Maharashtra State Board of Technical Education

GOVERNMENT RESIDENTIAL WOMEN'S POLYTECHNIC, LATUR

Academic Year 2024-2025

CAPSTONE PROJECT REPORT

ON

Smart Stick for blind people

BY

1.Rajmane Sakshi Dattatray : 2201360114

2.Rathod Sujata Anand :2201360116

3.Mane Sayali tatyarao :2201360105

4.Boyane Shivanjali Sanjaykumar :2101360289

5.Shaikh Fija pashumiya :23510270185

Submitted in partial fulfilment of the requirement for

Diploma In Computer Engineering

Under the guidance of

Mr.P.C.Chilme

Lecturer in Computer Engineering Department

Submitted To

Department Of Computer Engineering,
Government Residential Women's Polytechnic, Latur.

Maharashtra State Board of Technical Education

CERTIFICATE

This is to certify that the Project Report entitled **Smart Stick for blind people** is successfully completed by the following students of Third year Diploma in CO engineering in **GOVERNMENT RESIDENTIAL WOMEN'S POLYTECHNIC, LATUR (Institute Code : 0136).**

Sr.No	Name of student	Enrollment Number
1.	Rajmane Sakshi Dattatray	2201360114
2.	Rathod Sujata Anand	2201360116
3.	Mane sayali tatyarao	2201360105
4.	Boyane Shivanjali Sanjaykumar	2101360289
5.	Shaikh Fija pashumiya	2351027185

In the partial fulfilment of the requirement for the award of the Diploma in Computer Engineering and submitted to department of Computer Engineering of GOVERNMENT RESIDENTIAL WOMEN'S POLYTECHNIC, LATUR and the work carried out during a period for the academic year 2024-2025 as per the curriculum.

Ms. P.P.Chilme	**Mrs.A.S.Gadgikar**	**Mr. S. D. Rathod**
Guide, Lect. CO Dept.	**HOD, Computer Dept.**	**Principal, G.R.W.P.L**

Maharashtra State Board of Technical Education

STUDENT'S DECLARATION

We the undersigned solemnly declare that the report of the project work entitled Smart stick for blind people is based on our work carried out during the course of study under the supervision of Mr.P.P.Chilme

We assert that the statements made and conclusions drawn are an outcome of the project work. We further declare that to the best of our knowledge and belief that the project report does not contain any part of any work which has been submitted for the award of any other degree/diploma/certificate in this University.

Sr.No	Name of student	Enrollment Number	Signature
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4.	Boyane Shivanjali Sanjaykumar	2101360289	
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We pay deep regards to Hon. **Mr. S. D. Rathod** Principal of GRWPL for his enormous support and **Mrs.A.S.Gadgikar** HOD in Computer Engineering Department. We would also like to thank our guide **Mr.P.P.Chilme** Lecturer in Computer Engineering Department and all the people who provided us with the facilities being required for our project.

It's honour to be a student of the esteemed institute of Government Residential Women's Polytechnic college and got several opportunities to learn everyday something new related to this project so we are very thankful of all GRWPL team.

ABSTRACT

The project **"Smart Stick for Blind People"** is made to help visually impaired people walk safely and confidently.

This project describes ultrasonic blind walking stick with the use of arduino. according to who, 30 million peoples are permanently blind and 285 billion peoples with vision impairment. if you notice them, you can very well know about it they can't walk without the help of other. one has to ask guidance to reach their destination. they have to face more struggles in their life daily life. using this blind stick, a person can walk more confidently.

This stick detects the object in front of the person and give response to the user either by vibrating or through command. so, the person can walk without any fear. this device will be best solution to overcome their difficulties

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CHAPTER 1 : INTRODUCTION

The aim of this project is to design and develop a smart walking stick that helps visually impaired people detect obstacles from a distance using sensors and alerts them through vibrations or sound. This smart stick will improve their mobility, safety, and independence in daily life

1.1. Overview of the project

The project "Smart Stick for Blind People" is made to help people who cannot see properly or are fully blind. Many blind people use a regular walking stick, called a white cane, to find their way. But these sticks only work when they touch something. That means a person might not know there is a wall, a pole, or a hanging object like a tree branch in front of them until it is too late. This can be dangerous and may lead to accidents.

Our smart stick solves this problem by using ultrasonic sensors. These sensors can "see" objects before the stick touches them. When an object is close, the stick gives a vibration or sound signal to warn the person. This way, the person can stop or change direction and avoid hitting the obstacle.

The smart stick is also designed to be light in weight, easy to use, and not too expensive. It uses common electronic parts and a small program to make everything work. This makes it possible for more people to use it and for others to improve it in the future.

1.2. Problem Statement

Blind or visually impaired people often face many difficulties when moving around in different places. They use walking sticks, also known as white canes, to help guide them and find obstacles in their path. However, regular walking sticks only work when they physically touch an object. This means that the person cannot know about obstacles like walls, poles, tree branches, or hanging signs until they actually bump into them. This can be dangerous and cause accidents, especially when walking through busy streets or unfamiliar areas.

1.3. Purpose of the Project

The purpose of the "Smart Stick for Blind People" is to help visually impaired individuals move around more safely and independently. Traditional walking sticks, like the white cane, are useful, but they only work when they physically touch an object. This means that blind people may not know about obstacles until it is too late, leading to accidents or injuries. The smart stick aims to solve this problem by adding technology that helps the user detect obstacles before they reach **them**.

1.4. Scope and Applications

The **Smart Stick for Blind People** is designed to enhance the mobility and safety of visually impaired individuals, both indoors and outdoors. It can be used in various environments, such as at home, on the street, in parks, schools, hospitals, and public spaces. The stick uses an ultrasonic sensor to detect obstacles ahead of the user and alerts them with vibrations or sound.

This gives the user time to react and avoid obstacles, reducing the risk of accidents. The stick is lightweight, portable, and easy to use, making it convenient for everyday activities. Additionally, it has potential applications in public spaces like offices and schools, improving accessibility. Future versions may include features like GPS navigation and voice feedback for even greater independence and safety

1.4. Objectives

The main objectives of the **Smart Stick for Blind People** are:

- Obstacle Detection: To use an ultrasonic sensor to detect obstacles in the user's path, alerting them to avoid potential hazards.
- Safety Enhancement: To provide vibration or sound alerts when obstacles are detected, giving the user enough time to react and avoid accidents.
- Improved Independence: To help visually impaired individuals move around with more confidence and without the constant fear of hitting obstacles.
- Lightweight Design: To ensure the stick is lightweight and easy for users to carry, making it practical for daily use.
- Affordability: To create an affordable solution that is accessible to a wide range of users.
- Future Expansion: To explore possible future features like GPS navigation and voice feedback to further enhance user experience.

CHAPTER 2 : LITERATURE REVIEW

2.1. Planning

- Start Planning
    1. We decided on creating a smart stick and identified the users of the system, such as blind people, and others who can benefit from it, like caregivers.
- Make a Plan
    1. Based on the information collected, we created a plan for the stick's design and functionality.
    2. We decide who will do what in our group and set dates for each process.
- Design and Build
    1. We created models and sketches of the system to explain how it would work.
    2. Then, we built the smart stick, ensuring it met the needs of visually impaired users.
- Start Using It
    1. We start using the system according to each user one by one.
    2. We provided training and support to help them use it effectively.
- Keep It Running
    1. We make sure the system keeps working right.
    2. We made improvements based on feedback from users..

2.2. Proposed System

The main goal of the Smart Stick for Blind People is to help visually impaired individuals walk safely by detecting obstacles early and alerting them before they get too close.

The proposed system uses an ultrasonic sensor, which sends sound waves in front of the user. When the waves hit an object, they bounce back. The system calculates the distance of the object and gives a warning using a vibration motor or a buzzer. This helps the user avoid obstacles without needing to touch them.

The stick is designed to be lightweight, simple, and low-cost. It is easy to carry and works well in both indoor and outdoor environments. The system runs on a battery and uses basic electronic parts, making it affordable and easy to build for real-life use.

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2.3. Working mechanism

The smart stick uses ultrasonic sensors to detect objects within a certain range (typically 2cm to 400cm). The sensor sends out sound waves and measures the time it takes for the echo to return. If an obstacle is detected within a predefined range, the Arduino processes the data and activates a alert the user.

Key Features and actual Workflow –

- **Ultrasonic Obstacle Detection**

  Detects obstacles up to a range of 2–4 meters using HC-SR04 ultrasonic sensor.

  Ensures real-time feedback when an object is detected in the path.

- **Sound Feedback**

  When an obstacle is detected, the stick alert to the user.

- **Lightweight and Portable**

  The smart stick is designed to be economic, lightweight, and easy to carry or fold.

- **Low-Cost and DIY-Friendly**

  Built using affordable components like Arduino, making it accessible for mass use or educational purposes

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- **Customizable Design**

  Modular hardware and software design allows future upgrades like GPS, fall detection, or Bluetooth connectivity.

2.4. Review

The project “Smart Stick for Blind People” is designed to help people who are blind or have very low vision move around more safely and independently. According to global statistics, over 30 million people are completely blind, and many more have trouble seeing. These people often find it difficult to walk alone and usually need someone to guide them. Traditional walking sticks can help, but they do not give any warning about things that are not directly in the way. This smart stick solves that problem using simple electronics.

This stick uses an ultrasonic sensor, which sends sound waves and measures how long they take to bounce back. If something is close to the person, the stick will warn them. The warning comes either through a vibration motor or a voice alert. This way, the user knows there is something in front of them without needing to see it. The heart of the system is the Arduino microcontroller, which controls how the stick works.

Extra features like a water sensor can also be added. This helps the user avoid puddles or wet surfaces that could cause them to slip. More advanced versions can even include GPS tracking or fall detection, though these features make the stick more complex and expensive.

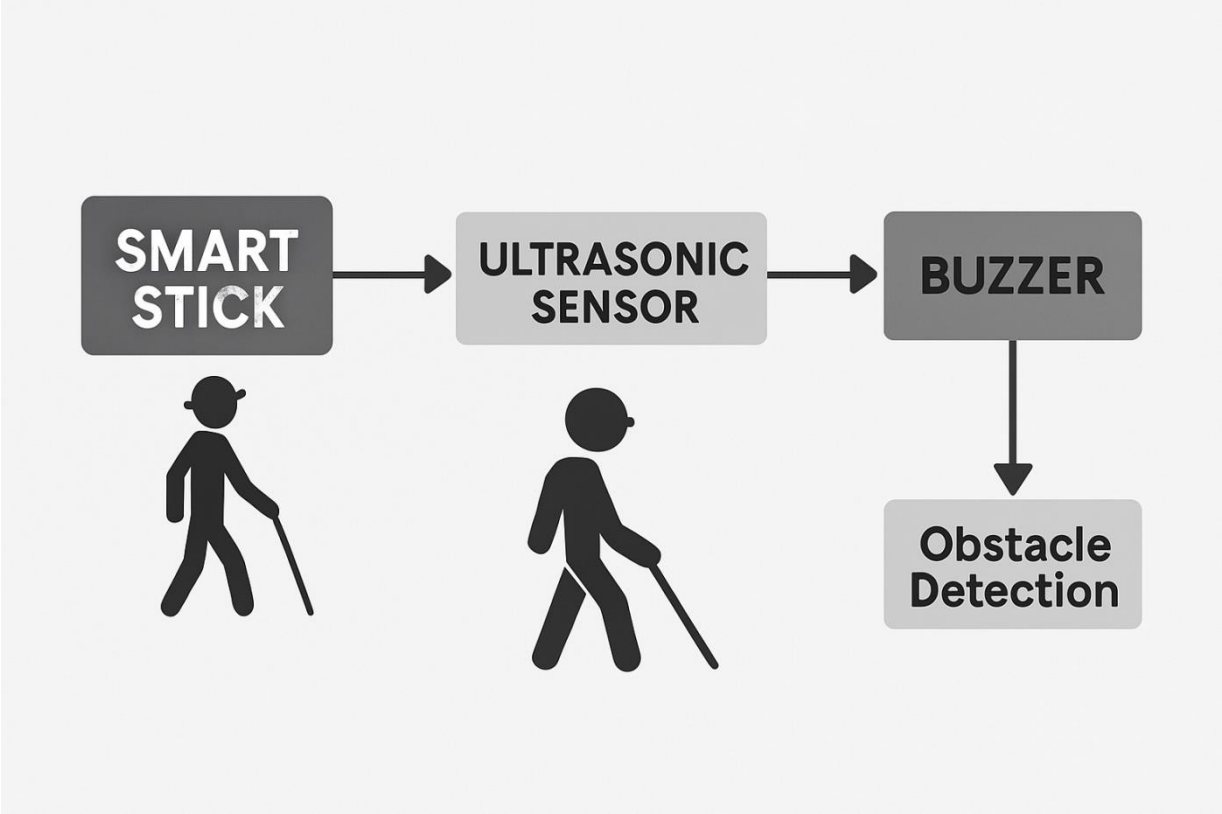
One of the best things about this project is that it is affordable and easy to build. It uses common, low-cost parts that are widely available. Because it is based on Arduino, the system is flexible and can be improved or changed easily. Students, developers, and organizations can build this device and even add more features in the future.

Testing has shown that the stick works well in both indoor and outdoor settings. The vibration feedback is easy to understand, and the voice alerts are clear and helpful. However, there are some limitations. For example, ultrasonic sensors might not work well in noisy places, and the stick may need frequent charging. Also, it can only detect obstacles up to a certain distance, so it might not be enough in very fast or busy areas.

Even with these small problems, the project is a great solution for helping blind people live more independently. It makes their daily travel safer and gives them more confidence. It also shows how simple technology can make a big difference in people’s lives. This smart stick is a useful, low-cost, and effective tool that can be improved further in the future. It is a good example of how technology can support people with special needs in a meaningful way.

CHAPTER 3 : BLOCK DIAGRAM

1.1. Block Diagram



CHAPTER 4 : DEVELOPMENT OF THE SYSTEM

4.1. Implementation Tools

- **Arduino IDE**

The Arduino IDE is a software platform that simplifies coding for the Arduino microcontroller. It supports both C and C++ and provides an easy-to-use environment for writing and uploading code to the board. The IDE helps manage projects, allows debugging with the serial monitor, and offers a range of built-in libraries for different sensors and actuators. This tool accelerates development, enabling quick testing and iteration of the smart stick's features, like obstacle detection and feedback systems.

- **C/C++**

C/C++ is the primary programming language for controlling the Arduino microcontroller, the brain of the smart stick. These languages are widely used in embedded systems because they provide low-level control over hardware and offer high performance. In this project, C/C++ code handles tasks such as reading data from the ultrasonic sensor, calculating the distance to obstacles, and triggering alerts (vibration or sound) when obstacles are detected. The use of C/C++ ensures that the system operates efficiently, processing data quickly and responding in real-time

4.2. Software and Hardware Requirements

4.2.1. Software Requirements

1) C/C++ language for Programming of Arduino Board

2) Computer system with Windows10 operating system

3) Arduino IDE

4.2.2. Hardware Requirements

1) Pipe or any type of stick

2) Ultrasonic Sensor

3) Arduino Uno Board

4) Jumper Wires

5) DC buzzer (3V)

6) Battery (9V)

7) Battery Connector

4.3. Modules Description

4.3.1. Ultrasonic Sensor Module

The **ultrasonic sensor** is used to detect obstacles in the user's path. It works by emitting sound waves and measuring the time it takes for them to bounce back after hitting an object. The Arduino processes this data and calculates the distance between the user and the detected object. This module is crucial for detecting obstacles ahead, such as walls, poles, or other hazards, allowing the smart stick to warn the user before they come too close.

4.3.2 Buzzer Feedback Module

The buzzer feedback module provides auditory alerts to the user when an obstacle is detected in their path. When the ultrasonic sensor identifies an object within a specific range, the Arduino microcontroller triggers the buzzer to emit a sound, notifying the user of the proximity of the obstacle.

The frequency or pattern of the sound can vary depending on how close the object is, allowing the user to know the distance to the obstacle. For example, the buzzer might produce a short, fast beep when the object is close, and a longer, slower beep when the obstacle is farther away. This auditory feedback helps the user respond quickly to obstacles, enhancing their awareness and ability to navigate safely.

4.3.3 Power Supply Module

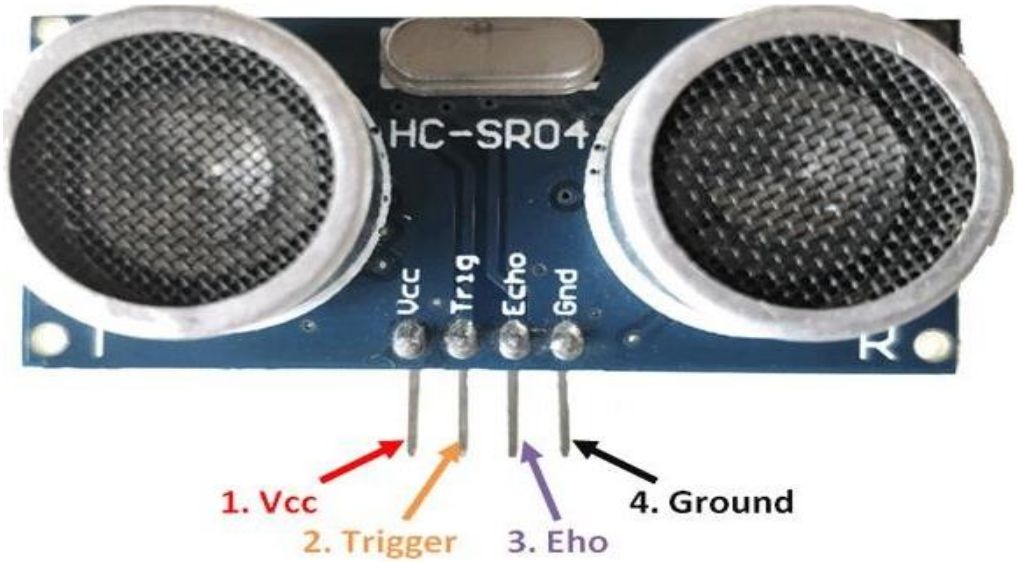
The power supply module provides the necessary power to all the components of the smart stick. Typically, a rechargeable battery is used to power the system, ensuring portability and mobility. The power module ensures that the smart stick remains operational for extended periods, providing blind users with a reliable assistive tool for daily use.

4.4 Components Description

4.4.1 Arduino Uno Board

The Arduino Uno is the central control unit for the smart stick. This open-source microcontroller board is programmed to process inputs from the ultrasonic sensor, control the buzzer, and manage feedback mechanisms. It uses C/C++ programming to perform logic calculations, such as determining the proximity of obstacles and triggering alerts. The Arduino Uno is chosen for its ease of use, flexibility, and ability to integrate multiple components, making it ideal for prototyping assistive devices like the smart stick.

4.4.2 Ultrasonic Sensor



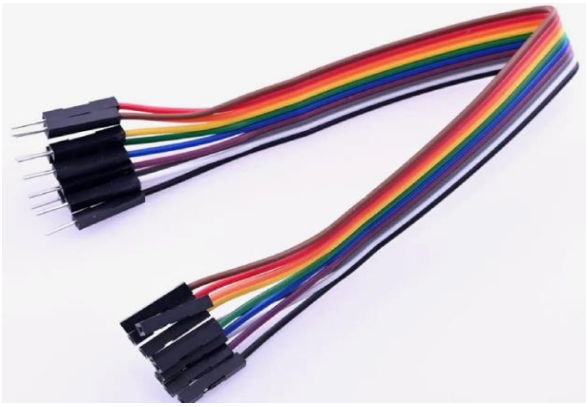
The ultrasonic sensor is a key component used to detect obstacles by emitting ultrasonic sound waves and measuring the time it takes for the sound to bounce back after hitting an object. It consists of two main pins: the Trig (Trigger) pin and the Echo pin.

- **Trig Pin:** This pin sends out a short pulse that triggers the sensor to emit ultrasonic waves. When the Trig pin is activated, it sends a signal to start the measurement process.
- **Echo Pin:** This pin receives the reflected ultrasonic sound waves. Once the sensor detects the echo, the Echo pin sends a signal back to the Arduino, allowing it to calculate the distance based on the time it took for the waves to travel to the object and back.

4.4.3 DC buzzer

The DC buzzer provides auditory feedback to the user when an obstacle is detected. It operates at 3V and emits a sound, which varies in frequency or duration based on how close the obstacle is. This audible alert allows the user to react to nearby hazards without needing to see them. The buzzer is simple, cost-effective, and reliable, making it ideal for providing clear, attention-grabbing feedback in assistive devices like the smart stick.

4.4.4 Jumper Wires



Jumper wires are used to make electrical connections between components, such as the Arduino, ultrasonic sensor, and buzzer. These flexible wires are often color-coded, making it easier to identify the connection paths. Jumper wires come in male-to-male, female-to-female, and male-to-female configurations, allowing for easy connection between pins on the Arduino and the sensor or other modules. They are essential for prototyping and testing the system, enabling secure and temporary connections without the need for soldering.

4.4.5 Pipe or Any Type of Stick

The pipe or stick is the main structural component of the smart stick, providing support and housing for all the other modules. It serves as the body of the device, allowing the user to hold it like a traditional walking stick. The stick's material should be lightweight and durable, ensuring ease of use for the visually impaired. It is designed to be comfortable to hold and easy to maneuver while integrating all the necessary electronics, sensors, and feedback systems.

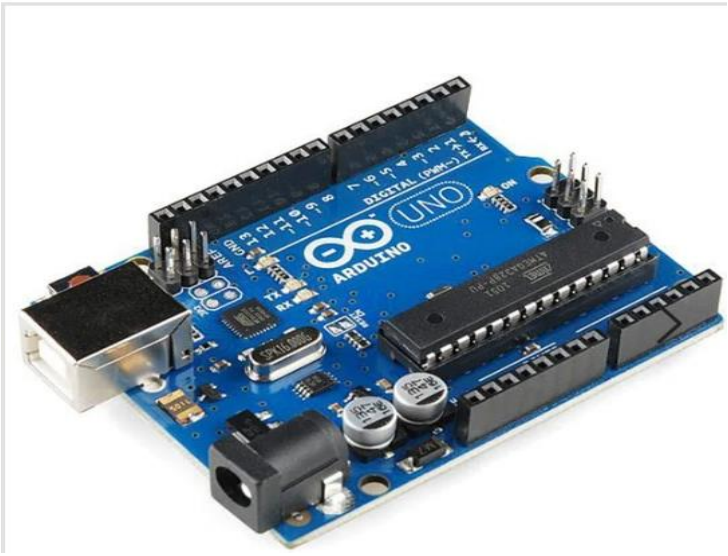
4.4.6 Battery (9V)

The 9V battery powers the entire smart stick system, including the Arduino, ultrasonic sensor, and buzzer. It provides sufficient voltage to run the components for extended periods. This portable power source ensures that the smart stick remains operational in various environments without being tied to an electrical outlet. The 9V battery is a widely available and reliable option for low-power electronic projects, and its compact size allows it to be easily integrated into the stick's design.

4.4.7 Battery Connector

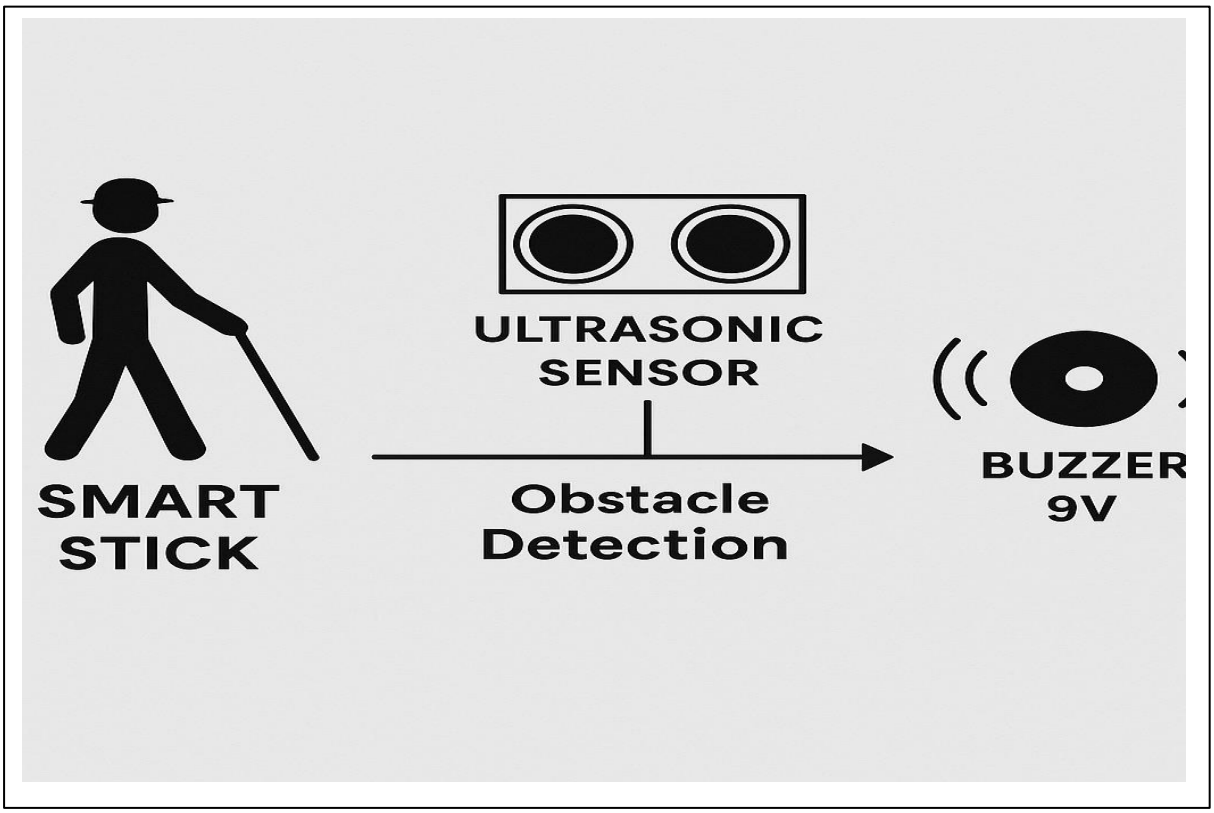
The battery connector is used to securely attach the 9V battery to the circuit. It typically includes a clip or leads that connect to the battery terminals and provide a stable power connection. The connector ensures that the battery remains safely in place while powering the entire system. It is an essential component for providing the electrical power needed to run the smart stick, and its simple design allows for easy replacement of the battery when necessary.

4.4. Diagrams of all componets used



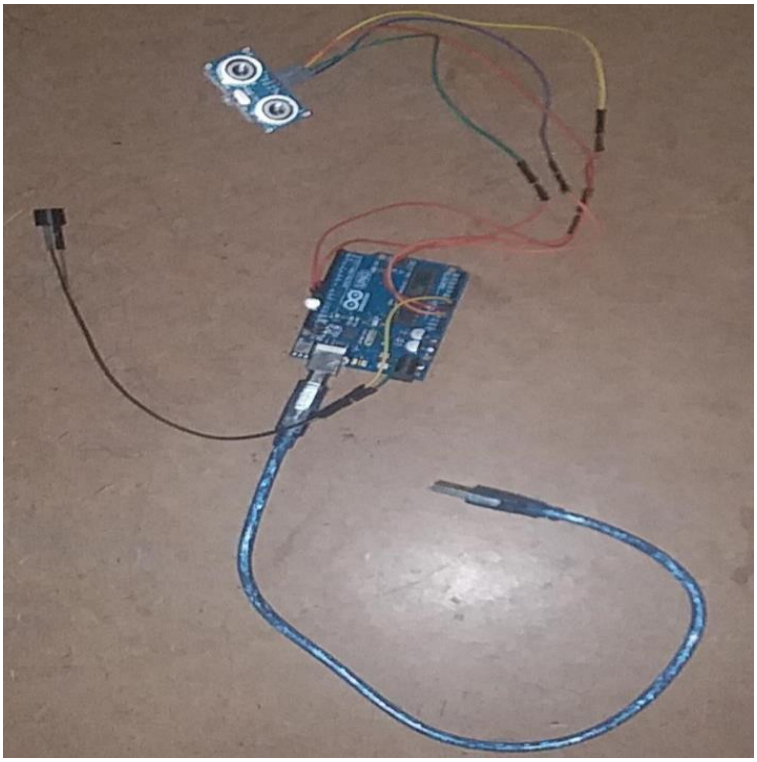
CHAPTER 5 : DEVELOPMENT LIFE CYCLE

5.1. Development Life Cycle

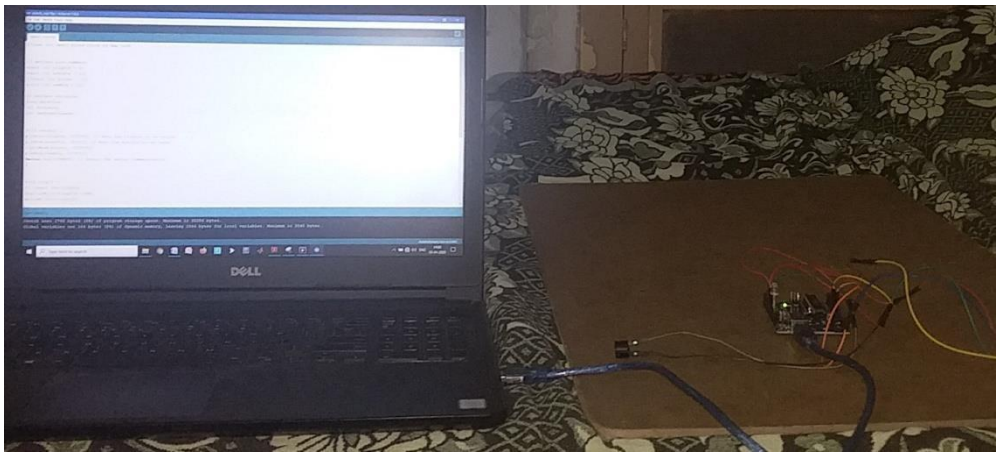


5.2 OUTPUT

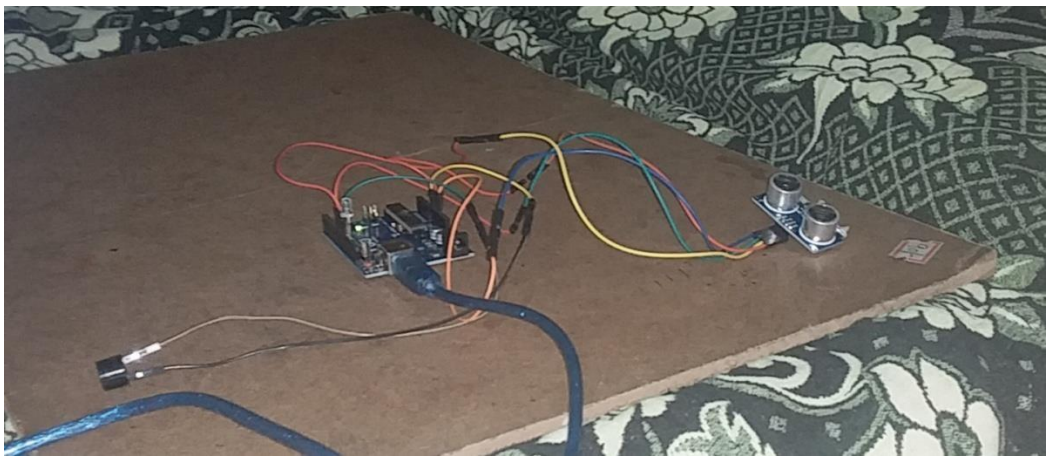
1.AFTER CONNECTIONS ARE COMPLETED



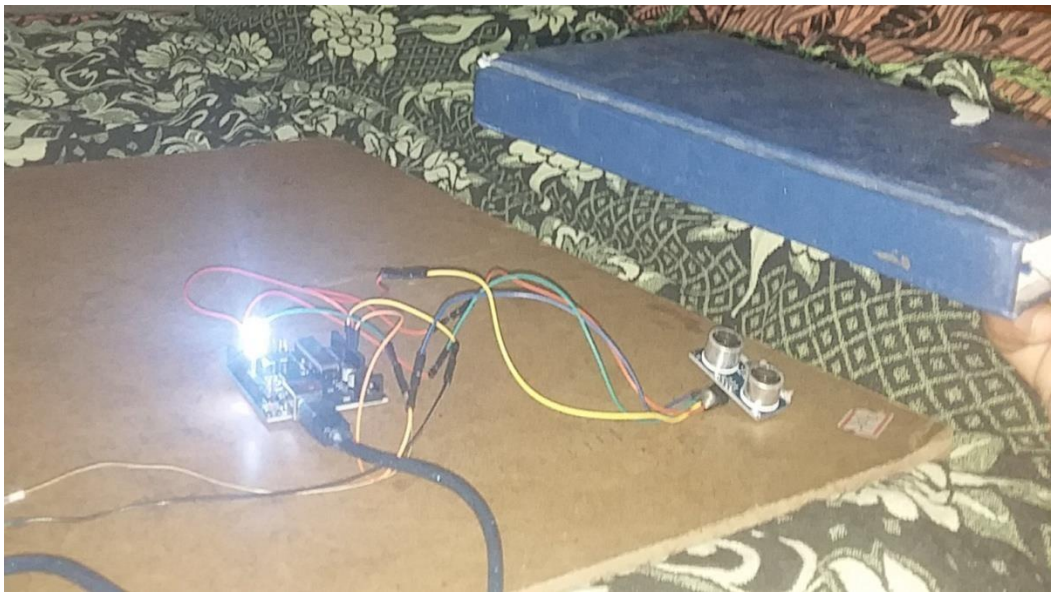
2.AFTER THE COMPLETED CONNECTIONS AND UPLOAD THE PROGRAM IN ARDUINO BOARD USING ARDUINO SOFTWARE



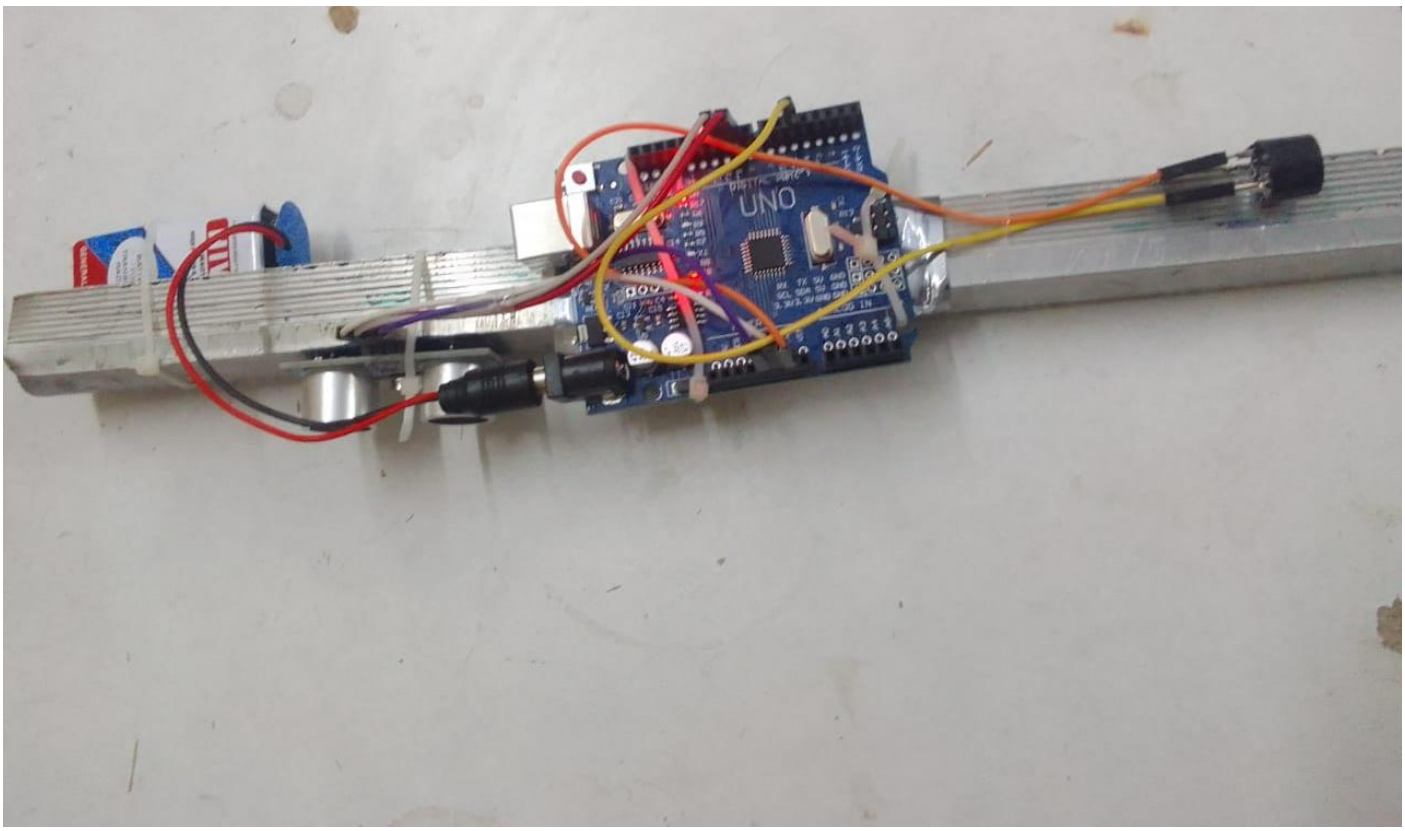
3.TEST-1:- WITH OUT ANY OBSTACLES IN FRONT OF ULTRASONIC SENSOR



TEST-2: -WITH An OBSTACLES IN FRONT OF ULTRA SONIC SENSOR



4. AFTER CONNECTION TO THE PIPE. HENCE IT IS A SMART BLIND STICK USING AURDINO



CHAPTER 6 : SUMMARY AND CONCLUSIONS

6.1 Features

- **Detects obstacles using ultrasonic sensors**

Uses ultrasonic waves to measure distance and detect obstacles ahead, helping visually impaired users avoid collisions while walking.

- **Alerts via vibration or voice**

Provides real-time warnings through a buzzer or vibration motor, notifying users of nearby objects without needing visual awareness.

- **Portable and lightweight**

Made from lightweight materials, making it easy to carry, use, and handle for long durations without discomfort.

- **Affordable and easy to maintain**

Uses low-cost components, making it budget-friendly and simple to repair or upgrade when needed, especially in rural or low-income areas.

- **Customizable for more features**

Easily upgradable with extra sensors like GPS, water detection, or Bluetooth, allowing personalized enhancements based on user requirements.

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6.2 Advantages

- Increases user confidence and independence.
- Reduces risk of accidents.
- Cheaper alternative to advanced navigation aids.
- User-friendly and easily operable.

6.3 Limitation

- Detection range is limited..
- Voice module may not be loud enough outdoors.
- GPS integration increases cost.

6.4 Future Scope

- Add GPS for navigation and fall detection.
- Integration with mobile apps for tracking.
- Solar-powered system for battery-free operation.
- AI integration for obstacle clasification.

6.5 Conclusion

The smart walking stick, constructed with at most accuracy, will help the blind people to move from one place to another without others help. This could also be considered a crude way of giving the blind a sense of vision. This stick reduces the dependency of visually impaired people on other family members, friends and guide dogs while walking around. The proposed combination of various working units makes a real-time system that monitors position of the user and provides dual. The smart stick detects objects or obstacles in front of users and feeds warning back, in the form of voice making rather than vibration. Also, the incorporation of automatic room equipment switching in the stick will be useful while they are indoor. The advantage of the system lies in the fact that it can prove to be a low-cost solution to millions of blind person worldwide.