Ultra Cane to Intimate Obstacle for Visually Impaired

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Abstract

The blind people struggle a lot to live their miserable life. They seek help from others to guide them whole day The main aim of this project is to make the blind person fully independent in all aspects. This system is based on arduino takes input as ultrasonic and IR sensor gives us sound and vibrating alert characteristics respectively[3]. This proposed system uses the microcontroller embedded system. The stick is capable of detecting all obstacle in the range of 4m during 39ms and gives a suitable message empowering blind to move twice his normal speed because she/he feels safe[9]. The smart stick is of low cost, fast response, low power consumption, light weight and ability to fold.

Keywords – *Smart Blind stick, Ultrasonic sensor, IRsensor*

I. INTRODUCTION

Blind people use a white stick as a tool for direction, when they move or walk in public places. To develop a tool which can serve as a blind stick being more efficient and helpful than the conventional one. Arduino ultra cane can assist with walking alone in new environment by taking inputs through an obstacle sensors and providing feedback to the person through haptics(a vibration motor)[4]. An ultra cane alerts visually impaired people over obstacles and pit in front could them in walking with less accident. It outlines a better navigation tool for the visually impaired. There are millions of visually impaired people in this world who are always in need of helping hands. Blind people find difficulties detecting obstacles in front of them, during walking in the street, which makes it dangerous. The ultra cane will help the blind person by providing more convenient means of life. Early days blind persons used a white stick for their navigation purpose. It is very difficult for them to find obstacles. Because ultra cane is helpful only indoors and it will not work in outdoor environments[6]. These visually impaired people face difficulty in going on foot. They need a special tool for directing them when they move or walk. A very important and necessary tool that helps blind people to walk is called white sticks. This walking stick for visually impaired people do not have anything special from the sticks that old people use, except the function they use, which is that the blind people use the stick to detect obstacle but the old people use the stick to support their body to stand or walk. Although, a walking stick for blind people are useful, it cannot give a high guarantee that it will safe them from all level of obstacles. Usually, blind people use a white stick for finding low obstacle, i.e., level from waist to feet, but not for high obstacle, i.e., level from breast to head. Normally, blind people do not use white stick to detect obstacle in higher than 30 centimeters from ground. Many researchers have been interested in studying application of range finding for obstacle avoidance. The topics are more on algorithms for vision of the robot. In addition, ultrasonic sensors and infrared sensors are most interested devices which have studied for such topics. The development and application of technology for mobility has a long history covering the postwar period. Although some early endeavours envisaged systems that might replace the cane or dog guide, more recent efforts have focused on devices and systems designed to supplement and provide a support system for these basic navigating tools. The navigator system designed will detect an object or obstacles using ultrasonic sensors. The signals from the ultrasound sensor are processed by a micro controller in order to identify sudden changes in the ground gradient or an obstacle in front of them. There is an international symbol tool of visually impaired people just like the white cane with a red tip which is used to enhance the blind movement. Nowadays, different types of these canes have been used such as the white cane, the smart cane, and the laser cane. However, this tool has several constraints: long length of the cane, limitations in recognizing obstacles, and also difficulty to keep it in outdoor places. Recently, many techniques have been developed to enhance the mobility of visually impaired people that rely on signal processing and sensor technology. These called electronic travel aid (ETA) devices which help the blind people to move freely in an environment regardless of its dynamic changes. According to the literature, ETA are mainly classified

into two major aspects: sonar input and camera input systems. The way these devices operate just like the radar system that uses ultrasonic fascicle or laser to identify height, the direction, speed of fixed and moving objects. The distance between the person and obstacles is measured by the time of the wave travel.

In our work we tried to overcome some of the following disadvantage:

- We designed a stick to detect obstacles and able to recognize the upward and downward stairs or puddles.
- The training of our product is not as expensive as training in other product. Our training is description of stick component and usage position.

We use facilities to transmit information to the blind people. We integrated vibration motor in the hand of stick which preserving it's natural dimension to keep it user friendly. We achieved very fast response time calculated as 39 ms in average distance less than or equal to 400 cm before hitting the obstacles. Regarding ease of use and independence of blind people.

II. METHODOLOGY

The ultra cane is basically an embedded system integrating the following pair of ultrasonic sensor to detect obstacles in front of the blind from ground level height to head level height in the range of 400 cm a head, infrared sensor is to detect stairscase and pit[2]. Ultrasonic sensors and infrared sensor collect real time data and send the data to microcontroller.

A. Sensors

The selection process of appropriate sensor depends on different factors such as cost, kind of obstacle to be detected, detection range and the desired precision of measurements collected information and its transmission frequency.

1. Ultrasonic sensor
2. Infrared sensor

***Ultrasonic sensor*:** Ultrasonic sensor which transmit and receives the ultrasonic signal. It is used to measure distance from 2-400cm. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an obstacle.

Wire connecting direct as following

- 5V Supply
- Trigger Pulse Input
- Echo Pulse Input
- 0v Ground

Infrared sensor: Recognize small obstacles but with less accuracy than laser sensors. When an object is close to the sensor, the light from the IR transmitter led hits the object and received by receiver led .

Vibration Motor: This type of DC vibration motors used in mobile phones. It requires a 3V to 5V voltage supply with current around 125 mA.

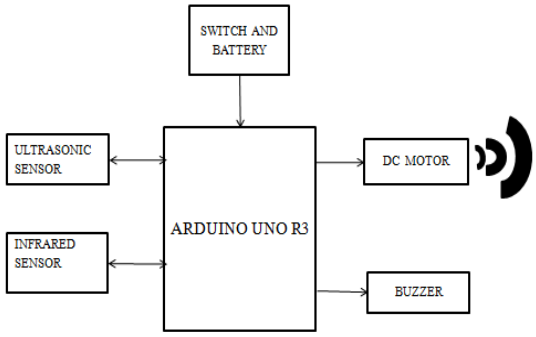

Fig. 3. Block Diagram of Ultra cane

In order to overcome the difficulties in the existing method to provide the cost effective and user -friendly system for blind navigation. Ultrasonic Sensor, IR sensor, Arduino Uno R3, vibrating motor and buzzer to detect the obstacle and alerts them.

B. Sensor Description

PARAMETERS	ULTRASONIC SENSOR	IR SENSOR
Working voltage	DC 5V	3-5V DC
Working current	15mA	23mA-43mA
Maximum range	4m	30cm
Minimum range	2cm	2cm
Detection angle	15 degree	35 degree
Dimension	45*20*15cm	3.2*1.4cm

Table.1.Description of sensor

C. Algorithm

STEP 1: The Power supply is given to the system .
STEP 2: Sensors get start to work.
STEP 3: Wait for the signal which is reflected back to the sensor .
STEP 4: If it receives a high edge in the ECHO line of the ultrasonic sensor or low signal in the OUT pin of the IR sensor

STEP 5:Then the distance calculated based on the time duration which is measured.
STEP 6:Depending on the value of it, alarm and vibration are used to alert them respectively.

***Any other details*:**

The two eyed component is ultrasonic sensor that is interfaced to the microcontroller (Arduino) chip with vibrating motor. When the sensor senses the obstacle in the circumference of 10 ft the vibrating motor intimates the person with different number of vibrations with respect to the direction from where the obstacle originates.

III. CONCLUSION

In this paper design of an ultra cane based on ultrasonic and IR sensor is proposed and implemented successfully. It can be used as an effective navigation tool for blind persons. On the detection of obstacle in the path of the concerned person the smart blind stick sounds a buzzer to make an alert.

With the proposed architecture, if constructed with at most accuracy, the blind people will able to move from one place to another without the help of others. The smart cane sends and receives ultra sonic waves. The reflections of these waves help the blind people to navigate around obstacles in their pathway.

A vibrator pad on the cane will vibrate with different frequencies and intensity depending on where the object is located relative to the user. Also, the design is reliable and cost effects. The implemented system can detect any obstacle within the range of 0-100cm.

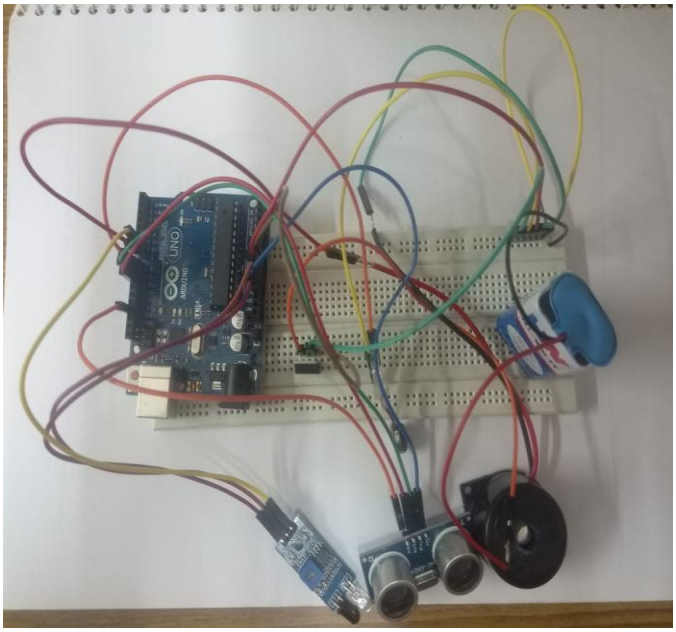

Fig.6. Ultrasonic and IR Sensor Based Ultra cane

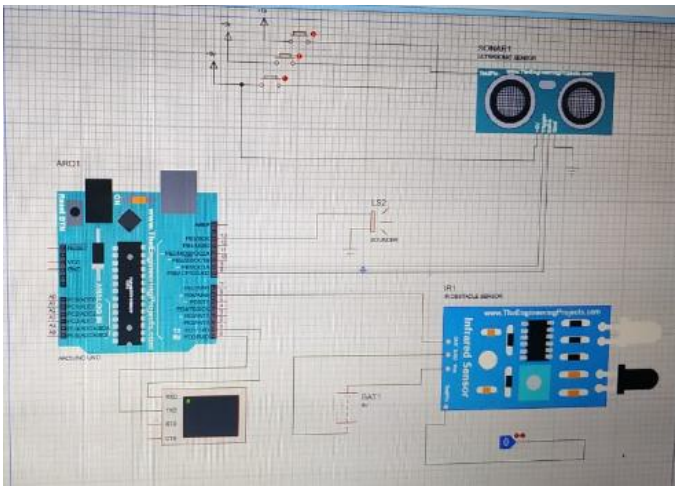

Fig.7. The circuit design using Proteus simulation

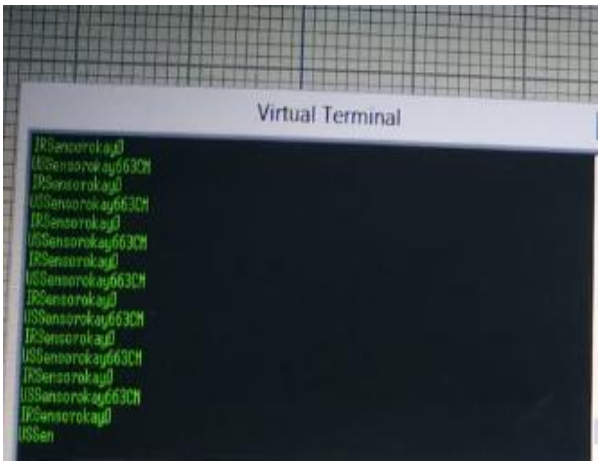

Fig.8. Simulated output using Proteus software

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