SMART STICK FOR VISUALLY IMPAIRED PEOPLE

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Abstract:
We all know that Vision is the most important part of human physiology. All round the world there are almost 284 million people who are visually impaired. Out of these 39 million people have a moderate eye-sight. Among which India has around 12 million sightless people, which results for one-third of the world's total blind population. They find it difficult while crossing the road or reaching from one destination to another. The traditional stick cannot detect the obstacles and potholes.
In this paper, an Arduino framework is provided for the working of this project. The obstacle sensing stick solves the major issue of visually impaired people by helping them in their day-to-day life without depending on others. Different ultrasonic sensors at different position on the stick are connected to Arduino Mega board along with buzzers.
Keywords: Arduino Mega, ultrasonic sensors, buzzers.

1. Introduction

Traditionally blind people were using the white cane stick which is a normal stick for daily usage. They were normally tapping this stick on the ground to find any object present in their way. This stick was not capable enough for detecting the obstacles present in their way. They find it very difficult to walk or cross the road using this stick. They might get injured if there is obstacle that is danger enough. Therefore, this traditional stick is outdated and hence there is a need to modify this stick using today's rapidly growing modern technology.

We have many reasons to implement this obstacle sensing stick; firstly, user should walk on the road like us. Secondly, this stick should be modest and familiar to that of the white cane, so that they should not feel the stick as something new. Thirdly and most importantly, the stick is designed to detect the obstacles and potholes that are present on the front of the user.

Problem Statement

Without vision it can be challenging for a visually impaired person to navigate without bumping into obstacles. With the traditional stick it can be sometimes inconvenient, uncomfortable and perhaps inaccurate in avoiding obstacles.

To overcome this, the proposed paper uses many ultrasonic sensors fixed with Arduino Mega board to detect obstacles without touching them.

Description about the work

One ultra sonic sensor is placed at the middle of the stick, which detects the obstacles which are above the ground level.

Three ultra sonic sensors are placed at the bottom of the stick, which detects the obstacles from all three directions.

One ultrasonic sensor is placed in the front, which detects the potholes on the road.

Thus, proposed paper uses different sensors and buzzers to find obstacles from different directions.

2. Architectural Design for Proposed System

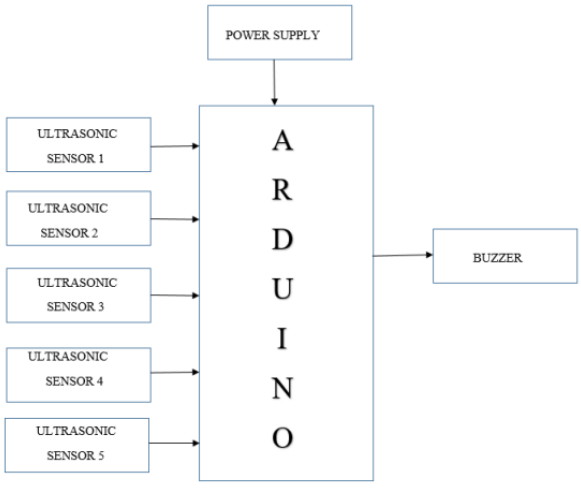

Fig 2.1. Proposed system block diagram

Fig 2.1 is the specified block diagram, which consists of power supply, Arduino mega board, ultrasonic sensors, and buzzers. Power supply is to initiate the hardware components. Ultrasonic sensors which sense the objects or obstacles acts as input to the Arduino mega and buzzer which gives the sound signal acts as the output.

Working Principle

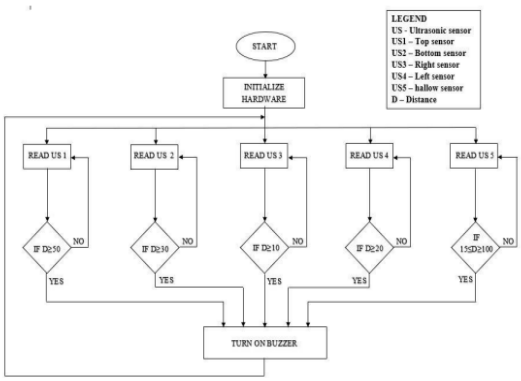

Fig 2.2.Flowchart of Smart Stick

Fig 2.2 shows the flowchart, the graphical representation of the process. This illustrates the workflow required to complete the task. When the power supply is turned on the hardware components gets initiated. This process requires 5 ultrasonic sensors which have to be placed on the stick appropriately. The ultrasonic sensor1 is placed at the top of the stick which can detect the obstacles within the range of 50cm. The ultrasonic sensor 2 is placed bottom of the stick which is to detect the smaller obstacles of range 30cm, ultrasonic sensor 3 is placed to the right of the sensor 2 which can sense the obstacles within the range of 10cm. The ultrasonic sensor 4 is placed to the left of the sensor 2 with the distance range of 20cm. The ultrasonic sensor 5 is for hollow detection which is placed below the stick where it can sense the pits/hollow objects with the range greater than 15cm and less than 100cm. If any of these sensors gets turned on by detecting the obstacles within the given ranges. The buzzer which acts as the output gets turned on and gives the audio output to the user and turns off once the obstacle is cleared, this process continues.

Hardware and Software Requirements

Hardware Components required for the project are:

1. Arduino Mega
2. UltraSonic Sensor
3. Buzzer

Software Components required for the project are:

1. Arduino IDE

3. Interfacing and Testing

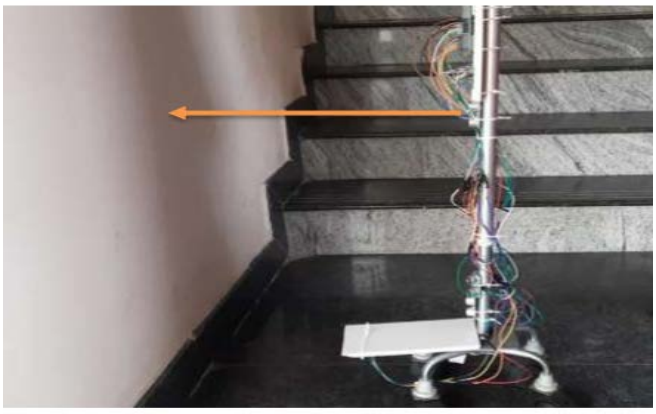

Fig3.1 Ultrasonic sensor1 detecting the wall

Above figure 3.1 shows the ultrasonic sensor 1 that is placed at the top of the stick is detecting the wall that is in the range of 100cm from the stick and the output sound to the user is given through the buzzer.

Table3.2 Ultrasonic sensor 2 detecting the box

Above figure 3.2 shows the ultrasonic sensor 2 that is placed at the bottom of the stick is detecting the box that is in the range of 30cm from the stick and the output sound to the user is given through the buzzer.

Table3.3 Ultrasonic sensor 3 detecting the hollow space (staircase) or pothole detection

Above figure 3.3 shows the ultrasonic sensor 3 that is placed at the beneath the stick is detecting the hollow space i.e., staircase which is in the range from 15cm to 100cm from the stick and the output sound to the user is given through the buzzer.

Table3.4 Ultrasonic sensor 4 detecting the right corner of the wall

Above figure 3.4 shows the ultrasonic sensor 4 that is placed at the bottom right of the sensor 2 is detecting the corner of the wall that is in the range of 50cm from the stick and the output sound to the user is given through the buzzer. The range of this ultrasonic sensor can be varied depending if the user is left-handed or right-handed.

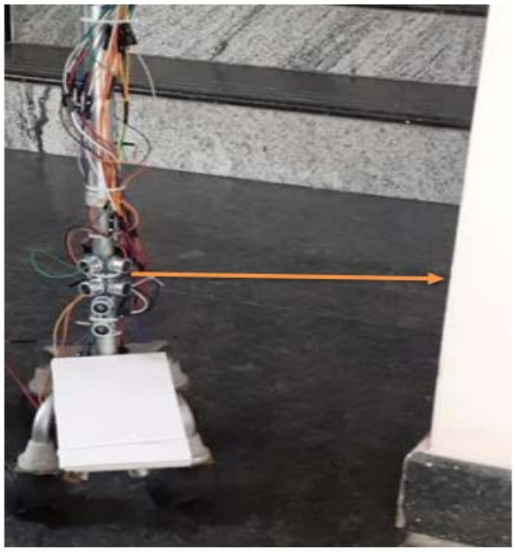

Table3.5 Ultrasonic sensor 5 detecting the left corner of the wall

Above figure 3.5 shows the ultrasonic sensor 5 that is placed at the bottom left of the sensor 2 is detecting the corner of the wall that is in the range of 30cm from the stick and the output sound to the user is given through the buzzer. The range of this ultrasonic sensor can be varied depending if the user is left-handed or right-handed.

4. Result

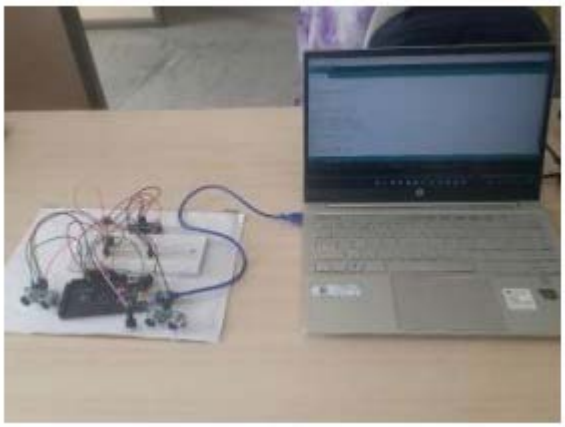

Fig 4.1: Initial Prototype

Fig.4.1 shows the prototype of our project, we have used 5 ultrasonic sensors and placed them on the stick, with buzzers respectively. The ultrasonic sensor 1 and the buzzer1 is placed at the top of the stick which detects the objects which is in the range of 100cm from the stick and gives the sound signal when sensor 1 detects the objects. Ultrasonic sensor 2 is placed at the bottom of the stick detects the objects of range 30cm and the buzzer 2 is placed beside of the ultrasonic sensor 2 gives the output to user.

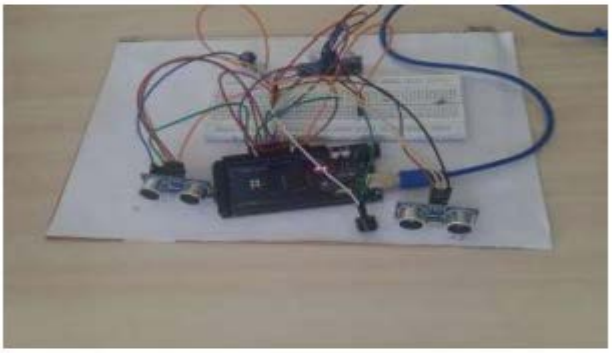

Fig 4.2: Hardware connections

The ultrasonic sensor 3 is placed beneath the stick detects the hollow spaces which is in the range of 15cm – 100cm from the stick, buzzer 3 is also placed beside the ultrasonic sesnor3 which gives the sound signal when sensor3 detects the pits. The ultrasonic sensor 4 and 5 placed bottom right and bottom left of the stick with a distance of 30cm and 50cm respectively detects any object/obstacle to that side, the buzzer 4 and 5 placed along with them gives respective output to user.

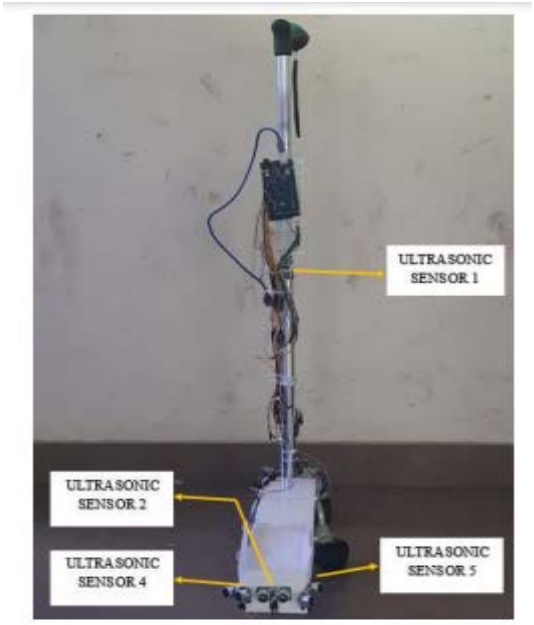

Fig 4.3: Prototype of Smart stick

Fig 4.4: Hollow (Pothole) Detection

6. Conclusion

Smart stick, constructed with at most accuracy, will help the blind people to move from one place to another without others help. This project could also be considered a crude way of giving the blind a sense of vision. The smart stick detects objects or obstacles in front of user and feeds warning back, in the form of buzzer.

7. References

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