Real-Time Ultrasonic Obstacle Alert System for the Blind Pedestrian

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Abstract: The system will be developed of a pair of worn glasses with a centrally mounted obstacle-detecting module, a processing unit, a warning output element, and a power source. In this setup, the sensing unit and the warning module are connected to the central processing circuit, while the power section delivers the required voltage for operation. The system uses an ultrasonic sensor for obstacle detection, a controller to handle data processing, and a buzzer to generate alerts. The controller manages every function—receiving distance readings from the ultrasonic sensor, analyzing the data, and activating the buzzer whenever an object is detected nearby. The Ultrasonic Smart Glasses designed for visually impaired users are lightweight, small in size, easy to carry, affordable, and simple to operate. This assistive tool helps guide individuals with vision loss by alerting them to obstacles around them, making movement safer and more reliable.

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I. INTRODUCTION

In this approach, if an object is detected beyond a distance of three meters, the system is unable to recognize it. However, once the object comes within 300 centimeters, the sensor identifies it and activates an audible alert. This principle forms the basis of many existing systems.

One such application focuses on improving the interaction of visually impaired individuals with their surroundings through smart glasses. Another design helps users understand social cues during normal face-to-face communication. A separate development involves creating and testing a single chip that uses a glass BGA type package with a Off chip I O lines arranged with a forty by eighty micrometer pitch, incorporating multilayer The wiring and TPVs are arranged at a pitch of one hundred sixty micrometers.

The Clima Win initiative aims to enhance the condition of the air within indoor spaces and raise the energy performance of both new and old setups renovated structures with the help of advanced eco-friendly smart windows. Another point research effort introduces a wearable indoor navigation aid that combines visual marker detection with ultrasonic sensing to offer audio guidance for people who are blind. This system alerts the user to nearby obstacles and produces warning sounds based on how close the obstacle is.

The Microsoft Kinect sensor allows mobile robots to handle key tasks such as mapping and navigation. A compact electronic cane design also exists, which utilizes Polaroid Ultrasonic Ranging technology to complement the traditional long cane. Additionally, a smart eyewear solution for visually impaired users integrates wireless communication, a high resolution the camera along with an infrared sensor, and a specialized eyeglass frame with a mounting system.

Finally, another concept describes a method that provides users with navigation details about their surrounding environment. One invention introduced is the electronic talking stick for the blind people functions as an educational tool to teach blind people how to walk.

II. METHODOLOGY AND WORKING

➢ *Components:*

- Ultrasonic sensor
- NE-555 IC
- 1 KΩ and 10 KΩ Resistor
- 10uf and 100uf 25v Capacitor
- 5V Buzzer
- 3.7V Battery
- Tactile switch
- Buzzer
- A Normal Glass

➢ *Block Diagram*

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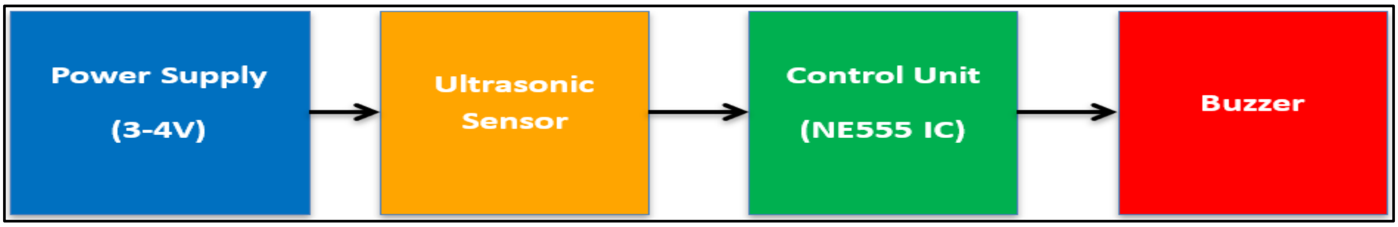

Fig 1 Block Diagram of Ultrasonic Obstacle Detection System.

➢ *Working:*

Ultrasonic Smart Glasses for visually impaired users utilize ultrasonic detection and control circuitry to help them sense nearby obstacles. The system is built using an ultrasonic transducer, a processing module, an audio alert unit, and a power source. The sensor, positioned at the center of the frame, continuously emits ultrasonic pulses and determines the presence of objects by analyzing the returning echoes. The measured distance is forwarded to the control section, where the signal is interpreted and compared with a predefined safety threshold (Power Supply 3–4 V, Ultrasonic Sensor, NE555 Control Circuit, Buzzer, 300 cm range).

When an obstacle enters this defined range, the controller activates the buzzer, producing a warning sound. As the object gets closer, the alert sound becomes faster, and when the object is farther away, the beep frequency decreases.

The entire device is intended to be compact, lightweight, and simple to operate, making it affordable and practical for individuals with vision loss to navigate their surroundings more safely and independently. Since this community requires additional support, it is essential to create tools that increase their confidence and freedom of movement. Traditionally, most users rely on a white cane, which helps them detect obstacles by tapping the ground or objects around them. Although easy to use, this tool offers limited functionality and may not effectively warn users of hazards such as uneven terrain or unexpected obstacles. As a result, blind individuals often face challenges related to poor road conditions, irregular surfaces, and objects that are hard to detect with a cane alone. Hanging in front of them. An ordinary cane really cannot be proved accurately. Safety will be seriously affected for a blind traveler.

III. FLOW CHART

➢ *Flow Chart*

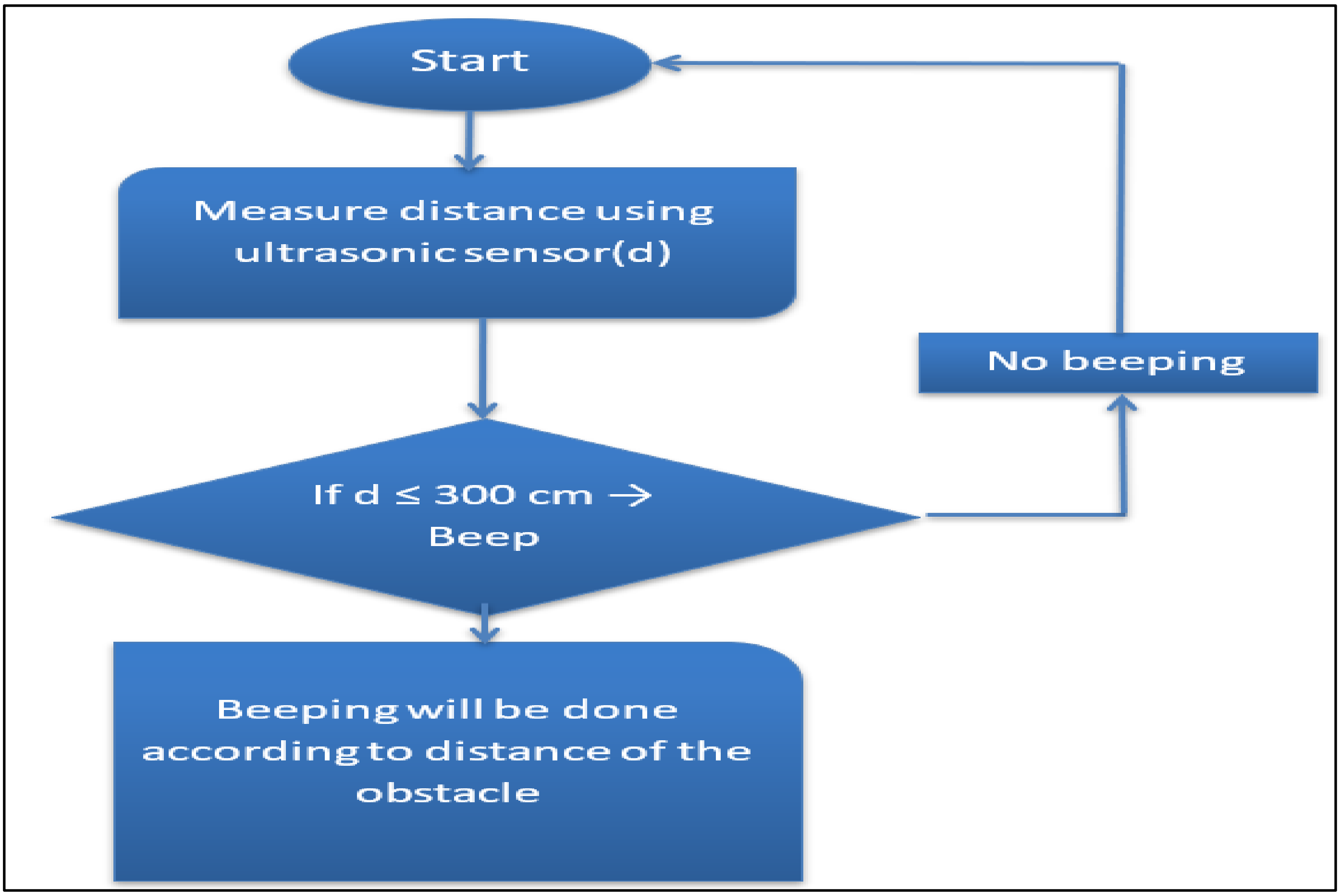

Fig 2 Working Flow Chart of System.

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➢ *Start:*

The Start block represents the place where the system is turned ON or where the program execution starts. This block simply marks the start of the process for the ultrasonic smart glasses. During this step, it does not sense or beep yet; it just means that the device is ready to start an operation. From this Start block, an arrow flows down to the next block, Initialize System, indicating that immediately after the system is powered up, it has to initialize before anything else.

➢ *Initialize System:*

The responsibility of the Initialize System block is to get the hardware and software components ready for proper operation. That is to say, functionally, it powers ON the microcontroller; turns ON the ultrasonic sensor; sets input/output pins; prepares the buzzer; and any other variable or timer set in the code. In other terms, what this block does is that when this block is executed, the controller runs its setup routine where it configures the sensor pins, initializes communication if needed, and sets the initial state of the buzzer to OFF. Once the system is fully initialized and stable, an arrow again goes seriously affected for a blind traveler.

➢ *Measure Distance (Using Ultrasonic Sensor)*

The Measure Distance block calculates the distance between any obstacle and the user by sending a trigger pulse from the microcontroller to the ultrasonic sensor to emit an ultrasonic sound wave. When this wave comes across an obstacle, it bounces back into the same sensor. The controller measures the duration needed for the echo to return and thereby works out the distance using the formula: Distance = (the speed at which sound travels × Time) / 2. This gives the distance d between the glasses and the nearest obstacle in front. With this value calculated, an arrow leads down from this block to the Check Distance/Threshold decision block, which means this measured distance is used to decide whether to beep or not.

➢ *Check Distance (Decision: If distance ≤ threshold):*

The Check Distance block is essentially a decision or comparison block that performs the function of checking whether the measured distance falls within any danger zone. At this point, the controller compares the calculated distance d with a preset threshold value such as 300 cm. During operation, this code would execute something like if (d ≤ 300 cm) to decide whether an obstacle is nearby and requires a warning. From this decision block, there are two arrows. One arrow goes to the right or downward depending on how you draw it, towards the Beep block when the condition distance ≤ threshold is true. Another arrow goes to the No Beep block when the condition is false - distance is greater than the threshold.

➢ *Beep (Intensity Based on Distance):*

The Beep block serves to alert the blind user in case it detects an obstacle within the threshold distance. When the program reaches here, it means that the condition 'distance ≤ threshold' was true. The ultrasonic glasses designed for visually impaired users use sound-wave sensing and simple electronic control to help them detect obstacles in their path. The system is built using an ultrasonic sensor, a small processing circuit, a buzzer for alerts, and a compact power supply. The sensor mounted at the center of the frame sends out ultrasonic waves and receives the echoes that return from nearby objects. The measured distance is then passed to the control unit, which interprets the signal and determines whether an object has entered the set detection range of about three meters. When an obstacle is detected, the buzzer is activated to warn the wearer. The sound pattern changes according to the distance; gentle intervals indicate that the object is still far away, while quicker beeps mean the object is getting closer, and a continuous tone warns of very close proximity. This sound pattern allows the user to understand the surroundings without needing visual input. After each alert, the circuit immediately returns to the distance-measurement step so that the environment is scanned continuously. Because the glasses are lightweight, small, and simple to operate, they are suitable for everyday use and offer an affordable solution that helps visually impaired individuals walk more confidently and safely. Traditional mobility tools like the white cane can only detect obstacles by physical contact and often cannot warn users about uneven roads or objects positioned above ground level. The ultrasonic-based design addresses these limitations by giving earlier warnings and improving the user's awareness of their surroundings.

➢ *No Beep:*

The No Beep section indicates a condition where the system does not need to generate any alert sound. Its role is to ensure that the buzzer remains switched off whenever the area around the user is free from obstacles and no warning is required. The program reaches this block when the decision in the Check Distance block is false, meaning distance > threshold and the obstacle is too far to be dangerous. In operation, the microcontroller either ensures the buzzer remains OFF or switches it OFF if it was previously ON. From the No Beep block, an arrow also goes back into the loop-usually to the Measure Distance or Repeat Sensing block-indicating that even though there is no current obstacle, the system continues to check again and again.

➢ *Repeat Sensing / Loop Back to Measuring:*

The Repeat Sensing or loop block shows the continuous nature of the system. This is designed to continuously run the process so that real-time information about obstacles is given to the blind user. How it works is that, after either Beep or No Beep, the program flow returns to the Measure Distance block and the same steps are executed again-measure distance, check the threshold, give output-until the device is powered OFF. In the flowchart, this is shown by arrows going from the Beep and No Beep paths connect back upwards or sideways to the Measure Distance block. This is a loop. The looping arrow illustrates that the sensing and decision-making cycle continues continuously for as long as the system is powered on.

IV. RESULT

If an obstacle appears at a distance greater than three meters, the system remains inactive and does not give any response. When something enters the 300-centimeter range, the device identifies it and produces an alert sound. The closer the obstacle moves toward the user, the faster and more frequent the sound becomes, allowing the wearer to understand how near the object is. These smart glasses rely on a sensor to recognize nearby obstacles and warn the user accordingly, as illustrated in the accompanying figure.

Fig 3 Prototype Model of Ultrasonic Smart Glasses

V. CONCLUSION

These smart glasses target those with impaired eyesight who are not able to view the obstacles around them, thus enabling such users to stay safe and avoid possible dangers. Later on, this system can function as upgraded to image-processing technology that makes it possible to the device to identify objects and provide detailed information to the user.

REFERENCES

[1]. "LOW-COST ULTRASONIC SMART GLASSES FOR BLIND", Published by Rohit Agarwal, Mohit Agarwal, Nikhil Ladha, Kuntal Kr. Majee, Abhijit Das, Subham Kumar, Subham Kr. Rai, Anand Kr. Singh. Published in 2017 (IEEE).
[2]. "ULTRASONIC SENSOR FOR BLIND PEOPLE" Published by D. Divya Priya, B. Venkatesh, P Chinnasamy, Ajmeera Kiran, P Purushotham. Published in 2024(ASSIC)
[3]. "Ultrasonic Distance Measuring Spectacles and Waist Belt with Alert System for Blind People", Published by Nagaraj P, C. Bala Subramanian, Stephi Jacob, Nithiya Lakshmi A, Rathieeswari R, Pommayan Thileja. Published in 2023 IEEE
[4]. "Smart Glasses for Blind Assistance: A Lightweight and Ergonomic Approach", Published by Shreevatsan S S, Yasasree Lasya Annambhotla, Anaswara Reji, Meena Belwal. Published in 2025 IEEE.