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ADAPTIVE ALERT SMART GLASSES FOR VISUALLY IMPAIRED PEOPLE

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Abstract:
This project presents adaptive alert smart glasses designed to help visually impaired people move safely and independently. The system uses sensors to detect obstacles in front of the user. When an obstacle is detected, the system provides an alert through a buzzer or vibration. The main goal of this project is to provide an efficient and affordable assistive technology that increases the mobility and freedom of people who are blind or visually impaired. This system is low-cost, portable, and easy to use.

Keywords: Smart Glasses, Visually Impaired People, Obstacle Detection, Ultrasonic Sensor, Arduino, Alert System.

Introduction:

Visually impaired people face many difficulties while moving from one place to another because they cannot see obstacles around them. Traditional tools such as walking sticks help them to some extent, but they cannot always detect obstacles at different distances. Therefore, there is a need for a smart and reliable assistive device that can help visually impaired people move safely and independently.

The Adaptive Alert Smart Glasses are designed to solve this problem by using sensors and an alert system. The obstacle detection module consists of an ultrasonic sensor, which scans up to 5-6 meters within a 30-degree range in the direction the person is walking.

The sensor detects obstacles and sends a signal to the device, which generates an automated voice message in a headset attached to the person's ear, alerting them to the obstacle. This project focuses on developing a low-cost and easy-to-use smart glasses system that can assist visually impaired people in their daily life.

Depending on the user's needs and preferences, the ultrasonic glasses use either visual clues, tactile vibrations, or auditory warnings as its feedback systems. By informing the user of potential difficulties nearby, these alerts allow the user to securely and confidently move past barriers. By offering contextual information and facilitating seamless interaction with the surrounding environment, these elements further improve the user experience.

Adaptive Alert Smart Glasses for Visually Impaired People" uses modern technology and user-centered design approaches to help close the gap that separates those who are visually impaired from their surroundings. This initiative aims to improve the quality of life for visually impaired people by empowering them to manage their daily lives with greater freedom and dignity

through increased awareness, accessibility, and empowerment.

LITERATURE SURVEY

Many researchers have worked on assistive technologies for visually impaired people. In this project adaptive distance detection with three levels: long distance, medium distance, and short distance. When the obstacle is far, the buzzer is off. When the obstacle comes closer, the buzzer beeps slowly. When the obstacle is very close, the buzzer produces a fast or continuous alert."

Several systems use sensors such as ultrasonic sensors and cameras to detect obstacles and provide alerts to the user. These systems help blind people move safely by detecting objects in their path.

Some existing devices use walking sticks with sensors to detect obstacles. However, these devices sometimes have limitations such as limited detection range and difficulty in identifying obstacles at different heights. Smart glasses systems use sensors and microcontrollers to detect obstacles and give alerts through sound or vibration. These technologies help visually impaired people navigate their surroundings more easily and safely.

Based on these concepts, the proposed project "Adaptive Alert Smart Glasses for Visually Impaired People" uses an ultrasonic sensor and Arduino to detect obstacles and provide adaptive buzzer alerts according to the distance.

I. METHODOLOGY

"Adaptive Alert Smart Glasses for Visually Impaired People" is based on obstacle detection using ultrasonic sensing technology and adaptive alert feedback. The system mainly consists of a power supply, a microcontroller unit, an ultrasonic sensor, and a buzzer alert system.

The obstacle detection is performed using the HC-SR04. This sensor works on the principle of ultrasonic wave transmission and reception. The sensor has two main pins called TRIG and ECHO. The Arduino sends a trigger signal through the TRIG pin, which causes the ultrasonic sensor to emit high-frequency sound waves.

These ultrasonic waves travel through the air and when they hit an obstacle, they are reflected back toward the sensor. The ECHO pin of the sensor receives the reflected waves. The time taken for the sound wave to travel to the obstacle and return back is measured by the Arduino.

Using this time value, the Arduino calculates the distance between the sensor and the obstacle using the following formula:

Distance = (Time × Speed of Sound) / 2

The calculated distance is then compared with predefined threshold values programmed in the Arduino. Based on these distance values, the system generates different types of alerts through the buzzer.

If the obstacle is far away, the buzzer remains off or produces slow beeps. When the object comes closer, the buzzer generates faster beep sounds. If the obstacle is very close to the user, the buzzer produces a continuous alert sound. This adaptive alert mechanism helps visually impaired people understand how close the obstacle is and enables them to take appropriate action.Thus, the system provides a simple, low-cost, and effective solution for obstacle detection and navigation assistance for visually impaired individuals.

1. HARDWARE COMPONENTS

- **Ultrasonic Sensor**

Fig. Ultrasonic Sensor

An ultrasonic sensor is a device that utilizes sound waves beyond the range of human hearing to detect objects or measure distances. It works by emitting high-frequency sound pulses and then listening for the echoes reflected off nearby objects. By measuring the time it takes for these echoes to return, the sensor can calculate the distance to the object. The ultrasonic sensor plays a pivotal role in enhancing the user's awareness of their surroundings and assisting in navigation. Here's how the ultrasonic sensor functions within this project: The ultrasonic sensor is used to detect obstacles in front of the visually impaired person. It works by transmitting ultrasonic sound waves and receiving the reflected waves from nearby objects. The sensor measures the time taken for the sound waves to return and calculates the distance between the user and the obstacle. This distance information is sent to the microcontroller (Arduino Nano). If the obstacle is detected within a certain range, the system activates a buzzer or vibration motor to alert the user. This helps visually impaired people avoid collisions and move safely.

- **Arduino**

Fig. Arduino Nano

Arduino is a popular open-source electronics platform that combines easy-to-use hardware and software. The Arduino programming language, which is based on Wiring, and the Arduino Software (IDE), which is based on Processing. In our project, we needed to interface with three major components, and using all of their required pins would result in a shortage of pins. To address this, we designed a self-made Audio module with VCC and GND pin-outs shorted, which provided power to the sensors.

This allowed us to directly interface only the Trigger and Echo pins of each sensor to the Arduino board. The Arduino Nano acts as the main controller of the system. It receives distance data from the ultrasonic sensor and processes it using programmed instructions. Based on the detected

distance, the Arduino Nano activates the buzzer or vibration motor to alert the user about nearby obstacles. It controls the overall working of the smart glasses and ensures proper communication between all components.

- **Buzzer**

Fig. Buzzer

In this project, it serves as an essential alert system, notifying the wearer of potential obstacles or hazards detected by the ultrasonic sensor. When the ultrasonic sensor detects an object within a certain range, the Node MCU triggers the buzzer to emit specific sounds or patterns corresponding to the distance of the detected object.

The buzzer is used to provide an audio alert to the visually impaired user when an obstacle is detected. The ultrasonic sensor detects the object and sends the distance data to the Arduino Nano. Based on this information, the Arduino activates the buzzer. The buzzer produces a sound that warns the user about the presence of a nearby obstacle, helping them move safely and avoid collisions.

2. CIRCUIT DIAGRAM

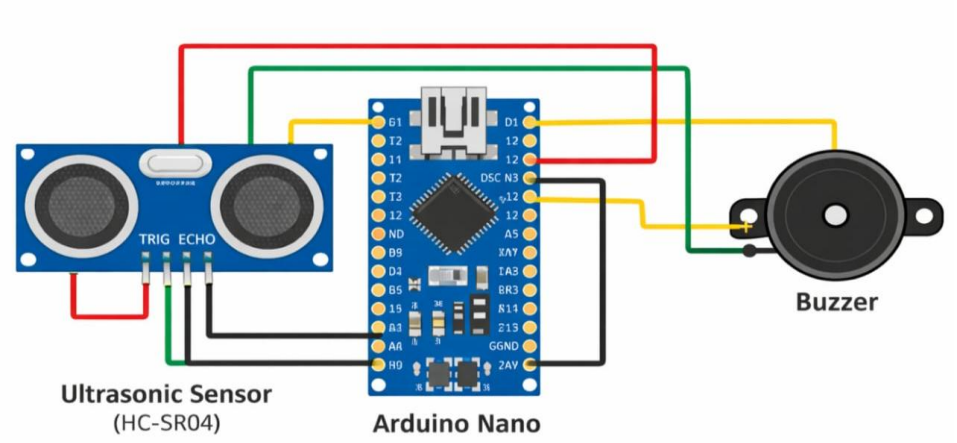


Fig. Circuit Diagram of Adaptive Alert Smart Glasses

The circuit diagram represents the connection of the Arduino Nano, ultrasonic sensor, and buzzer used in the adaptive alert smart glasses system. The ultrasonic sensor is connected to the Arduino Nano to measure the distance of nearby obstacles.

The sensor sends trigger and echo signals to the microcontroller. The Arduino Nano processes this signal and calculates the distance between the user and the obstacle.

The ultrasonic sensor is responsible for detecting obstacles in front of the user. It transmits ultrasonic sound waves and receives the reflected signals from nearby objects. The sensor has four pins: VCC, GND, TRIG, and ECHO. The VCC and GND pins are connected to the power supply, while the TRIG and ECHO pins are connected to the digital input and output pins of the Arduino Nano.

The Arduino Nano acts as the main controller of the system. It sends a trigger signal to the ultrasonic sensor and measures the time taken for the echo signal to return. Based on this time, the Arduino calculates the distance between the user and the obstacle.

If the calculated distance is below a predefined range, the Arduino Nano activates the buzzer to generate an alert sound. This sound notifies the visually impaired user about the presence of an obstacle, helping them move safely and avoid collisions.

II. BLOCKDIAGRAM

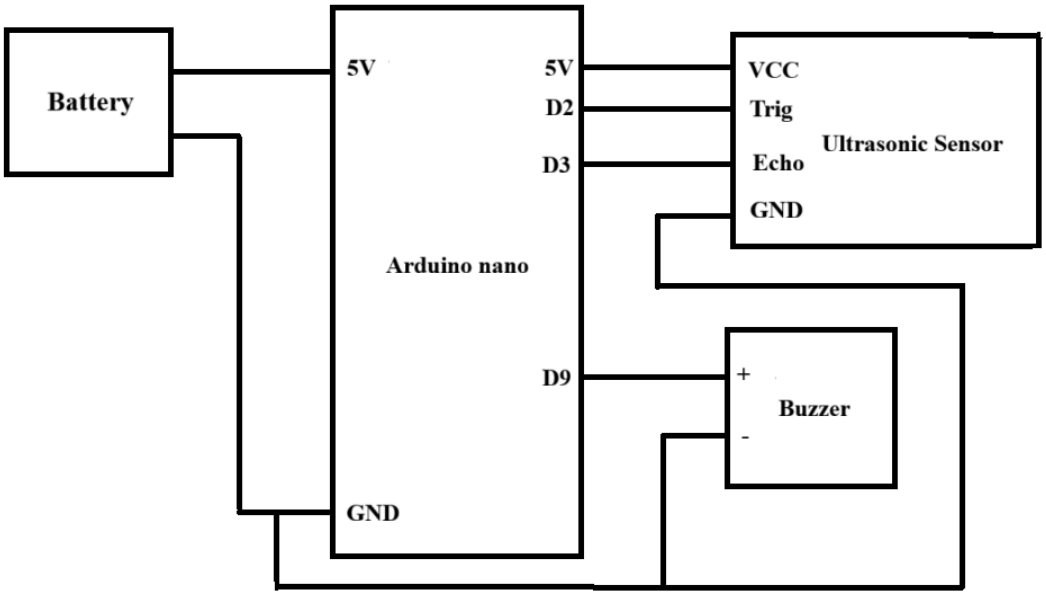


FIG .BLOCK DIG OF ADAPTIVE ALERT SMART GLASSES .

The block diagram of the proposed system consists of four main components: power supply, microcontroller unit, ultrasonic sensor, and buzzer alert system. The power supply is provided by a battery which supplies power to the system through the VIN pin of the Arduino Nano. The Arduino Nano acts as the main processing unit of the system. It controls all the operations and processes the signals received from the sensor.

An HC-SR04 is used for obstacle detection. The sensor has four pins: VCC, TRIG, ECHO, and GND. The VCC and GND pins provide power to the sensor, while the TRIG and ECHO pins are used for transmitting and receiving ultrasonic signals.

When the system is powered on, the Arduino sends a trigger signal to the ultrasonic sensor through the TRIG pin. The sensor then emits ultrasonic sound waves. These waves travel through the air and if they hit an obstacle, they are reflected back to the sensor.

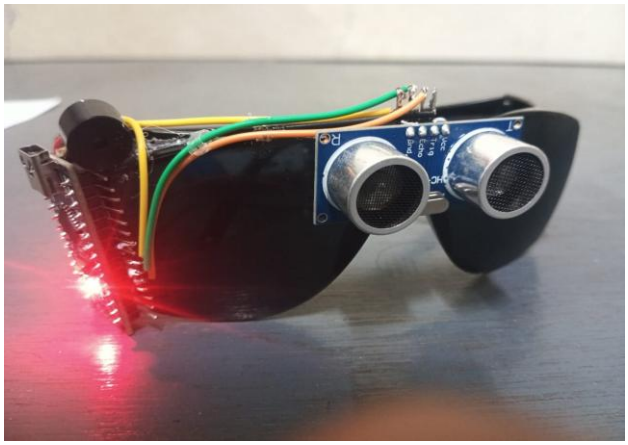
The ECHO pin receives the reflected signal and sends the information to the Arduino Nano. The Arduino calculates the distance between the sensor and the obstacle based on the time taken for the signal to return. A buzzer is connected to the Arduino Nano as an alert device. When the Arduino detects an obstacle within a certain distance, it activates the buzzer. The buzzer generates different alert sounds depending on the distance of the obstacle. This adaptive alert mechanism helps visually impaired users identify obstacles and move safely

RESULTS AND APPLICATIONS

Results:

The developed adaptive alert smart glasses system was tested to evaluate its performance in detecting obstacles. The ultrasonic sensor successfully detected objects within a range of approximately 2 meters. When an obstacle was detected, the Arduino Nano processed the signal and activated the buzzer to alert the user.

The system responded quickly and provided accurate alerts to the user. The device was lightweight, portable, and easy to use. The testing results show that the system can effectively assist visually impaired people in avoiding obstacles while walking.



Applications:

1. Navigation assistance for visually impaired people.
2. Obstacle detection while walking.
3. Improving safety and mobility of blind users.
4. Useful in public places like roads, parks, and buildings.
5. Assistive device for disabled persons.
6. Can be used in smart wearable technology.
7. Helps prevent collisions with nearby objects.
8. Useful in rehabilitation and support systems for visually impaired individuals

CONCLUSION AND FEATURE SCOPE

Conclusion:

The development and implementation of Smart glasses for visually impaired individuals represent a significant advancement in assistive technology. Through the integration of ultrasonic sensors, Arduino, buzzer offering a practical and affordable solution to improve the mobility and independence of individuals with visual impairments. These glasses have the potential to make a meaningful difference in the lives of countless individuals, enabling them to navigate the world with greater confidence and autonomy**.**

The adaptive alert smart glasses system is designed to assist visually impaired people in detecting obstacles and moving safely. The system uses an ultrasonic sensor to identify nearby objects and provides an alert through a buzzer. The Arduino Nano processes the sensor data and controls the alert system. The device is simple, low-cost, and easy to use. The results show that the system can effectively help visually impaired individuals avoid obstacles and improve their safety and independence in daily life.

Future Scope:

1. In the future, the system can be improved by adding a camera and image processing to detect different types of objects.
2. A GPS module can be added to help visually impaired people with navigation and location tracking.
3. The system can provide voice alerts instead of only buzzer or vibration alerts.
4. Mobile application integration can be developed for better control and monitoring of the device
5. The device can be made smaller, lighter, and more efficient for better comfort and usability.
6. Artificial intelligence techniques can be used to improve obstacle detection and accuracy.

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REFERENCES

1. Ali, A. (n.d.). History of sensors. [online] Slideshare.net.
2. Mahmud, M. H.,& Saha, R., and Islam, S. (2014). Smart walking stick-an electronic approach to assist visually disabled persons. International Journal of Scientific & Engineering Research, 4(10), 111-114.(online).
3. Bai, J.,& Lian, S.,& Liu, .,& Wang, K., and Liu, D. (2017). “Smart guiding glasses for visually impaired people in
   indoor environment”. IEEE Transactions on Consumer Electronics, 63(3), 258-266.(online).
4. Abdul Rasool, D., and Sabra, S. (2019). Mobile-embedded smart guide for the blind. In Digital Information and Communication Technology and Its Applications: International Conference,

DICTAP 2011, Dijon, France, June 21-23, 2011, Proceedings, Part II (pp. 571-578). Springer Berlin Heidelberg(online).

5. P. Singh and R. Verma, "Assistive device for blind people using Arduino and ultrasonic sensor," International Journal of Electronics and Communication Engineering, 2020.

A. Patel and M. Shah, "Obstacle detection system for visually impaired people," International Journal of Advanced Research in Electronics, 2018.

WEBSITE

1. International Journal of Creative Research Thoughts, "Official Website." Available: https://www.ijcrt.org
2. Arduino, "Arduino Nano Documentation." Available: https://www.arduino.cc
3. HC-SR04 Ultrasonic Sensor, "Ultrasonic Sensor Information." Available: https://components101.com
4. Arduino IDE Official Website: https://www.arduino.cc
5. Arduino Documentation: https://docs.arduino.cc