A PROJECT REPORT ON

<< *Smart Blind Stick using Arduino* >>

Submitted in partial fulfilment of the requirements for the award of the degree of

Bachelor of Technology

In

ELECTRONICS&COMMUNICATION ENGINEERING

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CERTIFICATE

This is to certify that the project titled **Smart Blind Stick** submitted by Anjali Shaw [Team Leader], Tuhina Roy Chaudhury, Shruti Das, Riya Kundu ,Students of UNIVERSITY OF ENGINEERING & MANAGEMENT, KOLKATA, as submitted for the partial fulfilment of requirements for the degree of Bachelor of Technology in Electronics & Communication Engineering, is a bona fide work carried out by them under the supervision and guidance of **Prof. Arpita Das** during 5th Semester of academic session of 2022. The content of this report has not been submitted to any other university or institute for the award of any other degree.

I am glad to inform that the work is entirely original, and its performance is found to be quite satisfactory.

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Abstract

Blind person finds it difficult to detect the presence of any obstacles in their way while moving from one place to another and it is very difficult to find the exact location of the stick if it have been misplaced. Thus, the smart stick comes as a proposed solution to help the visually impaired people in their day to day living without the help of others. In this paper we proposed a solution for the blind people by using an ultrasonic sensor in the blind stick. The instrument stands used to perceive the obstacles

This paper demonstrates an easy and efficient smart blind stick system. It is accomplished by using Arduino microcontroller and ultrasonic sensor that will control the buzzer and LED based object's detection. The buzzer is affixed with the system to warn the visually impaired person of the obstacle. An LED acts as an indicator for passer by people in case of a dark surroundings. The benefits of this proposed work is that the visually impaired. This proposed idea will surely be beneficial in the future applications of microcontrollers and sensors.

Keywords:

Smart system, Arduino, Sensors, Buzzer

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Table of Contents

List of Figures

List of Tables

INTRODUCTION

A survey by WHO (World Health Organization) carried out in 2011 estimates that in the world, about 1% of the human population is visually impaired (about 70 million people) and amongst them, about 10% are fully blind (about 7 million people) and 90% (about 63 million people) with low vision. The main problem with blind people is how to navigate their way to wherever they want to go. Such people need assistance from others with good eyesight. As described by WHO, 10% of the visually impaired have no functional eyesight at all to help them move around without assistance and safely. This study proposes a new technique for designing a smart stick to help visually impaired people that will provide them navigation. The conventional and archaic navigation aids for persons with visual impairments are the walking cane (also called white cane or stick) and guide dogs which are characterized by a many imperfections. The most critical shortcomings of these aids include: essential skills and training phase, range of motion, and very insignificant information communicated been communicated. Our approach modified this cane with some electronics components like the ultrasonic sensor, buzzer and LED. Ultrasonic sensors have the capacity to detect any obstacle within the distance range of 2 cm-450 cm. Therefore whenever there is an obstacle in this range it will alert the user.

Most blind guidance systems use ultrasound because of its immunity to the environmental noise. With the rapid advances of modern technology both in hardware and software it has become easier to provide intelligent navigation system to the visually impaired. Also, high-end technological solutions have been introduced recently to help blind persons navigate independently. Vision is the most important part of human physiology as 83% of information human being gets from the environment is via sight. The 2011 statistics by the World Health Organization (WHO) estimates that there are 70 million people in the world living with visual impairment, 7 million of which are blind and 63 million with low vision. The conventional and oldest mobility aids for persons with visual impairments are characterized with many limitations.

Some inventions also require a separate power supply or navigator which makes the user carry it in a bag every time they travel outdoor. These bulky designs will definitely make the user to be exhausted. In this project we have designed smart blind stick using Arduino.

HISTORY

The white cane is not just a tool that can be used to achieve independence; it is also a symbol of the blind citizens in our society. To honor the many achievements of blind and visually impaired Americans and to recognize the white cane's significance in advancing independence, we observe October 15th of each year as "White Cane Safety Day". Today, the white cane works both, as a tool for the blind as well as a symbol, but this has not always been the case.

Throughout history, the cane, staff, and stick have existed as traveling aids for the blind and visually impaired. Dating back to biblical times records show that a shepherd's staff was used as a tool for solitary travel. The blind used such tools to alert them to obstacles in their path. For centuries, the "cane" was used merely as a tool for travel and it was not until the twentieth century that the cane, as we know it today, was promoted for use by the blind as a symbol to alert others to the fact that an individual was blind.

This new role for the white cane had its origins in the decades between the two World Wars, beginning in Europe and then spreading to North America. James Biggs of Bristol claimed to have invented the white cane in 1921. After an accident claimed his sight, the artist had to readjust to his environment. Feeling threatened by increased motor vehicle traffic around his home, Biggs decided to paint his walking stick white to make himself more visible to motorists. It was not until ten years later that the white cane established its presence in society. In February, 1931, Guilly d'Herbemont launched a scheme for a national white stick movement for blind people in France. The campaign was reported in British newspapers leading to a similar scheme being sponsored by rotary clubs throughout the United Kingdom. In May 1931 the BBC suggested in its radio broadcasts that blind individuals might be provided with a white stick, which would become universally recognized as a symbol indicating that somebody was blind or visually impaired.

In North America the introduction of the white cane has been attributed to the Lion's Clubs International. In 1930, a Lion's Club member watched as a blind man attempted to make his way across a busy street using a black cane. With the realization that the black cane was barely visible to motorists, the Lion's Club decided to paint the cane white to increase its visibility to oncoming motorists. In 1931, the Lion's Club International began a national program promoting the use of white canes for persons who are blind Throughout the 1920s and 1930s, blind persons had walked with their canes held diagonally in a fixed position, and the role of the white cane took on a symbolic role as an identifier.

But when the blind veterans of World War II returned to America, the form and the use of the white cane was further altered in an attempt to help return veterans to participatory lifestyles at home. Doctor Richard Hoover developed the "long cane" or "Hoover" method of cane travel. These white canes are designed to be used as mobility

devices and returned the cane to its original role as a tool for mobility, but maintained the symbolic role as an identifier of blind independence. During this period, the white cane began to make its way into government policy as a symbol for the blind.

The first special White Cane Ordinance was passed in December 1930 in Peoria, Illinois. It granted blind pedestrians protections and the right-of-way while carrying a white cane. In 1935, Michigan began promoting the white cane as a visible symbol for the blind. On February 25, 1936, an ordinance was passed by the City of Detroit recognizing the white cane. To promote the new ordinance, a demonstration was held at City Hall where the blind and visually impaired people were presented with white canes. The following year, Donald Schuur wrote the provision of a bill and had it proposed in the Michigan State Legislature. The proposal gave the carrier of the White Cane protection while traveling on the streets of Michigan. Governor Frank Murphy signed the bill into law in March, 1937.

During the early 1960's, several state organizations and rehabilitation agencies serving the blind and visually impaired citizens of the United States urged Congress to proclaim October 15th of each year to be White Cane Safety Day in all fifty states. This event marked a climatic moment in the long campaign of the organized blind movement to gain state as well as national recognition for the white cane. On October 6, 1964, a joint resolution of the Congress, HR 753, was signed into law authorizing the President of The United States of America to proclaim October 15th of each year as "White Cane Safety Day." The resolution read, "Resolved by the Senate and House of Representatives that the President is hereby authorized to issue annually a proclamation designating October 15th as White Cane Safety Day and calling upon the people of the United States of America to observe such a day with appropriate ceremonies and activities." Within hours of passage of the congressional resolution, President Lyndon B. Johnson went down in history as the first to proclaim October 15th as White Cane Safety Day.

The Presidential proclamation emphasized the significance of the use of the white cane as both a tool and as a visible symbol. In the first White Cane Proclamation President Johnson commended blind people for the growing spirit of independence and the increased determination to be self-reliant and dignified. He said in part: "A white cane in our society has become one of the symbols of a blind person's ability to come and go on his own. Its use has promoted courtesy and opportunity for mobility of the blind on our streets and highways."

During most years since 1964, the President has proclaimed October 15th as White Cane Safety Day. On October 15, 2000, President Bill Clinton again reminded us of the history of the white cane as a tool, and its purpose as a symbol of blindness: "With proper training, people using the white cane can enjoy greater mobility and safety by determining the location of curbs, steps, uneven pavement, and other physical obstacles in their path. The white cane has given them the freedom to travel independently to

their schools and workplaces and to participate more fully in the life of their communities. It reminds us that the only barriers against people with disabilities are discriminatory attitudes and practices that our society has too often placed in their way. As we observe White Cane Safety Day, 2001, let us recall the history of the white cane, its emergence as a tool and a symbol through history; a staff of independence. Let us also recall the events that have permitted us to celebrate October 15th as White Cane Safety Day.

COMPONENTS REQUIRED

Components	*Quantity*	*Specifications*	*Cost (in Rs.)*
HC-SR04 ultrasonic sensor	1	5V, (4)I/O Pins, Operating current:15mA, Detection range:50cm	60
Arduino Uno	1	22 pins, operating voltage 6-20V	450
LEDs	1	5 mm , operating voltage 5V	1
Buzzer	2	Voltage: 4-8V, Current: 30mA	50
DC Battery	1	Operating voltage: 9V	20
Resistors	1	220 ohm (1)	2
Breadboard & jumper wires	1breadboard 20 jumper wires(approx.)	-	100
Cardboard, Paint, Glue Gun, Tape	As per requirement	-	150 (appox)
USB Cable	1	-	30

Table 1. Specification of electronic components used in to design the proposed system.

***TOTAL COST* = Rs. 870 (approx)**

COMPONENTS DESCRIPTION

A. HC-SR04 ULTRASONIC SENSOR

The HC-SR04 Ultrasonic Distance Sensor is a sensor used for detecting the distance to an object using sonar. It's ideal for any robotics projects we have which requires you to avoid objects, by detecting how close they are you can steer away from them. This sensor reads from 2cm to 400cm (0.8inch to 157inch) with an accuracy of 0.3cm (0.1inches), which is good for our project. In addition, this particular module comes with ultrasonic transmitter and receiver modules.

Figure 1: HC-SR04 ULTRASONIC SENSOR

B. Arduino Uno

The Arduino Uno is a microcontroller board which is based on the ATmega328 series controllers and has an IDE (Integrated Development Environment) for writing, compiling and uploading codes to the microcontroller. It has 14 digital input and output pins (of which 6 are PWM) and 6 analogue inputs for communication with the electronic components such as sensors, switches, motors and so on. It also has 16 MHz ceramic resonators, a USB connection jack, an external power supply jack, an ICSP (in-circuit serial programmer) header, and a reset button. Its operating voltage is 5v, input voltage 7 to 12v (limit up to 20v).

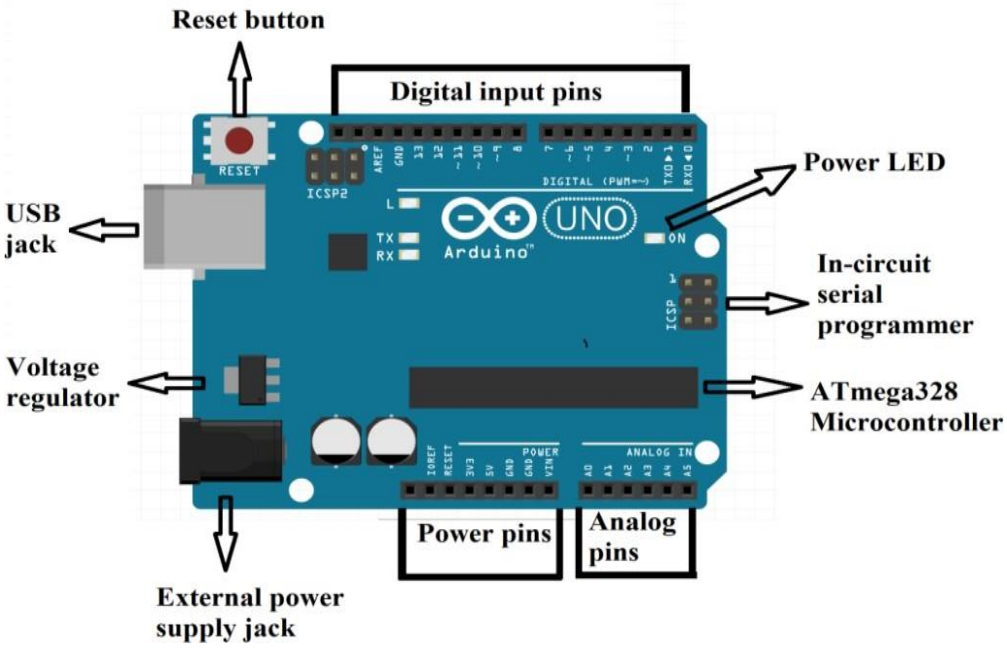

Figure 2: Arduino Uno board description

C. LEDs

A LED (light-emitting diode) is a PN junction diode which is used for emitting visible light when it is activated. When the voltage is applied over its elements, electrons regroup with holes within the LED, releasing energy in the form of photons which gives the visible light. LEDs may have the Dim/full capability.

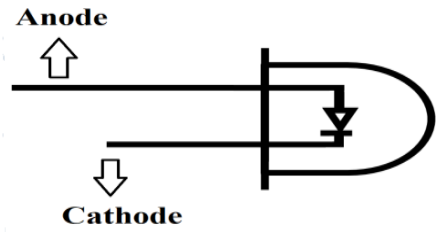

Figure 3. LED circuit diagram

How do LEDs Emit Light?

LEDs (Light Emitting Diodes) are semiconductor light sources that combine a P-type semiconductor (larger hole concentration) with an N-type semiconductor (larger electron concentration). Applying a sufficient forward voltage will cause the electrons and holes to recombine at the P-N junction, releasing energy in the form of light.

Compared with conventional light sources that first convert electrical energy into heat, and then into light, LEDs (Light Emitting Diodes) convert electrical energy directly into light, delivering efficient light generation with little-wasted electricity.

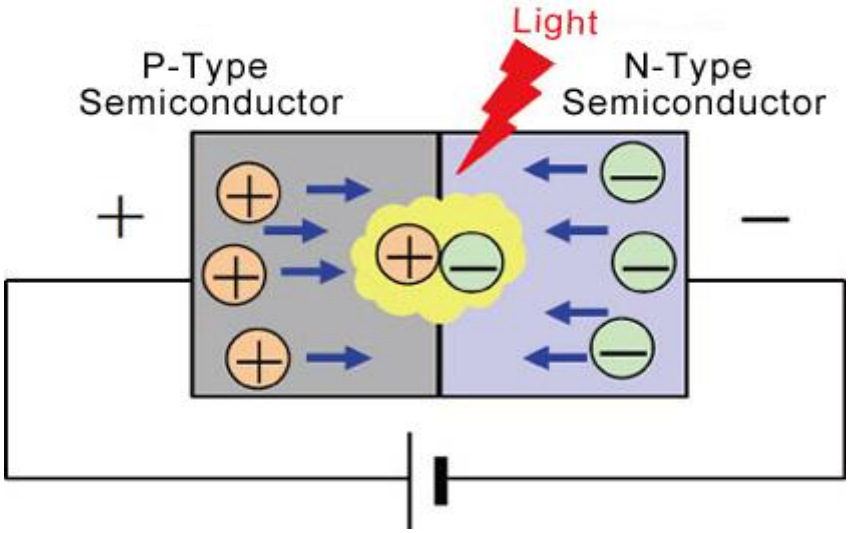

Figure 4. LED diagram

D. BUZZER

An audio signaling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren.

A "piezo buzzer" is basically a small speaker which will be connected directly to an Arduino. "Piezoelectricity" is an impression where certain crystals can deform once electricity is applied to them. By applying an electrical signal at the proper frequency, the crystal will create sound.

Figure 5. Buzzer

E. Resistors

A resistor is a passive electronic component, used with other electronic components such as LEDs and sensors to prevent or limit the flow of electrons through them. It works on the principle of Ohm's law which prevent overflow of voltage.

A **resistor** is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.

High-power resistors that can dissipate many watts of electrical power as heat, may be used as part of motor controls, in power distribution systems, or as test loads for generators.

Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity.

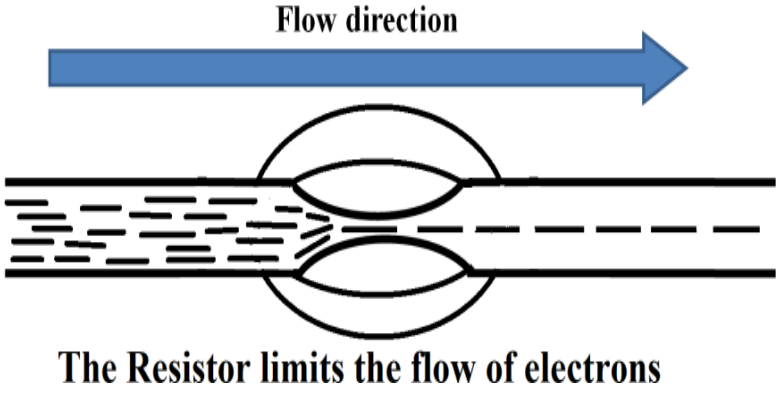

Figure 6: Working principle of resistor

Figure 7: 220 Ω resistor

F. Breadboard

A breadboard is a rectangular plastic board with a bunch of tiny holes in it. These holes let you easily insert electronic components to prototype an electronic circuit, with a battery, switch, resistor, and LED.

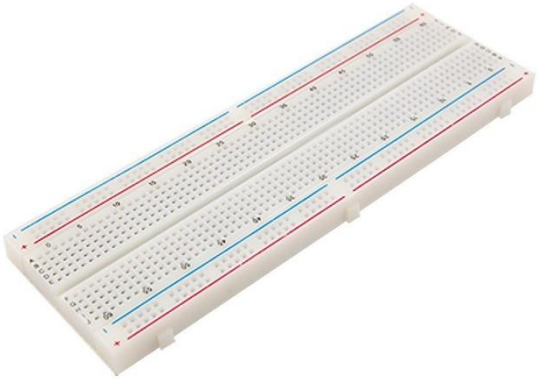

Figure 8: Breadboard

G. Jumper Wires

A jump wire is an electrical wire, or group of them in a cable, with a connector or pin at each end which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

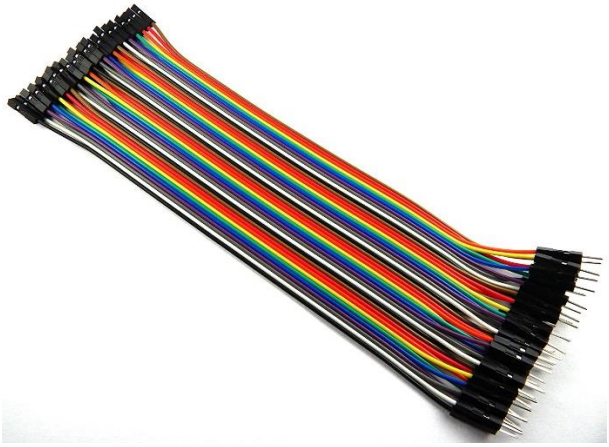

Figure 9: Jumper Wires

WORKING PRINCIPLE

The main working principle of this project is to help blind people to walk with ease and to be warned whenever their walking path is obstructed by obstacles. As a warning signal via buzzer, whose frequency of beep changes according to the distance of the object.

The main component used for this device is the Ultrasonic Sensor HC-SR04. The Arduino Uno microcontroller is used for communication with the ultrasonic sensor. The microcontroller sends a trigger signal to the sensor. When triggered, the sensor generates ultrasonic waves. Whenever any obstacles or object blocks the path of the sensor, the ultrasonic waves are reflected and echo signal is received. The output of the sensor is the time difference between the transmitted ultrasonic waves and the received echo signal. The microcontroller then interprets the time signal into distance.

DESIGN METHODOLOGY

CIRCUIT DIAGRAM:

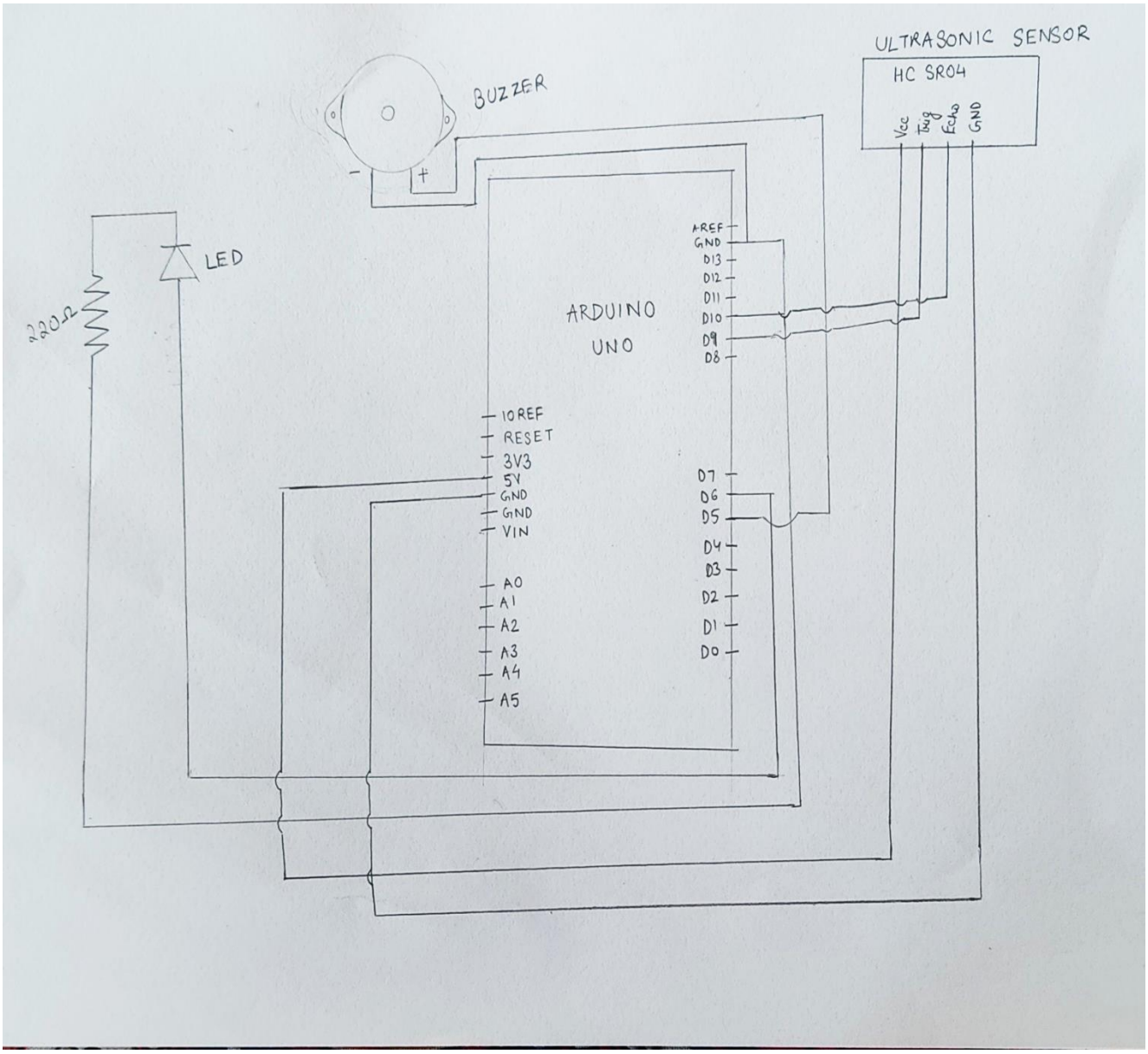

Figure 10: Circuit Diagram

CONNECTIONS:

A. Ultrasonic sensor connection

1.The VCC pin of the ultrasonic sensor is connected to the 5V pin of the Arduino.
2.The Trig pin of the sensor is connected to the D9 pin of the Arduino.
3.The Echo pin of the sensor is connected to the D10 pin of the Arduino.
4.The Ground (GND) pin of the ultrasonic sensor is connected to the GND pin of the Arduino.

B. Buzzer connection

1.The positive terminal of the buzzer is connected to the D5 pin of the Arduino.
2.The negative terminal of the buzzer is connected to the GND pin of the Arduino.

C. LED connection

1.The positive terminal of the LED is connected to the D6 pin of the Arduino.
2.The negative terminal of the LED is connected to the GND pin of the Arduino via a 220-ohm resistor.

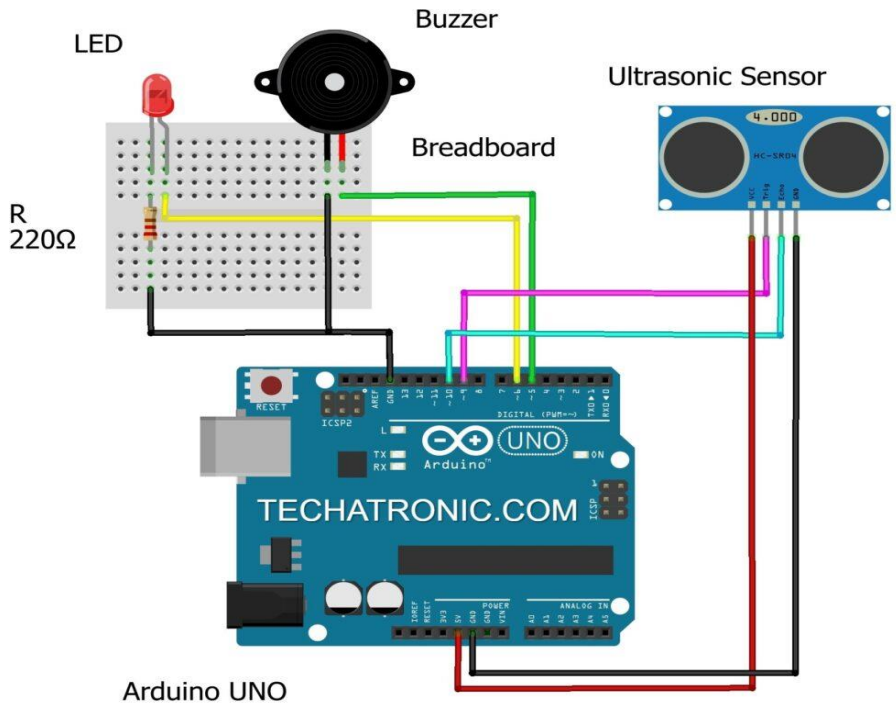

Figure 11: Circuit connections

CIRCUIT PICTURES:

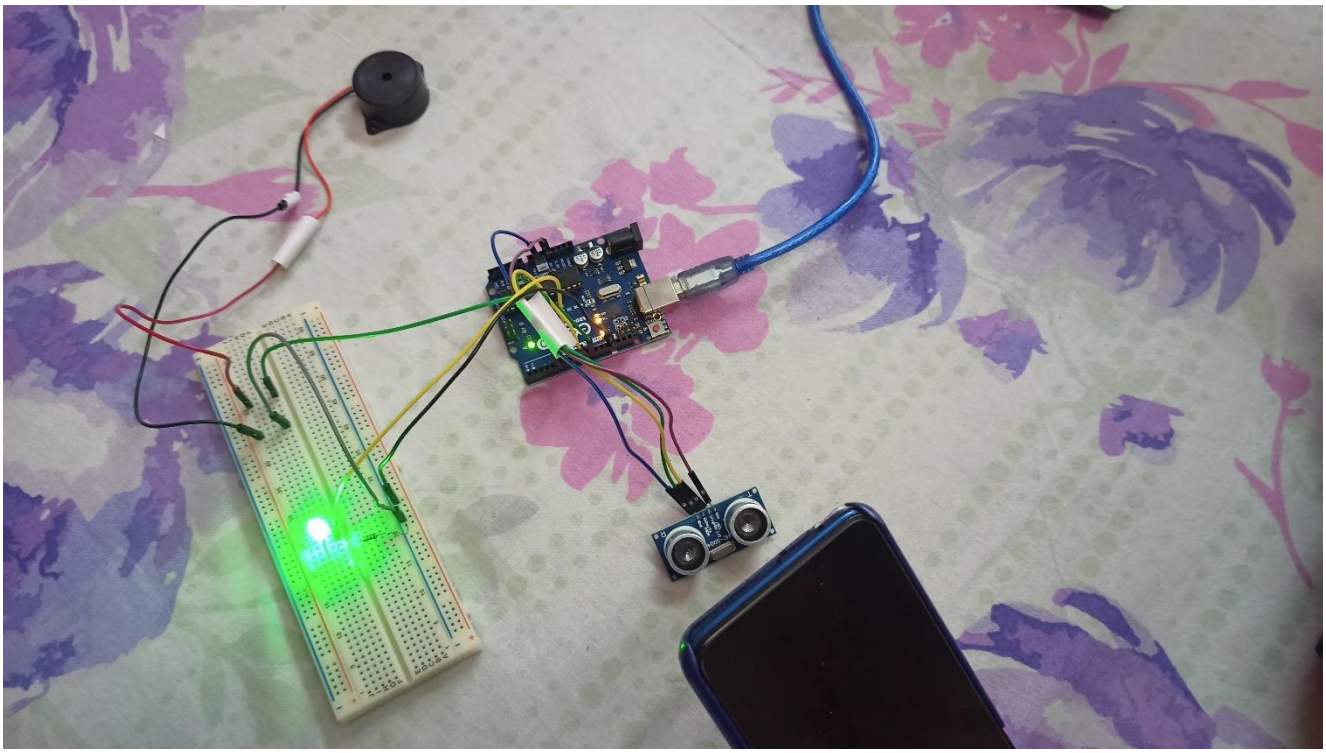

Figure 12: When obstacle is detected

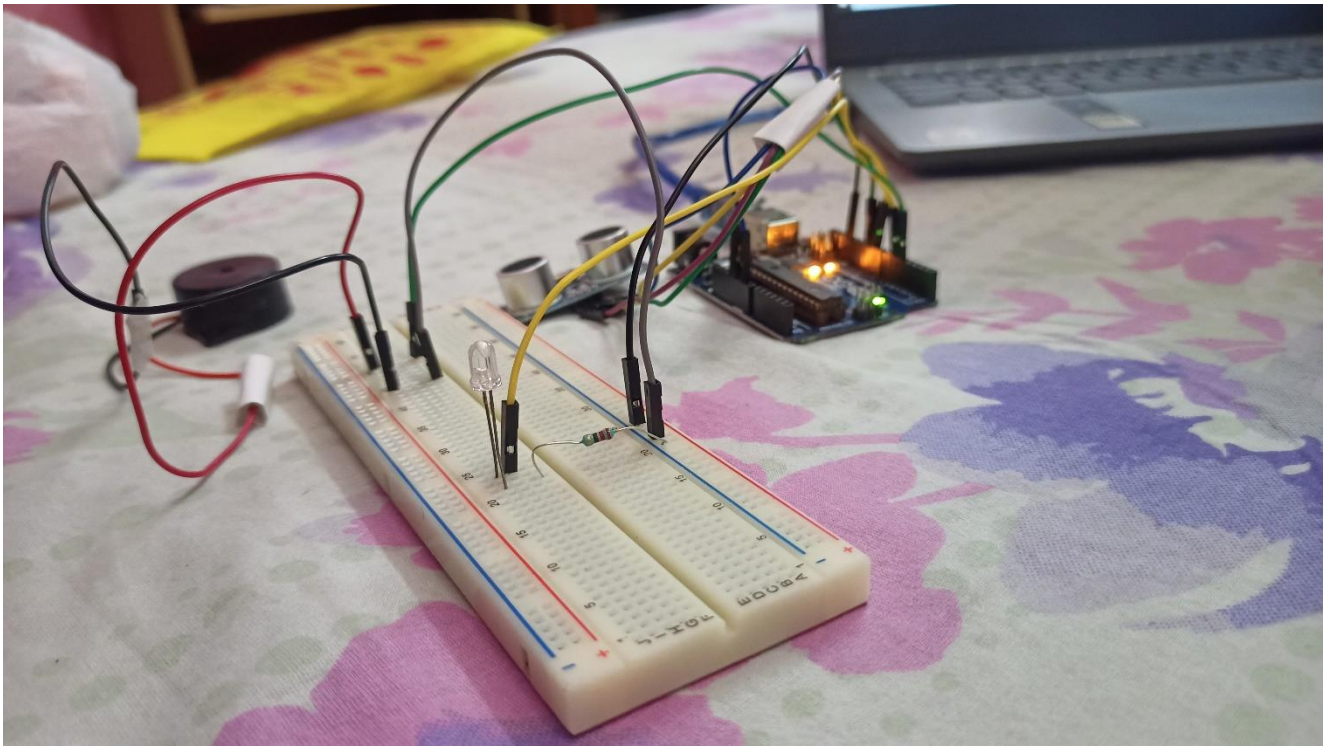

Figure 13: When no obstacle is detected

WORKING

Working of the Smart Blind Stick:-

- The Smart Blind Stick scans the path in front of it with the help of an HC-SR04 Ultrasonic sensor. The main advantage of this sensor is of the amount of distance upto which it can detect an obstacle, which is a plus point for it among any of the distance or obstacle detecting sensor. We can interface this sensor with the arduino easily.

  Secondly, it is very easy to use either with the help of library or manual code as it requires only basic function for calculation of time.

  Thirdly, it only uses two pin communication, which enables it to be used with mostly all the microcontroller.
- Whenever the sensor detects any object in its path the buzzer starts beeping and also at the same time the LED turns on.
- The blind person can hear the beeping of the buzzer and manage to change the way. In this way, the person can easily find his way without getting injured.
- One can also see the real-time values of the distance in cm on the Arduino serial monitor.
- Once the circuit is ready for this Arduino mini-project, the whole set-up is stuck on the stick using hot glue gun.

WORKING CODE

```
const int trigPin = 9;

const int echoPin = 10;

long duration;

int distanceCm, distanceInch;

void setup()

{

Serial.begin(9600);

pinMode(trigPin, OUTPUT);

pinMode(echoPin, INPUT);

pinMode(6, OUTPUT);  // Connect LED Pin D6

pinMode(5, OUTPUT);  // Connect Buzzer Pin D5

}

void loop()

{

digitalWrite(trigPin, LOW);

delayMicroseconds(2);

digitalWrite(trigPin, HIGH);

delayMicroseconds(10);

digitalWrite(trigPin, LOW);

duration = pulseIn(echoPin, HIGH);

distanceCm= duration*0.034/2;

distanceInch = duration*0.0133/2;

Serial.println("Distance: ");
```

```
Serial.println(distanceCm);
delay (100);
// See the Ultrasonic Sensor Value in Serial Monitor
if(distanceCm < 25) // We can Change the value
{
digitalWrite(5, HIGH); // Buzzer ON
digitalWrite(6, HIGH); // LED ON
}
else
{
digitalWrite(5,LOW); // Buzzer OFF
digitalWrite(6,LOW); // LED OFF
}
}
```

CONCLUSION

Currently there are thousands of blind people all over the globe. These include people from low sightseeing to complete loss of visual. They find it very difficult while crossing the road or reaching to their respective destination with the help any other individual. The traditional stick cannot help to detect the obstacles in front or the potholes in the way. It is outdated. Hence there is a need to update it using today's technology

Humans are not disabled. A person can never be broken. Our built environment, our technologies, is broken and disabled. We the people need not accept our limitations, but can transfer disability through technological innovation.

This system offers a low-cost, reliable, portable, low-power consumption and robust solution for navigation with obvious short response time. Though the system is hard-wired with sensors and other components, it's light in weight. This solution still has disadvantage for example it can’t detect obstructions that are hidden but very dangerous for the blind such as downward stairs, holes etc.

However future aspects of this system can be improved via wireless connectivity between the system components, thus, increasing the range of the ultrasonic sensor and implementing a technology for determining the speed of approaching obstacles. Moisture sensor can also be added to detect puddles. We can also try to build this setup on shoes to completely eliminate the use of stick.

While developing such an empowering solution, visually impaired and blind people in all developing countries were on top of our priorities.

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