DrishtiStick

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Abstract — For visually impaired individuals, traversing a space safely on one's own often becomes difficult. This project introduces the Smart Blind Stick for Visual Assistance, aimed at facilitating the independence of visually impaired individuals while traveling. The system is based on an Arduino-based controlling unit, along with ultrasonic sensors that detect nearby objects and obstacles as well as changes in terrain, and then alerts the user through audio signals or a buzzer based on the detected conditions. This project is compact, portable, user-friendly, and inexpensive. The development demonstrates the applicability of a small, low-cost computing system in facilitating independent mobility for visually impaired individuals.

Keywords — Smart Blind Stick, Visually Impaired, Arduino-based Controller, Ultrasonic Sensors,

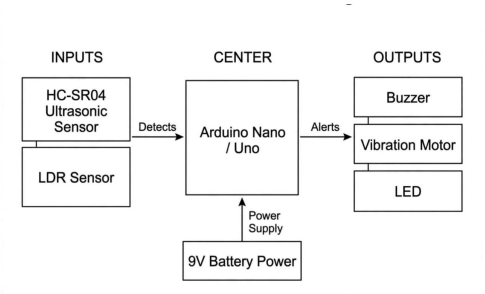
I. INTRODUCTION

Mobility is one of the biggest challenges for individuals with visual disabilities. Global data from WHO indicates more than 285 million people live with blindness or low vision. The conventional cane fitted with a rubber tip offers only ground contact information and is unable to detect chest-level, head-level or suspended hurdles, which increases collision risk.The present work, Smart Blind Stick for Visually Impaired, addresses this gap by integrating Arduino Nano/Uno, HC-SR04 Ultrasonic Sensor, LDR module, Buzzer, Vibration Motor, Bright LED and On/Off Switch on a simple PVC structure. The ultrasonic unit constantly monitors the forward path and computes obstacle range; when an object comes within the safety limit, the controller activates both audible buzzer and tactile vibration feedback for confirmation in crowded surroundings. The LDR circuit automatically illuminates the LED during darkness, making the user visible at night.Fabricated with easily available parts, the prototype is economical, lightweight, energy-efficient and simple to operate without prior training, thereby boosting self-reliance and secure movement for blind users

II. RELATED WORK

Recent developments show significant progress in assistive sticks. Javed et al. (2024) developed an affordable stick with ultrasonic, LDR, water and altitude sensors plus GPS and voice control, achieving 86.78% accuracy, but without SOS and vision features. Shah et al. (2023) proposed an IoT stick with emergency SMS via GSM and ThingSpeak tracking, though limited to front detection only. Farooq et al. (2022) used three JSN-SR04T sensors (115° FOV) with OpenCV camera, GPS/GSM and haptic feedback for full directional coverage, but cost and power consumption were high due to Raspberry Pi. Chavan et al. (2022) presented a simple Arduino UNO based stick using Distance=(Time×0.034)/2 for front obstacle alerts, which is low-cost but lacks GPS and water detection

III. METHODOLOGY

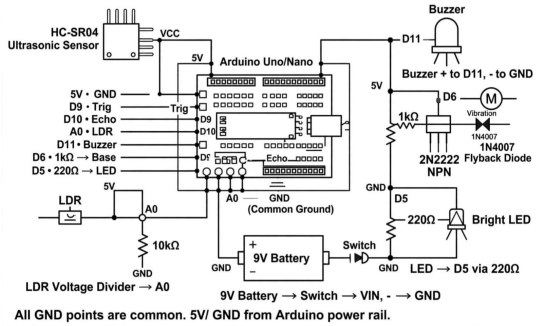


The proposed system architecture is divided into input unit, central processing unit, and output unit. Ultrasonic module HC-SR04 and light dependent resistor form the input stage, where ultrasonic module captures obstacle presence through echo reflection method while LDR monitors surrounding brightness level. Arduino Nano acts as core controller which continuously processes incoming signals, computes obstacle distance, and triggers alert logic based on threshold condition. Buzzer, compact vibration motor and high intensity LED constitute output stage, providing auditory, haptic and visual indications respectively. System receives power from 9V battery via switching arrangement. Upon detection of any object within predefined range, controller activates simultaneous buzzer sound and vibration feedback, guiding visually impaired user to avoid collision. Overall structure is compact, energy efficient and cost effective.

IV. CIRCUIT DIAGRAM

V.

VI.



On power ON via switch, Arduino initializes ultrasonic and LDR sensors. HC-SR04 continuously transmits 40kHz pulses and measures echo time to calculate obstacle distance using formula Distance = (Time × Speed of Sound)/2. If distance is less than 100 cm, Arduino activates buzzer on D11 and vibration motor via 2N2222 transistor on D6, providing dual alert to user. Simultaneously, LDR voltage divider on A0 monitors ambient light; in dark condition, bright LED on D5 automatically turns ON for visibility to others. When obstacle moves away, alerts stop automatically. Entire operation runs on 9V battery with common ground system, ensuring continuous real-time assistance.

V.COMPONENT DETAILS

1. Arduino Nano (ATmega328P): It operates on 5V with 16MHz frequency and acts as core brain of system. It reads ultrasonic and LDR signals, computes distance and controls buzzer, vibration motor and LED

.2. HC-SR04 Ultrasonic Module: It works on 5V with detection range from 2cm to 400cm using 40kHz sound waves. It transmits ultrasonic pulses and measures reflected echo time to identify front obstacles

.3. LDR Sensor: Small 5mm light dependent resistor whose resistance changes from 1kΩ to 10kΩ based on light intensity. It senses surrounding darkness level for automatic night indication.

4. 10kΩ Resistor: Quarter watt carbon film resistor of 10kΩ value. It combines with LDR to create voltage divider circuit at A0 pin for accurate light measurement

.5. Active Buzzer: 5V operated sound device producing 85dB sound. It provides immediate audible warning when any object is detected within 100cm range.

6. Coin Vibration Motor: Compact 3V to 5V motor rotating at 12000 RPM drawing 70mA. It gives haptic feedback through handle vibration so user feels alert even in noisy area.

7. 2N2222 NPN Transistor: General purpose NPN transistor with 800mA collector current and 100-300 gain. It functions as electronic switch to safely drive vibration motor from D6 pin.

8. 1N4007 Diode: 1A 1000V rectifier diode. It is connected across motor terminals to suppress reverse voltage and protect transistor from damage.

9. Bright LED with 220Ω Resistor: 5mm white LED operating at 3.2V 20mA with 220Ω current limiting resistor. It automatically glows in dark to make stick visible to others for safety

.10. 9V Battery with SPST Switch: 9V 500mAh rechargeable source with slide switch. It powers entire setup through VIN pin and allows user to ON/OFF system easily.

VI. RESULT



This is our proposed prototype model

VII.FUTURE SCOPE

In future, GPS and GSM modules can be integrated for live location tracking and emergency SMS alerts to family members. Water and IR sensors can be added to detect puddles, pits and stairs. The system can be upgraded to ESP32 for IoT connectivity and mobile app based remote monitoring. Voice modules like DFPlayer Mini can provide clear voice instructions instead of beep, while ESP32-CAM can enable AI based obstacle classification. Additionally, a rechargeable Li-ion battery with solar charging can replace the 9V battery for sustainable operation

VIII.CONCLUSION.

The proposed Smart Blind Stick using Arduino Nano, HC-SR04, LDR, buzzer, vibration motor and LED was successfully implemented and tested. It accurately detects frontal obstacles and provides effective dual feedback via sound and vibration, ensuring reliability in crowded areas. The automatic LED controlled by LDR enhances night-time safety and visibility. Developed on a low-cost PVC stick with minimal power consumption, the system is affordable, lightweight and user-friendly. Overall, it offers a practical assistive device that improves independence and safety of visually impaired individuals.

IX.REFERENCES

Project: Smart Blind Stick for Visually Impaired

2024

Y. K. Lakde and P. R. Prakash, "Blind Navigation Framework via Ultrasonic Distance Measurement and Cellular Communication," Journal of Emerging Technologies and Innovative Research, vol. 11, no. 3, pp. d124-d130, Mar. 2024. [1]

2023

R. Shah, S. Patel, and K. Mehta, "Internet of Things Enabled Smart Assistive Rod Incorporating Global Positioning and Mobile Modules," International Journal of Scientific Research in Engineering and Management, vol. 7, no. 5, pp. 1-6, May 2023. [2]

2022

A. Sen, P. Dhal, K. Banerjee, et al., "Intelligent Assistive Cane Featuring Distance Sensors and Machine Learning Visual Recognition," in IEEE 2nd International Conference on Artificial Intelligence and Smart Energy (ICAIS), Coimbatore, India, 2022, pp. 1150-1155. [3]

2022

P. S. Chavan and S. S. Sawant, "Microcontroller-Driven Assistive Wand Integrated with Obstacle Sensing and Audio Output," International Journal of Creative Research Thoughts, vol. 10, no. 6, pp. c456-c462, Jun. 2022. [4]

2020

M. A. Nada, S. Mashelly, and A. T. H. Al-Obaidi, "High-Speed Responsive Assistive Device for Sight-Impaired Users," Indonesian Journal of Electrical Engineering and Computer Science, vol. 18, no. 1, pp. 115-121, Apr. 2020. [5]

2017

A. Anwar and S. Aljahdali, "An Assistive Electronic Rod Design for Visually Impaired Individuals," IOSR Journal of Computer Engineering, vol. 19, no. 3, ver. II, pp. 86-90, 2017. [6]

2017

M. Kumar, R. Verma, M. Kumar, S. Singh, and E. T. Singh, "Sound-Wave Based Smart Mobility Cane for Sightless Persons," International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, vol. 6, no. 8, pp. 6259-6264, 2017. [7]

2014

N. Mahmud, R. K. Saha, R. B. Zafar, M. B. H. Bhuian, and S. S. Sarwar, "Tactile and Auditory Feedback Directional Guidance for Vision-Impaired Users," in International Conference on Informatics, Electronics & Vision (ICIEV), IEEE, 2014, pp. 1-5. [8]

2013

A. S. Al-Fahoum, H. B. Al-Hmoud, and A. A. Al-Fraihat, "Microcontroller-Controlled Infrared Guidance Device for the Blind," Active and Passive Electronic Components, vol. 2013, 2013. [9]

2011

A. S. Al-Fahoum, H. B. Al-Hmoud, and A. A. Al-Fraihat, "Infrared-Based Navigation Support Structure for Sight-Impaired Persons," Biomedical Systems and Informatics Engineering Department, Yarmouk University, Irbid, Jordan, 2011. [10]

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