UNIVERSITI TEKNIKAL MALAYSIA MELAKA

IMPLEMENTATION OF SENSITIVITY TRAVEL AID FOR BLIND PEOPLE BY USING MULTI-SENSORS

This report is submitted in accordance with the requirement of Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Computer Engineering Technology (Computer System) with Honours

by

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the Bachelor's Degree in Computer Engineering Technology (Computer System) with Honours. The members of the supervisory committee are as follow:

………………………………….

(Encik Aiman Zakwan bin Jidin)

ABSTRAK

Di dunia ini, sesetengah orang telah diberkati dengan penciptaan badan yang sempurna dan sesetengah orang mengalami kemalangan dalam penciptaan badan mereka. Mereka dilahirkan secara congenital buta atau buta yang diperolehi di mana ia boleh datang dari penyakit atau kecederaan. Walau bagaimanapun, kebiasaannya, yang disebabkan oleh manusia adalah buta. Kebutaan adalah kehilangan penglihatan yang berguna di mana ia boleh menjadi masalah sementara atau kekal. Dengan keupayaan visual yang terhad, kebanyakan orang buta menghadapi masalah dalam aktiviti harian mereka di mana mereka memerlukan bantuan lain untuk membantu mereka dalam pergerakan mereka. Nasib baik, dengan perkembangan teknologi, projek yang dicadangkan ini melaksanakan kepekaan bantuan perjalanan untuk orang buta dengan menggunakan pelbagai sensor yang boleh membimbing mereka dan membuat mereka merasa yakin untuk berjalan dan mengelakkan daripada mendapat apa-apa kejadian yang berlaku. Sensor ultrasonik, sensor air, dan sensor cahaya digunakan dalam bentuk untuk mengesan halangan di bawah lutut dengan jarak tertentu antara jarak antara buta dan halangan. Walaupun begitu, bantuan perjalanan menghasilkan corak bunyi dan bergetar yang berbeza untuk memberikan amaran kepada orang buta. Selain itu, orang buta juga boleh mengesan bantuan perjalanan mereka jika mereka hilang, tidak kena atau bantuan perjalanan jauh dari orang buta menggunakan IR Remote. Bantuan perjalanan juga menghasilkan bunyi dan bergetar. Semua proses dibina di Arduino. Arduino adalah platform prototaip sumber terbuka dengan perkakasan dan perisian yang membolehkan pengguna membuat atau mereka bentuk objek elektronik interaktif dan menguji prototaip elektronik kompleks. Mikrokontroler dan komponen elektronik lain telah ditubuhkan dalam perkakasan dan diprogramkan menggunakan perisian.

ABSTRACT

In this world, some people have blessed with a perfect body creation and some people are misfortune in their body creation. They are born congenitally blind or acquired blindness where it can come from disease or injury. Despite that, commonly disabilities that having by humans is blindness. Blindness is a loss of useful sight where it can be temporary or permanent disabilities. With limited visual capabilities, mostly the blind people are having problems in their daily activities where they need other helping hands to assist them in their movement. Luckily, with the development of technology, this proposed project implemented a sensitivity of travel aid for blind people by using multi-sensors which able to guide them and make them feel confident to walk and avoid from getting any incident happened. Ultrasonic sensor, water sensor, and light sensor are used in designed to detect obstacle below the knee with a specific range of distance between the blind and obstacle. Despite that, the travel aid produced a different pattern of sound and vibrate to give warning to the blind. Moreover, the blind also can trace their travel aid if they lost, misplaced or travel aid is far from the blind by using IR Remote. The travel aid also produces a sound and vibrate. All the process are built in Arduino. Arduino is open source prototyping platform with a hardware and software which enable user to create or design an interactive electronic objects and test the complex electronics prototypes. Microcontroller and other electronic component have been set up in hardware and programmed using the software.

DEDICATIONS

I would dedicate my dissertation work to my beloved family and my friends. To my beloved family, a special feeling of gratitude and sincere indebtedness to them for their love, dream, sacrifice, and word of motivation throughout my life. I am really thankful for their sacrifice, patience, and understanding that was inevitable to make this work possible.

I also dedicate this dissertation to my friends especially Muhammad Amirul Farhan, Mohd Nazim and Muhammad Syazmeer and Nurfarahani for being there for me and that helps me a lot to complete successfully the entire of this study. I will always appreciate their devotion, support, and faith in my ability to achieve my dreams

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First and foremost, all praise to Allah the Almighty for giving me the strength, health, knowledge, and patience to successfully complete this Final Year Project report at the given time. I have to thank my parents for their love and support throughout my life. Thank you for giving me the strength to climb the stairs and walking towards the paths of life. I would like to address my deepest appreciation to my supervisor, Encik Aiman Zakwan bin Jidin for his contributions, encouragement, comments, guidance, and enthusiasm through the time developing the report and project. Special thanks to my friends that have been through thick and thin throughout the completion of this project. This project report might be impossible to complete without all of their help. Last but not least, thank you to everyone that directly and indirectly involved in helping me finishing this Final Year Project report. To all of I have been mentioned, this success of mine couldn't be turned into reality without them with all of their helps me in a different way.

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LIST OF ABBREVIATIONS, SYMBOLS, AND NOMENCLATURE

WHO   -   World Health Organisation

GPS   -   Global Positioning System

RF   -   Radio Frequency

IDE   -   Integrated Development Environment

RFID   -   Radio Frequency Identification

IR   -   Infrared Sensor

GSM   -   Global Systems for Mobile communication

SMS   -   Short Message Service

PC   -   Personal Computer

PIC   -   Peripheral Interface Controller

I/O   -   Input/output

DC   -   Direct Current

USB   -   Universal Serial Bus

SRAM   -   Static Random Access Memory

m   -   Meter

Km   -   Kilometres

Kb   -   Kilobytes

PWM   -   Pulse Width Modulation

DC   -   Direct Current

LDR   -   Light Dependent Resistor

EDA   -   Electronic Design Automation

CHAPTER 1

INTRODUCTION

1.1 Background

The number of blind people in society is increase day by day until they might put themselves in a dangerous situation. This referring, the biggest problem for blind people is mobility. According to statistic World Health Organization (WHO), the number of people of all ages living with sight loss is estimated to be 285 million which 39 million are blind and 246 have a low vision WHO (2014).

Old day's version without development of technology, commonly blind people used a guide dog instead of travel aid to help them walk independently and confidently. A dog mostly is trained by the master to avoid obstacles and assists the blind people to watch their steps when using stairs. With the development of technology, travel aid now is famous portable tools used by the blind which contains many specifications. Since blind people can't be seen, yet they only can touch and feel by their long cane. By used this travel aid, blind people able to swing away back and forth around their feet to detect the obstacle surround them.

In this project, it proposed a sensitivity travel aid which capable of detecting an obstacle with a respective sensor and produced the sound pattern with vibration feedback generated through buzzer to overcome the limitations of visual capability. But, this travel aid is fully automated, easy to maintain, cheap and it is very comfortable to use. Thus, the blind people can be alert with an obstacle and make them self-dependent to do their daily routines.

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1.2 Problem Statement

Generally, blind people need other helping hands or assistant to accompany and guide them to walk. Walking safely and confidently without any human assistant in urban or unknown environments is a difficult task for blind people. So, to overcome their difficulties in their daily life, a travel aid is designed where it provides a convenient and safe method for the blind to use. But, the travel aid is only can guide and assist the blind to walk thus not to protect the overall body the blind if any incident happens. So it might high risk of danger and blind people might get lost if they travel alone.

Otherwise, in this proposed, the travel aid are designed which can sense his/hers only up to 3 meters from the blind if they misplaced his/hers travel aid by tracking using IR remote control. If the travel aid is far from the blind, it's difficult for the blind to detect and trace its travel aid. Thus, the travel aid can detect an obstacle up to 0- 15 cm around below knee by using ultrasonic sensor. It also can detect the presence of water by using water sensor and yet it can be detect the darkness room by using light sensor. Every sensor once it's detected either obstacle, light, water or even remote, the buzzer will produced different sound pattern. Nevertheless, the sound of buzzer play role as an output might difficult to be heard by the blind if the travel aid far from them (up to 3 meters) since it is limited of distance.

1.3 Objectives

The objective of this project are:

1. To study the characteristic and functionality of multiple sensors which can be used for travel aid.
2. To implement of sensitivity travel aid for blind people by using multi-sensors based on Arduino.
3. To analyze the overall performance of this project accurately.

1.4 Work scope

In this project, project scope consists of two part which is hardware and software design. For hardware part, it mainly consists of an ultrasonic sensor, light sensor, water sensor, buzzer, vibrating motor, battery, switch button, Arduino Infrared Remote control and Arduino controller (UNO) as the main controller of the project.

Thus, in software part, C/C++ programming language and Arduino IDE is used to control the hardware input and output and acts as a compiler. At the end of this project, the test of a prototype will be conducted to verify the functionality of every component. Limitation of this project is when the battery in travel aid is running out, it cannot function until it fully charged. Also, the distance to detect obstacle and track travel aid are limited.

Moreover, in this project, we able to estimate the weight of travel stick which helps the blind easy to bring along or carry and thus analyze how long the battery life can withstand.

1.5 Thesis Outline

In this thesis, it consists of five (5) chapters which include introduction, literature review, methodology, results and discussion and conclusion. Chapter 1 starts with the introduction of the project which describes the background of the project, the problem statement, objectives of the project, work scope of the study and thus project significantly. For chapter 2, it will briefly discuss literature review that related to fields of the project from the previous researcher. In this section also discuss the hardware and software part that related to the project. In Chapter 3 is about the methodology of the project which contains the flow of the project and it will focus on hardware and software design. In chapter 4, is represent results and discussion where all the results obtained will be discussed after the entire project is completely done. Lastly, Chapter 5 will be the conclusion of the project. It will discuss an overall project and wrap up all the finding and makes some recommendation for the future development.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

In this chapter, it will discuss the past and current researchers that have been carried out which are related to this project. Numerous aspect in term of sensors and the overall working system will investigate in order to make this project successful.

2.1 Previous research

By referring to WHO (2014), it can be estimated in worldwide, around 39 million are blind and 246 million have low vision. About 90% of the world's visually impaired live in the low-income background. Mostly around 82% of people with blindness are aged 50 and above and 19 million children below age 15 are visually impaired. With a development of technology, usually, blind people used a white cane to assist them to move by themselves. Without cane in their hand, they will feel hesitate to walk alone and they intend to stay in the house. This will affect daily routine of blind people become limited if there is no something to hold to assist them to move.

2.1.1 Obstacle Detection, Artificial Vision and Real-Time Assistance via GPS

Based on research (Dambhare and A, 2011), their project quite similar with the proposed project but they used GPS module, artificial vision, and real-time assistance. In their smart walking stick, GPS is used as to navigate the location accurately with also provide time information and thus, it suitable for outdoor navigation set by the blind via his/her voice independently. GPS is being installed to the walking stick which to help the blind arrived at the destination by their own with safe and sound without needing others helper to guide them. There will a control button which is used to record and play the voice. The capability of recording the voice and playback offered to the device is around 40 to 60 seconds. Moreover, if the power supply is being removed from the module, the recorded sound will remain retained. GPS that was installed in the walking stick contains the data of current location which received from the GPS system. Once the blind entered the destination location into the device by pressing the button and record via voice, the data will be processed and compared with the already data installed, so that it can trace the distance from the destination and produce an alarm to alert the blind by voice.

An artificial vision system is the sensory system which produces laser beam to surrounding and will reflect by the object. According to with the time difference between emitted and received beam, the system will calculate the distance from the object by greyscale methods (voice). The systems also can detect the static and dynamic object which can make used of stereo camera and processing unit to generate the data. When dealing a single dominant object, it can run at the rate around 6 frames per second on 320 x 240 images. Besides, the covering range of artificial vision system is between 1 and 15 m at 64 degrees which a pair stereo cameras mounted on a helmet connected via connectors to a computer.
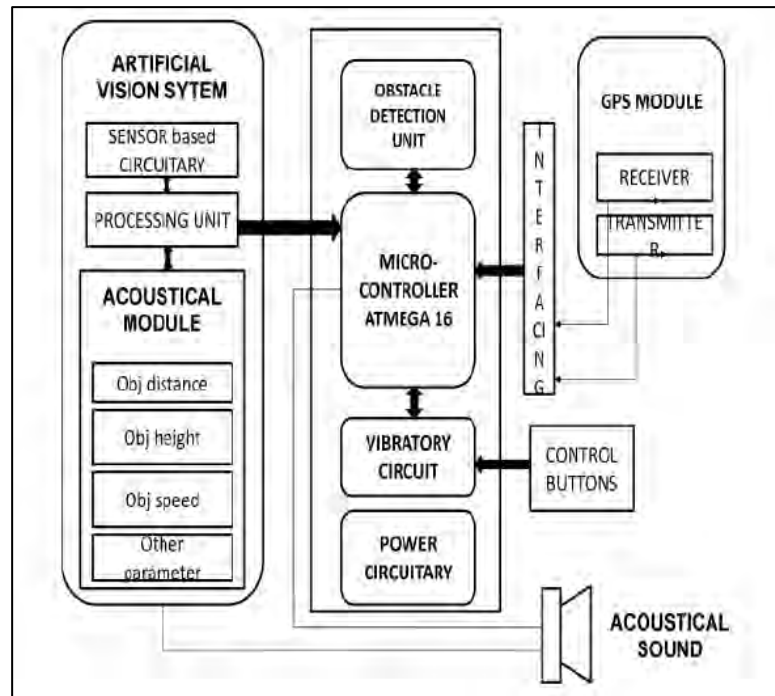
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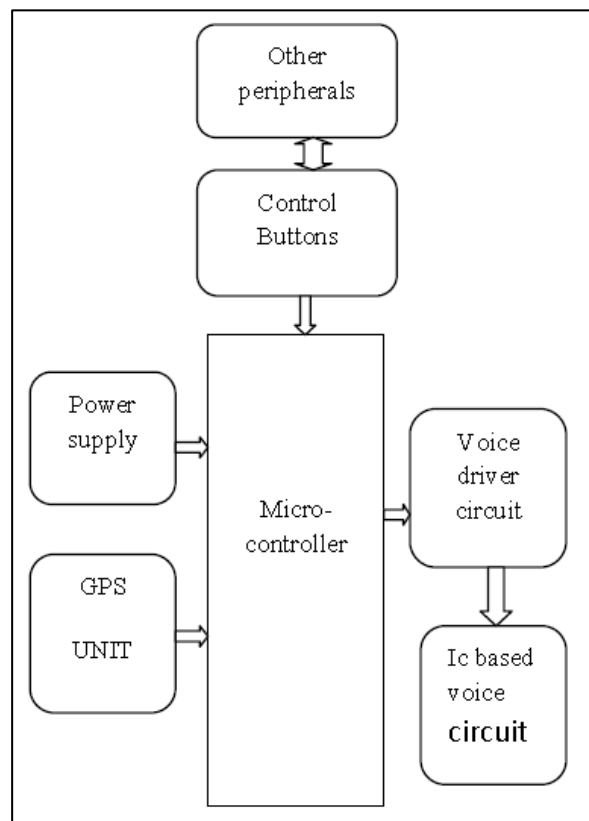Figure 2.1: The overall flow block diagram (Dambhare and A, 2011)

Figure 2.2: The GPS unit block diagram (Dambhare and A, 2011)

2.1.2 An Intelligent Walking Stick for the Blind

Past researcher (Kher Chaitrali *et al.*, 2015), found that in this study they used RFID technology, providing voice output for obstacle prevention and navigation and Android devices. Commonly, RFID sensor will be attached to a walking stick for detecting location usually when they are in the house. RFID tag is being installed on the walking stick and public area and Android application are designed which connected to an Android phone via Bluetooth. When the obstacle is detected by the IR sensor, it will transmit the data to the microprocessor via Bluetooth so that the phones will give vibration alerts and voice output to the blind once the RFID being read. Whenever the RFID tag is read by the RFID sensor the information will be sent to the application.

RFID tag contains the landmark and the additional location and direction of the blind and it will send to the Android application via Bluetooth. However, it will also keep updating the blind location information on the server where the family member can easily access to trace the current blind location through the server. Location of the blind will be fetched whenever the button is pressed. Otherwise, with the used and existence of GPS for navigation to the blind when they in outdoor, GSM module will send an urgent message (SMS) directly to the relative member about the current blind location
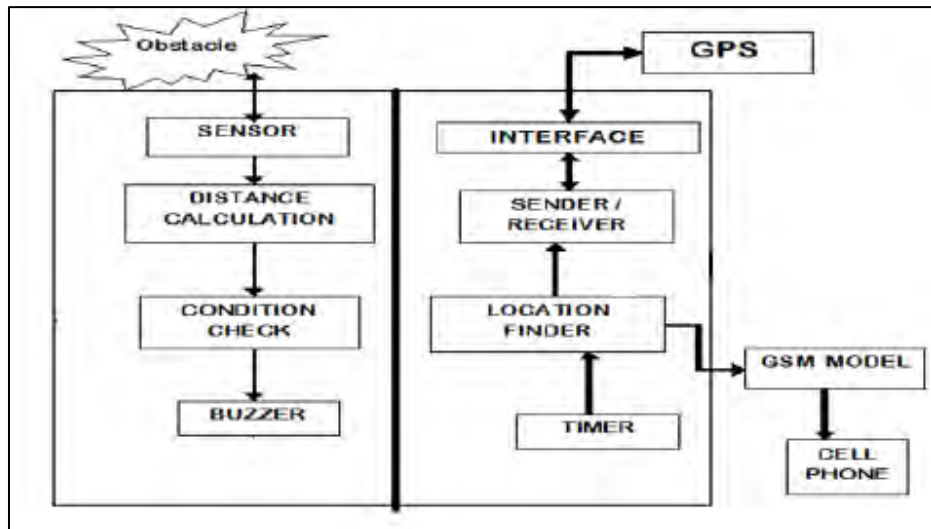
Figure 2.3: Block Diagram of GSM and GPS based system
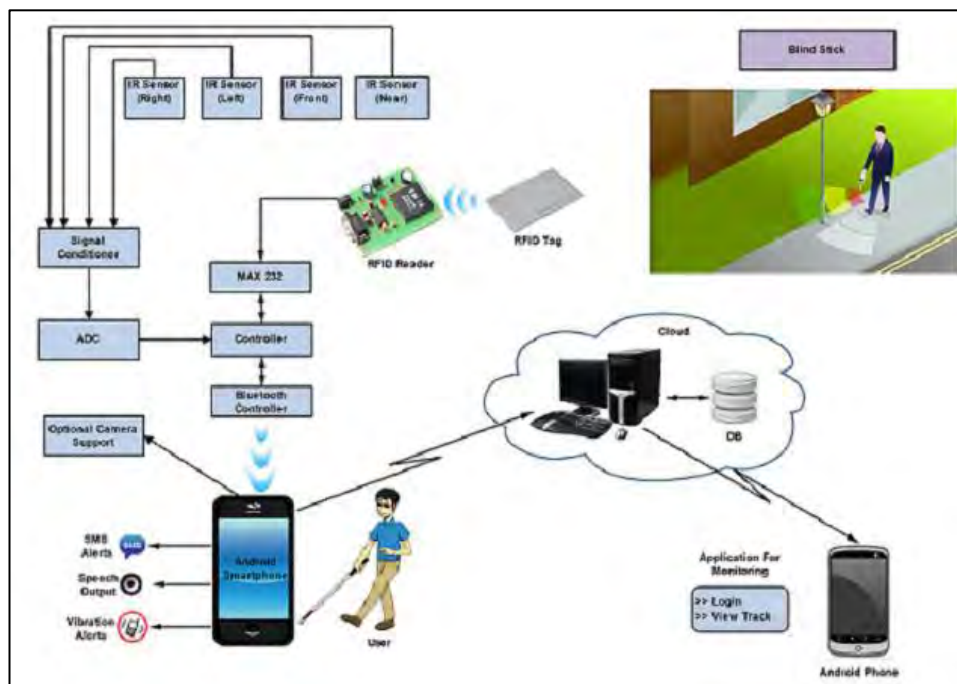
(Kher Chaitrali *et al.*, 2015)

Figure 2.4: System Architecture (Kher Chaitrali *et al.*, 2015)