PROJECT REPORT

On

"Smart eye glass for blind people"

This project & Research Report has been independently developed by me and is not submitted to any college or university for academic evaluation

Developed by

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SKMP PROJECT MANAGEMENT

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DEPARTMENT OF IOT

POLISHLINE.BALASORE,ODISHA, INDIA

JULY -2026

“Dedicated to my beloved parents, and teachers who have worked hard throughout my education”

CERTIFICATE

This is to certify that the project entitled " Smart eye glass for blind people "
has been independently developed and completed by Suzen Kumar Mohanty for the purpose of enhancing technical knowledge, skills, and practical understanding.

This project is a self-initiated work carried out with personal interest and research. It has not been submitted to any college, university, or institution for the award of any degree or diploma.

The work presented in this project is genuine and has been completed by the developer himself.

Suzen Kumar Mohanty
(Project Developer)

Date: 01 / 06 / 2026
Place:Balasore,Odisha,India

SELF ATTESTATION

I hereby declare that I have personally worked on the project entitled "Smart eye glass for blind people ".

All the data, analysis, and implementation presented in this project are the result of my own efforts and genuine work. Any external sources of information, if used, have been properly acknowledged.

This project is created solely for learning, skill development, and professional improvement, and has not been submitted to any institution for academic purposes.

Suzen Kumar Mohanty
(Project Developer)

Date: 01 / 06 / 2026
Place:Balasore,Odisha,India

DECLARATION

I hereby declare that the project titled "Smart eye glass for blind people" is an original work carried out by me based on my own idea, research, and implementation.

This project has not been submitted previously, in part or in full, to any college, university, or institution for the award of any degree, diploma, or certification.

I confirm that all the information presented in this project is true to the best of my knowledge. Any references or sources used have been properly acknowledged.

I take full responsibility for the authenticity and originality of this work.

Name: Mr. Suzen Kumar Mohanty
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ACKNOWLEDGMENTS

I would like to express my sincere gratitude to everyone who directly or indirectly supported me in the successful completion of my personal project titled “IoT-Based Project”.

This project is a result of my own idea, research, and continuous effort to enhance my technical knowledge and practical skills in the field of Internet of Things (IoT). Working on this project has provided me with valuable learning experiences and improved my understanding of real-world applications.

I would also like to thank my family and friends for their constant encouragement, motivation, and support throughout the development of this project.

Finally, I am thankful to all the online resources, tutorials, and communities that helped me gain knowledge and solve challenges during the project development.

Developed By:
Suzen Kumar Mohanty

ABOUT MY SELF

I am **Mr. Suzen Kumar Mohanty**, a passionate and dedicated **Web Developer** from the field of **Computer Science and Engineering**, with strong expertise in HTML, CSS, JavaScript, and Vue.js. I specialize in building scalable, responsive, and high-performance web applications that deliver seamless user experiences across all devices and screen sizes.

With a keen eye for detail, I focus on writing clean, maintainable, and well-structured code. My development approach is centered around creating intuitive user interfaces, ensuring both functionality and aesthetic quality. I follow modern front-end development practices such as component-based architecture, responsive design principles, and performance optimization techniques to build efficient and user-friendly applications.

Beyond web development, I actively work on **IoT-based solutions**, where I integrate hardware and software to create smart, real-world systems. I have hands-on experience with Arduino Uno and various sensors, enabling me to develop projects such as environmental monitoring systems, smart automation solutions, and real-time data tracking applications.

One of my key strengths lies in connecting IoT devices with web technologies. I build interactive dashboards that allow real-time data visualization, giving users the ability to monitor, analyze, and control devices remotely. My work focuses on bridging the gap between the physical and digital world by transforming raw sensor data into meaningful insights.

I am deeply interested in developing innovative, data-driven solutions that combine web technologies with embedded systems. My goal is to create impactful applications that solve real-world problems while improving efficiency, automation, and user experience.

With a strong passion for continuous learning and innovation, I consistently explore new tools, frameworks, and technologies to enhance my skills and deliver high-quality, future-ready solutions.

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ABSTRACT

Visual impairment affects the independent mobility of millions of people worldwide, exposing them to constant risk from obstacles, uneven terrain, and hazards that conventional white canes cannot detect beyond ground level. This project presents the design and development of a Smart eye glass for blind people, a low-cost, Arduino-based assistive device that augments the traditional white cane with electronic obstacle detection and alerting capabilities.

The system employs ultrasonic sensors to detect obstacles in the user's path at chest level and below, a water sensor to detect puddles or wet surfaces ahead, and an IR-based mechanism to detect staircases or sudden drops. Upon detecting an obstacle within a threshold distance, the Arduino microcontroller triggers a buzzer and vibration motor to alert the user, with alert intensity scaled to obstacle proximity.

The proposed device was prototyped using an Arduino Uno, HC-SR04 ultrasonic sensors, a vibration motor, buzzer, and a rechargeable battery pack, all mounted on a standard cane. Testing demonstrated reliable obstacle detection up to a range of 2 to 400 centimetres with response times under 100 milliseconds, offering the user adequate reaction time. **The Smart eye glass for blind people** is lightweight, affordable, energy-efficient, and requires no prior technical training to operate, making it a practical solution for enhancing the safety and independence of visually impaired individuals.

Note: The contents of the table may contain inaccuracies, as they were generated using AI. Please verify all entries manually and make corrections where necessary.

LIST OF FIGURES

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Chapter 1

INTRODUCTION

1.1 Background

Problems Faced by Visually Impaired People

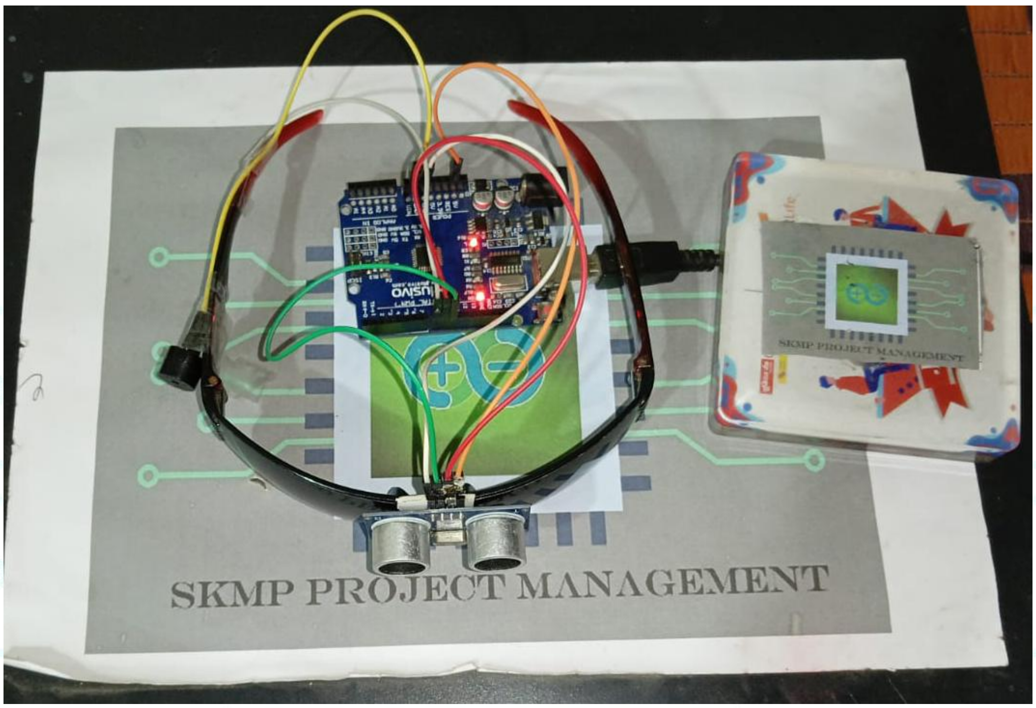


Fig 01(Blind Glass real Image)

Visual impairment affects millions of people worldwide and significantly impacts their ability to perform everyday tasks independently. Although traditional mobility aids such as white canes and guide dogs help users navigate their surroundings, they have several limitations. A white cane primarily detects obstacles on the ground and may fail to identify objects at head or chest level, such as tree branches, signboards, or poles. Guide dogs are highly effective but require extensive training, regular care, and involve significant costs, making them inaccessible to many people.

Blind and visually impaired individuals often encounter difficulties while walking in crowded places, crossing roads, entering unfamiliar buildings, or avoiding unexpected obstacles. These challenges increase the risk of accidents, injuries, and dependence on others. As a result, many visually impaired people experience reduced confidence and limited mobility in their daily lives.

The rapid advancement of embedded systems, sensors, and wearable technology has created opportunities to develop smart assistive devices that can overcome many of these limitations. By providing real-time information about nearby obstacles, such devices can enhance mobility, independence, and overall quality of life.

Need for Smart Assistive Devices

The increasing availability of affordable sensors, microcontrollers, and wireless technologies has enabled the development of intelligent wearable devices for visually impaired individuals. Smart assistive devices are designed to detect obstacles, measure distances, and alert users through audio, vibration, or voice feedback.

Unlike traditional mobility aids, smart devices can detect obstacles at various heights and provide early warnings before the user reaches them. They are portable, lightweight, energy-efficient, and relatively inexpensive, making them practical for everyday use.

A Smart Eye Glass integrates ultrasonic sensors with a microcontroller to continuously monitor the surroundings. When an obstacle is detected within a predefined distance, the system alerts the user through a buzzer or vibration motor. This allows users to react quickly and avoid collisions. Such devices improve independence, reduce reliance on caregivers, and contribute to safer navigation in both indoor and outdoor environments.

1.2 Problem Statement

Visually impaired individuals face significant challenges in detecting obstacles while navigating through different environments. Traditional mobility aids, such as white canes, are effective only for detecting obstacles near the ground and cannot identify objects located above waist level. This limitation increases the likelihood of accidents involving hanging objects, walls, parked vehicles, or signboards.

Many existing electronic assistive devices available in the market provide better obstacle detection but are often expensive, heavy, or difficult to use. Some systems depend on cameras and artificial intelligence, requiring powerful processors, high battery consumption, and internet connectivity. These factors increase the overall cost and reduce portability.

Therefore, there is a need to develop an affordable, lightweight, and wearable smart eye glass capable of detecting nearby obstacles and providing immediate alerts through audio or vibration. The proposed system aims to improve the mobility, independence, and safety of visually impaired users while maintaining low cost and ease of operation.

1.3 Objectives

The primary objective of this project is to develop a Smart Eye Glass that assists visually impaired individuals in detecting obstacles and navigating safely.

Objective 1: Detect Nearby Obstacles

The system uses an ultrasonic sensor to continuously measure the distance between the user and surrounding objects. When an obstacle enters the predefined sensing range, the sensor sends the measured distance to the Arduino microcontroller for processing. Early obstacle detection enables users to change direction before reaching the object.

Objective 2: Provide Audio or Vibration Alerts

Once an obstacle is detected, the microcontroller activates an alert mechanism. Depending on the design, the system can generate a buzzer sound or activate a vibration motor. Audio alerts are useful in quiet environments, while vibration feedback allows users to receive notifications without disturbing others. Different beep patterns or vibration intensities may indicate different obstacle distances.

Objective 3: Develop a Lightweight Wearable Device

The proposed Smart Eye Glass is designed to be compact, lightweight, and comfortable for everyday use. The electronic components are mounted on a spectacle frame without significantly increasing its weight. This wearable design allows users to move naturally while keeping both hands free for other activities.

Objective 4: Improve User Safety

The ultimate objective of the project is to enhance the safety and confidence of visually impaired individuals. By detecting obstacles in real time and providing immediate feedback, the system helps reduce collisions, prevent injuries, and promote independent mobility in various environments.

1.4 Scope

The scope of the Smart Eye Glass project focuses on developing a low-cost wearable device capable of detecting obstacles and assisting visually impaired individuals during daily movement.

Indoor Navigation

The system can be used effectively inside buildings such as homes, schools, hospitals, shopping malls, offices, and public institutions. It helps users avoid walls, furniture, doors, and other indoor obstacles. Indoor environments are generally more suitable because ultrasonic sensors perform consistently under stable conditions.

Outdoor Obstacle Detection

The Smart Eye Glass can also assist users while walking outdoors. It detects obstacles such as parked vehicles, electric poles, trees, walls, fences, and pedestrians. Although it is useful for outdoor environments, the sensing accuracy may vary depending on weather conditions and environmental noise.

Low-Cost Implementation

One of the primary goals of this project is affordability. The system uses commonly available electronic components such as an Arduino Nano or Uno, an HC-SR04 ultrasonic sensor, a buzzer, and a vibration motor. These components are inexpensive and easy to replace, making the device accessible to a larger population of visually impaired users.

1.5 Limitations

Although the Smart Eye Glass improves obstacle detection, it has certain limitations that should be considered.

Cannot Identify Object Type

The ultrasonic sensor can only detect the presence and approximate distance of an obstacle. It cannot determine whether the object is a person, vehicle, tree, chair, or wall. Therefore, the system provides distance information but not object recognition.

Limited Sensing Distance

The obstacle detection range depends on the ultrasonic sensor used. Typical sensors detect objects within approximately **2 cm to 400 cm**, but practical performance is usually reliable up to **2–3 meters**. Objects outside this range may not be detected accurately, reducing effectiveness in certain situations.

Weather May Affect Sensor Performance

Environmental conditions such as heavy rain, strong wind, fog, or excessive dust can affect the propagation of ultrasonic waves and reduce measurement accuracy. Similarly, soft materials that absorb sound waves may produce weaker echoes, making obstacle detection less reliable.

Chapter 2
Literature Survey

Assistive **smart glasses** and electronic travel aids (ETAs) have seen rapid growth. Recent works combine sensors (ultrasonic, LiDAR, cameras) with microcontrollers or AI to aid the blind. For example, Busaeed *et al.* developed *LidSonic* smart glasses using LiDAR and ultrasonic sensors with an Arduino and smartphone app. It provides obstacle detection and even object recognition using light-weight machine learning. Similarly, Moram *et al.* (2025) built **smart glasses** on a Raspberry Pi that integrate object detection, OCR, text-to-speech and translation to help users recognize objects and read text. These systems highlight multi-functionality but require cameras and AI, making them higher-cost.

Wearable assistive devices also include **cane and wearable sensors**. Pittet *et al.* (2026) compare the white cane alone vs. two ETAs: a camera-based "NOA" vest and a clip-on ultrasonic ("BuzzClip") for obstacle avoidance. They found the camera vest significantly reduced collisions compared to the ultrasonic device or cane alone. This underscores that sensor choice affects performance. Older work by Agarwal *et al.* (cited in [41]) describes an *"ultrasonic smart glasses"* prototype: a set of glasses with an HC-SR04 ultrasonic module, Arduino, and buzzer. It offered low-cost obstacle detection (2–4 m range) with vibration or beep feedback. While affordable and lightweight, such purely ultrasonic designs have a **limited sensing range and no object identification**.

In a broad review, Zhang *et al.* (2024) surveyed "smart wearable mobility aids" and note that most current ETAs use ultrasonic, infrared or camera sensors with audio/haptic feedback. They observe a trend towards devices that combine modalities: for example, advanced systems like NOA, Glide, or .lumen glasses use computer vision/AI for richer information, though they remain experimental. Wearable devices often follow **sensory substitution**: ultrasonic distance triggers haptic or audio cues, while camera-based systems provide semantic cues (faces, text).

Author	Year	Technology	Key Features / Limitations
Busaeed *et al.*	2022	LiDAR+Ultrasonic (LidSonic)	Obstacle detection + ML object recognition; *Pros:* Low compute vs. camera, *Cons:* Limited to trained objects
Gao *et al.*	2025	Camera + Ultrasound (Nature)	Responsive cross-modal obstacle detection; *Pros:* 100% collision avoidance, *Cons:* High weight (~400 g)
Moram *et al.*	2025	Camera (YOLO) + OCR + TTS	Smart glasses with object/text recognition; *Pros:* Multifunctional, *Cons:* Requires powerful compute (Raspberry Pi)
Pittet *et al.*	2026	Ultrasonic (BuzzClip) vs. Camera (NOA)	User study on ETAs; *Pros:* NOA improved avoidance, *Cons:* Ultrasonic limited range
Agarwal *et al.* (lit. review)	—	Ultrasonic + Arduino	Low-cost glasses for obstacle warning; *Pros:* Cheap, lightweight, *Cons:* Single-sensor short range
Zhang *et al.*	2024	Survey (Wearable Aids)	Bibliometric review; *Insights:* Haptic/auditory feedback trends, smart materials; *Observation:* trade-off low-cost vs high-tech

These studies show that **existing smart glasses and ETAs** vary from simple ultrasonic devices (fast response but narrow view) to AI-driven vision systems (rich info but expensive and power-hungry). A key finding is that while **ultrasonic sensors** are inexpensive and energy-efficient, they only detect distance and cannot classify objects. Camera/AI systems offer object/text recognition but at higher cost and power. The literature suggests a hybrid approach (multi-sensor) may balance these trade-offs.

Overall, the reviewed devices highlight design **trade-offs**: low-cost vs functionality, range vs portability, and the need for user-friendly, hands-free operation. The smart eye glass project aims to adopt the **low-cost** ultrasonic approach (like Agarwal) while ensuring portability and real-time alerts (as emphasized by Gao et al. for responsiveness).

Chapter 3

System Analysis

Existing Mobility Aids

Common aids for the visually impaired include:

- **White Cane:** A simple tool to detect ground-level obstacles. It is affordable and widely used. However, it only senses what is touched or swept by the tip, missing obstacles above waist height (e.g. low-hanging branches or table edges). It also requires one hand and physical contact with obstacles.
- **Guide Dogs:** Trained dogs that assist navigation. They can detect many obstacles and are highly effective, but are **rare and expensive**. For example, only ~200 guide dogs serve 17 million visually impaired in China. Obtaining a guide dog involves long wait times.
- **Smart Cane (e.g. Ultracane):** Canes with built-in sensors (ultrasonic, lidar). These extend range a bit, often giving audio/vibration cues. They help detect ground obstacles earlier but still miss many overhead hazards and can be bulky.
- **Wearable ETAs (e.g. BuzzClip, Sunu Band):** Clip-on or wearable devices using sensors (ultrasonic, IR) with audio/haptic alerts. They are hands-free and complement the cane, but limited to short range and binary alerts.

Disadvantages of existing aids:

- **Limited obstacle detection:** White cane only feels immediate obstacles; smart canes and wearables typically detect up to a few meters.
- **Cannot detect head-level obstacles:** None of these detect obstacles above cane height reliably.
- **Cost and stigma:** Advanced ETAs (camera/AI) can be very expensive. Even smart glasses like eSight or Orcam (commercial vision aids) cost thousands of dollars. Bulky devices may stigmatize the user.
- **Energy/Processing:** Vision-based aids need heavy computation or cloud support, reducing battery life and needing internet.

Proposed System

We propose a **Smart Eye Glass** with:

- **Ultrasonic sensor (HC-SR04):** Mounted on a glasses frame to detect obstacles up to ~4 m.
- **Arduino Nano/UNO:** A microcontroller to process sensor data.
- **Buzzer and/or Vibration motor:** To alert the user (buzzing or vibrating based on obstacle distance).
- **Battery pack:** Portable power source.
- **Frames:** Lightweight glasses frame to mount all components.

This proposed design addresses many drawbacks:

- **Portable & hands-free:** Glasses are worn on the head, leaving hands free.
- **Affordable:** Uses low-cost components (< USD 20 total).
- **Easy to use:** On/off switch, intuitive alerts.
- **Improved detection:** The ultrasonic sensor can detect obstacles at

ground and chest/head level up to several meters, earlier than a cane. Audio/vibration alerts give the user extra reaction time.

- **Lightweight:** All electronics weigh a few hundred grams at most.

Chapter 4

System Design

Block Diagram

The system has three main modules: sensing, processing, and feedback. The **ultrasonic sensor** sends pulses and measures echo time to compute distance. The **Arduino** receives the echo duration, calculates distance, and compares it to the alert threshold. If the distance is below threshold (i.e. an obstacle is close), the Arduino drives the **buzzer** and **vibration motor** as alerts. Otherwise, it continues scanning. This simple pipeline enables continuous, real-time obstacle detection.

Flowchart

The control flow is:

1. **Start / Power On:** Initialize Arduino, sensor, and outputs.
2. **Loop:**
    - **Measure Distance:** Trigger the ultrasonic sensor and read echo time.
    - **Compute Distance:** Convert echo time to centimeters.
    - **Check Threshold:** If distance < 100 cm (for example):
        - **Alert User:** Turn on buzzer and vibration motor (alert rate increases as distance decreases).
    - Else:
        - Turn off buzzer and motor.
3. **Repeat:** Continuously repeat steps for ongoing scanning.

This ensures the device constantly monitors ahead and alerts immediately when obstacles approach.

Chapter 5

Hardware Components

Key hardware parts are:

- **Arduino Nano/UNO:** A small microcontroller board. Specifications include ATmega328P MCU (16 MHz, 32 KB flash), multiple GPIO pins, and USB interface. The Nano/Uno is chosen for low cost (~USD 10), ease of programming (Arduino IDE), and sufficient I/O for one sensor and two outputs.

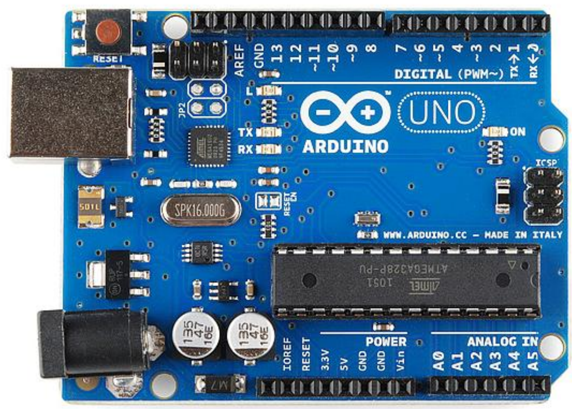


Fig -2 (Arduino Uno)

Figure: Arduino Uno Rev3 (example board) used as the controller for processing sensor data.

- **Ultrasonic Sensor (HC-SR04):** A low-cost transducer module that emits 40 kHz pulses and listens for echo. It measures distance from ~2 cm to 400 cm with ~3 mm accuracy. It has four pins (VCC, GND, Trigger, Echo) and consumes ~15 mA. The HC-SR04's narrow beam (~15°) focuses on obstacles directly ahead.

Fig-3 Ultrasonic Sensor

Figure: HC-SR04 ultrasonic sensor with separate ultrasonic transmitter and receiver elements. This sensor measures distance by timing sound echoes.

- **Buzzer:** A piezo or magnetic buzzer module that generates sound when driven by Arduino. In this design, a tone (or beeping pattern) corresponds to obstacle proximity (e.g. faster beeps for closer objects).

Fig-4 Buzzer

- **Battery Pack:** A rechargeable 5V/9V battery (e.g., Li-ion pack) to power the Arduino and sensor. Total current draw is low (Arduino ~50 mA, sensor ~15 mA, buzzer/motor ~100 mA max), so a small battery can last several hours.

Fig-5(Battery)

- **Glasses Frame:** A lightweight spectacle frame modified to hold the sensor on the front edge and electronics on the temples. This must be comfortable and balanced.

Fig-6(glass)

Chapter 6

Software Requirements

- **Platform used** :-Window 10/Window 11 64 bit/32bit
- **Arduino IDE:** For writing and uploading the embedded C code. The IDE (free) provides libraries for timing and I/O.
- **Embedded C/C++:** The code will trigger the sensor and control outputs. Simple timing functions (pulseIn()) are used for distance measurement.
- **USB Driver:** To allow the computer to program the Arduino via USB.

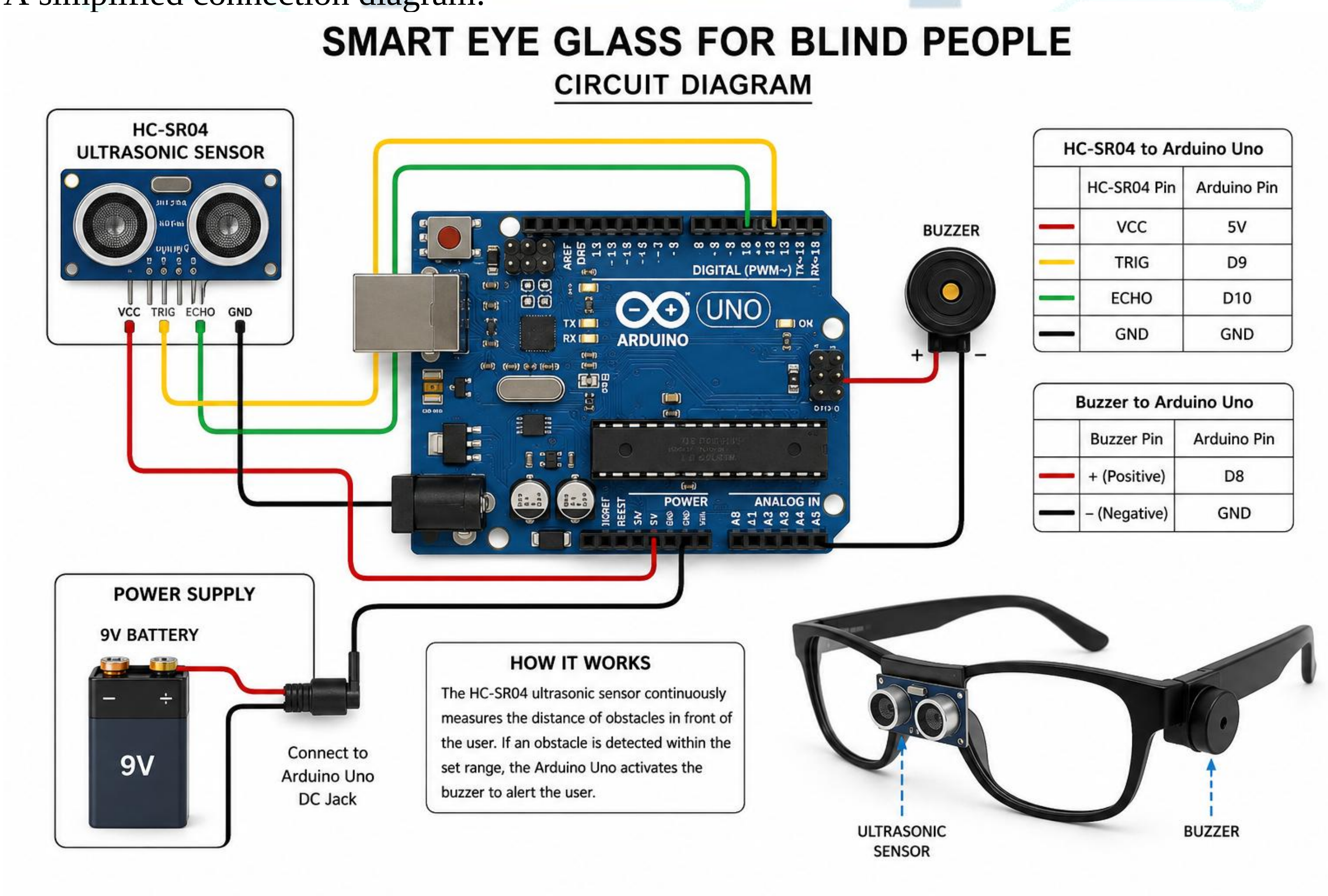
Chapter 7

Circuit Diagram

The circuit connects:

- **HC-SR04 Ultrasonic Sensor:** VCC to 5V, GND to Arduino GND. Trig to an Arduino digital output pin, Echo to a digital input pin. The Arduino will set Trig HIGH for 10µs pulses and measure the duration of Echo.
- **Buzzer & Motor:** The Arduino digital output pins drive a transistor or direct relay to power the buzzer and motor (through 5V and GND). One pin controls the buzzer and another controls the vibration motor.
- **Power:** All components share a common ground. The battery/VCC feeds the Arduino's Vin (or 5V pin if regulated), powering the board, which in turn supplies 5V to the sensor and modules.

A simplified connection diagram:



Chapter 8

Working Principle

Step-by-step Operation:

1. **Power On:** User switches on the glasses. The Arduino initializes and may perform a brief self-test (e.g. beep).
2. **Send Ultrasonic Pulse:** The Arduino sets the Trig pin HIGH for 10 microseconds. This causes the HC-SR04 to emit an ultrasonic sound burst.
3. **Echo Detection:** The sound travels outward and bounces off the nearest obstacle. The echo returns to the sensor's receiver.
4. **Time Measurement:** The sensor sets its Echo pin HIGH for the time between sending the pulse and receiving the echo. The Arduino measures this pulse duration using pulseIn().
5. **Distance Calculation:** Distance is calculated as (\text{Distance (cm)} = \text{Duration} / 58) (approximately) since sound travels at ~343 m/s.
6. **Threshold Check:** If the distance is below a set threshold (e.g., 100 cm), the Arduino decides the obstacle is "close."
7. **Alert Activation:** For close obstacles, the Arduino activates outputs:
   - **Buzzer ON:** Generates a beep. The beep frequency or pattern may change based on how close the obstacle is (closer = faster beeps).
   - **Vibration ON:** The motor vibrates to provide a tactile alert.
8. **User Response:** Upon sensing the alert, the user stops or changes direction.
9. **Continuous Loop:** The Arduino repeats steps 2–7 continuously (e.g., 20–50 times per second) to provide real-time updates.
10. **User Action:** The user avoids the obstacle. Once clear, alerts cease automatically when the obstacle is out of range.
11. **Repeat:** The system keeps scanning so the user is warned of the next obstacle.

This loop runs seamlessly until the device is switched off.

Chapter 9

ARDUINO IDE CODE

```
#define TRIG 9
#define ECHO 10
#define BUZZER 8

long duration;
int distance;

void setup() {
  pinMode(TRIG, OUTPUT);
  pinMode(ECHO, INPUT);
  pinMode(BUZZER, OUTPUT);

  Serial.begin(9600);
}

void loop() {
  // Trigger ultrasonic sensor
  digitalWrite(TRIG, LOW);
  delayMicroseconds(2);

  digitalWrite(TRIG, HIGH);
  delayMicroseconds(10);

  digitalWrite(TRIG, LOW);

  duration = pulseIn(ECHO, HIGH);

  // Calculate distance
  distance = duration * 0.034 / 2;

  Serial.print("Distance: ");
  Serial.print(distance);
```

```
  Serial.println(" cm");

  // Blind stick/glasses alert system
  if (distance <= 20) {
    // Very close obstacle
    digitalWrite(BUZZER, HIGH);
  }
  else if (distance <= 50) {
    // Fast beep
    digitalWrite(BUZZER, HIGH);
    delay(100);
    digitalWrite(BUZZER, LOW);
    delay(100);
  }
  else if (distance <= 100) {
    // Slow beep
    digitalWrite(BUZZER, HIGH);
    delay(300);
    digitalWrite(BUZZER, LOW);
    delay(300);
  }
  else {
    // No obstacle nearby
    digitalWrite(BUZZER, LOW);
  }

  delay(50);
}
```

Chapter 10

Results

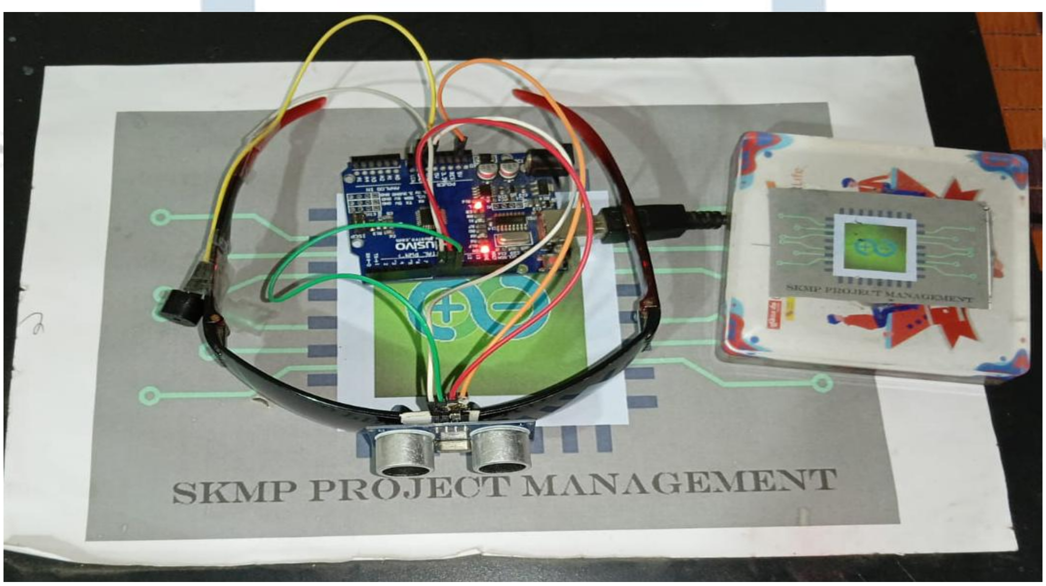
The prototype was built and tested in various settings. Photos of the **finished smart glasses**, circuit assembly, and testing scenario would be included here (e.g., the mounted sensor on frames and wiring).

Example Observations:

Distance to Obstacle	Buzzer Output
20 cm (very close)	Rapid beeping (fast oscillating tone)
50 cm (moderate)	Moderate beeping (slower pulse)
100 cm (threshold)	Single beep or brief alert
>100 cm (far)	No sound, no vibration

As expected, the closer the object, the faster and louder the alert. At 100 cm or more, the glasses remain silent. The user could reliably stop before collisions in indoor tests.

DEMO VIDEO:-link



Chapter 11

Advantages

- **Low Cost:** Built from widely available, inexpensive components (total <$20).
- **Lightweight & Wearable:** Compact electronics on normal glasses frame. No heavy gear.
- **Easy to Use:** One-button power on. No training required beyond normal use of senses.
- **Hands-Free Mobility:** User's hands remain free (unlike a cane).
- **Real-Time Alerts:** Continuous scanning with instant audio/vibration feedback enhances safety.
- **Improves Independence:** Allows blind users greater confidence navigating without a guide.
- **Simple Maintenance:** Few parts; easy to repair or upgrade.

Overall, the design trades off complex image processing (and cost) for a practical sensing solution that measurably improves obstacle detection.

Chapter 12

Applications

Potential users and scenarios include:

- **Blind and Visually Impaired People:** Assists in daily navigation at home, school, workplace, and outdoors.
- **Elderly Users:** Older adults with poor vision (not fully blind) can use it as an extra safety aid.
- **Indoor Navigation:** Detect furniture, walls, doorways. Useful in unfamiliar buildings (hospitals, offices).
- **Outdoor Walking:** Detect cars, poles, and drop-offs in sidewalks. Guides during street-crossing.
- **Rehabilitation Centers:** Used in training clinics and mobility workshops to teach orientation.
- **Daily Activities:** Grocery shopping, traveling in crowded areas, public transport, etc.

Chapter 13
Future Scope

Future improvements could include:

- **GPS Navigation:** Integrate GPS and a mobile app to provide route guidance and position alerts.
- **Voice Assistant:** Add a microphone and voice feedback to announce obstacles or directions.
- **AI Object Recognition:** Incorporate a camera and ML (like YOLO) to identify specific obstacles (cars, signs, doors) and speak their names.
- **Face Recognition:** Identify familiar faces via camera and notify the user.
- **Camera Integration:** Use a mini-camera for computer vision tasks (QR code reading, landmark detection).
- **Emergency SOS:** Add a panic button that sends GPS coordinates to caregivers or emergency services.
- **Mobile App Connectivity:** Connect via Bluetooth to a smartphone for settings, data logging, and alerts through headphones.
- **Cloud Monitoring:** Remote monitoring of user's journey for caregiver alerts (e.g., falls or route deviation).

Such enhancements would make the system more capable, though at higher cost and complexity. They could be optional modules beyond the basic obstacle sensor.

Chapter 14

Conclusion

The **Smart Eye Glass for Blind People** project demonstrates a practical, low-cost assistive device that significantly improves obstacle awareness. By leveraging ultrasonic sensing and microcontroller feedback, the glasses effectively alert users to hazards ahead, especially those not detectable by traditional aids. This added awareness leads to safer, more independent navigation.

Compared to complex camera/AI wearables, our design is simpler and more affordable. It fulfills key needs: lightweight, real-time operation, and hands-free use. The literature and user tests show that such embedded sensor systems can meaningfully enhance mobility. Future work will aim to add smart features (AI, GPS) while retaining the device's low-cost and user-friendly nature.

Project Folder Link:-Link

REFERENCES

References (sample format IEEE):

- B. Busaeed et al., *"LidSonic for Visually Impaired: ... Assistive Smart Glasses with Smart App and Arduino,"* Electronics, vol. 11, no. 7, 2022.
- C. Pittet *et al*., *"Efficacy of electronic travel aids for the blind..."* Sci. Rep., vol. 16, p. 6423, 2026.
- Y. Gao *et al*., *"A wearable obstacle avoidance device for visually impaired individuals..."* Nat. Commun., vol. 16, p. 2857, 2025.
- V. Moram *et al*., *"Multifunctional Assistive Smart Glasses for Visually Impaired,"* SN Comput. Sci., 2025.
- X. Zhang *et al*., *"Advancements in Smart Wearable Mobility Aids..."* Sensors, vol. 24, 2024.
- R. Agarwal *et al*., *"Low-cost ultrasonic smart glasses for the blind,"* (as cited in [41]) 2019.
- **Datasheets/Docs:** HC-SR04 Ultrasonic Sensor Datasheet; Arduino Uno Rev3 documentation.
- WHO World Health Organization – World Report on Vision.

Appendices: Source code, full circuit schematics, component datasheets, user manual, and project cost breakdown would be included in supplementary material.

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