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Smart Assistance System for the Blind Using Genuino Board

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ABSTRACT—In today's world, technology has a great and wide scope which could serve us for the rest of our peaceful lives. A wise man once told "Humans are not disabled. A person can never be broken. Our built environment, our technologies, is broken, and disabled. We the people need not accept our limitations, but can transfer disability through its own technological innovation". Although the technological world has a reached a higher level than ever before. This paper gives the basics of making a similar creation using an Ultrasonic Sensor, IR Sensor, WTV-SR IC and an Arduino.

Keywords—WTV-SR IC, impaired people, ultrasonic sensor, arduino, blind people, smart stick

I. INTRODUCTION

Walking safely and confidently without any human assistance in urban or rural localities is a difficult task for blind people. Especially visually impaired people use either the typical white cane or the guide dog to walk independently. Although the white stick gives a warning about 1 m from the obstacle, which gives them a very short period of time to react accordingly. The stick scans the floor and consequently cannot detect certain obstacles like rears of trucks, holes on the roads, people walking towards them, etc. The safety and confidence could be increased using devices that give a signal to find the direction of an obstacle-free path in unfamiliar directions. Individuals with visual impairment have trouble communicating within their surroundings. They don't have much interaction with the world. Moving movement is a difficulty for people with visual impairment, as it is difficult to discern where it is and how to go from one position to the other. He or she can provide help to a smart family member or his friend to explore unknown locations. More than half of the world's legally blind are disabled. Because the jobs they can do are small. They have a lower proportion of jobs. They rely on mobility and financial support from their families. [2]

In this system we are going to use an obstacle ultrasonic sensor as the heart of the system of the project. As well as we are going to use an LDR for sensing lighting conditions and a RF transmitter using which the blind man could remotely find a obstacle in the given range i.e. set from the arduino. The signal after hitting the obstacle will be received back. This echo signal is collected by the sensor receiver and based on computing signal thus alerting the person well in advance about the obstacle. In this system we are going to interface a obstacle sensors and a buzzer with the Microcontroller and the complete module will be attached with the blind person's stick. So whenever the blind Person will detect any obstacle up to a distance of 1-2 meters automatically a buzzer will indicate about it to the blind person using the sonar sensor and a beep will be announced as soon as the obstacle is detected to the blind person.

II. RELATED WORK

A. Advanced Electronics Based Smart Mobility Aid for the Visually Impaired Society)

The realm of electronics is growing rapidly. Advanced electronics are employable in assisting the visually impaired society in various ways. According to World Health Organization (WHO) approximately 285 million people are blind. Major researches have been under consideration on developing a smart stick for seeking a smoother routine life and welfare towards the blind society. However, this paper proposes and analyses a brand new thought in eliminating the stick and mount these sensors on the visually handicapped person body itself.

B. Assistive Infrared Sensor Based Smart Stick for Blind people

In this paper we tend to propose a smart stick with lightweight weight, low cost, user friendly, quick response and low power consumption and stick supported by infrared technology. [3] A combination of infrared sensors will observe stair-cases and

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different obstacles presence within the user path. The experimental results gives good accuracy and therefore the stick is ready to observe all the obstacles that comes in front of it.

III. IMPLEMENTATION

A. Arduino Environment

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. The Arduino IDE uses a simplified version of C++, and a bit of java syntax. [5] The Arduino library is open source and is continuously being built. Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.

Here we have used Arduino Uno the most basic form of Arduino available. It uses Atmega-328 as its microcontroller.

Fig 1 The basic circuit of the Arduino/Genuino Uno

The Tx an Rx pins on the Genuino are used to connect the Bluetooth device to the Arduino, these pins are specially made for receiving and transmitting data. [4]

For connecting the pins to their respective slots we shall follow the following order:

1. VCC of the Ultrasonic transducer to the Arduino 5v.
2. GND of the Ultrasonic transducer to the Arduino GND.
3. TRIG of the Ultrasonic transducer to the Arduino D12.
4. ECHO of the Ultrasonic transducer to the Arduino D11.
5. RED slot of the Buzzer to the Arduino D8 slot.
6. BLACK slot of the Buzzer to the Arduino GND slot.
7. Motor pin 1 of the Vibrator Motor to the Arduino D7 slot.
8. Motor pin 2 of the Vibrator Motor to the Arduino GND slot.

B. Hardware to be used during implementation

1. Ultrasonic Sensor

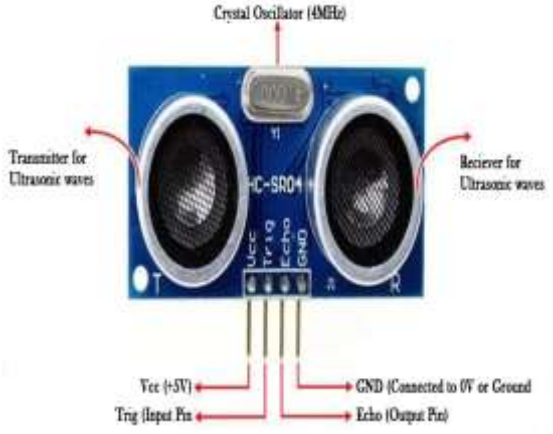

Fig 2 Ultrasonic Sensor (HC-SR04)

In the circuit an Arduino Uno is used as the platform. Ultrasonic sensor is connected to Arduino. The ultrasonic sensor has 4 pins:-

1. V_{cc} or 5 volt which is connected to 5 volt pin of Arduino
2. Trigger which is connected to D12 pin of Arduino
3. Echo pin is connected to D11 pin of Arduino
4. Ground which is connected to GND pin of Arduino

The HC – SR04 module offers a semi-contact calibration feature of 2 cm – 400 cm, with a range of accuracy of 3 mm. The devices comprise of ultrasonic transmitters, receiver and control links. The key operating principle: ·

1. Using the IO trigger, the module sends eight 40 kHz to detect if there is a reversed pulse signal for at least 10U high-level signal.
2. IF the signal back is the time from sending ultrasound to the return, through high IO output times.

Positive terminal of 9-volt battery is connected to V_{in} pin of Genuino through a DPDT switch and the negative terminal is connected to GND pin of Arduino. A buzzer is connected between D9 pin of Arduino and GND pin. Here we use the Ultra Sonic Sensor HCSR04. [6]

The circuit diagram and PCB design are given below:

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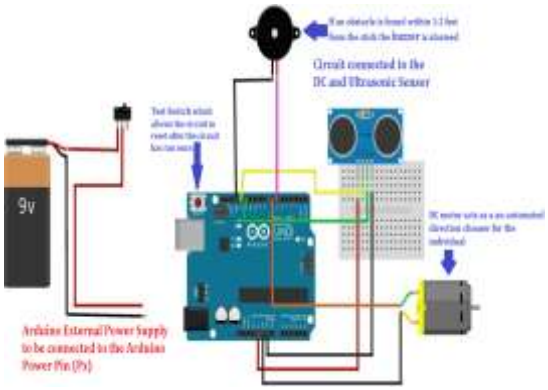

Fig 3 Labelled circuit of the proposed system

2. Buzzer

A small 10mm diameter 5 volt buzzer is used to alert the user about the obstacles. It beeps once for a obstacle in either directions accordingly. You can also connect a vibrator motor in parallel with the buzzer. This will provide a vibrational feedback along with audio beeps.

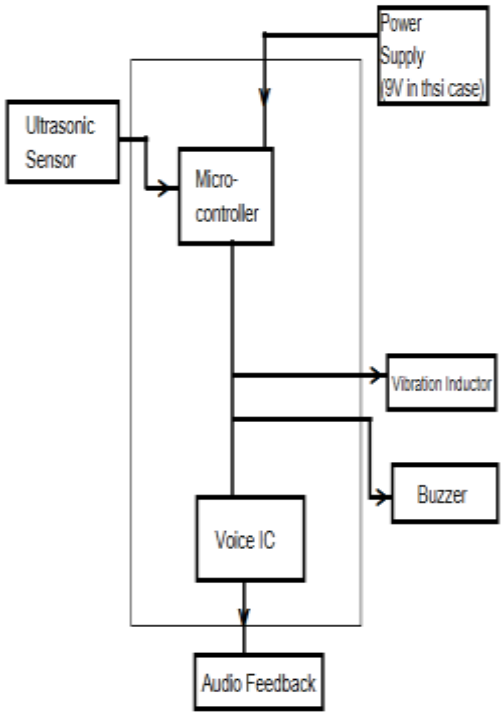

Fig 4 Labelled Block diagram of the proposed system

3. IR Sensor

IR Sensor that are used to identify obstacles when the infrared waves are transmitted and the target is struck and the sensors are returned. It is between 720 nm and 1 mm. IR performance varying according to the obtained infrared rays. As this variance cannot be evaluated as such, the output is comparable.

4. WTV-SR IC

This module senses the word spoken by a mic or a speaker. It alerts the person to whom any object or obstacles are identified via an established program spoken order. [1] For recognition the module we use in this project uses a WTV-SR IC. This module can record, track, and choose a variety of control modes, as well as fixed voice replay, upload content. This has a significant advantage in recording time and cost efficiency.

C. Advantages

1. The system can be used both indoor and outdoor navigation.
2. Blind person's location can be tracked whenever needed which will ensure additional safety.
3. Detects obstacles and alerts the blind person through vibration alert and speech output.

D. Training the proposed system as a common applicaation

1. Additional devices can also be used, such as vehicle detection, slippery board, incoming vehicle detection, fire alarm or smoke alarm.
2. A further request is to allow the family members access to the place of the blind person through the server whenever they need it.
3. In addition, when the intelligent stick is within its range, use of RFID tags will automatically forward localization information to the PCB device.

IV. RESULTS

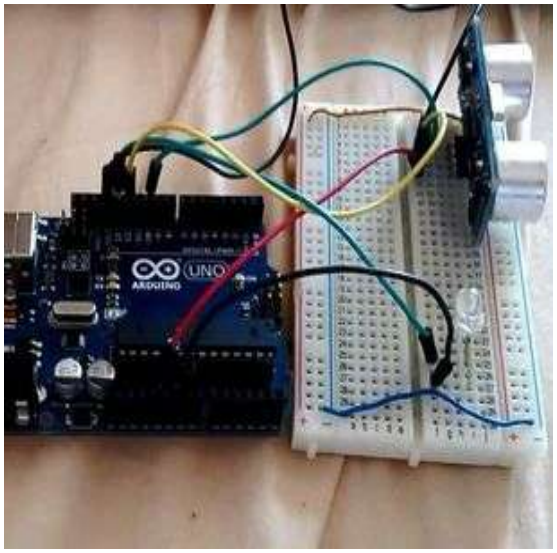

Fig 5 The proposed system has been made

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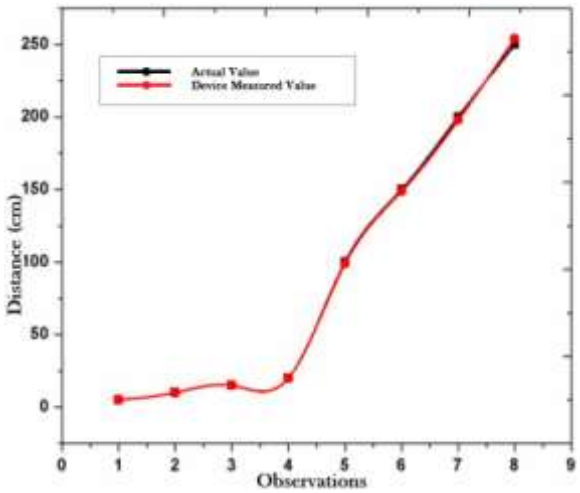

Fig 6 Output graph when the blind stick was used in a less crowded locality

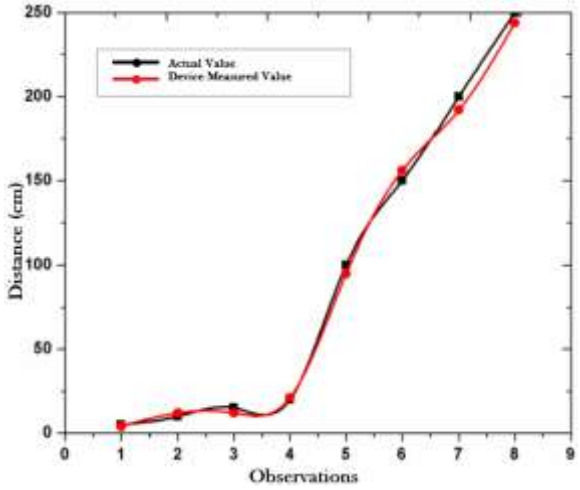

Fig 7 Output graph when the blind stick was used in a crowded locality

V. FUTURE SCOPE

The future scope of the smart stick we have designed, guides the visually impaired person in his navigation independently in an efficient manner ensuring the person's safety.

1. The programmable wheels would steer the stick away from the obstacles and also leading the blind person towards the destination.
2. Internet of Things is a trending concept which can increase the benefits of the smart stick by allowing one stick to communicate with another smart stick (or mobile , PCs) nearby to utilize the functionality of the other stick when one stick's functionality breaks down.
3. In order to run this micro controlled set of hardware we can use solar panels as an alternative to the battery. The use of solar panel occurs to be more advantageous as it uses sunlight, the easily available renewable resource of energy, to get recharged.

VI. CONCLUSIONS

We have proposed to provide constructive assistance and support for blind and visually impaired people with a perfect solution which is reliable. The system is designed, implemented, tested, and verified. The real-time results of the system are encouraging; it revealed an accuracy of approx. 90% in detecting different shapes, materials, and distances. It is able to scan areas left, right, and in front of the blind person regardless of its height or depth. The IR sensor and the LDR have been fully utilized in order to advance the mobility of the blind and visually impaired people in a safe and an independent way. If constructed with utmost precision, blind people can move from one position to another without any other support, thereby improving the autonomy of blind people. The developed intelligent stick with multiple sensors helps to move when walking and warns the person if there is any sign of danger or discomfort. This system does not require a huge device to be hold for a long distance, and it also does not require any special training. This system also resolves limitations that are related to the most of the movement problems that may influence the blind people in their environment.

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