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Smart Assistant for Visually Impaired People

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Abstract: It is difficult for blind persons to move around. While traditional white canes only offer 3D space assistance and do not inform the user of oncoming objects, potholes, waterways, flames or slopes. In this paper, we have so far developed the filter blind stick with an Arduino UNO and different sensors, such as the fire sensor, water sensor, depth sensor, and ultrasonic sensor, to detect heat, water, and obstacles in the user's path. The new proposed system improves mobility, safety, and independence of blind individuals.

Smart assistant for visually impaired is designed to process the data in real-time which helps the user identify the obstacles in the way and warn at the earliest time via voice so that the user can walk more confidently. The use of several sensors guarantees broad hazard detection, reducing risk in both indoor and outdoor settings. The addition of LED indicators and a switch improves usability too.

The device utilizes an Arduino Uno microcontroller, an APR9600-based 8-channel voice module, and four environmental sensors—fire, water, depth, and ultrasonic—to detect hazards. The system issues real-time voice alerts via a speaker and sends GPS location details through a GSM core board module. Power is regulated using a buck converter, ensuring efficiency and portability. The prototype emphasizes accessibility, low cost, and ease of use, with potential applications in both urban and rural areas. This research proposes a cost-effective, smart assistant device designed to increase situational awareness and safety for visually impaired persons.

Keywords: Smart blind stick, Arduino UNO, ultrasonic sensor, fire sensor, water sensor, depth sensor, voice module, assistive technology, visually impaired navigation, buck convertor, GSM core board module.

I. INTRODUCTION

The lack of vision makes the visually impaired individuals struggle to see the hurdles or danger in their environment. Traditional aids such as white canes do not offer the capability of real time hazard detection. This paper presents an innovative design of a smart assistant for visually impaired incorporated with the latest sensors and Arduino UNO to provide a real-time response which makes the navigation simple and efficient and enhances the overall safety of the blind people.Cognition device there is a gap as technology all to cell phone so there is a gap in light sensor device that goal of mobile human assistance there is add so smart stick is a light and lossless for smart system maybe be detect the environment. Unlike classic white canes that return tactile feedback upon direct contact with an obstacle, this method can detect hazards before contact. Integrating multiple sensors makes the device more accurate and reliable, providing more coverage of the user's surroundings.

Over the last few years, the trends of sensor technology, embedded systems, and advancements in the cost-effective and efficient devices have led various assistive devices to be designed. The proposed smart blind stick, on the other hand, utilizes these technologies not only to improve navigation support but also added safety features including fire and water detection. Using an Arduino UNO microcontroller in this process of converting HK data and header files into a user friendly computer interfacing for our Microcontroller is more sophisticated as each bit data can easily be processed, manipulated or written into the main controller of the Microcontroller. The focus this work is to create assistive device, which improves visually impaired people independence and confidence. The smart blind stick provides an easy and low-cost solution to enhance movement and navigation in daily life by integrating multiple sensors and voice feedback system. This research proposes a multi-sensor smart assistant that integrates real-world awareness into a compact device using Arduino Uno, capable of alerting users via voice commands and emergency SMS alerts. The system is designed to be low-cost, scalable, and applicable in real-world scenarios, especially in developing countries where accessibility to expensive assistive technology is limited.

Visually impaired individuals often face significant challenges in independently navigating their environments. Traditional walking sticks provide only limited feedback, typically physical contact with obstacles. Recent technological developments have led to the creation of assistive devices with advanced sensors, offering safer and smarter alternatives.

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II. LITERATURE SURVEY

In recent years, several assistive technologies for the visually impaired have emerged, leveraging advancements in embedded systems, IoT, and AI. Traditional devices include:

White Canes: Offer tactile feedback but lack environmental awareness'

Smart Canes (e.g., We Walk, Smart Cane): Include ultrasonic sensors for obstacle detection but are often costly.

Wearable Assistive Devices: Some utilize computer vision (e.g., Orcam My Eye), but these are expensive and power-intensive.

Research by Kaur et al., 2021 developed a wearable ultrasonic-based obstacle detection system. However, it lacked multi-hazard awareness such as fire or water hazards. Another study by Ramesh et al., 2022 incorporated GPS modules for location tracking but did not provide audio feedback or real-time alerts.

The APR9600 voice playback module has been used in educational and emergency applications due to its ability to store pre-recorded messages. Combining it with environmental sensors and GSM modules in assistive technology remains under-explored. This research fills that gap by providing a multi-sensor, audio-guided assistant with GSM-based location broadcasting, intended for use by visually impaired individuals.

III. METHODOLOGY

1) A structured methodology will be adopted during the development of the smart blind stick to ensure optimal functionality and usability. Here is an outline of the process:
2) Sensors Selection: Choosing appropriate sensors and electronic components to detect barriers, fire, water, and depth.
3) Designing the circuit with Arduino UNO as the central processing unit, integrating all the sensors including voice module, LED indicators, and power supply.
4) Arduino Code Writing: Processing the data coming from the sensors and triggering alert voice alerts accordingly.
5) Construction of the Prototype: The final assembly of all components onto the PCB (which is 6x4 cm) producing a compact portable device.
6) Fewer tests and adjustments only for responsiveness evaluating accuracy of a sensor for detecting obstacles, changes in depth, whether it is fire or water, if it varies in a different environment.
7) Training: Evaluating the effectiveness of device with visually impaired users
8) This way, the smart blind stick is created as an easy to use and effective solution for better security and independence of users with insufficiently sight.

WORKING**:** The device continuously monitors the surroundings using its four sensors. When the ultrasonic sensor detects an object within 1.5 meters, it triggers the playback of “Obstacle ahead”. If the fire sensor detects a flame or high temperature, it triggers “Fire detected.” The water sensor alerts the user with “Water on the ground,” helping avoid slipping or damage to footwear. The depth sensor detects pits or uneven terrain, warning “Be careful, depth ahead.” These alerts are played through the speaker using the APR9600 module. When any sensor triggers an alert, the Arduino also sends a command to the GSM module to transmit a predefined message like:“Emergency! Hazard detected at [location ID]. A GPS module can be optionally integrated with the GSM module to include exact coordinates. Inputs from the sensors connected to digital and analog pins. Output triggers to the APR9600 module via 8 digital pins. Audio output connected to a speaker with 8–16 Ohm’s impedance.

The GSM module isconnected to TX/RX and powered via the buck converter. A rechargeable battery is used for portability. The buck converter reduces the battery voltage (7.4–12V) to 5V for Arduino and 3.7–4.2V for the GSM module, ensuring stable operation. The 12V input from the battery is connected to the input terminals of the buck converter. Using the adjustable potentiometer knob, the output voltage is set precisely to 5V for the Arduino Uno, voice module

(APR), and sensors. A separate buck converter output (or another small buck converter) is configured to supply 3.7V–4.2V to the GSM module, which is sensitive to over-voltage.

n a project designed to assist visually impaired individuals’ real-time communication is critical. The GSM module enhances safety by providing the capability to: Automatically send an SMS alert when any environmental hazard (fire, water, obstacle, depth) is detected by the sensorsCommunicate the type of hazard and optionally include the user’s location if a GPS module is integrated.Send alerts even if the user is alone or unconscious, ensuring help can be summoned quickly.

The Arduino continuously monitors the environment using sensors.If a hazard is detected, the Arduino sends AT commands to the GSM module through its serial pins. The GSM module sends an SMS to a predefined phone number (caregiver, family member, emergency contact).

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The message content is customizable and can be something like: “Alert: Obstacle detected in front of the user. Location: [Latitude, Longitude]” To ensure the GSM module works reliably: It is supplied with 3.7V to 4.2V using a dedicated buck converter, as over-voltage can damage it.An external antenna is used (if needed) to improve network reception, especially in remote areas.A SIM card with good signal and SMS pack is recommended for continuous functionality.

This module adds a life-saving communication feature to the system, giving the smart assistant a real-world application in emergency scenarios. It ensures that help can be requested even without human intervention, making the device truly intelligent and supportive for the visually impaired.

The Arduino code performs the following: Reads sensor values at regular intervals. Compares them with threshold limits. Triggers corresponding APR voice channel and sets HIGH signal.

Sends SMS via GSM using AT commands. Incorporates delays to prevent message spam or repeated triggers Code snippets are modular to allow additional sensors or voice modules in future expansions.

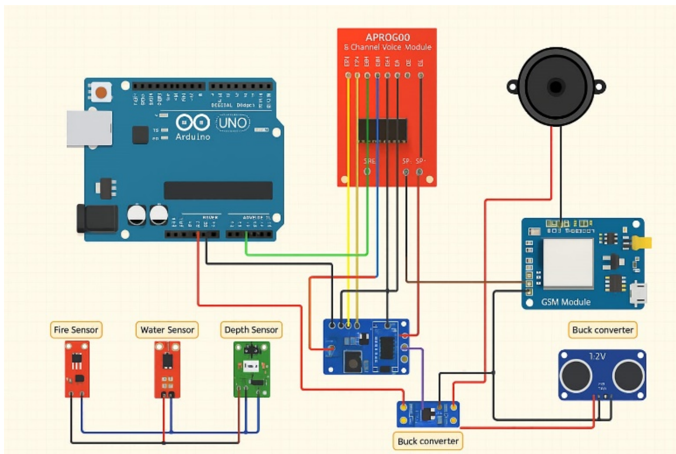


Fig: CircuitDiagram of Smart Assistance for Visually Impaired People

IV. CONCLUSION

The development of a smart assistive walking stick using an Arduino UNO and multiple environmental sensors offers a significant step forward in enhancing the independence, mobility, and safety of visually impaired individuals. Traditional white canes, while helpful in detecting immediate obstacles by physical contact, do not provide any warning about distant or non-contact hazards such as holes, fire, or water. This smart stick addresses these limitations by proactively identifying potential threats in the user's path and delivering timely audio alerts through a simple voice module.

The inclusion of an ultrasonic sensor enables real-time detection of obstacles up to several meters ahead, allowing the user to adjust their path before encountering the object. The depth sensor adds another layer of protection by detecting sudden drops or uneven terrain that may pose a falling risk. The fire sensor helps detect the presence of flames, which can be particularly life-saving in indoor or emergency scenarios. Meanwhile, the water sensor alerts the user to slippery or wet surfaces, reducing the chance of slipping or damage to footwear.

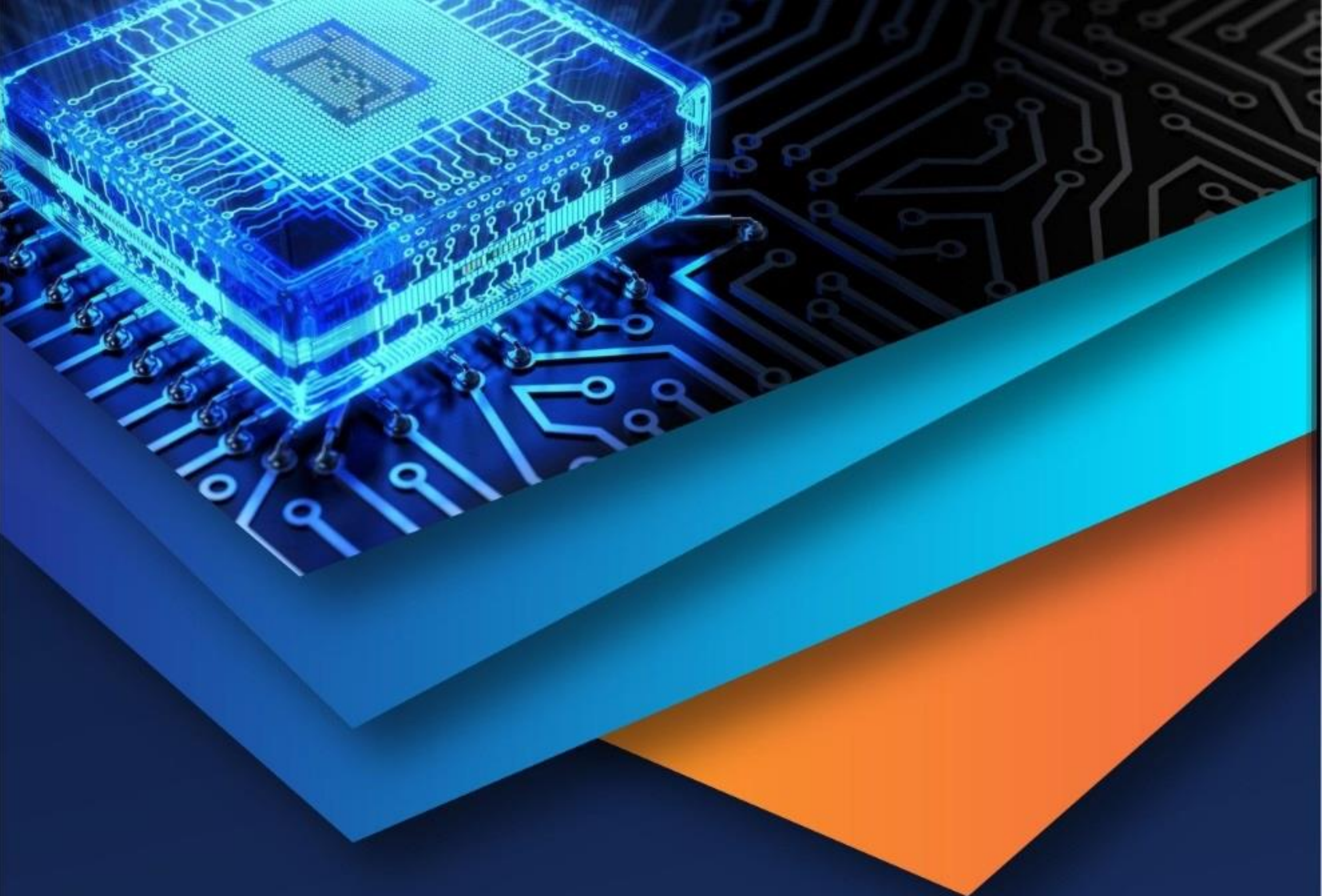
All sensor data is processed by the Arduino UNO, which acts as a reliable and cost-effective control unit. By utilizing the APR9600 voice module, the system provides pre-recorded, clear voice messages corresponding to each type of hazard. This approach maintains simplicity while ensuring that the user receives crucial information in real-time. The device also includes a vibration motor and buzzer, offering tactile and audible feedback as additional layers of communication, especially useful in noisy or crowded environments. Importantly, this project avoids the use of artificial intelligence or complex algorithms, which not only reduces cost and technical complexity but also ensures the device remains accessible to users in rural or underdeveloped regions where internet connectivity and AI-support infrastructure may be lacking. Its low power consumption, ease of use, and modular design make it an ideal candidate for wide-scale implementation, including government-assisted disability aid programs.

This research demonstrates the feasibility of building a cost-effective smart assistant for the visually impaired using an Arduino-based platform. The integration of multiple sensors, a voice module, and a GSM communication system provides both real-time feedback and emergency notification capabilities.

With a modular design and scalable features, this system can be customized for various real-world environments and can significantly improve the quality of life and safety of visually impaired individuals. Its affordability and ease of assembly also make it an excellent candidate for deployment in rural and low-income areas.

REFERENCES

[1] World Health Organization (WHO). (2019). World Report on Vision.
[2] https://www.who.int/publications/i/item/world-report-on-vision
[3] APR9600 Datasheet.
[4] https://files.seeedstudio.com/wiki/Grove-Sound_Recorder/res/Datasheet_of_APR9600.pdf
[5] SIM800L GSM Core Board Datasheet.
[6] https://www.makerhero.com/img/files/download/Datasheet_SIM800L.pdf
[7] HC-SR04 and Arduino Integration Guide.
[8] https://howtomechatronics.com/tutorials/arduino/ultrasonic-sensor-hc-sr04/
[9] Arduino.cc - Official Documentation.
[10] https://docs.arduino.cc/



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