navigation feature in all project discussed above, where the system needed to communicate with the remote server in order to process the information extracted from the Tags and send back to the client for navigation, most of the information is stored in the remote server. Thus, communication between server and client have to be maintain in order to prevent navigation failure. Without the remote server, the system would not be able to navigate or perform the basic task which is point detection.

However, although the system feature with point to point navigation, the basic feature of the system would not alert the user from deviation when they walking on the designed footpath. In this project, tactile detection by using RFID, only the basic navigation system is taking into account based on the integration of RFID technology, yet providing a standalone and simple navigation system to the user. The system is capable to retrieve the stored data and notify the user about the landmark or point of interest that they looking for without the remote server.