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Blind Safe Obstacle Detection

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Abstract: *Visually impaired individuals face challenges navigating streets due to difficulty detecting obstacles, which can make walking dangerous. A proposed solution is a smart device equipped with LiDAR sensors to detect obstacles and alert users through vibrations or buzzer sounds. Unlike traditional devices that only detect nearby obstacles, this advanced system offers broader detection for safer navigation. Additionally, it includes GPS and GSM features to track the user's location, enhancing both navigation and safety.*

Keywords: LoRa communication

I. INTRODUCTION

Visually impaired are those who are unable to detect even the smallest details with their healthy eyes. These individuals require assistive devices to overcome challenges related to blindness. It is reported that 10% of blind individuals have no usable vision, making independent and safe movement difficult. Electronic assistive devices are designed to address these challenges.

This work focuses on solving several issues faced by blind people, such as detecting obstacles or people at a certain distance, which could lead to collisions. Another concern is identifying hazards like holes or stairs that could result in falls. For most of us, navigating an urban environment is easy and automatic, but for a blind person, it requires intense focus to move independently, even on familiar routes. Without the ability to see, a blind person must rely on other methods for navigation, like feeling the ground with their feet, using the sound of their footsteps to judge distances to obstacles, recognizing specific smells or sounds in certain locations, or counting steps to determine when to change direction.

Any brief lapse in focus, unexpected obstacles, missed signals, or errors in counting steps can cause the blind person to lose their sense of direction, forcing them to seek assistance from others. The blind people are go to surrounding so it is important for home people know about where they are going. Because they face problem at any time and any were.

II. METHODOLOGY

The primary objective of the "Blind-Safe Obstacle Detection" system is to assist visually impaired individuals in safely navigating their environment by detecting obstacles and providing real-time feedback using vibration and audio signals. The system combines various sensors and communication modules to enhance mobility and ensure safety.

The methodology involves integrating multiple hardware components with a microcontroller to gather environmental data and alert the user accordingly. The workflow is structured as follows:

- Obstacle Detection: Use of LIDAR sensor to detect obstacles in the surrounding environment.
- Water Detection: A water sensor identifies wet or slippery surfaces.
- Location Tracking: A GPS module continuously updates the user’s location.
- Emergency Communication: A GSM module sends SMS alerts in emergency situations.
- User Feedback: A vibration motor and buzzer alert the user about obstacles or water hazards.
- Power Supply: A rechargeable battery powers the entire system.
- Microcontroller Control: All components are interfaced with a microcontroller that manages data flow and decision-making.

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III. PROPOSED SYSTEM

The human eye is one of the most important parts of the body, and losing sight, whether due to a genetic condition or an unfortunate accident, can be a significant challenge in life. Although other senses and intelligence can help compensate for the loss, the adjustment period can be difficult. To address this, we are developing a smart, sensor- enabled walking device designed to help blind individuals walk more confidently, with an extended range of obstacle detection.

By integrating an lidar sensor, the smart device will be able to detect objects within a specific range. The sensor's data will be processed and used to trigger a piezo buzzer, providing dynamic alerts based on the direction of the device. Traditional walking aids for the blind, such as a simple cap or hand belt, are limited by their fixed detection range and lack an alert system. These limitations will be addressed by our smart device, which offers an expanded range and an alert feature, benefiting both the user and others who may be in the blind person's path.

The design will focus on incorporating the lidar sensor and the Arduino unit into the device in a compact and efficient manner. Another challenge will be positioning the sensor in such a way that it minimizes the amount of movement required by the user to detect obstacles. Once these issues are resolved, the smart device will provide valuable assistance, helping blind individuals navigate more easily and get accustomed to walking independently.

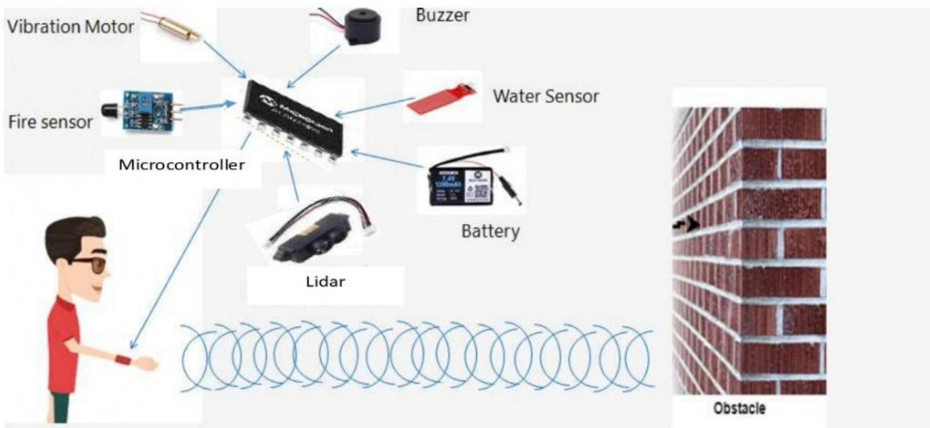

Fig. 1: Obstacle Detection

IV. WORKING PRINCIPLE

Startup**:** The system initializes all sensors and modules on boot.

Continuous Monitoring:

The LIDAR sensor scans for obstacles. If an object is detected within a predefined range (e.g., 1 meter), the microcontroller triggers the vibration motor and buzzer.

The water sensor checks for moisture. If water is detected, a distinct vibration pattern or buzzer sound is triggered.

Location Services**:**

The GPS module continuously logs the user's position.

In case of a button press (panic or emergency), the system uses the GSM module to send a message with GPS coordinates to a predefined contact.

Power Management**:** The system is powered by a battery, with voltage regulation circuitry to ensure safe operation.

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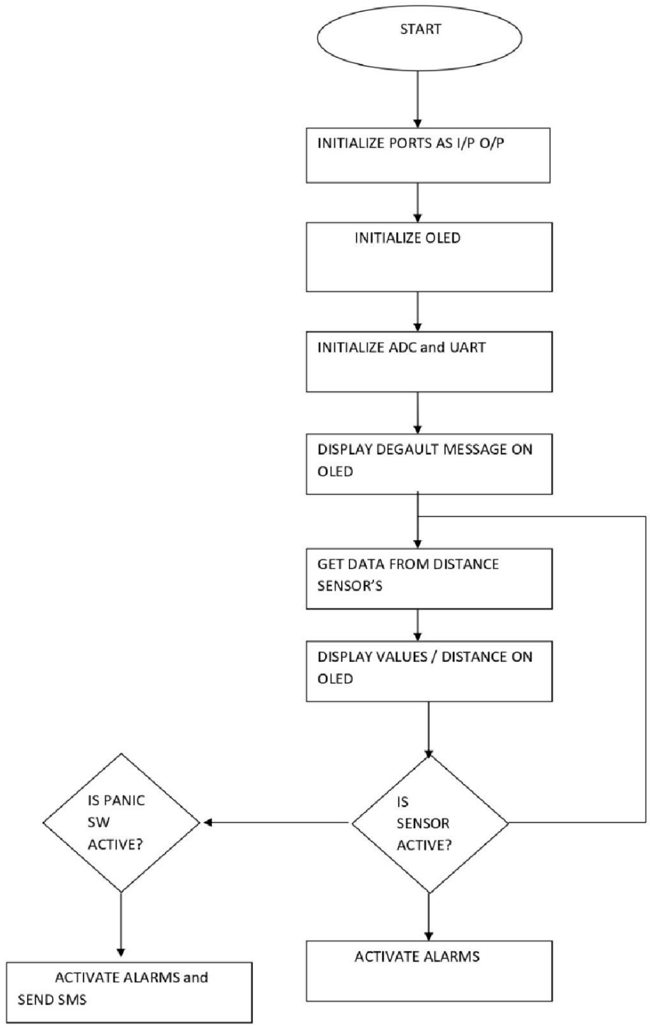

Fig. 2: Working flow of Component

V. RESULT & DUSCUSSION

The Blind Safe Obstacle Detection system was successfully tested and performed as expected in all scenarios. The LIDAR sensor accurately detected obstacles within 50 cm, activating the vibrator motor to alert the user. The fire sensor responded quickly, triggering both the buzzer and an emergency SMS with GPS coordinates. The GPS and GSM modules worked efficiently, sending accurate location data to a guardian's phone. The system operated for around 5.5 hours on battery, meeting power efficiency goals. No false alerts were observed, and all components integrated smoothly. Overall, the system proved to be reliable, responsive, and suitable for enhancing the safety and independence of visually impaired users.

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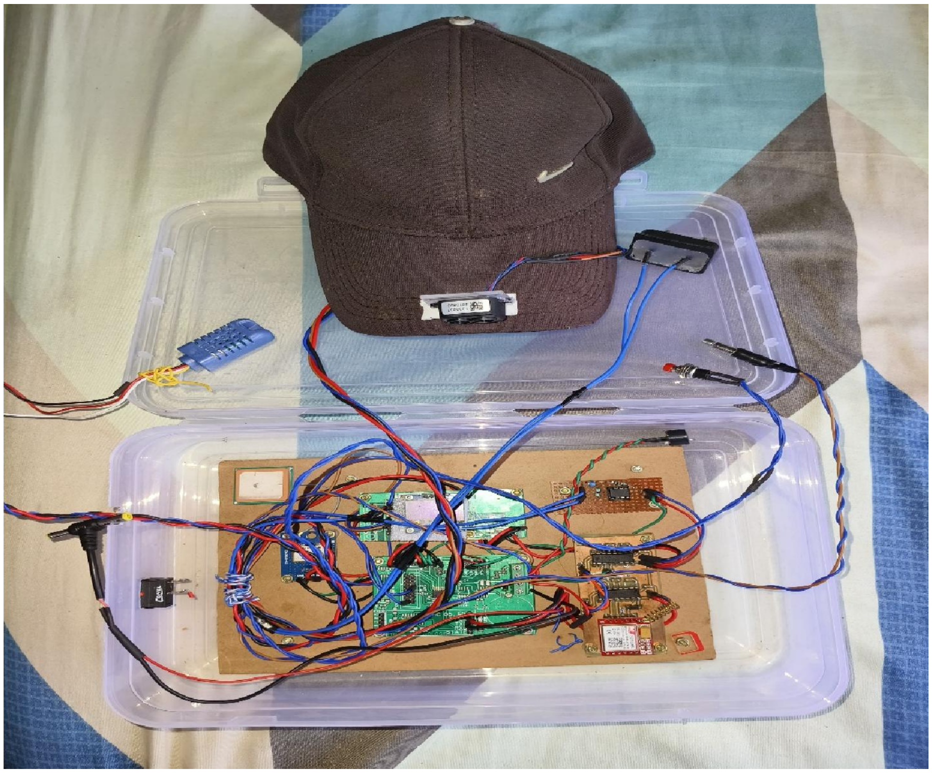

Fig. 3.1: Hardware Implementation

Fig. 3.2: Project Implementation

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VI. CONCLUSION

Smart sensors are not just a passing trend; they are shaping the future. As more people recognize the benefits of these technologies, the fields will continue to grow without limits. The design of this project demonstrates practicality, cost-efficiency, and great usefulness. This project is specifically aimed at helping blind individuals. It can be further enhanced with more sensors to make decisions, allowing it to serve different purposes.

The system focuses on solving challenges faced by blind people in their daily lives and ensuring their safety. It introduces an obstacle detection system that helps visually impaired people navigate safely. The system uses an lidar sensor to detect obstacles and objects in the path of the user. This system is used to find the location of blind people using GPS and received the SMS using GSM. The prototype is both easy to use and affordable, making it a valuable advancement in the field of blind recognition systems due to its durability, user-friendliness, and cost- effectiveness.

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