FINAL REPORT

DIPLOMA KEJURUTERAAN ELEKTRONIK (KOMUNIKASI)

SESI I 2023/2024

STEP ASSIST PRO

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CONFIRMATION OF THE PROJECT

The project report titled " Step Assist Pro " has been submitted, reviewed, and verified as a fulfills the conditions and requirements of the Project Writing as stipulated.

Checked by:

Supervisor’s name : PUAN ROFIZAH BINTI ABDUL MUTALIB

Supervisor’s signature :

Date : 11 NOVEMBER 2024

Verified by:

Project Coordinator name :

Signature of Coordinator :

Date

ENDORSEMENT

“I hereby acknowledge that I have read and I find that its content meet the Requirements in terms of scope and quality for the Diploma in Electronic of Communication.”

Signature:

Name : MUHAMMAD ILHAN MANSIZ BIN NOOR AZLAN

Registration Number: 08DEP22F1089

Date: 11 NOVEMBER 2024

DECLARATION OF ORIGINALITY AND OWNERSHIP

TITLE: STEP ASSIST PRO

SESSION: SESI 1 2024/2025

1. I, MUHAMMAD ILHAN MANSIZ BIN NOOR AZLAN (08DEP22F1089)

   is final year students of Diploma in Electrical Engineering, Department of Electrical, Politeknik Sultan Salahuddin Abdul Aziz Shah, which is located at Persiaran Usahawan, 40150 Shah Alam, Selangor.
   (hereinafter referred to as the 'Polytechnic')

2. We hereby declare that ‘Sorting Recycle Colour Paper Using Sensor’ and the intellectual property contained are our own original work in which no part has been taken or copied from other parties.

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(Identification card No: - (040410-14-0919)

(.....)
MUHAMMAD ILHAN MANSIZ
BIN NOOR AZLAN

In front of me, PUAN ROFIZAH BINTI ABDUL MUTALIB

(.....)
PUAN ROFIZAH BINTI ABDUL MUTALIB

ACKNOWLEDGEMENTS

All the praise and thanks to Allah SWT. I am very thankful to my supervisor PUAN ROFIZAH BINTI ABDUL MUTALIB whose encouragement, guidance, and support from the initial to the final level enables me to continue to develop an understanding of the subject.

I am really grateful because I managed to complete this project within the time given by PUAN ROFIZAH. This project cannot be completed without the effort and help of other members. Next, i would like to express our gratitude to our friends and respondents for their support and willingness to spend more time with me.

I also want to thank my parents who gave me permission and capital expenditure to buy components for my project until it has been successfully done. They have given me all the ease and infinite moral support until I succeeded in my project. They help to answer any questions that we point out to them. Last but not least, we would like to thank those who are directly involved in our final project. Thank you.

ABSTRACT

This innovative sensor shoe is designed to assist the blind in moving more safely and independently. Previous studies have shown that mobility aids like canes have limitations in distance detection and require physical interaction. Based on this, the shoe is equipped with ultrasonic sensors that detect obstacles and provide feedback through vibrations on the sole. The methodology used involves the development of an electronic prototype, sensor programming, and testing in various environments. The results show that the shoe works effectively in helping users avoid obstacles quickly. In conclusion, this sensor shoe has the potential to improve the quality of life for the blind by offering a more advanced and practical mobility aid.

ABSTRACT

Kasut sensor inovatif ini direka untuk membantu golongan buta bergerak dengan lebih selamat dan berdikari. Kajian terdahulu menunjukkan bahawa alat bantu pergerakan seperti tongkat mempunyai batasan dalam pengesanan jarak dan memerlukan interaksi f izikal. Berdasarkan fakta ini, kasut ini dilengkapi dengan sensor ultrasonik yang mengesan halangan dan memberi maklum balas melalui getaran pada tapak kasut. Metodologi yang digunakan melibatkan pembangunan prototaip elektronik, pemprograman sensor, dan ujian dalam pelbagai persekitaran. Hasil kajian menunjukkan bahawa kasut ini berfungsi dengan baik dalam membantu pengguna mengelak halangan dengan cepat. Kesimpulannya, kasut sensor ini berpotensi meningkatkan kualiti hidup golongan buta dengan menyediakan alat bantu mobiliti yang lebih canggih dan praktikal.

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CHAPTER 1

INTRODUCTION

1.1. Introduction.

In today's cutting-edge manufacturing environment, innovation is essential to remain competitive. It's critical to improve operational efficiency, reduce labor costs, and minimize downtime of production equipment. Manual sorting of products in various stages of manufacturing is labor-intensive and time-consuming, making automation a key driver for improvement.

This paper discusses an innovative solution aimed at aiding visually impaired individuals—a sensor-equipped shoe designed to detect obstacles. This project employs ultrasonic sensors to detect objects in the user's path, providing real-time alerts to enhance navigation and prevent collisions. By measuring the distance between the user and nearby obstacles, the system issues timely audio or vibration alerts, allowing the user to adjust their path accordingly.

The primary goal of this project is to provide an effective mobility aid for the visually impaired, especially in environments that may be unsafe or challenging to navigate independently. The sensor-based shoe uses a microcontroller to process data from ultrasonic sensors, with vibrating motors or speakers to deliver feedback to the user. This enables a seamless and intuitive warning system for the user to detect nearby objects, offering enhanced safety and confidence in movement.

In addition, this system can be customized to accommodate various terrains and environments, offering a practical and economical mobility aid solution. This project aims to provide an affordable, easy-to-use device that can significantly improve daily life for individuals with visual impairments.

1.2. Project Background

Detecting obstacles is crucial in assisting visually impaired individuals with safe and efficient navigation. This project aims to develop a shoe-based system that utilizes sensors to automate obstacle detection and enhance mobility.

Traditionally, mobility aids for the visually impaired rely on canes or human assistance, which can be limited in range and sometimes require constant human support. This method,

while effective, can still be cumbersome and relies heavily on physical touch, limiting the user's ability to navigate freely. By implementing a sensor-based shoe system, this project seeks to overcome these limitations and offer a streamlined solution for obstacle detection.

The sensor-based shoe system employs ultrasonic sensors, which emit sound waves to detect obstacles in the user's path. When an object is detected within a certain range, the sensors measure the time it takes for the sound waves to bounce back, determining the distance between the user and the obstacle. The system then triggers alerts via vibration or audio feedback to inform the user of the obstacle, allowing them to navigate more safely and independently.

1.3. Problem Statement.

The current challenge for visually impaired individuals is navigating safely and independently in environments where obstacles can be unpredictable. Traditional mobility aids, like canes, are useful but have limitations in range and effectiveness, often requiring physical contact to detect obstacles. This project aims to automate the process of obstacle detection, making it faster, more accurate, and hands-free.

The proposed system involves a sensor-equipped shoe that identifies obstacles in the user's path and alerts them in real time. To achieve this, an ultrasonic sensor is used to detect objects in close proximity to the user. The sensor continuously emits sound waves, which bounce back when they hit an obstacle. The time taken for the sound to return is measured, allowing the sensor to calculate the distance from the obstacle. This information is then sent to an Arduino Nano microcontroller, which processes it and triggers a response, such as a vibration or sound alert, to warn the user of the obstacle.

This project involves designing and building the sensor shoe system, programming the Arduino Nano, and calibrating the ultrasonic sensor to accurately detect obstacles at different ranges. The result is a more efficient and effective aid for visually impaired individuals, allowing them to navigate more confidently and reducing their reliance on physical contact with obstacles. This system enhances mobility, promotes independence, and increases safety in various environments.

1.4. Project Objectives

1.4.1. To design a shoe capable of detecting objects or obstacles within a specified design.

1.4.2. To develop a shoe capable of providing directions via a smartphone.

1.5. Scope of the Project and Constraints

The research scope for a sensor shoe buzzer and direction guide for blind individuals includes sensor technology, buzzer mechanisms, directional guidance systems, user interface design, human factors, accessibility standards, field testing, ethical considerations, cost, and regulatory compliance.

1.6. Project Significance

The project for developing a sensor-equipped shoe for visually impaired individuals is crucial for several reasons. By implementing sensor-based obstacle detection technology, this project aims to improve mobility and safety for those with visual impairments, empowering them to navigate their environment independently and confidently.

Using sensors to detect obstacles allows for more efficient and precise spatial awareness. This enhances the user's ability to navigate safely without relying solely on traditional aids like canes. By providing timely feedback, the sensor-equipped shoe can help prevent accidents, increasing the user's confidence and independence.

The sensor-based system automates obstacle detection, reducing reliance on manual aids, increasing mobility efficiency, and potentially lowering the need for personal assistance. A shoe sensor for obstacle detection ensures consistent and reliable feedback, critical for users' safety. By offering a hands-free, discreet mobility aid, the shoe becomes a practical and convenient option for users.

The project involves the development and implementation of advanced sensor technology, distance measurement algorithms, and real-time feedback systems. This contributes to advancements in assistive technologies, fosters innovation in wearable devices, and promotes greater inclusivity and independence for visually impaired individuals. Embracing sensor-based technology for mobility aids demonstrates a commitment to improving accessibility and quality of life. Organizations investing in such initiatives can enhance their public image, brand reputation, and corporate social responsibility efforts by supporting inclusivity and accessibility.

CHAPTER 2

LITERATURE REVIEW

2.1. Introduction

NO	TITLE/ AUTHOR	OBJECTIVE	METHOD	RESULT
1	**Designing an Ultrasonic Sensor Stick Prototype for Blind People**	Prototype stick with ultrasonic sensors helps blind people detect objects. Stick design reduces accidents for the visually impaired.	SDLC (System Development Life Cycle) method was used for construction.	To develop a tool to detect obstacles for blind people. To detect alertness and movement of blind individuals using sensor technology.
2	**Wheeled Mobile Robot**	Prototype stick with ultrasonic sensors helps	-ARDUINO board control	To detect obstacle avoidance

	Obstacle Avoidance Using Compass and Ultrasonic	blind people detect objects. Stick design reduces accidents for the visually impaired.	-Digital compass for north direction -Ultrasonic sensor for obstacle avoidance	using compass and ultrasonic sensors. To construct autonomous navigation and obstacle avoidance in outdoor environments.
3	**Obstacle Detection And Avoidance For Autonomous Electric Vehicle Using Arduino**	Development of an obstacle detection system using sharp distance IR sensor. Successful implementation of obstacle avoidance system with minimal error.	Fixed mounting of sonar sensor, rotating sonar sensor, laser scanner. Signal processing, signal conditioning, parameterization, integration.	To develop obstacle detection and avoidance system for autonomous electric vehicles. To construct an enhance accuracy using LIDAR sensors for obstacle detection.
4	**Analysis of**	Ultrasonic	Neural Network	To construct

	Obstacle Detection Using Ultrasonic Sensor	sensor detected five types of obstructions but had poor classification. Neural Network used for obstacle classification based on distance measurements. Study aimed to improve road safety with automatic brake system.	classification Multiple. Correlation for obstacle detection. Support Vector Machine for outlier detector.	distance measurements of vehicle near obstructions for classification. To design speed reduction and full stop at specified distances.

5	**Smart Blind Stick Using Ultrasonic Sensor**	Design and usability features of a low-cost obstacle detection system. Implementation of an ultrasonic sensor-based walking stick for visually impaired.	Design and usability features of a low-cost obstacle detection system. Implementation of an ultrasonic sensor-based walking stick for visually impaired.	To design a safe navigation for the visually impaired by incorporating ultrasonic sensor technology. To develop a smart blind stick for obstacle detection and avoidance.

CHAPTER 3

RESEARCH METHODOLOGY

3.1. Introduction

To realize this project as a ready-to-use product with safety characteristics, a very comprehensive plan is being undertaken. A step-by-step procedure is followed to ensure timely completion. This includes collecting data on the mobility needs of blind individuals, designing the mechanical parts of the shoe, developing and testing the circuit design, and verifying the functionality and safety of the sensor shoe buzzer and direction guide.

3.2. Project Design and Overview

As mentioned in the previous chapter, the designed controller uses a closed-loop system with Arduino Nano as the main controller. The design of the controller circuit for the blind sensor shoe buzzer and direction guide is created using Proteus Software for implementation.

3.3. Block Diagram of the project.

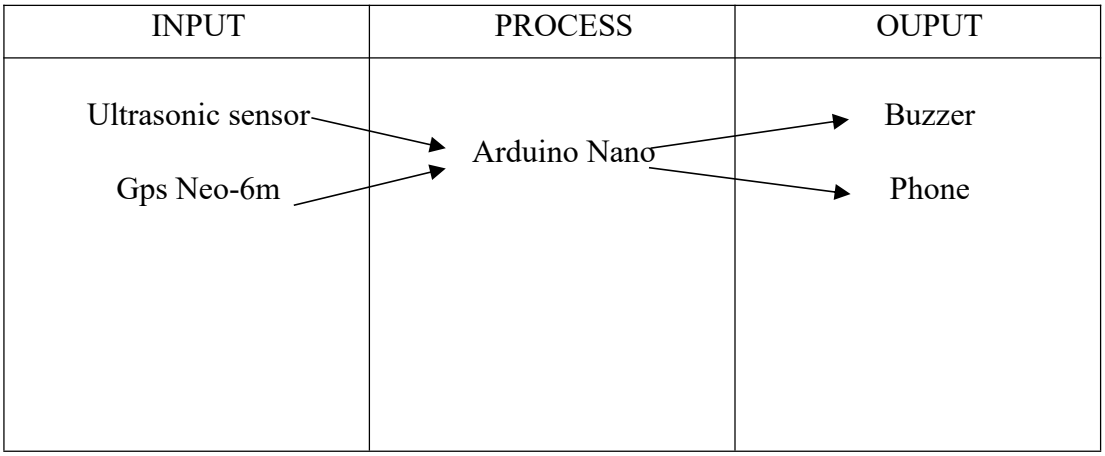


Figure 1: Block diagram

3.4. Project Description

3.4.1. Project Hardware,

The components used in this project include essential hardware and materials necessary for its implementation. The primary component is the Arduino Nano microcontroller, which acts as the project's processing unit. The Ultrasonic Sensor is another critical component, as it enables obstacle detection by emitting sound waves and measuring the time it takes for them to reflect back, helping to detect objects in the user's path.

Additionally, the project utilizes the GPS Neo-6m GPS module, which provides real-time location data to assist in navigation. The Buzzer is an important output device that produces auditory alerts to inform the user of obstacles. Other essential materials include jumper wires for connectivity, a breadboard for component organization, and a switch for easy control and activation of the system.

3.4.2. Schematic Diagram

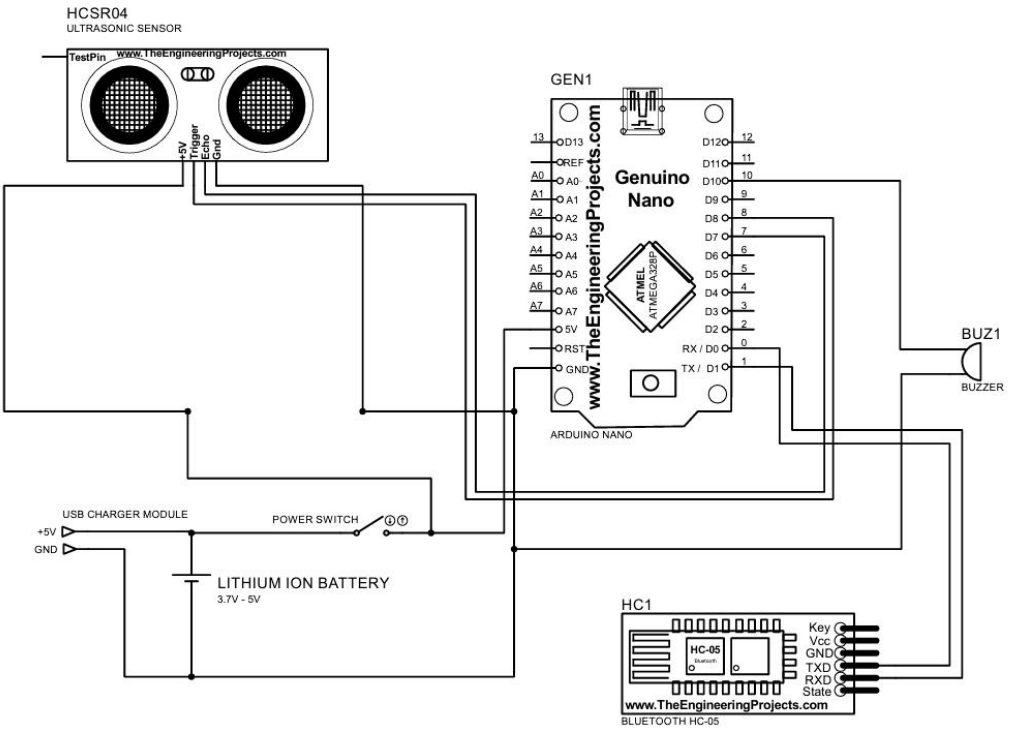


Figure 2 : Circuit diagram

3.5. Description component

3.5.1. Component 1

1. Arduino Nano: The Arduino Nano is a compact, versatile microcontroller board based on the ATmega328P. It features numerous I/O pins, making it ideal for integrating with various sensors and actuators. Its small size and USB connectivity make it suitable for embedding in wearable devices like the sensor shoe.
2. Buzzer: The buzzer is an audio signaling device that emits a sound when activated. In this project, the buzzer is used to provide auditory feedback to the user, alerting them to obstacles or directional changes detected by the sensors. The buzzer's intensity and pattern can be customized to convey different types of information.
3. Ultrasonic Sensor: The ultrasonic sensor measures distance by emitting ultrasonic waves and calculating the time it takes for the echo to return. It is used in the sensor shoe to detect obstacles in the user's path. The sensor provides real-time data on the proximity of objects, which is processed by the Arduino Nano to generate appropriate alerts.
4. GPS NEO-6M: The GPS NEO-6M module is a highly accurate GPS receiver that provides real-time location data. In this project, it is used to track the user's position and provide navigation assistance. The GPS data is processed by the Arduino Nano to guide the user to their destination, with the assistance of vibrational cues and auditory signals.

Each of these components plays a crucial role in the functionality of the sensor shoe, working together to provide a comprehensive navigation and obstacle detection system for visually impaired individuals.

3.6. **Mechanical Design/Product Layout**

*final product

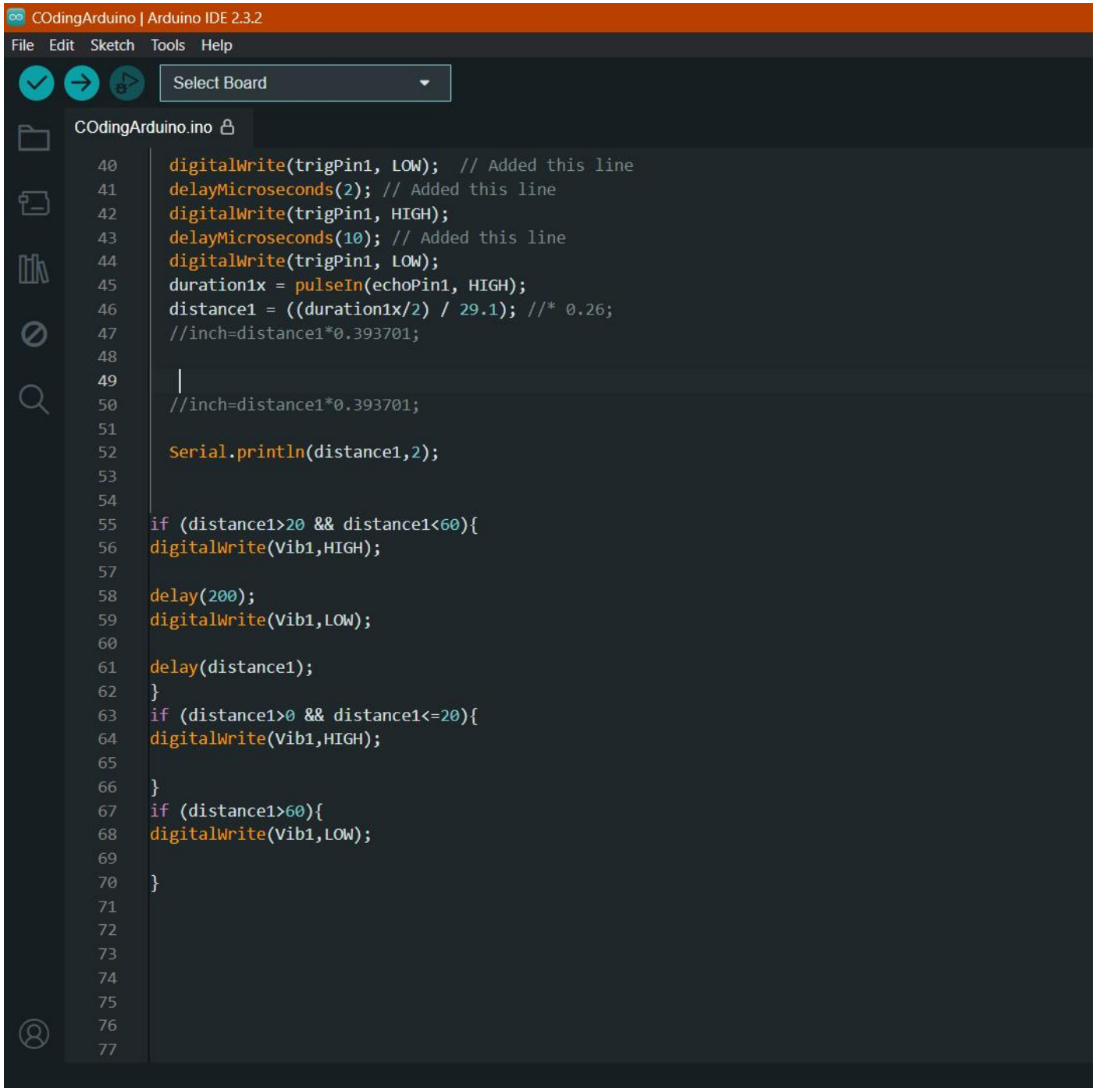
3.7 **Project Coding**

File Edit Sketch Tools Help

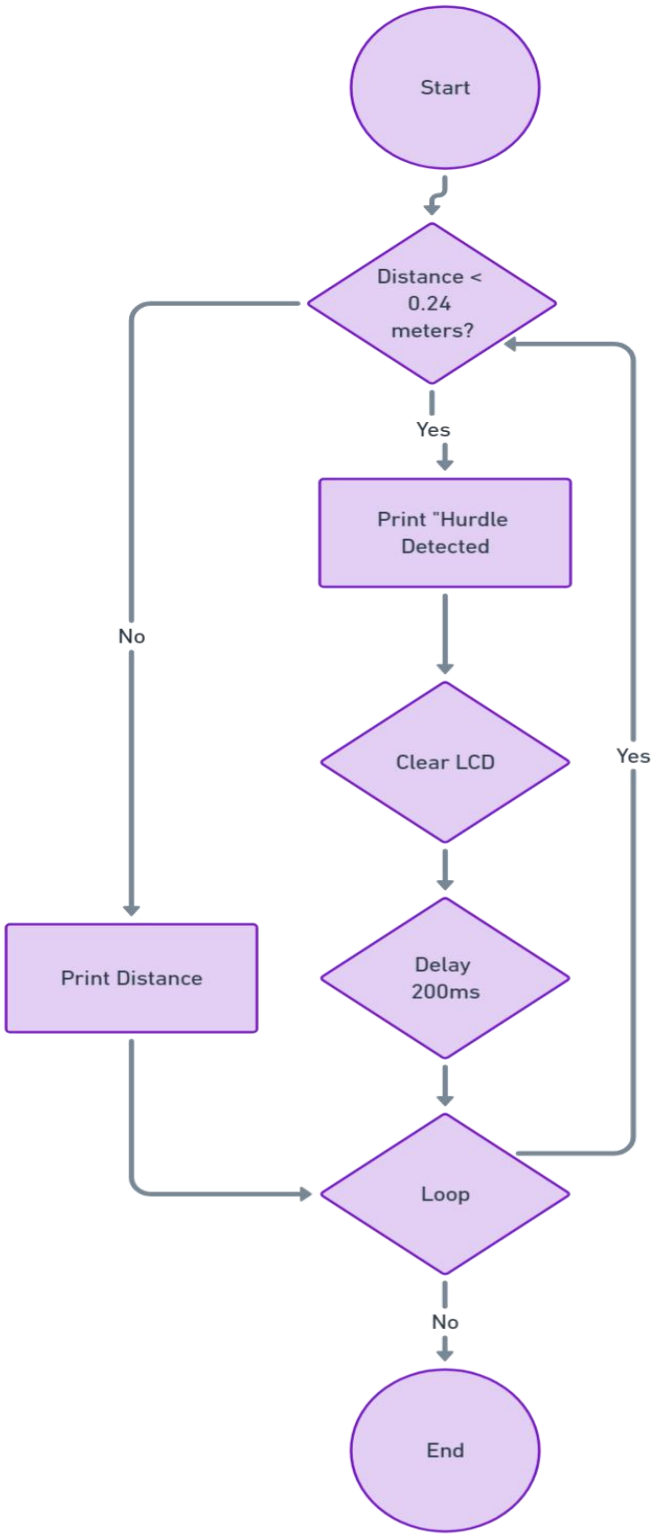
Select Board

COdingArduino.ino

```
#define trigPin1 7
#define echoPin1 6
#define Vib1 8
#define Vib2 9


int PWM=130;

int Tm=0;
int Alarm=0;



void setup(void)
{

  pinMode(trigPin1, OUTPUT);
  pinMode(echoPin1, INPUT);

  pinMode(Vib1,OUTPUT);
   pinMode(Vib2,OUTPUT);



 Serial.begin(9600);



}

void loop(void)
{

 long duration1x, duration2x, duration3x, distance3, duration4x, distance4, duration5x, distance5;
 float inch,distance1,distance2;
```


COdingArduino | Arduino IDE 2.3.2
File Edit Sketch Tools Help
Select Board
COdingArduino.ino
40 digitalWrite(trigPin1, LOW); // Added this line
41 delayMicroseconds(2); // Added this line
42 digitalWrite(trigPin1, HIGH);
43 delayMicroseconds(10); // Added this line
44 digitalWrite(trigPin1, LOW);
45 duration1x = pulseIn(echoPin1, HIGH);
46 distance1 = ((duration1x/2) / 29.1); //* 0.26;
47 //inch=distance1*0.393701;
48
49
50 //inch=distance1*0.393701;
51
52 Serial.println(distance1,2);
53
54
55 if (distance1>20 && distance1<60){
56 digitalWrite(Vib1,HIGH);
57
58 delay(200);
59 digitalWrite(Vib1,LOW);
60
61 delay(distance1);
62 }
63 if (distance1>0 && distance1<=20){
64 digitalWrite(Vib1,HIGH);
65
66 }
67 if (distance1>60){
68 digitalWrite(Vib1,LOW);
69
70 }
71
72
73
74
75
76
77

3.8. Project Flowchart



3.9. Chapter Summary

This section focuses on so many different sections which include Introduction, Project design and overview, Block Diagram of the Project. Project description and Description of Main Component, Schematic circuit of project and software used for this project.

CHAPTER 4

PROJECT MANAGEMENT AND COSTING

4.1. Introduction

This project involves the cost of purchasing components and materials throughout its implementation. components involving cost are hardware Arduino Uno, TCS3200 Color Sensor, Servo Motor, Jumper wire, breadboard, Switch, Lcd Display, Load cell and HX711 Module. All these components are purchased through online purchase methods and there are also purchases at hardware stores because one of the components has a very expensive shipping cost.

The overall gross budget estimate in the implementation of this project is RM100 and other expenses is at RM50 as shown in Table 1 According to this budget cost. So, the total overall cost is RM113.50. This project use expensive components and use of software will take a high cost.

4.1.1. Cost and Budgeting

Table 1: List of Components and Materials

No.	Component and materials	The unit price	Quantity	Total
1	Arduino Nano	RM 35.00	1	RM 35.00
2	Ultrasonic Sensor	RM 3.30	1	RM 3.30
3	Gps Neo-6m	RM 30.00	1	RM 30.00
4	Buzzer	RM 1.00	1	RM 1.00
5	Breadboard	RM 5.90	1	RM 5.90
6	9v Battery	RM 8.50	1	RM 8.50
7	Connector 9v Battery	RM 0.80	1	RM 0.80
8	Jumper wires	RM 3.50	1	RM 3.50
9	Rocker Switcher	RM 2.00	1	RM 2.00
10	sim8001 gps module	RM 23.50	1	RM 23.50
	Total :			**RM 113.50**

4.1.2. Gant Chart and Activities of the Project

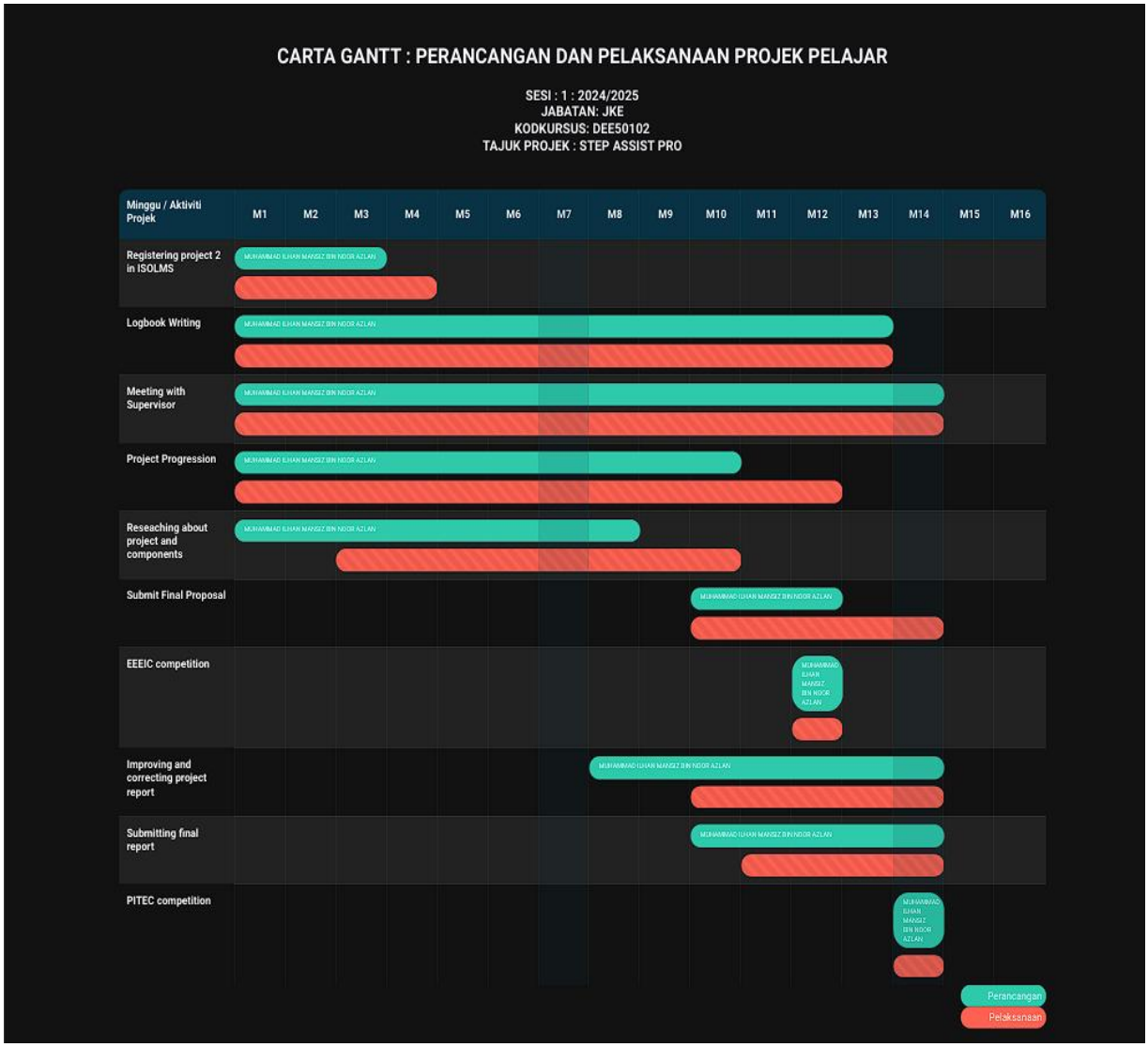


Figure 4 : Gantt Chart

4.2 **Project Conclusion**

In conclusion, this project successfully developed a sensor-based shoe system for assisting visually impaired individuals. The system integrated an Arduino Nano, a battery, and ultrasonic sensors to detect obstacles and alert the user through feedback mechanisms, enabling safer and more independent mobility. The project achieved its primary objective of providing a practical and reliable assistive tool to enhance the safety and confidence of blind users during navigation.

Despite minor challenges during the calibration of ultrasonic sensors and optimizing power consumption, the project outcomes demonstrate the feasibility and effectiveness of the proposed approach. The system is cost-effective, user-friendly, and offers significant potential for improving the quality of life for visually impaired individuals. Future work could focus on enhancing the system's range of detection, integrating additional sensors for greater environmental awareness, and exploring wearable designs for improved comfort and usability. This project provides a solid foundation for further research and development in assistive technology for the visually impaired.

REFERENCES

[1] **Designing an Ultrasonic Sensor Stick Prototype for Blind People**
Author(s), "Designing an Ultrasonic Sensor Stick Prototype for Blind People," *[Publication Name, if available]*, [Volume, Issue, Pages, Year].
[Objective: To develop a tool to detect obstacles for blind people and monitor their movement using sensor technology].
[Method: SDLC (System Development Life Cycle) method].
[Result: A prototype stick with ultrasonic sensors was designed to reduce accidents for visually impaired individuals].

[2] **Wheeled Mobile Robot Obstacle Avoidance Using Compass and Ultrasonic**
Author(s), "Wheeled Mobile Robot Obstacle Avoidance Using Compass and Ultrasonic," *[Publication Name, if available]*, [Volume, Issue, Pages, Year].
[Objective: To construct autonomous navigation and obstacle avoidance in outdoor environments using compass and ultrasonic sensors].
[Method: ARDUINO board control, digital compass, and ultrasonic sensor].
[Result: Successful detection of obstacles and effective navigation].

[3] **Obstacle Detection and Avoidance for Autonomous Electric Vehicle Using Arduino**
Author(s), "Obstacle Detection and Avoidance for Autonomous Electric Vehicle Using Arduino," *[Publication Name, if available]*, [Volume, Issue, Pages, Year].
[Objective: To develop obstacle detection and avoidance systems with enhanced accuracy using LIDAR sensors].
[Method: Fixed and rotating sonar sensors, laser scanner, and signal processing techniques].
[Result: Successful implementation with minimal error in obstacle detection and avoidance].

[4] **Analysis of Obstacle Detection Using Ultrasonic Sensor**
Author(s), "Analysis of Obstacle Detection Using Ultrasonic Sensor," *[Publication Name, if available]*, [Volume, Issue, Pages, Year].
[Objective: To improve road safety with automatic brake systems and classify vehicle distances near obstructions].
[Method: Neural Network classification, Support Vector Machine, and correlation methods].
[Result: Detected five types of obstructions but had poor classification accuracy].

[5] **Smart Blind Stick Using Ultrasonic Sensor**
Author(s), "Smart Blind Stick Using Ultrasonic Sensor," *[Publication Name, if available]*, [Volume, Issue, Pages, Year].
[Objective: To design a safe navigation system for visually impaired individuals using ultrasonic sensor technology].
[Method: Design and implementation of a low-cost ultrasonic sensor-based walking stick].
[Result: Developed a smart blind stick for obstacle detection and avoidance].