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LAPORAN PROJEK SARJANA MUDA

DEVELOPMENT OF VOICE RECOGNITION ON NAVIGATION SYSTEM FOR VISUALLY IMPAIRED PERSON

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Bachelor of Mechatronic Engineering

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"I hereby declare that I have read through this report entitle "Development of voice recognition on navigation system for visually impaired person" and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Mechatronic Engineering".

Signature : .....

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Date : 16/06/2014

DEVELOPMENT OF VOICE RECOGNITION ON NAVIGATION SYSTEM FOR VISUALLY IMPAIRED PERSON

NG WAN TENG

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 2014

I declare that this report entitle “Development of voice recognition on navigation system for visually impaired person” 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 : NG WAN TENG

Date : 16/06/2014

To my beloved family

Acknowledgement

First of all, I would like to express my gratitude towards all helpful people during my project. Without their help, I would not be able to complete my second semester of Final Year Project successfully.

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Abstract

White cane has been widely used nowadays as a mobility tool for visually impaired person but it is still insufficient for them to live their life independently. Many navigation methods have been developed in the past to assist on improvement of visually impaired person mobility. In this project, the methods proposed by other researchers are studied. The methods include the use of coloured line, white cane, RFID tag, sensors, GPS and speaker. In order to improve the current navigation method, voice recognition is proposed in this project. The aim of this project is to develop a voice recognition system that can recognize facilities such as toilet and prayer where EasyVR module is used as a voice recognition device. The system is designed using Arduino programming language and Arduino Uno is used in this project. In order to measure the performance of the system developed, an experiment is conducted to evaluate how a sound matches the pre-recorded voice command in the voice recognition system. While the other experiment is conducted to test the accuracy of the method proposed under different environment with different sound intensity level. From the experiment, waveform of sound and graph is plotted to analyze the performance of the system. At the end of the project, visually impaired person will be able to reach their destination through inputting the voice command into the navigation system.

Abstrak

Rotan putih telah digunakan secara meluas pada masa kini sebagai alat mobiliti untuk orang cacat penglihatan tetapi ia masih tidak mencukupi bagi mereka untuk hidup kaedah navigasi kehidupan secara berdikari.Banyak caranavigasi telah dibangunkan pada masa lalu untuk membantu pada peningkatan mobiliti orang cacat penglihatan. Dalam projek ini , kaedah yang dicadangkan oleh penyelidik lain telah dikaji. Kaedah-kaedah termasuk penggunaan talian berwarna, rotan putih, tag RFID, sensor, GPS dan pembesar suara. Dalam usaha untuk memperbaiki kaedah navigasi semasa, suara adalah dicadangkan dalam projek ini. Tujuan projek ini adalah untuk membangunkan satu sistem pengecaman suara yang boleh mengiktiraf kemudahan seperti tandas dan surau di mana modul EasyVR digunakan sebagai alat pengecaman suara. Sistem ini direka dengan menggunakan bahasa pengaturcaraan Arduino dan Arduino Uno digunakan dalam projek ini. Untuk mengukur prestasi sistem yang dibangunkan , satu eksperimen dijalankan untuk menilai bagaimana bunyi perlawanan arahan suara yang telah dirakam dalam sistem pengecaman suara. Manakala eksperimen yang satu lagi dijalankan untuk menguji ketepatan kaedah yang telah dicadangkan di bawah persekitaran yang berbeza dengan intensiti bunyi yang berbeza level. Daripada kajian yang telah dijalankan, bentuk gelombang bunyi dan graf diplot untuk menganalisis prestasi sistem. Pada akhir projek , orang cacat penglihatan akan dapat sampai ke destinasi mereka melalui memasukkan arahan suara ke dalam sistem navigasi.

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CHAPTER 1

INTRODUCTION

1.1 Project background

Undeniably, mobility is the main concern for visually impaired person throughout their life. The ability for a person to move independently from one point to the other loses with the lost of eyesight. Navigation tool such as white cane has been developed for decades to assist visually impaired person in detecting and avoiding obstacles along their pathway. However, it is still insufficient to guide them to their desired destination precisely and independently especially when the surrounding environment is new to them. Besides that, visually impaired person tend to feel helpless wherever there are. Hence, a complete navigation system which is able to provide correct path for them to reach their desired destination and simple to use is required so that they can travel around without one's assistant.

1.2 Motivation

Unlike us, visually impaired individuals know nothing about their surroundings. In order to move around, mobility tools is needed. At the moment, visually impaired individuals depend mainly on white cane as their mobility tools to move around but it is insufficient in giving the correct direction to reach the destination and also for them to know their current position as white cane only serves the purpose of avoiding obstacles while walking around. Many researchers have been done in the past to improve their mobility but it is still insufficient to guide them from place to place. A survey conducted by World Health Organization on the numbers of visually impaired person in the world shows that there are

around 285 million visually impaired people around the world where 90% of it is from developing countries which include Malaysia[1]. According to the information collected by the International Agency for the Prevention of Blindness as shown in Table 1.1, it shows that around 0.5% (144 295) of peoples in Malaysia are visually impaired[2].

Table 1.1: Statistic for Blindness in Malaysia (Estimated) [2]

Indicator	**Value**
Population	28,859,000
National Prevention of Blindness Committee Active	No
National Eyes Health Plan Developed	Yes
Number of ophthalmologists	380
Blindness prevalence	0.5%

1.3 Problem statement

Visually impaired persons need consistent help from peoples around the area as a guide to reach their destination which can be very inconvenient as they are unable to see peoples around. This may cause them to be more home oriented and less sociable as they are unable to move around independently. Voice recognition is implemented in the navigation system so that when the users speak out their desired destinations such as toilet and ATM, they will be guided to the place through voice guidance. With the combination of white cane and the newly developed navigation system, they can feel the safeness while moving around with voice guidance and white cane.

1.4 Objectives

The main objective of this research is

1. To design and develop a voice recognition system by using EasyVR Shield to allow visually impaired person to reach desired destination.
2. To evaluate the performance of the developed voice recognition system.

1.5 Scope of research

The scope of this project covers the voice recognition and implementation on navigation system for visually impaired person to walks from current position to facilities set for voice recognition according to RFID tag set on tactile paving.

1. Voice recognition covers only voice set to recognize facilities (toilet, ATM, platform and surau)
2. Performance of the voice navigation will be tested in different environment with different sound intensity level.

1.6 Contribution of research

Today, lack of convenient navigation tools causes restriction on mobility of visually impaired person. The proposed voice recognition system is able to guide them from place to place just by speaking out the name of their desired destination such as toilet, prayer and information counter in a building. This research is design to be easy to learn and use, at the same time help visually impaired person to live independently and feel secure even nobody around them. Finally, around 0.5% of population in Malaysia who are visually impaired can get benefit from the system proposed.

1.7 Report outlines

i. Chapter 1

This chapter gives a brief introduction on the research of navigation system for visually impaired person and also set the objectives and limitations of the research.

ii. Chapter 2

This Chapter provides a better understand on the project background and also the methods of navigation proposed by other researcher. Comparison is made and the best method is stated.

iii. Chapter 3

This chapter provides the flow of the project and how the experiment is setup to evaluate the performance of method proposed.

iv. Chapter 4

This chapter will analyze and discuss on the result obtain from the experiments conducted.

v. Chapter 5

This is the final chapter where it will conclude according to the objective of the project set.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

With the advancement of technology, many researchs have been done to improve the navigation tools or system for visually impaired person. Several methods were invented in the past to assist mobility of visually impaired person. These methods which include the use of white cane, sensor based shoe, eyeglasses, capasitive touch braille keypad, CYCLOPS glove, video sunglass and INSIGHT are studied and analyzed in detail by comparing each method with the type of system involve and how the methods proposed by other researchers are able to help and improve the mobility of invisually impaired person. Lastly the review on each methods on whether it is sufficient in navigating visually impaired person to their desired destination is summarized.

2.2 Methods of navigation for visually impaired person

A total of 7 methods proposed by different researchers in the world are studied. Each method proposed shows different way of navigation for visually impaired person.

i. Coloured navigation line, RFID tag and white cane

Coloured navigation line, RFIF tag and white cane are used in completing a navigation system. Coloured navigation line is placed along the pathway of each destination while RFID tag is placed on the coloured line. For path dectection, the tip of a white cane is installed with a colour sensor[3]. When the user walking along the line and detect RFID tag, a pre-recorded

voice will be play to indorm the area information to the user. Besides that, white cane must be swing so that the colour sensor can detectand find the navigation line on the floor[4]. Swinging can be done when surrounding of the user is empty but in a crowded area, swinging maybe difficult to perform. Figure 2.1 shows the navigation with colour navigation line, RFID and white cane.

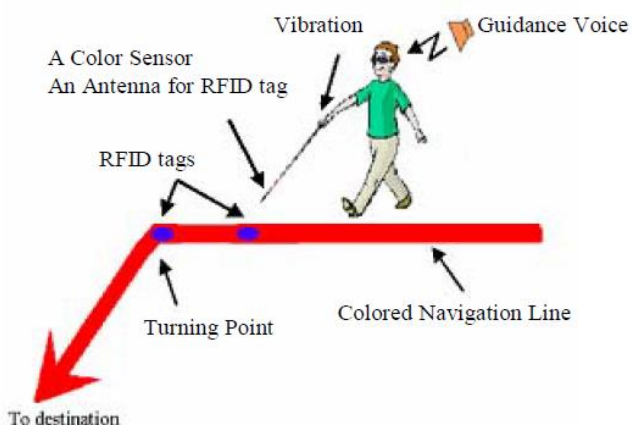

Figure 2.1: Navigation with colour navigation line, RFID and white cane[3]

ii. Sensor based shoe

Another method for navigation is by wearing a sensor based shoe. This method uses IR sensors that attached infront and underneath the shoe to detect obstacles infront and the reflectivity of the standing surface repectively. On the other side, a feedback unit will be wear by the user where it will infrom user by vibration according to the obstacles and surfaces detected[5].

iii. Cane and eyeglass

Navigation for visually impaired person is also done with the combination of cane and eyeglass. Ultrasonic sensor is installed in the cane and eyeglass to detect obstacle in the groud and above the head respectively while temperature sensor is installed in the cane to sense danger such as fire that causes change of temperature. When obstacles is present, information will be send to user by headphone as audio feedback and vibration by motor that wear in the

hand of user[6]. However, it does not give the actual guidance to visually impaired person to arrive at their desired destination.

iv. GPS-GSM based navigation with Braille capacitive touch keypad and sensor glove

This method uses Global Positioning System (GPS) to detect the position of the user and GSM module to send SMS regarding information of user location. The Braille capacitive touch keypad allow visually impaired person to key in notes and control operation of the device while sensor glove with sound navigation and ranging to detect obstacles and notify user with vibrator installed[7]. GPS is more suitable to use in indoor as GPS signal is extremely low inside the buildings [8]. Figure 2.2 shows the sensor glove.

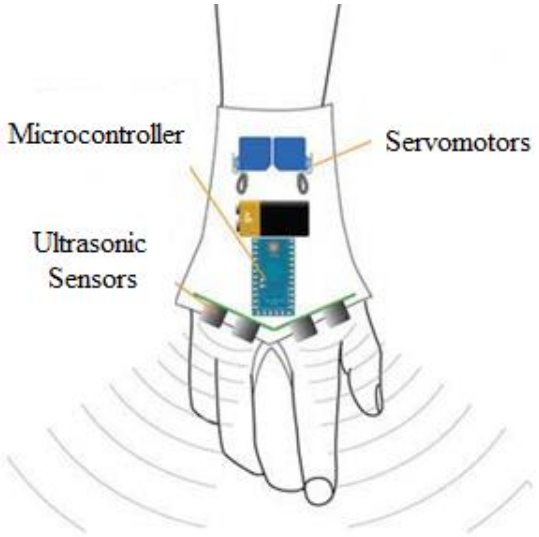

Figure 2.2: Sensor glove[7]

v. CYCLOPS glove

CYCLOPS is another method of navigation that designed to be wearable. This system is designed to be useful to visually impaired person even without the use of white cane, it is intuitive to use and low cost. CYCLOPS is used as obstacle avoidance system with ultrasonic transceiver to measure the distance between the user and the obstacles [9]. CYCLOPS glove is a hand free device for navigation which would be very convenient to the users but it is not

sufficient for visually impaired individual to walk in a correct pathway from place to place. Figure 2.3 shows the CYCLOPS wearable aids.

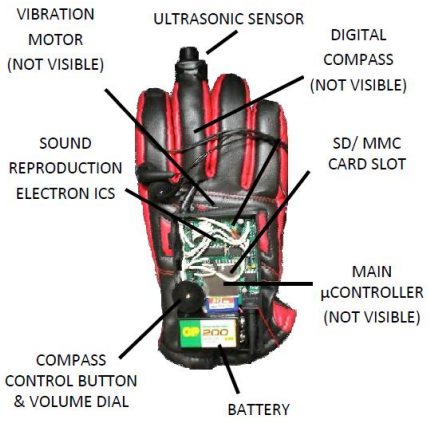

Figure 2.3: CYCLOPS wearable aid[9]

vi. Video Sunglass

One of the methods of navigation is by using video sunglass with detection of yellow line. A tiny video camera is attached in the center of the glasses to capture the pattern and image recognition in order to detect Braille tiles to aid mobility and the information obtained will be informed through audio message [10]. To be reminded, Braille tiles are not necessary yellow in colour. Figure 2.4 shows the video sunglass.

Figure 2.4: Video sunglass[10]

vii. INSIGHT

This method is used for indoor navigation to guide visually impaired person moving in a building. RFID and Bluetooth technology is used in this method direct and track users. Precise localization and convey zone based localization is provided by passive RFID tags (R tags) and Bluetooth tracking unit (B-tracks) respectively. Visually impaired person can go to their desire destination by reading the R-tag representing their destination using personal digital assistant (PDA) provided in the building and the direction to the destination will be given in audio form by using Text To Speech Engine [11]. This navigation method is able to direct and guide visually impaired person to their destination by reading the R-tag placed from place to place.

2.3 Studies on navigation methods

Table 2.1 shows the analysis on methods studied. Each method is classified according to the type of system.

Table 2.1: Analysis on methods studied

Methods	**Type of system**			
	Obstacle avoidance	**Directional with output voice command**	**Directional with sensor**	**Input command (destination)**
Coloured navigation line, RFID tag and white cane	✓		✓	
Sensor based shoe	✓			
Cane and eyeglass	✓			
GPS-GSM based navigation with Braille capacitive touch keypad and sensor glove	✓	✓		
CYCLOPS glove	✓			
Video Sunglass	✓			
INSIGHT	✓	✓		✓

From the seven methods studied, all of the methods have different function to lead visually impaired person. The methods such as sensor based shoe, cane and eyeglasses, GPS-GSM based navigation with Braille capacitive touch keypad and sensor glove, CYCLOPS glove and video sunglass is non-directional navigation with obstacle avoidance while others methods are directional navigation with obstacles avoidance.

2.4 Summary of review

From the above studies, it shows that many research have been done to help the mobility of visually impaired person from place to place with the advancement of technology nowadays. The research done include helping them in obstacle avoiding to prevent injuries, arrive at a destination independently with the help of output voice command on the direction orthrough detection of colour line on the ground with colour sensor installed in the white cane. Before the system can guide them to their destination, input destination is important. However, there is lack of research on the ways to input the destination. One of the way is by reading the RFID tag place around the building but is it incovenient as they will have to look for the correct RFID tag in order to arrive in their desired destination. The proposed research on voice recognition will be easy for the users where they only have to speak out the name of the destination such as toilet and they will be guided to the destination time to time.