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Review Article

Comparative Study of a Smart Blind Stick for Blind People

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Abstract
Eyes, organs of vision, are an important part of human physiology, as they have the ability to receive and process visual detail to the brain. In addition, they play a vital role in the lives of humans, since 83% of environmental information is obtained through the eyes. There are various benefits to a smart blind stick with sensor integration. By identifying impediments and sounding an alarm via beeps or audio signals, it makes it easier for people who are blind or visually impaired to navigate their environment. The stick can identify impediments including walls, pools of water, cars, and staircases thanks to its infrared and ultrasonic sensors. Additionally, some sticks contain tilt sensors that can be used to send messages to family members via GPS and GSM connectivity and identify accidents. If the stick is lost, it can also be paired via Bluetooth with a smartphone app to assist the user in finding it.

Keywords: Smart Stick, Blind, Ultrasonic Sensor, GPS, GSM, Arduino.

I. INTRODUCTION
6826 (0.4%) of the participants in the 1987 National Sample Survey of Persons with Disabilities (NSSPD) were blind. 12.33 million patients with visual impairments were reported in the 2nd NSSPD in 2006, making up 14.9% of all impaired individuals [1]. In addition to being a part of the general public, blind persons also belong to a unique group. Their physiological impairments, whether acquired or inherited, will cause them a great deal of inconvenience in their daily lives. The inability of blind individuals to precisely and promptly identify and avoid obstacles is one of their main challenges. Currently, guide dogs and guiding instruments make up the majority of assistive devices used to guide the blind both domestically and internationally. As everyone is aware, training a guide dog requires money and effort, and they are unable to remain with their owners forever.

II. RELATED WORKS
The CTT blind guide developed by Xu Xiangyu's group [2] is accurate and clear in locating obstacles from a three-dimensional standpoint. It still cannot be used practically, and its operability and practicability are restricted. The intelligent trip navigation helmet for blind individuals made by Huang Hongzhi [3] uses visual processing to identify obstructions and traffic signals. Despite its many features, the helmet is heavy and difficult to carry. Although infrared detection is used by Lin Chen's intelligent blind walker [4] to automatically avoid obstacles and transmit information with head-mounted sensors, the precision of infrared rays is not high, is highly dependent on the surroundings, and is cumbersome 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]. Low-Cost 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].

III. ADVANTAGES OF SMART STICK FOR THE BLIND PEOPLE

1. Detects obstacles in front of you.
2. Less falls and stumbles meaning less bruises.
3. You can feel so much through the cane for example change in ground texture.
4. Simple to use and low cost [14].

IV. COMPONENTS USED IN THE IMPLEMENTATION OF THE SMART BLIND STICK

Below are the materials needed in the implementation of the smart blind stick for blind people.

1. Arduino Nano

An open-source microcontroller board is called Arduino. Based on the ATmega328P, the Arduino Nano is a compact, feature-rich, and breadboard-friendly board (Arduino Nano 3.x). Arduino software is used to program the board's microcontroller. Sets of digital and analog input/output (I/O) pins on the boards allow them to be interfaced with other expansion boards, breadboards, and other circuits. Usually, a variant of C and C++ programming languages is used to program the microcontrollers.

Figure 1: Arduino Nano

2. GPS Module

GPS (Global Positioning System) is a satellite navigation system used to determine the ground position of an object. GPS technology was first used by the United States military in the 1960s and expanded into civilian use over the next few decades. Today, GPS receivers are included in many commercial products, such as automobiles, smartphones, exercise watches, etc. GPS systems include 24 satellites deployed in space about 12,000 miles (19300 kilometers) above the earth's surface. The earth orbits every 12 hours at an extremely fast pace of roughly 7000 miles per hour. The satellites are evenly spread so that satellites are accessible via direct line-of-sight anywhere on the globe. The navigation messages are broadcast at a rate of 50 bits per second. Utilizing this collocation of data, a GPS receiver in order to generate position data.

Figure 2: GPS Module

3. GSM-Module

GSM (Global System for Mobile Communication) is a digital mobile telephony system that is widely used all over the world. A GSM module requires a SIM (subscriber's identity module) card to be operated and operated over a network range subscribed by the network operated. It can be connected to an Arduino through a cable or Bluetooth connection. GSM module can be communicated to PIC-microcontroller using normal serial USART protocol. GSM is a mobile communication modem; it stands for global system mobile communication (GSM). The idea of GSM was developed at Bell in 1970. It is a widely used mobile communication system in the world. GSM is open and digital cellular technology used for transmitting mobile voice and data services operated at the 850 MHz, 900 MHz, 1800 MHz, and 1900 MHz frequency bands. GSM system developed a digital system using time division multiple access (TDMA) technique for communication purposes. The digital system has the ability to carry 64 kbps to 120 mbps of data rates.

Figure 3: GSM Module

4. Ultrasonic sensor

An ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. The ultrasonic transmitter sends an ultrasonic wave. This wave travels in air, and when it gets absorbed by any material, it gets reflected back toward the sensor. This reflected wave is observed by the ultrasonic receiver module. The accuracy of an ultrasonic sensor can be affected by the temperature and humidity of the air in which it is being used. It operated in frequency at 40 Hz. It can measure the distance from 2 cm to 80 cm. This sensor is very popular because of its multiple-purpose application.

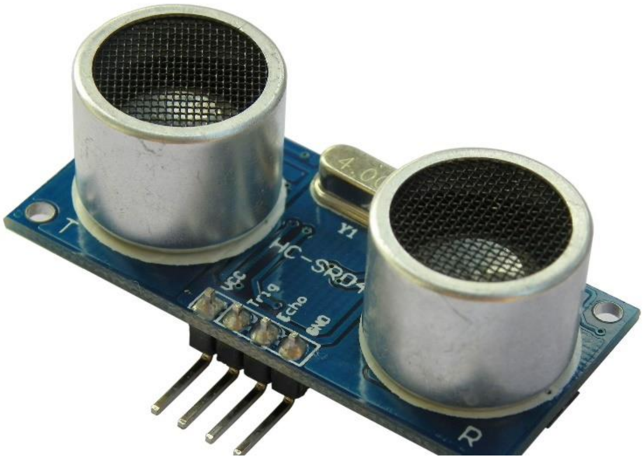

Figure 4: Ultrasonic Sensor

5. Rain Sensors

The rain sensor module is an easy tool for rain detection. It can be used as a switch when raindrops fall through the rain board and also for measuring rainfall intensity. The module features a rain board and the control board that are separated for more convenience, a power indicator LED, and an adjustable sensitivity through a potentiometer. The rain sensor detects water that completes the circuits on its sensor board printed leads. The sensor board acts as a variable resistor that will change from 100 ohms when wet to 2m ohms when dry. In short, the wetter the board, the more current that will conduct.

Figure 5: Rain Sensor

6. Buzzer

A buzzer is a compact but effective part that gives our project system sound capabilities. It is a two-pin structure that is incredibly small and compact. The audible frequency range of 20 Hz to 20 KHz includes the lower range of the buzzer. In order to do this, an electric, oscillating signal in the audible range is covered, and the result is mechanical energy [15].

Figure 6: Buzzer

V. CONCLUSION

Several publications have been read in this research, and we have seen how technology is progressing and the effects of using them for blind or impaired people. We've also spoken about the implementation strategy and the materials that must be employed to carry it out. The benefits of employing the smart blind stick are demonstrated by the fact that many of the reviewed papers did not address both implementation methods and benefits at the same time.

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