WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Smart Glasses For Blind Person

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ABSTRACT :

In recent years, technological advancements have played a crucial role in enhancing the quality of life for visually impaired persons. This project presents the design and development of smart glasses equipped with ultrasonic sensors, aimed at improving navigation and obstacle detection for visually impaired users. Utilizing three ultrasonic sensors strategically positioned (right, left, and center), the system continuously measures distances to detect obstacles within a pre-defined range. The Arduino Nano board serves as the core processing unit, managing sensor input and providing feedback through an audio system. The integration of a 10K ohm potentiometer allows users to set reference distances, facilitating customization based on individual needs. Upon obstacle detection, the Arduino triggers an MP3 player module to deliver audio alerts via pre-recorded messages indicating the location of obstacles (front, left, or right). Additional alerts are provided by a piezo buzzer and a red LED for critical distances. The system is powered by a lithium-ion battery with a step-up module, ensuring efficient operation. This innovative system offers visually impaired individuals enhanced awareness of their surroundings, thereby promoting independence and mobility.

Keywords: Smart Glasses, Automation, Wearable device, Ultrasonic Sensor, Arduino, MP3 Module.

Introduction :

The visually impaired community faces numerous challenges in their daily lives, particularly concerning navigation and mobility. Traditional aids, such as canes and guide dogs, provide limited sensory feedback and may not accurately detect obstacles at various heights or distances. The need for innovative solutions that utilize technology to enhance the independence of visually impaired individuals has prompted this research project aimed at developing smart glasses. These glasses leverage ultrasonic sensors to detect obstacles, offering real-time feedback to users through auditory alerts.

Modern technology, specifically the Internet of Things (IoT) and microcontroller systems, presents unique opportunities for creating assistive devices that are compact, affordable, and effective. The integration of ultrasonic sensors into wearable devices, such as glasses, is particularly advantageous due to their light weight and ease of use. By providing immediate auditory feedback about potential hazards, users can navigate their environments with greater confidence.

The main innovation of this project lies in seamlessly integrating three ultrasonic sensors, an Arduino Nano microcontroller, and an audio alert system into a pair of glasses. The combination of these components enables the glasses to provide spatial awareness to users, informing them about their surroundings through designated audio cues. This report outlines the design specifications, implementation, and expected benefits of the proposed smart glasses, emphasizing their ability to transform mobility aids into intelligent devices that significantly enhance the everyday experiences of visually impaired individuals.

Survey and Specification :

- **Low-cost Smart Glasses for People with Visual Impairments[1]**

An efficient visual aid is essential for visually impaired candidate. At the same instance it has to be simple, robust and cost effective. However, regardless of being expensive, it is challenging to incorporate high end artificial intelligence into a compact device to serve the purpose. This paper presents a prototype of low-cost smart glasses for visually impaired individuals. Also, a brief survey on the cost and features of the goggles available in the market are included. In this work a prototype is developed integrating Raspberry Pi module, camera, sensors and a goggles. The captured images are processed using object recognition models and its corresponding text is read aloud using google text to translator. Subsequently, a comparative analysis of object recognition model is explored and discussed. Essential experimental results are incorporated along with cost involved for the prototype development.

- **Smart Glasses: A Visual Assistant for the Blind[2]**

Computer vision has helped systems gain high-level understanding in the field of image and video processing. The Smart Glasses allows partially blind and partially sighted individuals to identify and understand the workplace tools that surround them, which they can see through mini camera. Our research aims to utilize the computer vision to detect objects using MS COCO dataset and trained a CNN (Convolutional Neural Network) model. It recognizes faces using deep learning approach. It recognizes text using EAST (Efficient Accurate Scene Text Detector) and EASYOCR models and gives output using Festival Speech synthesis. The glasses are provided by Ultrasonic sensor which is used to measure the required distance between the users and object to avoid obstacle. The Smart glasses start detecting using the wake word "UP" which is trained using CNN and TensorFlow and Vosk speech recognition module for simple commands. The system is a complete visual assistance for the blind.

- **Sensor-Based Assistive Devices for Visually-Impaired People[3]**

This paper provides a comparative survey of various wearable and portable assistive devices designed for visually impaired individuals. It discusses the capabilities and limitations of these systems, emphasizing the importance of improving user independence and safety through enhanced navigation technologies. The review outlines the context and progress of assistive device development, paving the way for future research [3].

- **Ultrasonic Navigation Based Blind Aid for the Visually Impaired**

The study presents an ultrasonic navigation system specifically designed for urban environments, enabling visually impaired users to walk easily and avoid obstacles. It demonstrates the practical application of ultrasonic sensors in developing aids that provide spatial awareness and orientation to users, detailing the system's architecture and functionality [4].

- **Haptic Wearable System to Assist Visually-Impaired People**

The authors explore the integration of ultrasonic sensors and additional functionality, such as GPS detection, into wearable devices. The paper highlights the effectiveness of these devices in providing obstacle detection and auditory feedback, illustrating how wearable technology can significantly enhance navigation for visually impaired individuals [5].

- **An Ultrasonic Navigation System for Blind People**

This paper investigates a navigation aid that utilizes ultrasonic sensors to guide visually impaired users. It analyzes the system's user interaction and feedback mechanisms, demonstrating the feasibility and effectiveness of ultrasonic technology in practical applications for enhancing mobility [6].

- **Wearable Obstacle Detection Systems: A State-of-the-Art Review**

This comprehensive review discusses various wearable obstacle detection systems, emphasizing the use of ultrasound sensors for obstacle identification. It addresses the challenges and potentials in designing effective assistive technologies, providing insights into how these systems can be optimized for better user experience [7].

- **Vision System with 3D Audio Feedback to Assist Navigation for Visually Impaired**

The paper presents a novel vision system that incorporates 3D audio feedback for navigation. By combining visual information with auditory cues, the system aims to deliver accurate navigation assistance. This research highlights the critical role of auditory feedback in enhancing spatial awareness and navigational skills for visually impaired users [8].

Discussion and Methodology :

Sensor Selection: Choose appropriate ultrasonic sensors based on range and accuracy for detecting nearby obstacles. Microcontroller Programming: Program the Arduino Nano to process sensor data, interpret distance readings, and trigger audio alerts. Audio System Integration: Integrate an MP3 player module capable of playing recorded messages based on sensor input. Power Management: Design a power system using a lithium-ion battery and a step-up module to ensure longevity and reliability. System Assembly: Create a physical prototype by mounting components onto the glasses frame, ensuring comfort and usability for the end-user.

BLOCK DIAGRAM

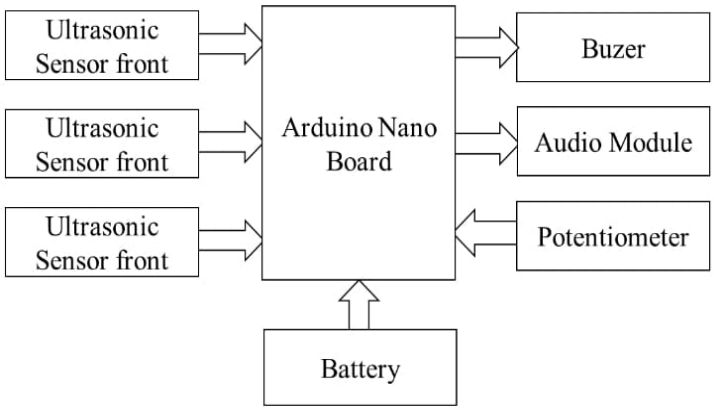

Fig.1.Block Diagram

The block diagram for the smart glasses illustrates the major components and their interactions. At the core of the system is the Arduino Nano, acting as the main controller that processes inputs and controls outputs. The three ultrasonic sensors, positioned on the right, left, and middle of the glasses frame, continuously measure distances to obstacles. The distance readings are delivered to the Arduino, which uses this data to determine the proximity and direction of obstacles.

The Arduino is paired with a 10K ohm potentiometer, allowing the user to set a reference voltage that dictates the threshold distance for alerts. When an obstacle is detected at or below this threshold, the Arduino activates the MP3 player module to play audio alerts through a small speaker, based on the sensor that detects the obstacle. Additionally, when obstacles are detected at a critical distance, the system activates a piezo buzzer and a red LED as secondary alert mechanisms. The entire system is powered by a lithium-ion battery that connects to a step-up module, ensuring sufficient power for all components. This energy efficiency is crucial for the mobility of the user, making the system functional for extended periods without frequent recharging..

The applications are as follows : -

- Public Transportation: Smart glasses can be utilized by users to navigate complex environments like bus or train stations.
- Rehabilitation Settings: These glasses can be applied in rehabilitation programs for visually impaired persons to enhance their mobility skills.
- Increased Safety: The real-time feedback helps prevent accidents and improves safety for users.
- User-Friendly Design: The integration of ultrasonic sensors and audio alerts into a wearable device promotes ease of use.
- Customizable Features: The ability to adjust sensory thresholds according to personal preferences increases comfort and functionality..

Conclusion :

We conclude that, This Smart Glasses is development for visually Impaired for Blind Person to faces daily life challenges to enchance their mobility and independence in theri life. This Glasses Concerning navigation and mobility. Samart Glasses can detect obstacles upto 120 cm due to that's accident are avoidable in affordable Rate.

Acknowledge

It gives us immense pleasure in bringing out the project entitled " Smart Glasses For Blind Person " We express our deep sense of gratitude and sincere regards to our project guide Prof.V.S.Patil for his valuable supervision, cooperation and devotion of time that he/she has given to our project.We are also grateful to head of departmen Prof. V.S.Patil for his facilities extended during project work and for her personal interest and inspiration.We wish to express our profound thanks to Prof. P.M.Dharmadhikari, Principal, Sandip Polytechnic, Nasik, for providing necessary facilities to make this project success.

Finally, we would like to thank all those who directly or indirectly helped us during the work. We also owe our sincere thanks to all faculty members of Electrical Department who have always extended a helping hand.

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