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# A Study on Iot-Enabled Smart Glasses for Visually Impaired

**Hasna T[1], Mr. P. Boopathi[2], AnuKeerthana S[3], Athul K Das[4], Gulshan kumar[5], Fathima S[6]**

[1]hasnaworkcontact@gmail.com

[2]Assistant Professor, Department of Computer Applications, Nehru Arts and Science College. Coimbator.

Email ID: boopathimca1985@gmail.com

[3]anukeerthanasivarajkavitha@gmail.com

[4]athulkdas7@gmail.com

[5]gulshankkumarmandal@gmail.com

[6]fathimasmm786@gmail.com

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**ABSTRACT**

IoT-enabled smart glasses for visually impaired individuals aim to provide real-time assistance by detecting obstacles and offering navigational support. This paper presents a novel approach to developing smart glasses integrated with IoT technologies, incorporating ultrasonic sensors, GPS, and NodeMCU ESP8266 to enhance the mobility and safety of visually impaired users. The system uses ultrasonic sensors to detect obstacles and provides feedback through a buzzer. A GPS module transmits real-time location data, including latitude and longitude, to the Esskay Live online platform. The proposed system aims to reduce mobility challenges and provide an affordable, user-friendly solution. The effectiveness of the system is evaluated through a prototype, demonstrating its potential to improve navigation for visually impaired individuals.

**Keywords** *IoT, Smart Glasses, Visually Impaired, Ultrasonic Sensor, GPS, NodeMCUESP8266, Assistive Technology, Real-time Navigation, Obstacle Detection, Wearable Technology, Esskay Live Platform..*

## 1. INTRODUCTION

The World Health Organization (WHO) estimates that over 285 million people worldwide experience vision impairment, with 39 million classified as blind. Navigation and mobility remain significant challenges for visually impaired individuals, often requiring assistance from guide dogs or human companions. Traditional mobility aids, such as canes, provide limited situational awareness and do not offer real-time navigational feedback.

IoT-enabled smart glasses present an innovative solution by integrating advanced sensors and IoT modules to detect obstacles and provide real-time feedback to the user. This system uses ultrasonic sensors for obstacle detection, a GPS module to transmit location data, and NodeMCU ESP8266 to establish wireless connectivity. The processed information is transmitted to the Esskay Live platform, enabling real-time location tracking to enhance safety and mobility.

## 2. BACKGROUND

Assistive technology for visually impaired individuals has seen significant advancements over the years, with wearable devices playing an increasingly vital role. Previous studies have explored various smart wearables, such as ultrasonic canes and GPS-enabled belts, but many of these solutions are bulky, expensive, and lack real-time feedback.

Wearable smart glasses, however, offer a compact and intuitive alternative by providing obstacle detection and location tracking without disrupting the user's mobility. Existing research highlights the potential of IoT and AI technologies in improving the effectiveness of assistive devices. This paper builds on these advancements by presenting a system that combines real-time obstacle detection and GPS tracking to enhance the autonomy of visually impaired individuals.

## 3. PROBLEM STATEMENT

Visually impaired individuals often face challenges in navigating unfamiliar environments safely and independently. Existing mobility aids, such as canes or guide dogs, provide limited situational awareness and do not offer real-time location tracking or assistance. Furthermore, current IoT-based solutions are either too expensive or complex to use.

This paper addresses the need for an affordable, user-friendly solution that offers real-time navigation and obstacle detection

by proposing IoT-enabled smart glasses that enhance the mobility and safety of visually impaired users.

## 4. OBJECTIVES

1. Develop IoT-enabled smart glasses that assist visually impaired individuals by detecting obstacles and providing real-time feedback.
2. Integrate GPS technology to transmit the user's location data to the Esskay Live platform for remote monitoring.
3. Enhance the safety and autonomy of visually impaired users by offering a compact, affordable, and easy-to-use solution.
4. Evaluate the system's effectiveness through prototype testing to ensure its reliability and accuracy.

## 5. RELATED WORK

Considerable research has been conducted in the field of assistive technology for visually impaired individuals, focusing on wearable devices that enhance navigation and safety. Various systems have been developed using ultrasonic sensors and GPS modules to detect obstacles and provide feedback through different alert mechanisms, such as audio or vibration.

Previous studies have explored IoT-based navigation systems that integrate GPS and real-time location tracking to assist visually impaired individuals. Some systems utilize machine learning algorithms for object detection, while others incorporate AI techniques to enhance obstacle detection and recognition. However, many of these systems face challenges in ensuring real-time accuracy, minimizing latency, and improving overall reliability.

This paper focuses on addressing these limitations by proposing an IoT-enabled smart glass system that combines obstacle detection using an ultrasonic sensor, real-time alert through a buzzer, and GPS tracking to provide a reliable and efficient navigation solution for visually impaired users.

## 6. METHODOLOGY

### A. System Design

The smart glasses consist of:

**Ultrasonic Sensor:** Detects obstacles and provides feedback through a buzzer.

**GPS Module:** Tracks the user's location and sends data to the Esskay Live platform.

**NodeMCU ESP8266:**Acts as the communication module to transmit data wirelessly.

**Buzzer:** Provides audio feedback when obstacles are detected.

### B. Data Transmission and Processing

The ultrasonic sensor measures the distance of nearby obstacles and triggers the buzzer to alert the user. Simultaneously, the GPS module transmits latitude and longitude values to the Esskay Live platform, enabling real-time monitoring of the user's location.

### C. Hardware and Software

**Hardware**: Ultrasonic sensor, GPS antenna, NodeMCU ESP8266, and buzzer.

**Software:** Arduino IDE for programming the NodeMCU and integrating sensor data.

## 7. IMPLEMENTATIONDETAILS

### A. Data Collection

User data, including obstacle proximity and GPS location, is collected in real time. This data is processed and transmitted to the Esskay Live platform for remote monitoring.

### B. Prototype Development

The system is built using NodeMCU ESP8266, ultrasonic sensors, and a GPS module. The prototype is tested in controlled environments to evaluate its obstacle detection accuracy and GPS data transmission reliability.

### C. User Interface

The Esskay Live platform provides an interface for remote monitoring of user location.

## 8. EVALUATION AND METRICS

The system's performance is evaluated based on:

**Obstacle Detection Accuracy:** The reliability of the ultrasonic sensor in detecting obstacles at varying distances.

**GPS Data Transmission:** The accuracy and timeliness of GPS data transmitted to the Esskay Live platform.

**System Performance:** Overall effectiveness of the system in real-world conditions.

## 9. TESTING &IMPLEMENTATION

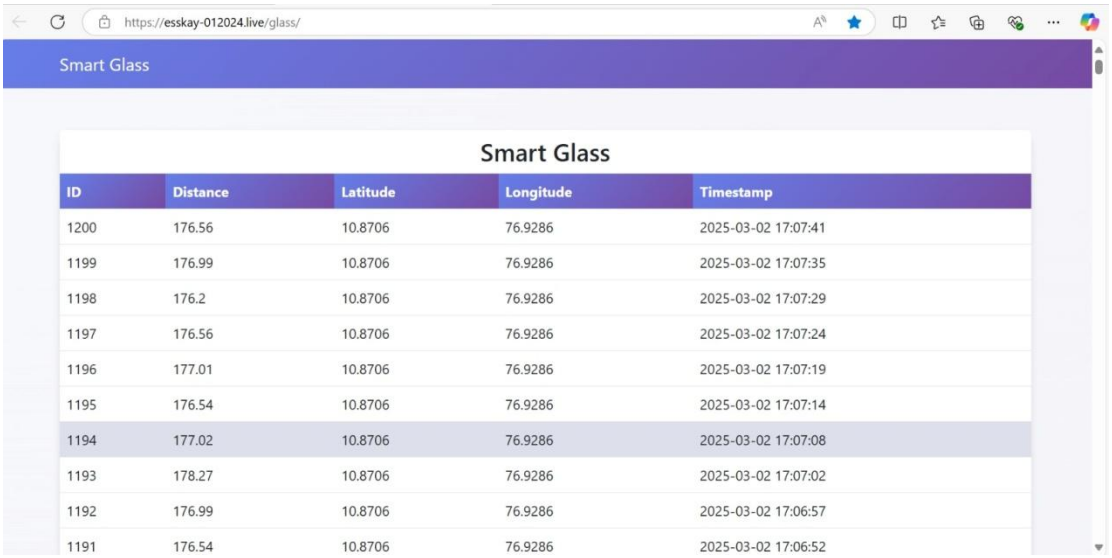
### A. Usability Testing

The prototype is tested to assess functionality and reliability in controlled and real-world environments.

### B. Performance Testing

The system is tested under different environmental conditions to evaluate obstacle detection accuracy and GPS data transmission consistency.

## 10. CASE STUDY

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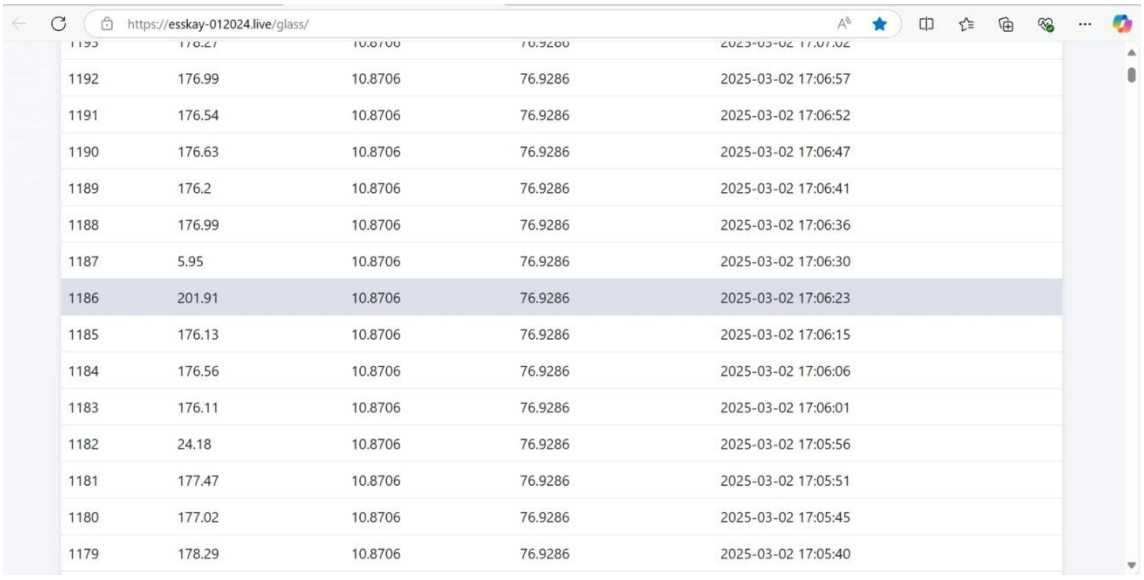


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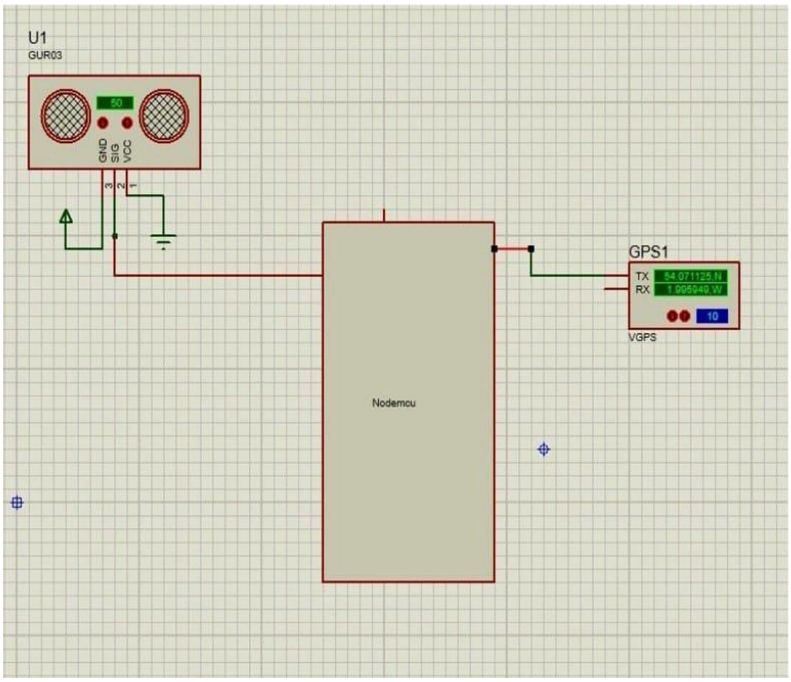
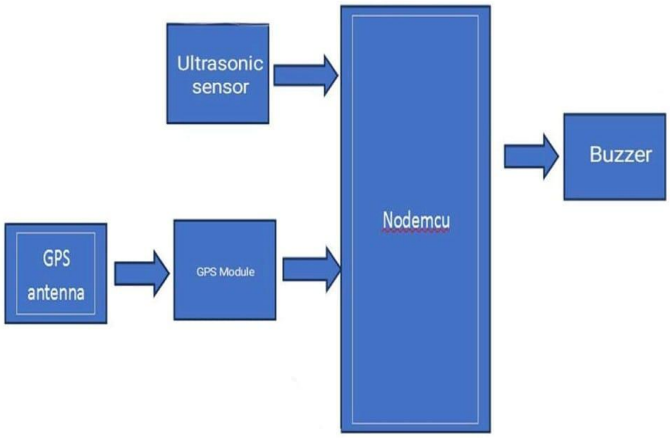
***Circuit diagram***




***Block diagram***




## 11. DISCUSSION

Early results indicate that the IoT-enabled smart glasses significantly improve obstacle detection and provide real-time navigational assistance. Challenges remain in optimizing power consumption and enhancing the system's adaptability to diverse environments. Future work will

focus on improving sensor calibration and expanding the system's functionality to support additional assistive features.

## 12. CONCLUSION

This paper presents IoT-enabled smart glasses that leverage ultrasonic sensors and GPS technology to assist visually impaired individuals. By providing real-time feedback and location tracking, the system enhances user mobility and safety.

Prototype testing demonstrates the system's effectiveness in improving navigation and situational awareness. Future iterations will focus on enhancing the system's performance and integrating additional features to further support visually impaired users.

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