



## Smart Blind Sticks for People with Visual Impairments in the Digital Age: Suggestions and Prospects

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### Abstract

In order to improve mobility and independence for visually impaired people in the digital age, this study designs and develops an intuitive Smart Blind Stick. This project aims to boost accessibility and safety, improve user experience through user-friendly notifications, and improve obstacle detection accuracy. Compared to current systems, our novel system offers better audibility and position tracking capabilities by integrating ultrasonic sensors, GPS (Global Positioning System), GSM (Global System for Mobile Communications), and amplifier modules. The GSM module, which makes use of the digital infrastructure of Industrial Revolution 4.0, allows emergency location sharing via SMS, giving visually impaired people more security and autonomy. There is a thorough discussion of the suggestions and future course of the smart blind stick for individuals with vision impairments in the digital era.

**Keywords:** Future Directions, Recommendations, Arduino Uno, Loudspeaker, GPS Module, GSM Module, Ultrasonic Sensor.

## I. INTRODUCTION:

In the 1987 NSSPD, 0.4% of participants (6,826 people) reported being blind; by 2006, that number had risen to 12.33 million, or 14.9% of all handicapped people [1]. Because of their physiological limitations, blind people have particular everyday difficulties. Accurately identifying and avoiding obstacles is the main challenge, which is currently handled by guiding devices and guide dogs. However, training guide dogs necessitates a significant investment of time and money, and their help is only temporary. The goal of this project is to create a novel, affordable Smart Blind Stick that will improve the mobility and independence of people with visual impairments by detecting obstacles intuitively and offering a convenient substitute for conventional guiding devices.

## II. FUTURE DIRECTIONS AND RECOMMENDATIONS

With continuous research and development concentrating on improving usability and usefulness, smart blind sticks for visually impaired people have a bright future in the digital age. These are some suggestions and future paths for the sector:

- i. **Integration of Advanced Sensors:** To enable more precise obstacle detection and environmental awareness, smart blind sticks' ultrasonic, infrared, and LiDAR sensors should be continuously improved.
- ii. **Improved Audio Feedback:** Create smart blind sticks with more advanced audio feedback features, like speech cues or haptic feedback, to give consumers instantaneous, clear alerts.
- iii. **User-Driven Design:** Encourage the involvement of visually impaired individuals in the design and testing process to ensure the smart blind stick meets their needs and preferences.
- iv. **Accessibility and Usability:** Focus on making smart blind sticks more accessible and user-friendly, with features

- v. Cooperation with Other Technologies: To develop a more complete assistive technology solution, investigate how smart blind sticks can be integrated with other technologies like Bluetooth, GPS, and the Internet of Things.
- vi. Continuous Testing and Improvement: To improve the smart blind stick's functionality and dependability in practical situations, conduct frequent testing and improvement cycles.

The smart blind stick sector may continue to innovate and enhance the lives of visually impaired people by adhering to these guidelines and suggestions, guaranteeing that they can move around more independently and confidently.

### III. RELATED WORKS

When it comes to identifying obstacles from a three-dimensional perspective, Xu Xiangyu's group's CTT blind guide [2] is precise and understandable. Its operability and practicability are limited, and it is still not practically usable. Huang Hongzhi's intelligent trip navigation helmet [3] employs visual processing to recognize traffic signals and obstacles. The helmet is hefty and challenging to carry despite its many functions. Although Lin Chen's intelligent blind walker [4] uses infrared detection to autonomously avoid obstacles and relay information via head-mounted sensors, the accuracy of infrared rays is low, highly reliant on the environment, and difficult to carry. According to the intensity of reflected light, Wu Xue et al.'s multi-directional infrared-ranging intelligent bracelet [5] uses infrared ranging, and the system accurately verifies its obstacle avoidance capability over black, white, and gray obstacles. The bracelet can detect just a restricted number of things, which limits its use. A blind aid system is available in the public space created by the Karen Duarte team; however, its use is restricted to the relatively small space of a shopping center. The Sularso Budilaksono team's blind guide rod, which is small and only has one function—the HC-SR04 ultrasonic sensor—is controlled by an Arduino master controller. This means that blind individuals cannot benefit from a better experience. This paper designs a blind guide stick with an STM32 single-chip microcomputer at its core. This microcomputer can accurately measure the distance by ultrasonic and feed back to the blind in time through voice broadcast, making up for the shortcomings of the above system's slow real-time detection, inaccurate infrared rays, and delayed feedback. When faced with danger, the vibration motor alerts the blind and allows them to send an SMS to their guardians. The system's implementation can significantly lower the potential safety risk associated with blind persons walking and the number of accidents brought on by their incapacity to perceive impediments [6]. This paper's primary contributions include an assessment of the state-of-the-art in travel aids from a design standpoint and an investigation of the following problems: (1) The significance of design concerns in wearable travel aids and the degree to which these are considered in various devices; (2) Any connection, if any, between the location and mode of use of travel aids and their features, design, and functions; (3) The limitations of current devices, the absence of certain ones, and future directions for research, especially in terms of satisfying the needs of potential users [7]. In this study, we provide a tool that facilitates the detection of impediments and puddles of water. This system consists of Android applications (APPs) and a walking stick. The walking stick has sensors, a global position system (GPS) module, a Raspberry Pi and programmable interface controller (PIC) as a control kernel, and components that provide alerts embedded in it. Obstacles can be identified with the use of sensors, and the VCP is alerted about them via buzzers or vibrations. Parents can use an application to track their child's location after the GPS module receives the coordinates of the VCP. Another crucial app is the emergency app, which allows the VCP to instantly contact friends or parents by shaking their phone or, in an emergency, pressing the power button four times in five seconds. We employed fewer parts to create a lightweight, comfortable, and feature-rich gadget with excellent performance. In the end, this gadget will boost VCPs' confidence in an unfamiliar setting by enabling them to live somewhat independently (and securely) [8]. Third Eye for the Blind using Ultrasonic Sensor [9]. A heart pulse sensor and other electronic modules that can be linked to the nearest relative's Android smartphone are used in the construction of this blind stick. The purpose of using pulse heart sensors is to measure a person's pulse rate per minute in order to assess their overall health [10]. LowCost Walking Stick for Obstacle and Stair Detection using Arduino [11]. The design, development, and testing of an Internet of Things-enabled smart stick that can identify and alert users to impediments is presented in this work [12]. The device is intended to help visually impaired persons traverse the outside world. This study presents the design, development, and testing of an Internet of Things (IoT)-enabled smart stick that can identify and notify users of impediments to aid visually impaired people in navigating their environment [13].

### IV. MATERIAL AND METHODS

#### 3.1. The table below shows the materials used in this research

S/N	Names	Quantity used
1	Arduino Uno	1
2	Ultrasonic Sensor	1
3	GSM Module	1
4	GPS Module	1
5	Loudspeaker	1
6	Batteries	3
7	Switch	2

### 3.2 Methods

In the study, an adapter is used to power on the system using dry cell batteries, and if the batteries run out, the adapter is utilized to charge the batteries. To turn the entire system on or off, use a switch button. When the system is powered on, the system will not create any sound until the ultrasonic sensor used in this research senses an obstacle, then it will make a sound that “Obstacle Detected” with the help of the sound amplifier used in this research. In the event that the blind man presses the panic button and finds himself in danger, the GPS module utilized in the study also notifies the registered cell phone number.

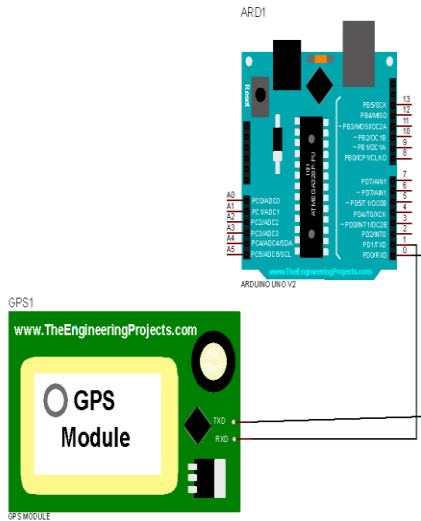


Fig. 1: Interfacing of the GPS Module to the Arduino Uno

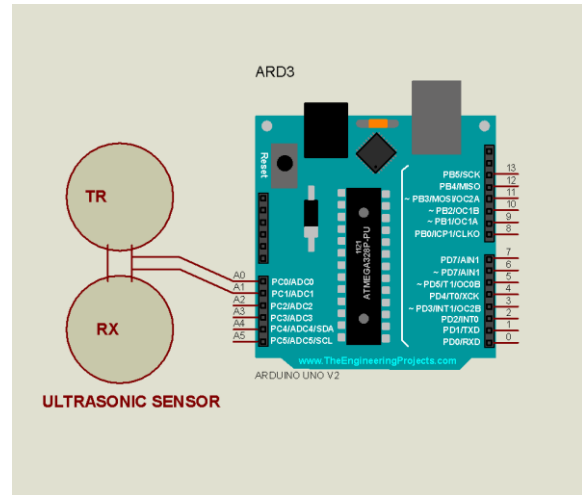


Fig. 3: Interfacing of the Ultrasonic Sensor to the Arduino Uno

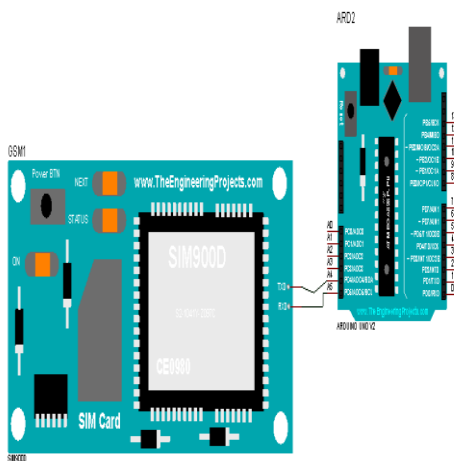


Fig. 2: Interfacing of the GSM Module to Arduino Uno

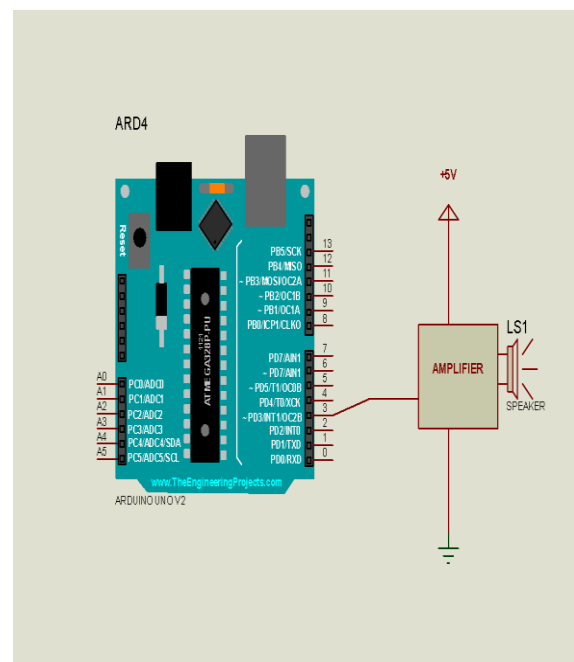


Fig. 4: Interfacing of the Sound module amplifier

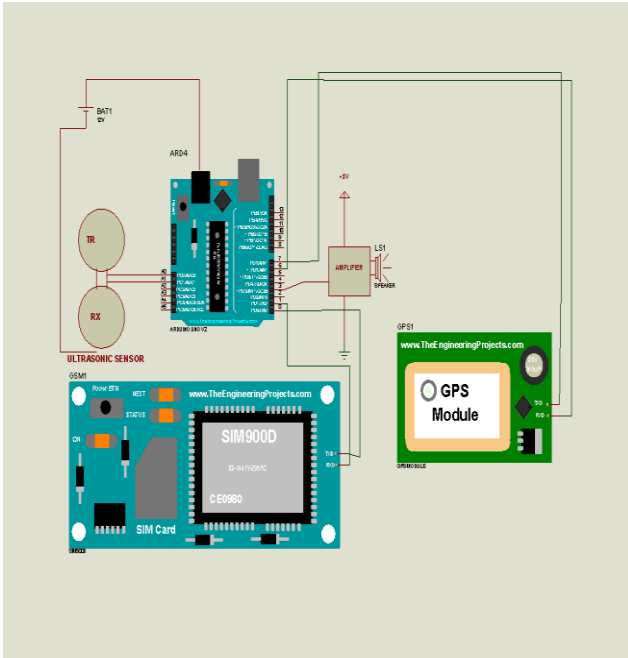


Fig. 5(a): The Pin Configuration of the whole Circuit

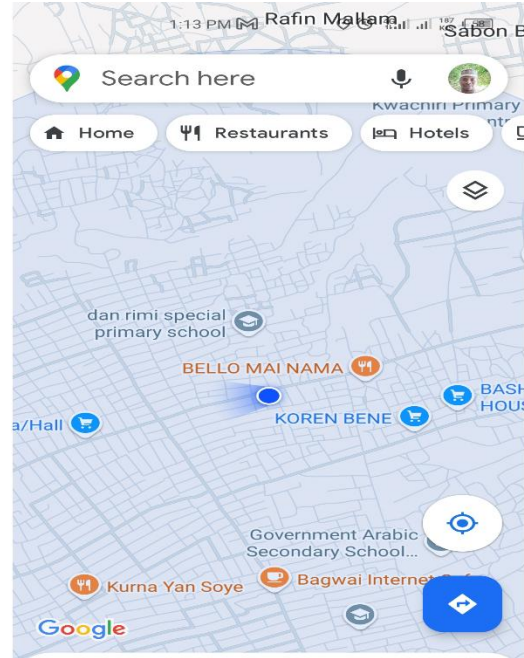


Fig. 7: Location of the stick from google map



Fig. 5(b): The internal circuitry of the implemented system

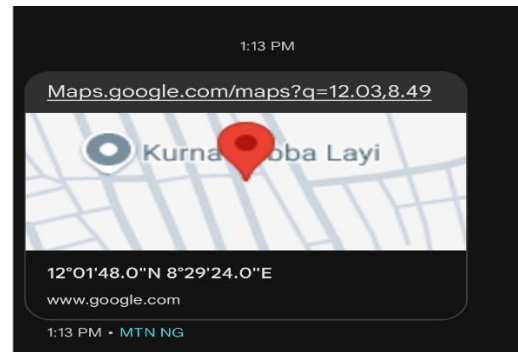


Fig. 8: The message sent via smart phone



Fig. 6: The Ultrasonic sensor used in the detection of an obstacle



Fig. 9: The implemented blind man stick

## V. RESULT

The outcomes of the deployed system and text messages sent from a smartphone are shown below.

## VI. CONCLUSION

This study has looked at several publications that demonstrate how technology is evolving and what happens when blind or visually impaired persons use it [18]. In light of the fourth industrial revolution (4.0), we have also discussed the implementation strategy and the materials required to carry it out. The advantages of employing the smart blind stick are demonstrated by the fact that many of the reviewed papers did not discuss implementation strategies and advantages at the same time [14–16]. In this work, we developed and constructed a low-cost blind man stick using an Arduino Uno, an ultrasonic sensor, GPS, a GSM module, and a sound amplifier system.

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