**THE BAT HAT**

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**Eighth Grade**

**Engineering Design**

**Materials Used:**

* Two Hats to hold the Arduino Uno and the Ultrasonic sensors
* Arduiono Uno Micro Controller
* 2 HCSR04 Ultrasonic Sensors
* Piezo Buzzer
* Break Board
* Battery pack
* Mount for Sonar Sensor
* Connecting Wires
* Packing Tape
* Measuring tape (for measuring the distance)

**Design Criteria:**

I used the HCSR04 Ultrasonic sensor because it had a 15-degree range, with a 40KHZ sound signal output and accurate in measuring obstacles in the range of 2

- 400 cms and also very inexpensive. I used 2 Ultrasonic sensors to make the detection of the obstacle easier.

I chose the piezo buzzer for warning the user because it is compact and makes an audible sound which is not very loud but effectively warns the user.

**How BATHAT Works:**

I programmed the Arduino to send a 10uS pulse to the trigger pin of the HCSR04 to make the sensor send out eight 40KHZ pulses towards the obstacle. The time taken for the pulse to reach the obstacle and come back was measured. The distance between the obstacle and the device was calculated using the formula:

Distance in centimeters = Ping\_time \* speed\_of\_sound\_in\_cms\_per\_microsecond/2,

where ping\_time is the time taken for the pulse to reach the obstacle and come back.

I programmed the Arduino to send a beep to a Piezo buzzer whenever the obstacle is within the 100 cms radius. I tested the accuracy of my BatHat by testing it against all the different materials a visually impaired person would encounter every day. For each material (obstacle), I moved the BatHat back until it stopped beeping.

I then slowly moved it closer to the obstacle until it starts beeping again. I recorded the distance shown in the Arduino's serial monitor when the buzzer starts beeping again. I recorded this distance for all the different materials. I also measured the responding distances for obstacles of different widths ranging between 1 to 3 inches in 1/2 inch interval. I then graphed all the distances that I had recorded for each material and size.

Most of the responding distances were around 40 inches (100 cms). So I feel the device will accurately warn the blind person of an obstacle.

**Cost Analysis:**

The cost of building my prototype was around 30$. I strongly believe that I can reduce the cost to 20$ - 25$ if I mass produce it. Even a regular white cane used widely by blind people costs around 25$ - 30$. So, I think my product would be pretty competitive in the market.