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Smart Obstacle Detection Stick for Blind Persons

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Abstract - Blindness is a big hurdle in one's life. They find it difficult while travelling may not be able to identify the obstacles that come in their way through a normal walking stick. Now a day's blind people use the white cane as a tool for guidance, when they are moving or walking. As usual, the blind move around using a trained dog and a simple white stick. There are many ways to help the blind persons for their navigation. Thus, by using Internet of Things we construct a smart stick for blind person to detect obstacles using sensors like Infrared Sensors, Ultrasonic sensors. Here, we developed a device which can serve as a better navigator to a blind person to feel more efficient and helpful than a conventional one. Blind stick is an innovative stick designed for blind person for improving their navigation better.

Keywords-Internet of Things, Infrared Sensors, Ultrasonic Sensors, Obstacles, Navigation

I. INTRODUCTION

In today's digital age, more devices are built with Wi-Fi capabilities. Also, various sensor scan now be embedded in most of the devices. All this is due to the boom in Internet connectivity and the fact that with each day, the speed of the Internet is improving and its cost is decreasing. This has led to the concept of the Internet of Things. The Internet of Things is the network of physical devices, vehicles, home appliances and other it embedded with electronics, software, sensors, actuators, and connectivity with enable the objects to connect and exchange data. So clearly, the "things" referred to in "Internet of Things", are nothing but devices, vehicles that have sensors and software embedded in each other via internet and hence its name is called as Internet of things. This is a network of physical objects or people called "things" that are embedded with software, electronics, network, and sensors that allows these objects to collect and exchange data. The goal of the Internet of Things is to extend the range of Internet connectivity from standard devices such as a computer, mobile phone, and tablet to relatively dumb devices such as a toaster. The Internet of Things makes almost everything "smart," by improving aspects of our lives with the power of data collection, AI algorithm, and networking. An object in the Internet of Things could also be a person with an implant to monitor diabetes, an animal with trackers,

and so on. Internet of things is a network of physical objects or people called “things” that are embedded with software, electronics, network, and sensors that allows these objects to collect and exchange data. We are designing and developing a smart stick for blind people to help them for better navigation. They are facing a lot of issues during their mobility. This making those to lose hope in this competitive world. Government should provide them a respectable education rather them giving a special tag called “specially treated persons”.

Applications of Internet of Things:

The scope of Internet of things is quite extensive with technology expanding with each growing year. The major applications of Internet of things are:

1. Smart Homes
2. Smart Cities
3. Automation Sector
4. Industrial Sector
5. Health Care

II. Related Works

As it has been noted earlier the implanted smart walking stick scheme corresponds of several sub systems. These sub systems fundamentally sensor based. The integrated circuit is designed with a basic circuit on a PIC microcontroller (PIC16F90). This microcontroller powers the entire scheme by powering up the subsystems and interconnecting them in good order. APIC16F90 Microcontroller reads these sensors and drives a buzzer, a LED and a motor with PWM .Vibratory module comprised with a micro pager motor which outputs is assured by PWM to obtain different vibratory patterns. An output is designated by a buzzer alarm. The output signals are driven by PWM to retain a distinct beep as well as indicate system status. It is fully automated, easy to maintain, very convenient to use. As this system is developed with PIC microcontroller. It cannot interface a better power device directly. A smart stick is built for visually impaired people that help to detect obstacles with the use of infrared, ultrasonic and GPS module, water sensors [1]. The pair of ultrasonic sensor to detect the obstacles in front of blind from ground level height to head level height. Infrared sensors are used to detect ascending and descending stairs. Water sensor is to detect pools of water. The sensors collect data in real time and send it to the microcontroller for processing. After processing, the microcontroller calls the correct speech warning message.. This system facilitates the blind person to make calls and tracing at the time of emergency using GPS module. As this system is embedded with too many sensors, it is very complex in structure and extravagant[2].The main aim of this initiative is to enable the blind navigate

with confidence and to be Alert if their walking route becomes obstructed with other things, objects, people or related odds. In the circuit, the buzzer is connected as a warning signal, the frequency of which changes depending on the distance of the target. The smaller the obstacle gap, the more frequent the buzzer is used. We can say that the length of the beep is inversely proportional to the size. This system offers low cost, reliable, lightweight, low power and efficient navigation with fast response times. The system completely depends on hardware components [3]. In this system, the image processing and microcontroller (Arduino)–Based Visual aid model for blind people is discussed. The system consists of both stereo vision and sensors. The calculation of the long distanced obstacles through stereo-vision and short distanced using the ultrasonic sensors, a precise awareness of the Obstacles, is obtained for real-time surroundings. The internal architecture is connected to the Arduino module, which is connected to the other sensors like Wifi module, GSM module, LDR sensor, Voice module, buzzer, GPS module [4]. When the system is on, distant obstacles are detected using stereo vision, connected to the Arduino module on the walking stick and the ultrasound will detect shorter distance obstacles[5]. In case of obstacle is found, the buzzer will start to buzz and user can also send notifications to the registered mobile using a press button. This system overcomes the problem of finding holes and descending stairs and uses monoscopic vision. It includes CCD which uses high energy power consumption, smearing effects due to overexposure compared to CMOS [6].

Sno	Overview	Positive Aspects	Limitations
[1]	In this system, the integral system is designed with a circuiting fundament on PIC microcontroller-PIC16F90 and a ping sonar sensor,GH-311 ultrasonic sensor	It is fully automated, easy maintenance, very comfortable to use.	As this system is designed with PIC microcontroller, it cannot interface a better power device directly
[2]	This system is embedded with ultrasonic sensors, IR sensors, GPS and GPS modules.	This system facilitates the blind person to make calls and tracing at the time of emergency using GPS module	As this system is embedded with too many sensors, it is very complex in structure and extravagant.
[3]	This system is embedded with ultrasonic sensors, water sensors, buzzer, IR sensors, node MCU, includes an international system for locating individual via the GPS system	It offers low-cost, reliable, light weight, low power and efficient navigation with fast response times	This system completely depends on hardware components.
[4]	The system is used CCD cameras for capturing the obstacle images.	This system overcomes the problem of finding holes and descending stairs and uses monoscopic vision	It includes CCD which uses high energy power consumption, smearing effects due to overexposure compared to CMOS

Table 1: Literature Survey

III. Methodology

An architectural diagram is a visual representation that maps out the physical implementation for components of a software system. It shows the general structure of the software system and the associations, limitations, and boundaries between each element.

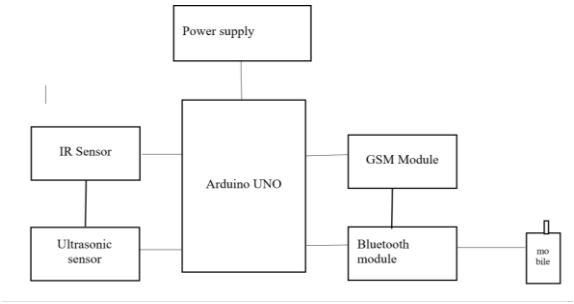

Figure 1: Proposed Methodology

In our proposed methodology, the Bluetooth module is connected to ArduinoUNO and user's mobile. Infrared sensor and Ultrasonic sensors are connected with each other and these are connected to Arduino UNO board. GSM is a built-in function in the Arduino UNO board. GSM and Bluetooth modules are connected with each other for a better signals passage. All these are collaborated with a power supply of 5V.

- **INFRARED SENSOR**

This sensor checks whether the obstacle is present or not. If any obstacle is detected,

then it sends the signals to the ultrasonic sensor for next step.

- **ULTRASONIC SENSOR**

This sensor will measures the obstacle distance from the user's perspective and it sends the data to the built-in function of Arduino UNO that is LCD to display the obtained obstacle distance.

- **BLUETOOTH MODULE**

Bluetooth get connected to mobile. User can get to know the obstacle information by the voice notification.

- **GSM MODULE**

This acts as built-in function to the Arduino UNO. It helps the whole system by giving voice notification to the user and it sounds varies from the closeness of the obstacle. All these modules are works together to build the system more efficient. These modules help the blind person during their navigation. All these modules are inter-connected to the power supply of 5Vor12V.

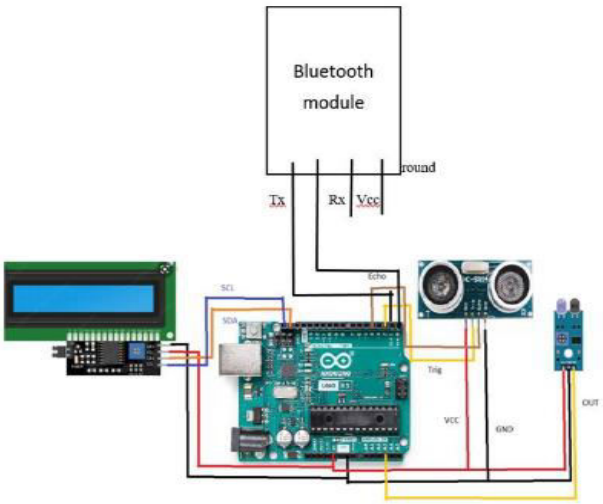

Figure 2: Circuit Diagram

A Circuit diagram (wiring diagram, elementary diagram, and electronic diagram schematic) is a graphical representation of an electrical circuit. A pictorial circuit diagram uses simple images of components, while a schematic diagram shows the components and interconnections of the circuit using standardized symbolic representations. The presentation of the interconnections between circuit components in the schematic diagram does not necessarily correspond to the physical arrangements in the finished device.

CONNECTIONS DESCRIPTION:

INFRARED SENSOR:

1. Out pin of IR sensor is connected to GROUND 4 pin of Arduino UNO

2. VCC pin of IR sensor in connected to positive terminal
3. GND pin of IR sensor is connected to Negative terminal

ULTRASONIC SENSOR:

1. Trigger pin of ultrasonic sensor is connected to second pin of Arduino UNO
2. ECHO pin of ultrasonic sensor is connected to third pin of Arduino UNO
3. VCC pin of ultrasonic sensor is connected to Positive terminal
4. GND pin of ultrasonic sensor is connected to Negative terminal

BLUETOOTH MODULE:

1. RXD pin of Bluetooth module is connected to TXD pin of Arduino UNO
2. TXD pin of Bluetooth module is connected to RXD pin of Arduino UNO
3. VCC pin of Bluetooth module is connected to Positive terminal
4. GND pin of Bluetooth module is connected to Negative terminal

IV. IMPLEMENTATION

User connects the Bluetooth of his/her mobile to the device using the Bluetooth module which we have placed in the device. Then Infrared sensor performs its operations by checking the presence of obstacle around. It sends signals to the ultrasonic sensor module for checking the obstacle distance. It sends the collected data to the built-in function of Arduino that is GSM module; it sends the voice notification about the obstacle information. The obstacle distance is displayed on LCD on the Arduino UNO board. Obstacles which are less than 30cm can be detected by the device. The distance is displayed in the form of centimeters and meters to on the LCD.

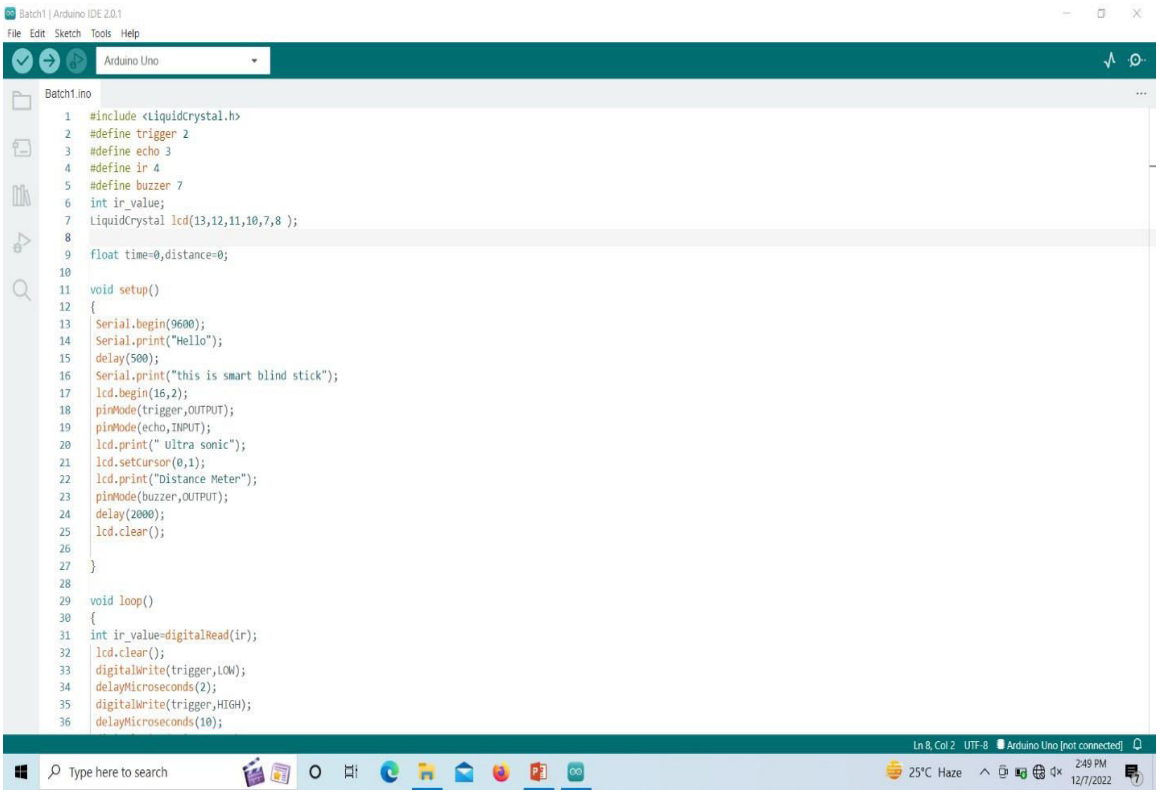

Figure 3. Sample Code

- The above screenshot represents the Arduino code, that includes the LCD connections. The LOC describes the obstacle distance measurements by the Ultrasonic sensor.
- The code is made clear that if the device is perfectly connected then it will notify the user by taking **" Hello, this is smart blind stick"**

V. RESULTS

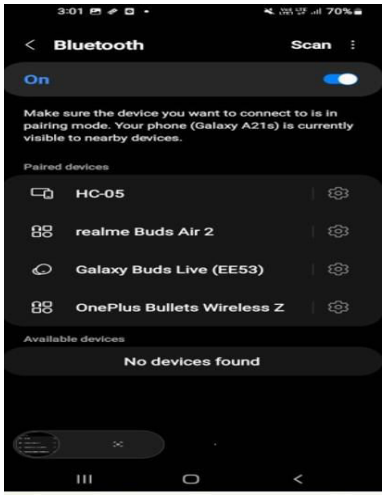

Figure 4 Bluetooth connection

User connects the Bluetooth with the Arduino Board with the Bluetooth module. After establishing the Bluetooth connection, the stick gives a voice notification "Bluetooth is connected" which makes the user has successfully connected. If obstacle is detected by the smart stick, the stick starts to responds by giving a voice notification by saying "Obstacle is detected in front of you, please move in other direction".

Figure 5: Smart Stick for Blind Persons

This is our proposed system, it is a device for the visually impaired to guide the user to respective destination and avoiding to collide with the obstacles. Obstacle detection is one of

the major concerns for a fully or a partially blind person presented here is a smart stick using Node MCU.

VI. CONCLUSION

The smart stick is a device for the visually impaired to guide the user to respective destination and avoiding to collide with the obstacles. It uses ultrasonic sensor to detect the depth below or the obstacles in between. The technologies behind blind sticks are updated day by day. Our model guarantees one thing and that is to make the task of transporting a blind person easy and comfortable. The stick is also very light and easy to hold. Also, the components or parts that we used in the stick are readily available at the lowest cost. Bluetooth connection is enabled over a range of 10m. In future, Arduino can be replaced by upgraded Microcontroller or chip. It can be further improved by using VLSI technology to design PCB module. This can make the system more compact. More sensors can be used for further application like water sensors. It can be future enhanced by Image processing can be used for knowing about the volume of obstacles and object patterns. GPS tracker can also be used for finding more accurate location. High range ultrasonic sensor can be used. We can also integrate the Arduino UNO with the Image processing techniques and machine learning techniques to identify the obstacle names using boundary points of the image captured.

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