BLIND NAVIGATION SYSTEM BY USING ARDUINO WITH 1SHEELD

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JUNE 2015

"Saya akui laporan ini adalah hasil kerja saya sendiri kecuali ringkasan dan petikan yang tiaptiap

satunya telah saya jelaskan sumbernya."

Tandatangan : ……

Nama Penulis : MASNAH GAMBILOK

Tarikh : 8 JUN 2015

"Saya/kami akui bahawa saya telah membaca karya ini pada pandangan saya/kami karya ini

adalah memadai dari skop dan kualiti untuk tujuan penganugerahan Ijazah Sarjana Muda

Kejuruteraan Elektronik (Elektronik Industri)."

Tandatangan : …….

Nama Penyelia : PUAN KHAIRUN NISA BINTI KHAMIL

Tarikh : 8 JUN 2015

For My Beloved Family And Friends

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I would like to express my highest gratitude to God and to both of my parents, as because of them I manage to be where I am now. This project development would be hard if i don't have them as a biggest comforter and supporter in my life. My big appreciation also goes to my supervisor, Madam Khairun nisa Bt Khamil, for she is the sources of some of the idea, concept and materials. As for our, panel, Mr Vigneswara Rao A/L Ganapathy (Co – supervisor) and Dr Wira Hidayat, thank for their comments and suggestions, I had able to see and discover the drawback of some part in this project and think of ways to improve my design and scope. It is undeniable that all the lecturers in Universiti Teknikal Malaysia Melaka that had pour their knowledge in many circumstances for students including me, are deserve to be given the biggest applause as they were not only teaching by book but also fully by heart. For my friends in 4BENE and all the senior that always give their hand to share knowledges, I sincerely will not forget it.

ABSTRACT

Blind Navigation by using Arduino and 1sheeld is about project that helps blind community in the whole world to get a better access to the environment. The project provides alert system through vibration and speech system by using cane, 1Sheeld, Arduino Programming , ultrasonic sensor and vibration motor. Nowadays, when it comes to travelling alone, blind people always prepared all his/her guider, whether the cane,the surrounding noise, a guide dog, an assistive technology, or a relative. This project is an assistive technology which consist of four ultrasonic sensor(above waistline, left, right and front detector) mounted on the cane gripper and two mini Grove vibration motor embedded on the gripper. The system also provides alternative ways everytime an obstacles is detected.

ABSTRAK

Projek Alat Pembantu Orang Buta Dengan Menggunakan Arduino Dan 1Sheeld adalah projek yang dicipta khas untuk meberikan informasi yang lebih banyak kepada orang buta tentang keadaan sekeliling mereka. Projek ini menyediakan sistem pemberitahuan atau amaran melalui getaran dan bunyi, dan komponen yang terlibat ialah tongkat, 1Sheeld, Pengprograman Arduino, sensor ultrasonik, dan motor getaran. Pada masa kini, orang buta sentiasa ditemani tongkat, bunyi sekeliling,anjing penunjuk arah, teknologi atau keluarga. Projek ini terdiri daripada empat sensor ultrasonik (pengesan halangan atas paras pinggang, kiri, kanan dan depan), dipasang pada bahagian atas pemegang dan dua motor getaran di bahagian dalam pemegang. Sistem ini juga memberikan arah alternatif setiap kali objek dikesan.

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CHAPTER I

INTRODUCTION

1.1 Project Summary

This project is about a blind navigation system that sends information wirelessly from Arduino's shield to a smartphone, in order to alert the user about the distance of obstacles through speech warning and vibration. Alternative ways also notified each time an obstacle is detected. Four ultrasonic sensors are mounted on cane to detect objects from all four directions, front, left, right and over waistline space. The ultrasonic sensor is chosen because it performs distance calculation which is not affected by ambient light with better detection range compared to the infrared sensor. Speech to alert the user will be written in arduino coding as a distance notification.

1.2 Introduction

Sight is categorized to be the most crucial of all the senses and people lacking this sense are looked upon with pity by others [3]. According to World Health Organization (WHO), there are about 39 million people who are blind in the world.Recent 2014 stastistic made by WHO, shows that 82% of blind people are in the age of 50 and above [6]. Some causes which lead to blindness are cataract, Age – related Macular Degeneration and Diabetic Retinopathy.

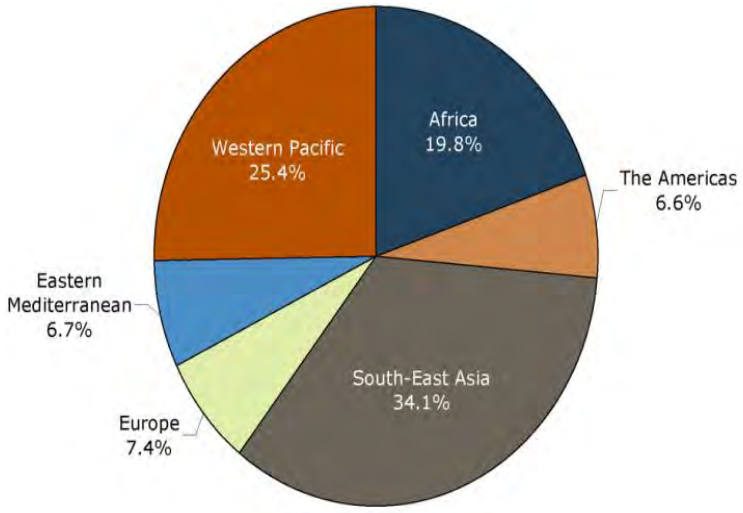

Figure 1.2.1 : Chart for blind people statistic globally [13]

The most terrifying problem that blind people should accept every day is to travel alone or lost their confidence due to their disability when trying to figure out a way in the center of sighted people and crowded area. For instances, its hard to find their way to classroom or bus station. They need more access to the environment so that accident can be avoided[1]. To make sure users can easily access to his/her surrounding, many features of the ordinary cane have been developed. For example, a SmartCane provide preloaded city map, wireless charging to charge cane battery and sim card slot for data connectivity[7]. Other inventions using many feature and it cause the inventors to spend more money in order to complete the cane. However, after five students from Helwan University invented and produce 1Sheeld in 2013, it opens new and wider possibilities of smartphone being a device that able to access many thing in environment. 1sheeld is an additional board that can turn any Android

smartphone into actuator or sensors in the real world[8]. In blind aids prespective, some feature of 1sheeld can be applied, such as text to speech to alert the user about obstacles.By using 1Sheeld, cost is reduced by reducing the item list to create this project, as there is no need to purchase additional hardware feature such as speech Integrated Circuit to fulfil or provide many functionality of the cane. In addition, in this 21st century, smartphone already become a neccescity and most people using this can download 1sheeld application easily to transform their smartphone into a sopishticated sensors.

1.3 Problem Statement

In growing technologies, many types of wearable computers and assistive technology were created for visually impaired people with varying amounts of cost.However, Until today, traditional white cane is still the number one choice among blind people, due to its low cost, as low as RM15 in Malaysia. Some inventions have drastically changed their lifestyle, such as electronic canes like Ultra cane (Sound Foresight Technology LTD) and Bat K sonar (Bay Advanced Technologies Ltd) [1]. The ultra cane provide protection on the user by using 2 ultrasound sensor attached in front, foward the chest and head of the user [3]. However, ultra-cane is expensive (estimated at RM 2957.04 and RM 2299.92) and it detects excessive vibration with heavy pedestrian flow even though it can sense signal over the waist line level [1]. Some invention also needs a separate power supply or navigator which is requiring the user to bring it in a bag every time they travel outdoor [2]. These bulky designs will tire out the user, especially in a long way travelling. Other than that, those novel invention such as smart belt and other cane features require necessary skills and training phase of the user [3].

1.4 Objective

This project will fulfil the following objectives;

1. To design an assistive technology for visually impaired people in which can detect obstacles and provides alternative ways.
2. To alarm the user through speech (earphone/headphone) and vibration to determine the obstacles direction sources.
3. To build low cost blind navigation using Arduino with 1sheeld to connect to smartphone.

1.5 Importance of project

1. To enhance the mobility of blind people.
2. protecting blind people from possible hazard
3. less costly product will be affordable for many people.

1.6 Scope

- Speech alert delivered to smartphone using 1sheeld text-to-speech feature.
- Vibration alert triggered in 2 mini vibration motor.
- 4 ultrasonic sensor are set up on the cane gripper to detect obstacle from four directions(up, front ,left ,right)
- Controller used is the Arduino Uno.

1.7 Organization Of Thesis

Each chapter's goal is described and arranged as below;

CHAPTER 1

Introduction, objective, scope and project summary are written to gives better understanding on where this project direction, and generally explain the significance of this project. This chapter also try to discover the problem or deficiency that has emerged in previous inventions.

CHAPTER 2

All data collection such as theories and possible solutions are written in this chapter. This chapter is neccesary to enable or verify that this invention is achieveable, based on many method from vary sources of reference. In other words, chapter two is more on comparisons of researches, fundamental working principles of component involved and formulas.

CHAPTER 3

This chapter is considered as one of the most crucial part and all the statement has to be written thoughtfully. Chapter three is about the way of managing this project and provides first step on much clearer view on how the theories and researches can be adapted in this project to solve the problem in chapter 1. It is consist of a Gantt chart, flowchart and the system design.

CHAPTER 4

The circuit and arduino program are analysed, simulated and explained in this chapter. It involves the program for grove mini vibration motor and ultrasonic sensor. The prototype body was decided after all the functionality met the objectives requirement.

CHAPTER 5

Chapter 5 conclude all the significant achievement of this project and consists of some suggestion for future work to improvises its feature.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

In this chapter, all the sources from journals, books and websites that related to this project is clarified. This chapter covering five different types of research about cane invention that had been produced in several years before and also elaborate about some background of component specification which are expected to be implemented in this project.

2.2 My 2nd Eye

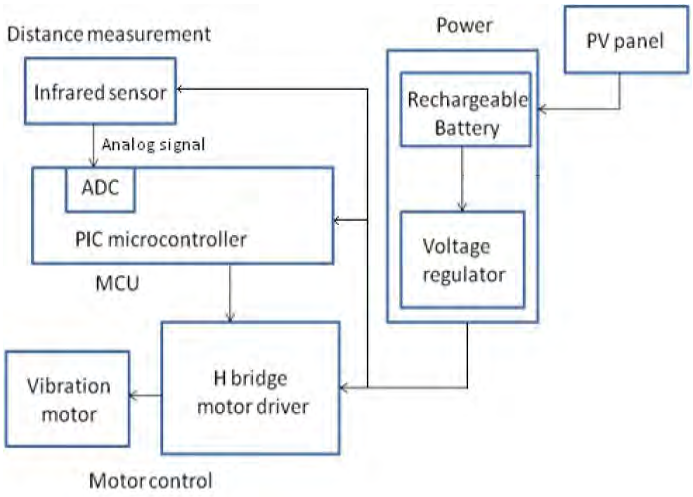

Figure 2.2.1: My 2nd Eye Block diagram[4]

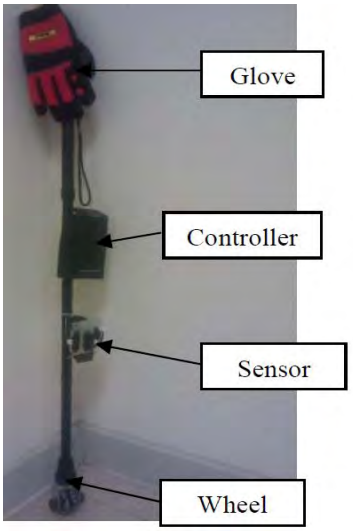

Figure 2.2.2: My 2nd Eye Prototype [4]

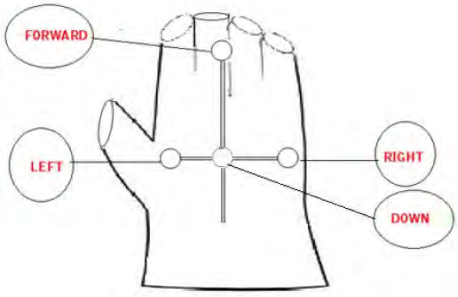

Figure 2.2.3: Location of vibration motors [4]

My 2nd Eye use solar panel to charge the battery. The power produced will be used by the motor driver, 4 vibration motor, PIC microcontroller and 4 infrared sensors. When obstacle detected by infrared sensor, signal will be sended to controller and controller will deliver signal about the obstacle direction source and distance in the glove's vibration motor. The vibration concept is same with a phone vibration. This type of warning system is a good choice as it use human sense of touch and therefore, the fastest way to alert them[4]. However, this invention does not provides alternative ways for the user.

2.3 GPS based Virtual Eye for the Blind People

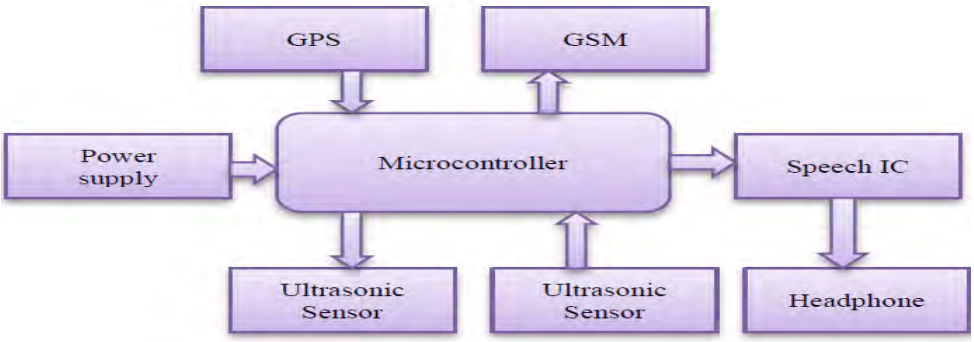

Figure 2.3.1: Block diagram for GPS based Virtual Eye [3]

Global Positioning System (GPS) and Global System for Mobile communications (GSM) are interfaced to the microcontroller to detect the blind person location [3]. Microcontroller get the location from the GPS modem and transmit the location to the GSM modem which will send a SMS messages to the all saved numbers[3].Which is means, if the blind person is missing, his/her relative can identify the person coordinate location as tha GPS will send the information continuously to the controller. The coordintae location can be received immediately as the relative send one message such as 'TRACK' to the blind person. The controller used for this system is the ARM7 based ATMEGA 328 microcontroller. For its obstacle avoidance, GPS based Virtual Eye use 1 ultrasonic sensor with distance ranging from 2cm-400cm non-contact measurement function. Obstacle notification also provided by speech ic (APR33A3). APR33A3 is integrated circuit that can record and play audio in 11 Minutes . The controller will send signal about the obstacle to the speech ic and it will inform the user that obstacle has been detected. To obtain better speech alert, headphone is applied as well, directly from the speech ic. Power supply used consist of battery, rectifier, filter and regulation[3].

Advantages of this system are, it is applicable inside and outside of house and also in known and unknown evironment such as airport, hospital and market. However, even though it is a dynamic system, the item list is too many and this subsequently increase the cost of product. For example, item such as GSM module, GPS module and speech ic(APR33A3) need to be purchased. This system does not

use vibration as in MY 2nd EYE and it can detect obstacle in one direction only as there is only one ultarsonic sensor which is mounted to the cane.

2.4 Smart Cane: Assistive Cane for Visually-impaired People

Smart Cane was designed resembling the funtionality of the Guide Cane, where it provides alternative ways for blind people when there is obstacles in front of them[2]. It would invoke voice alert about the obstacle distance, such as 'No object 4 feet in front of you'(far), ' Object are 3 to 4 feet in front of you'(medium), and 'An object is right in front of you'(near). Smart cane is equiped with one ultrasonic sensor attached at the near top of the cane, a water detector , vibration motor and voice chip circuit. The controller used was PIC microcontroller.

Figure 2.4.1: Smart Cane

Some disadvantages was founded in this design, which are;

1) The voice message is too repetitive and confused the user
2) The water sensor can only funtion well if the water level is 0.5 cm and above.
3) Buzzer for the water sensor alert cannot stop automatically unless, the water sensor is dry.
4)It detect obtacles in front space only.

2.5 Evaluation of Electronic Haptic Device for Blind and Visually Impaired People (Electronic Long Cane) : A Case Study.

Maintaining the long cane design is an advantageous choice as most blind people already being familiar of the way of handling it. Electronic long cane design is the same with traditional long cane. The difference is laid in the space detection range, where an electronic long cane can also sense any objects that located above the user waistline or same level with their head. By having above waistline detector, user will no longer bang their head accidently to object in front of them. For the lower body protection, the electronic long cane detect obstacle manually like the traditional white cane. It use one ultrasonic sensor , pic microcontroller and haptic device, which are all fitted inside the gripper. Haptics is define as a tactile feedback technology which recreates the sense of touch by returning forces, vibrations, or motions to the user[9]. In this case, tactile feedback from micro motor will be triggered everytime an obstacle is sensed by the ultrasonic sensor.

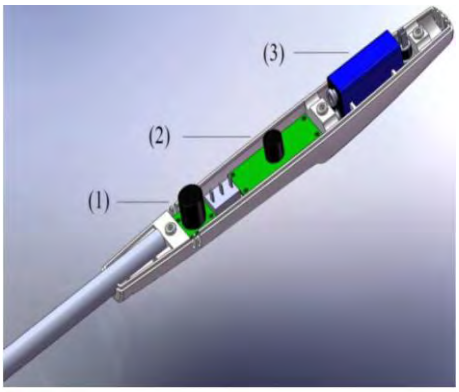

Figure 2.5.1: components inside gripper; (1) ultrasonic sensor and micro motor, (2) microcontroller, and (3)battery

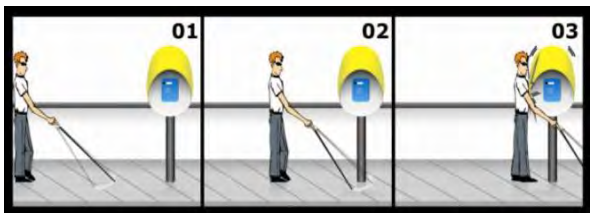

Figure 2.5.2: Ordinary Cane Limitation [1]

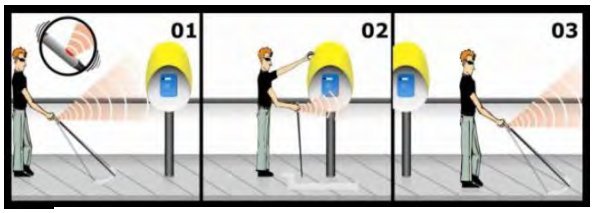

Figure 2.5.3: Electronic Long Cane Improve Spatial Perception [1]

The grip of the prototype was 22 cm long, 3 cm in diameter, and 0.170 kg in weight[1]. The ultrasonic sensor range was set at 1.5 m, covering an angle of 30°[1]. Battery life was ten hours[1]. The disadvantages of this prototype is that, it generates too much vibration whenever it being used in a heavy pedestrian flow.