DESIGN OF ARDUINO BASED SHOE FOR BLIND WITH WIRELESS CHARGING

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Abstract - Good Vision is one of the gift from the God, vision enable a person to know about his surroundings. But Unfortunately millions of people are deprived of this gift. Lack of Vision add to low esteem in visually impaired person making them conservative because they are not able to interact with world in a manner others do. In taking all these point in consideration a cheap, friendly user wearable Shoe is proposed that aid blind people in doing everyday stuffs and make them self-Independent. This Shoe enable both partially and totally blind person to self-navigate in an unknown environment. The Proposed shoe comes with feature such as Obstacle detector sensor, Water Sensor, Wireless Charging, GPS Tracking.

Keywords - Arduino Uno, Ultrasonic Sensor, DC-DC Boost Convertor, Wireless Charging Pad, Piezo Buzzer

I. INTRODUCTION

The eyes are described as window of the soul, that is the importance of eyes. An eye is a vital part of human body which enables a person to know about his surroundings. Blindness hampers a Person ability to do daily chores and earn wages for their Survivor. According to a recent report of World Health Organization (WHO), India is the home of nearly 30% of total blind globally. The population of visually impaired people in India has now reached to 12 million which is going to be increase in upcoming days. From the data it is clear that how big is problem of blindness in India. The blindness can be of two types: -Partially blindness and totally blindness. Partially blindness refers to condition in which a person is only able to perceive a part of visual light and totally Blindness refer to Complete absence of visual light interception.

Many People Suffer from serious visual impairment due to which they get trapped in their known environment. People suffering from total blindness are not able to do even simple task for example switching on the fan, finding their daily stuffs or going on a walk. The main problem with blind people is loss of self-esteem and physical integrity due to which they loss self-confidence. Whenever they enter in new environment they need to memorize the position of each and every object of their need and obstacle. Accordingly, they need some tool or technique which can help them in their mobility and in doing daily chores. One of the method is use of trained dog which can help visually impaired person to move by navigating around the obstacle. However, this method is not quite efficient as it requires a lot of effort and time in training a dog and it is also very difficult for the blind person to take care of other living creature. Another method is use of a cane which is again unpractical because of its limited range.

There are broadly three stages involved in the design of the proposed blind shoe:

(i) Input Stage: - It consist of two HC-SR04 ultrasonic sensor, the sensor is uses to detect obstacle in the path of blind person. A water sensor is also used which is mounted on bottom of shoe which will detect presence of water in the blind person path.

(ii) Control Stage:- It consists of a microcontroller here we used Arduino Uno, the microcontroller receives the obstacle distance via ultrasonic sensor, microcontroller has inbuilt comparator which will compare obstacle distance and reference distance and then generate an error as according. The microcontroller also receives the signal from water sensor. The microcontroller is programmed in such a way that it will sends a required trigger signal to the two vibrating motor and a piezo buzzer whenever error is found to be beyond tolerance range.

(iii) Output Stage:- It involves two-coin vibrating motor which will act according to signal receive by microcontroller. A piezo buzzer is also there that sound when water sensor detects presence of water.

II. DESIGN AND DETAIL EXPERIMENTAL

(A) ARDUINO IDE

Arduino IDE (Integrated Development Environment) is used to write the code and for uploading on the Arduino Uno Microcontroller. The program was written in C language. Autodesk 123D Online circuit simulator is used for simulation purpose and for checking the code. The Circuit diagram is generated using Fritzing Software.

(B) HCSR-04 Ultrasonic Sensor

Two HCSR-04 ultrasonic sensor is used to locate the obstacle in the path of blind person. One sensor is mounted on the front end of shoe for detecting obstacle in forward path, while second sensor is mounted on the side of shoe for detecting sideward obstacle.

Forward Obstacle Sensor - The trigger pin and echo pin of ultrasonic sensor used for detecting forward

obstacle is connected to digital pin 7 & 8 of microcontroller respectively.

Sideward Obstacle sensor - The trigger pin and echo pin of ultrasonic sensor used for detecting sideward obstacle is connected to digital pin 12 & 13of microcontroller respectively.

The trigger pin is used to trigger the sensor for sending the ultrasonic pulse, while echo pin is used to receive the echo pulse from obstacle, the time duration between transmitted pulse and received pulse (echo pulse) is then used to calculate the distance of obstacle.

Burst of short ultrasonic pulse can be send from two sensors by putting the trigger pin high for appropriate time.

(C) Water Sensor

A water sensor is used to detect the presence of water in the path of blind person. The water sensor is mounted on the bottom of shoe. The water sensor is made up of rubber pad with four stripes of copper wire. Out of four stripes, one strip is kept at high potential using microcontroller supply while rest of the copper stripes are connected to ground potential of microcontroller via a 470ohm resistor. The copper strip along with resistor form a voltage dividing circuit. The Voltage across 470ohm resistor is measured using A0 analog pin of microcontroller. whenever sensor gets in touched with water a path gets formed between copper stripes and we get a voltage reading across the resistor. The value of voltage across 470ohm resistor gives the amount of water present. Table 1 show the voltage level across resistor under different conditions. When the voltage level is greater than reference value, microcontroller will trigger a buzzer that will allow the visually impaired person to become aware about the presence of water in his path.

Table 1

Condition	Voltage Across 470ohm Resistor in volt
NO water	0
Muddy Path	0.778
Water	1.75

(D) Arduino Microcontroller

For manipulating or processing the information as received by ultrasonic Sensor a microcontroller is used. Here we have used an Arduino Uno microcontroller. The microcontroller is programmed to receive signal from two ultrasonic sensors and a water sensor.

The microcontroller is programmed to trigger the two-coin vibrating motor, whenever ultrasonic sensor found obstacle within its range. The obstacle detection range of ultrasonic sensor can be set through the program written in microcontroller, which can be change according to the walking pattern and step size of the visually impaired person.

The microcontroller is programmed to read the voltage across 470ohm resistor of voltage dividing circuit formed by water sensor, in the absence of water, voltage across 470ohm resistor will be zero due to open circuit between copper stripes, in the presence of muddy path a voltage is observed across the resistor on detecting the voltage, microcontroller will trigger the buzzer to let the blind person aware about the muddy path .On detecting presence of water a higher voltage reading is observed across resistor, microcontroller is programmed such that sound of buzzer will be proportional to voltage reading across 470ohm resistor this is done using PWM controlled digital pin 9 of microcontroller.

(E) Coin Vibrating Motor

Two-coin vibrating motor is used to make the visually impaired person aware about the obstacle, each of this motor get triggered from microcontroller when ultrasonic sensor detects an obstacle within its range. One of the vibrating motor is placed near the front end of the shoe, this motor will get triggered when ultrasonic sensor responsible for detecting forward path obstacle, detects an obstacle in the path of visually impaired person, while the other vibrating motor is placed near the side end, this motor will gets trigger when the ultrasonic sensor responsible for detecting sideward obstacle, detects an obstacle in the visually impaired person path. The positive terminal of each motor is connected to digital pin 3,4 respectively of Arduino microcontroller, while the negative terminal is attached to ground pin of microcontroller.

(F) Piezo Buzzer

A Piezo Buzzer is an electronic part commonly used to produce sound or a beep. In this proposed shoe, piezo buzzer sounds whenever the water sensor detects the presence of water in visually impaired person path. The buzzer is connected to PWM control digital pin 9 of Arduino Microcontroller. The intensity with which buzzer sounds depend on the intensity of water present in the blind person path. The intensity of buzzer sound can be controlled using Pulse Width Modulation technique provided in the microcontroller. By varying the pulse width on PWM controller digital pin 9 of microcontroller intensity of sound can be modify as require.

(G) Wireless Charging. The proposed shoe comes with an ease of wireless charging, wireless charging removes the problem, the blind person may face while charging the shoe using conventional method of charging which include a wire and a bulky charger. The Wireless charging is done using a wireless charging pad which act as a transmitter, these pads are mostly used for charging the mobile, the proposed shoe has used a Samsung wireless charging pad that produce 5v with 1000ma as an output.

A wireless charging receiver pad is used to receive energy from transmitter, a DC-DC 5v to 9v Boost

convertor is used, the boost convertor boosts the 5v output from receiving pad to 9v for charging purpose. Each shoe can be individually charge just by keeping the shoe on the charging pad. The proposed shoe is powered using 9v ,600mah Li-ion cell which can be fully charge using the wireless charging pad within a half an hour.

(H)Power Supply

A 9v 600mah Li-ion rechargeable cell is used as power supply for microcontroller and other peripherals. The cell is charge using 9v supply from the output of boost convertor using a charging circuit.

(I) GPS Tracker

A portable GPS tracker is used that allow the visually impaired persons relative to track his position. The blind person position can be track on Google map. To track the position a call, have to be made on the GPS tracker which will send the coordinate of the blind person position on mobile, the coordinate can be then used the track the position on Googlemap. The Geo-Fence feature of GPS tracker have been used to send a SOS message on mobile, whenever the blind person breached the restricted area.

III. ALGORITHM

The following are the general steps involved in obstacle detection using Ultrasonic Sensor and detection of water in blind person paths. (Fig 1)

1. A Burst of ultrasonic pulse is send from both ultrasonic sensors to detect the obstacle in path, this is done by putting the trigger pin of ultrasonic sensor high for 10microseconds.
2. The echo pulse is received using Echo pin of ultrasonic sensor.
3. The time duration between transmitted pulse and echo pulse is used to calculate the distance between shoe and obstacle.
4. If the obstacle detected by forward sensor is within the distance of 90cm or less, forward vibrating motor get trigger.
5. If the obstacle detected by sideward sensor is Within the distance of 60cm or less, sideward vibrating motor get triggered
6. If the voltage across 470ohm resistor of voltage dividing circuit of water sensor is found within a range of 0.7v to1.2v piezo buzzer get trigger with moderate sound indicating the presence of watery mud in the blind person path.
7. If the voltage across 470ohm resistor of voltage dividing circuit of water sensor is found greater than 1.2v piezo buzzer get trigger with sharp sound indicating the presence of water in the blind person path.

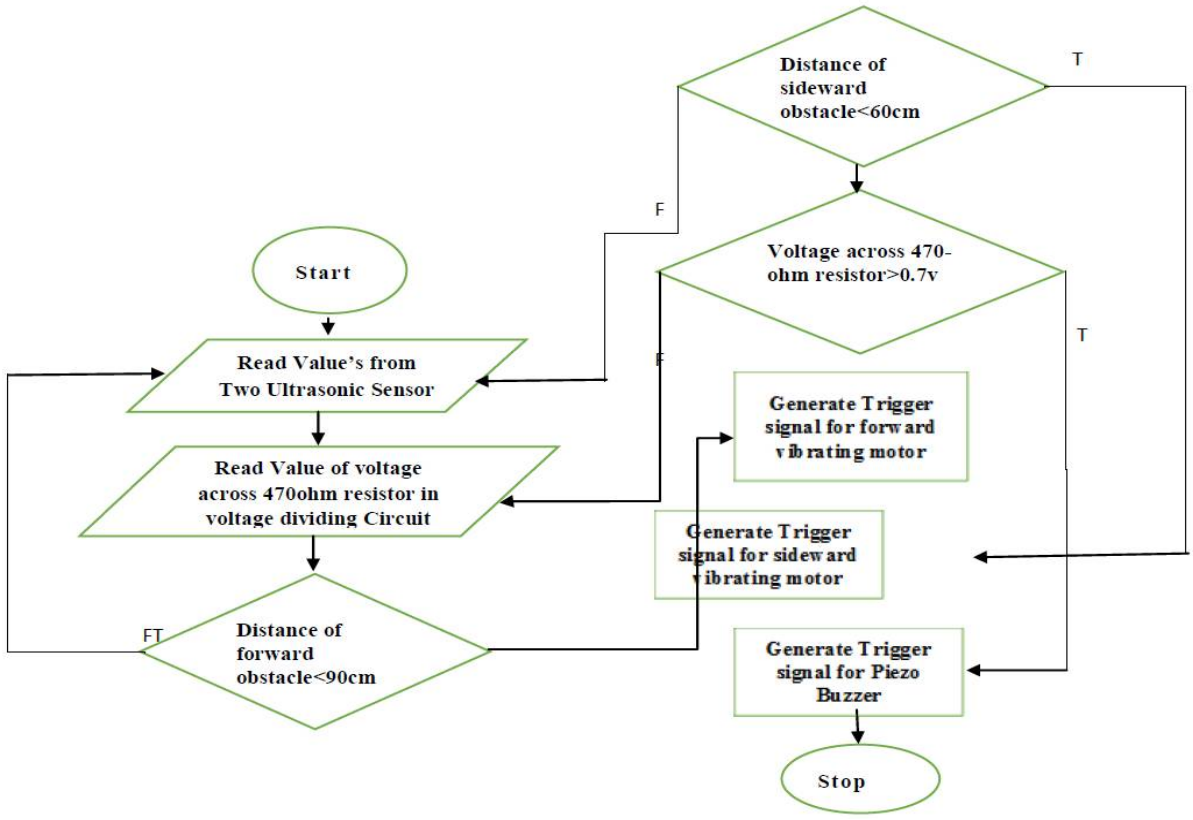

Fig1. Flowchart

IV. CIRCUIT DIAGRAM

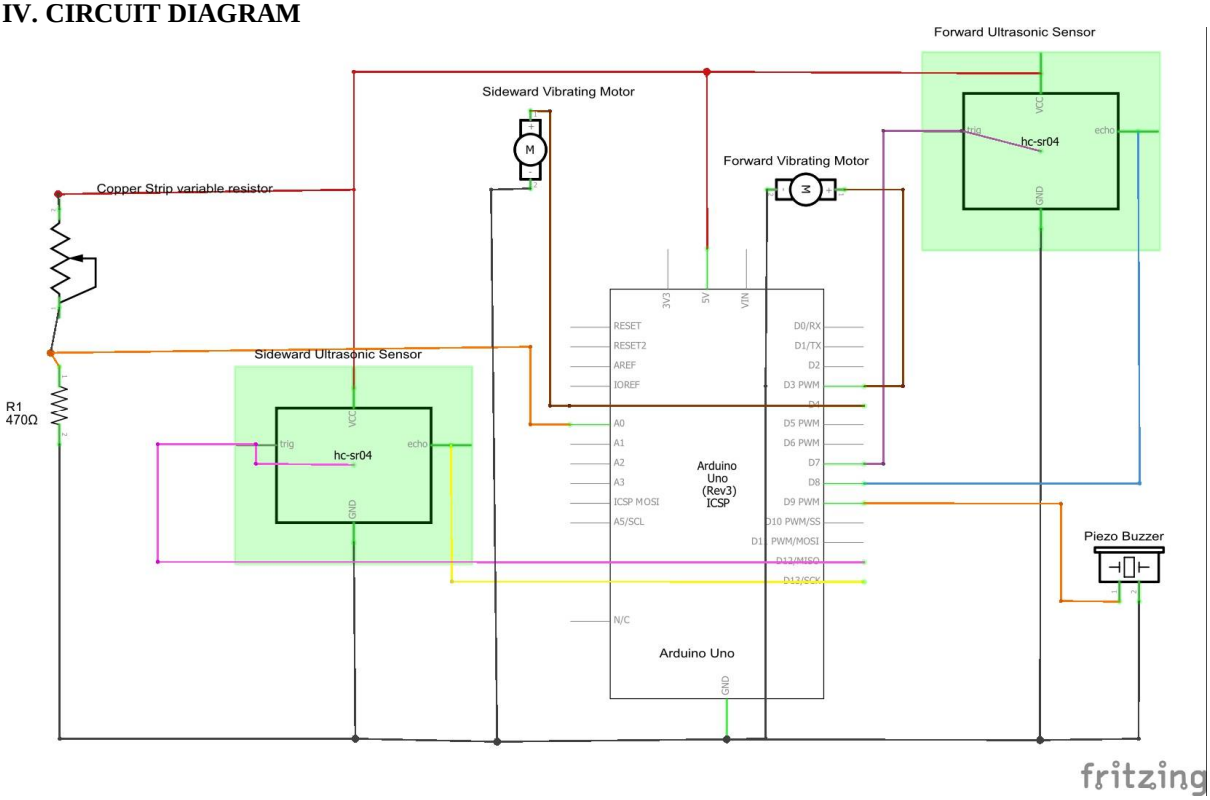

Fig 2. Schematic of the Blind Shoe circuitry

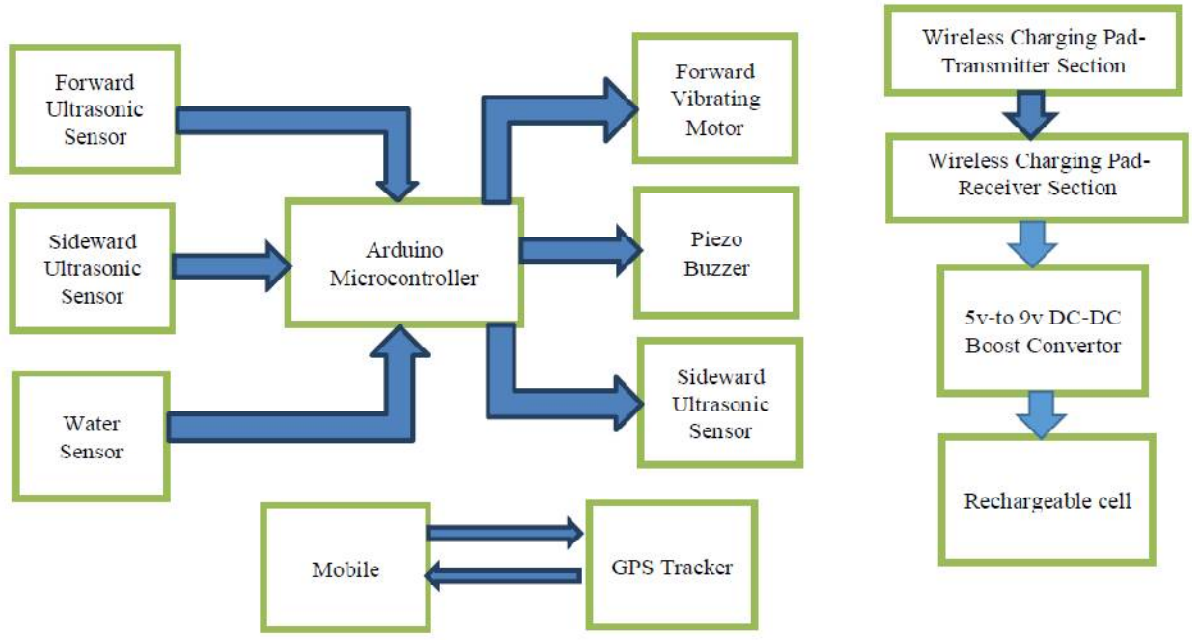

Fig 3. Block Diagram

Table 2

S.NO	Device	Application in proposed shoe.
1	Arduino Microcontroller	1.For receiving data from two ultrasonic sensor and water sensor. 2.Trigger the vibrating motor and buzzer.
2	HC-SR04 Ultrasonic sensor	For detecting the Obstacle in the blind person path.
3	Coin Vibrating motor	To allow the blind person get aware

		about the obstacle .
4	Piezo Buzzer	To allow the blind person get aware about the presence of water.
5	5v-9v DC-DC Boost Convertor	For stepping up the 5volt form wireless charger receiver to 9volt.
6	Wireless charging Pad	For Transmitting Energy Wirelessly.
7	Wireless Charging Receiver	For Receiving the energy from wireless transmitter pad.
8	9v,600mah Li-ion cell	For providing power to Circuitry.
9	Portable GPS Tracker	For monitoring the position of blind person.

Fig 4. Working Prototype Model of Proposed Shoe

CONCLUSION

A shoe that help visually impaired person in walking has been designed. The shoe proposed here can be wear by visually impaired person while walking. The prototype was implemented with the minimum resources. The circuitry was kept simple. To ensure fast and easy charging, wireless charging is added. A 9V 600mah rechargeable battery is used to power the circuitry. The Shoe can be used for nearly 3-4 hour once the rechargeable battery gets fully charged. The obstacle detection range can be set just by making a small change in the program, according to walking pattern and step size of visually impaired person. GPS is also added for monitoring visually impaired person movement and to track his positon. The proposed shoe is mainly suitable for lightly populated area such as an institute campus and indoor.

MICROCONTROLLER CODING

```
int trigPin1 = 7;    //Trig - purple Jumper  trigger pin of forward sensor
int echoPin1 = 8;    //Echo - blue Jumper  echo pin of forward sensor
int trigPin2 = 12;    //Trig - pink Jumper trigger pin of sideward sensor
int echoPin2 = 13;      // echo-yellow  echo pin of sideward sensor
int forwardmotor=3;    // forward vibrating motor
int sidewardmotor=4;    //sideward vibrating motor
int a=A0;           // voltage acroos 470ohm resistor of water sensor
int buzzer=9;    // piezo buzzer
long
duration1,duration2,dcm1,dcm2,voltaged,voltage;
 void setup() {
  //Serial Port begin
  Serial.begin (9600);
  //Define inputs and outputs
pinMode(trigPin1, OUTPUT);
  pinMode(trigPin2, OUTPUT);
  pinMode(echoPin1, INPUT);
  pinMode(echoPin2, INPUT);
  pinMode(forwardmotor,OUTPUT);
  pinMode(sidewardmotor,OUTPUT);
  pinMode(a,INPUT);
  pinMode(buzzer,OUTPUT);
}
void loop()
{
  // The sensor is triggered by a HIGH pulse of 10 or more microseconds.
  // Give a short LOW pulse beforehand to ensure a clean HIGH pulse:
  digitalWrite(trigPin1, LOW);
   digitalWrite(trigPin2, LOW);
  delayMicroseconds(5);
  digitalWrite(trigPin1, HIGH);
  digitalWrite(trigPin2, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin1, LOW);
  digitalWrite(trigPin2, LOW);
  duration1 = pulseIn(echoPin1, HIGH);
   duration2 = pulseIn(echoPin2, HIGH);
 // convert the time into a distance
  dcm1 = (duration1/2) / 29.1;
  dcm2 = (duration2/2) / 29.1;
    if (dcm1<90){
   digitalWrite(forwardmotor,HIGH);}
  else {
    digitalWrite(forwardmotor,LOW);}
    if (dcm2< 60) {
      digitalWrite(sidewardmotor,HIGH); }
      else{
        digitalWrite(sidewardmotor,LOW); }
         voltaged=analogRead(a);   // voltage in digital
        voltage=(voltaged*5)/1023;       // voltage in corresponding
   analog
```

```
      if (voltage>0.7||voltage<=1.2){
       analogWrite(buzzer,150);}      //buzzer with
moderate sound
       if (voltage>1.2){
        analogWrite(buzzer,255);}  //  buzzer  with
sharp sound
        else{
         analogWrite(buzzer,0);}
 delay(250);
}
```

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