



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF BLIND PERSON TOOLS BY USING ULTRASONIC SENSOR

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours.

by

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I hereby, declared this report entitled “DEVELOPMENT OF BLIND PERSON TOOLS BY USING ULTRASONIC SENSOR” is the results of my own research except as cited in references.

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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 degree of Bachelor of Engineering Technology (Industrial Electronic) (Hons.). The member of the supervisory is as follow:

.....
(Miss Siti Halma Binti Johari)

ABSTRACT

The purpose of this project is to develop the Electronic Travel Aid for the blind people. It will involve the ultrasonic technology to be more useful and reliable compare to the classical cane in order to provide fully automatic obstacle avoidance with audible and vibration notification. Developments in embedded systems have opened up a vast area of research and development for affordable and portable assistive devices for the physically challenged. Besides, it is design to consume less power, portable in size and has an acceptable accurate performance in object distance. This project aimed at the design and implementation of a detachable unit which acts to augment the functionality of the existing white cane, to allow knee-above obstacle detection. However, due to its inherent limitation, the classical method does not provide the protection for the body. Consequently, there is no guarantee that's the presence of obstacle, can be detected by the blind to avoid a collision. The cane developed helps a blind person find way without any difficulty in terms of improving the social life for the blind pedestrian.

ABSTRAK

Projek ini bertujuan untuk membina satu alat bantuan pergerakan elektronik untuk orang buta. Ia melibatkan teknologi ultrasonik dan dijangka dapat menggantikan tongkat sedia ada. Ciri bagi alat bantuan ini termasuk menyediakan pengesanan halangan automatik sepenuhnya melalui penghasilan bunyi. Selain itu, alat bantuan perjalanan elektronik (ETA) ini, menjimatkan kerana penggunaan kuasa yang minimum dan saiz yang kecil membolehkan ia dibawa dengan mudah. Walaubagaimanapun, berdasarkan keadaan semasa, tongkat yang terdahulu tidak dapat menyediakan perlindungan kepada tubuh badan. Oleh itu, tiada jaminan kepada halangan yang bakal dihadapi dapat dikesan oleh orang buta pada masa yang sama dapat mengelakkan daripada berlakunya pelanggaran. Selain daripada meningkatkan kemajuan alat bantu terdahulu dan menggantikannya, ia merupakan satu pembaharuan dalam peningkatan kehidupan sosial golongan orang kurang upaya ini.

DEDICATIONS

I dedicated this final project report, in thankful appreciation for support, encouragement and understanding to my beloved mother, father, sister, brothers and friends.

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LIST OF SYMBOLS AND ABBREVIATIONS

SPDT	=	Single Pole Double Throw
GND	=	Ground
ANT	=	Antenna
PC	=	Personal Computer
USB	=	Universal Serial Bus
AC	=	Alternating Current
DC	=	Direct Current

CHAPTER 1

INTRODUCTION

1.0 Introduction

From this chapter contribute the sketch of this research project. In this chapter it divide into five sub-sections which is including the background project, problem statement, objective, project statement and project significant.

1.1 Background

In light of information from Malaysian Association for the Blind (MAB) there are 63,000 individuals in the Malaysia was evaluation visually impaired, and 53,000 individuals are having an awful foggy of eye. Hence , solicitation of innovation are vast for both the span of the business and the measure of the need . The essential trouble to create an attractive variant of the proposed innovation is the structure variable. This item ought to be grow in simple approach to utilize and lightweight. At the point when the item we construct in little size it makes the item look exceptionally alluring. As more markets are produced for this innovation, the sensor will have the capacity to be made in high volume at low cost. According to (Dakopoulos & Bourbakis, 2010) Electronic travel aids can likewise be arranged relying upon how the data is assembled from the earth and relying upon how this data is given to the client. Data can be assembled with sonar , laser scanners, or cameras, and the client can be educated through the sound-related and/or material sense.

The Ultrasonic sensor HC_SR04 is the main component of this project. According to (Batarseh, Burcham, & McFadyen, 1997) this sensor utilized a pulse of ultrasonic waves to decides the separation of hindrance. The sensor has two vital

element which is direct simple of the separation measured by utilizing DC voltage output and an inward switch. These two elements are utilized to created framework that capacity in a simple or recognition in advanced mode..

1.2 Problem Statement

For supported introduction and portability, as should be obvious basically visually impaired individuals utilize an old school long stick, which expanded dimensional detecting is give inside and are around 0.5 meters in front of the client. On the other hand, the long stick does not give security to their body. The long stick has a few confinements, for example, a reach constrained to the length of the stick, normally one pace in front of the client, challenges distinguishing overhanging impediments, and safe stockpiling in broad daylight places. Because of its inborn confinements, the long stick does not give security to the body over the waist height. Therefore, there is no ensure the vicinity of obstructions, for example, boxes, tree limbs and overhanging wires, can be distinguished by the visually impaired individual so as to stay away from a crash.

Along these lines the issue of versatility can be reframed as an issue in spatial detecting. The strategies for spatial detecting are no doubt understood, for example, radar, sonar, and optical triangulation systems being the most widely recognized, and the recent two have been fused into a wide mixed bag of past ETA outlines [Duen Hsi Yen, 1996].

1.3 Objective

- To study transmitter and receiver of ultrasonic sensor characteristics.
- To develop blind person tools by using ultrasonic sensor prototype that consume less power , portable size and acceptable accurate
- To analyse the performance of the ultrasonic sensor.

1.4 Project Statement

1.4.1 Scope

The inspiration for this venture was to plan an electronic portability help for the visually impaired. The objective of this task is to outline Electronic Travel Help (Estimated time of arrival) for the visually impaired and to enhance the confinements of the long stick and to supplant it. It will included ultrasound innovation to be more valuable and solid than traditional stick. The ultrasonic stick is utilization to permit the visually impaired individuals for helped introduction and simple versatility. The model is fitted in a box that will attached at stick with an outside battery pack as force supply, a audible output and a scope of 0 up to 1 meter. This project suitable for indoor used only.

The open ultrasonic sensor manufactured gold foil stretched over a grooved plate. The grooved, metallic back plate in contact with the insulated side of the foil forms a capacitor which, when charged, exerts an electrostatic force to the foil thus transforming electrical energy into acoustical waves. Similarly the energy flow can be reversed to transform the returning echo into electrical energy.

In this configuration, ultrasound is separate out and the ultrasonic reverberation's are returning back and the visually impaired client will get capable of being heard area and introduced binaurally after the reverberation has been interpreted back . The time based signals in charge of spatial hearing are encoded upon the sound, in this manner making the figment of an externalized sound-related picture situated out in space at the recognized object's position.

1.5 Project significant

It is expected to build up one system that can sense the obstacle and give a notification to a blind person when he or she by using Arduino microcontroller. Other than that, this system will automatically run and it also will implement new method of technology. This project also can give benefit toward the blind person

where they can use this tool to help them cross the road and walk without breaking any obstacle and no longer need to use a cane.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

On this chapter provide the study of this research project. It is divided into sub-sections of introductions, basic principle of ultrasonic sensor, about hardware and microcontroller that used for this project and last but not least the previous work about this project. In this chapter some elaboration on the low power technology was stated. The fundamental of ultrasonic sensor was explained based on findings from variety of sources. All the material and information that were used in this project are from journal, book and trusted website.

2.1 Previous Work

2.1.1 Echolocation

Next, there is list of the most important projects with a brief description for each one. We will study these systems taking the above guidelines into consideration and then give some comparative results to answer the questions of how advance, useful, and desirable each system According to (Dakopoulos & Bourbakis, 2010) this project was create based on bat's echolocation system and they want to design a new mobility aid modelled which started in the early 1990s in Japan. This project used on conventional eyeglasses which is two ultrasonic sensors are attached and using a microprocessor to stored the data and converted to a stereo audible sound using A/D converter and sent it via headphones. The reflected of ultrasound wave transmitted can be difference cues different intensities and time and also the sensors indicate the different directions and sizes of obstacles, creating a form of localized sound images.

By using different ultrasound frequencies some exploratory experiments were performed to evaluate the user's capability to discriminate between objects in front of the user's head. Figure 2.1 shown the frequency characteristic of ultrasonic sensor. The results provided show that the users can identify and discriminate objects in some limited cases, but more experiments and statistical results are required to support the viability of the project. The simplicity and portability of the prototype are also major advantages (Ifukube, Sasaki, & Peng, 1991).

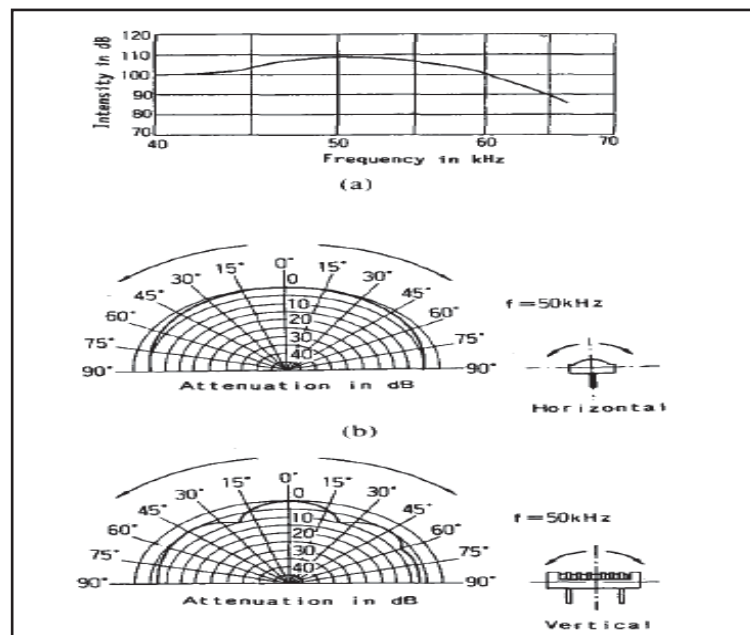


Figure 2.1: Frequency characteristic of ultrasonic transducer

2.1.2 UCSC Project

Manduchi and Yuan from University of California Santa Cruz (UCSC) (Yuan & Manduchi, 2004) developed a noncontact handheld tool for range sensing and environment discovery for the visually impaired. The fundamental contention is that a recognition through exploratory developments which is like those utilizing a white stick, seems, by all accounts, to be a characteristic methodology for environment disclosure. Along these lines, the instrument is handheld and as the client swings it around (vertical or even) he/she will get data by method for material gadgets.

The framework bargains just with 1-D information, which is computationally less expensive than PC vision or spatial sound systems. The model is comprised of a laser extent sensor as found in Figure 2.2, and a PC. The anger sensor is in light of dynamic triangulation. What's more, the time profile of the extent is examined by the PC to identify ecological components that are discriminating for portability, for example, checks, steps, and drop-offs , by method for an expanded Kalman channel tracker. The location system utilized works for distinguishing planar structures.



Figure 2.2: Example project

Likewise, in spite of the fact that it is handheld, it is little and simple to convey. The drawbacks are that it is not tried with outwardly impeded individuals, in the middle of gadget and client there is no interface and just attempt on just planar structures and protests close to the ground. A portion without bounds upgrades that are proposed by the creators are change of highlight recognition calculations; supplant of point laser with laser striper; manufactured in processor in the gadget will supplant PC and material gadgets that will advise client for elements identified.

2.2 Introduction of basic Principle of Ultrasonic Sensor

In engineering and basic science field ultrasonic sensing techniques have become famous and are widely used. Outstanding capability to probe inside objects non-destructively is the one of advantages of ultrasonic sensor. This is because ultrasound can propagate through any kinds of media which is solids, liquids and gases except vacuum. In typical ultrasonic sensing the ultrasonic waves are travelling

in a medium and often focused on evaluating objects so that useful information on the interaction of ultrasonic energy with the objects are acquired as ultrasonic signals that are in wave forms variations with transit time. Piezoelectric is the one medium to generate ultrasound waves. Piezoelectric means "pressure electric" effect. Shape of quartz crystal will changes with polarity when electric current is applied. This causes expansion and contraction that in turn causes compression and rarefaction of sound waves will occur because of expansion and contraction. As we can see Figure 2.3 shown the example of Ultrasonic sensor HC-SR04.



Figure 2.3: Ultrasonic sensor HC-sr04

According to (Rastogi, 2012) speed of ultrasonic and time needed to travelling will be impact the separation of obstacle. The estimation of distance should be possible on the off chance that we measure the time needed in travelling to every part of the pulse from sensor to question and return back to sensor. By utilizing a ultrasonic module which can give the time waveform on C.R.O. regarding pulse width the estimation of separation can be accomplished. The output pulse width will differ in corresponding to the separation go by the ultrasonic wave.

According to (Innet & Ritnoom, 2009) by measuring the beat width of output wave, the separation to target can undoubtedly be computed. By measuring the pulse width of output wave, the distance to target can easily be calculated . The ultrasonic sensor produces pulse width in the output. In (Rastogi, Mehra, & Chandigarh, 2012) they describe ultrasonic sensor contains 4 pins these are Vcc, Trigger, OUT and GND as demonstrated in Figure. 2.4, Vcc and GND are supply and ground pins. Trigger input receives 10 μ s trigger pulse. Microcontroller will make this pin HIGH

then postpone for around $10 \mu\text{s}$ and make pin LOW once more. OUT pin gives the output pulse width relying on separation travel. After the trigger is given to microcontroller it allots pulse output on pin. Timing outline of ultrasonic sensor yield wave is demonstrated in Figure 2.5. The output pulse span is changed over to separation measured and the temperature impact is likewise considered. The method is described.

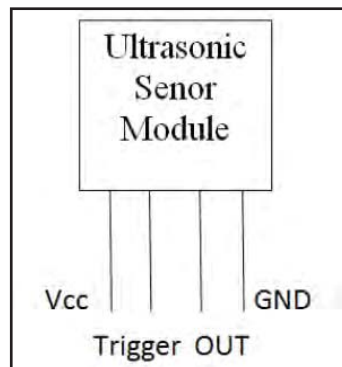


Figure 2.4: Ultrasonic sensor pin

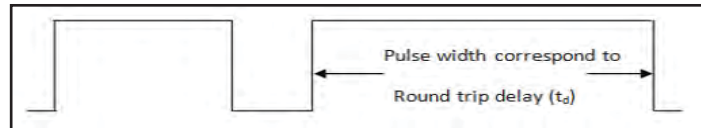


Figure 2.5: Timing diagram of ultrasonic sensor output wave

2.2.1 Ultrasonic Transmitter

Before transmit the ultrasonic wave, there is a section which is ultrasonic wave generator that capacity to produce ultrasonic wave. In that part, producing a guideline signal for discontinuously giving ultrasonic waves. After ultrasonic wave was created, ultrasonic transmitter transmits the ultrasonic waves toward a street surface to discover the impediment. The extent that snag distinguished is relies on upon the scope of ultrasonic sensors that utilized.

2.2.2 Ultrasonic receiver

In the event that the ultrasonic wave distinguish the impediment, it will create a reflected wave. A ultrasonic recipient is utilized for getting the ultrasonic waves reflected from the street surface to produce a reception signal. The signal is compared with reference signal to detect components in the amplified signal due to obstacles on the road surface. The size of the reference signal or the enhancement element of the intensifier is controlled to keep up a steady proportion between the normal of the reference sign and the normal of the increased sign.

2.2.3 The fundamental of Ultrasonic sensor

Ultrasonic going and recognizing gadgets utilize high-frequency sound waves to identify the vicinity of an item and its range. The frameworks either measure the echo reflection of the sound from items or distinguish the intrusion of the sound beam as the articles go between the transmitter and receiver. A straightforward delineation of the ultrasonic waves created in a strong where mutilation brought on relying upon whether a power is connected ordinary or parallel to the surface toward one side of the strong can bring about delivering pressure or shear vibrations individually, with the goal that two sorts of ultrasonic waves, longitudinal waves or transverse waves engender through the solid.

The vitality of the wave is additionally conveyed with it. In a ceaseless medium, the conduct of ultrasonic waves is firmly identified with a harmony between the powers of idleness and of versatile disfigurement. A ultrasonic wave moves at the wave speed) that is controlled by the material properties and state of the medium, and once in a while the frequency. The ultrasonic wave gives movement to the material when it engenders. It is noted in ultrasonic estimations that the particle speed is much littler than wave speed. Likewise, one can comprehend that no ultrasonic wave spreads in vacuum in light of the fact that there are no vibrating particles show there.