BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY DHAKA-1000, BANGLADESH

ME 366

ELECTRO-MECHANICAL SYSTEM DESIGN AND PRACTICE

PROJECT: THIRD EYE

SUBMITTED BY

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Abstract

The main task of a blind man is differentiating object distance while moving in everyday life. Few methods have been invented to help them and provide them with some level of mobility comfort. Our goal here is developing an ultrasonic vibrating glove which can measure distance of obstacle up to certain range. This glove can automatically detect an obstacle and give the user feedback response by vibrating the motor. As a result of evaluating the proposed application, it is shown that it is easy to use and useful and can be employed for many important purposes in daily life.

Acknowledgement

First, We would like to take this opportunity to thank our professor Monjur Morshed sir and Md. Rakib Hossain sir for their guidance and advice on this project. Their useful suggestion for this whole work and co-operative behavior are acknowledged. At the same I also will not forget my group participants too because they are quite helpful with sharing their information to complete our project.

We thank all our lecturers who have directly or indirectly helped our project. We pay our respect and love to our parents and friends for their love and encourage throughout our project.

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Introduction

For blind people, walking freely is a challenge due to lack of information about the destination addresses, obstacles, etc. For them, there are plenty of modern technologies that could be employed to decrease the difficulties caused by this impairment, making the relationship between man and environment more harmonious as possible. Blind people use the canes to move around and avoid obstacles. That is an especially useful instrument and widely spread among blind people worldwide. Unfortunately, it is still a limited resource unable to provide independent navigation and it cannot be used to detect objects or people more than a few feet away or above the waist of the user. Related proposals are dealing with this problem based on modern technologies. The statistics by the World Health Organization (WHO) estimates that there are 39 million blind people and 246 million with low vision in the world. There are about 1.24 million blind people in Myanmar. Mostly, blind people use a white stick for directing them when they move or walk. Now our vision here is to develop a vibrating gloves and sound generator for blind man for more efficient and helpful than stick. This will help blind people when they walking when the sensor detects the obstacle, give alert sound and vibrating from motor.

Background:

Navigating Around the Places

The biggest challenge for a visually impaired person is to navigate around in 3d places. Blind people roam easily around their house without any help because they know the position of everything in the house. People living with and visiting blind people must make sure not to move things around without informing or asking the blind person. But outside of home Blind people have harder time to navigate because they don't have the positional sense. So, they will need other people's help to move around.

Dealing with sight loss, already, is a challenge. The lack of emotional support at diagnosis centers, the limited accessibility to activities and information, the societal stigma, and the lack of unemployment, are all factors frequently leading blind or low vision individuals in isolation. Blind people face way more problems than normal people as they can't visualize any kind of scenarios. But this certainly does not mean

that you can always help blind persons to contribute in the society. They too, just like any individual, take up life's challenges and live a normal life, even if it does not seem normal to the sighted individuals.

Getting Devices to Become Independence

The most valuable thing for a disabled person is gaining independence. A blind person can lead an independent life with some specifically designed adaptive things for them. There are lots of adaptive equipment that can enable a blind person to live their life independently but they are not easily available in the local shops or markets. A blind person needs to be privileged enough to get equipment that can take them one step closer towards independence.

Status quo:

The development of walking assistants for visually impaired people has become a prominent research area due to the rapid growth of these individuals in recent decades. Although numerous frameworks have been developed to aid visually impaired people, a considerable portion of these is limited in their scopes. In this review, we exhibit a similar review of walking assistants for visually impaired people to demonstrate the advancement of such technologies. But our device provides better efficient service to the blind people to navigate in the space. Now a days there are so many instruments and smart devices for blind peoples to navigation but most of them have certain problems for carrying and the major drawbacks is those need a lot of training to use. The one of the main peculiarities of this innovation is, it is affordable for everyone, the total cost being less than $25. There are no such devices available in the market that can be worn like a cloth and having such a low cost and simplicity. When manufactured on large scale, with improvements in the prototype, it will improve the experience of the community.

Design and Methodology

To develop our project, we need some Hardwares and software tools. We also must learn ARDUINO language to develop a code for our project and then we must ensure our code runs well through try and error process. After a code being made, we can simulate our project through using proteus simulation. Hardware we have used are given below-

1. Arduino UNO
2. HC-SR04 ultrasonic sensor
3. Pref board
4. Vibrating motor
5. Buzzers
6. Red LEDs (light emitting diodes)
7. Switches
8. Male and female header pin
9. Jumper cable
10. One power bank
11. One 3.3-volt old mobile battery
12. Some elastics and stickers (to make it as a band for wearing).

Advantages of HC-SR04 Ultrasonic sensor:

1. Not affected by color or transparency of objects.
2. Can be used in dark environments
3. Low-cost option
4. Not highly affected by dust, dirt, or high-moisture environments
5. They have greater accuracy than many other methods at measuring thickness and distance to a parallel surface
6. Their high frequency, sensitivity, and penetrating power make it easy to detect external or deep objects
7. These ultrasonic sensors are easy to use and not dangerous during operation to nearby objects, people or equipment
8. sensors easily interface with microcontrollers or any type of controller

Software we have used are given below-

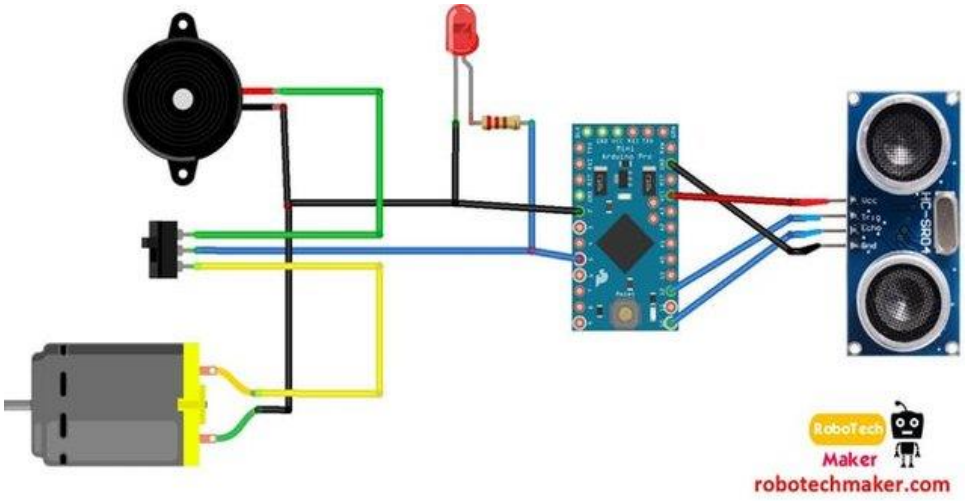
1. Arduino for coding
2. Proteus for simulation

After that we have designed our circuit. Here one thing to notify that we must be careful while giving the connections because if any connection is connected to wrong terminal entire system may collapse.so we have noted our wiring instruction here-

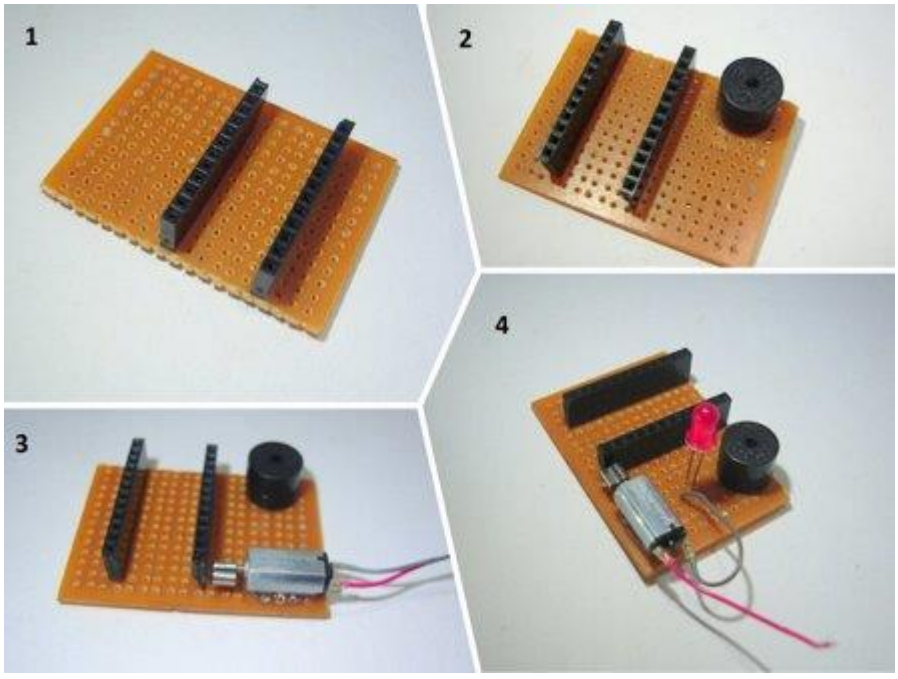
1. Ground of LED (Light Emitting Diode), buzzer and vibration motor to GND of Arduino
2. +ve of LED and middle leg of switch to Arduino pin 5
3. +ve of Buzzer to first leg of switch
4. +ve of Vibration motor to third leg of switch
5. Ultrasonic sensor
6. Ultrasonic sensor pin VCC - Arduino pin VCC
7. Ultrasonic sensor pin GND - Arduino pin GND

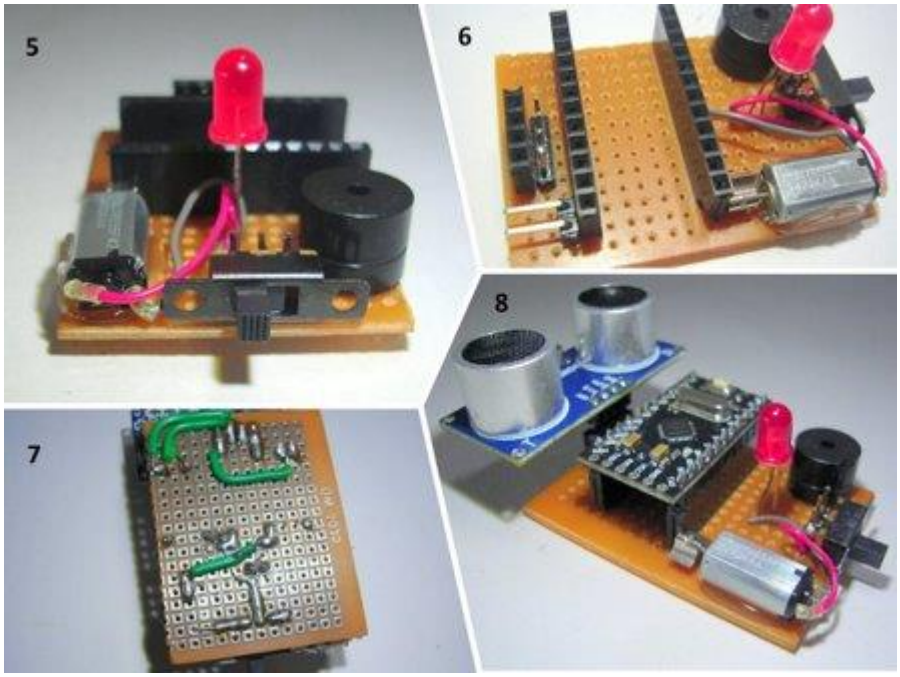
8. Ultrasonic sensor pin Trig - Arduino pin 12
9. Ultrasonic sensor pin Echo - Arduino PIN 12
10. The switch used here is for selecting the mode. (Buzzer or vibration mode.)

For ease of checking wiring connection, we have made an image of it-



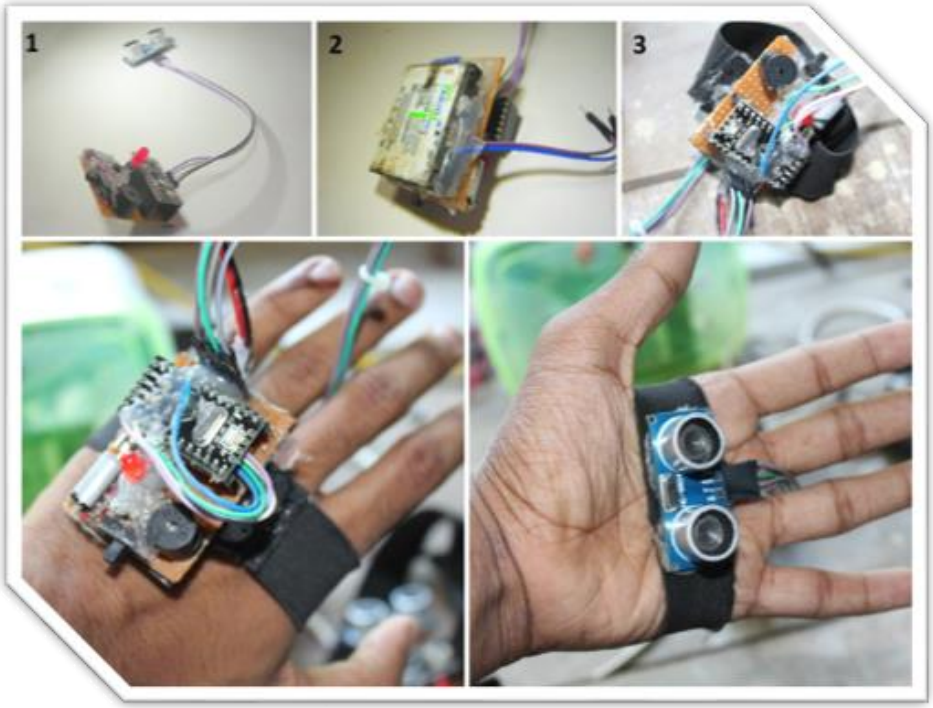
Here are the design drawing of our project:



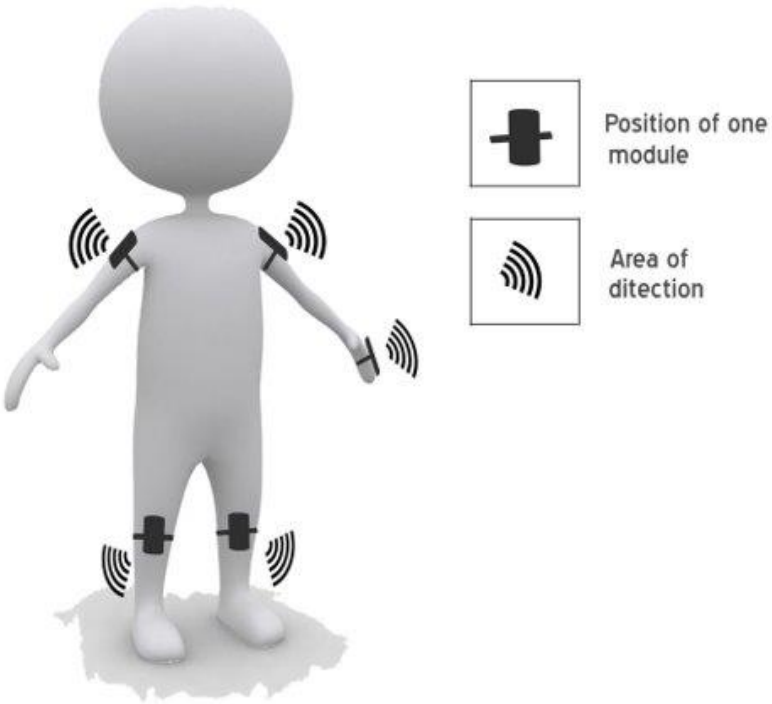


After building a hardware model we must fabricate it in hand. For that we have used hand band for ease of wearing that will also ensure the structure will stick to hand after slight collision and will resist considerable amount of vibration and will not fall from hand. Here is our fabrication process image and process-

1. Connect the ultrasonic sensor to the board by using 4 jumper cables.
2. Then connect a 3.7-volt mobile battery to this module.
3. Then connect the elastic band as shown in the figure.



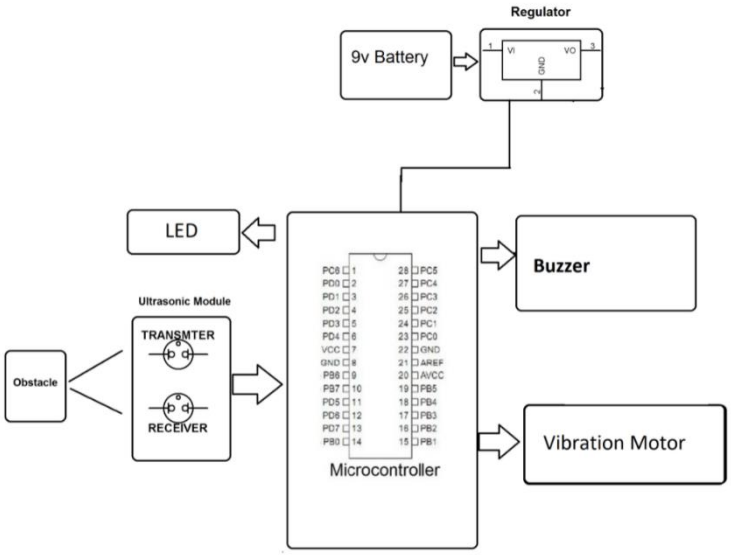
We have noticed if we use only one device for one person, he will get information from only one direction but constraint may come from any direction so using only one device is not going to be efficient so we design a model for it so that blind man will get notified of constraints coming from several direction-



In our overall project we have tried to reduce total cost so that anyone may effort it. we can upgrade our sensor if we need further better range.

Calculation, Data & Discussion:

We collect data from different sensors and based on their values, particular element will turn on or off.



Schematic diagram of working procedure

Vibration of motor by measuring distance

We have used an ultrasonic sensor, vibration motor, a LED, a switch, resistance, serial monitor (for simulation purpose), potentiometer to measure obstacle distance for blind people. All the sensors relate to Arduino Uno.

When a person is x cm away from the ultrasonic sensor, the sensors scan the obstacle distance. If the distance is below 50 cm (about half the length of a baseball bat), then the vibration motor will start to rotate and shake the specified parts of body. From this one can understand the obstacle presence.at the time of entering the room, we increase the number of persons by one. At the time of going closer to obstacle, we increase the rpm of motor gradually.

If the distance is equal or above 50 cm the motor will not vibrate.

Beeping Alert using Buzzer

The basic of sensing and measure ment is same as before. A alternative option has been kept here.Rules are same here for both output system. The closer the user to an obstacle the more periodic time of the signal will decrease. Thus, our user will get an idea of distance.

Mathematical Terms for Calculation

For a standard condition we have consider the velocity of sound as, v= 340 ms^{-1}

Let us assume,

The value of signal receiving time t

Then the value of obstacle distance will be, d = (2*t/v);

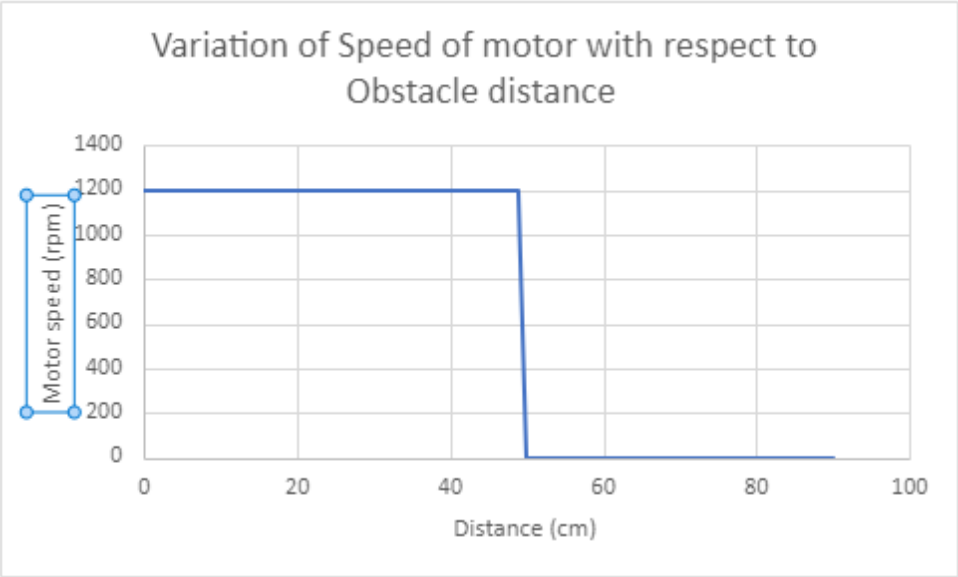
So ‘d’ is proportional to ‘t.’

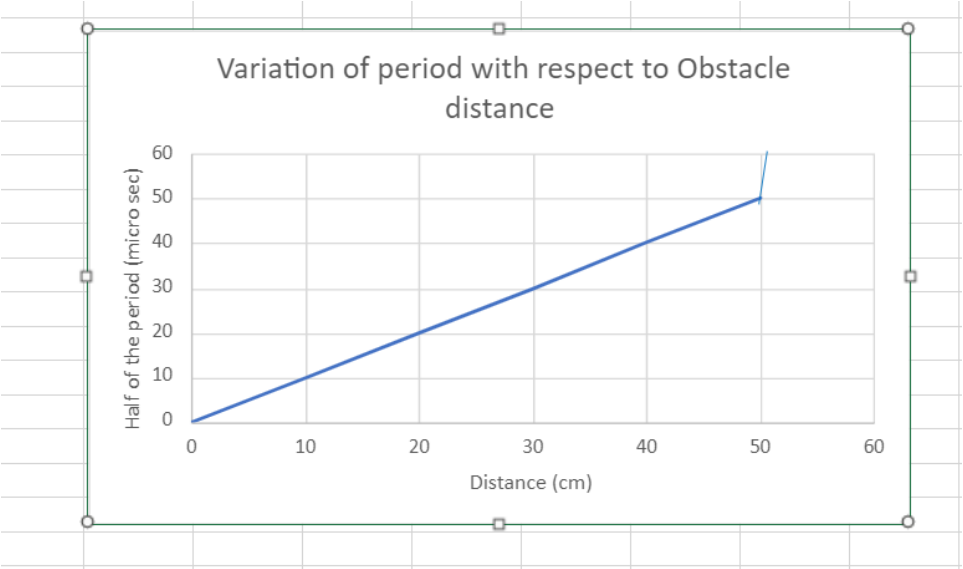
Here d is used as the half period of the signal output where buzzer or motor will give signal for the half of the period and for the rest time it is kept digital mode low which means off.

So, from the above relation it can be said that the less the value of t the less of d will be

And the frequency of giving warning will increase. By this method our user will be alert and avoid the obstacle. As mentioned, we have used five modules, the user will get a proper idea of obstacle around him/her.

Here is some graphical representation,





Learnings

- We have learned AURDUINO language
- We have gained experience of doing any project in future
- We have come to know how to deal with any technical and coding problems
- This experience will help us work together as a group
- We will be comfortable to any critical project in any upcoming life
- Now we know how to use simulation to check all the connections are correct and whether it runs or not

Future Aspect of The Project

- The programmable device would steer the device away from the obstacles and also leading the blind person towards the destination.
- Internet of Things is a trending concept which can increase the benefits of the smart device by allowing one device to communicate with another smart device (or mobile, PCs) nearby to utilize the functionality of the other devices when one device's functionality breaks down.
- In order to run this integrated set of hardware we can use solar panels as an alternative to the battery. The use of solar panel occurs to be more advantageous as it uses sunlight, the easily available renewable resource of energy, to get recharged.
- We can develop app to function the devices more efficiently.

Conclusion

In conclusion it's clear that the summary of our project is simple. We have tried to made our project for people who are blind and which helps the blind people to navigate with speed and confidence by detecting the nearby obstacles using the help of ultrasonic waves and let them know with buzzer sound or vibration. They only need to wear this device as a band or cloth. We can classify our main aim my three main parts-

• An improved wearable technology for people who are visually impaired

• Using SONAR sensor to detect the obstacles

• warning the user through vibrations/buzzer sound

After all we have achieved our destiny. After wearing our band everything has worked fluently. Vibration motor and buzzer is doing their work as obstacle comes closer.

Reference

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Appendix

Program code for Arduino UNO

```
const int pingTrigPin = 12; //Trigger connected to PIN 7
const int pingEchoPin = 10; //Echo connected to PIN 8
int buz = 5; //Buzzer to PIN 4
void setup() {
  Serial.begin(9600);
  pinMode(buz, OUTPUT);
  pinMode(pingTrigPin, OUTPUT);
  pinMode(pingEchoPin, INPUT);
}
void loop()
{
  long duration, cm;

  digitalWrite(pingTrigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(pingTrigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(pingTrigPin, LOW);

  duration = pulseIn(pingEchoPin, HIGH);
  cm = duration * 0.034 / 2;
  if (cm <= 50 && cm > 0)
  {
    int d = map(cm, 1, 100, 20, 2000);
```

```
    digitalWrite(buz, HIGH);
    delay(d);
    digitalWrite(buz, LOW);
    delay(d);
  }
  Serial.print(cm);
  Serial.print("cm");
  Serial.println();

}
```

Diagram of Motor Simulation: