Use of Ultrasonic Sensor to Guide the Visually-Impaired

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Abstract
According to the World Health Organization (WHO), at least 2.2 billion people are visually impaired, suffering from eye-sight issues (Vision Impairment and Blindness). Many of these people injure themselves or even die while trying to cross streets, because it is difficult for them to distinguish where they are or what is around them with traditional blind sticks (D’Apice). The purpose of this study is to improve a traditional blind stick with the use of technology (What Will People Think About Me If I Use a White Cane?). The new blind stick has the capability to detect obstacles upfront before an individual collides with the obstacle. An ultrasonic sensor will be used to measure the distance between an individual and an object (Hassan 2012). The buzzer will be used to emit a sound when an object is close. In what way is this blind stick different from the traditional blind stick that already exists? The ultrasonic sensor has a set of threshold limits and if any obstacle is found within that range, the buzzer will turn on. The buzzer will act as a way to alert right-after the ultrasonic sensor detects the object. The new blind stick’s goal is to ensure that the task of moving a blind person is easy and comfortable. The components of the new blind stick are fairly affordable to most people (Blind Arduino Project). The new blind stick can reduce the need to bring an additional individual to navigate places.

Keywords
Blind, stick, obstacle, technology, and arduino

Background
A breadboard is a quick means of constructing and testing circuits, without the need for soldering. It is great for putting together temporary circuits or trying out an idea. A breadboard has a series of “holes” where you insert circuit elements such as resistors, capacitors, and integrated circuits (Figure 3, bottom illustration). Once you insert the circuit elements, the lead is held in place by a tight-fitting connection. The breadboard has a series of metal strips that connect rows and columns of the breadboard holes together. Small wires (“jumper” wires) are used to connect various elements together to form the electrical circuit (Pendergast 2019).
There are two key sections in an Arduino program - the setup part, and a continuous loop sequence. The instructions for each part are contained in curly braces {}. Before, the setup and loop sections, also need to declare variables that will be used (Introduction to Arduino Uno 2019).

```c
void setup( )
{
}

void loop ( )
{
}
```

The setup part is the first to execute when the program is executed, and this function is called only once. The setup function is used to initiate the pin modes and start serial communication.
This function has to be included even if there are no statements to execute (Introduction to Arduino Uno 2019).

After the setup ( ) function is executed, the execution block runs next. The execution block hosts statements like reading inputs, triggering outputs, checking conditions, etc. The loop ( ) function executes the set of statements (enclosed in curly braces) repeatedly. As a side note, Arduino always measures the time duration in milliseconds. Therefore, whenever mentioning the delay, keep it in milliseconds (Pendergast 2019).

**Material**

Ultrasonic sensor, Arduino Uno, piezo buzzer, jumper wires, zip ties, wooden stick, computer/laptop (for programming), Arduino IDE software, breadboard, and LED pin.

Ultrasonic sensor

This sensor has four pins: VCC, TRIG, ECHO, GND. Measures distance of an object using ultrasonic sound waves

Arduino IDE

Uses a simplified version of C++ (explaining to a computer how to perform a certain set of instructions)

Piezo Buzzer

Sound-producing device; the longer leg is positive and the shorter leg is negative (Pendergast 2019).

Prototype

Step 1: Connect the jumper wires to the ultrasonic sensor

Step 2: Connect the other end of the jumper wires on Arduino Uno accordingly- GND to Arduino Uno GND, ECHO to pin 10, TRIG to pin 9, VCC to 5V.
Step 3: Connect the positive tail (longer length) of the LED light to pin 13 and the negative tail (shorter length) to GND on the Arduino Uno.

Step 4: On the breadboard, attach the buzzer anywhere in the middle of the board.

Step 5: Connect negative to GND on the Arduino Uno and positive to pin 11

Step 6: Upload code on Arduino IDE

Conclusion

The advantage of this blind stick lies in the fact that it can essentially improve the lives of millions of blind people worldwide. This device gives a blind person an opportunity to navigate on their own without the help of an additional person. The hypothesis was accepted: the new blind stick can detect obstacles and emit sound when the obstacle is detected.

Future Study
This blind stick opens doors to investigate different types of sensor to make a new device that can improve the lives of the visually impaired (Five Innovations Harness New Technologies for People with Visual Impairment, Blindness 2013).

Use of Global Positioning System (GPS) can further provide the position and destination to a blind person by voice (Holton).

In order to prove accurate validation of the new blind stick, multiple tests will be done to measure the accuracy of the sensor.

References:


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Biography
Mahbuba Sumiya is a current high school student at Benjamin Carson High School of Science and Medicine. She has been working in labs around Detroit for almost her entire high school year. She hopes to go into the field of medicine in the future.