جامعة المستقبل

الكلية التقنية الهندسية

قسم هندسة تقنيات الاجهزة الطبية

Scan Me

أسبوع المستقبل الدولي الرابع للاستدامة

4th International Al-Mustaqbal Sustainability Week 2026

Smart Glasses for the Blind

Supervisor

Dr. Faryal Ibrahim

Students

- Mustafa hamed hadi
- Mohammed Muhannad
- Mustafa Amir Hassan
- Mustafa Maitham
- Mohammed Amer
- Mustafa Moayad

SDGs

8 DECENT WORK AND ECONOMIC GROWTH | 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE | 10 REDUCED INEQUALITIES

Abstract

This study provides a comprehensive overview of the design and implementation of smart assistive glasses for the visually impaired, emphasizing their role in enhancing independent navigation and safety. The research focuses on the importance of developing wearable devices that can detect obstacles effectively and provide real-time feedback to users, addressing both technical and practical considerations. By exploring the fundamental principles of sensor integration and human-machine interaction, the study aims to highlight the potential benefits of innovative and efficient assistive technology solutions.

Methods & Design

The hardware architecture of the smart glasses consists of the following key components:

- Microcontroller (Arduino Nano): The brain of the system, chosen for its small form factor and low power consumption, making it ideal for wearable devices.
- Ultrasonic Sensors (HC-SR04 x2): Two sensors are used to provide a wider field of view (Left and Right). They measure the distance to objects by emitting ultrasonic waves and timing their reflection.
- Vibration Motors (x2): These act as the haptic feedback interface. Two motors are placed on the frame (Left and Right) to provide directional warnings to the user.
- Power Supply: A compact battery (e.g., Li-ion or 9V) to ensure the portability of the glasses.
- Connecting Wires: Jumper wires used to establish electrical connections between the sensors, motors, and the Arduino. The methodology for building the smart glasses involves several key stages:

1. Hardware Assembly: Mounting the two ultrasonic sensors on the front of the frame and the vibration motors on the temples.
2. Circuit Integration: Wiring the components to the Arduino Nano pins (Trig/Echo for sensors and Digital PWM pins for motors).
3. Software Calibration: Programming the Arduino to convert time-of-flight data from the sensors into distance (cm).
4. Spatial Feedback Logic: Setting a safe distance threshold (e.g., 70cm). If an object is detected within this range, the corresponding motor is activated.

Results

The implementation of the smart glasses prototype yielded successful results during practical testing:

- Detection Range: The two ultrasonic sensors accurately detected obstacles within a range of 2cm to 200cm with a high precision rate.
- Directional Accuracy: The system correctly identified the position of obstacles (Left vs. Right) and activated the corresponding vibration motor without interference.
- System Stability: The Arduino Nano handled the continuous processing loop efficiently, providing real-time feedback with negligible latency (less than 100ms).
- Power Efficiency: The battery-operated system proved capable of sustained operation, making it suitable for daily use.

Discussion

This project successfully designed and implemented a smart assistive device for the visually impaired. By integrating dual ultrasonic sensors with haptic feedback, the system provides a reliable "electronic eye" that enhances the mobility and safety of the user. The experimental results confirm that the device is accurate, responsive, and easy to use. It bridges a significant gap in traditional assistive technology by offering directional guidance at a fraction of the cost of commercial alternatives.

THE GLOBAL GOALS For Sustainable Development

References

1. Agarwal, R., et al. (2024). "Low-cost Ultrasonic Smart Glasses for the
2. Blind: A Comprehensive Solution for Obstacle Detection and
3. Navigation." Journal of Assistive Technologies, 18(2), pp. 45-58.
4. Malla, S., Sahu, P. K., & Patnaik, S. (2023). "Obstacle Detection and
5. Assistance for Visually Impaired Individuals Using an IoT-Enable