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Ultrasonic Vision for Outwardly Impeded People

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***Abstract*: Self-supportiveness plays a significant role for achieving aim, aspiration, ambition and other necessity of lives. For decades, walking stick had enhanced a widely known attribute for the visually impaired people. They must aware of every article in their habitat such as location and movement of furniture in order restrain from trauma (injury). Owing to the fact that they need to sacrifice their autarky and in this tricky world they should hang on other people for their lives. But, our module is pretty much differing from other. Here we have designed a device (Ultrasonic vision) for visually impaired people. By using walking stick it is risky in our locality, anytime it may fall. So, visually impaired people may get scared at once it fell. Here we designed a prototype module to aid these visually impaired people to walk fearlessly. Our module can detect any type of upcoming obstacle. Our main intention is to contribute a suitable and habitual protective method for their movement.**

***Keywords*: ultrasonic sensor, buzzer, vibrating motor.**

1. Introduction

The aim of our project is to provide an artificial vision for the visually disabled people. The idea behind our project is to avoid the dangers that are encountered by the blind people in their day to day life. Most common problem they are facing on roads are because of improper/damaged road, presence of barrier gates, closed roads, man-holes etc. Our project design helps them to find any obstacle present in their path and gives an alert to them. Here, the concept we are used is based on the ultrasonic principle. Ultrasonic or ultrasound waves are having an ability of generating echo signals when they strike on any medium. These echo signals are detected by an ultrasonic detector and further proceed to measure the distance between the obstacle and source. Bats use the same ultrasonic concept to visualize the things on its way.

In this project we had used ultrasonic generator/detector to produce the ultrasonic waves and to receive back the echo signals produced after striking an obstacle. ARDUINO atmega328 microcontroller is implemented to process the echo signals and to calculate the distance from obstacle. It is an 8 bit microcontroller having 28 pin configuration. An electronic buzzer is added to provide the audio signal output as an alert to the blind person when they approach nearer to the obstacle. We had also placed a vibrating motor which provides vibration as an alert if the person is having added disability in hearing (deaf).The power supply to the whole system set is provided by using a 9V HW battery.

2. Literature review

Visual deficiency which is very common around the globe may happen from sickness, mishap, by birth and different troubles. To make life simpler for visually impaired people, numerous endeavors have been made till now. Over the decades, different techniques are utilizing to direct the visually impaired individuals. One of them, a prepared canine, has been utilizing throughout the years. Another case of outwardly hindered navigation help is nonelectric stick, for example, bamboo, plastic or other material stick. Nowadays, diverse strolling sticks are structured and actualized, for example white cane, assistive electronic walking stick [6]. The basic properties and limitations of existing devices are discussed here.

- Microcontroller based walking stick [1]: used to detect the obstacles by using infrared sensor and ultrasonic sensor.
- Ultrasonic Blind Stick for Completely Blind People to Avoid Any Kind of Obstacles [2]: it is used to detect and identify any obstacles in most crowded areas like market by placing ultrasonic sensors in various parts of body.
- Haptic based walking sticks for visually impaired people [3]: An electronic blind stick with haptic perception uses ultrasonic sensors, a vibrator motor scheme, a controller and a power unit inside the walking stick.
- Intelligent ultrasonic detection of walking sticks for the blind [4]: it is an another smart walking stick detects obstacles using ultrasonic sensor with wristband GPS for transmitting location of user to their family.
- An electronic walking stick for blinds [5]: it is electronic walking stick capable of detecting obstacles and staircase by using two and more ultrasonic sensors.

All these walking sticks are used for obstacle detection and identification but length is an issue and it is difficult to carry in the crowded areas. In order to overcome these difficulties, we proposed the following system the ultrasonic vision.

3. Hardware requirement

The main hardware components used for implementing this system are:

- Microcontroller
- Ultrasonic sensor
- Power supply
- Buzzer
- Vibrating motor

A. Microcontroller

Microcontroller is the brain of our system. It will handle all the processing and communication of data. We can use ARDUINO UNO Atmega328 microcontroller which is 8 bit and 28 pin. It has dimensions of width, height and weight that is 54 cm ,67 cm and 32g respectively.

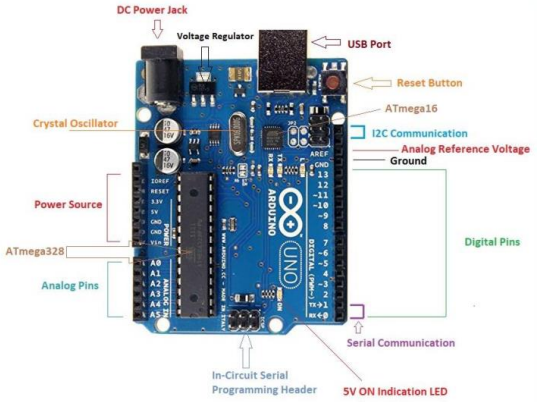

Fig. 1. Arduino Uno

B. Ultrasonic sensor (HC-SR04)

These are electronic device which produces ultrasonic waves, it is used for detecting and measures the distance of obstacles. It is made of fiber plastics and it has 4 pin they are VCC, ground, trigger and echo.

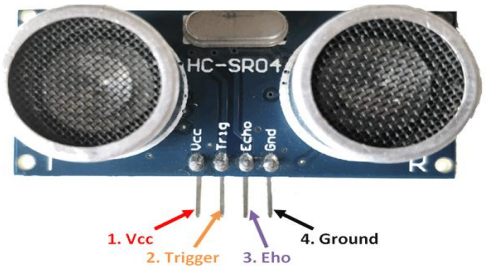

Fig. 2. Ultrasonic sensor

C. Power supply

Fig. 3. HW battery with Arduino cable

Here the HW battery is used for power supply. It is also used in handheld device and digital instruments. The input voltage of battery is 9V and it have positive and negative terminal.

D. Buzzer

A buzzer is a device which is used to generate alarm sound when the obstacle is detected by ultrasonic sensor.

Fig. 4. Vibrating motor

E. Vibrating motor

It is a dc motor and made up of silicon material, which is less weight tiny motor with 2 wires. It has input voltage of 5v and size is 10×2.5mm. It is used in also used in mobile for vibration. It is also called as coin vibrator motor.

Fig. 5. Vibrating motor

F. Other components

Other components include connecting wires and PCB board. The PCB board is used to place the components and connecting wires are used to connect the components in the PCB board.

4. System description

The project aims at giving simplicity to visually impaired individuals in exploring the environment and moving from one place another place. The absolute first thought is object location and alert system. The obstacle detection is done using ultrasonic sensors then the buzzer and vibrating motor are used for alert system.

In this framework, the ultrasonic sensor is used to detect the obstacles. In the event that any hindrance before the sensor, the sensor identifies the snag and get the sign which at that point send to the microcontroller to work buzzer and vibrator. The ultrasonic sensor sends a sound wave at an explicit frequency towards the impediment and gets the reflected wave by the impediment. It records the movement time of sound wave for forward and back. By utilizing the movement time, sensor figures the separation between the sensor and the obstacle.

Fig. 6 shows the block diagram of the obstacle detection and alert system by using ultrasonic sensor, buzzer and vibrating motor.

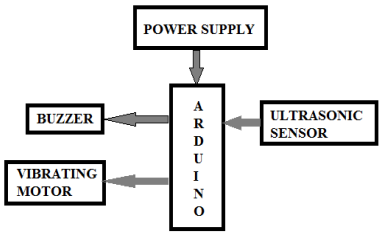

Fig. 6. Block diagram of the system

The system was designed using an ARDUINO microcontroller board with ultrasonic sensors. When the power is applied to the circuit the device will be active. Ultrasonic sensors were used to detect the obstacle in all the direction according to the convenient of the user. By using these sensors in the device the user will be alerted at 50 cm far from the obstacle and distance can be adjusted as per the user's requirement. A vibrator is used along with buzzer in order to provide a haptic feedback to the user in the noisy environment. The feedback of each sensor is connected to a designated buzzer which provides beep sound and a vibrator to alert the blind people about the obstacle. Fig. 7 shows the flowchart of the system.

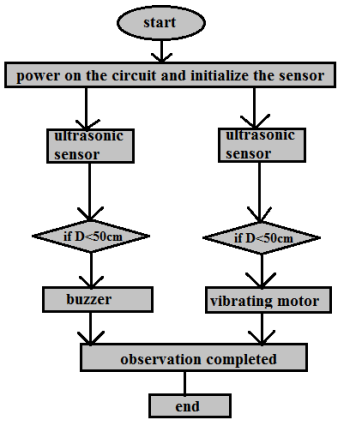

Fig. 7. Flow chart of the system

The distance of the obstacle can be displayed by using serial monitor in the ARDUINO IDE. Fig. 8 shows the distance of the obstacle in centimeters, Further the actual distance and the distance measured by ultrasonic sensor is verified.

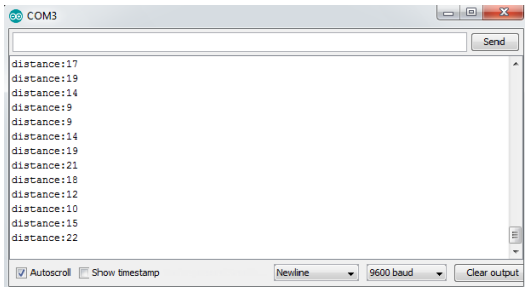

Fig. 8. Measurement of distance (in cm) of obstacles using ultrasonic sensor

Fig. 9 shows the graph plotted between Actual distance and distance measured by ultrasonic sensor.

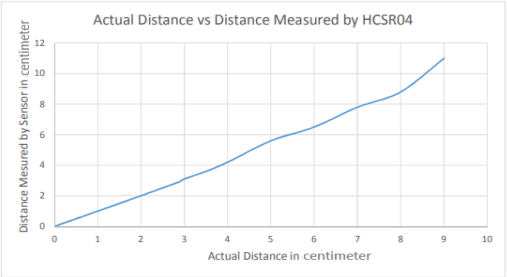

Fig. 9. Actual distance vs. distance measured by HC-SR04

Here, port no. 9 and 10 of the Arduino Uno is connected to the echo and trigger pin of ultrasonic sensor which is used for detecting the obstacles. Port no. 4 and 5 of the Arduino Uno is connected to the buzzer and vibrating motor, if any obstacle is detected buzzer and vibrating motor will be switched ON. The system is portable as 9v battery is connected to provide the power supply. Power button is used to ON/OFF the system.

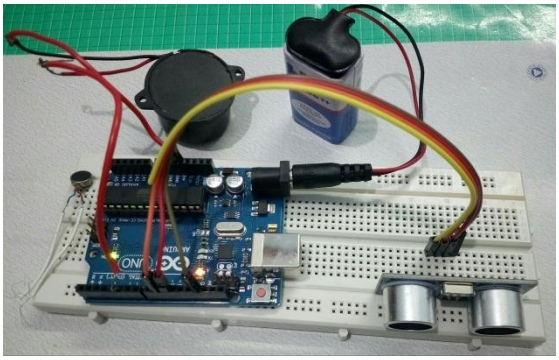

Fig. 10. Simulation using breadboard

Thus, fig. 10 show the actual design of the system using breadboard.

5. Result and discussion

The ultrasonic vision is designed to detect any kind of obstacles and provide an alarm sound and vibrations to the user. The device uses the ultrasonic sensor for detecting the obstacles rather than other sensors like infrared sensors. The vibration provides the clear detection of obstacles even in most noisy and crowded areas like bus stand, railway station and other public places.

The device can be easily portable from one place to another and also movable between right and left side of the user by which it can completely replace the walking stick.

6. Conclusion

To help the visually impaired individual's ultrasonic vision is planned so that the device works simply like a radar framework which is portable and easily carried by the visually

impaired persons. The fundamental goal of this work is to create a complete model that can help the outwardly impeded individual by recognizing an article or obstacles before them. On the off chance that the proposed design is built with all things considered precision these individuals will be moved starting with one spot then onto the next spot more often with less mishap than they have. This moreover guarantees their wellbeing. The framework is structured, executed, tried demonstrating the plausibility of the proposed framework.

7. Future scope

The system can be implemented with GPS module to find the actual position of the user. The device may be connected through a mobile phone if any accident occurs an alert is sent to the phone thus the family member of the user easily tracks user's position.

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