THED EVELOPMENT OF AN ULTRASONIC BLIND STICK

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THE DEVELOPMENT OF AN ULTRASONIC BLIND STICK

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ABSTRACT

Blindness are common disability around the world. Blind can be classed into total loss of vision and low vision. Walking stick are normally used by the blinds through an unknown environment become real and they cannot rely on their eyes. People with completely blind often have difficult time self-navigating outside. There are lot of obstacles such as big object, car, puddle so on that as normal people need to help them with something that may help them to walk freely without any fear. This product is use to develop an ultrasonic blind stick that can improve sightless people walk cross the street and pedestrian without getting any injuries using the vibrating motor and navigation (sound). It is also designed with low cost project for the blind stick with simple electronic components and analyse an ultrasonic blind stick with distance related to obstacles. This project hardware use ultrasonic sensor (HR-S04), water sensor (LM393)to detect those obstacles in a certain distance allowed. For the software, it uses programmable Arduino ide and Arduino nano atmega 328 to program the system to get good signal from the stick. The output will be the vibration and sound buzzer in allowed certain distance and it will depend on obstacle occur.

ABSTRAK

Buta adalah kecacatan biasa di seluruh dunia. Buta boleh dikelaskan ke dalam jumlah kehilangan penglihatan dan penglihatan terhad. Berjalan menggunakan tongkat kayu biasanya digunakan oleh orang buta melalui persekitaran yang tidak diketahui dan mereka tidak boleh bergantung kepada mata mereka. Orang yang benar-benar buta sering mempunyai masa yang sukar mengemudi sendiri di luar. Terdapat banyak halangan-halangan seperti objek besar, kereta, lopak sebagainya bahawa orang-orang seperti biasa perlu untuk membantu mereka dengan sesuatu yang boleh membantu mereka untuk berjalan bebas tanpa rasa takut. Produk ini digunakan untuk membangunkan kayu buta ultrasonik yang boleh meningkatkan orang buta berjalan menyeberangi jalan dan pejalan kaki tanpa mendapat apa-apa kecederaan dengan menggunakan motor bergetar dan navigasi (bunyi). Ia juga direka dengan projek kos rendah untuk batang buta dengan komponen elektronik mudah dan menganalisis satu kayu buta ultrasonik dengan jarak yang berkaitan dengan halangan. Ini perkakasan projek menggunakan sensor ultrasonik (HR-S04), sensor air (LM393) untuk mengesan halangan-halangan dalam jarak tertentu dibenarkan. Untuk perisian, ia menggunakan atur cara ide Arduino dan Arduino nano ATmega 328 untuk program sistem untuk mendapatkan isyarat yang baik dari batang. output akan menjadi getaran dan bunyi loceng dalam jarak tertentu yang dibenarkan dan ia akan bergantung kepada halangan berlaku.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Blindness are common disability around the world. Blind can be classed into total loss of vision and low vision. They need help to walk outside and all other daily work. Walking stick are normally used by the blinds through an unknown environment become real and they cannot rely on their eyes.

Mobility for the blind is always a great problem. Just like a sighted, blind also needs to travel around inside a closed premises like house, factory, office, school etc. They may also like to go for shopping, visiting friends and other places of their interest. Presently available electronic travelling aids like sonic path finder, sonic torch etc. are not suitable for using inside a closed premises such as school, factory, office etc.

Many of these travelling aids use either ultrasound or laser beam. One of such devices is the laser cane that is similar to a long cane with built-in laser ranging facilities, But most of the commonly used electronic travelling aids use ultrasound for functioning.

An interesting possibility, which has been investigated by several authors, is the use of ultrasonic sensors based on the well-known time of flight technique[1] Such sensors are reasonably cheap and work for ranges of up to a few meters, even though problems arise regarding both their accuracy and their behaviour in noisy open-air conditions.

Ultrasonic blind stick help blind people to their daily life that have improvement in term of awareness while they walking as pedestrian. It will be difference between traditional stick (normal stick) and modern stick because of the sensor that put in the moden stick and have some features such as can detect puddle or water, give vibration and buzzer if front of them have obstacle within the range. By having the ultrasonic blind stick, they can have more safety and confident to walk freely without have any hesitation.

1.2 PROBLEM STATEMENT

People with completely blind often have difficult time self-navigating outside well-known as environment, in fact physical movement is one of the biggest challenge to them. There are lot of obstacles such as big object, car, puddle because of that we as normal people need to help them with something that may help them to walk freely without any fear. If a blind people walk with the others, which is normal person they have no need to worry because they have people that guide them, what we care about when they walk alone in middle of day or night without any help, in case of that we as engineer need to develop something new for them instance of traditional stick (normal stick) for them, we develop electronic stick for them so they can use.

This project provides the best solution for the mobility difficulties of the blind people, by which they can easily, mobilized themselves, be successful part of society, earn their living in easy manner and get a position which suits them positively. This project facilitates blind's in a manner that they can handle any obstacle, wet material, uneven surface[2].

1.3 OBJECTIVES

This paper is focuses on the main objectives. There are the following objectives which are:

- To develop an ultrasonic blind stick that can improve sightless people walk cross the street and pedestrian without getting any injuries using the vibrating motor and navigation (sound).
- To design low cost project for the blind stick (component).
- To analyse an ultrasonic blind stick.

1.4 SCOPE OF PROJECT

The scope of this project is divided into two parts which are software and hardware part. In software part, Arduino Software will be the main software that will synchronized between hardware and software. From the simulation part, I should be able to study measure the signal strength of the component that will be implement in this project. For the hardware part, I will construct a hardware device, this project is used an electronic device such as ultrasonic sensor, water sensor, vibrating motor, Arduino NANO, speaker to produce sound to create electronic result.

The main focusing respondent for blind user. This project is analyzed for several features that can match with condition and user friendly to blind user when used it. Overall, for scope of project, I will implement hardware, software and questionnaire which is construct survey to completing my final year project's requirement. For the questionnaire part, I will distribute questionnaire to blind user public and blind user under Malaysian Association for Blind. This will enhance my knowledge and skills in completing Ultrasonic blind stick.

1.5 SIGNIFICANT OF THE PROJECT

The significant for this project is to help impaired person or blind people to walk freely without get any injury while walking dealing with obstacle, climb stair, walking after rain, all of this problem can avoid if they use electronic blind stick instant of traditional stick which is just a normal stick. Second is not all side walk that have tactile paving that actually is to warn visually impaired people about edge of all street such as, railway platform, walkway to bus station. Back to objective all of this is to help them. Beside of that, we develop light weight component integrated to stick which makes it user friendly.

Certain blind users have their own suggestion about blind stick (white cane stick). From that, the judgments can be refutes with the proves during testing this devices at the end of the projects. All the data can be analysed by observation conduct by experiment . It is easy for me to see whether this device very helpful or not to the blind user.

CHAPTER 2

LITERATURE REVIEW

2.1 ULTRASONIC SENSOR

Bats are superb animals. Daze from the eyes but then a dream so exact that could recognize a moth and a broken leaf notwithstanding when flying at full speed. Undoubtedly the vision is more honed than our own and is much past human capacities of seeing, however is unquestionably not outside our ability to grasp. Ultrasonic going is the procedure utilized by bats and numerous different animals of the creature for navigational purposes. In an offered to emulate the methods for nature to acquire an edge over everything, we people have comprehended it as well as have effectively imitated some of these signs and tackled their capability to the best degree.[3]

2.1.1 History

The history dates back to 1790, when Lazzaro Spallanzani first discovered that bats maneuverer in flight using their hearing rather than sight. Jean-Daniel Colladon in 1826 discovered sonography using an underwater bell, successfully and accurately determining the speed of sound in water. Thereafter, the study and research work in this field went on slowly until 1881 when Pierre Curie's discovery set the stage for modern ultrasound transducers. He found out the relationship between electrical voltage and pressure on crystalline material. The unfortunate Titanic accident spurred

rigorous interest into this field as a result of which Paul Langevin invented the hydrophone to detect icebergs. It was the first ultrasonic transducer. The hydrophone[4] could send and receive low frequency sound waves and was later used in the detection of submarines in the World War 1.

On a note parallel to the SONAR[5], medicinal research likewise began appreciating ultrasonic. In late 1930's Dr Karl Dussik utilized a strategy called hyper phonography which recorded echoes of ultrasonic waves on a delicate paper. This system was utilized to create ultrasound photos of the mind to help distinguish tumors and denoted the introduction of ultrasound imaging. From that point forward, numerous researchers like Ian Donald, Douglas Howry, Joseph Holmes, John Wild and John Reid enhanced the different parts of ultrasonic sensors in the restorative field which empowered finding of stomach growths, ovarian sores, discovery of twin pregnancies, tumours and so on. Industry too did not sit idle in bouncing on to the fleeting trend and soon created methods like ultrasonic welding and non-dangerous testing at the start of the 1960s.

2.1.2 Working of ultrasonic

Ultrasonic sensors are devices that use electrical–mechanical energy transformation, the mechanical energy being in the form of ultrasonic waves, to measure distance from the sensor to the target object. Ultrasonic waves are longitudinal mechanical waves which travel as a succession of compressions and rarefactions along the direction of wave propagation through the medium. Any sound wave above the human auditory range of 20,000 Hz is called ultrasound. Depending on the type of application, the range of frequencies has been broadly categorized as shown in the figure below[3]. Ultrasonic Sensor (transducers) is a type of sensor that uses sound waves to detect an object or target It works on similar principle of rada r or sonar which generates high frequency sound waves and evaluates the echo[6] which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. Comparing with other sensors, the ultrasonic is more accurate. Han and Hahn have proven that the distance and angle measurements of ultrasonic are highly reliable by proving that the

relative errors and variances of the measurements are within a reasonably small range[7].

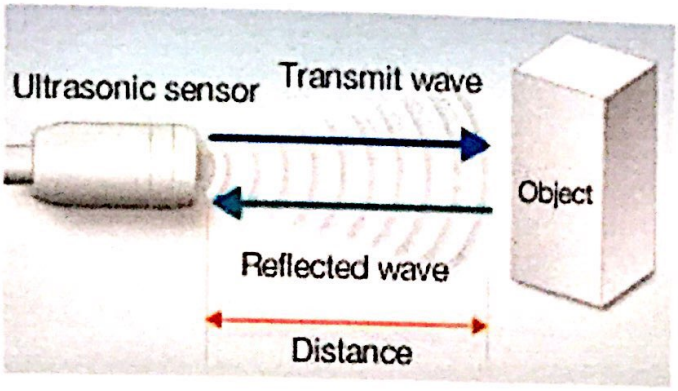

Figure 2.1: Working ultrasonic[8]

An optical sensor has a transmitter and receiver, whereas an ultrasonic sensor uses a single ultrasonic element for both emission and reception. In a reflective model ultrasonic sensor, a single oscillator emits and receives ultrasonic waves alternately. This enables miniaturization of the sensor head[9].

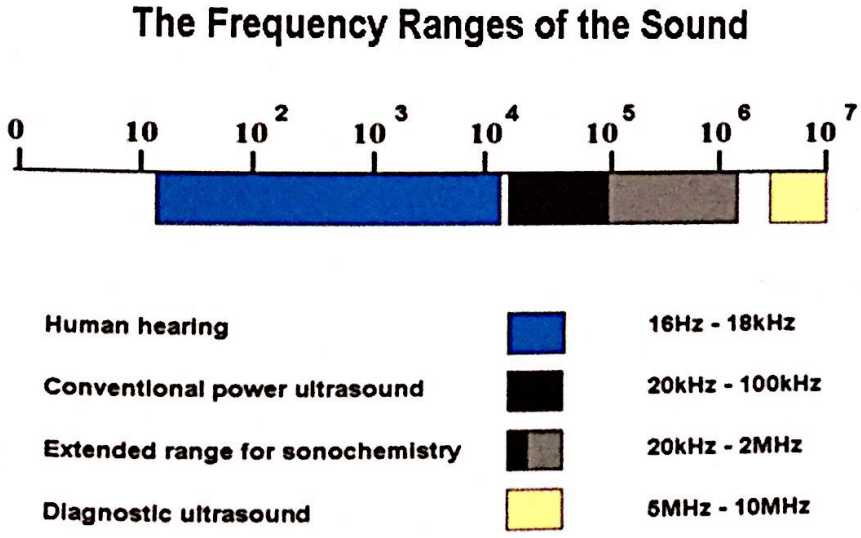

Figure 2.2: The Frequency ranges of The sound

2.1.3 Importance of Ultrasonic Sensor

There are a variety of sensors based on other physical transduction principles like the optical range finding sensors and the microwave based devices too. Then why should one use ultrasonic transducers in the first place, given that the speed of sound is very slow than the speed of electromagnetic waves? The answer lies in the question itself. Because the EM waves[10] based devices are too fast. Being slower that the EM waves, the time taken by ultrasonic waves is much longer than that taken by the latter and hence its measurement can be done more easily and less expensively. Because these are based on sound waves rather than EM waves, these would work in places where the latter would not.

For example, in the case of clear object detection and measurement of liquid levels or high glare environments, light based sensors would suffer greatly because of the transmittance of the target or the translucence of the propagating media. Ultrasonic devices being based upon sound propagation would remain practically unaffected. These also function well in wet environments where optical beams may suffer from refraction from the water droplets in the environment. On account of range and accuracy, the ultrasonic sensors may lie in between two EM wave based sensors, the Infrared rangefinders on the lower end and the LIDARs on the upper end. Not as accurate or long distance as the LIDARs, the Ultrasonic rangefinders fare better than the IR rangefinders which are highly susceptible to ambient conditions and require recalibration when environment changes. Further these devices offer advantage in medical imaging as compared to MRI or X-Ray scans due to inexpensiveness and portability. No harmful effects of ultrasonic waves at the intensity levels used have been detected in contrast to X-rays or radioactivity based methods and is particularly suited for imaging soft tissues[3].

2.2 BLIND STICK(WHITE CANE)

A white cane stick is one of the most common mobility aids for the visually impaired. However, it does not help users with visual impairments find obstacles at head- or knee-level, or at distances greater than 1 m. The white cane was introduced in the 1940s and is the most common mobility aid for the visually impaired with about 130,000 users in the US. It allows the detection of obstacles in front of a user within 1 m. Users typically tap the cane in an arc from left to right as far ahead as the cane's length. This tapping provides rich information about the surface and slope of the ground in the user's environment. However, there are several problems with a white cane, such as those in terms of detection and usability[11].

According to Mazo and Rodriguez the blind Cane is the assisting tools for the visually-impaired and it is very important. According to Herman ,one of the main problems of the visually-impaired, is that most of these people have lost their physical integrity. Also, they do not have confidence in themselves. This statement has been proven by Bouvrie, in which an experiment name "Project Prakash" has been carried out. It was intended at testing the visually-impaired to utilize their brain to identify set of objects. According to Chang and Song , this can also be applied to different situation. When the visually-impaired walk into a new environment, they will find it difficult to memorize the locations of the object or obstacles. These examples demonstrate the difficulties of visually-impaired[7].

2.2.1 Problem with white cane

The problem white cane is range of detection, which is limited to less than two paces and generally allows detection obstacle only at a distance equal to the length of the cane itself. The short distance detection interrupt the running speed of users, because it does not allow the user to confidently evaluate the approaching obstacle outside the range. Therefore, users are required to focus and list the obstacles because they are not able to predict obstacles at a distance greater than two paces. It is a conscious effort to reduce the running. In addition, showed that walking speed can be

influenced by the level of the knowledge of information. In fact, the investigation of the speed of visually impaired people showed that continuing the preview information (3.5 m) using Sonic Path sounder increased the operating speed of as much as 18% compared to walking speed by using a white cane. This is an increasing level of confidence of the user, greater confidence a user has, the closer they are running at a speed of their choice. Concept that walking speed depends on how confident and competent users are running. Therefore, the speed can be used as a measure of consumer confidence and improved by expanding the knowledge of information.

The reduction of unwanted contact with obstacles has also been associated with a increase in walking. Lack of information is a preview without warning (ie, limited range of detection) deceleration running and also lead to a potential risk collisions and falls from unwanted obstacles contact. In general, movement counting incidents defined as the number of contacts with obstacles. Manduchi and Robinson (2011) reported that more than 50% of the 289 participants were blind and legal blindness in the survey who had the misfortune to fall at least once a year, while 36% of respondents indicated that accident which caused the fall was medical effect. In addition, the most dangerous situation for visually impaired people involves fast-moving obstacles. Various detection only 1 m is very close to track fast-moving because it does not provide users with adequate response cane users require fast response time due to the limited detection range[12].

Thus, the detection area are protected when using the white cane can cause another problem from the perspective of usability. The white cane is not as obstacle detection level of the upper body, the user is exposed to risks involving a high risk of falls and collisions. Given this situation, as noted earlier, visually impaired people experience a white stick accidents involving head-level barrier. It is important for the safety of visually impaired users to provide some means to detect obstacles in the knees and in a variety of advanced.

2.3 ASSISTIVE TECHNOLOGY

Advances of innovation and better information in human psycho-physiological[5] 3D world discernment allow the plan and improvement of new capable and quick interfaces helping people with inabilities. For the visually impaired, investigate on steady frameworks has generally centred around two fundamental ranges data transmission and portability help. All the more as of late, PC get to has been added to the rundown.

Issues identified with portability help are additionally testing. They include spatial data of the quick condition, introduction and impediment evasion. Numerous electronic travel helps (ETAs) for protected and autonomous versatility of the visually impaired have been proposed in the course of the most recent decades. They all have a similar operation guideline they all output nature (utilizing distinctive advancements) [13] and show the data accumulated to other sense (mostly hearing and touch), for example the reading braille dot code that introduce Louis Braille in the 19th century.

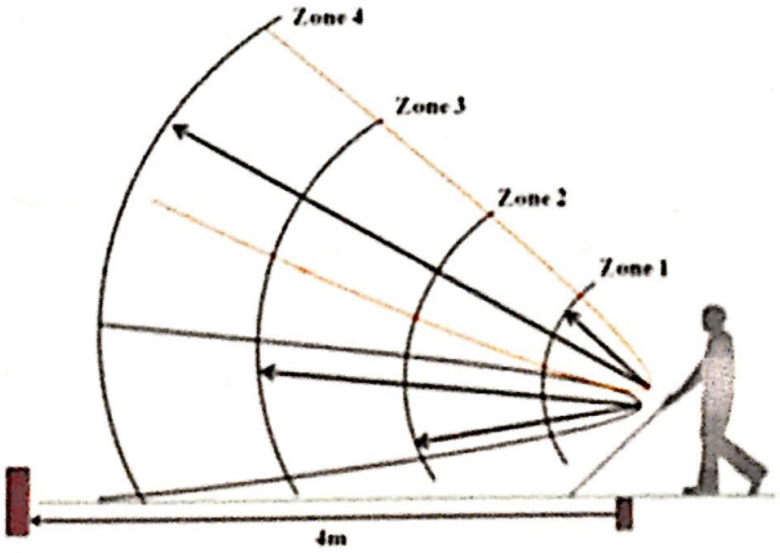

Figure 2.3 : Angle coverage of detection zone[14]

Every one of the reviews which had been checked on demonstrate that, there are numerous methods of making a smart sticks for visually impaired individuals. In any case, the review conclusion demonstrates that, utilizing the ultra-sonic sensors would be a proficient answer for distinguish the impediments with greatest scope of 7 meters and 45 degree scope[8].

2.4 COMPARISON SMART CANE WITH SIMILIAR IN MARKET

For all we have known, in past three decade taht several of electronic aids were introduced from manny inventor that had one aimed that is to improving the mobility of blind user in term of safety and speed[15]. The intersting part are, there are so many type of device were had been created and have various price in market.

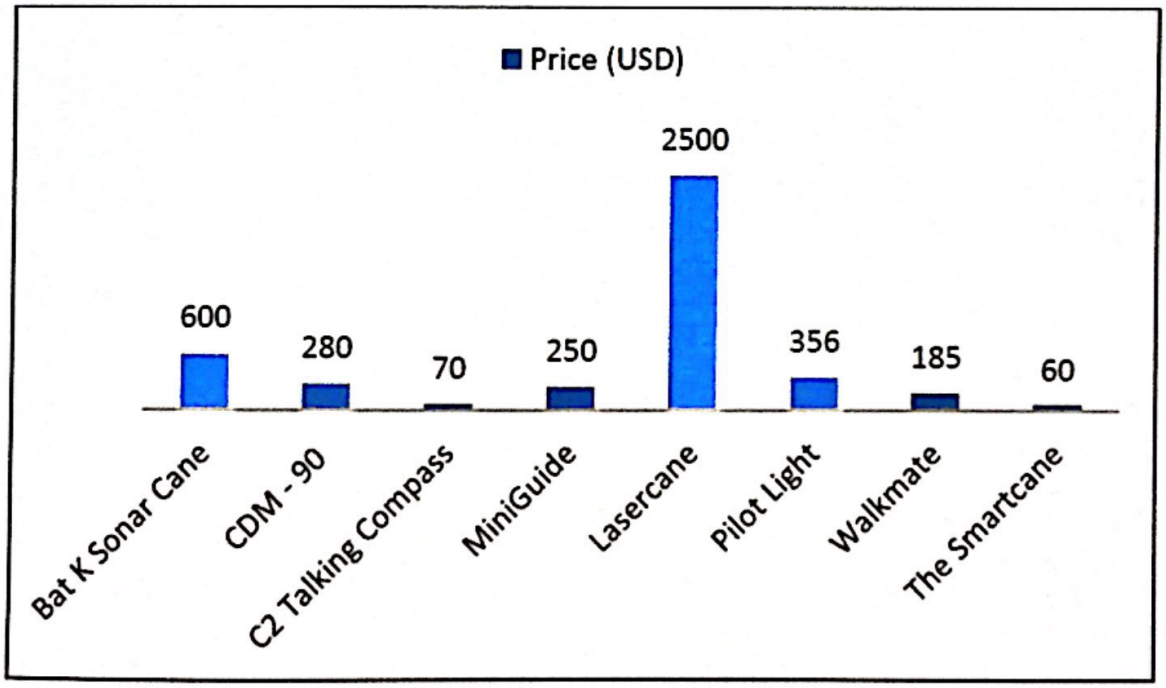

Figure 2.4: Price comparison of Smartcane with similar market products. [2]

2.5 BASIC PRINCIPLE FOR TRAINING PEOPLE VISUAL IMPARED

Overall Cognition

- Encourage people with visual impairment to touch physical objects more frequently and use simple verbal descriptions, to strengthen conceptual understanding of objects and events.

Sensory Training

- Strengthen sensory training on senses other than vision, e.g. the sense of touch, hearing, smell and taste.

Residual Vision

- Assist people with visual impairment in protecting and making good use of their residual vision.

Personal Experience

- Encourage people with visual impairment to participate actively in activities so as to enrich life experience. Avoid helping on everything and allow them learn independently as appropriate.

2.6 CONSIDERATION OF TOUCH AND HEARING

The real faculties for the visually impaired is hearing and touch. Daze individuals depend on hearing ecological prompts for key assignments, for example, security, versatility and mindfulness. For instance when they are strolling with their stick they cleared from side to side while touch to the ground and heard the sound stick tapping at first glance to guarantee each progression they are sheltered before handled their foot.

The ear is the sense organ that recognizes sound vibrations. It is in charge of transducing vibrations into nerve driving forces that are seen by the cerebrum. Mind handle workable for human ready to decide or distinguish the normal for sound, for example, pitch, tumult, separation and heading to the source.

For the blind, touch becomes the primary input for the receipt of non-audible physical information. Blind people can rapidly and accurately identify three-dimensional objects by touch. They can also locate and orient themselves in known environments by touching objects. Braille readers access information through touch.

Skin is sense organ that can be includes of 3 main group of sensor arranged by biological function which is the thermoreceptors[16], responsible for thermal sensing, the nociceptors, responsible for pain sensing and the mechanoreceptors, sensitive to mechanical stimulus and skin deformation. Mechanoreceptor is more interested to focus as they are responsible for sensing and transmission of physical deformations by external forces to the nervous system. Four kinds of mechanoreceptors can be found on the human glabrous skin in Figure below: Pacini corpuscles, Ruffini endings, Merkel cells and Meissner corpuscles.

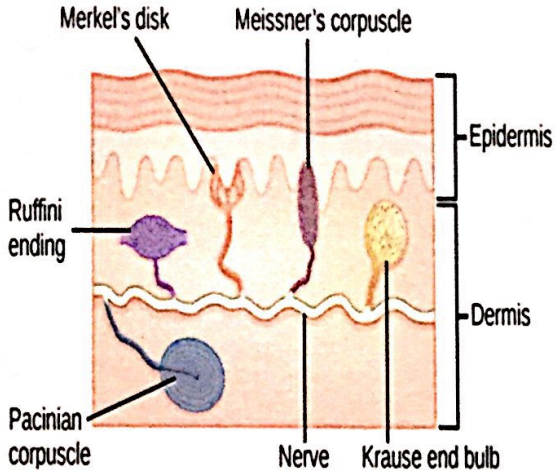

Figure 2.5 : Mechanoreceptors

Four kinds of mechanoreceptors can be found on the human glabrous skin: Pacini corpuscles, Ruffini endings, Merkel cells and Meissner corpuscles. According to [17] , Meissner corpuscles respond to touch, Pacini corpuscles respond to vibration, Ruffini endings respond to lateral extension of the skin and articular movement and Merkel cells perceive pressure. The ability to discriminate stimuli on the skin varies throughout the body. The physiologic order of mechanoreceptors takes after a two-class assignment in view of the receptor's reactions to incline and-hold-like jolts which is a boosts that rapidly indent and manage in contact with the mechanoreceptor. The two general names of these classes are Quick Adjusting (FA, additionally called rapidly adjusting and quickly adjusting) and Gradually Adjusting (SA). There are subclasses of FA and SA mechanoreceptors: FA I, FA II, SA I and SA II.

2.7 AUTOMATED MOBILITY

Blind mobility is one of the main challenges that scientists are still facing around different parts of the world. According to the World Health Organization, approximately 0.4% of the population is blind in industrialized countries while the percentage is rising to 1% in developing countries.

The least complex and most generally utilized voyaging help utilized by all blinds is the white stick. It has given those individuals a superior approach to achieve goal and identify deterrents on ground, yet it can't give them a high certification to shield themselves and being far from all level of snags. With the current advances in assistive innovation, it is conceivable to extend the bolster given to visually impaired individuals mulling over the idea of the white stick.

Historically, there are various types of assistive technologies that are currently available to blind or visually impaired people . One example is the smart phone, which addresses some of the concerns that the blind and partially sighted people needed in their daily life. The smart phones allow those people to listen to voice mails and even write and send emails.

Another example refers to the electronic oriented aids, is the laser or ultrasonic. In this technology, energy waves are emitted ahead, then it is reflected from obstacles in the path of the user and detected by a matching sensor. Thus, the distance to the obstacle is calculated according to the time variance between the two signals.

2.7 SUITABLE SENSOR

There are three elements to picking a reasonable sensor in the improvement of model brilliant shoe. It is natural variables, financial elements and trademark sensor itself. Ecological components incorporate temperature go, erosion, measure, toughness, overrange assurance and power utilization. This is imperative element to guarantee the sensor that appended in the shoe are viably while utilizing and agreeable to client. The financial variables is costing and lifetime of the sensor. The best nature of sensor likewise longer life expectancy of sensor. The elements of trademark sensor, for example, affectability, run, steadiness, linearity and reaction time. All variables are vital to picking the appropriate sensor before begin the venture.

Ultasonic and infrared sensor used in development of prototype smart shoes. Majority ultrasonic sensor implant in the shoes for obstacle detection. These because ultrasonic sensor can detect all type of obstacle (e.g., metal, wooden, concrete, plastic, glass, etc.) and it is not affected by poor lighting condition [19]. It also accurately detected. Alternatively, infrared sensors can be used in obstacle detection because of their high resolution, low cost and faster response times compared to ultrasonic sensors [20]. Both sensor have advantages and characteristics that suitable to implement in the shoes.

The sensors are attached to sub-controllers to provide directions for a blind person by collecting ultrasound signals [22]. In the research G. A. Kumar state ultrasonic has a better range and more accurate compared to the other sensor. These discussions explain that the ultrasonic is suitable for developing the smart navigation for blind [21].

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter will cover the explanation of methodology that being used to make this project complete and working well. Methodology is a part an important role in implementing development an ultrasonic blind stick. The main component that be use in this device is Arduino software and Ultrasonic sensor. Ultrasonic sensors are devices that use electrical–mechanical energy transformation, the mechanical energy being in the form of ultrasonic waves, to measure distance from the sensor to the target object it also generates high frequency sound waves and evaluates the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. Comparing with other sensors, the ultrasonic is more accurate.

The development of this project base on research that has been made by using several journal, lectures and biomedical engineer. The detail and all explanations of the methodology are explained in this chapter such as the process of making the ultrasonic blind stick. In this research to develop ultrasonic blind stick, there are two part involve which is hardware and software.

3.2 DESIGN OF BLIND STICK (SKECTH)

3.2.1 Over view of the device

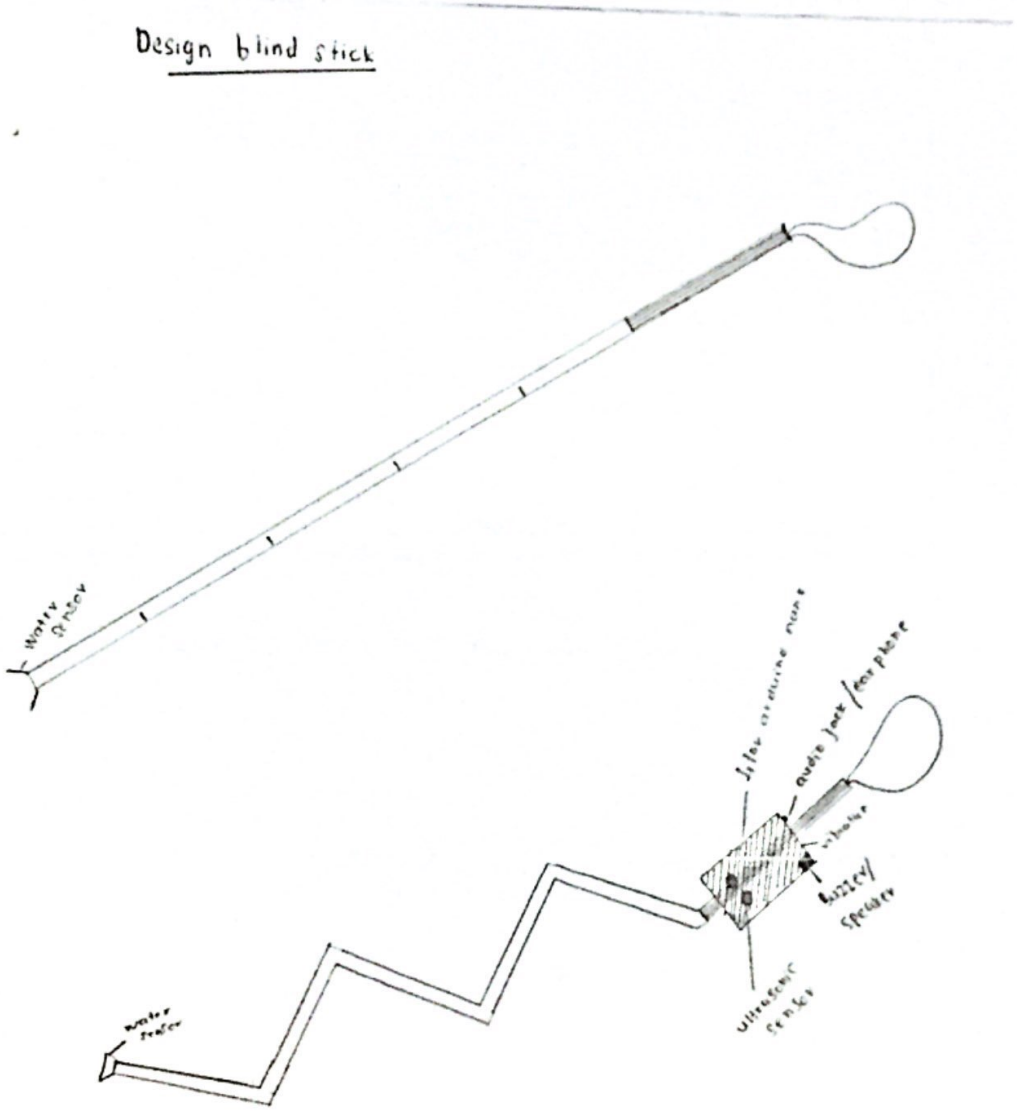

Figure 3.1 : Sketch of ultrasonic blind stick

According to the Figure 3.1,Basiclly this is the sketch of design ultrasonic blind stick that use white cane stick that can be fold.

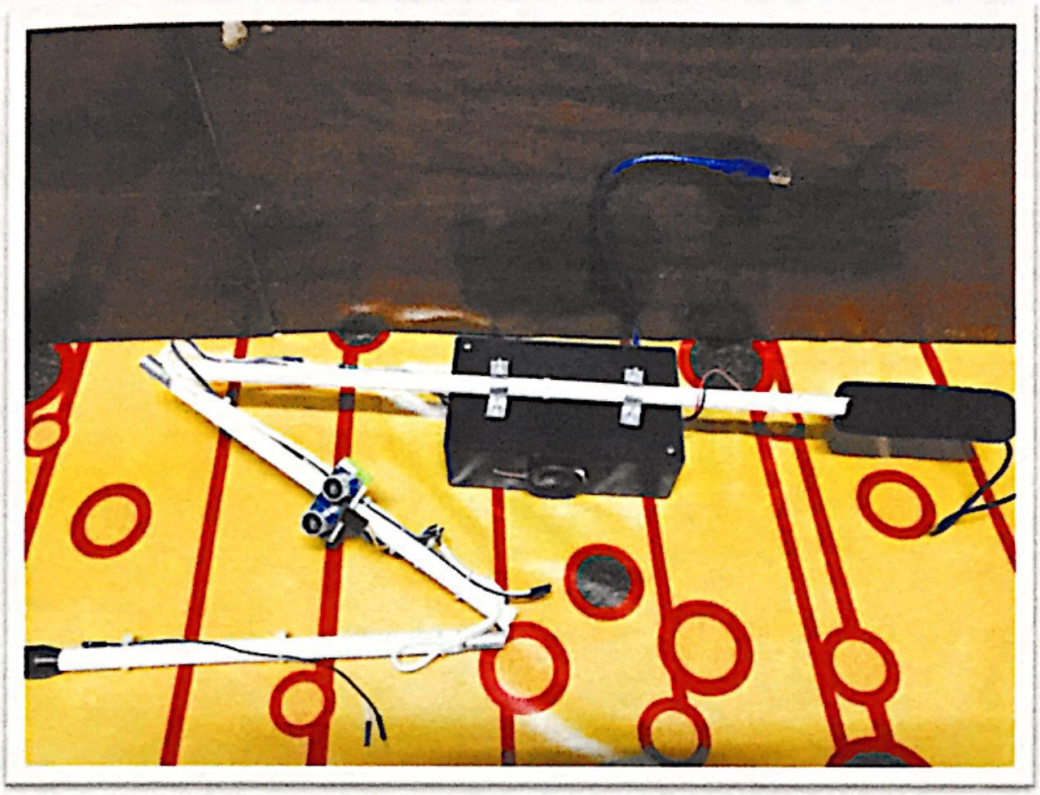

Figure 3.2 : Prototype of ultrasonic blind stick

3.2.2 Example of wiring

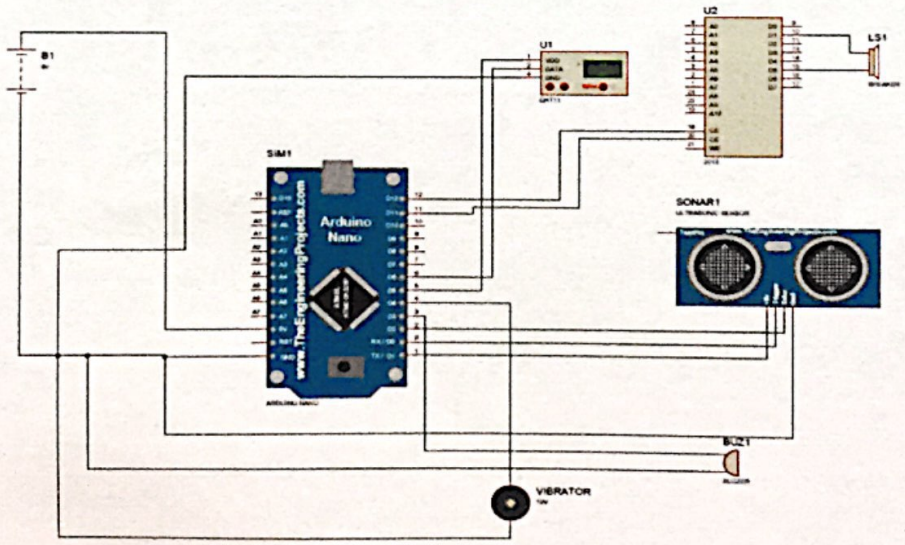

Figure 3.3 : Wiring on Protues

3.3 HARDWARE AND COMPONENT

For this project there will be a several component that will be used to complete of the development of an ultrasonic blind stick such as the main component is ultrasonic sensor, water sensor Arduino nano, battery rechargeable, vibration, white cane and buzzer. This hardware or component will use to develop ultrasonic blind stick.

3.3.1 Ultrasonic sensor

The model of us used HC-SR04. This sensor is owned by citron technology and is manufactured in Malaysia. The sensor used sonar to calculate distance to an object in a manner similar to bats or dolphins. It excellent detect object without making any contact with them. Range of device varies by sunlight or any black material e.g. sharp

Table 3.1: Feature of HC-SR04(ultrasonic sensor)

Power supply	+5DV
Quiescent Current	<2mA
Working Current	15mA
Effectual Angle	<15°
Ranging Distance	2cm-400 cm/ 1" 13ft
Resolution	0.3 cm
Measuring Angle	30 degree
Trigger Input Pulse Width	10us
Dimension	45mm x 20mm x 15mm

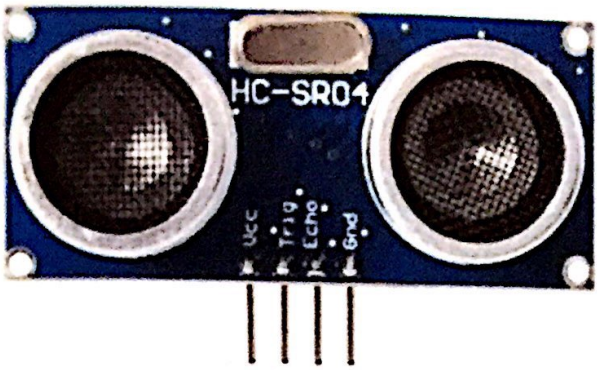

Figure 3.4: Ultrasonic sensor HC-SR04

3.3.2 Water sensor/rain detector

Water sensor available are used to detect water level or puddle. A water detector is an electronic device that is designed to detect the presence of water and provide an alert in time to allow the prevention of water damage. A common design is a small cable or device that lies flat on a floor and relies on the electrical conductivity of water to decrease the resistance across two contacts. The device then sounds an audible alarm together with providing onward signalling in the presence of enough water to bridge the contacts. These are useful in a normally occupied area near any infrastructure that has the potential to leak water, such as HVAC, water pipes, drain pipes, vending machines, dehumidifiers, or water tanks.

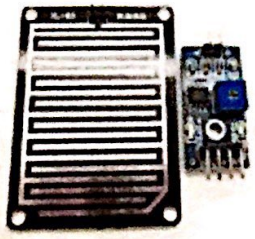

Figure 3.5: Water sensor

3.3.3 Arduino Nano

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x) or ATmega168 (Arduino Nano 2.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one. The Nano was designed and is being produced by Gravitech.

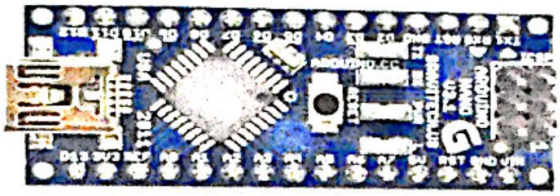

Figure 3.6: Front View of Arduino NANO

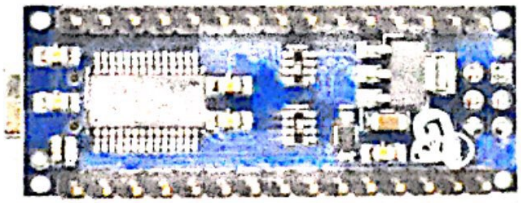

Figure 3.7: Back View of Arduino NANO

Arduino Nano Pin Layout

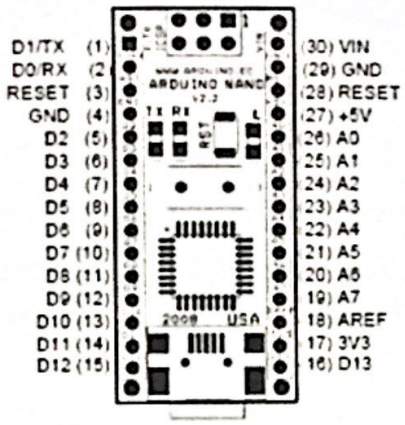

Figure 3.8: Pin Arduino Nano

Table 3.2: Pin Arduino Nano

Pin No.	Name	Type	Description
1-2 , 5-6	D0 – D13	I/O	Digital input/ output port 0 to 13
3, 28	RESET	Input	Reset (active low)
4, 29	GND	PWR	Supply Ground
17	3V3	Output	+3.3V Output (from FTDI)
18	AREF	Input	ADC reference
19-26	A7-A0	Input	Analog input channel 0 to 7
27	+5V	Output or Input	+5V output (from on-board regulator) or +5V (input from external power supply)
30	VIN	PWR	Supply Voltage

3.3.4 Battery

IN A NUTSHELL

- The highest-capacity 9V rechargeable: Accupower's 300 mAh 9 Volt Rechargeable NiMH Battery
- The best low-discharge 9V rechargeable: Tenergy Centura 9V 200mAh Low Self-Discharge NiMH Rechargeable Batteries
- The best lithium-ion 9V rechargeable: EBL 9V Lithium Ion Batteries

THE DETAILS

- Low-self discharge 9v Ni-MH batteries have become available in the last few years. The "low-self discharge" label means these batteries will hold their charge for a year, unlike previous NiMH batteries. This makes these 9V battery much more compelling, because 9V batteries are often used in applications like fire alarms, where the battery must sit for year or more.

Figure 3.9: Battery 9V

3.3.5 Vibration Motor

Vibrator which is able to produce vibration according to the voltage supplied. It has two terminals which are voltage supply and ground terminal. This vibrator needs enough current to operate properly. This is the type of DC vibration motor used in mobile phone. It required a voltage 3v to 5v with current around 125ma. This type motor can be programmed to control its speed by using PWM.

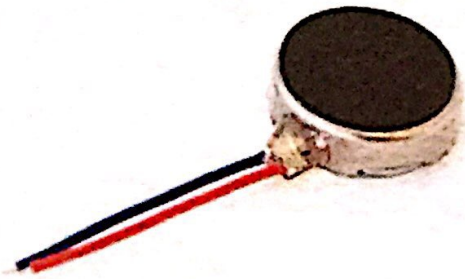

Figure 3.10: Vibration motor

3.3.6 White cane

A simple walking cane used to build the proposed devices. A white cane is used by many people who are blind or visually impaired. Its primary uses are as a mobility tool and as a courtesy to others, but there are at least five varieties, each serving a slightly different need.

Figure 3.11: White cane

3.3.7 Buzzer

An electrical device, similar to a bell, that makes a buzzing noise and is used for signalling. The buzzer converts the electrical signal it receives into a vibration, which creates a buzzing sound. The higher the signal it receives, the more intense the vibration, and the louder the sound is.

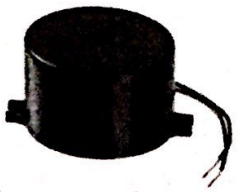

Figure 3.12: Buzzer

3.4 SOFTWARE

For software development there will several a software that will be used to completing of development an ultrasonic blind stick such as Arduino software (ide), Proteus 8 profesional and Microsoft excel. Basically all the source code or coding will be write in Arduino based (ide) and will try on Proteus to see whether the coding is running correctly or not.

3.4.1 Arduino Software (ide)

The open source Arduino Software (IDE) makes it easy to write code and upload it to the board. It run on Windows, Mac OS X and Linux. The environment is written in Java and based on Processing and other open-source software.

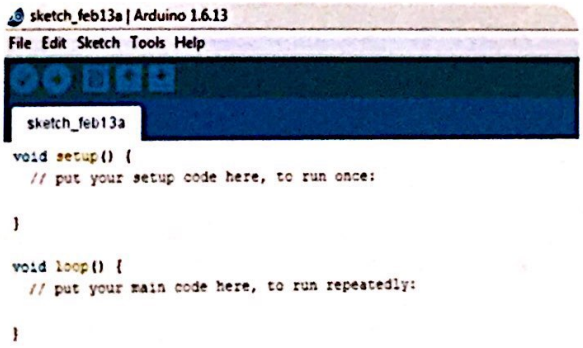

Figure 3.13: Arduino software ide

3.4.2 Proteus 8 profesional

Proteus 8 is a electronics circuit board design, PCB circuit board assembly and prototyping software that can also be used to for real time simulation of microcontroller such as 8051, design of schematics of electronics and external electrical circuits and PCB(printed circuit board) design.

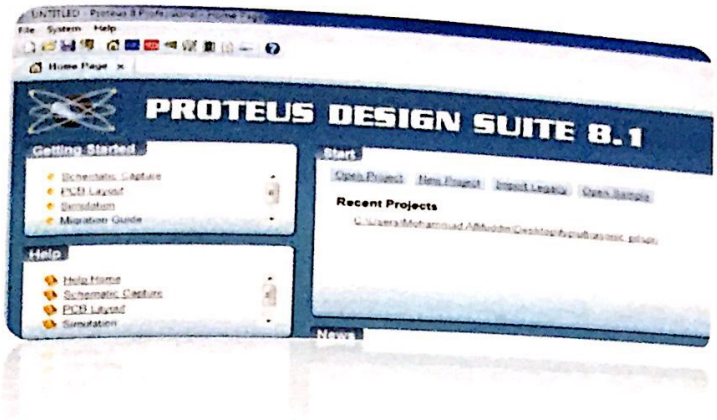

Figure 3.14: Protues 8

3.4.3 Microsoft Excel

Microsoft Excel is used to interpret my questionnaire or early survey in analysis my devices among hospital's staff and public. By using Microsoft Excel, graph is the suitable method to analyze and differentiate between each questions of my survey.

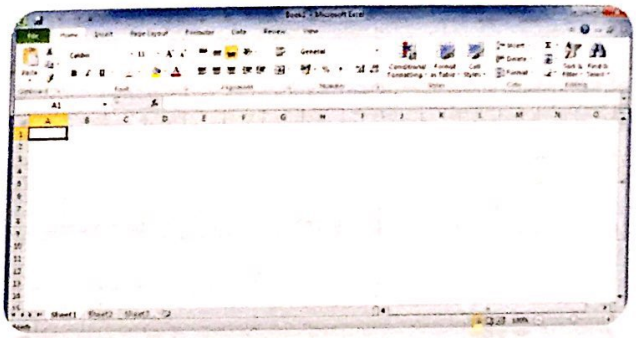

Figure 3.15: Microsoft excel

3.5 Flow chart

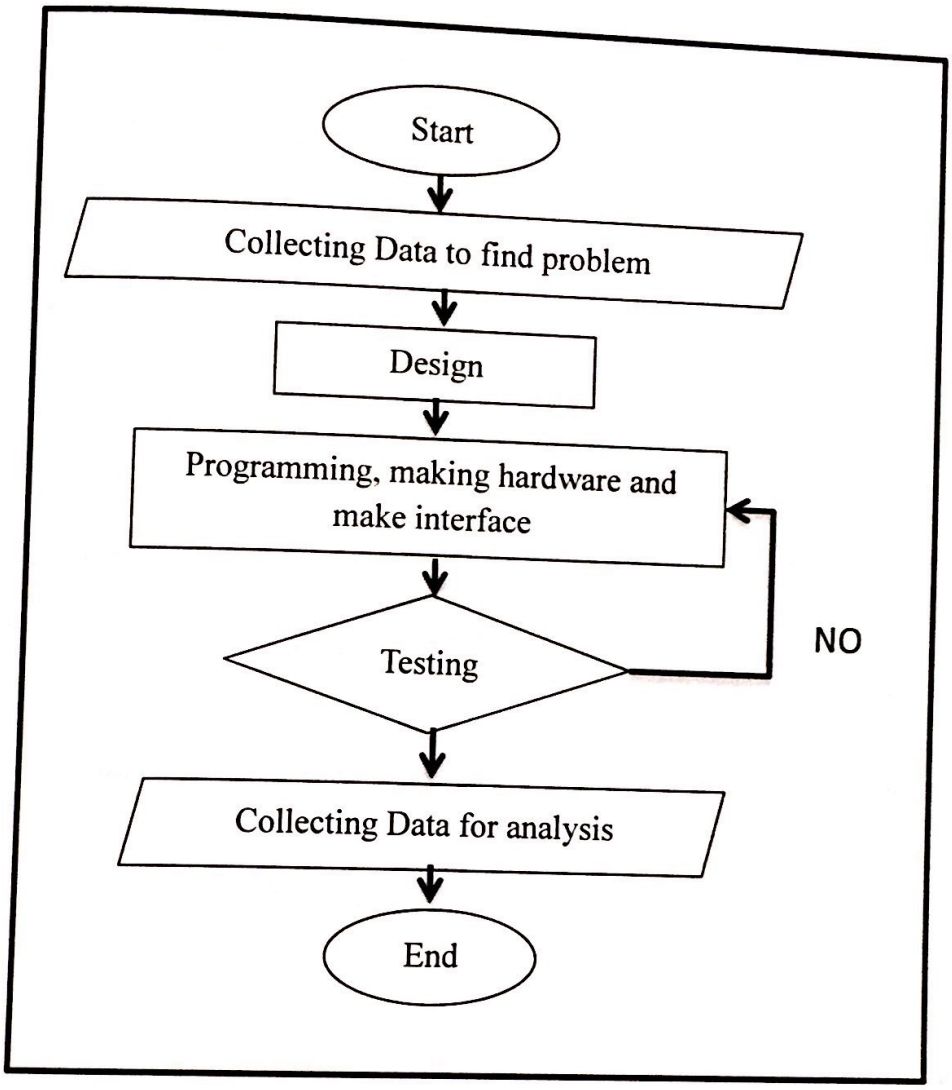

Figure 3.16: Flow chart of project

Figure 3.16 shown the flow chart of project for the development of an ultrasonic blind stick.

3.6 Block diagram

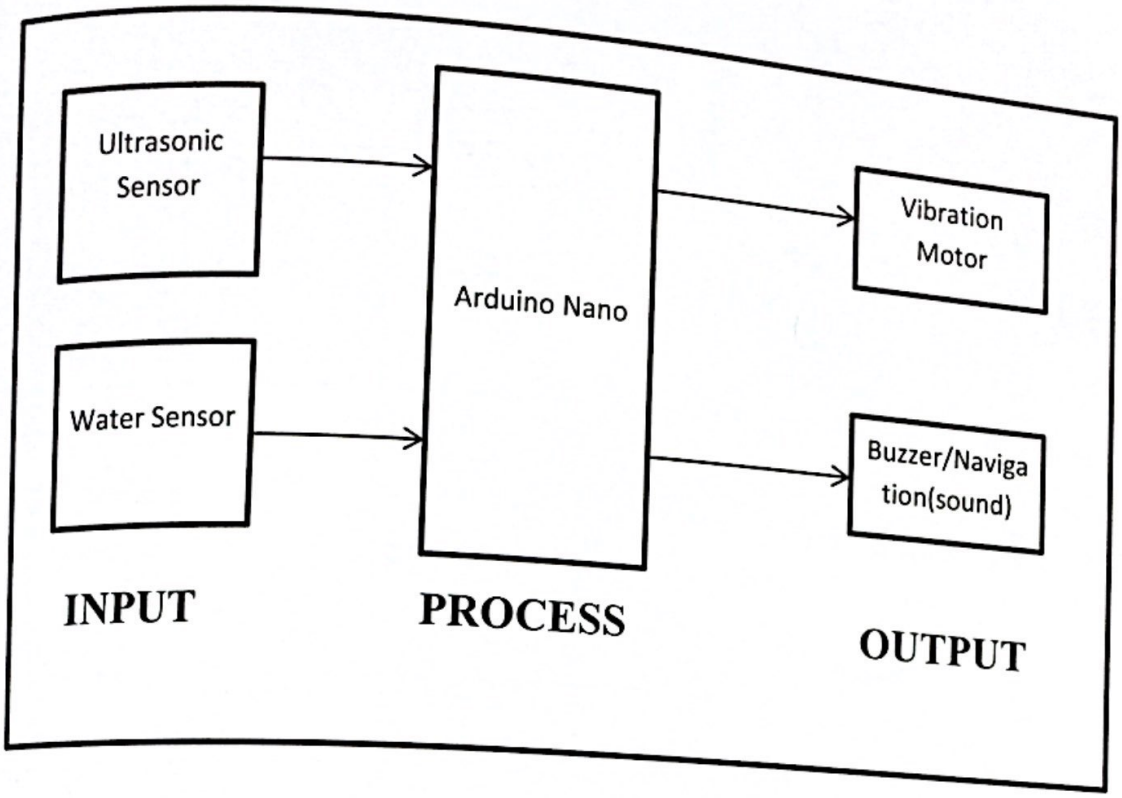

Figure 3.17 : Block diagram

From figure 3.17 show the block diagram that consist of input for the sensor, the process is use microcontroller Arduino nano and the output is vibration motor and buzzer.

3.7 DESCRIPTION OF SENSOR DETECTION

3.7.1 Ultrasonic sensor

Table 3.3: Description ultrasonic sensor

No	Range (cm)	Output
1.	0-50 cm	Vibrator ON frequently and sound
2.	50-100 cm	Vibrator ON slightly and no sound

3.7.2 Water sensor

Table 3.4: Description water sensor

Input	Output
Touch with water	Buzzer and Vibrator ON

For the first operational range, the distance is set to vary from 0cm to 50cm .The second range is set from 50cm until it is out of range (100cm). Ultrasonic sensors are assigned with the same output from the sound and vibrator. The output for the first range which is between 0cm – 50cm produces continuous sound and vibration which indicate that the user is close to the obstacles. For the second range, which is from 50cm until it is out of range(100cm), the sound off and vibrator will on slightly. It shows that the user is safe to continue walking. For water sensor, if sensor touch with water, buzzer and vibrator will active to alert the user.

3.8 LOGIC ALGORITHM

3.8.1 Logic Algorithm Ultrasonic Sensor

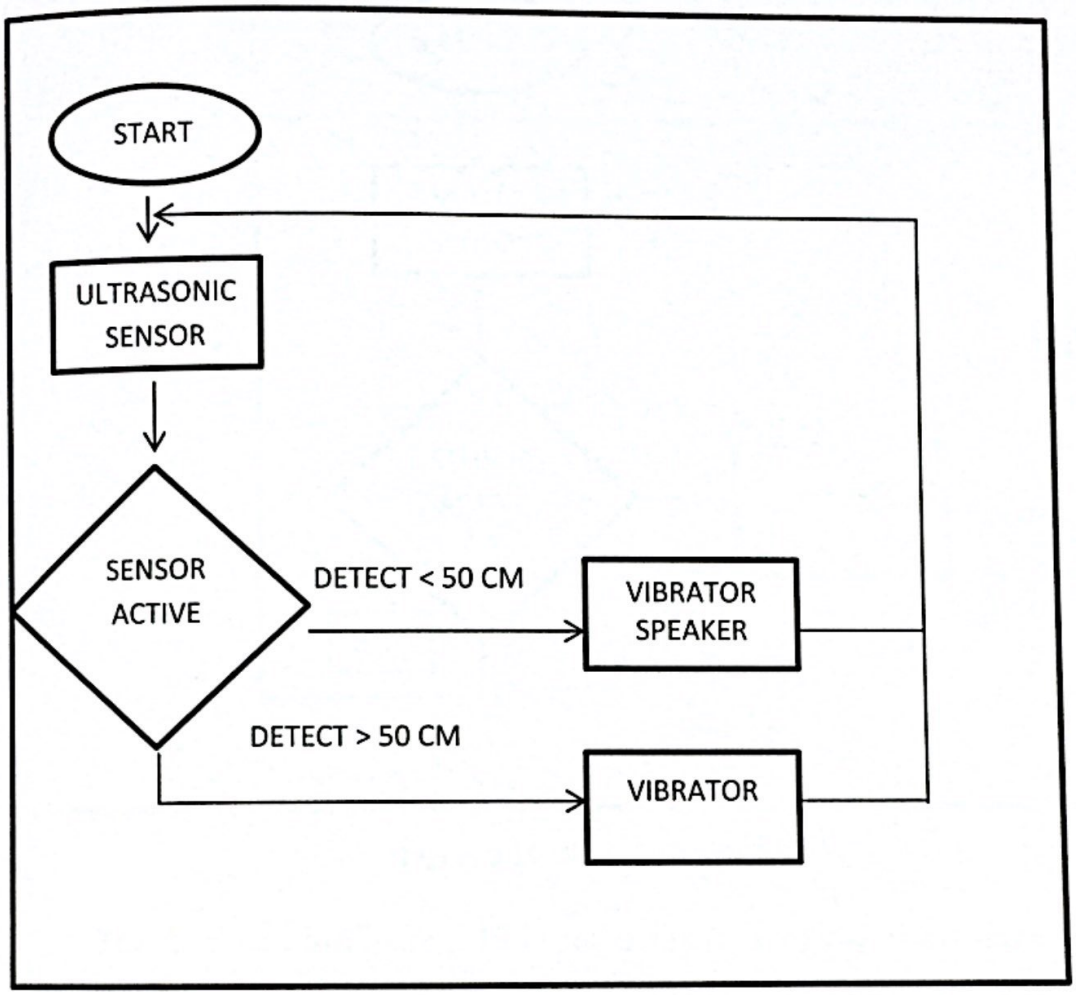

Figure 3.18: Ultrasonic sensor logic

The flowchart in Figure 3.18 explains the flow of object detection for ultrasonic sensor. The sensors operate simultaneously and the system repeats continuously. The outputs are set to be both sound and vibrator for different distance ranges.

3.8.2 Logic Algorithm Water Sensor

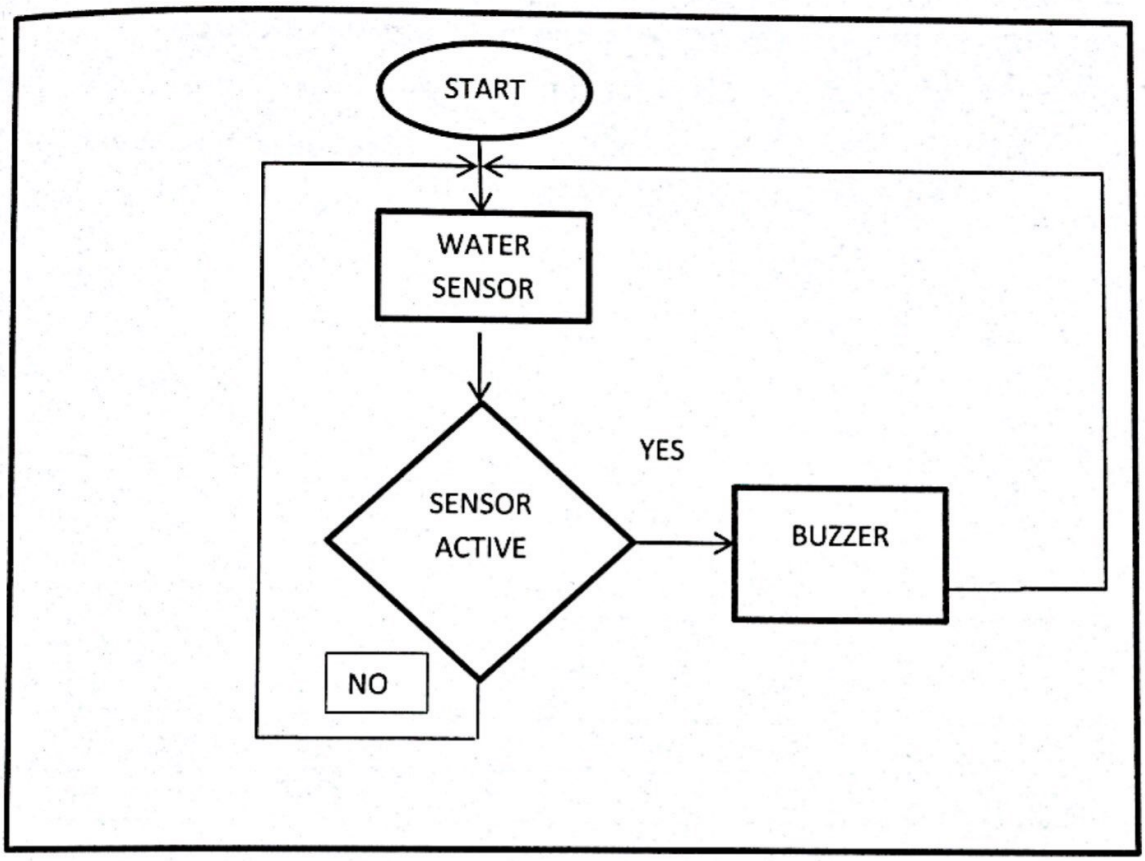

Figure 3.19 : Water sensor logic

The flowchart in Figure 3.19 explains the flow of object detection for water sensor. The sensors operate simultaneously and the system repeats continuously. The outputs are set to be buzzer and vibrator for contact with water.

3.9 ESTIMATION COST OF PROJECT

For develop this project the planned is to use low cost for the component to archived the objective and the price is reasonable for everyone that capable to use it. Market price for this stick around 50-70 Euro(Rm238.51-333.91). So this is cost of project to develop this device.

Table 3.5: Cost of project

COMPONENTS	QUANTITY (UNIT)	PRICE (PER UNIT)	PRICE (RM)
ARDUINO UNO	1	50.00	50.00
BATTERY 9V	1	5.2	5.20
MINI VIBRATION MOTOR	1	3.00	3.00
ULTRASONIC SENSOR	1	25.00	25.00
BUZZER	1	4.00	4.00
WATER SENSOR	1	7.00	7.00
SPEAKER 9 OHM	1	2.00	2.00
WIRE (BUNDDLE)	1	15.00	15.00
WHITE CANE	1	35.00	35.00
OTHERS	DEPENDS	-	100.00
TOTAL PRICE (RM)		246.20	

3.10 GANTT CHART OF THE PROJECT FOR FIRST SEMESTER

Table 3.6: Gantt chart of the project for first semester

Progress / week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Choose project tittle														
Make research														
Initial proposal														
Development the device														
Defend proposal														
Log book														

Table 3.6 shows the Gantt chart of the project for semester 1. It is a plan to conduct on this project. On week 1 and 2 the project progress will be choose the tittle of project and write the report in log book. On week 3 until 4 is the time to make a preparation for initial proposal also make a research about this tittle and write the report on logbook. On week 7 until 13 was planned for a defend proposal.

3.11 GANTT CHART OF THE PROJECT FOR SECOND SEMESTER

Table 3.7: Gantt chart of the project for second semester

Progress / Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Development of the device														
Collect data														
Thesis Writing														
VIVA														
Log book														

Table 3.7 shows the Gantt chart of the project for semester 2. It is a plan to conduct on this project. On week 1 until 6 the project progress will be development of device and write the report in log book. On week 4 until 8 is the time to collect some data from survey questions and also write the report on logbook. On week 7 until 12 was planned for a thesis writing. On week 12 and 13 is a VIVA presentation.

CHAPTER 4

DATA ANALYSIS

4.1 INTRODUCTION

This chapter will cover the explanation of data analysis In this part, it is implement analysis and collection of data. Through the this data, it is can compare between the accuracy and correlation between normal white cane stick and ultrasonic blind stick. There are several parts that constructed in completing the Ultrasonic blind stick. All the data is recorded in tabulated data and graph form.

4.2 QUESTIONNAIRE

Through this part, the questionnaire (pre-survey) is conducted among public and respondent at Malaysian Association for The Blind. A part from that, all the data in the survey form is tabulated in graph bar below. As overall, through the data collected from this questionnaire showed positive feedback in development of an ultrasonic blind stick.

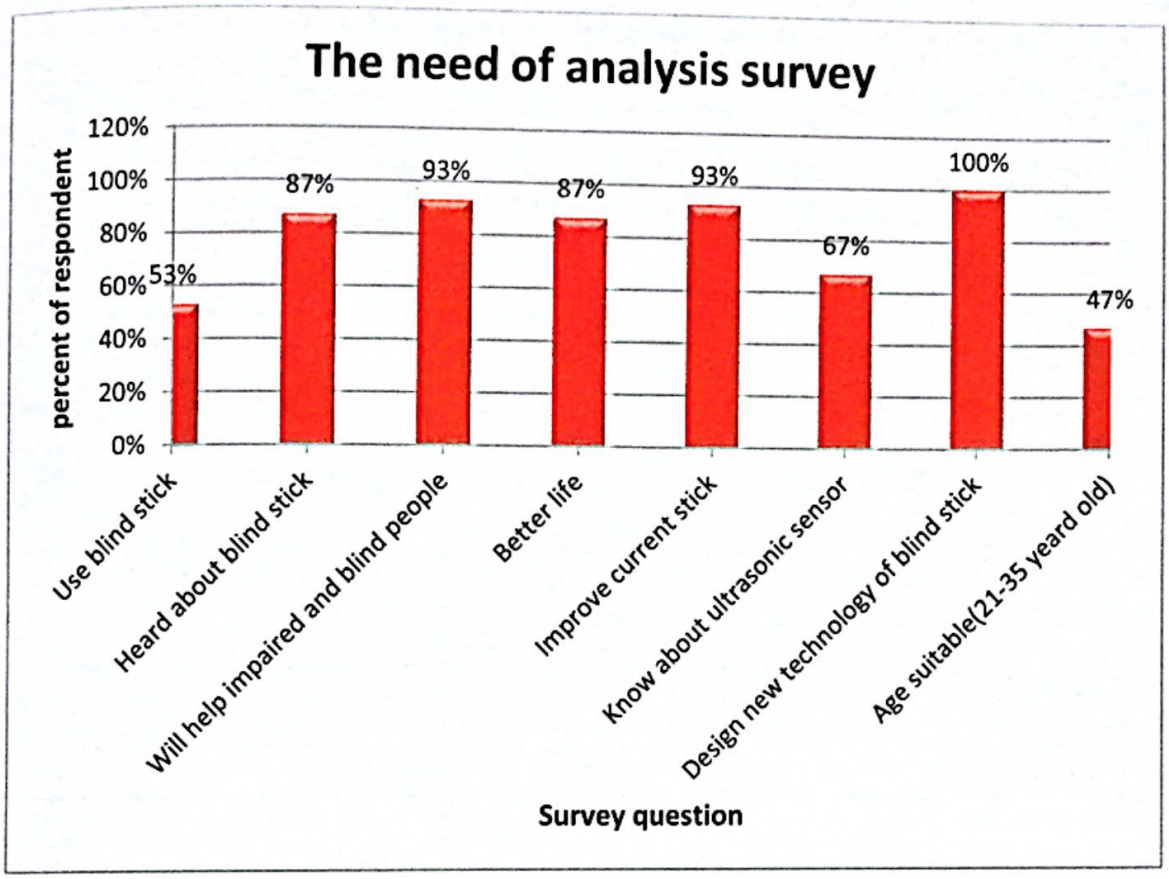

Figure 4.1: Graph survey questionnaire

From the graph survey questionnaire above, out of 30 respondent are use blind stick which is state in percent as 53%. For the next question is about are they heard about blind stick, 87 % say yes for this question and 93% of respondent agreed that this project will help impaired and blind stick. 87% agreed that this innovation will lead to better life and there are slightly higher with 93% agreed to improve the current stick. When come to know about ultrasonic sensor only 67% of them know about this sensor. There is 100% agreed about to design new technology of blind stick and they agreed the age that suitable to use this blind stick is between 21-35 years old.

For the performance of ultrasonic sensor that has being conducted with actual distance and measured distance, all the unit for the distance were use in cm. The sensor was able to detect between range 2- 400cm long. Table 4.1 below show the performance analysis of ultrasonic sensor in obstacle detection, the range will be 30-90cm.

Table 4.1: Actual and Measured distance

Actual distance (cm)	**Measured distance(cm) 'average'**	**Error of percentage %**
30	30.2	0.6
40	39.8	0.5
50	50	0
60	60	0
70	69.8	0.3
80	80.1	0.13
90	90.1	0.1

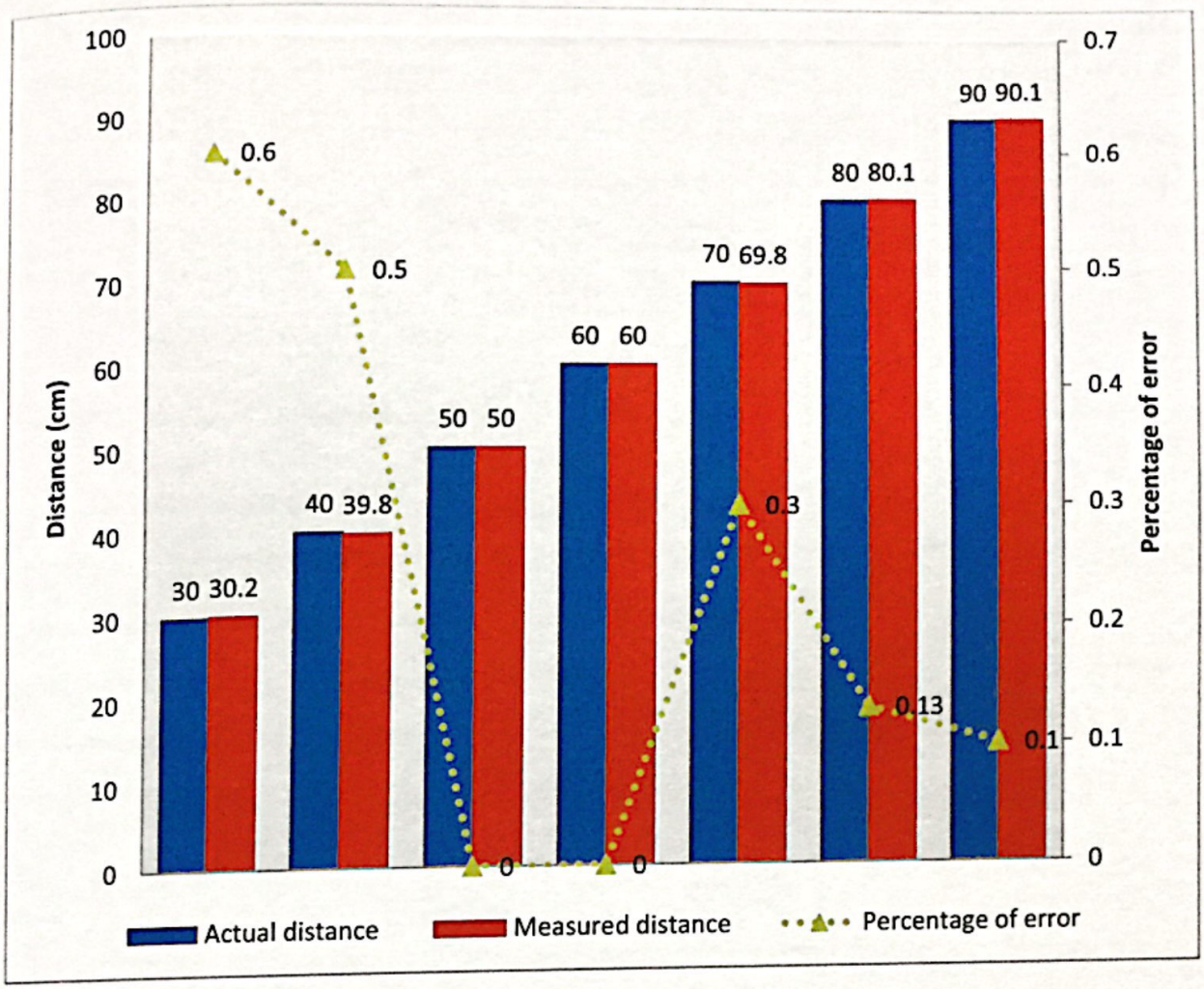

Figure 4.2: Performance analysis of ultrasonic sensor

From the figure 4.2 for performance analysis of ultrasonic sensor. The analysis done between range 30cm until 90cm, and the result are not same with actual distance and measured distance, it is because in this experiment we must consider all the possible the existence of error such as systematic error and random error. For the first bar graph is 30cm, they were slight different with actual measurement which is the 30cm but in measured the result get 30.1cm. It has 1% of error. For the second is 40cm is actual measured but in measured distance, 39.3cm and it has 2% of error. The third bar graph which is 50cm for actual and the measured for also get 50cm, it is show that they have no error in this section. It is also same for 60cm, the actual and measure distance were same with 0%.

For 70cm bar graph, they were slight different form actual and measured distance, the measured distance were record 69.8cm and it has 0.3% of error. Next measurement is 80cm actual distance but in measured it get slightly higher that which is 80.1cm and the error is 0.125%. For 90cm and the measured distance that I get is 90.1cm. It is also slightly higher that actual distance and the error is 0.11%.

4.4 RESPONE OF STICK FOR VARIOUS OBSTACLE

For this part, data has taken from Malaysia Association for blind to testing the device. For data collection, the experiment to test the device on detection range for various object. The object such as, wall, human body, plastic, metal and wood. The procedure for this experiment is, to take three time of testing which is for the first part is 50cm , second part is 100cm and last part is 150cm. All the data has been tabulate in to the table 4.2 below and being graph in figure 4.3.

Table 4.2: Detection range for various object

Obstacle	Test 1 (50cm)	Test 2 (100cm)	Test 3 (150cm)
Wall	50cm	100cm	149.6cm
Human Body	49.9cm	99.8cm	149.7cm
Plastic	50cm	100cm	149.9cm
Metal	50cm	100cm	150cm
Wood	50cm	100cm	149.8cm

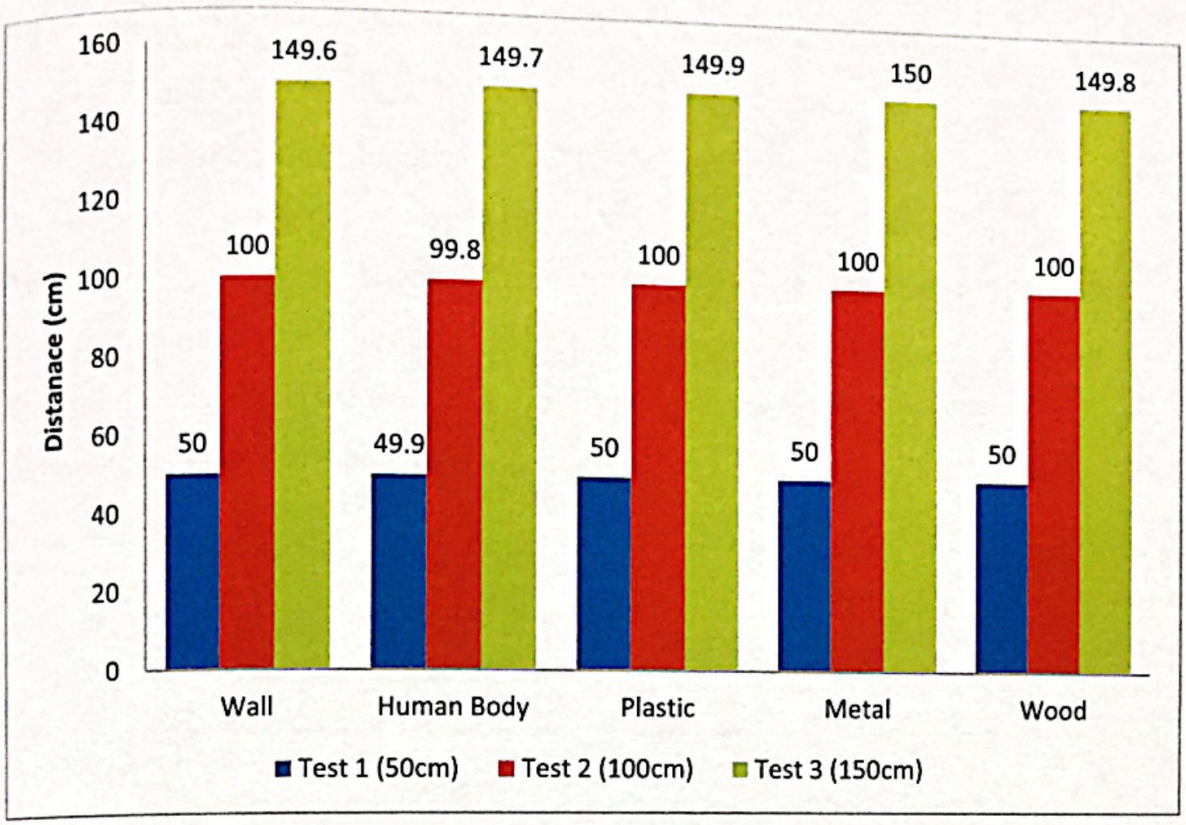

Figure 4.3: Graph detection on various object

From figure 4.3 above, the graph shown data for detection on various object. For 50cm test, it show that sensor can recognise the object precisely within 0.1 error only for material human body. For testing 100cm, the device also detect precisely but in human body there some error with 0.2 only. For testing 150cm only at metal material the device detect precisely at 150cm and other material the device detect but have some error with it (0.1-0.5).

4.5 QUESTIONNAIRE OF POST-SURVEY

After completing hardware part, To see reliability of the device, data collection among public and respondent at Malaysian Association for The Blind. Through this part, the questionnaire (post-survey) is distributed among them. A part from that, all the data in the survey form is tabulated in graph bar below. As overall, through the data collected from this questionnaire showed positive feedback in development of an ultrasonic blind stick.

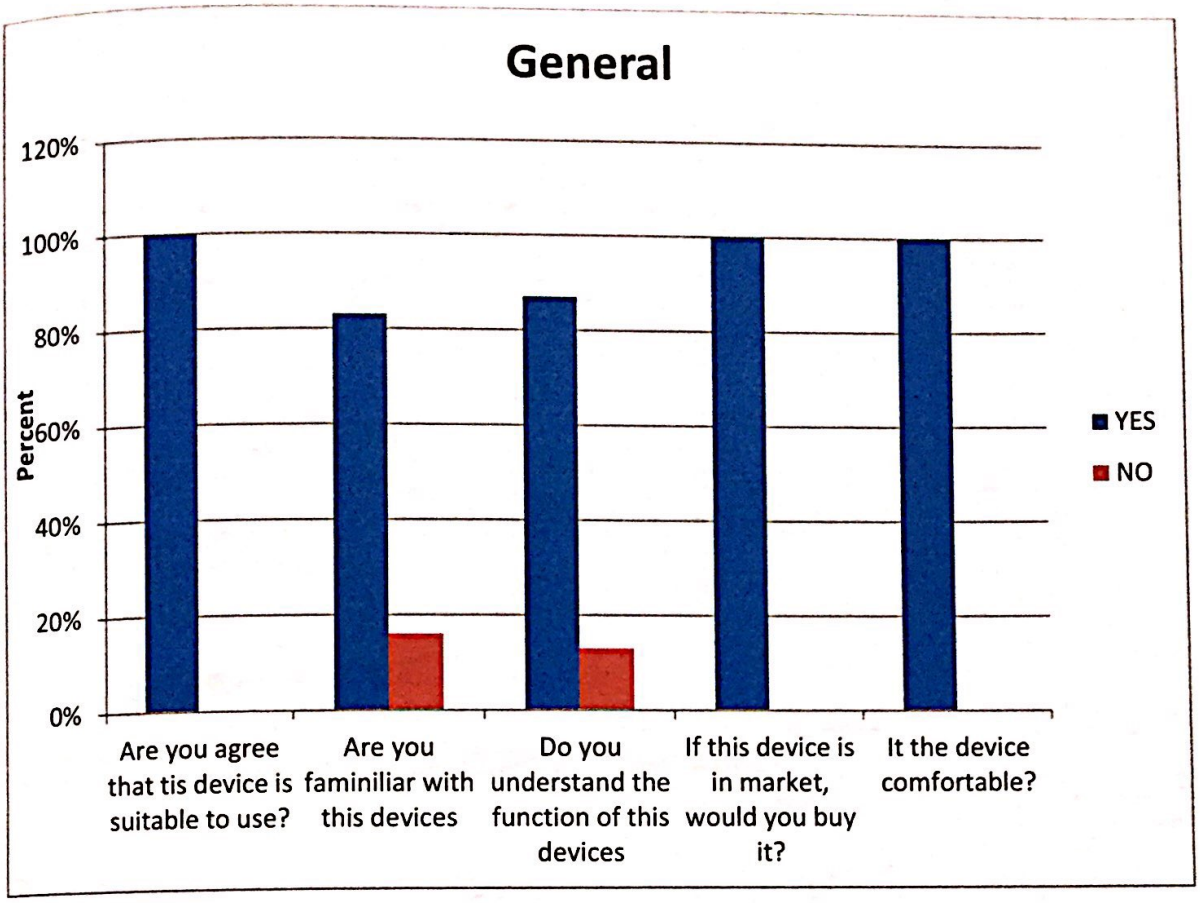

Figure 4.4: graph for General

From figure 4.5 shown the data of general question about the device. 100% agree that this device is suitable to use and some of respondent not familiar with this device but 83% familiar with this device. 87% agree that they know and understand function of this device and 100% of respondents agree to buy this device in market and also agree this device comfortable.

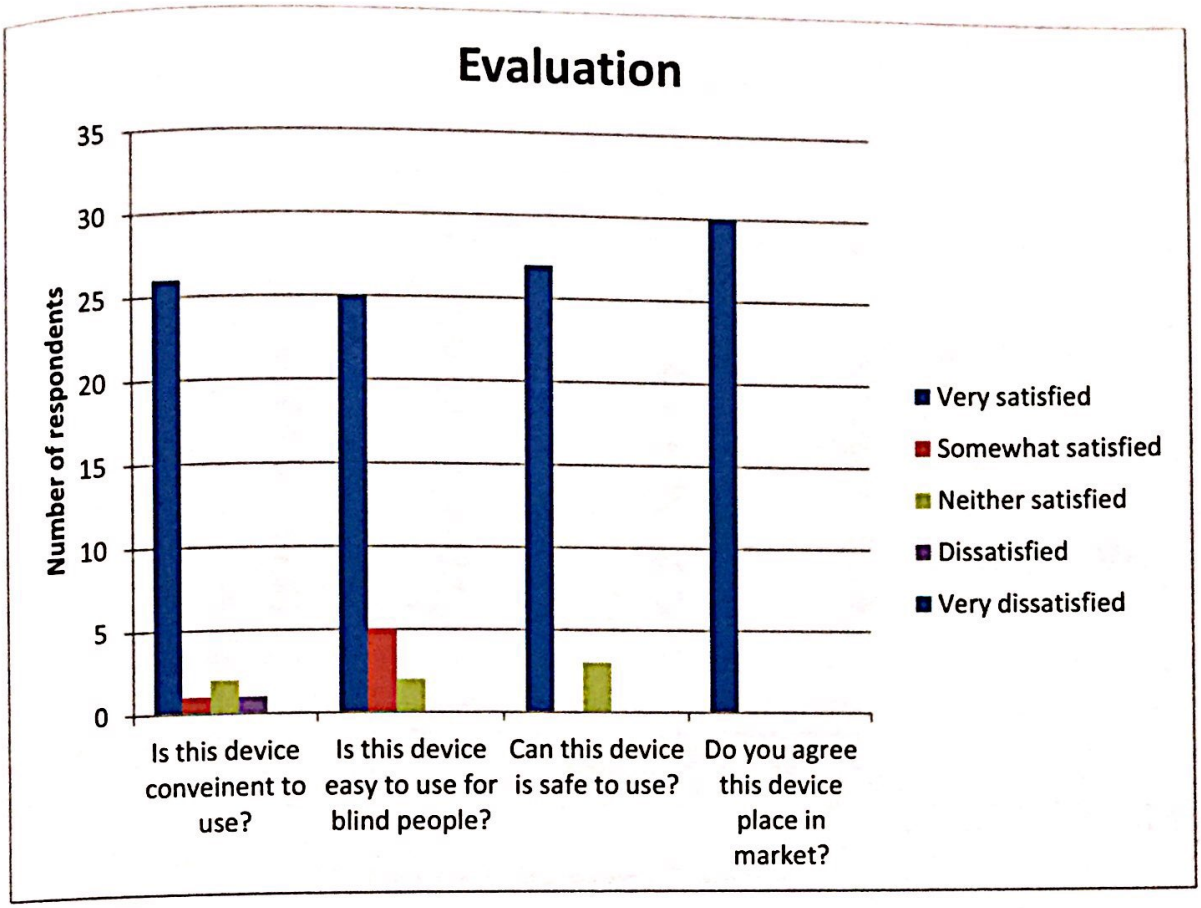

Figure 4.5: Graph for evaluation

From figure 4.6 above shown data for evaluation of device. 26 of respondent very satisfied that this device convenient to use and 24 respondent also very satisfied that this device easy to use for blind people. 30 respondent say they agree this device place in market and 27 among them say this device is safe to use.

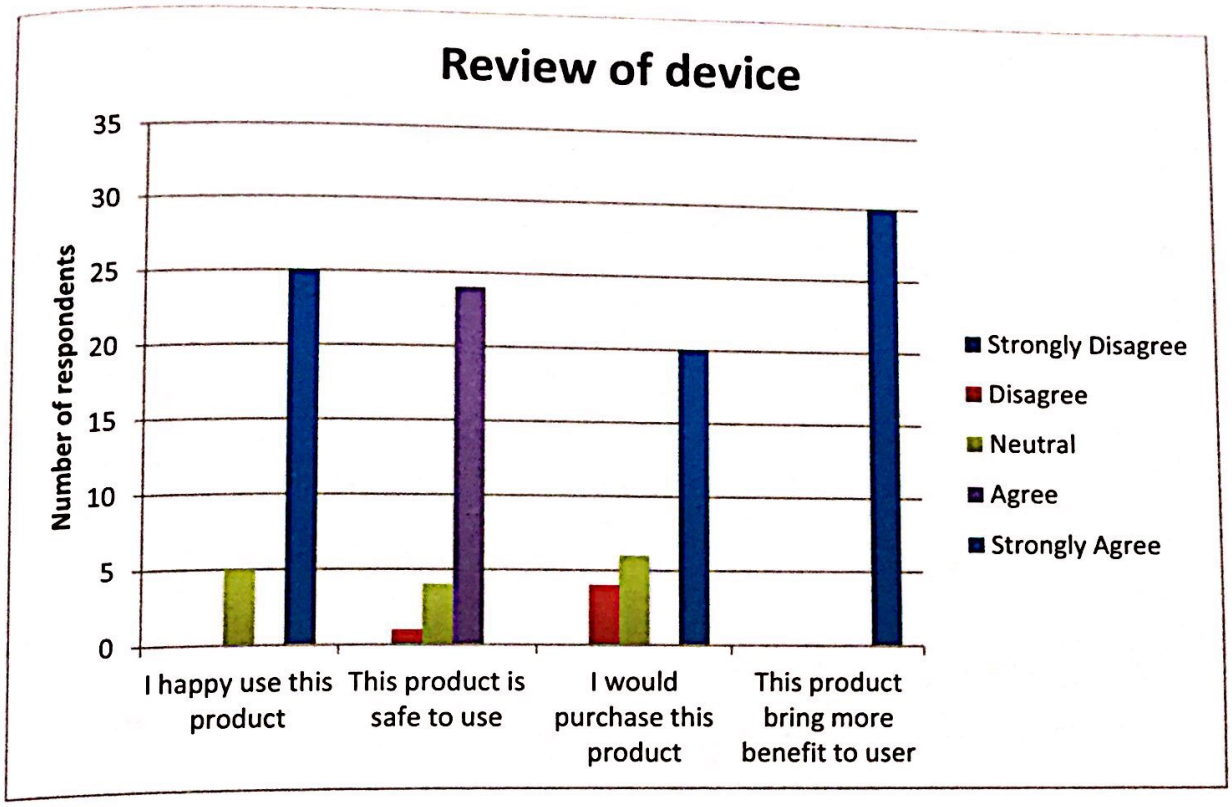

Figure 4.6: Graph for Review of device

From figure 4.7 above shown of data for review of device. 25 respondent strongly agree that they happy use the product and 30 respondent strongly agree the product bring more benefit to user.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

This is the last chapter in this writing. This section can lead to a conclusion, summarization and recommendation about The Development of An Ultrasonic Blind Stick. Based on the previous chapter, there is a lot of knowledge and the information and there is also data collection in order to prove the accuracy, correlation and learning process in designing The Development of An Ultrasonic Blind Stick.

These part provide innovation ideas to those who interested to develop this project. By undertaking this recommendations , the device can be improve from time to time. A good device cannot be done in a short period, it must done along with research in completing or achieve to get the good result.

Moreover, lot of improvement can be done in future by adding new features and give more comfort for the use of the device . The device can be more benefit and more advantages to visual impaired to help on their daily life. From this section, all the improvements and future are state to enhance this device

5.2 CONCLUSION

Automation and robotics based system and technology are built rapidly in field of computer engineering. Most of Development country are expose in research and modern high end technologies. The development of this product is to see whether is necessary for blind people to use the electronic stick rather than using the tradisional stick and the goal for this project is to see the prototype of ultrasonic blind stick is working excellent without any error and blind user can use this product. The encroachment of this stick is for the blind can executed using several way of distance measurement detection. Ultrasonic range of sensor are appropriate to system and it more suitable to implemented due to several factor such as environment and economical factor.

Ultrasonic sensor can be measured wide range material including hard or soft, color or transparent, flat or curve and the sensor is less affected by target material and surface and not affected by color. It is also resistance to external disturbances such as vibration and ambient noise

The objective for this project is to develop an ultrasonic blind stick that can improve sightless people walk cross the street and pedestrian without getting any injuries using the vibrating motor and navigation (sound). The stick is very easy to carry everywhere because of it can be fold and not so heavy. The term not so heavy because their circuit is simple and required 1 battery 9v only to operate the circuit, meanwhile it is also designed with low cost project for the blind stick with simple electronic components and analyse an ultrasonic blind stick with distance related to obstacles.

5.3 RECOMMENDATION

For overall of this project it can say it completed and the prototype of the visually impaired aid is able to detect obstacles in all the directions of the user. And, it is therefore capable of guiding a visually impaired person to navigating his environment. However, the walking stick cannot determine the distance of the obstacle to the multidimensional. This can be an improvement on this multidimensional stick. There are several recommendation has been listed. Which are:

- Servo motor can be added at the ultrasonic sensor so that it can rotate and detect any obstacles towards extreme right and left side.
- The battery selection is also an important part. It can be improved by implementing a rechargeable battery.
- The walking sticks available with GPS system installed in it.

REFERENCES

[1] A. Carullo and M. Parvis, "An ultrasonic sensor for distance measurement in automotive applications," *IEEE Sens. J.*, vol. 1, no. 2, pp. 143–147, 2001.

[2] "The Smartcane for Blind People An Electronically Smart Stick to Aid Mobility The Smartcane for Blind People An Electronically Smart Stick to Aid Mobility," no. May, 2016.

[3] A. Thakur, "Ultrasonic (UV) Sensors or Ultrasound Sensors - EngineersGarage." [Online]. Available: http://www.engineersgarage.com/articles/ultrasonic-sensors.

[4] Bruel & Kjaer, "Hydrophone - Types 8103, 8104, 8105 and 8106 Product Data Sheet," *Prod. Data*, pp. 1–8.

[5] H. I. Stern, J. P. Wachs, and Y. Edan, "4_Designing hand gesture vocabularies for natural interactions by combining psychi-psysiological and recognition factors," *Int. J.*, vol. 2, no. 1, pp. 137–160, 2008.

[6] S. Chaurasia and K. V. N. Kavitha, "An electronic walking stick for blinds," *2014 Int. Conf. Inf. Commun. Embed. Syst. ICICES 2014*, no. 978, pp. 1–5, Feb. 2015.

[7] M. H. A. Wahab, A. Talib, and H. Kadir, "Smart Cane: Assistive Cane for Visually-impaired People," *IJCSI Int. J. Comput. Sci. Issues*, vol. 8, no. 4, pp. 21–27, 2011.

[8] O. B. Al-barrm, "3D Ultrasonic Stick for Blind," vol. 3, no. 3, pp. 108–114, 2014.

[9] L. Kay, "An ultrasonic sensing probe as a mobility aid for the blind," *Ultrasonics*, vol. 2, no. 2, pp. 53–59, 1964.

[10] L. Du, C. Gao, and Q. Zhang, "Numerical analysis on electromagnetic radiation environment of the bounded-wave simulator with a metal plate," *J. Electromagn. Waves Appl.*, vol. 5071, no. June, pp. 1–10, 2017.

[11] S. Y. Kim and K. Cho, "Usability and design guidelines of smart canes for users with visual impairments," *Int. J. Des.*, vol. 7, no. 1, pp. 99–110, 2013.

[12] M. A. Dietz, C. G. Goetz, and G. T. Stebbins, "Evaluation of a Modified Inverted Walking Stick as a Treatment for Parkinsonian Freezing Episodes," *Mov. Disord.*, vol. 5, no. 3, pp. 243–247, 1990.

[13] A. B. Devices, "Wearable Assistive Devices for the Blind," 2010.

[14] G. Gayathri *et al.*, "Smart Walking Stick for Visually Impaired," *Int. J. Eng. Comput. Sci.*, vol. 3, no. 3, pp. 4057–4061, Feb. 2014.

[15] M. Badoni and S. Semwal, "Discrete Distance and Water Pit Indicator using AVR ATmega8 in Electronic Travel Aid for Blind," *Int. J. Disaster Bus. Contin.*, vol. 2, pp. 1–8, 2011.

[16] "1-s2.0-S0022202X15450778-main.pdf." .

[17] E. R. Kandel, J. H. Schwartz, T. M. Jessell, S. A. Siegelbaum, and A. J. Hudspeth, *Principles of Neural Science, Fifth Edition*, vol. 3. 2014.

[18] Abdel I. N. A., (2013) Automated Mobility and Orientation System for Blind or Partially sighted People. Department of Electrical Engineering Tafila Technical University, Tafila 66110, Jordan.

[19] T. Mohammad, "Using Ultrasonic and Infrared Sensors for Distance Measurement," World Academy of Science, Engineering and Technology, pp. 293-298, 2009.

[20] G. Benet, F. Blanes, J.E. Simo, P. Perez, "Using Infrared Sensors for Distance Measurement in Mobile Robots," Journal of Robotics and Autonomous Systems, vol. 10, 2002, pp. 255-266.

[21] G. ARUN KUMAR, P. RAMAKRISHNA, M. SRINIVASULU. "Naveye A Guiding System for Blinds". International Journal of Innovative Technologies Volume.03, Issue No.04, July-2015, Pages: 0593-0598.

[22] Ashish.N.Suryavanshi, Mayuri.S.Chavan, Santosh.B.Jadhav. "Assistance for visually impaired people". International Journal for Research in Applied Science & Engineering Technology (IJRASET). Volume 4 Issue IV, April 2016. ISSN: 2321-9653

APPENDIX A

Questionnaire for pre survey

A SURVEY OF FINAL YEAR PROJECT " DEVELOPMENT OF A ULTRASONIC BLIND STICK"

Age:

Gender: ☐ male ☐ female

Race:

☐ PUBLIC ☐ STUDENT ☐ HOSPITAL STAFFS

1. Do you use blind stick?
   ☐ yes ☐ no
2. Have you heard about blind stick?
   ☐ yes ☐ no
3. Have you see impaired person use blind stick?
   ☐ yes ☐ no
4. Do you have any relative/friend that have eyes problem?
   ☐ yes ☐ no
5. Do you think this project will help impaired and blind people?
   ☐ yes ☐ no
6. What ages that suitable use this devices?
   ☐ 10 - 20 years old
   ☐ 21 - 35 years old
   ☐ 36 - above
7. Are you agree if I design new technology of blind stick?
   ☐ yes ☐ no
8. Do you know about ultrasonic sensor?
   ☐ yes ☐ no
9. Do you think ultrasonic blind stick will help blind people to a better life?
   ☐ yes ☐ no
10. If you are a blind user, would you like to improve your stick?
    ☐ yes ☐ no

.....

Questionnaire for post survey

POLITEKNIK Sultan Salahuddin Abdul Aziz Shah
Jabatan Pengajian Politeknik

SURVEY QUESTIONNAIRE – DEVELOPMENT OF AN ULTRASONIC BLIND STICK

DISCLAIMER:

This survey is based on final year project of Bachelor of Electronic Engineering (Medical Electronic). The name of this device is Ultrasonic blind stick. The aim of this survey is to understand the device after the pre-survey is done. It can be helpful to improve and to enhance the device in future. It is also to analyze the device in getting the correct readings and measurement. Participation of this survey is completely voluntary and anonymous. You may choose to discontinue this survey at any time. No harm will befall to anyone of the participation. This device is focusing for below three months age. All the data will be recorded and analyzed.

CONSENT:

I have read and understood all the information written above. My participation in this survey is voluntary and I am willing to share necessary information for this survey.

This survey is divided into three sections. Section A, B, and C.

SECTION A

1. Are you agree that this device is suitable to use?

☐ Yes
☐ No

2. Are you familiar with this device? Do you heard about similar device like this before?

☐ Yes
☐ No

3. Do you understand the function of this device?

☐ Yes
☐ No

4. If this device is in market, do you prefer to have it?

☐ Yes
☐ No

5. Which one of the method did you prefer?

☐ White cane stick (tradisional)

☐ Upgraded white cane stick

6. Is this device is suitable to use and help blind people?

☐ Yes

☐ No

SECTION B

Directions: Please check and rate yourself honestly based on what you actually do given the statements using the following scales:

5 - Very satisfied 4 - Somewhat satisfied 3 - Neither satisfied
2 - Somewhat dissatisfied 1- very dissatisfied

NO	STATEMENTS	5	4	3	2	1
1	Is this device convenient to use?					
2	Is this device easy to use for blind people?					
3	Can this device is safe to use to blind people?					
4	Do you agree if this device placed in market of our country?					
5	Do you think blind people will use electronic stick?					

SECTION C

Please rate how strongly you agree or disagree with each of these statements.

Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I happy use this product.					
This product is safe to use.					
I would purchase this product.					
This product brings more benefit to user.					

Recommendation / Comments:

_____

_____

_____

_____

Signature,

_____

Date:

APPENDIX B

Source code

```
#define echopin  9 // echo pin
#define trigpin 8 // Trigger pin
int sw1=2;      // water sensor pin2
//int sw2=3;
int maximumRange = 50;
long duration, distance;
void setup() {
 Serial.begin (9600);
 pinMode (trigpin, OUTPUT);
 pinMode (echopin, INPUT );
 pinMode (7, OUTPUT);      // pin vibrater
 pinMode (6,OUTPUT);       //pin buzer
 Serial.begin(9600);
 Serial.println("CONTROLLER READY...");
}
void loop ()
{
 {
  digitalWrite(trigpin,LOW);
  delayMicroseconds(2);
  digitalWrite(trigpin,HIGH);
  delayMicroseconds(10);
  duration=pulseIn (echopin,HIGH);
  distance= duration/58.2;
  delay (50);
  Serial.println(distance);

  delay(100);
   }
```

```
if (distance >= 100 ){      // jarak bila off buzer n vibrate
  digitalWrite (7,LOW);//  vibrater off
  digitalWrite (6,LOW);// buzer off
  delay(100);
}
 else if (distance >=50 && distance <= 99) {      // jarak utk on buzer n vibrate
  digitalWrite (7,HIGH); // vibrater on
  digitalWrite (6,HIGH);// buzer on
  delay(500);
  digitalWrite (7,LOW);// vibrater off
  digitalWrite (6,LOW);// buzer off
  delay(200);
}
 else if (distance <=49) {      // jarak utk on buzer n vibrate
  digitalWrite (7,HIGH); //vibrater on
  digitalWrite (6,HIGH);// buzer on
  delay(100);
  }
 //------------------------------water detector----------------------------------
  if (digitalRead(sw1)==0){

  digitalWrite(7,HIGH);
  digitalWrite(6,HIGH);
  delay(200);
  }
  if (digitalRead(sw1)==1){
 digitalWrite(7,LOW);
 digitalWrite(6,LOW);
 delay(200);
```

APPENDIX C

Letter of endorsement

Persatuan Bagi Orang Buta Malaysia,

Pusat Latihan & Pemulihan MAB(Lembah Kinta),

No 2A, Persiaran Gunung Rapat 4,

31350 Ipoh,

Perak Darul Ridzuan,

2 May 2017

Sir/Madam

Subject: Letter of Acknowledgement for " The Development of An Ultrasonic Blind stick"

Hereby with a sense of gratitude and appreciation for the innovation that has been made on the Ultrasonic sensor for blind device. The innovator detail as below:

Name of innovator : Muhammad Afifuddin Bin Abdul Aziz
NRIC : 930921-10-6573
Innovation's name : **The Development of An Ultrasonic Blind Stick**

2. This innovation also demonstrated the ability to provide the consumer and society. Furthermore, the innovation is suitable to market for the use by blind people.

3. We hope for more innovation to improve the quality of therapy in rehabilitation field.

Thank You

Sincerely,

.....

Name: Pusat Latihan Dan Perkhidmatan Gunung Rapat,

Date: Persatuan Bagi Orang Buta Malaysia,
No. 2A, Persiaran Gunung Rapat 4,
Gunung Rapat, 31350 Ipoh, Perak.
Tel: 05-312 9335 Fax: 05-312 9335

Darul Ehsan Medical Center,
Jalan Ikhtisas,
Seksyen 14,
40000 Shah Alam,
Selangor Darul Ehsan.

9th May 2017

Sir/Madam,

Subject: Letter of Acknowledgement for "Development of an Ultrasonic Blind Stick"

Hereby, with a sense of gratitude and appreciation for the innovations that has been made on the for Blind. The innovator detail as below:

Name of Innovator	**: MUHAMMAD AFIFUDDIN BIN ABDUL AZIZ**
NRIC	**: 930921-10-6573**
Innovation's name	**: Development of an Ultrasonic Blind Stick**

2. This innovation also demonstrated the ability to provide benefit to the consumer and society. Furthermore, this innovation is suitable to market for the use by blind people.

3. We hope for more innovation to improve the quality of therapy in rehabilitation field.

Thank you

Sincerely,

Name:

MOHD RAZALI ZULKIPLY
Senior Technical Executive (Biomedical)
Engineering & Facility Maintenance Department
DEMC Specialist Hospital Shah Alam

APPENDIX D

Picture visiting MAB and testing device