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A Review: Blind Safety Device

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Abstract: Over the past 20 years, a wide range of useful assistive devices have been proposed, planned, and made in an effort to aid visually Blind people in navigating their living and working environments. In this study, an obstacle detection and alert device is proposed. [6] The individuals who are all affected by these visual impairments can benefit from this effort and improve their current situation. The use of an ultrasonic sensor in this endeavor is essential. It is capable of detecting objects in front of it within a specific area. When an object is found, a buzzer notifies the user of itsdiscovery. They are able to identify obstacles in their way when they hear this sound. [4]
Index Terms: Obstacle Detection, Ultrasonic sensor, Arduino Uno, Piezo buzzer

I. INTRODUCTION

Blind people frequently encounter obstacles and battle with issues like crossing the street in a densely populated area. They are therefore more susceptible to harm and occasionally even death. There is no equipment available to assist these people in crossing highways when there is heavy traffic. It is an embedded device that warns blind people about dangers and guides them around nearby items and obstacles.

The mobility required of the visually impaired is not only seen from a social point of view. It is very difficult for blind individuals to lead normal lives. This idea can be developed as a tool or a portable device that can detect barriers. Because it is more precise and affordable, this device is more efficient than the existing one. In this instance, an Arduino UNO board is what we're using to carry out this procedure. For blind people to lead as regular a life as possible, this device could be very helpful. By holding this tool or device in their hands and becoming accustomed tothe buzzer sound, they can quickly appraise an item on their own. [5].

To recognize objects at a greater distance, the device makes use of an ultrasonic sensor with a wide field of view. Basedon this initiative, we conduct a survey within our institution.

This paper aims to develop a product that any blind individual can use to travel safely and comfortably. The growing number of visually impaired people in India and around the world has sparked our desire to truly apply our technological know-how for a social purpose. Visually impaired people struggle to navigate independently when they aren't in their familiar settings. Even walking down, a busy thoroughfare might be extremely challenging for them. Theyconsequently need constant help when navigating. Blind or visually impaired people must learn how to navigate their home's obstacles, such as the tables, seats, and shelves. [6]

II. LITERATURE REVIEW

For individuals who are blind or visually impaired, numerous new technologies have been developed in recent years. But these new innovations come with a lot of restrictions and limitations.

“Smart Assistive System for Visually Impaired People Obstruction Avoidance Through Object Detection and Classification” [7] is a technique for the blind that Usman Masud suggested. The system's primary flaw is that it always recognizes the object in this specific circumstance, independent of the frame.

[8]“Wearable Obstacle Detection System for People with Visual Impairments” was first proposed by Sylvain Cardin, Daniel Thalmann, and Frederic Vexo. The system that is being suggested uses a stereoscopic sonar system to locate the closest obstacle and then sends back vibro-tactile feedback to the user. The system's primary drawback is the blind angles that constrict its range of motion. The "Blind Guide," [9] an ultrasound sensor-based body area network for guiding the blind, was suggested by Elsevier B.V. The drawback of this phrase is that sometimes head-level obstacles go undetected.

[4]MA. Espinosa and S. Ungar proposed a more expensive concept than the norm. He didn't take into account how expensive those items are for the impoverished.

All of the aforementioned existing systems fall short of meeting the precise needs of blind people. This research will aid in overcoming a number of obstacles. There are many technologies for the blind and visually impaired accessible today,but our device is the least expensive of them all.

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III. PROBLEM STATEMENT

There are several million blind or visually impaired people in the world. Blind people not be able to see objects and they can not be recognize known, unknown people.

IV. PROPOSED SYSTEM

The proposed system deals with the more affordable and accurate obstacle detection with broad coverage.

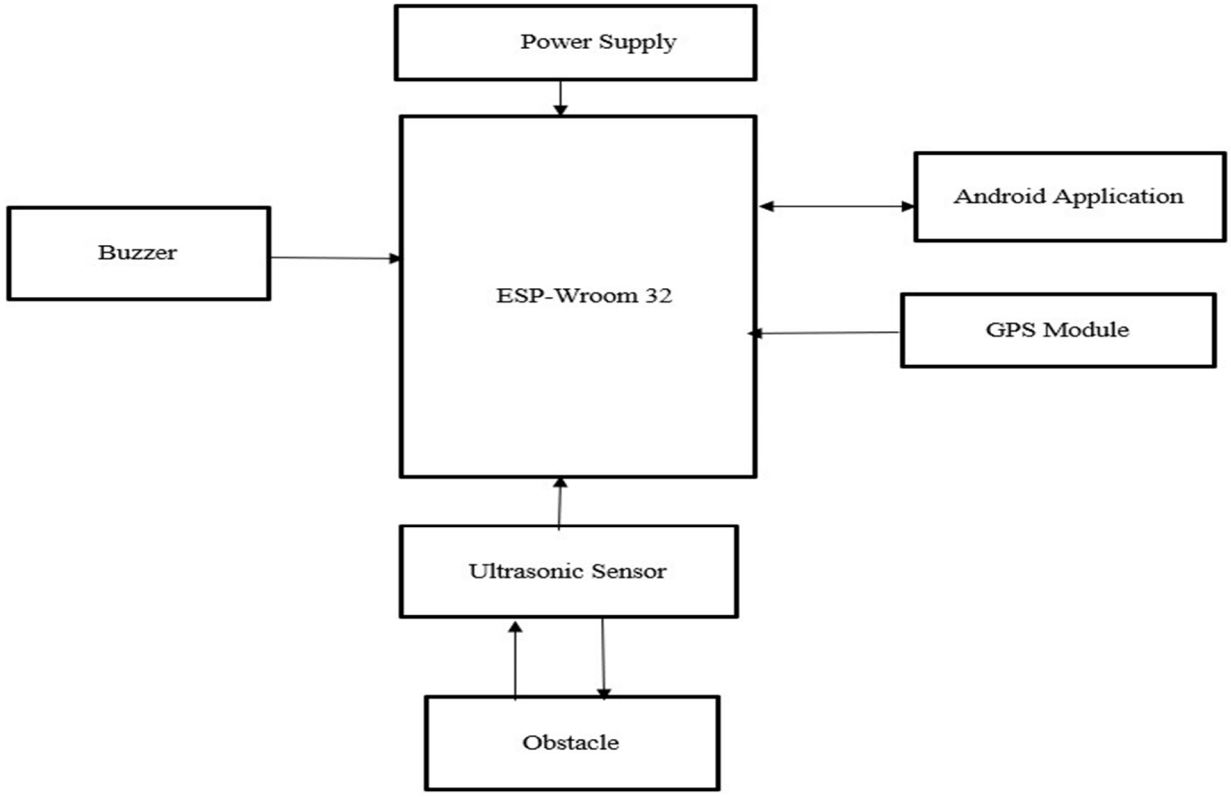

Figure : Proposed System

The components to be used in proposed system are:

1) ESP32

The ESP32 is a powerful and versatile microcontroller and system-on-a-chip (SoC) that is widely used in the field of embedded systems and Internet of Things (IoT) applications. It is developed by Espress if Systems, a Chinese company known for their expertise in Wi-Fi and Bluetooth technology. The ESP32 combines a dual-core processor, Wi-Fi and Bluetooth connectivity, various peripherals, and ample memory into a single chip, making it an ideal platform for developing IoT devices.

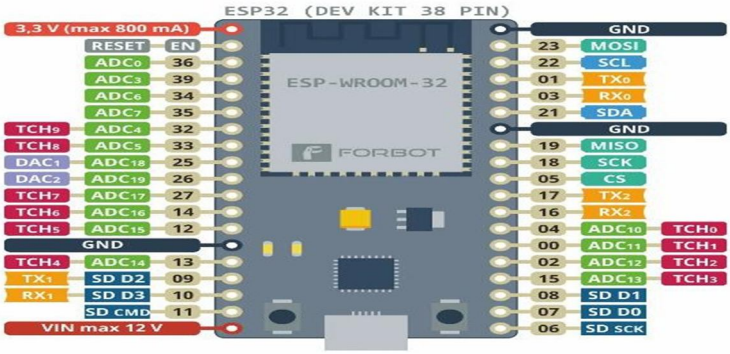

Figure 1. ESP32

2) Ultrasonic Sensor

Transmitter, receiver, and transceiver make up the ultrasonic sensor. Soundwaves are produced by the transmitter from electrical signals. The receiver again transforms the audio waves into electrical signals. The reception and transmitter functions are carried out by the transceiver. Crystal oscillators are also included in it. It will carry out the ultrasonic sensor's stabilising process.

Figure 2: Ultrasonic sensor

3) Jumper Wires

The cables used to connect devices are also referred to as jumpers. We can link gadgets more easily without soldering. These are offered as a pair of wires with pins on both sides. These wires are used to connect the appropriate device at one end and the breadboard at the other.

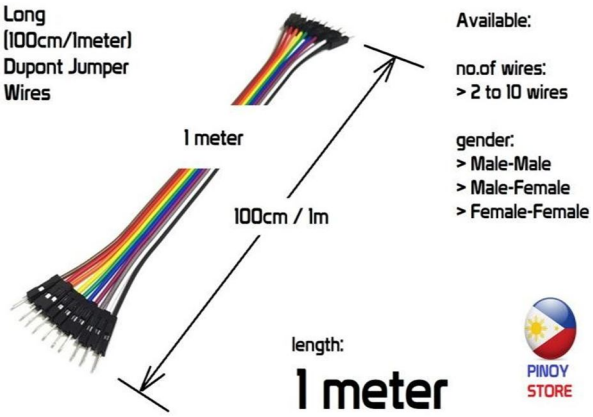

Figure 3: Jumper wires

4) Piezo Buzzer

The piezo buzzer is an electronic gadget that produces sound. The buzzer serves as a user indication. It serves as anindicator in the car's braking and reversing systems. It is based on the piezoelectricity theory that Jacques and Pierre Curie discovered in 1880.

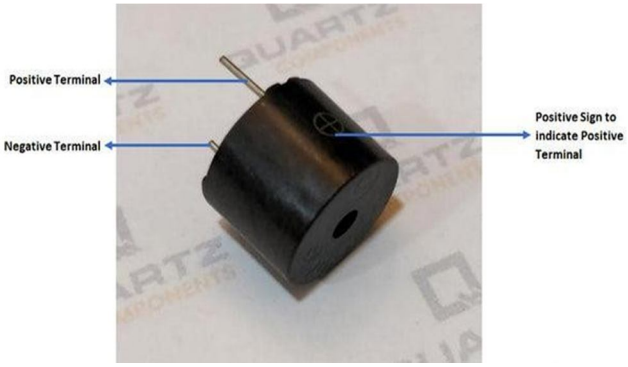

Figure 4: Piezo buzzer

5) Smart Cap

This system was created for the visually Impaired person for their daily use and for their better use. This cap is very easy to use, understandable, and easy to access in daily life to blind people. The cap has been tested and is approx. 95% accurate in detecting objects. Still initial testing results were encouraging. Initial testing showed that the cap was able to identify obstacles in the left, front, and right of the blind person. Being a cap, it also protects the person from the heat in environment. The focus of this project was to make a cost-effective solution which is achieved indeed. With further modification in reducing the size and weight of the components, it can be commercialized

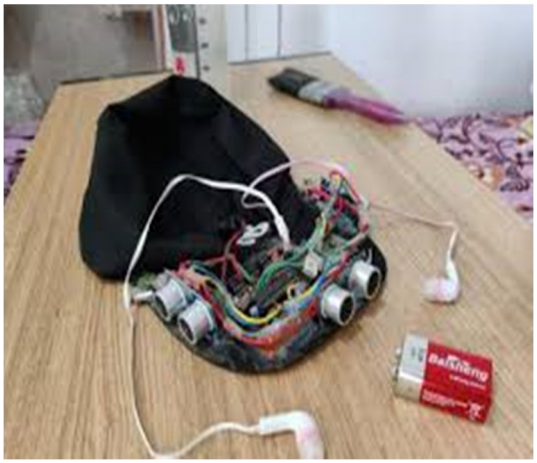

Figure 5: Smart Cap

V. MATHEMATICAL MODEL

Now let us look at the mathematical calculation of the obstacle detection system. Let us assume that the ultrasonic sensor sends out sound waves at a frequency of 40 kHz. The speed of sound in air is343 m/s. Therefore, the wavelength of the sound waves is:
wavelength = speed of sound / frequency
= 343 / 40000
= 0.008575 m

Let us assume that the ultrasonic sensor sends out sound waves in a cone-shaped beam with an angle of 15 degrees. Thearea covered by the beam at a distance of 200 cm is:

area = pi * (tan(15/2) * 200)^2
= 0.2618 * 40000
= 10472 sq. cm

Therefore, the resolution of the sensor at a distance of 200 cm is:

resolution = area / (200^2 * pi)
= 10472 / (40000 * pi)
= 0.0264 sq. cm

This means that the sensor can detect obstacles with a size of 0.0264 sq. cm at a distance of 200 cm.

The buzzer will be triggered if an obstacle is detected within a threshold distance of 50 cm. Therefore, the buzzer willbe triggered if the distance to the obstacle is less than or equal to 50 cm.

The GPS module can give accurate coordinates up to 6 decimal places. This means that the accuracy of the location ofthe vehicle is up to 10^-6 degrees. The GSM module can send an SMS with the location of the vehicle. Let us assume that the SMS costs Rs. 1. The obstacle detection system will be triggered if the emergency switch is pressed.

Overall, the obstacle detection system using ultrasonic sensor, buzzer, GPS, GSM module, and emergency switch can be designed to detect obstacles in the path of the vehicle, alert the driver, and send the location of the vehicle to an emergency contact in case of an emergency. The system can be programmed to work mathematically based on the specifications of the individual components.

VI.CONCLUSION

This device will help the blind person be more about the obstacles. This project is mainly for the blind peoples to avoid obstacles by themselves. This project provide efficient and a economical security system for the blind people. This project proposes an obstacle detection system for blind people to enhance their independence and safety. The system is portable, cost-efficient, and easy to use, offering various advantages. It utilizes sensors to detect obstacles in all directions, allowing blind individuals to navigate without relying on others. The combination of different components creates a real-time system that monitors the user's position and provides feedback, making navigation safer.

VII. FUTURE ENHANCEMENT

The blind device can be trained by using machine learning techniques for more number of objects which in turn would help the blind person to move around in various neighbourhoods with increased level of safety. Also, the voice sensor can be used for give instructions to the model from user and by using sound sensor instruction given by model can be received by user. In the future, the integrated Device is being folded and portable to use. These changes can increase the safety and convenient to use for the Blind people.

VIII. ACKNOWLEDGEMENT

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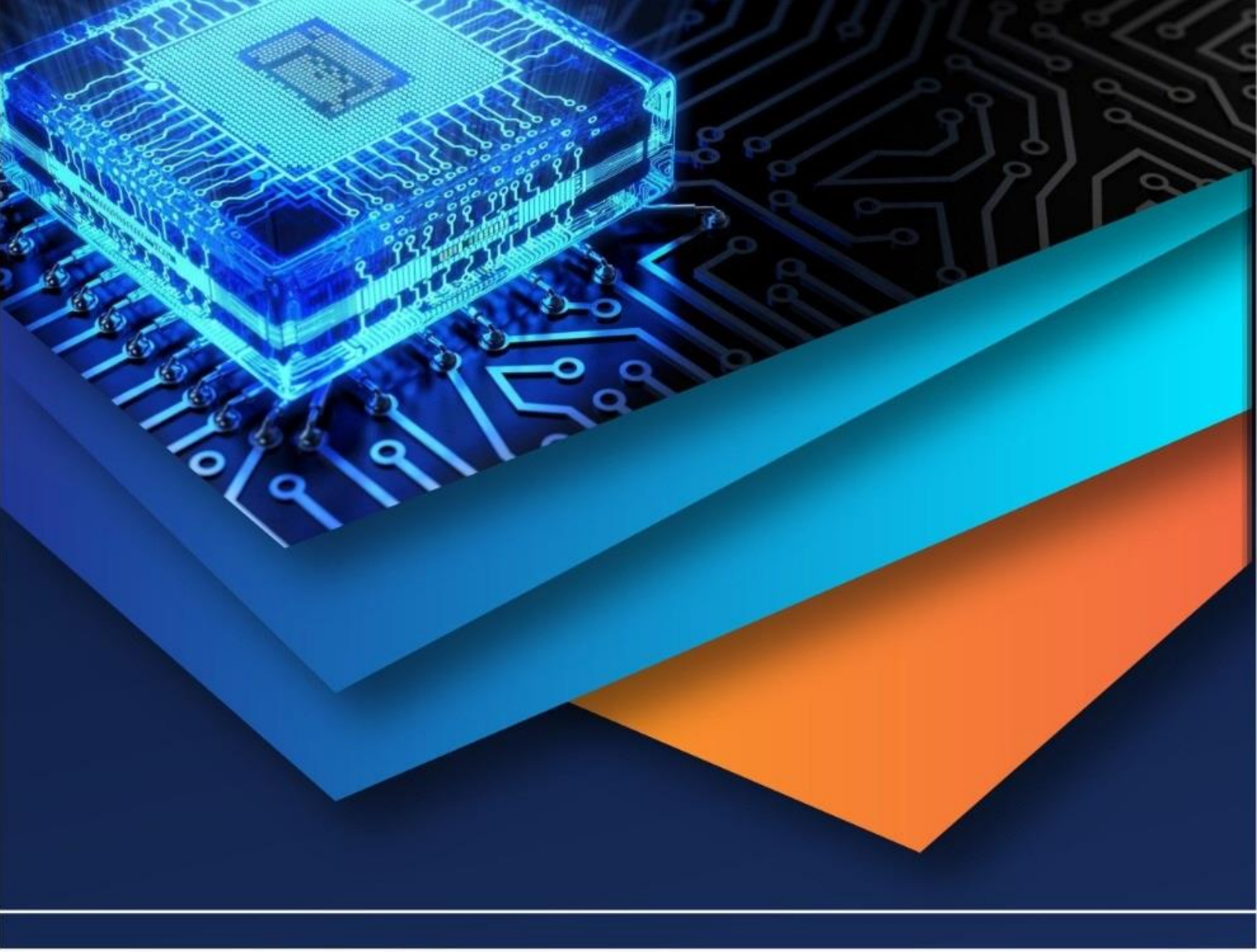

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