CHENNAI INSTITUTE OF TECHNOLOGY

Sarathy Nagar, Kundrathur, Chennai-600069

An Autonomous Institute Approved by AICTE and Affiliated to Anna University, Chennai

BIOMEDICAL ENGINEERING

NAVIGATION AND WEATHER SENSING USING BLIND STICK USING IoMT

A Report on Core Course Project

Biomedical Engineering

By

NARESH RAVI THAIYALNAYAKI-210421121032
MANOJ T-210421121027
BHARATH G-210421121007

Oct / Nov – 2023

CHENNAI INSTITUTE OF TECHNOLOGY
CHENNAI-69

CHENNAI INSTITUTE OF TECHNOLOGY
Transforming Lives

CHENNAI INSTITUTE OF TECHNOLOGY
(Approved by AICTE, New Delhi & Affiliated to Anna University Chennai), Sarathy Nagar, Kundrathur, Chennai - 600069.

Vision of the Institute:

To be an eminent centre for Academia, Industry and Research by imparting knowledge, relevant practices and inculcating human values to address global challenges through novelty and sustainability.

Mission of the Institute:

IM1.To creates next generation leaders by effective teaching learning methodologiesand instill scientific spark in them to meet the global challenges.

IM2.To transform lives through deployment of emerging technology, novelty and sustainability.

IM3.To inculcate human values and ethical principles to cater the societal needs.

IM4.To contributes towards the research ecosystem by providing a suitable, effectiveplatform for interaction between industry, academia and R & D establishments.

CHENNAI INSTITUTE OF TECHNOLOGY
(Autonomous)

DEPARTMENT OF BIOMEDICAL ENGINEERING

Vision of the Department:

To create a transformative knowledge experience through Research, Industrial technology based training, nurturing entrepreneur skill, inculcating human values and solving global healthcare challenge in a eco-friendly sustainable way

Mission of the Department:

- **DM 1:** To provide high quality education by imparting strong foundation in fundamental biomedical engineering courses
- **DM 2:** To empower the students to cope the global challenges by industry connect , technology support and facilitating research
- **DM 3:**To promote entrepreneur, management creative skill and leadership quality for nation building
- **DM 4:** To transform the students by nurturing human values and Indian knowledge system
- **DM 5:** To implement professionalism in all activities in a eco-friendly sustainable way.

CHENNAI INSTITUTE OF TECHNOLOGY

An Autonomous Institute

CHENNAI-69

CERTIFICATE

This is to certify that the "**NAVGATION AND WEATHER SENSING IN BLIND STICK USING IoMT**" Submitted by Naresh Ravi Thaiyalnayaki (Reg no:210421121032), Manoj T (Reg :210421121027), Bharath G (Reg No:210421121007) is a work done by us and submitted during **2023-2024** academic year, in partial fulfilment of the requirements for the award of the degree of **BACHELOR OF ENGINEERING** in **DEPARTMENT OF BIOMEDICAL ENGINEERING**.

Core Course Project Coordinator **Internal Examiner**

Head of the Department **External Examiner**

ACKNOWLEDGEMENT

We express our gratitude to our Chairman **Shri.P.SRIRAM** and all trust members of Chennai institute of technology for providing the facility and opportunity to do this project as a part of our undergraduate course.

We are grateful to our Principal **Dr.A.RAMESH M.E**, **Ph.D.** for providing us the facility and encouragement during the course of our work.

We sincerely thank our Head of the Department, **Dr.M.Kayalvizhi** Department of Biomedical Engineering for having provided us valuable guidance, resources and timely suggestions throughout our work.

We would like to extend our thanks to our faculty coordinator of the Department, **Dr.N.Archana** of Biomedical Engineering for their valuable suggestions throughout this project.

We wish to extend our sincere thanks to our project Faculty Coordinator **Mr.K.Pradeep** of the Biomedical Engineering for their valuable suggestions and their kind cooperation for the successful completion of our project.

We wish to acknowledge the help received from the **Lab Instructors of the Biomedical Engineering** and others for providing valuable suggestions and for the successful completion of the project.

Naresh Ravi Thaiyalnayaki

(Reg no:210421121032)

Manoj T

(Reg no:210421121032)

Bharath G

(Reg no:210421121007)

PREFACE

We the students Naresh Ravi Thaiyalnayaki, Manoj T, Bharath G in the Department of Biomedical Engineering need to undertake a project to expand my knowledge. The main goal of my core project is to acquaint me with the practical application of the theoretical concepts I've learned during my course.

It was a valuable opportunity to closely compare theoretical concepts with real-world applications. This report may depict deficiencies on my part but still it is an account of my effort.

The results of my analysis are presented in the form of an industrial Project, and the report provides a detailed account of the sequence of these findings. This report is my Core Course Project, developed as part of my 2023 project. As an engineer, it is my responsibility to contribute to society by applying my knowledge to create innovative solutions that address their changes.

ABSTRACT

Visually impaired individuals face limitations in navigating their surroundings independently, making them vulnerable to obstacles and hazards, while lacking comprehensive navigation and communication tools.

The project introduces an enhanced blind stick that integrates multiple sensors to improve safety and autonomy for visually impaired individuals. The stick detects obstacles, wet surfaces, and variations in lighting conditions. It incorporates a remote-control feature for lost sticks and a buzzer alert system. Notably, it can sense real-time weather conditions, aiding visually impaired individuals in making informed decisions.

The project's methodology involves assembling hardware components, including water sensors, light sensors, ultrasonic sensors, and location-sharing modules. It also features a user-friendly remote-control interface and a sound alert system with a buzzer. The integration of a weather sensing component enhances safety and convenience for visually impaired individuals. Significance This project has the potential to significantly improve the lives of visually impaired individuals, enabling them to navigate their environment more confidently and safely. It addresses both immediate safety concerns and long-term autonomy. The uniqueness of this project lies in its ability to provide real-time weather information, which is a valuable feature for the visually impaired in planning outdoor activities.

Keywords: Blind stick, sensor integration, obstacle detection, safety, autonomy, real-time weather information.

	Table of Contents	
S.NO.	**Title**	**Page No.**
i	**Preface**	
ii	**Abstract**	
iii	**Table of Contents**	
iv	**Chapter-1 (INTRODUCTION)**	
	1.1)Definition	
	1.2)Background	
	1.3)Scope	
v	**Chapter-2 (PROJECT OVERVIEW)**	
	2.1)Problem statement	
	2.2)Project objectives	
	2.3)literature	
	2.4)Methodology	
	2.5)result	
	2.6)complete analysis of project	
	2.7)Technology used	
	2.8)Circuit diagram	
	2.9)Project photos	
	2.10)Conclusion	
	2.11)References	

CHAPTER 1

INTRODUCTION

1.1)**DEFINITION**

Visually impaired individuals encounter numerous challenges in their daily lives, with independent navigation representing a significant obstacle. The traditional white cane, a commonly used tool, falls short in providing a comprehensive solution for safe and autonomous travel. This project seeks to address these limitations by introducing an innovative and integrated approach to enhance the functionality of the blind stick. By incorporating a variety of sensors and technologies, this project aims to significantly improve the quality of life and autonomy of visually impaired individuals.

1.2)**BACKGROUND**

- Prevalence of Visual Impairment: Visual impairment is a widespread issue globally, with millions of people affected by various degrees of vision loss. The exact numbers may vary by region, but it's a significant concern in many parts of the world.

- Impact on Daily Life: Visual impairment significantly affects a person's daily life. It can create challenges in mobility, communication, education, and employment opportunities. These challenges often lead to a decreased quality of life.

- Dependency on Assistive Tools: Visually impaired individuals often rely on assistive tools and technologies to navigate their surroundings and

perform daily tasks. Traditional tools like white canes have limitations in detecting obstacles beyond immediate reach.

- Safety Concerns: The inability to detect obstacles, uneven terrain, and environmental hazards can pose serious safety concerns for visually impaired individuals. These hazards can range from low-hanging branches to street furniture and tripping hazards.

- Autonomy and Independence: Achieving greater autonomy and independence is a primary goal for many visually impaired individuals. They aspire to lead fulfilling lives and participate in society as active, self-reliant members.

- Assistive Technology: Advances in technology have opened up opportunities for the development of innovative assistive devices. These technologies aim to improve the quality of life for visually impaired individuals by enhancing their mobility and safety.

- Social and Communication Challenges: Visual impairment can also create challenges in social interactions and communication. It may lead to isolation and hinder the ability to access information independently.

- Accessibility and Inclusion: There is a growing recognition of the importance of accessibility and inclusion for people with disabilities, including those who are visually impaired. Laws and regulations in many countries mandate accessibility standards to ensure equal participation in society.

- Advocacy and Support: There are numerous organizations and advocacy groups dedicated to the well-being of visually impaired individuals. These organizations work to promote awareness, offer support, and push for policies and technologies that enhance the lives of the visually impaired.

- Diversity in Visual Impairment: Visual impairment is not a one-size-fits-all condition. It can range from partial sight to complete blindness, and the specific challenges and needs of individuals can vary widely.

1.3)**SCOPE**

- **Sensor Integration**: The project scope includes the integration of multiple sensors into a blind stick, comprising a water sensor for wet surface detection, a light sensor for assessing ambient lighting conditions, and an ultrasonic sensor for obstacle detection.

- **Safety Enhancement**: The primary scope is to enhance the safety of visually impaired individuals by providing real-time alerts about obstacles, water puddles, and variations in light conditions, helping them avoid potential hazards.

- **Remote-Control Feature**: The project includes the development of a user-friendly remote-control feature, allowing users to locate and retrieve lost sticks easily. This feature is essential for ensuring accessibility and ease of use.

- **Buzzer Alert System**: The scope involves implementing a sound alert system with a buzzer. This system will provide audio cues to alert visually impaired individuals to obstacles and other hazards in their path.

- **Weather Sensing Capability**: A key aspect of the project's scope is the integration of a weather sensing component. This component enables the blind stick to provide real-time weather information, empowering users to make informed decisions about outdoor activities based on current weather conditions.

- **Comprehensive Navigation Tool**: The project aims to create a comprehensive navigation and communication tool for visually impaired individuals, reducing their dependency on traditional white canes and enhancing their autonomy.

- **Testing and Integration**: The scope includes rigorous testing and integration of the various hardware components and software modules to ensure the functionality and reliability of the enhanced blind stick.

- **User-Friendly Design**: The project will prioritize a user-friendly design, ensuring that the integrated technology is intuitive and easy to use for visually impaired individuals.

- **Safety and Accessibility for All Environments**: The project will address obstacles at different heights and environmental conditions to ensure that visually impaired individuals can navigate safely in diverse environments.

- **Potential for Life-Changing Impact**: The ultimate scope of the project is to create a valuable and potentially life-changing solution.

CHAPTER-2

PROJECT OVERVIEW

2.1)Problem Statement:

- Visually impaired individuals face multitude of challenges in navigating their surroundings independently and also through the world around them which restricts their mobility and diminishes their quality of life. The reliance on traditional white canes limits their ability to detect obstacles beyond their immediate vicinity, leaving them vulnerable to potential hazards such as low hanging branches, street furniture, and obstacles at different heights. Furthermore, the absence of a comprehensive navigation and communication tool hinders their autonomy and interaction with their environment.

2.2)Project Objectives:

1. **Enhance Mobility and Independence**: Develop a blind stick with integrated sensors to enhance the mobility and independence of visually impaired individuals.

2. **Improve Safety**: Enhance safety for visually impaired individuals by enabling the detection of obstacles, water puddles, and variations in light conditions.

3. **Address Specific Challenges**: Address challenges related to the limitations of traditional white canes in detecting obstacles beyond the immediate vicinity.

4. **Facilitate Navigation**: Provide a comprehensive navigation tool to improve the navigation and communication capabilities of visually impaired individuals.

5. **Remote Control Feature**: Develop a remote-control feature for lost blind sticks to facilitate easy retrieval, reducing the risk of loss.

6. **Buzzer Alert System**: Implement a sound alert system with a buzzer to provide real-time auditory cues, ensuring users are aware of obstacles and potential hazards.

7. **Weather Sensing Capability**: Integrate a weather sensing component to empower users with real-time weather information, allowing them to make informed decisions about outdoor activities.

8. **Accessibility and Ease of Use**: Ensure the blind stick is accessible and easy to use for visually impaired individuals, promoting greater autonomy and interaction with their environment.

2.3) Literature:

S.No	Title of the Paper	Authors	Name of the journal, year, Volume, Issue	Observation
1	Ultrasonic Blind Stick For Completely Blind People To Avoid Any Kind Of Obstacles	Arnesh Sen, Kaustabh Sen and Jayoti Das	IEEE Sensors, Year-2018, Issue-2	Observed about the operation on avoiding
2	Voice Recognition and Voice Navigation for Blind using GPS	Manisha Bansode, Shivani Jadhav and Angela Kashyap	International Journal of Innovative Research In Electrical, Electronics, Instrumentation and Control Engineering, Year-April 2015, Vol-3, Issue-4	Observed about the Voice Recognition and Navigation module utilization and output
3	Review on Smart Stick for Blind People	Komal Lende, Anuja Muntode, Sanjivani Shelar, Shubhangi Adhav	International Journal of Creative Research Thoughts(IJCRT), Year- March 2021,Vol 3, Issue 3	A study on to style a sensible walking stick

4	IoT based Smart Stick with Automated Obstacle Detector for Blind People	Vyash Natrajan, Yogeshwaran, M,Aroul Canessane	IEEE Sensors, Year-2022, Issue-4	We studied about proposing an automated model for the blind stick used by blind people
5	Modern Blind Stick	Tejaswi N Rao, Guru Charan M A, Punith N, Rakesh Reddy, K Nagesh Pai, Ramdev R C	International Journal of Engineering Reasearch & Technology,Vol.8 Issue 09, September 2019	Observation on Integrating Google API for navigation purpose.
6	Arduino based Smart Blind Stick for People with Vision Loss	P.Rajesh, R.Sairam, M.Dinesh Kumar	7th International Conference on Computing Methodologies and Communication (ICCMC)	Observed the latest technology utilized on the project.
7	Smart Assistance Navigational System for Visually Impaired Individuals	S.Divya, Shubham Raj, M. Praven Shai, A.Jawahar Akash	2019 IEEE International Conference	Studied about the Smart Assistance Navigation System.

2.4)Methodology:

1.**Hardware Component Assembly**:

- A water sensor for detecting wet surfaces, enhancing safety when navigating through rainy or wet environments.
- A light sensor to assess ambient lighting conditions, helping visually impaired individuals adapt to changes in lighting.
- An ultrasonic sensor designed for obstacle detection, providing real-time feedback on objects or obstructions in the user's path.
- A module for location sharing to facilitate communication with caregivers, family members, or emergency services in case of need.

2.**Sound Alert System with Buzzer**:

- To ensure the safety and awareness of visually impaired users, a sound alert system with a buzzer is implemented. This system alerts users to potential hazards and obstacles, enhancing their overall safety while navigating.

3.**Weather Sensing Component Integration**:

- A unique feature of our project is the integration of a weather sensing component. This addition allows the enhanced blind stick to provide real-time weather information. The integration of weather sensing is crucial in helping visually impaired individuals make informed decisions about outdoor activities, considering weather conditions.

2.5)Result:

- **Navigation Enhancement**: The proposed system will provide accurate and real-time navigation assistance for caretaker and integration of sensors to detect obstacles and create safer paths.

- **Weather Sensing Integration**: The system will incorporate weather sensors for real-time weather updates. Mention how users will receive weather alerts and warnings.

- **User-Friendly Interface**: The design considerations for an intuitive interface accessible to the visually impaired.

- **Potential Benefits**: the potential benefits including real-time weather awareness, and enhanced user experience.

2.6)Complete analysis of Project:

Project Title: Enhancing the Functionality of Blind Sticks for Visually Impaired Individuals

Problem Statement Analysis:
Visually impaired individuals face numerous challenges in their daily lives, primarily related to mobility and safety. The reliance on traditional white canes has significant limitations, including the inability to detect obstacles beyond immediate vicinity. This leads to the vulnerability of visually impaired individuals to various potential hazards. Additionally, the absence of a comprehensive navigation and communication tool restricts their autonomy and interaction with the environment.

1. **Solution Analysis**: Your project aims to address the challenges faced by visually impaired individuals by enhancing the functionality of blind sticks. This is to be achieved through the integration of multiple sensors and innovative technologies. The key features of the solution include:

2. **Sensor Integration**: Integration of various sensors like a water sensor for detecting wet surfaces, a light sensor for assessing ambient lighting conditions, and an ultrasonic sensor for obstacle detection.

3. **Safety Enhancement**: The project focuses on improving safety by providing real-time alerts to visually impaired individuals about obstacles, water puddles, and variations in light conditions. This feature aims to reduce the risks associated with mobility.

4. **Remote-Control Feature**: The development of a user-friendly remote-control feature is essential for the project. This feature will assist users in locating and retrieving lost sticks, ensuring accessibility and ease of use.

5. **Buzzer Alert System**: An alert system with a buzzer is to be implemented, which will provide audio cues to alert users to obstacles and other hazards in their path.

6. **Weather Sensing Capability**: The project's unique aspect is the integration of a weather sensing component, enabling the blind stick to provide real-time weather information. This feature empowers users to

make informed decisions about their outdoor activities based on current weather conditions.

Methodology Analysis:

The methodology involves several key steps:

7. **Hardware Integration**: The initial step includes assembling hardware components, including water sensors, light sensors, and ultrasonic sensors, which are essential for detecting various environmental factors that affect mobility and safety.

8. **User Interface Development**: The project involves creating a user-friendly remote-control interface, making the system easy for visually impaired individuals to operate and control.

9. **Sound Alert System Implementation**: The sound alert system with a buzzer is an important element of the project, providing real-time feedback to users about their surroundings.

10. **Weather Sensing Integration**: The integration of a weather sensing component is a significant step, enhancing the safety and convenience of visually impaired individuals by providing real-time weather information.

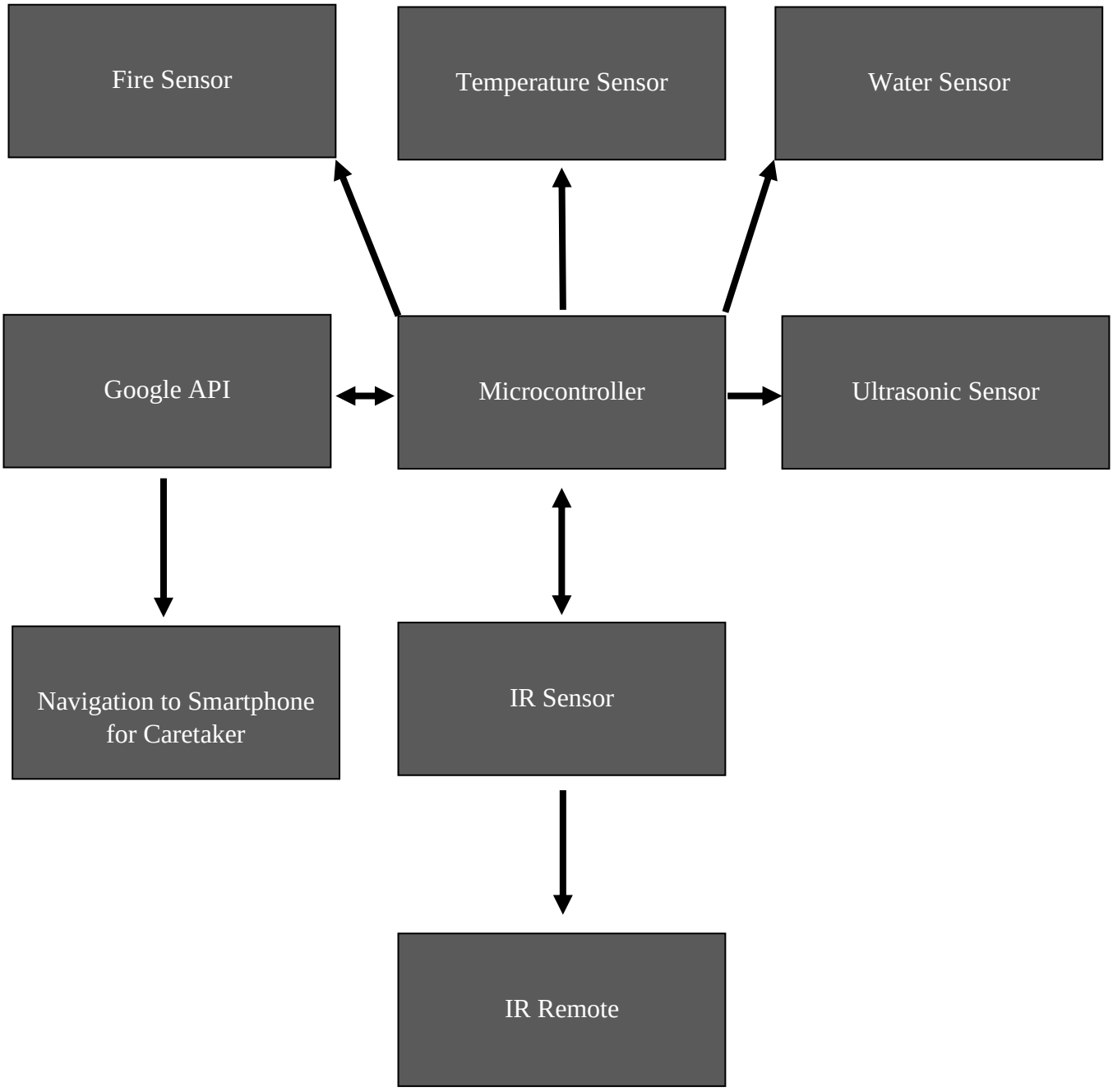
Overall Project Analysis:
Our project addresses a critical issue faced by visually impaired individuals and offers a comprehensive solution to enhance their mobility, safety, and quality of life. By integrating various sensors and innovative technologies into the blind stick, your project aims to provide real-time information and alerts to visually impaired users, helping them navigate their surroundings with increased confidence and autonomy. The incorporation of a weather sensing component adds a unique and valuable feature, enabling users to make informed decisions about outdoor activities.

2.7)Technology Used:

Sensors Integration: The project involves the integration of various sensors, including:

1. **Water Sensor**: Used for detecting wet surfaces and water puddles.
2. Light Sensor: Utilized to assess ambient lighting conditions, providing information about the lighting environment.
3. **Ultrasonic Sensor**: Employed for obstacle detection, helping the blind stick detect objects and obstacles in the user's path.
4. **Weather Sensing Component**: Integrated to sense and provide real-time weather information, enabling users to make informed decisions about outdoor activities based on weather conditions.
5. **Hardware Components**: The project includes the assembly of hardware components to support the sensors and their functionality. This involves the physical integration of these components into the design of the blind stick.
6. **Remote-Control Interface**: A user-friendly remote-control interface is developed as part of the project. While the specific technology behind the interface isn't detailed in the provided information, it could involve wireless communication technology, such as Bluetooth or radio frequency (RF), to interact with the blind stick.
7. **Sound Alert System**: The project implements a sound alert system with a buzzer to provide audio cues and alerts to the user. The sound alert system may use audio technology and speakers to convey important information and warnings.
8. **Location Sharing Module**: Mentioned in the methodology, a location sharing module is integrated, although specific technology details are not provided. This could involve GPS technology, wireless communication, or other positioning systems.

2.8)Circuit Diagram:



2.9)Project photos:

2.10)Conclusion:

- This project addresses a critical and pressing issue faced by visually impaired individuals – the challenges in navigating their surroundings independently and safely. The reliance on traditional white canes, while valuable, falls short in enabling them to detect obstacles beyond their immediate vicinity, leaving them susceptible to potential hazards and limiting their autonomy and quality of life.

- The proposed solution offers a comprehensive and innovative approach to enhance the functionality of the blind stick, making it more than just a mobility aid. By integrating a range of sensors, including those for obstacle detection, water puddle sensing, ambient light assessment, and even real-time weather information, our project empowers visually impaired individuals to navigate their environments with increased safety and confidence.

- The project's unique and transformative aspect is its ability to sense and provide real-time weather information, enabling visually impaired individuals to make informed decisions about their outdoor activities. It goes beyond the traditional functionalities of a white cane and offers a potential life-changing solution.

References:

[1]Y. F. S. Kom, E. Andiono, and M. Khamali, “Aplikasi Object Detection and Tracking Untuk Penyandang Tunanetra dengan Internet of Things (IoT)(Menggunakan Bahasa Pemrograman
Phyton),” J. Informatics, Sci. Technol., vol. 10, no. 1, pp. 1–6, 2020.

[2] S. Budilaksono et al., “Designing an Ultrasonic Sensor Stick Prototype for Blind People,” J. Phys. Conf. Ser., vol. 1471, no. 1, 2020.

[3] T. Supriyadi, P. N. Bandung, and B. Barat, “Tongkat Pintar Sebagai Alat Bantu Pemantau Keberadaan Penyandang Tunanetra Melalui Smartphone,” pp. 181–191, 2018.

[4] S.-J. Kang, Y. Ho, and I. H. Moon, “Development of an intelligent guide-stick for the blind,” in Proceedings 2001 ICRA. IEEE International Conference on Robotics and Automation (Cat. No.
01CH37164), 2001, vol. 4, pp. 3208–3213.

[5] N. Dey, A. Paul, P. Ghosh, C. Mukherjee, R. De, and S. Dey, “Ultrasonic Sensor-Based Smart Blind Stick,” Proc. 2018 Int. Conf. Curr. Trends Tower. Converging Technol. ICC CT 2018, no. April 2020, pp. 1–4, 2018.

[6] A. A. Nada, M. A. Fakhr, and A. F. Seddik, “Assistive infrared sensor-based smart stick for blind people,” in 2015 science and information conference (SAI), 2015, pp. 1149–1154.

[7] M. P. Agrawal and A. R. Gupta, “Smart Stick for the Blind and Visually Impaired People,” Proc. Int. Conf. Inven. Commun. Comput. Technol. ICICCT 2018, no. Icicct, pp. 542–545, 2018.

PO & PSO Attainment:

PO.No	Graduate Attribute	Attained	Justification
PO 1	**Engineering knowledge**	Yes / No	
PO 2	**Problem analysis**	Yes / No	
PO 3	**Design/Development of solutions**	Yes / No	
PO 4	**Conduct investigations of complex problems**	Yes / No	
PO 5	**Modern Tool usage**	Yes / No	
PO 6	**The Engineer and society**	Yes / No	
PO 7	**Environment and Sustainability**	Yes / No	
PO 8	**Ethics**	Yes / No	
PO 9	**Individual and team work**	Yes / No	
PO 10	**Communication**	Yes / No	
PO 11	**Project management and finance**	Yes / No	
PO 12	**Life-long learning**	Yes / No	

PSO.No	Graduate Attribute	Attained	Justification
PSO 1	To analyze, design and develop solutions by applying the concepts of Robotics for societal and industrial needs.	**Yes/No**	
PSO 2	To create innovative ideas and solutions for real time problems in Manufacturing sector by adapting the automation tools and technologies.	**Yes/No**	