Faculty of Electronic & Computer Engineering and Technology

DEVELOPMENT OF AN ULTRASONIC VIBRATION BELT FOR MONITORING BLIND PEOPLE BY USING ESP8266

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Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

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A project report submitted
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DEDICATION

This project report is dedicated to my family and friends. I want to express special thanks to my mother Puan Hasmah Binti Hamat for teaching me that if I approach things one step at a time, I can complete even the most challenging tasks. I also dedicate this work to my friends and the community members that helped me to complete it. I will always be grateful for the support and guidance provided.

I also like to thank Dr. AKM Zakir Hossain, my PSM Supervisor, for giving me guidance on how to successfully do my final year project.

ABSTRACT

The goal of this project is to create an ultrasonic vibration belt for blind persons using ESP8266. When an obstruction is discovered, the belt incorporates an ultrasonic sensor, buzzer, LED, and switch to give the user haptic input. To help blind people navigate their environment, the ESP8266 board interprets signals from the ultrasonic sensor and causes vibrations on the waist, accompanied by auditory and visual alerts. The device is adaptable, inexpensive, and simple to put together, making it available to a wider spectrum of consumers. By giving blind people a non-intrusive and efficient way to detect obstructions in their route, we hope to increase their freedom and mobility through this initiative.

.

ABSTRAK

Projek ini bertujuan untuk membangunkan tali pinggang getaran ultrasonik menggunakan ESP8266 untuk orang yang buta. Tali Pinggang ini menggabungkan sensor ultrasonik, buzzer, LED, dan suis untuk memberikan maklum balas taktil kepada pengguna apabila mengesan halangan. Papan ESP8266 memproses isyarat daripada sensor ultrasonik dan memicu getaran di kawasan piggang, disertai dengan pengumuman audio dan visual, untuk membantu individu yang buta dalam menavigasi persekitarannya. Peranti ini boleh disesuaikan, berpatutan, dan mudah dipasang, menjadikannya boleh diakses oleh pelbagai pengguna. Melalui projek ini, kami berusaha untuk meningkatkan kemandirian dan mobiliti orang yang buta dengan menyediakan mereka dengan penyelesaian yang tidak mengganggu dan berkesan dalam mengesan halangan di laluan mereka.

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LIST OF ABBREVIATIONS

V	-	Voltage
IOT	-	Internet of things
$Wi-Fi$	-	Wireless Fidelity
GPS	-	Global Positioning System
GSM	-	Global System For Mobile Communications
AC	-	Alternating Current
DC	-	Direct Current
VCC	-	Voltage Common Collector
CS	-	Control Subject

CHAPTER 1

INTRODUCTION

1.1 Background

Blind persons deal with a variety of visual obstacles on a daily basis, such as reading the label on a frozen meal and determining if they are at the correct bus stop. While numerous technologies have been made available to assist in solving these issues employing computer vision and other sensors. Their skills are determined just as much by cutting-edge technological advancements as they are by actual human concerns. It may be possible to drive innovation to address problems by developing a greater grasp of the questions that blind people would like to ask in their daily lives[1].

The development of an ultrasonic vibration belt using ESP8266 for the visually impaired community addresses a significant issue that they face in navigating their environment. When walking, blind persons frequently need the help of others to help them avoid obstacles in their way. The user of the ultrasonic vibration belt can identify obstructions in their way by feeling the vibrations on their waist.[2].

With the non-intrusive obstacle detection mechanism offered by this technology, navigation confidence and independence are increased. Intelligent city solutions and the expansion of assistive apps have become well-known for their unique features, practical qualities, or affordability. Additionally, there are a number of benefits to developing the ultrasonic vibration belt using ESP8266. It enables the device to be customised to the user's unique requirements and preferences. Additionally, The device is also straightforward to install and reasonably priced, which opens up its application to a larger user base. Because it allows visually impaired people to move around more confidently and independently, technology has the potential to enhance their quality of life. It is anticipated that as technology develops, even more creative solutions to the problems encountered by the visually impaired community will be created.

1.2 Addressing Global Issues Through Ultrasonic Vibration Belt Project.

One remarkable effort to address worldwide concerns is the Ultrasonic Vibration Belt Project, which puts safety and societal well-being first. The goal of this project is to increase worker safety in hazardous environments by employing belt-integrated ultrasonic sensors to alert workers in real time to possible risks. Furthermore, the project intends to empower people with disabilities or visual impairments and foster inclusivity and independence by providing them with real-time feedback on their environment. An example of how technology can be used to prevent mishaps, save lives, and remove obstacles is the Ultrasonic Vibration Belt Project. All of these things contribute to a safer and more inclusive world.

1.3 Problem Statement

The community of people who are visually impaired faces several difficulties when navigating their surroundings, especially when it comes to identifying obstructions in their route when walking. Blind people frequently need other people's help to avoid barriers, which reduces their independence and may cause them to feel alone. While several technologies have been created to aid those who are blind or visually impaired in navigating their environment, not everyone can afford or use these gadgets.[3].

Creating a low-cost, user-friendly technology, such an ultrasonic vibration belt with an ESP8266, could provide a solution to this problem. By vibrating around the user's waist, the belt may give them tactile feedback and warn them of possible dangers without the need for outside help. To make a device that is specifically designed to meet the needs and preferences of visually impaired people and is also reasonably priced and simple to assemble, more research and development are necessary. Therefore, the problem statement for developing an ultrasonic vibration belt using ESP8266 for blind people is to design a device that is customizable, affordable, and easy to use, and can provide non-intrusive and effective feedback to help visually impaired individuals navigate their surroundings with more confidence and independence.

Power distribution feeders (and network) stretches over extensive geographical areas and have a myriad of characteristics associated with different voltage levels, circuit lengths, installed transformation capacity, number of load points, circuit construction types (e.g., underground, aerial, mixed) and load segments served. This poses great challenges to analyze the power and energy flow, including TL as these parameters vary significantly from each feeders and networks.

1.4 Project Objective

The major objectives of the PSM lead after considering the above problem statement are:

i. To design and simulate an ultrasonic vibration belt.

ii. To monitor visually impaired people through Blynk software.

iii. To produce the prototype of the ultrasonic vibration belt by using ESP8266 and assess the quality by comparing with existing works.

1.5 Scope of Project

This project involves creating an ultrasonic vibration belt that can help blind people navigate their surroundings by detecting obstacles and providing haptic feedback through vibrations. The ESP8266 microcontroller and ultrasonic sensors will be used by the belt to regulate the motors and sensors. Ultrasonic sensor research, belt design and development, ESP8266 programming, prototype testing and evaluation, and project documentation are all part of this project. Supervisors and panel will receive progress reports during the project's approximately six-month duration. A functional belt, a report, code, and other pertinent documentation will be among the deliverables.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The blind can benefit greatly from the ultrasonic vibration belt, which also has a significant impact on concerns of social inclusion and worldwide safety. It improves safety and reduces accident risk since it provides visually impaired people with instant input about their surroundings. The suggested project aims to create an ultrasonic vibration belt that would assist those with low vision or blindness in identifying impediments. The ESP8266 board will process the data from the ultrasonic sensors in the belt to generate vibrations on the belt fingers, providing the user with a haptic experience. With the help of this input, the user might be able to move through their environment more safely and self-assuredly[4] .

The focus of this review of the literature will be on related projects and research on haptic feedback technologies for visually impaired individuals. We will look at the practicality of using existing haptic feedback devices and their limitations, as well as the efficacy of using haptic feedback to improve the lives of individuals who are blind. The assessment will also look at the benefits and drawbacks of using the ESP8266 board as a development platform for assistive technology devices and ultrasonic vibration as a haptic feedback method.[5].

2.2 Related Previous Project

2.2.1 Technology Development for The Visually Impaired: Assistive Devices

The objective of a previous project, "*Technology Development for the Visually Impaired: Assistive Devices*," was to create cutting-edge methods that would increase the mobility and independence of individuals who are blind or visually impaired. As part of the project, three essential assistance devices were developed: the ultrasonic vibration belt, smart cap, and smart cane[6].

The development of the ultrasonic vibration belt required the combining of multiple components. There were cleverly placed ultrasonic sensors on the palm and fingertips of the belt. To determine distance, these sensors generated sound waves and timed how long it took for the waves to return.[7]. An Arduino Nano microcontroller evaluated the sensor data and generated vibration patterns according to the items' proximity. When the user touched the belt, vibrating motors inside it began to vibrate. The belt was easy for the user to wear and comfortable due to its lightweight, washable construction.

Figure 1 : Smart Belt Project[6]

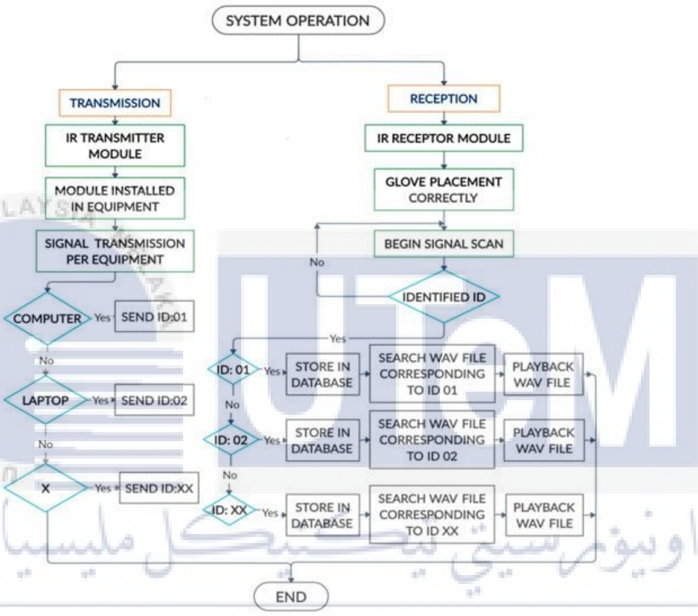

Figure 2: Flow diagram of autonomous nature Smart Belt[6]

Figure 3: Internal structure of Smart Belt[6]

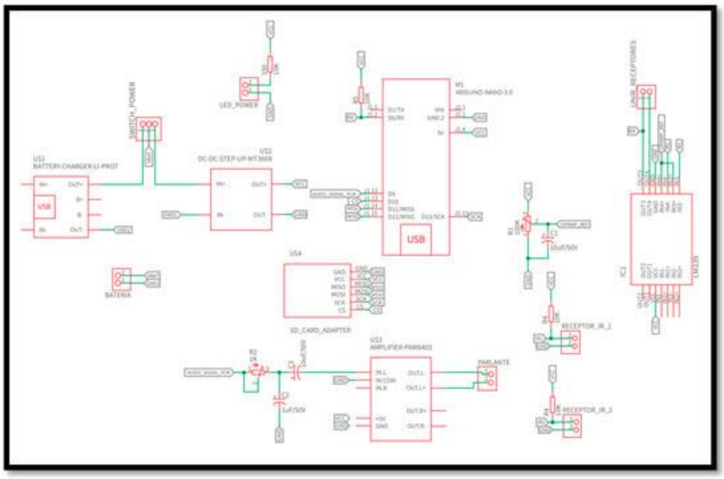

Figure 4: Schematic Circuit for Smart Belt (transmitter project)[6]

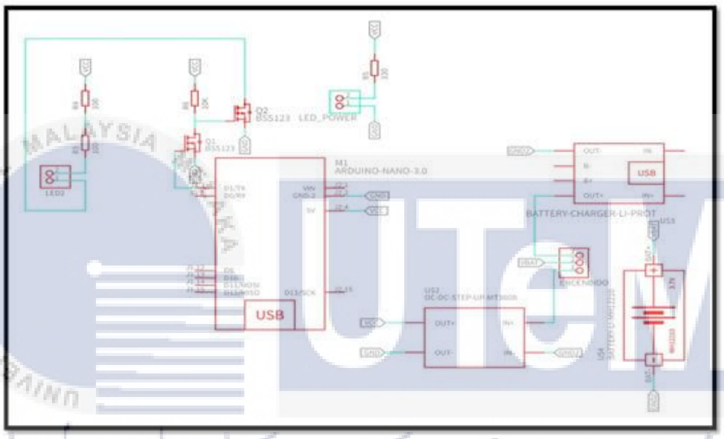

Figure 5: Schematic Circuit for Smart Belt (Receiver project)[6]

A number of components were integrated into the smart cap to allow object recognition above eye level. The headgear was designed with sensors and cameras integrated in to capture visual data of the surroundings. The data was gathered and processed using sophisticated algorithms before being delivered into a microcontroller or other computing device[7]. The user was given real-time indication about the presence of low-hanging branches or overhanging impediments through the use of audio or haptic feedback systems, such as vibration motors or bone conduction technologies.

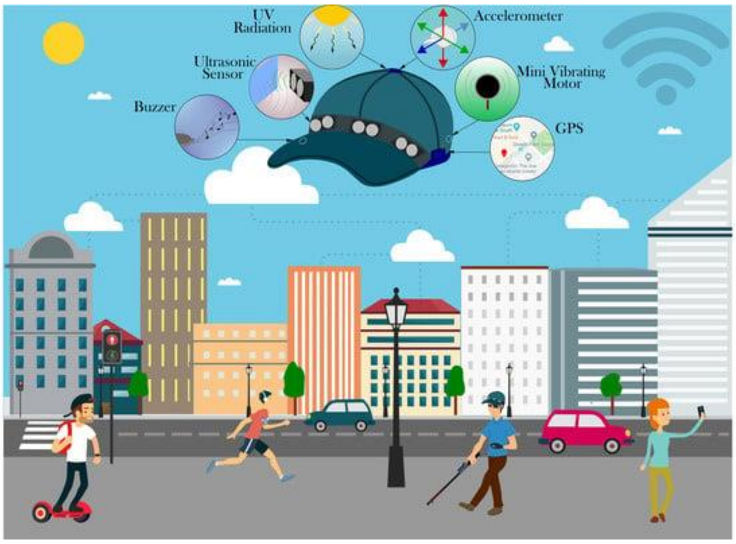

Figure 6: Smart Cap Project[6]

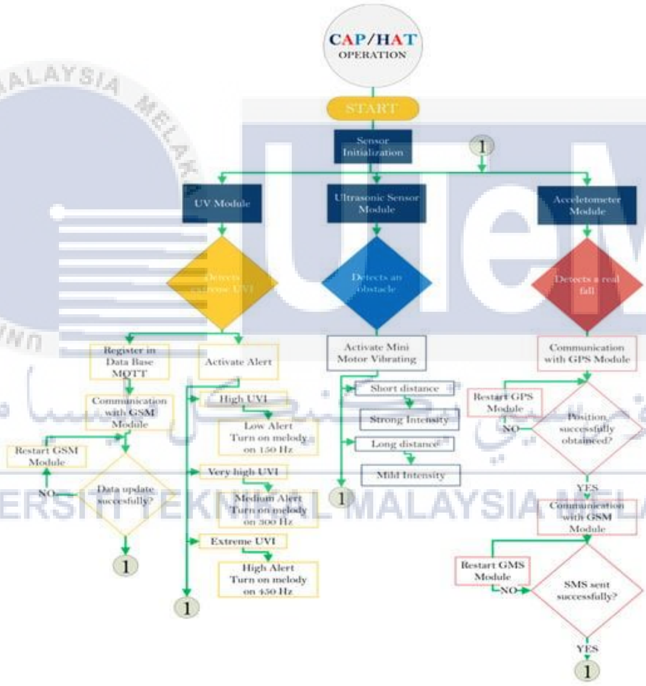

Figure 7: Flow diagram of autonomous nature Smart Cap[6]

Figure 8: Internal structure of Smart Cap[6]

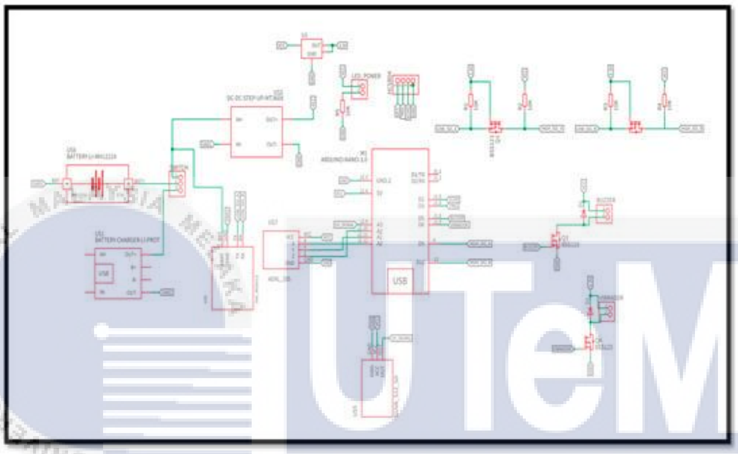

Figure 9: Schematic Circuit for Smart Cap[6]

Similar to this, the smart cane used a range of elements to recognise impediments on the ground and provide feedback to the user. The cane's infrared or ultrasonic sensors enable it to recognise items in its immediate vicinity. These sensors were connected to a microcontroller, which processed the signals and turned on the appropriate feedback mechanisms using the sensor data[6]. The vibrating motors or built-in speakers on the cane produced sounds or vibrations to alert the user to any possible hazards.

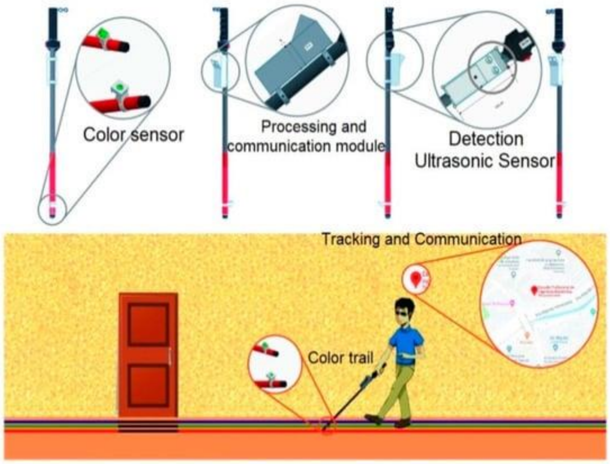

Figure 10: Smart Cane Project[6]

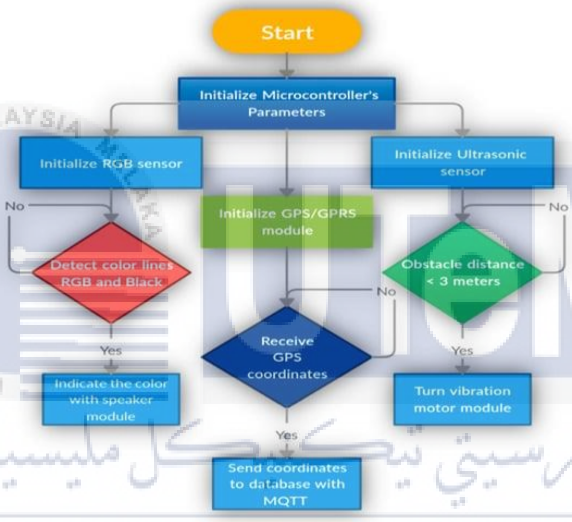

Figure 11: Flow Diagram of autonomous nature Smart Cane[6]

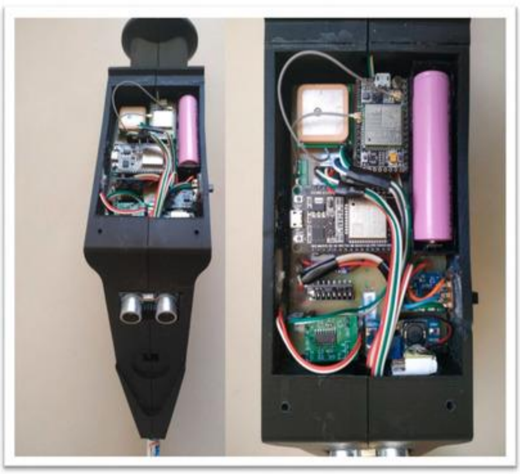

Figure 12: Internal view of the Smart Cane[6]

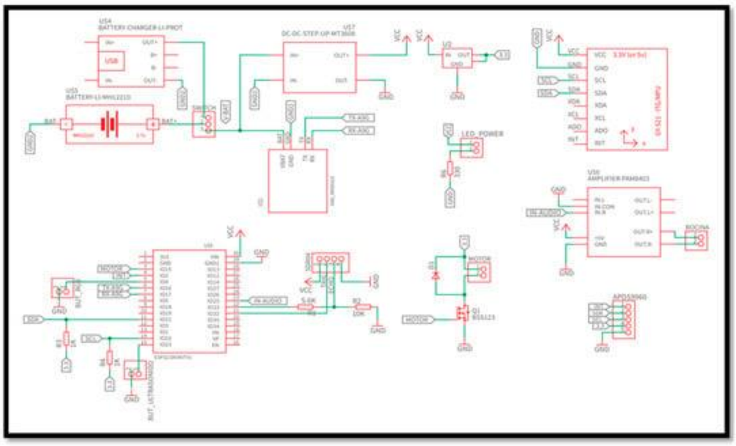

Figure 13: Schematic Circuit for Smart Cane[6]

A variety of assistive devices were tested on visually impaired individuals in real-world settings to determine their efficacy. The ultrasonic vibration belt effectively provided users with sensory feedback, assisting them in identifying and categorising objects in their surroundings. Users expressed increased confidence in their movements and improved spatial awareness. Both the smart cap and the smart cane displayed encouraging results. Users were able to walk around in dangerous regions since the smart hat correctly detected overhanging impediments and quickly alerted them via voice or haptic feedback. By precisely identifying barriers at ground level and alerting users to possible dangers through vibrations or sounds, the smart cane increased users' mobility and safety[6].

An integrated solution to the issues faced by the blind and visually impaired was established by merging several assistive technology, improving perception, movement, and independence. Processing sensor data, controlling feedback mechanisms, and coordinating system operation across all three devices were made possible using an ESP8266 microcontroller. The flexible and intuitive ESP8266 provided a great foundation for the development and prototype of a wide range of assistive devices.

Later studies in this domain may investigate increasingly sophisticated elements and technologies to enhance the effectiveness and utility of these assistive gadgets. For example, object detection and recognition could be improved by fusing machine learning algorithms with computer vision techniques. Furthermore, advancements in miniaturisation and wireless communication could contribute to the creation of portable devices with reduced dimensions.

To conclude, the prior project "Technology Development for the Visually Impaired: Assistive Devices" shown how different parts might be integrated to produce a smart cane, smart belt, and smart cap. Ultrasonic sensors, microcontrollers, vibrating motors, cameras, and feedback mechanisms were some of these parts. When used in tandem, these devices helped those who are blind or visually challenged recognise barriers, gain sensory feedback, and increase their movement and independence. The experiment's positive results highlight the potential of assistive technologies to enhance the quality of life for people who are visually impaired. Further research and advancements in component technology could greatly improve the accessibility, efficacy, and functioning of these assistive devices.

2.2.2 Belts With Ultrasonic Sensors for Blind People Made with Lilypad Arduino

The goal of the research is to make belts that promote independence in blind people, based on the previous project "*Ultrasonic sensors belts for blind people using Lilypad Arduino*." Beyond just impairing vision, blindness has a major detrimental impact on independence, social integration, and daily activities. This article aims to cover the challenges faced by blind individuals, the many types of blindness, and the potential solutions given to promote their independence, with a focus on the development of belts as assistive technology.[7].

For blind people, assistive technology is essential to increasing their freedom. It has gained attention recently because belts made especially for blind people are being developed. These belts are intended to improve blind people's ability to navigate their environment by providing them with sensory feedback and improving their spatial awareness[7]. Through the use of tactile and aural signals, these belts offer a viable means of empowering blind individuals to depend less on others and more on themselves.

This article suggests that for any system, programme, or device to function successfully, appropriate and well-chosen hardware is required. This review of the literature concentrates on how belts are used in conjunction with different technologies to look at the parts of a system meant to assist the blind[7]. The system consists of vibration motors, superconductor fibres, and a Lilypad Arduino microcontroller. This study provides a general summary of the hardware's features and emphasises how it might boost blind people's freedom and security.

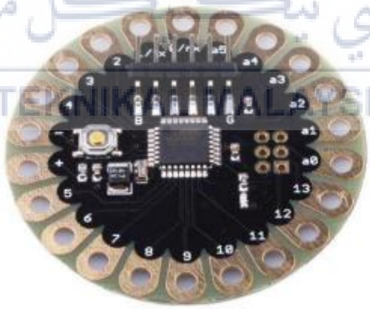

Figure 14: Lilipad Arduino Board[7]

The system uses an ultrasonic sensor as a source of input data. This sensor employs high-frequency waves to detect objects and calculate their distance, much like radar systems do. The sensor can accurately identify angles and distances with a limited margin of error, making it useful for helping persons who are blind or visually challenged. Ultrasonic sensors have shown to be beneficial in a range of applications, including the robotics and sensor industries, because of their dependability and precise findings[7]. The use of ultrasonic waves in assistive technology is further supported by the fact that they are less detrimental to human health than infrared waves.

Figure 15: Ultrasonic Sensor[7]

The primary processing unit of the system is the Arduino board, a kind of clever microcontroller called Lilypad. To control motors, lights, and other actuators, this C++-programmed microcontroller receives input from a variety of sensors. The Lilypad Arduino board's small size, low weight, and flat design make it simple to sew into the cloth belts worn by the blind. This integration allows for seamless connection between the hardware components and the microcontroller, allowing sensory input to be transferred for further processing[7].

Vibration motors are used in the technology as output devices to give blind individuals input. These small electrical devices vibrate to alert users to the presence of objects in their immediate environment. With 5-volt power, vibration motors can be programmed to generate certain vibration patterns or intensities, assisting the blind in safely navigating their surroundings and preventing collisions.

Figure 16: Vibrator Device[7]

Figure 17: Different versions of Maurin Donneaud's[8]

Superconductor fibres are used to connect and integrate all of the system's physical components. The microprocessor, vibration motors, and ultrasonic sensor can all communicate with one another discreetly thanks to these conductive threads. By carefully sewing the conductive wires above the fabric belts, the method ensures a consistent and efficient flow of data and permits real-time contact between the various elements..

Figure 18: Electrically Conductive Wires[7]

The advancement of assistive technology, like the integrated belt system discussed in this article, has a significant positive impact on the safety and freedom of blind individuals. The system makes use of components including vibration motors, Lilypad Arduino microcontrollers, ultrasonic sensors, and superconductor fibres to give blind people real-time feedback about their surroundings. Blind persons may perceive their surroundings more effectively thanks to this mix of physical components, which reduces their reliance on outside assistance and promotes more independence. The community's access to assistive technology for the blind and visually impaired may advance due to continued research and innovation in this field[7].

2.2.3 Visually Impaired People's IOT Enabled Intelligent Stick for Obstacle Recognition

The authors of Muhammad Siddique Farooq et alpaper's "*IoT Enabled Intelligent Stick for Visually Impaired People for Obstacle Recognition*" talk about the challenges faced by the blind and visually impaired and offer a smart stick system that can help them traverse their environment. The writers highlight the importance of assistive technology in improving the quality of life for those who are visually impaired while also examining the drawbacks of existing solutions. The recommended smart stick identifies obstacles, allows location sharing, and ensures the safety of people with visual impairments by utilising IoT technology, ultrasound sensors, water sensors, GPS/GSM modules, and other components[9].

The smart stick, which has several sensors and modules, was made using IoT-enabled technology. The physical design of the stick is centred on characteristics such as comfortable hand grip, height adjustment for varying user heights, and lightweight [9]. Aluminum is used for the stick's rod and synthetic plastic for the handle, respectively. The CAD design of the stick includes the power ON/OFF and function selection switches in addition to a panic button for emergency response..

Ultrasonic sensors and image processing are used for the capabilities of obstacle detection and recognition. To identify obstacles in the front and overhead, three ultrasonic sensors are positioned at various angles. The time that passes between transmitting and receiving sound waves is used to calculate the separation between the sensor and the object. The device has two modes which are one that uses ultrasonic sensors for detection only, and the other that uses image processing and the OpenCV library for detection and recognition [9]. A customized water sensor that makes use of copper terminals and the conductive property of water is used to detect the presence of water.

A GPS/GSM module is built into the smart stick for sharing and tracking whereabouts. Users can SMS specific carers their location by pressing the panic button on the stick. Every 10 seconds, the linked GSM module transmits the user's real-time location to an IoT server using GPS. The ultrasonic sensors, Raspberry Pi camera, OpenCV library, water sensor, GPS/GSM module (SIM800l), and IoT server are among the parts of the IoT-enabled intelligent stick. The actual stick is comprised of aluminum for the rod and synthetic plastic for the handle. For comfort and safety, a silicone anti-skid coating is applied to the handle[9].

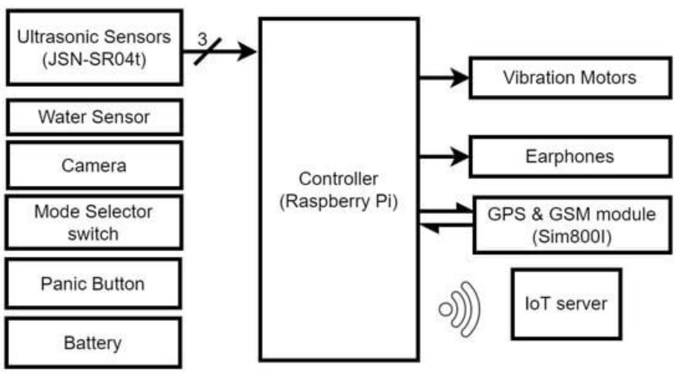

Figure 19: Block diagram of electronic circuitry for the smart stick[9]

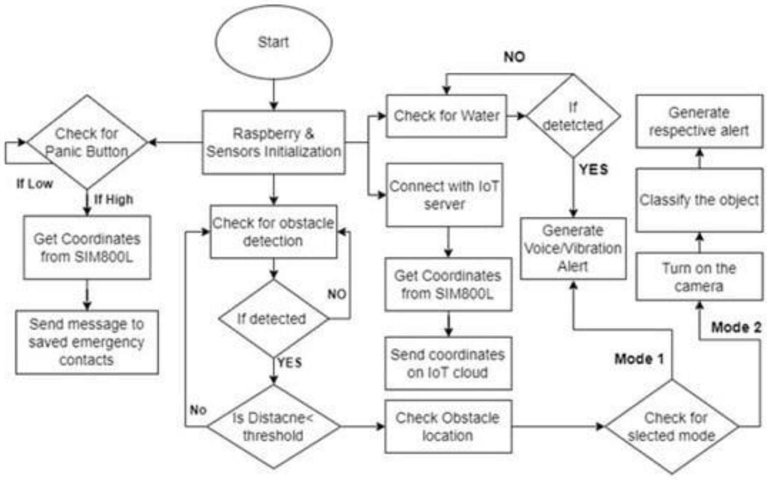

Figure 20:Functional flow diagram of the intelligent stick[9]

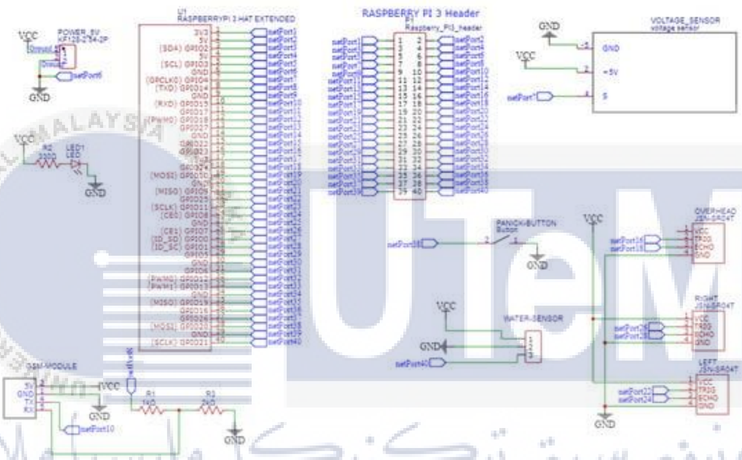

Figure 21: Schematic diagram of the proposed design[9]

Comparing the proposed smart stick to existing solutions reveals better functionality. It offers water detection, GPS-based location sharing, obstacle detection and recognition, and an emergency response capability. The design of the stick makes it comfortable, adjustable, and lightweight to use. To maximize the area covered by obstacle detection, the sensors are carefully positioned. The system is effective at identifying obstacles and warning users about them using audio messages and vibration motors. Common objects seen on the street can be accurately identified by the image processing algorithm utilizing OpenCV. To detect water, a specifically designed water sensor is employed. The GPS/GSM module allows caregivers to share and track a person's position, making it easier for them to monitor the locations of visually impaired individuals. The IoT-based technique enhances the stick's usefulness and global tracking capabilities[9].

The literature review concludes by outlining the shortcomings of the assistive technology currently on the market for people with visual impairments and suggesting the Internet of Things-enabled intelligent stick as a viable solution. Several sensors and modules are combined in this IoT-enabled smart stick to enhance functionality and solve problems encountered by users. The stick's design places a high priority on user comfort and versatility, offering features like obstacle detection, object recognition, water detection, GPS-based position sharing, and emergency response. Its efficacy has been assessed, and the findings indicate that it can effectively detect water, obstructions, and objects[9]. All things considered, the IoT-enabled intelligent stick holds great potential for improving the independence and security of blind individuals; nevertheless, additional effort is required to refine its operation and explore its possible applications.

2.2.4 Vibrotactile Belt For Deaf-Blind People: Sensing Performance

The study "Sensing Performance of a Vibrotactile Belt for Deaf-Blind People" by Albano Carrera, Alonso Alonso, Ramón De la Rosa, and Evaristo J. Abril focuses on the creation of a vibrotactile belt as a communication tool for people who are deaf-blind. Vibrotactile stimulation is used in the belt's construction to send information, enabling communication for those who are deaf-blind and others. The study attempts to assess the feasibility of vibrotactile concept communication by introducing the TactileCom communication system[10].

The study team collaborated extensively with engineers, caregivers, and future deaf-blind users, using a user-centered design approach. Through iterative design revisions, the project team developed a vibrotactile belt as the efferent human-machine interface (HMI) for the TactileCom system. The belt consisted of five tactors, each attached to a finger. To control them, an Arduino Micro board was utilised[10]. The system had a Bluetooth link to communicate with the interlocutor, who used a tablet or smartphone as the afferent interface.

The study population consisted of four deaf-blind people (DBS) and eighteen control volunteers (CS). Usher's syndrome was present in the deaf-blind subjects, while no sensory deficits were present in the control group. The volunteers in the tests were given different stimulation patterns or tactons on a vibrotactile belt, and their ability to recognise the signals was assessed.

The study project's conclusions revealed positive outcomes in terms of the TactileCom system's effectiveness and acceptability[10]. The high rate of accuracy in tacton identification by the control participants demonstrates the usefulness of the vibrotactile belt as a communication tool. The TactileCom system's signals were also readable and understood by the deaf-blind subjects, despite their lack of familiarity with other haptic or vibrotactile devices. This demonstrated how the system could improve deaf-blind people's interaction and communication.

The TactileCom system was examined for acceptance and utility in collaboration with deaf-blind users and caregivers. The intended user group's opinions and comments influenced the design of the belt and the selection of stimulation patterns. The deaf-blind test participants thought the technology was good and could be used to send and receive communications[10]. This user interaction highlighted how important it is to consider the requirements and perspectives of individuals with disabilities when building assistive technologies.

The research project also revealed non-deaf-blind people who could benefit from the TactileCom system. In noisy workplaces or multicultural environments, for example, when verbal communication is difficult, the technique may facilitate language-independent communication[10]. The wireless link between the vibrotactile belt and the mobile phone or tablet interface allowed people to communicate with each other and solved barriers in noisy environments.

Figure 22: Graphical abstract of Vibrotactile Belt[10]

This article concluded by demonstrating the TactileCom system's feasibility and potential as a communication aid for people who are deaf-blind. A vibrotactile belt was used in conjunction with a mobile phone or tablet interface to promote involvement with the environment and other people, as well as to effectively express messages. The findings emphasised the value of user-centered design and the involvement of individuals with disabilities in the development and use of assistive technology. Similar strategies could improve interaction and communication for individuals with sensory impairments, as the TactileCom system showed.[10].

2.2.5 Intelligent Belts for Real-Time Use

Taking inspiration from the article "Smart Belts For Real Time Applications," According to the studies, the Third Eye is a wearable gadget designed to assist vision impaired persons in independently navigating indoor environments. This innovative device not only reduces the need for sighted assistance but also allows the blind to move around freely. The gadget detects obstacles using ultrasonic modules and microcontrollers, alerting the user with tactile and auditory input. This research study explores the history and effects of the Third Eye with a particular focus on how it can improve the quality of life and mobility for individuals who are visually impaired[11].

This article also noted how mobility aids, such as guide dogs and canes, are commonly used by blind individuals to help them traverse their environment. There are certain disadvantages to these traditional aids, though. Canes need users to move slowly and deliberately and only provide a limited preview. The results of training guide dogs may not be very good and require a tremendous deal of coordination. To overcome these difficulties, researchers have focused on developing assistive technologies to augment the limited abilities of the visually handicapped. With the help of an ESP8266 microcontroller and an ultrasonic sensor (HC-SR04), the Third Eye assistive belt promises to increase blind people's mobility and independence in doing daily tasks[11].

This article's block diagram's ultrasonic sensor and microcontroller enable users to identify obstacles in their path. The system alerts users in real time about obstacles in their way via a range of output devices, including an LED light, a vibrating motor, and a buzzer. By comprehending these signals, people may safely navigate their environment and make informed decisions[11]. This review looks at the components and functionality of the system and emphasises how it may be used to make users safer and move about more easily.

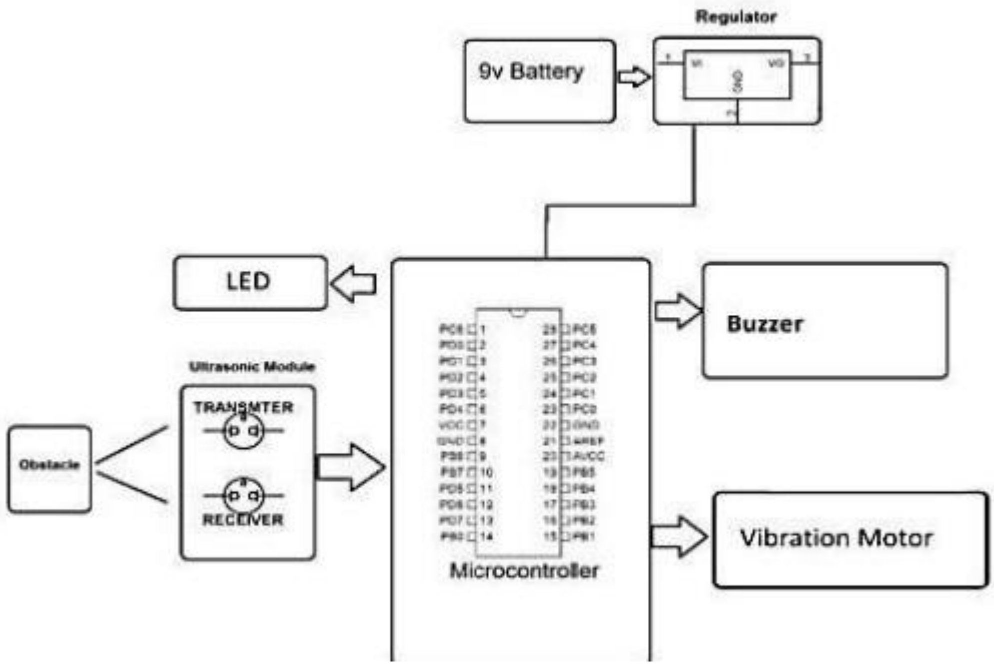

Figure 23: Block diagram[11]

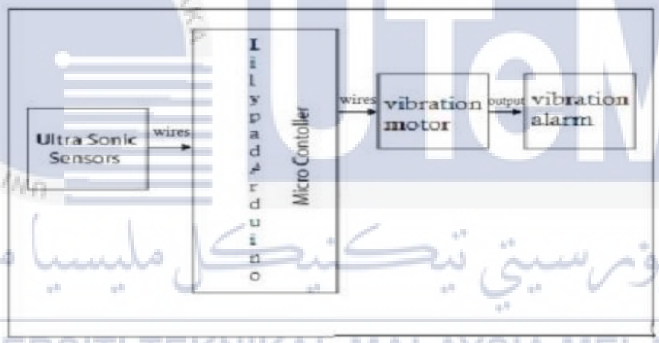

Figure 24:System Block diagram[11]

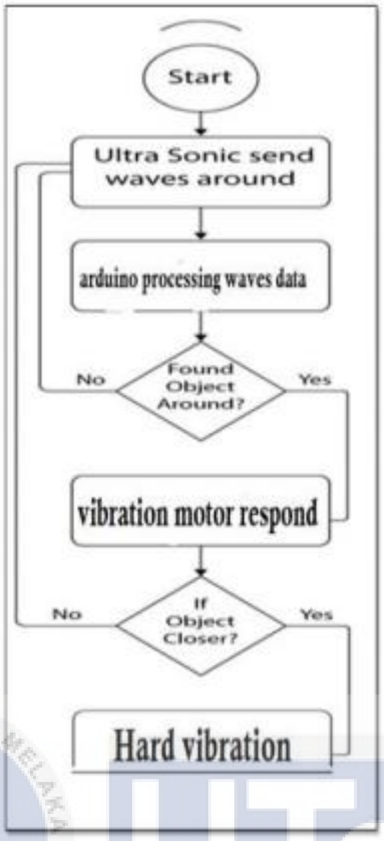

Figure 25:Data flow diagram of the project[11]

The suggested system consists of vibration motors, microprocessor, Bluetooth-connected smartphone, and ultrasonic sensors. When in navigation mode, the ultrasonic sensors generate ultrasonic waves that bounce off obstacles. The sensors provide the position and orientation of obstacles to the microcontroller. Based on the proximity and location of the barrier, the vibration motors vibrate at different intensities, which are controlled by the microcontroller using this data[11]. By sensing these vibrations, the user can determine whether impediments are there and their approximate location. Obstacles up to 1.5 metres distant can be detected by the system.

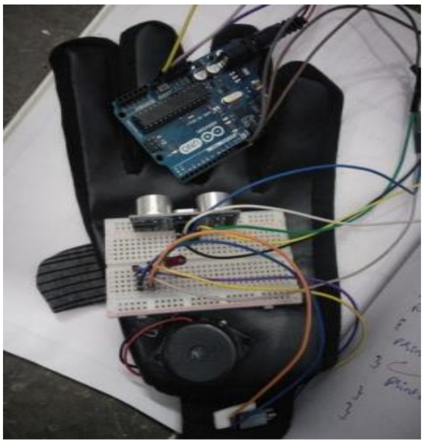

Figure 26: Final Output of the project[11]

The suggested system offers a complete solution to help users with tactile image identification and obstacle avoidance by integrating navigation and printed image detection modes. Through the use of vibration motors, microcontrollers, IR sensors, and ultrasonic sensors, the system provides users with real-time input in several modes. The navigation mode provides obstacle identification and location, boosting user safety and mobility. The device offers haptic feedback for edge, form, and grayscale image recognition when it is in the printed image detection mode. This system is a promising technology for people with visual impairments or those who need aid with navigation and tactile picture perception because of its adaptability and possible applications.[11].

2.3 Advantages And Disadvantages of Previous Projects

No.	Reference	Components	Advantages	Disadvantages
1	[6]	-Ultrasonic Sensor -Cane -ESP32 -SPN32 -GSM module	-SPN32 has function of processing and integrating Smart Cane's internal devices -GSM module can track device and transmit navigation information to web environment	-ESP32 can use a lot of energy, particularly when using capabilities like Wi-Fi or Bluetooth connectivity.
2	[7]	-Lilypad Arduino -Vibrator Device -Electrically conductive wires	-Lilypad Arduino has structure. This makes it perfect for including electronics in textiles, accessories, and clothes. - Electrically conductive wires can be applied to many different things, including as power transmission, electrical circuits, telecommunications, electronics, and more	-Due to its extremely little RAM and flash memory, Lilypad Arduino has very little memory. All electrically conductive cables contain some resistance, which results in a voltage drop along the whole length of the cable. This could be an issue, particularly for applications that call for long wire runs or low voltage..
3	[9]	-OpenCV software -High-definition video camera -Earphone	-OpenCV (Open-Source Computer Vision) software provides strong object recognition and recognition algorithms and tools. This talent can be used to help blind persons recognize and identify objects in their environment. -With the use of high-definition video cameras, perfect depth sensing is made possible. For applications that call for exact measuring or monitoring of things in	-OpenCV, an open-source computer vision package, focuses on image processing and analysis, which may not directly address the needs of blind people. -Due to their often-constrained depth range, high-definition video cameras may find it difficult to detect things that are either too near to the camera or too far away from it. This

			three dimensions, this accuracy is essential.	constraint may limit their usefulness in applications where a wide depth range is necessary.
4	[10]	-Arduino Micro board -Tactor Activation -DC Motor	-Tactor activation can provide tactile feedback that enhances or complements other sensory inputs, tactor activation can significantly improve the user experience. This input can improve the immersion, engagement, and intuitiveness of interactions with digital or virtual settings. -DC Motor have the ability to precisely control the motor's rotational speed	-The intended sensation may not always be accurately or realistically represented by tactile feedback. Tactile activation can only simulate a small number of sensations, and the level of accuracy and precision may not equal the complexity of the real-world experience. -DC motors need routine upkeep, such as brush replacement and recurrent lubrication
5	[11]	-ATmega328p microcontroller -Voltage Regulator -Ultrasonic Sensor (HC SR04)	- ATmega328p Microcontrollers are affordable, making them suitable for low-cost projects, students, and hobbyists. - A voltage regulator can maintain a constant output voltage regardless of changes in input voltage or load conditions. This minimizes the possibility of damage or malfunction by ensuring that delicate electronic components receive a steady and dependable power supply.	- The ATmega328P has less processing capability than more sophisticated microcontrollers or processors because it is an 8-bit microcontroller. This might be a drawback for applications that call for complicated algorithms or heavy computations. - Voltage regulators might become hot while operating as it has a large voltage difference between the input and output.

Table 1: Advantages and Disadvantages of Previous Projects

CHAPTER 3

METHODOLOGY

3.1 Introduction

The goal of this project is to develop an Ultrasonic Vibration Belt that will help blind individuals become more mobile and aware of their surroundings by utilising the ESP8266 as a basis. One of the methodological processes this chapter covers is the creation of the project's flowchart. After that, a block diagram that is appropriate for the project is made in the section that follows. The operating flow of the project has also been depicted. The hardware and supplies for the project have been discussed. With this approach, we aim to create a useful and reasonably priced device that provides haptic feedback to help visually impaired individuals navigate their surroundings more easily.

3.2 Project Workflow

A project management workflow consists of a number of actions that must be taken in order to finish the project. It starts with defining the project and its goals, followed by the development of a thorough plan that specifies the project's scope, timetable, and resource requirements. Following completion of the planning stage, the project enters the execution stage, during which tasks are given and advancement is monitored. Monitoring and control procedures make sure that the project stays on course and that any problems or adjustments are dealt with. The project is then concluded by finishing all deliverables, assessing its performance, and handing over the results to the stakeholders. The workflow makes sure that initiatives are well-managed, organized, and accomplish their intended objectives.

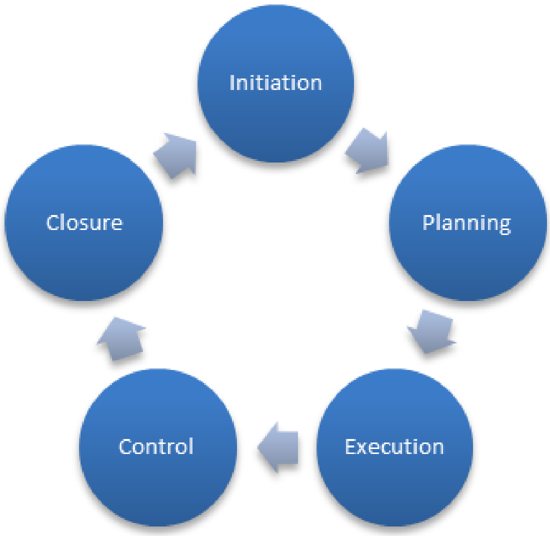

Figure 27: Project Workflow

3.2.1 Flowchart of Overall PSM

Flowchart is a diagram showing the order and structure of steps in a process. In quality improvement, there are two different kinds of flow charts used. A high-level flowchart that lists six to ten significant steps provides a general overview of a process. These flowcharts show the key building blocks of activity or key system parts of a process.[12]

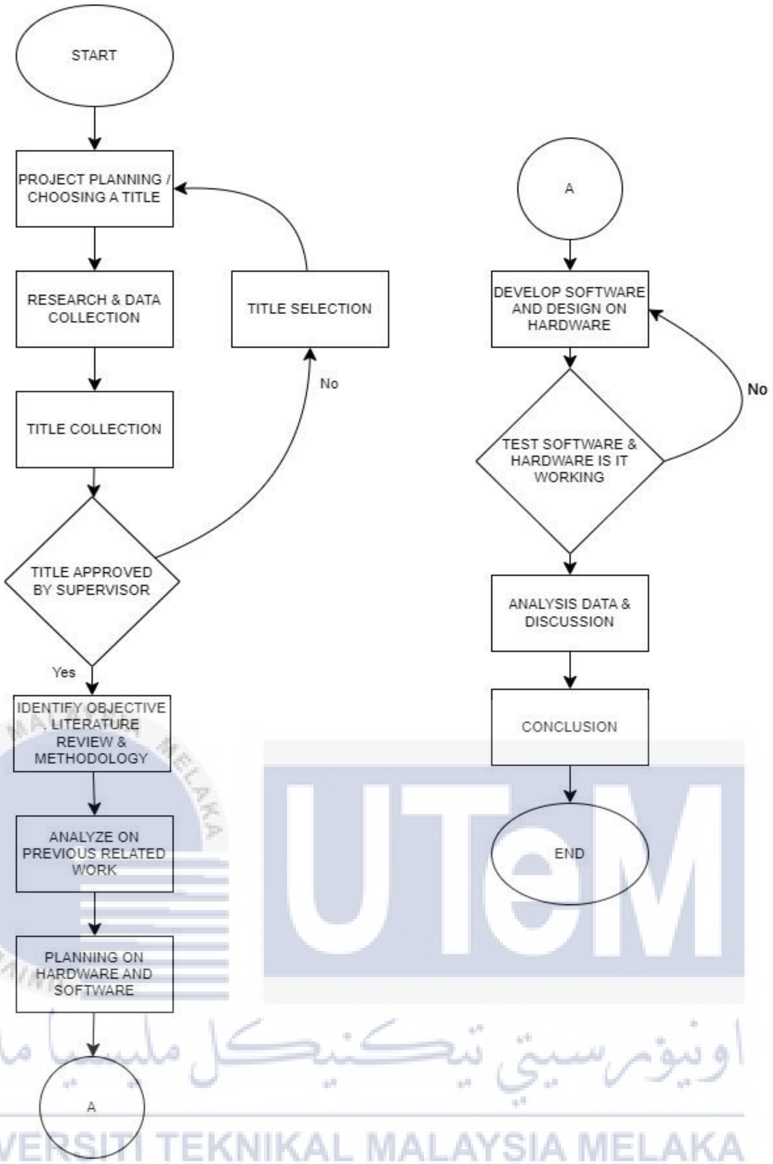

Figure 28: Flowchart of overall PSM

3.3 Data Collection

The process of data collection required to assess the project's effectiveness is known as data collection. As a result, the project's literature review will act as a guide for gathering data and information.

All required data, such as amperes, watts, volts, and kilowatt-hours, will be stored on ESP8266. Furthermore, data from the Internet of Things (IoT) will be saved on a newly built cloud server via a smartphone application.

This project's production made use of all the data collected from various sources. Analyzing prior attempts may also provide you with additional information about the project, including its objectives, strategies, and outcomes, enabling you to make more educated judgements.

3.4 Design

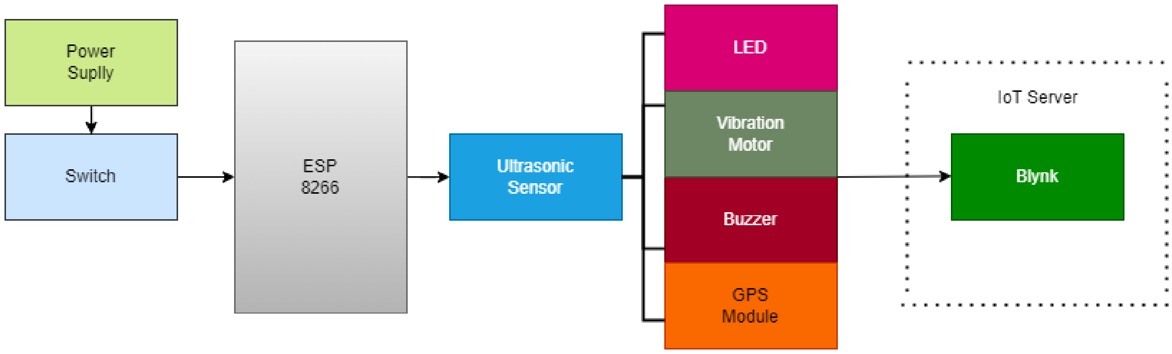

Figure 29: Project System Block Diagram

Block diagrams can be made up of a single block or several blocks. These are employed to visually illustrate the control systems. A block, the summation point, and the take-off point are the fundamental components of a block diagram[13]. The block diagram for an ESP8266-based system for an ultrasonic vibration belt is shown in the figure above. In this specific block diagram, the hardware and software are physically connected to demonstrate how the system functions. The ESP8266 connection input devices, including ultrasonic sensors and switches, serve as the system's central processing unit. The ultrasonic sensor works by sending out high-frequency sound waves and monitoring how long it takes for the waves to return after striking an object in order to determine the distance based on the speed of sound. When this happens, the buzzer, light, and motor will turn on. Then the output will send data to the blynk server that can be monitor through phone.

3.5 Hardware Specification

Hardware specs are the specifics of the capabilities and physical parts of a system or device. Users can evaluate the performance and compatibility of a device by understanding its hardware specs, which helps them decide whether it is appropriate for their needs. To achieve the desired outcome, numerous hardware elements were used in this project.

3.5.1 ESP8266

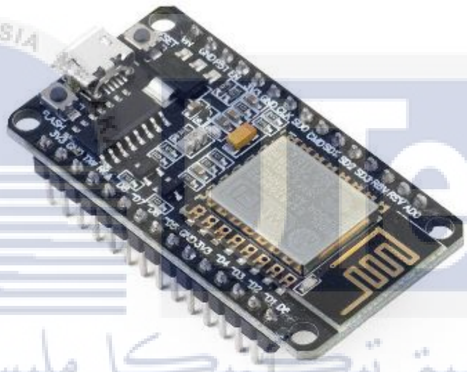

Figure 30: ESP8266

Based on the ESP8266 microcontroller, ESP8266 is an open-source firmware and development kit that offers an affordable option for Internet of Things (IoT) projects with integrated Wi-Fi[14].

ESP8266 was first created for Lua scripting, but it has since developed to support the Arduino IDE, allowing it to be compatible with the vast Arduino ecosystem and being available to a wider range of users.

The versatility in connecting with sensors, actuators, and other peripherals that the ESP8266's GPIO ports offer is essential for a variety of Internet of Things applications. Because the ESP8266 has built-in Wi-Fi, it can connect to local networks and the internet, allowing Internet of Things projects to benefit from remote control and monitoring. The vibrant and active ESP8266 community helps developers and keeps the platform updated and improved on a regular basis.

3.5.2 GPS Module (GY-GPS6MV2)

Figure 31 : GPS Module

The GY-GPS6MV2 is one of the most well-known GPS modules among the many that are utilized in different electronic systems for exact location monitoring and navigation. A sophisticated GPS chipset, which enables the module to process signals from satellites in orbit, is its main component. The GY-GPS6MV2 can precisely compute and transmit speed, time, and position data by utilizing this capability. Communication with other devices is made easier via a serial interface, which often uses the Universal Asynchronous Receiver-Transmitter (UART) protocol. This results in interchangeable location data and simpler integration into larger electronic systems. Furthermore, the module meets the requirements of the power supply, often operating within a designated voltage range. Additionally, it features an antenna that can be integrated within or mounted externally. The antenna is necessary[15].

The GY-GPS6MV2 often outputs data in the National Marine Electronics Association (NMEA) language format. Important information like latitude, longitude, altitude, and timestamp can be found in these common expressions. This large dataset is critical to the operation of many applications that require precise location data, including tracking devices, navigation systems, and other location-based projects.

3.5.3 Step-Up Converter

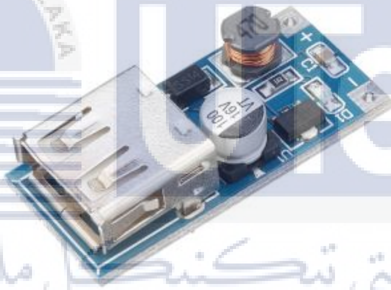

Figure 32: Step Up Converter

A step-up converter, also known as a boost converter, is a crucial electronic circuit that is used to increase the voltage level of a certain input power source to a bigger output voltage. This type of DC-DC converter is particularly useful when the required voltage for a system or device is more than what the available input source can deliver. Basically, a step-up converter modifies the energy flow via critical components with great care.

The inductor is a crucial part of a boost converter since it is necessary for energy storage and release. When an input voltage is present, the inductor stores energy; when a greater output voltage is needed, it releases the stored energy. Transistors are often the switching device that controls this energy flow. The transistor's state is managed by a pulse-width modulation

(PWM) signal, which determines when energy is supplied to the inductor and subsequently to the output.[16].

When the transistor is off, a diode also referred to as a flyback or freewheeling diode—is employed to prevent current from flowing backward from the output to the input. Additionally, an output capacitor is used in the circuit to stabilize the output voltage, lessen ripples, and provide a more consistent voltage supply to the load. To keep the output voltage at the desired level, control circuitry coordinates the transistors' switching, maintaining, and regulating the boost converter's overall performance.

In real-world applications, step-up converters are often used to power LED drivers, generate high voltage supplies for various electronic components, and provide a consistent power source for devices that require a voltage higher than what the input source originally delivers. Because of their versatility and efficiency, boost converters are integral components of many electronic systems where voltage up conversion is necessary.

3.5.4 Ultrasonic Sensor

Figure 33: Ultrasonic Sensor

A common tool for detecting objects and measuring distances based on the principles of sound waves is an ultrasonic sensor. Its capabilities and performance are defined by a few important hardware specs. The ultrasonic sensor's working frequency range is one crucial feature. The ultrasonic frequency range, which is above the range of human hearing, is where most ultrasonic sensor’s function. Ultrasonic sensors typically operate in the frequency range of 20 kHz to many tens of kilohertz. The ultrasonic sensor is composed of a transmitter, receiver, and transceiver.

Electrical signals are converted to sound waves in the transmitter. The receiver translates transferring sound waves back into electrical signals. The transceiver performs the roles of transmitter and receiver. It also has crystal oscillators in it[17].

The ultrasonic sensor's detection range is an additional crucial characteristic. This is the greatest distance that the sensor can reliably detect objects across. Depending on the model, the detection range can change, although it typically ranges from a few centimeters to several meters. The beam angle of ultrasonic sensors also controls the detecting cone's width. The angular range that the sensor can detect objects within is represented by the beam angle. It can differ amongst sensors and is commonly expressed in degrees.

Another important specification is the output format. Typically, ultrasonic sensors give outputs for measuring distance in multiple formats, including serial data, digital (binary) signals, and analogue voltage. The way that the distance information is transmitted to other parts or systems depends on the output format. Another crucial factor to consider is power requirements. Depending on the sensor model, ultrasonic sensors usually function within a certain voltage range, which is frequently 5V or 3.3V. To guarantee dependable and precise functioning, it is crucial to make sure the power source is compatible with the voltage needs of the sensor.

3.5.5 Buzzer

Figure 34: Buzzer

Microcontrollers and other digital circuits of any kind can operate buzzer modules. They consist of a transducer that electromechanically converts electrical signals into sound waves. In a buzzer module, the three essential components are a diaphragm, a coil, and a casing. One important feature of a buzzer is its operating voltage. Often, buzzer modules have a recommended voltage range within which they can operate. For example, a voltage source that operates within the 3V to 5V operational voltage range may be used to power a buzzer module[18].

Buzzer modules have a range of frequency capabilities that are generally represented in hertz (Hz). While the frequency of certain buzzers is fixed, that of others can be adjusted by adding external components like resistors or capacitors. The sound pressure level is used to determine how loud the buzzer will sound (SPL). Usually, decibels are used to describe it (dB). The buzzer's output gets louder as the SPL level rises.

3.5.6 Light Emitter Diode

Figure 35: Light Emitting Diode (LED)

An popular electronic component that emits light for usage in a range of applications is the Light Emitting Diode (LED). LED technology has advanced significantly, offering a wide range of options with different qualities to meet different purposes. Red, green, blue, yellow, and white are some of the colour options for LEDs. They are available in a variety of package types, such as through-hole LEDs and surface-mount LEDs, giving you a variety of mounting and installation options[19].

The forward voltage of an LED is one of its primary characteristics (Vf). The LED needs at least this amount of voltage to produce light. The Vf value changes according to the technology and colour of the LEDs. Standard LEDs typically have forward voltages of between 1.8 and 3.6 volts. The forward current (If), which denotes the current required for the LED to function effectively and output light at the given brightness level, is another crucial characteristic. Usually, it is expressed in milliamperes (mA). The forward current may vary depending on the LED and the desired brightness level. For example, common LEDs typically have values between 5 and 20 mA.

3.5.7 Mini Electric Motor

Figure 36: Mini Electric Motor

Depending on the type of motor, little electric motors usually run at low voltages, usually between 1.5 and 12 volts. Because they are designed to convert electrical energy into mechanical motion, they are appropriate for a wide range of applications. These motors are lightweight and usually compact in size, making them ideal for use in small-scale applications.

A tiny electric motor's operating voltage, current consumption, torque, speed, and size are among its specifications. The operating voltage determines the power source required to drive the motor efficiently. The motor's current consumption indicates how much current it draws when operating, which is important information for power management and selecting the most effective power sources.

Two of a motor's most important performance factors are speed and torque. The speed of a motor is generally measured in revolutions per minute (RPM), which is the rate at which the motor shaft rotates. Torque, which is given in Newton metres (Nm) or ounce-inches, is the rotating force that the motor produces (oz-in).

The physical specifications of micro electric motors, such as their diameter, length, and shaft size, may also be specified. These dimensions specify how the motor can be installed or integrated into a project, as well as how well it works with other components. It is essential to consider your project's requirements when selecting a small electric motor to ensure that it meets the voltage, current, speed, torque, and physical dimensions required[20].

3.5.8 9V Battery

Figure 37: 9V Battery

The 9-volt battery is a common power source that may be recognized by its distinctive rectangular prism shape and nominal voltage of 9 volts. Powering a variety of electrical devices and tiny appliances requires this type of battery. Positive and negative terminals are often found on top of the 9-volt battery. Its common architecture allows it to work with a wide range of modern gadgets. Generally, the negative terminal is larger, and the positive terminal is smaller to allow for an easy and consistent connection.

3.5.9 Stripboard

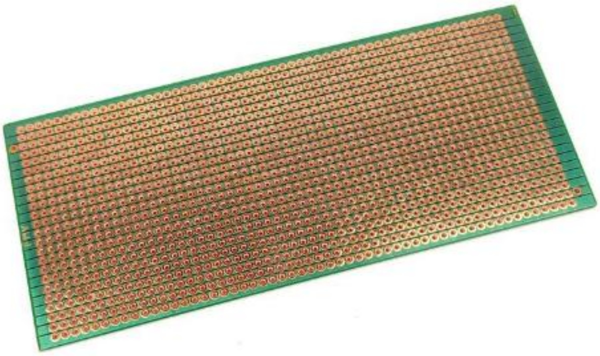

Figure 38: Strip Board

Stripboard is a typical tool for electronic circuit prototyping; it is also known as Veroboard or Perfboard. The board is constructed from a base material that acts as insulation and is crossed by parallel copper strips. These copper tracks form a grid-like structure, with each pad holding soldered connections between electronic components. The board can be used with widely available electronic components since its holes are typically spaced at a standard pitch.

Electronic components such as resistors, capacitors, and integrated circuits are mounted on the stripboard by fastening their leads to the copper pads. The components are assembled to cross the copper tracks, and the leads are bent or chopped to connect to additional pads. Solder is then used to make the necessary electrical connections, creating a circuit on the board.

Stripboard's adaptability and suitability for a wide range of applications make it a popular material for rapid prototyping among engineers, students, and enthusiasts. It makes it possible to quickly construct electrical circuits and does away with the requirement for specially built printed circuit boards (PCBs). It's also vital to keep in mind that complex circuit designs or high-frequency applications may not be appropriate for stripboard.

3.6 Implementation

3.6.1 Project Implementation

The ESP8266 board and the component parts must be connected correctly for the project "Developing an Ultrasonic Vibration Belt Using Arduino for Blind People" to be implemented.

Ultrasonic Sensor:

- Connect the VCC pin of the ultrasonic sensor to the 3V pin on the ESP8266 board.
- Connect the GND (Ground) pin of the ultrasonic sensor to the GND pin on the ESP8266 board.
- Connect the Trig pin of the ultrasonic sensor to digital pin 1 on the ESP8266 board.
- Connect the Echo pin of the ultrasonic sensor to digital pin 2 on the ESP8266 board.

Buzzer:

- Connect the positive (longer) leg of the buzzer to digital pin 7 on the ESP8266 board.
- Connect the negative (shorter) leg of the buzzer to the GND pin on the ESP8266 board.

LED:

- Connect the positive leg (anode) of the LED to digital pin 5 on the ESP8266 board.
- Connect the negative leg (cathode) of the LED to the GND pin on the ESP8266 board.

Mini Electric Motor:

- Connect the positive leg (anode) of the Mini electric motor to digital pin 7 on the ESP8266 board.

- Connect the negative leg (cathode) of the Mini electric motor to the GND pin on the ESP8266 board.

GPS Module:

- Connect the VCC pin of the GPS Module to the 3V pin on the ESP8266 board.
- Connect the GND (Ground) pin of the GPS Module to the GND pin on the ESP8266 board.
- Connect the RX pin of the GPS Module to digital pin TX on the ESP8266 board.
- Connect the TX pin of the GPS Module to digital pin RX on the ESP8266 board.

Antenna:

- Connect the antenna to the GPS module by its cable.

to carry out the project "Creating an Ultrasonic Vibration Belt for Blind People Using ESP8266." To connect the ultrasonic sensor, the GND and Echo pins should be linked to the GND and digital pin 2 (D2) on the ESP8266. The VCC and Trig pins should be connected to the 3V and digital pin 1 (D1) on the ESP8266, respectively. Attach the positive and negative legs of the buzzer to GND and digital pin 7 (D7) of the ESP8266, respectively. Attach the LED's positive leg to digital pin 5 (D5) and its negative leg to the ground of the ESP8266. To finish the connection, attach the miny electric motor's positive and negative legs to ground (GND) and digital pin 8 (D8) on the ESP8266. Attach the ESP8266's digital pins TX and 3V to the GPS Module's RX and VCC pins, respectively. Attach the TX and GND pins to the digital pins RX and GND of the ESP8266, respectively. Ensure that the antenna is correctly attached to the GPS module by using the cord to do so.

3.6.2 **Flowchart of The System**

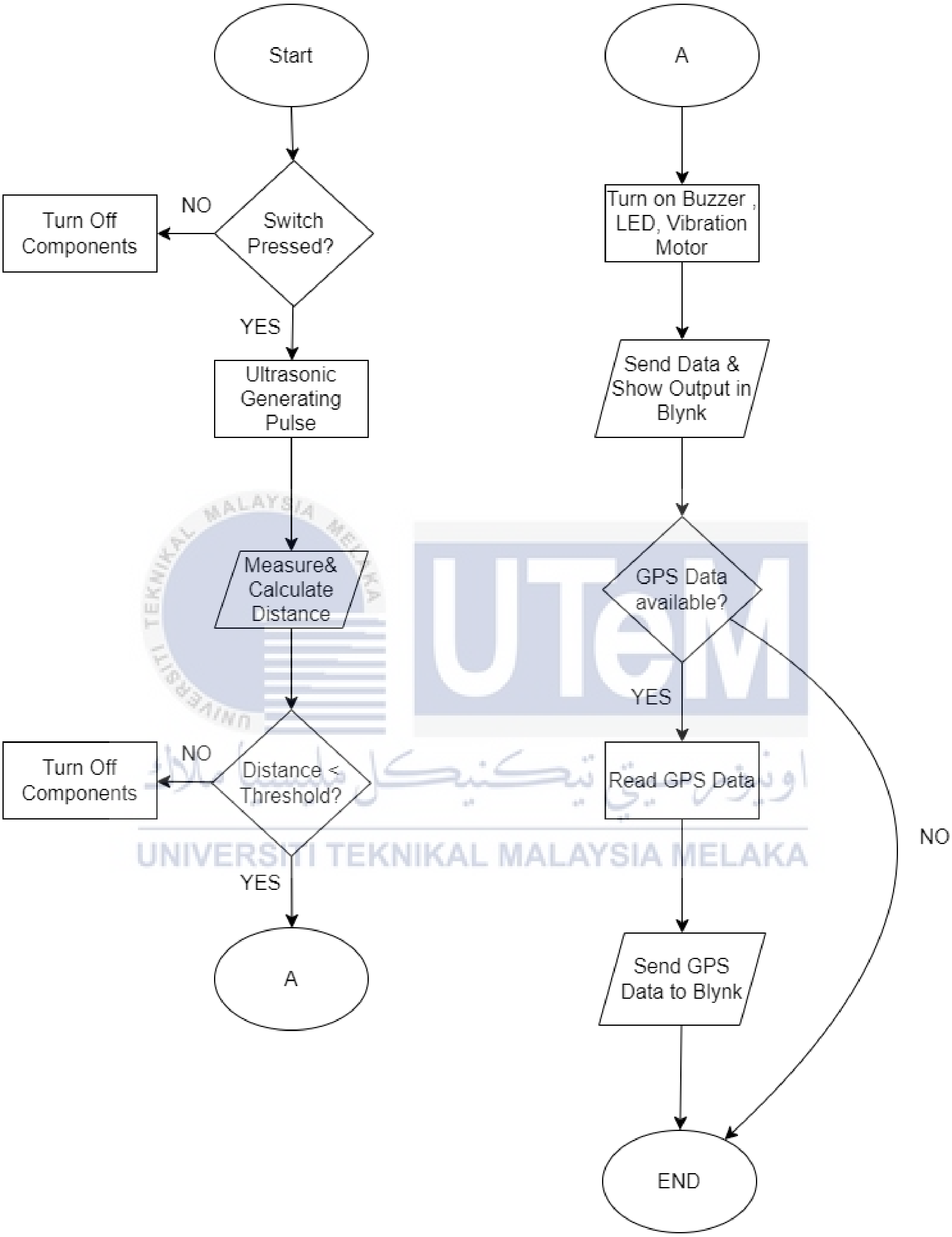

Figure 39: Flowchart of The System

3.7 Software Configuration

3.7.1 Arduino Ide

The Arduino IDE (integrated Development Environment) is a piece of software that facilitates the writing, compilation, and upload of code to an Arduino board. It's a tool that makes it simpler to design and manage Arduino-powered electronic devices.[21]

Here are the steps of the main parts of Arduino IDE:

- **TEXT EDITOR**

  This is where the code being wrote that is provided by IDE. To make coding simpler, it provides functions like syntax highlighting, auto-indentation, and code suggestions.

- **SKETCH**

  A code that being wrote in this software referred as a *"sketch"*. If the user wants to write a new code, then they could open a new *"sketch"*.

- **LBRARY**

  Collection of pre-written code that can help the user to refer. Users also can add third party library.

- **VERIFY/COMPILE**

  After finishing write the code, users can check for bugs by selecting the "Verify" or "Compile" button in the IDE. The users' code will be examined by the IDE, which will notify you of any errors that need to be corrected.

- **UPLOAD**

The "Upload" button can be used to upload the users' code to the Arduino board when it has been successfully verified. This enables the board to carry out the commands based on users typed and manage linked devices like sensors, motors, or lights.

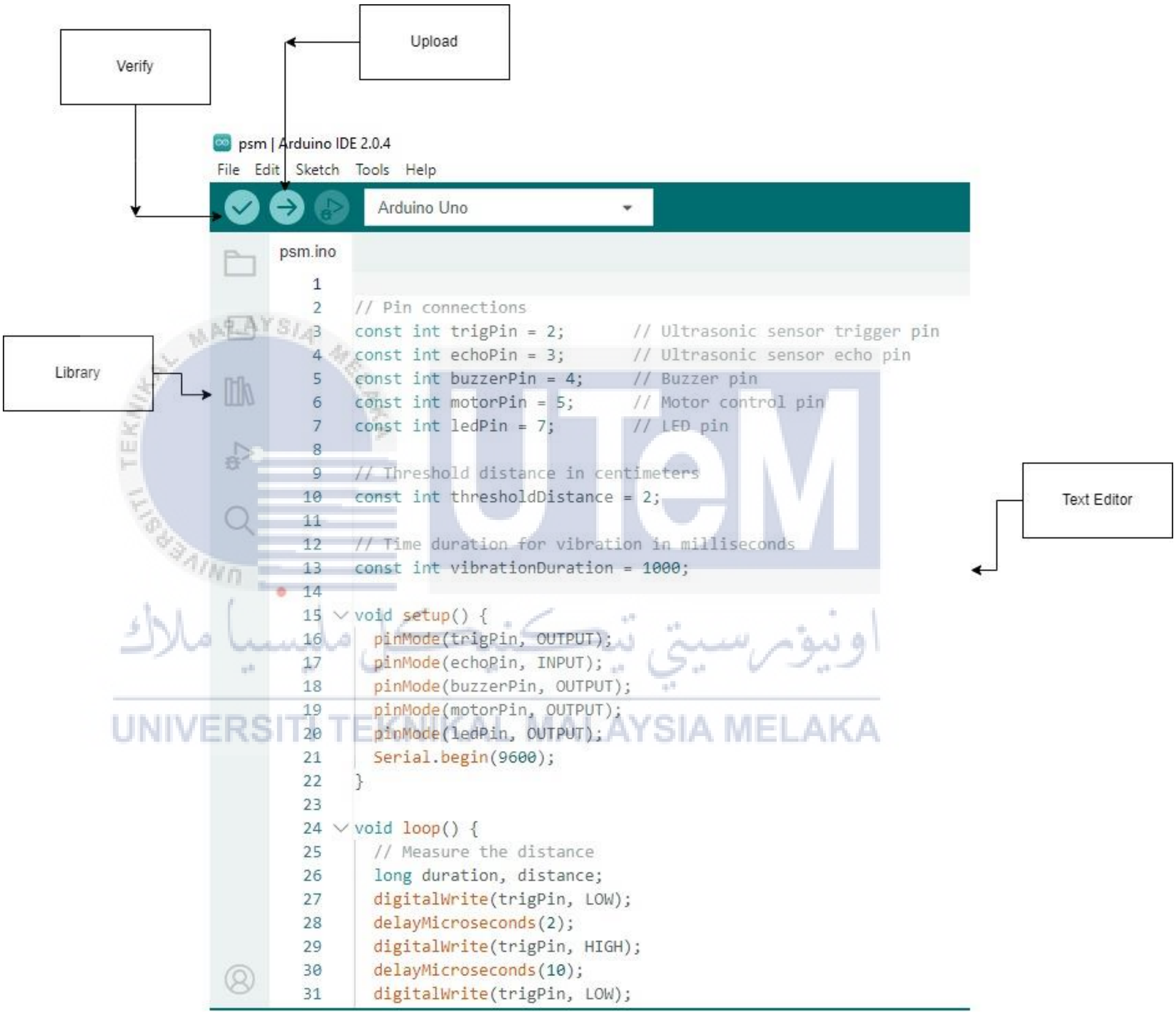

Figure 40: Arduino Ide Software

3.7.2 Cloud Server (Blynk)

Blynk acts as a bridge between hardware and mobile applications, providing an intuitive user interface for building customized smartphone applications that track and oversee Internet of Things projects. Even non-programmers can create Internet of Things (IoT) projects more simply with the aid of the user-friendly platform Blynk. With this platform, anyone may design and manage smart devices. With Blynk, users can effortlessly connect various hardware components, such as sensors or microcontrollers, to the cloud, enabling real-time communication between devices and mobile applications. This platform will be especially useful to those who wish to build remotely managed, interactive Internet of Things solutions without delving too far into complex programming. To sum up, Blynk offers users a user-friendly platform that makes it simple for them to implement their IoT ideas.[22].

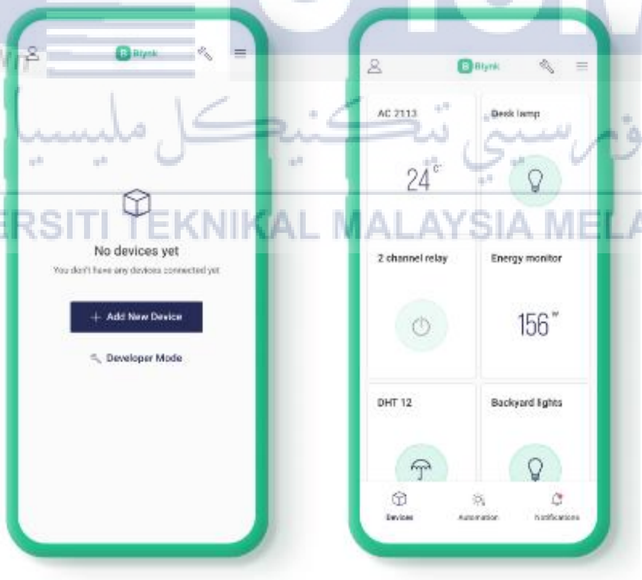

Figure 41 : Blynk's Interface[22]

3.7.3 Proteus 8 Professional

Electrical circuit simulation, testing, and creation are common uses for the software Proteus 8 Professional. Engineers, students, and amateurs can design and model circuits before building them in real life thanks to its user-friendly interface. Thanks to the extensive array of electronic parts and devices in its library, Proteus 8 Professional enables users to design complex circuits and virtually analyses their behavior. With features including schematic capture, PCB (Printed Circuit Board) design, and real-time simulation, it provides a comprehensive environment for the entire electronics development process. This software saves users time and money by identifying and fixing issues in the virtual world before moving on to the actual one. It is useful for both professional and academic electrical design projects[23].

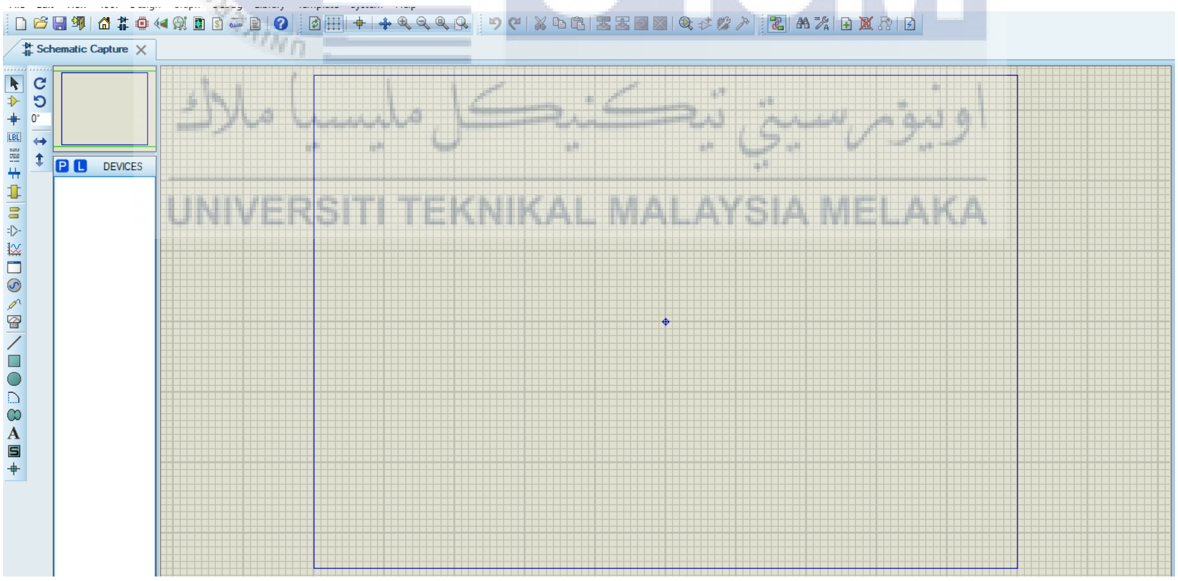

Figure 42 : Proteus's Interface

3.7.4 Autodesk Fusion 360

A dynamic 3D design tool, Autodesk Fusion 360 functions as a digital workshop for building and perfecting object or product models. It makes it simple for users to shape and alter 3D models by integrating a variety of design capabilities into a single platform. Fusion 360 is unique in that it allows teams to collaborate on the same project at the same time. Additionally, the programmed makes digital testing easier by modelling how designs would function in various scenarios. By creating machine instructions for devices like 3D printers and CNC machines, Fusion 360 goes beyond design to support the production process. Fusion 360, which simplifies the entire product development cycle, is a priceless tool for independent designers as well as cooperative teams[24].

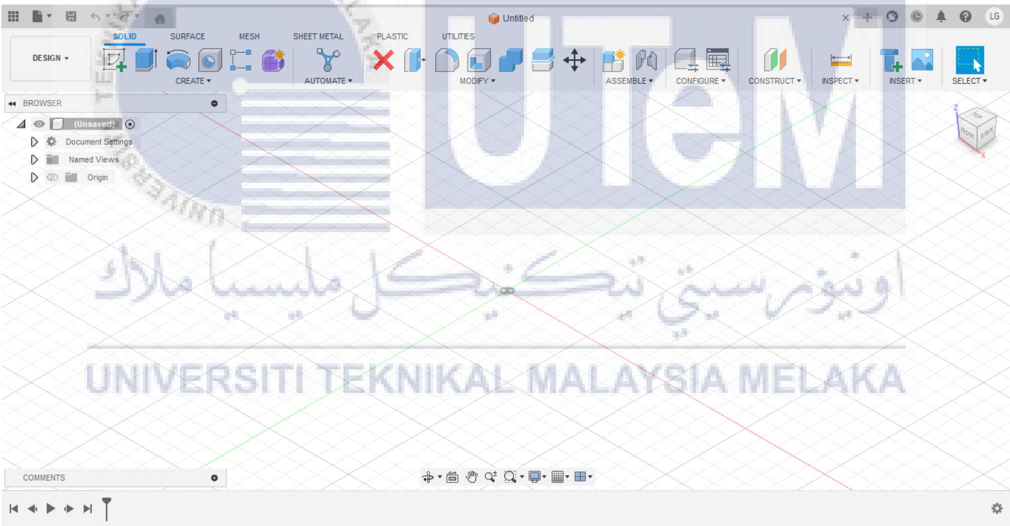

Figure 43 : Autodesk Fusion 360's Interface

3.8 Summary

In summary, the ultrasonic vibration belt using ESP8266 need to be linked all hardware and software for its properly working to meet the requirements. Any errors pertaining to the project will be resolved so that the goals may be met. Chapter 4 will detail the data collecting and analysis procedures.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

In this part, the findings, and outcomes of Development of an Ultrasonic Vibration Belt for monitoring blind people by using ESP8266 will be presented and addressed. This chapter will show the simulation part of the projects as well as the design circuit.

4.2 Hardware Development

In this hardware development all the component except the buzzer connected to the female connector that were soldered to the Stripboard. The ESP8266 acts as the project's core microcontroller as well as acts as the internal hardware development's "brain," allowing it to interface with other components. First ESP8266 was connected to 9V battery but the ESP8266 only supported maximum 3.6V that is why the step-down converter comes in handy so it can convert the input voltage to suitable level. The Trig pin of the ultrasonic sensor was connected to the digital pin 1 of the ESP8266. The Echo Pin or the Pin 3 was connected to the digital pin 2 of the ESP8266 and the VCC and GND (ground) of the ultrasonic sensor was connected to the 3V and GND pin of the ESP8266.

The positive terminal of buzzer was connected to the digital pin 7 and the negative terminal was connected to ground. The vibration motor was connected to the ESP8266's digital pin 7, while the other terminal was connected to the ESP8266's GND (Ground) pin. The switch was also integrated into the circuit by connecting one of its terminals to the ESP8266's digital pin 6 and the remaining terminal to the ESP8266's GND (Ground) pin. The LED connection, the negative terminal of the LED was linked to the ESP8266's GND (Ground) pin while the connection to digital pin 5. Lastly, the GPS Module’s VCC and ground connected to 3V pin and GRD pin of the ESP 8266 while the RX and TX connected to TX and RX simultaneously. These connections were built to create the electrical pathways needed for the components to communicate with the ESP8266 while the project was running. The hardware connection can see as the diagram below:

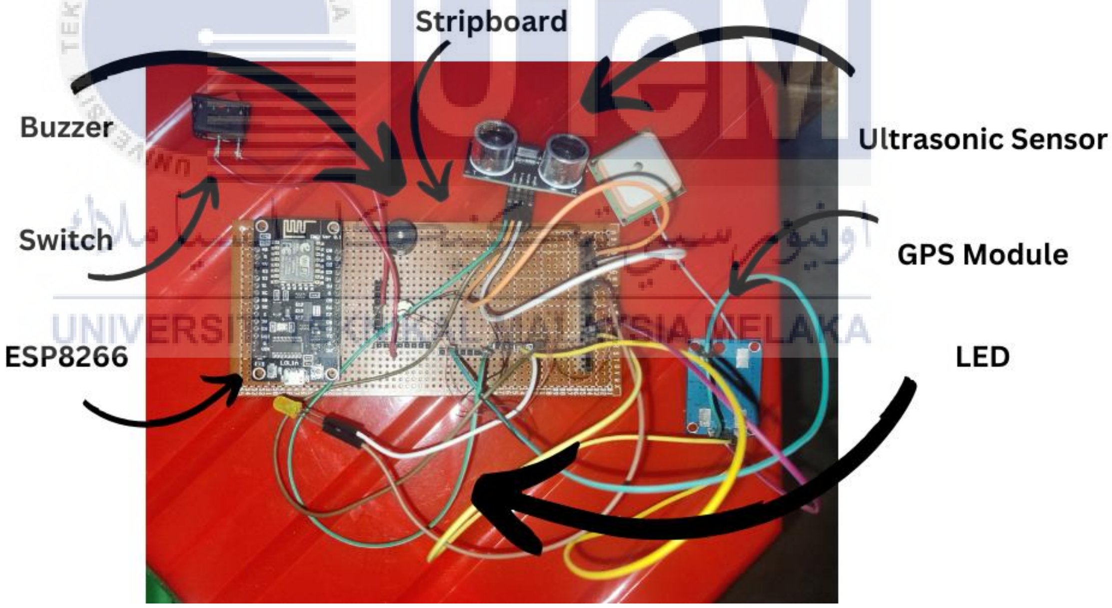

Figure 44 : Hardware Connections

4.3 Simulation Development

For the simulation part, Proteus 8 Professional software was used as it is very straightforward and very easy to add more components to the library. In this software components such as ESP8266, Ultrasonic Sensor and GPS module were added separately because it does not come beforehand. The connection is the same as hardware and the schematic design can see as below:

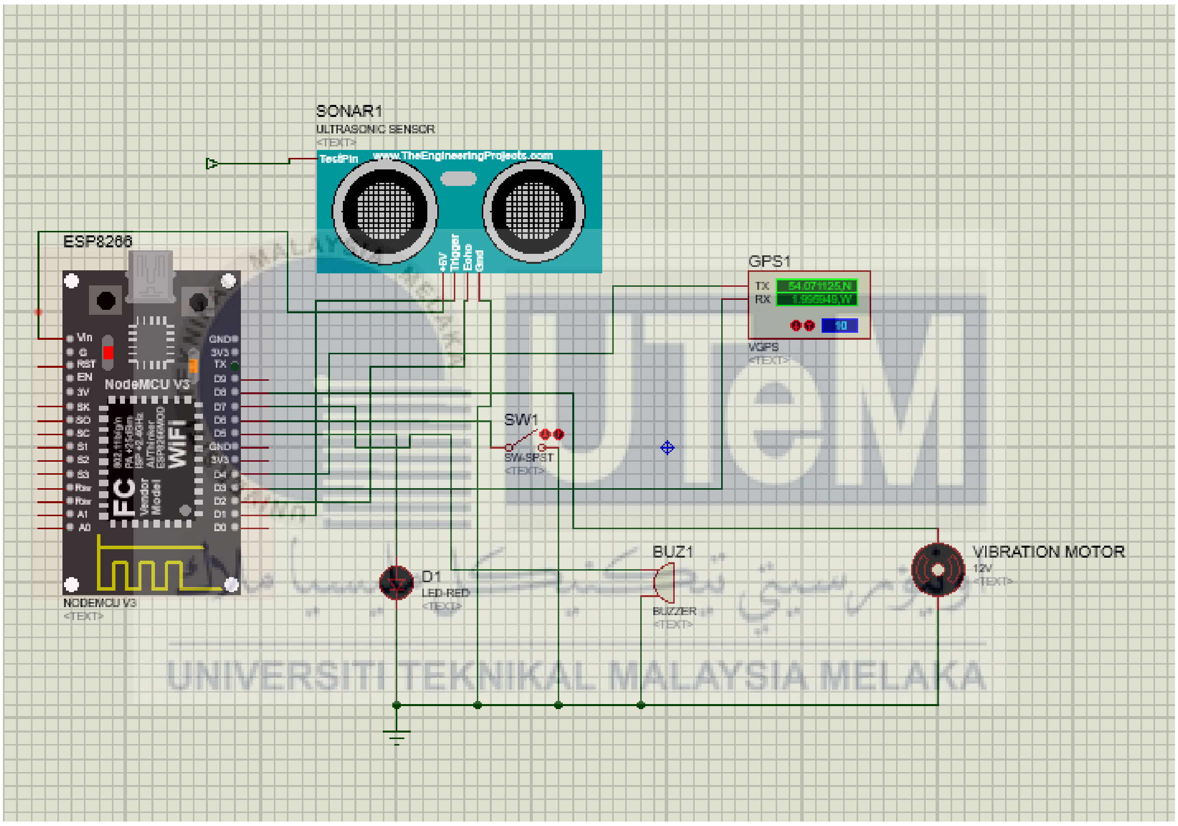

Figure 45 : Simulation Design in Proteus 8

4.4 Blynk Application Development

Blynk application was used in this development as the core software for the IoT based system for monitoring as it can show real-time interaction with this project is made possible by using Blynk widgets, such as a Value Display for the ultrasonic sensor distance, a Button for the switch, a GPS Display for longitude and latitude, and LED, Buzzer, and Motor widgets to signal triggering events. This provides a smooth and convenient solution for project supervision and control by enabling the user to keep an eye on distance measurements, switch states, GPS coordinates, and the activation status of LED, buzzer, and motor from the comfort of the Blynk app on smartphone.

Figure 46 : Blynk Desktop Interface

4.5 Prototype Development

4.5.1 Designing Casing Using Autodesk Fusion 360

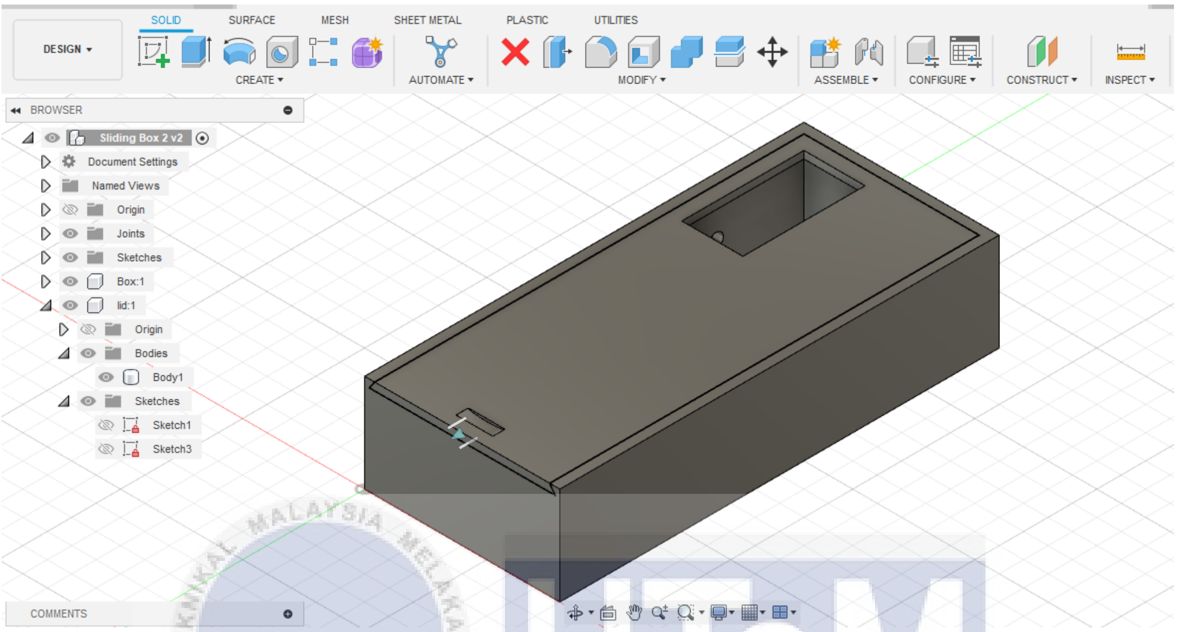

Figure 47: Overall Design

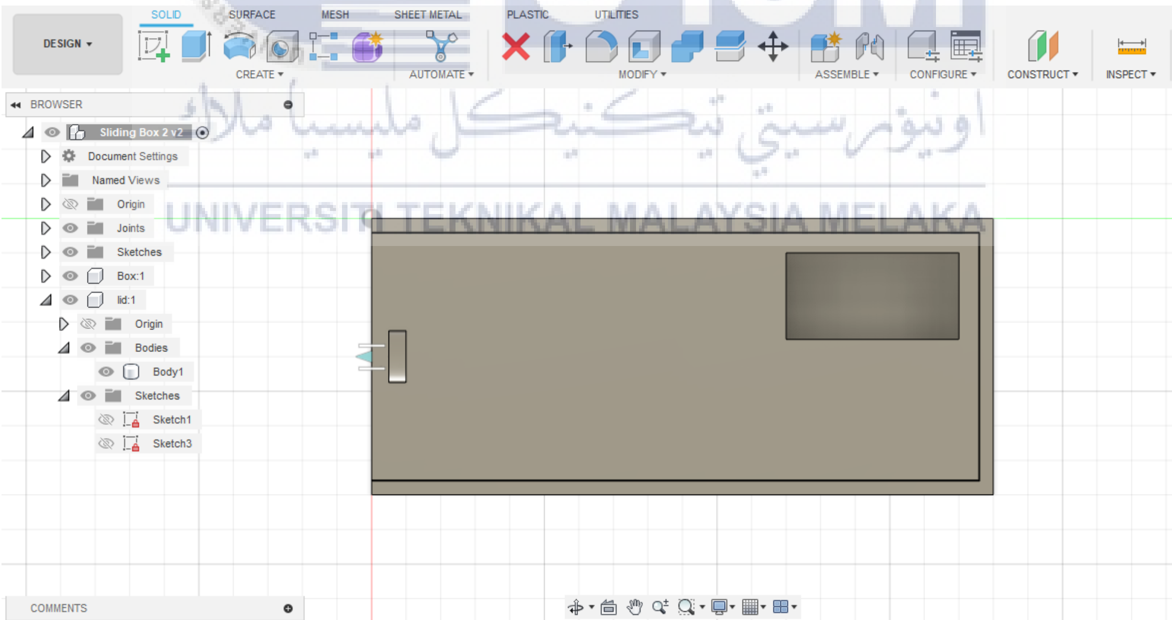

Figure 48: Top View

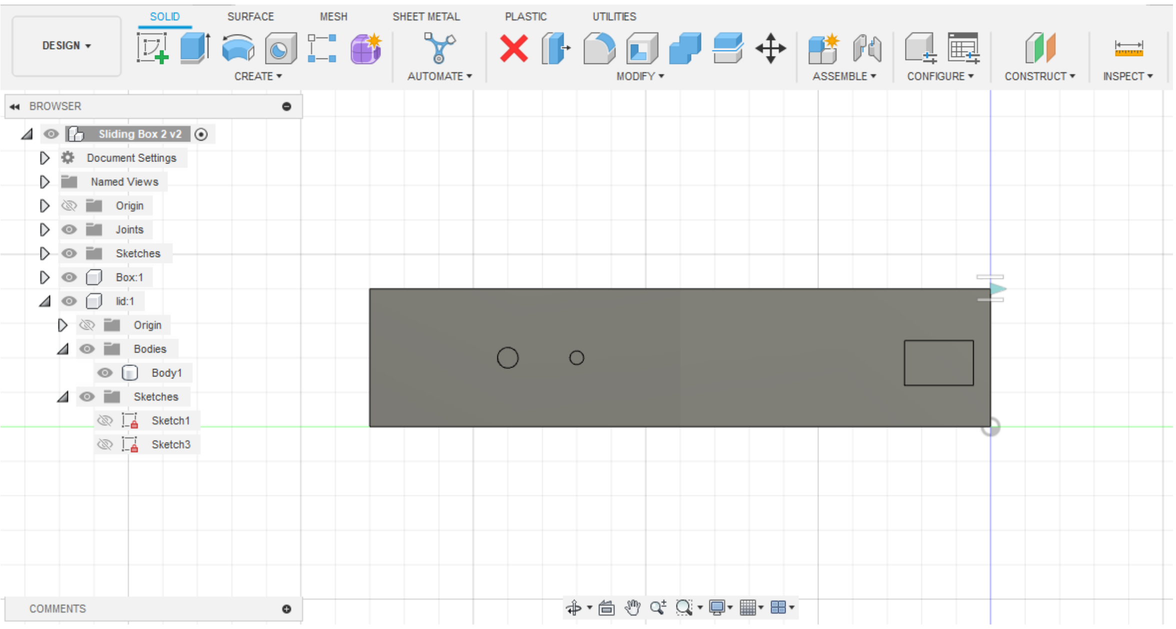

Figure 49: Left View

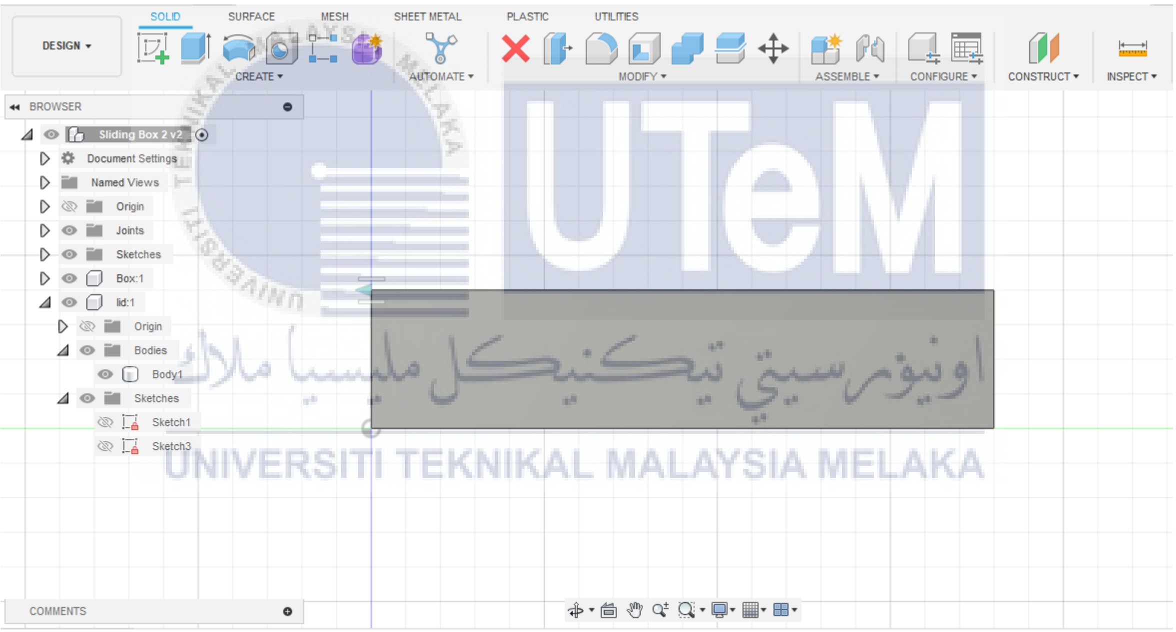

Figure 50: Right View

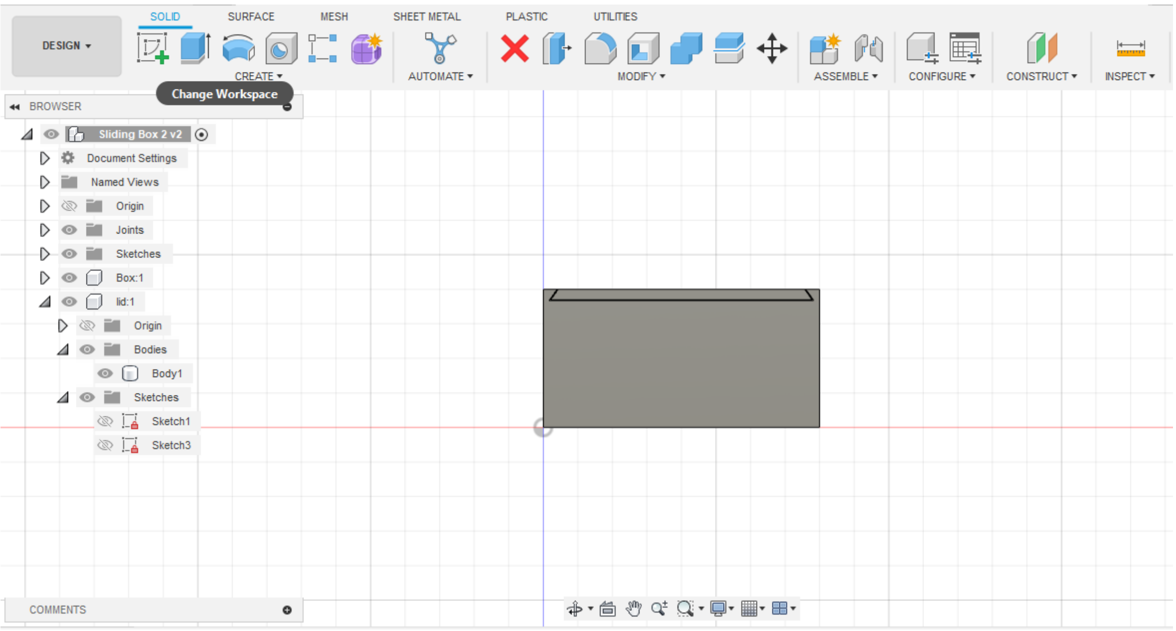

Figure 51: Front View

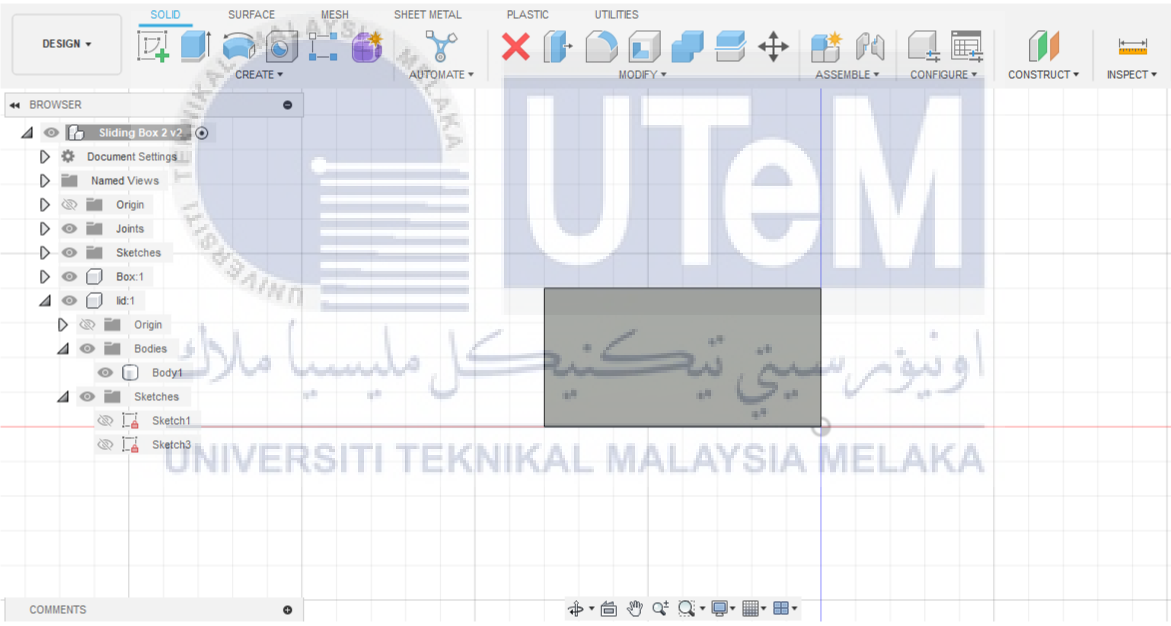

Figure 52: Back View

4.5.2 Designing Ultrasonic Casing Using Autodesk Fusion 360

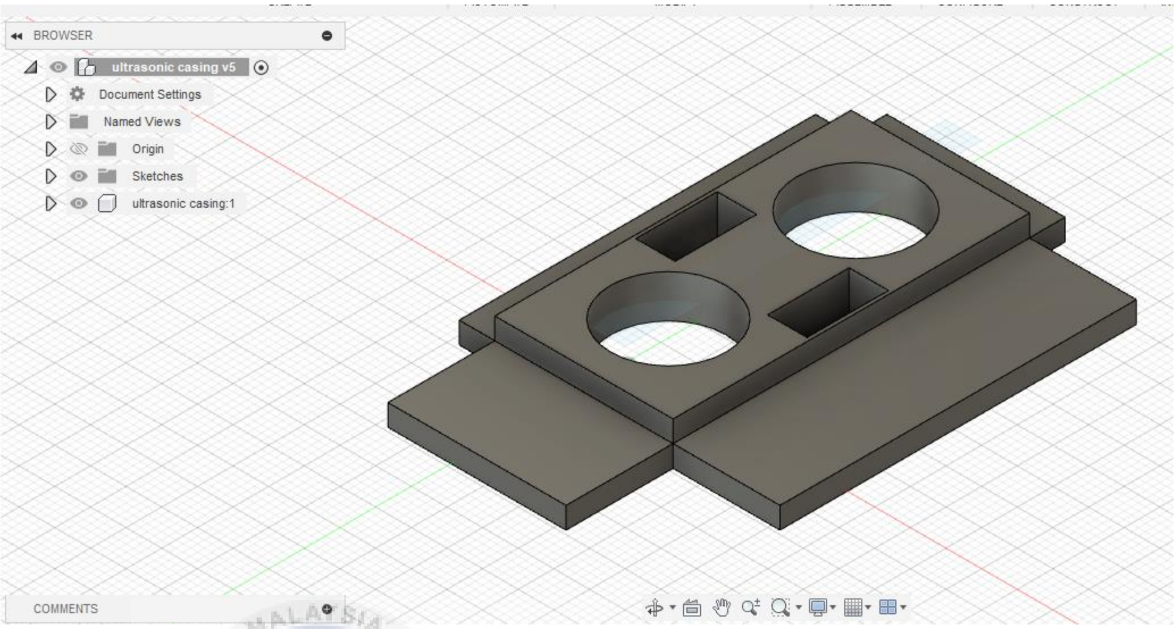

Figure 53 : Overall Design

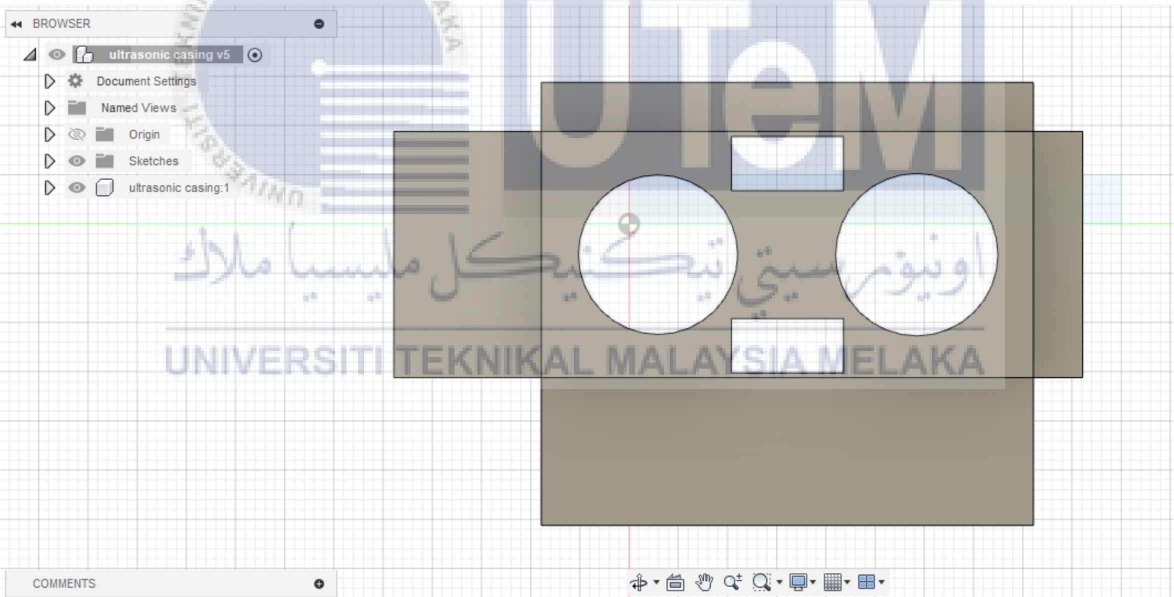

Figure 54 : Top View

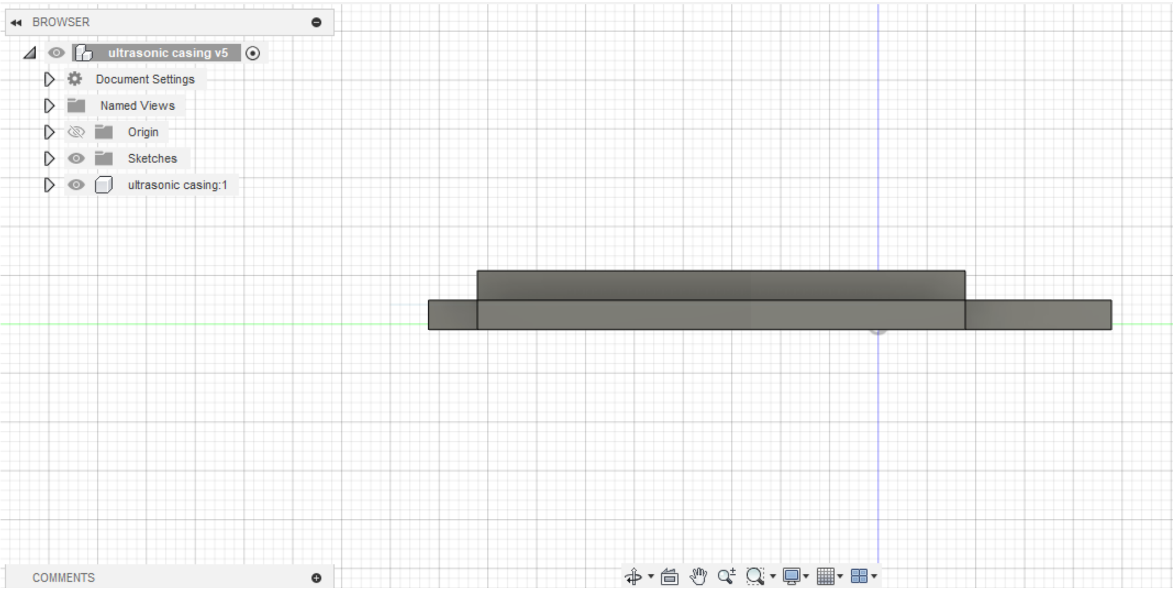

Figure 55 : Left View

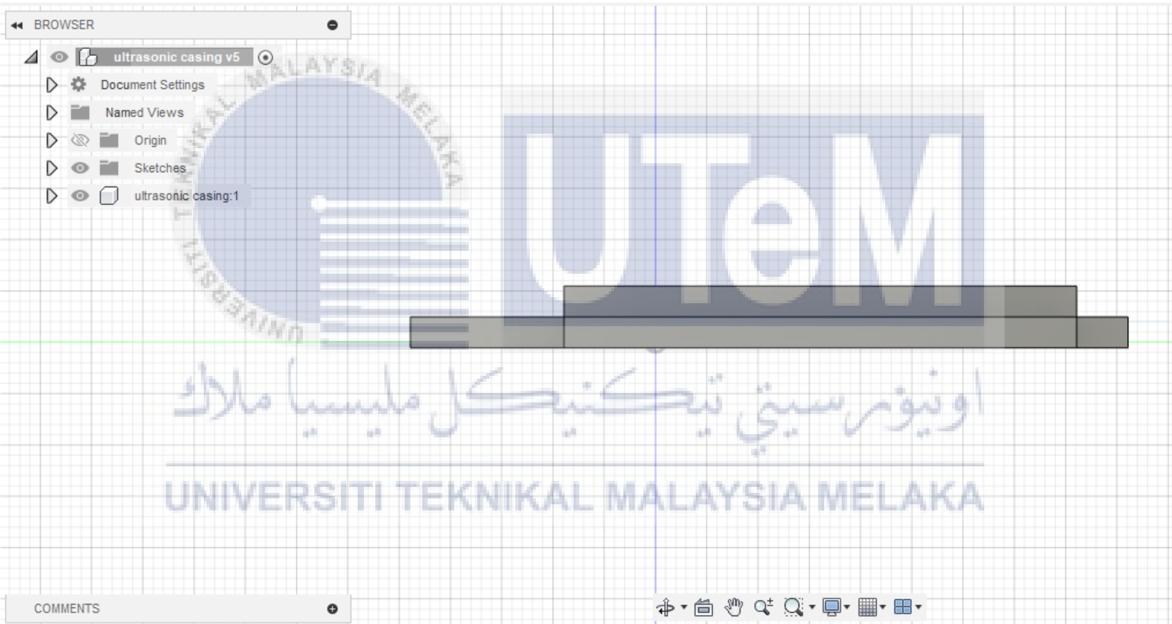

Figure 56 : Right View

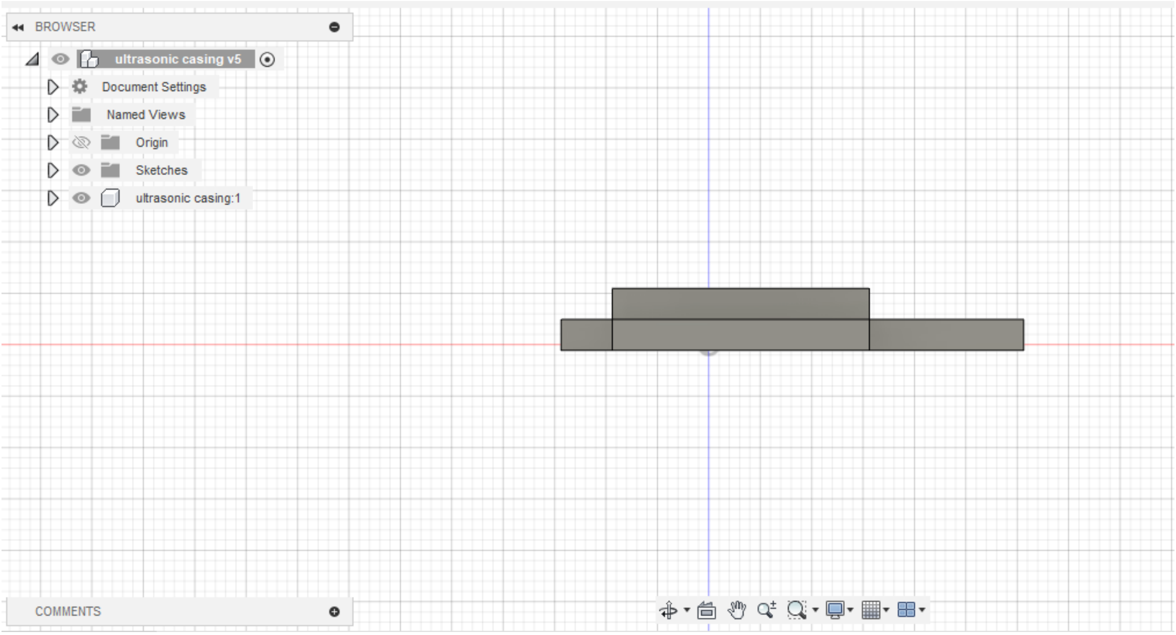

Figure 57 : Front View

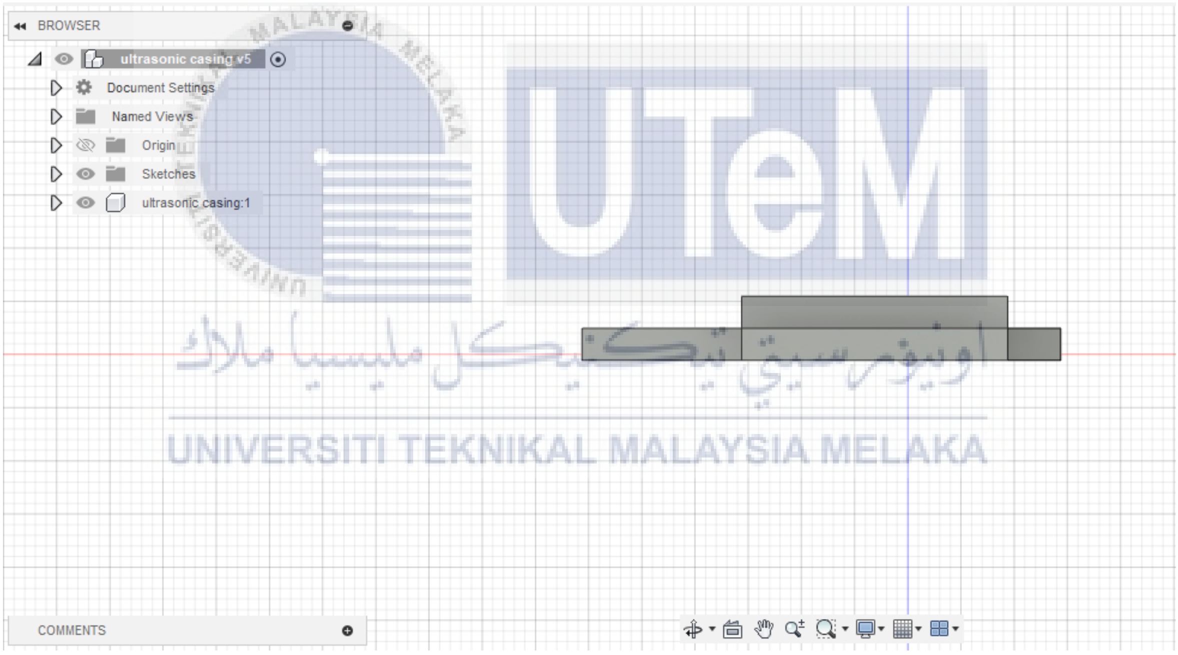

Figure 58 : Back View

4.5.3 3D Printing the Design

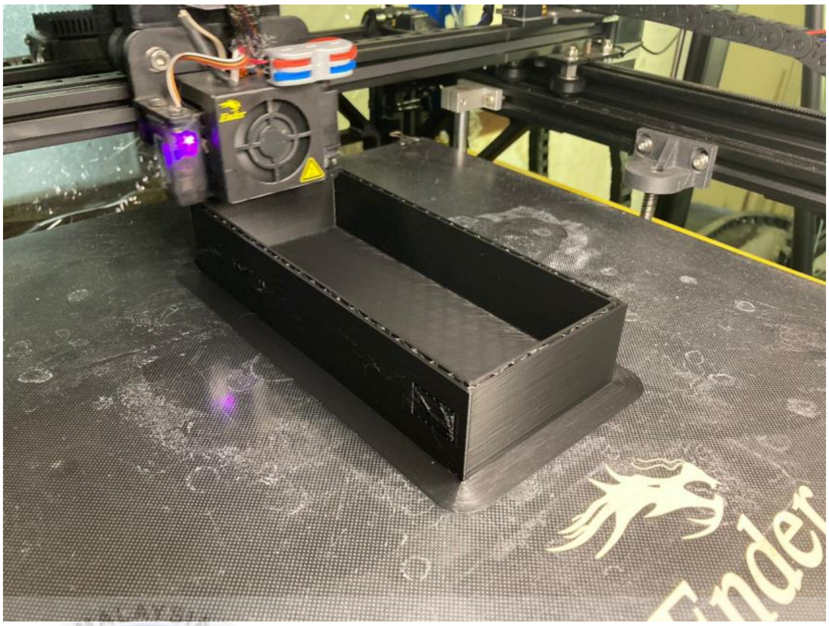

Figure 59 : 3D Printing Process of the Casing

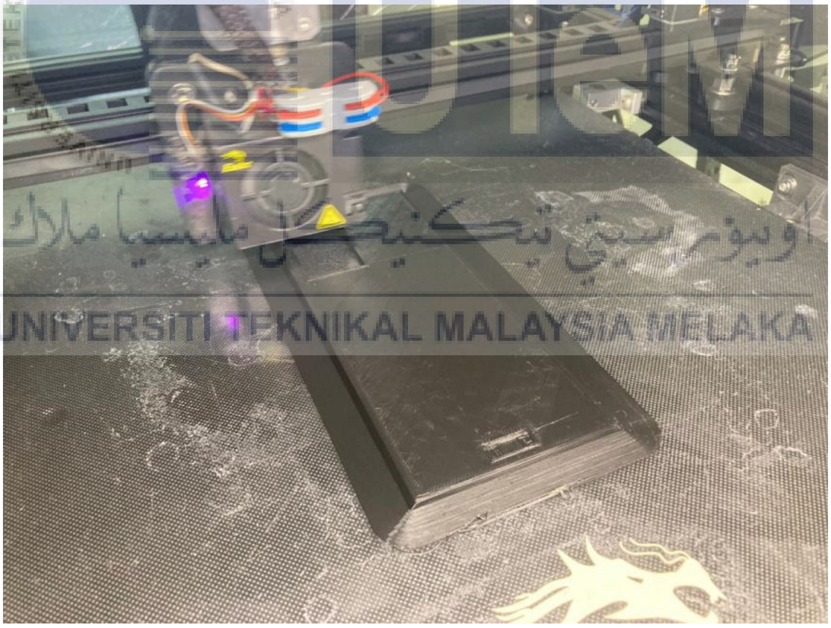

Figure 60 : 3D Printing Process of the Lid

4.5.4 Final Product of the 3D Printing Process

Figure 61 : 3D Printed Casing

Figure 62 : 3D Printed Ultrasonic Casing

Figure 63 : Final Product

4.5.5 Stripboard Prototype

Most of the connection connected to the female connector that were soldered to the stripboard. Stripboard function to provide connection through its connection line so all the components must connect to their assigned line to get connection.

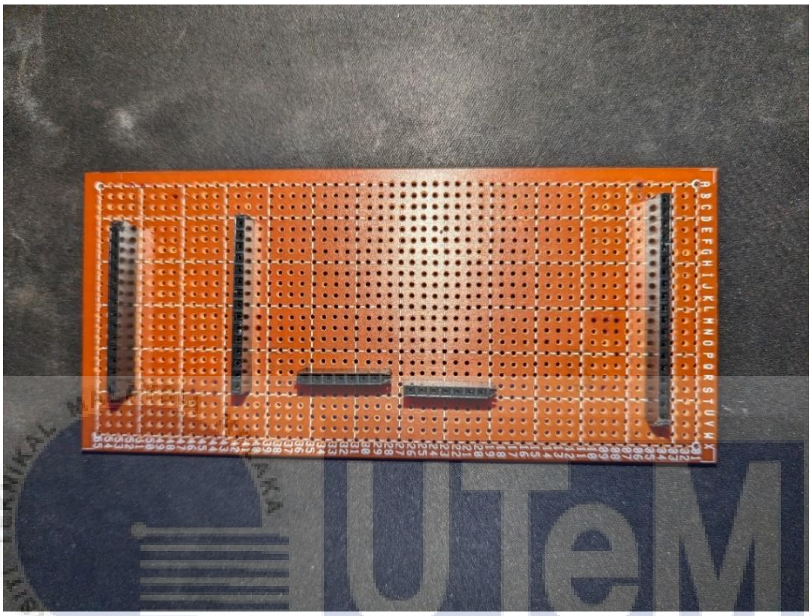

Figure 64 : Female connectors Soldered to the Stripboard

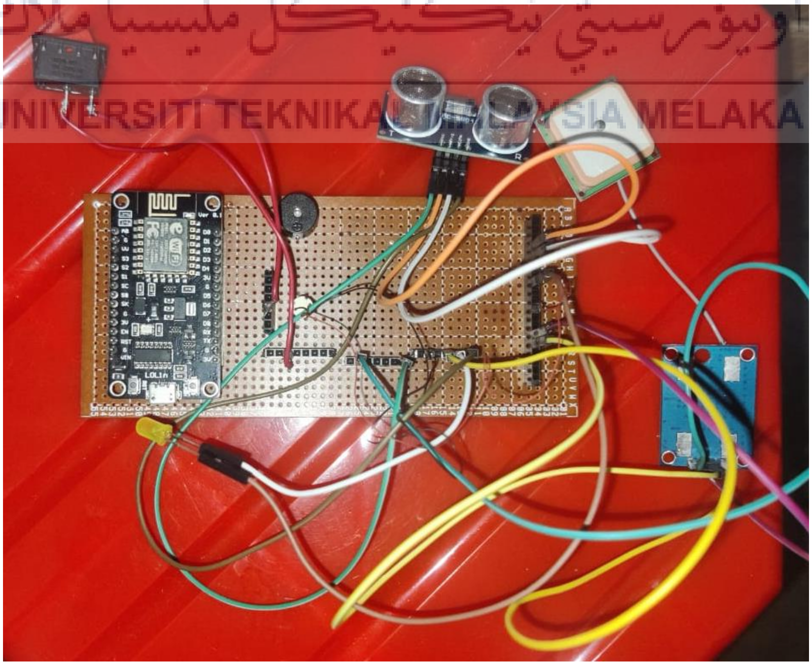

Figure 65 : Components attached to the Stripboard

4.6 Prototype Assembled

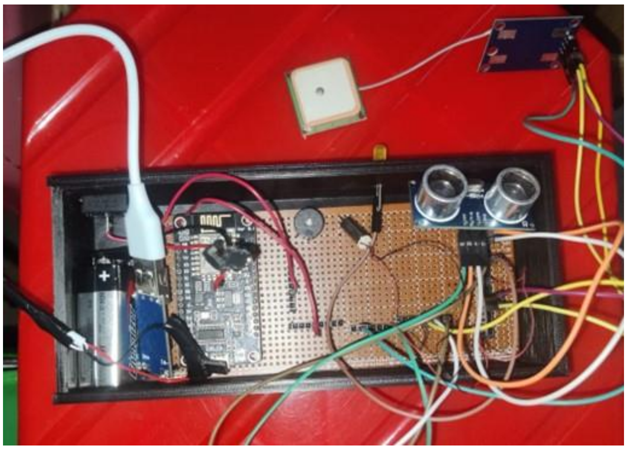

Figure 66 : View inside the Casing

Figure 67 : Side View from the Casing

Figure 68 : Protoype Properly Assembled

4.7 Data Analysis

4.7.1 Ultrasonic Sensor State

Distance	Output
>100	No obstacle
100	Far
50	Medium
25	Close
Dead Zone	Unreliable distance reading

Table 2 : Ultrasonic Sensor State

4.7.2 Buzzer Output and Intensity

Distance	Buzzer Output	Intensity
>100	Off	0
100	Low	50
50	Medium	128
25	High	192
Dead Zone	Off	0

Table 3 : Buzzer Output and Intensity

4.7.3 Vibration Motor Output and Intensity

Distance	Vibration Motor Output	Intensity
>100	Off	0
100	Low	128
50	Medium	192
25	High	255
Dead Zone	Off	0

Table 4 : Vibration Motor Output and Intensity

4.7.4 LED Output and Intensity

Distance	LED Output	Intensity
>100	Off	0
100	Low	50
50	Medium	128
25	High	192
Dead Zone	Off	0

Table 5 : LED Output and Intensity

4.7.5 Buzzer and Vibration Motor Intensity Based on the Distance

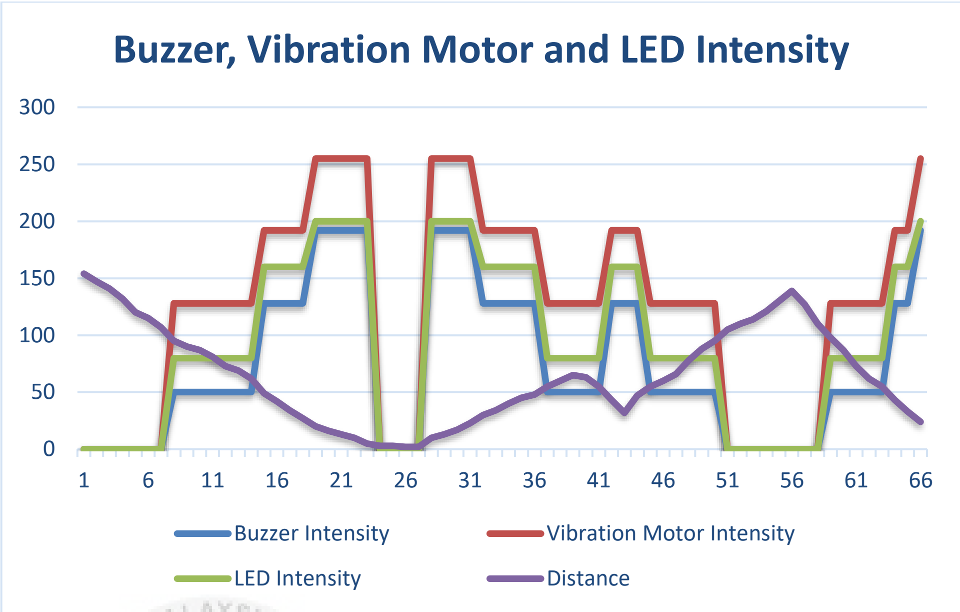

Figure 69 : Intensity react to Distance Pattern

The data of graph above can be reffer to Appendix 2. The graph shows when the distance of obstacles decrease, the intensity of Buzzer, Vibration Motor and LED increase.

4.7.6 Output when no Obstacle Detected in Blynk Mobile Interface

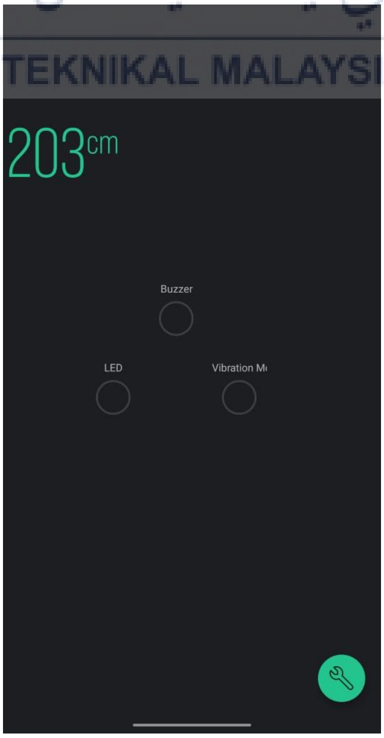

Figure 70 : No obstacle detected

4.7.7 Output when there are Obstacles Detected in Blynk Mobile Interface

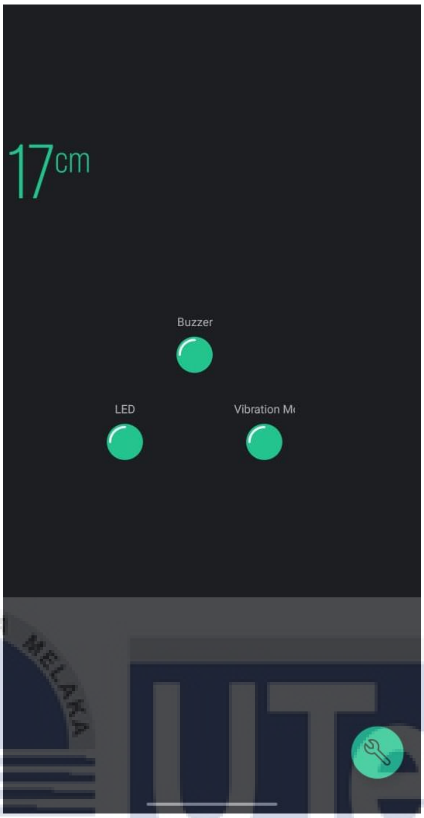

Figure 71 : Obstacles Detected

4.7.8 Result for GPS Module when the Sensor is on using Blynk

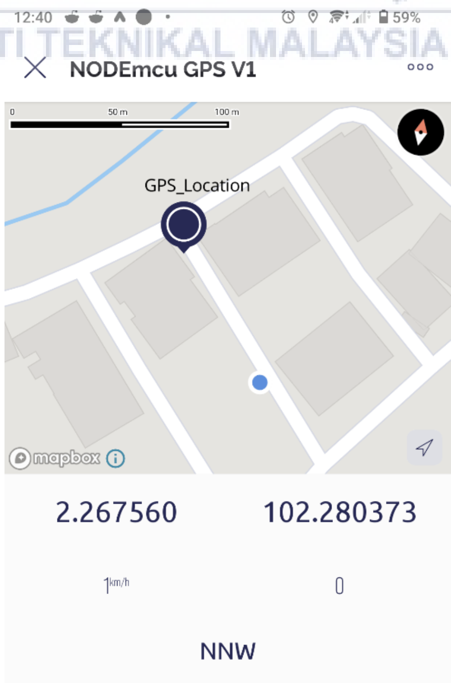

Figure 72 : GPS Module Output

CHAPTER 5

CONCLUSION AND FUTURE WORKS

5.1 Introduction

This chapter describes the Development of an Ultrasonic Vibration Belt for monitoring blind people by using ESP8266 and the accomplishments depending on objectives. This chapter also discusses the difficulties encountered in completing this project. Proposals for the project's future work will also be presented and discussed in this chapter. Based on the project's advantages and shortcomings, recommendations for improving its efficacy will be made.

5.2 Conclusion

In conclusion, the development of an ultrasonic vibration belt using ESP8266 has the potential to considerably benefit visually impaired people. The belt can detect obstructions and offer haptic feedback through vibrations by utilizing ultrasonic sensors and vibration motors. The ESP8266 serves as the control hub, analyzing sensor data and actuating motors as needed. This belt allows users to navigate their surroundings more autonomously, which increases their safety and confidence. This technology, with additional advances and features such as wireless connectivity, has the potential to improve the lives of visually impaired people and promote greater independence.

5.3 Future Works

This project was developed and tested on a single-phase analyzer. This project can still be modernized and be improved in various aspects so it can be more suitable for commercialized. This project can be improved by using a smaller case, more advanced distance sensor, more powerful vibration motor, printed circuit board so it can be designed more efficiently and compact so it will be easier to attach to the belt. It also will work better if it has a camera so it will be more secure to monitor the physically impaired people. All the components can design to be more compact so it can be designed to come already attach to the belt.

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APPENDICES

Appendix 1

******************CODE FOR DETECTING THE OBSTACLES*****************

```
#define BLYNK_TEMPLATE_ID "TMPL6zFfvgMsW"
#define BLYNK_TEMPLATE_NAME "PSM ESP8266"
#define V0 BLYNK_V0
#define V1 BLYNK_V1
#define V2 BLYNK_V2
#define V3 BLYNK_V3
#define V4 BLYNK_V4
#define V5 BLYNK_V5

#include <BlynkSimpleEsp8266.h>

char auth[] = "PaYdzABMZ-vwziHna9y6d8Sl9goV7BeJ";
char ssid[] = "LUQMAN";
char pass[] = "";

#define TRIG_PIN 5    // NodeMCU pin D1 connected to Ultrasonic Sensor's TRIG pin
#define ECHO_PIN 4    // NodeMCU pin D2 connected to Ultrasonic Sensor's ECHO pin
#define BUZZER_PIN 13 // NodeMCU pin D7 connected to Piezo Buzzer's pin
#define LED_PIN 14    // NodeMCU pin D5 connected to LED
#define VIBRATION_MOTOR_PIN 15 // NodeMCU pin D8 connected to Vibration
Motor's pin
#define SWITCH_PIN 12 // NodeMCU pin D6 connected to Switch's pin
#define DISTANCE_THRESHOLD 60 // centimeters

// variables will change:
float duration_us, distance_cm;

File dataFile;

void setup() {
  Serial.begin(9600);         // initialize serial port
  pinMode(TRIG_PIN, OUTPUT);   // set ESP8266 pin to output mode
  pinMode(ECHO_PIN, INPUT);    // set ESP8266 pin to input mode
  pinMode(BUZZER_PIN, OUTPUT); // set ESP8266 pin to output mode
  pinMode(VIBRATION_MOTOR_PIN, OUTPUT); // set ESP8266 pin to output mode
  pinMode(SWITCH_PIN, INPUT_PULLUP); // set ESP8266 pin to input mode with
internal pull-up resistor
  pinMode(LED_PIN, OUTPUT);     // set ESP8266 pin to output mode for LED

  Blynk.begin(auth, ssid, pass);
```

```
  // Open the data file in write mode
  dataFile = SPIFFS.open("/data.csv", "w");

  // Write header to the CSV file
  dataFile.println("Distance,LED Intensity,Buzzer Speed,Vibration Motor Speed");
}

void loop() {
  Blynk.run();

  int switchState = digitalRead(SWITCH_PIN);

  if (switchState == LOW) {
    digitalWrite(TRIG_PIN, HIGH);
    delayMicroseconds(10);
    digitalWrite(TRIG_PIN, LOW);

    duration_us = pulseIn(ECHO_PIN, HIGH);
    distance_cm = 0.017 * duration_us;

    int buzzerSpeed, motorSpeed, ledIntensity;

if (distance_cm <= 100 && distance_cm > 50) {
  buzzerSpeed = 50;
  motorSpeed = 128;
  ledSpeed = 80; // Set a different value for LED speed
} else if (distance_cm <= 50 && distance_cm > 25) {
  buzzerSpeed = 128;
  motorSpeed = 192;
  ledSpeed = 160; // Set a different value for LED speed
} else if (distance_cm <= 25) {
  buzzerSpeed = 192;
  motorSpeed = 255;
  ledSpeed = 200; // Set a different value for LED speed
} else {
  buzzerSpeed = 0;
  motorSpeed = 0;
  ledSpeed = 0;
}

// Set LED intensity based on the LED speed
ledIntensity = map(ledSpeed, 0, 255, 0, 255);

    analogWrite(BUZZER_PIN, buzzerSpeed);
    analogWrite(VIBRATION_MOTOR_PIN, motorSpeed);
    analogWrite(LED_PIN, ledIntensity);
```

```
 Blynk.virtualWrite(V0, distance_cm);
Blynk.virtualWrite(V1, ledIntensity);
Blynk.virtualWrite(V2, buzzerSpeed);
Blynk.virtualWrite(V3, motorSpeed);
Blynk.virtualWrite(V4, buzzerSpeed);
Blynk.virtualWrite(V5, ledIntensity);

Serial.print("Distance: ");
Serial.print(distance_cm);
Serial.print(" cm - LED Intensity: ");
Serial.print(ledIntensity);
Serial.print(" - Buzzer Speed: ");
Serial.print(buzzerSpeed);
Serial.print(" - Vibration Motor Speed: ");
Serial.println(motorSpeed);

// Log data to CSV file
dataFile.print(distance_cm);
dataFile.print(",");
dataFile.print(ledIntensity);
dataFile.print(",");
dataFile.print(buzzerSpeed);
dataFile.print(",");
dataFile.println(motorSpeed);
} else {
Serial.println("Switch is not pressed. Turning off the buzzer, vibrating the motor, and
turning off the LED.");

digitalWrite(BUZZER_PIN, LOW);
digitalWrite(VIBRATION_MOTOR_PIN, LOW);
analogWrite(LED_PIN, 0);

Blynk.virtualWrite(V1, 0);
Blynk.virtualWrite(V2, 0);
Blynk.virtualWrite(V3, 0);
Blynk.virtualWrite(V4, 0);
Blynk.virtualWrite(V5, 0);
}

delay(500);
}
```

******************************END OF CODE****************************

Appendix 2

Datasheet for Figure 69

Distance	Buzzer Intensity	Vibration Motor Intensity	LED Intensity
154	0	0	0
147	0	0	0
141	0	0	0
132	0	0	0
120	0	0	0
115	0	0	0
107	0	0	0
95	50	128	80
90	50	128	80
87	50	128	80
81	50	128	80
73	50	128	80
69	50	128	80
62	50	128	80
49	128	192	160
42	128	192	160
34	128	192	160
27	128	192	160
20	192	255	200
16	192	255	200
13	192	255	200
10	192	255	200
5	192	255	200
3	0	0	0

3	0	0	0
2	0	0	0
2	0	0	0
10	192	255	200
13	192	255	200
17	192	255	200
23	192	255	200
30	128	192	160
34	128	192	160
40	128	192	160
45	128	192	160
48	128	192	160
55	50	128	80
60	50	128	80
65	50	128	80
63	50	128	80
55	50	128	80
43	128	192	160
32	128	192	160
47	128	192	160
55	50	128	80
60	50	128	80
66	50	128	80
78	50	128	80
88	50	128	80
95	50	128	80
105	0	0	0
110	0	0	0

114	0	0	0
121	0	0	0
130	0	0	0
139	0	0	0
127	0	0	0
110	0	0	0
98	50	128	80
87	50	128	80
73	50	128	80
62	50	128	80
55	50	128	80
43	128	192	160
33	128	192	160
24	192	255	200