"SMART STICK FOR VISULLY IMPAIRED PERSONS"

SUBMITTED BY :-

GADAGE SANTOSH

UNDER THE GUIDANCE OF:-

MRS. GHULE MAM

DEPARTMENT OF PHYSICS

OUTLINE

- Introduction
- Components
- Microcontroller
- Ultrasonic transceiver
- Buzzers and vibrators
- Switches

>>CONTENT<<

ABSTRACT

This project describes ultrasonic blind walking stick with the use of Arduino. According to WHO, 30 million peoples are permanently blind and 285 billion peoples with vision impairment. If u notices them, you can very well know about it they can't walk without the help of other. One has to ask guidance to reach their destination. They have to face more struggles in their life daily life. Using this blind stick, a person can walk more confidently. This stick detects the object in front of the person and give response to the user either by vibrating or through buzzer sound. So, the person can walk without any fear. This device will be best solution to overcome their difficulties.

CHAPTER 1

INTRODUCTION

Vision is the most important part of human physiology as 83% of information human being gets from the environments is via sight. The 2017 statistics by the world health organization (WHO) estimates that there are 285 billion people in world with visual impairment, 39 billion of which are blind and 246 with low vision.

Presently, blind people use a white stick as a tool for directing them when they move or walk.

Here, we develop a tool which can serve as a blind stick being more efficient and helpful than the conventional one.

This will assist the blind persons during the walk and provides an alarms if any hurdle is detected within the set range.

CHAPTER 2

COMPONENTS

Microcontroller	
Development Board	Arduino Uno
Ultrasonic transceivers	
SNR1	HC-SR04
Buzzers and Vibrators	
SND1	Piezo-electric buzzer
SND2	Vibrating motor
Switches	
S1	Toggle switch

CHAPTER 3

METHODOLOGY

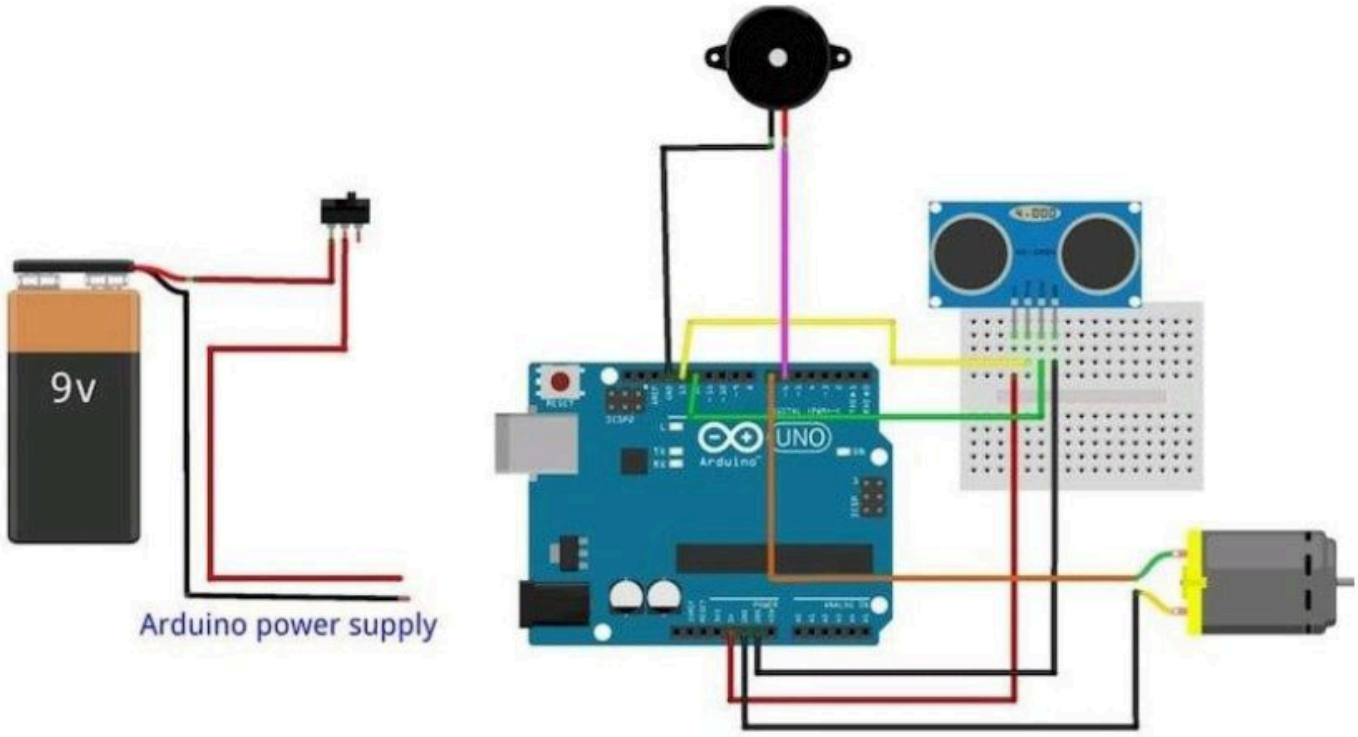
3.1 How Does the Smart Cane Work?

The technology behind the Arduino smart cane is pretty straight forward. There are mainly three blocks behind it: input, controller, and output. The input consists of an ultrasonic sensor that is capable of detecting obstacles in front of it at a range of up to about 13 feet. It is interfaced to the Arduino, which determines if an obstacle is too close to the cane and triggers the output if it is. The output consists of a vibration motor to provide haptic response, and a piezo buzzer.

3.2 Circuit and its working

Circuit shown below operates using a minimum of 5V DC power supply (Across Vcc & GND pin of Arduino UNO). The Arduino itself requires only 5V to operate but considering the fact that it has to power ultrasonic sensor, one piezo-electric buzzer & a vibrating motor we have used a 9V supply. Arduino has an inbuilt 5V voltage regulator so we also have the options to power it using a 6V or 12V supply.

The brain of the circuit is Arduino Uno MCU board (Board). Ultrasonic sensor “HC-SR04” are used for obstacle detection using ultrasonic waves. These sensors operate up to a distance of 3 m and can detect obstacles within an average angle of 25 degrees in the sphere.



Two of the four pins of this sensor namely Vcc & GND are connected to Arduino's power output. The remaining two pins – TRIG & ECHO are connected to Arduino's output and input.

Apart from this, a peizo-electric buzzer SND1 and a vibrating motor SND2 are connected so that it can guide the user using different tones and vibration. Also, a toggle switch, S1 is used to save the power when the device is not in use or when the impaired person has support of others to guide him/her.

The Arduino is programmed in such a way that on switching 'ON' the Arduino, it sends a LOW to HIGH signal on the TRIG pin of Ultrasonic sensor. This ultrasonic sensor will send an Ultrasonic wave using the ultrasonic transmitter of the sensor. These ultrasonic waves travel through air and on colliding with an obstacle, get reflected back. Programming is done in such a manner, that when this obstacle is in the range of 0.7m of the sensor, the Arduino will play the buzzer and delay for the long distance measurement. To further enhance its performance vibrating motor is also used

The sensor would give an electrical response at the ECHO pin of the sensor. This response is the time taken by the wave for a round journey from sensors to obstacle and back to the sensors. For our calculation, we need only the one-way distance. This can be calculated by Arduino using the following formula:

$$Distance = \frac{\frac{Duration}{2}}{29.1}$$

Here,Duration=Echooutput;
and since we need only one-way distance, hence we divide this duration by2. Here the constant 29.1 is derived as follows:

- The speed of sound is 343.5 m/s or 0.0345 cm/microseconds.
- 1/0.0345 cm/microseconds is 29.1 microseconds/cm.

3.3Arduino

Arduino is a software company, project and user community that designs and manufactures computer open-source hardware, open-source software, and microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices.

What is Arduino?

A microcontroller board contains on board power supply, USB port to communicate with PC, and an Atmel microcontroller chip.

It simplify the process of creating any control system by providing the standard board that can be programmed and connected to the system without the need to any sophisticated PCB design and implementation.

It is an open source hardware, any one can get the details of its design and modify it or make his own one himself.

Arduino uno board

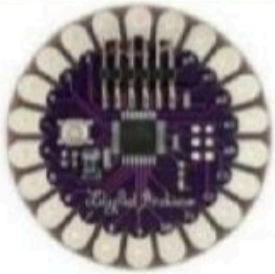
The **Uno** is a microcontroller board based on the **ATmega328P**. It has **14 digital inputs/output pins** (of which 6 can be used as PWM outputs),**6 analog inputs**, a **16 MHz** quartz crystal, a **USB connection**, a **power jack**, an **ICSP header** and a reset button. It contains everything needed to support the microcontroller, simply connect it to a computer with a USB cable or power it with a **AC-to-DC** adaptor or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, wrost case scenario you can replace the chip for a few dollars and start over again.

TYPES OF ARDUINO

Arduino boards:

UNO

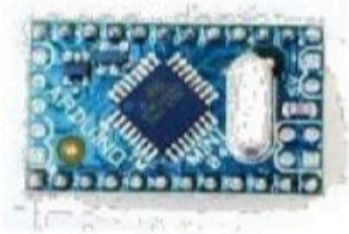
Mega



LilyPad

Arduino BT

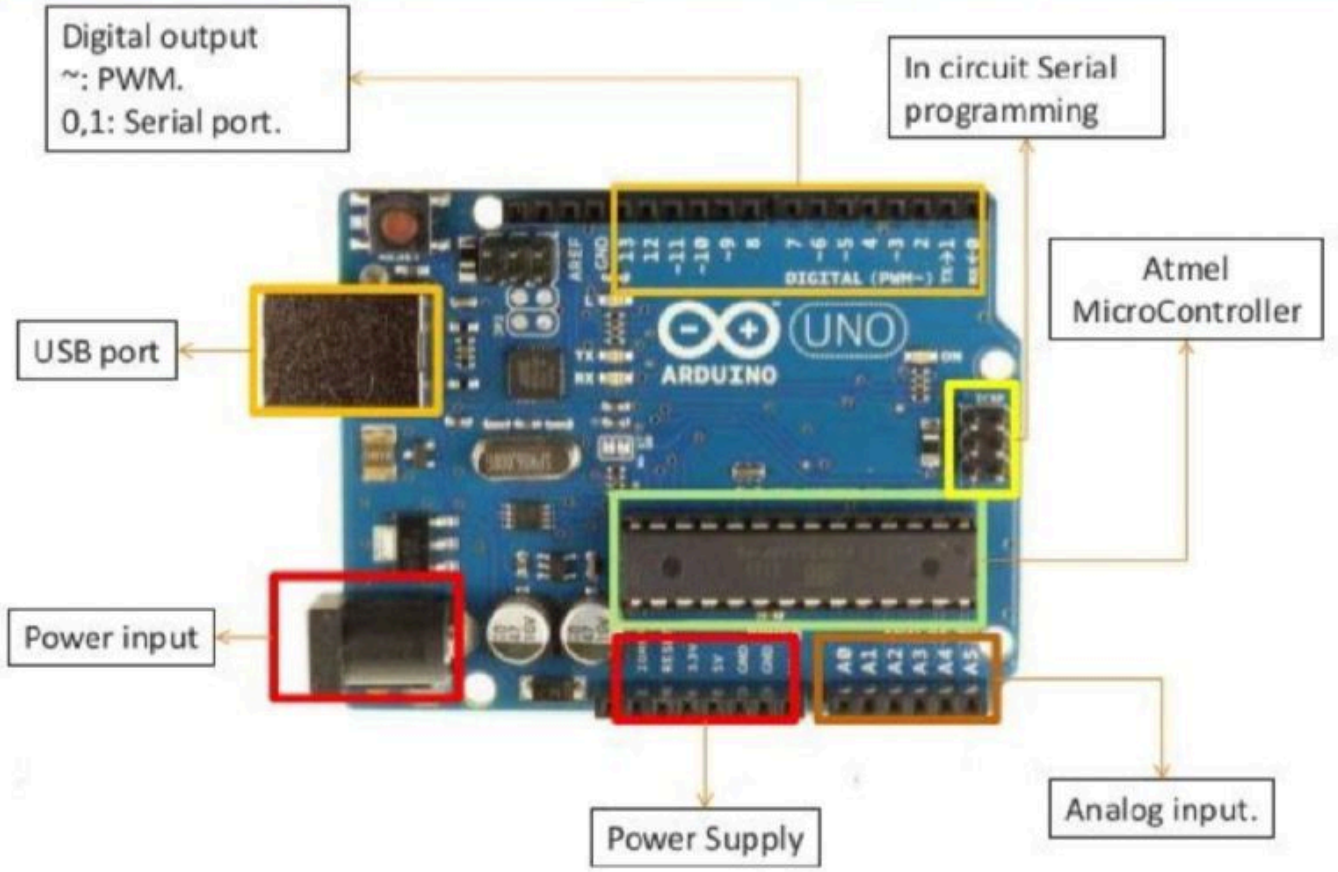
Arduino Nano



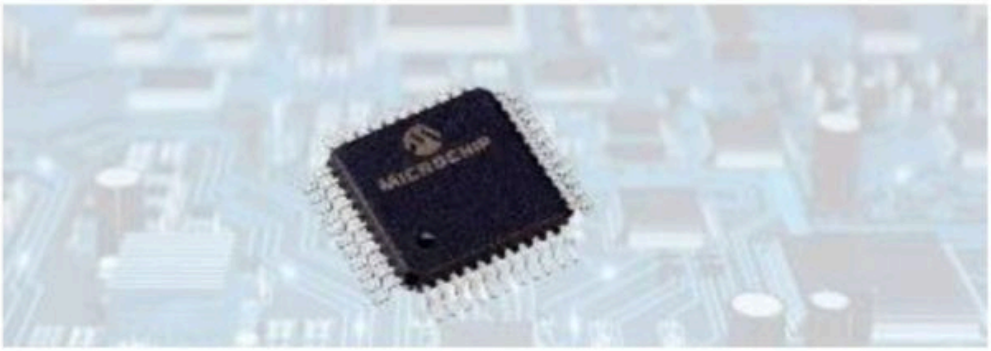
Arduino Mini

ARDUINO UNO (CONFIGURATION)

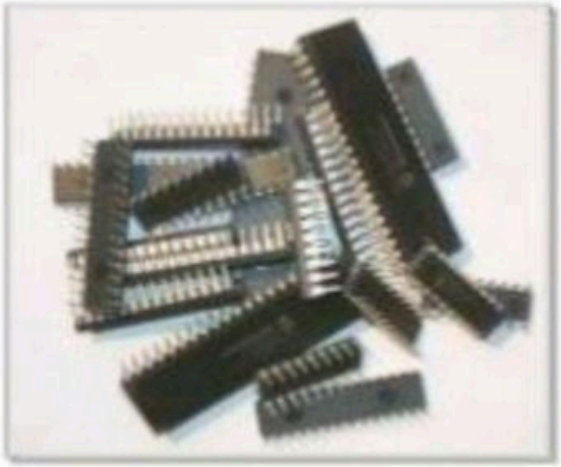
Arduino UNO:



MICRO-CONTROLLER



A **microcontroller** is a small computer (SoC) on a single integrated circuit containing a processor core, memory, and programmed input/output peripherals. Program memory in the form of Ferroelectric RAM, NOR flash or OTP ROM is also often included on chip, as well as a typically small amount of RAM.



Famous microcontroller manufacturers are Microchip, Atmel, Intel, Analog devices, and more.

DESCRIPTION OF ARDUINO UNO ATMEGA328

The **Arduino Uno** is a **microcontroller board** based on the Atmega328.It has 14 **digital input/output pins**,**6 analog inputs**,A**16 MHz ceramic resonator**, A USB connection, A power jack, An ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it doesn't use the FTDI **USB-to-serial driver chip**. Instead, it features the Atmega16U2atmega8U2 up to version R2 programmed as a USB-to-serial convertor.

WORKING OF ARDUINO UNO ATMEGA328

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC- to-DC adaptor (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center- positive plug into the board's power jack. Leads from a battery can be inserted in the GND and Vin headers of the power connectors. The board can operate on an external supply of 6 to20 volts. If supplied with less than 7v, however, the 5v pin may supply less than five volts and the board may be unstable. If using more than 12v, the voltage regulator may overheat and damage the board. The recommended range is **7 to12 volts**.

3.4 ULTRASONIC SENSOR:HC-SR04

Introduction

Also known as transceivers when they send and receive, but more generally called transducers work on the principle similar to radar or sonar which evaluate attribute of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generates high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.

This technology can be used for measuring wind speed and direction (anemometer) tank or channel level, and speed through air or water. For measuring speed or direction a device uses multiple detectors and calculates the speed from the relative distance to particulates in the air or water. To measure tank or channel level, the sensor measures the distance to the surface of the fluid. Further application include: humidifiers, sonar, medical ultrasonography, burglar alarms and non- destructive testing.

Systems typically use a transducer which generates sound waves in the ultrasonic range, above 18000 hertz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed.

Uses:

1) Medical ultrasonic transducers.
2) Ultrasonic sensors are used to detect movement of targets and to measures the distance to targets in many automated factories and process plants.

HC-SR04: ULTRASONIC MODULE

MODULE PIN DEFINITIONS AND ELECTRICAL PARAMETERS

1) Module pin definitions

Types	Pin Symbol	Pin Function Description
HC-SR04	VCC	5V power supply
	Trig	Trigger pin
	Echo	Receive pin
	GND	Power ground

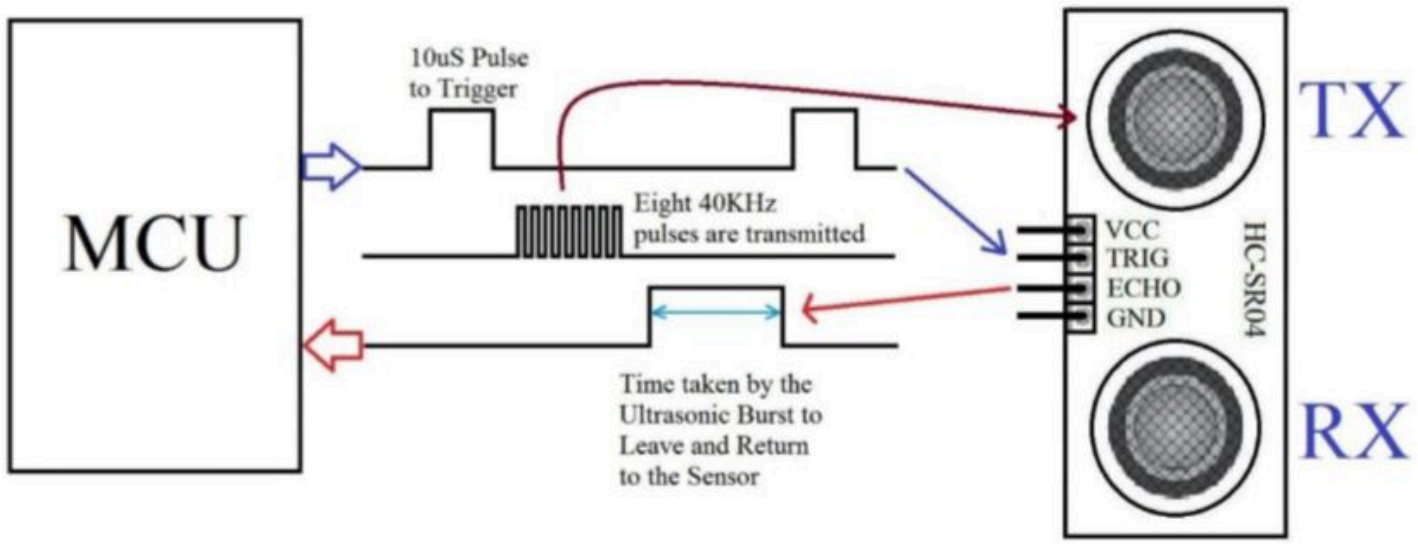
2) Electrical parameters

Electrical Parameters	HC-SR04 Ultrasonic Module
Operating Voltage	DC-5V
Operating Current	15 mA
Operating frequency	40KHz
Farthest Range	3m
Nearest Range	2cm
Measuring Angle	25 Degree
Input Trigger Signal	10us TTL pulse
Output Echo Signal	Output TTL level signal, proportional with range
Dimensions	45*20*15mm

WORKING OF ULTRASONIC SENSOR HC-SR04

We know that sound vibrations cannot penetrate through solids. So what happen is when a source of sound generates vibrations they travel through air at a speed of 220 meters per second. These vibrations when they meet our ear we describe them as sound. As said earlier these vibration cannot go through solids, so when they strike with a surface like wall, they are reflected back at the same speed to the source, which is called echo.

Ultrasonic sensor"HC-SR04" provides an output signal proportional to distance based on the echo. The sensor here generates a sound vibration in ultrasonic range upon giving a trigger, after that it waits for the sound vibration to return. Now based on the parameters, sound speed (220m/s) and time taken for the echo to reach the source, it provides output pulse proportional to distance.



As shown in fig. at first we need to initiate the sensor for measuring distance, that is a HIGH logic signal at trigger pin of sensor for more than 10us, after that a sound vibration is sent by sensor, after a echo, the sensor provides a signal at the output pin whose width is proportional to distance between source and obstacle.

This distance is calculate as, distance (in cm) =width of pulse (in us)/58.

Here the width of the signal must be taken in multiple of us (micro second or 10^-6).

Product Features

1. Stable performance

2. Accurate distance measurements

3. High-density

4. Small blind

Application Areas: Ultrasonic Application Technology is the thing which developed in recent decades. With the ultrasonic advance, and the electronic technology development, especially as high-power semiconductor devices technology matures, the application of ultrasonic become increasingly widespread;

1. Robotics barrier

2. Object distance measurement

3. Level detection

4. Public security

5. Parking detection

3.4 VIBRATING (MOTOR)

A vibrating motor is essentially a motor that is improperly balanced. In other words, there is an off-centered weight attached to the motor's rotational shaft that causes the motor to wobble to wobble. The amount of wobble can be changed by the amount of weight that you attach, the weight's distance from the shaft, and the speed at which the motor spins.

This type of motor can be used affixed to all kinds of objects, which all cause them to vibrate and move freely about. This is quick and dirty way to get a simple but to move about, but not exactly the most elegant.

Vibrating motors can be found insides cell phones, pagers, gaming controller, and personal massagers.

In absence of those, you can easily build your own vibrating motor by attaching any off centered weight to any motors shaft. They can also be created by breaking in half balanced components already to motor shafts.

3.5 BUZZER

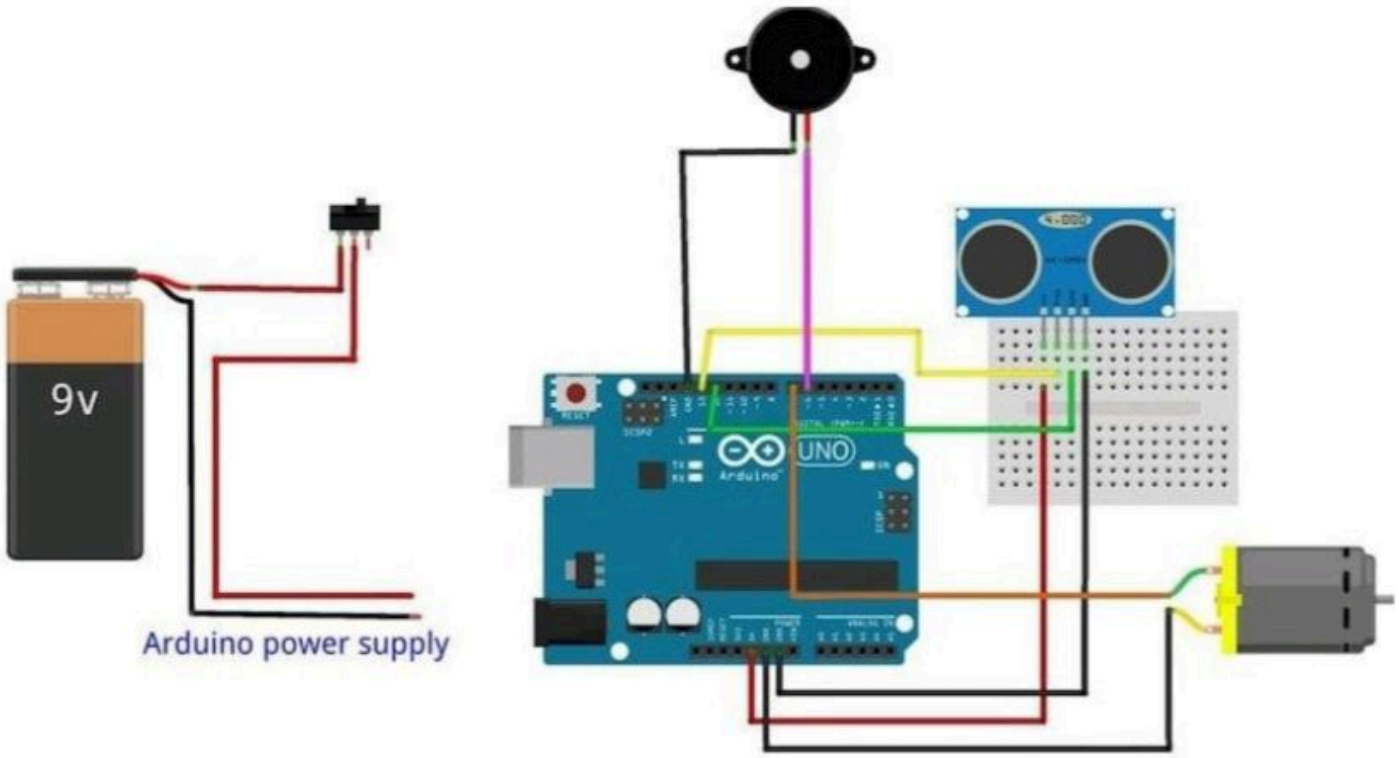
The piezo buzzer produces sound based on reverse of the piezoelectric effect. The generation of pressure variation or strain by the application of electric potential across a piezoelectric material is the underlying principal. These buzzers can be used to alert a user of an event corresponding to a switching action, counter is single or sensor input. They are also used in alarm circuits.

The buzzer produces a same noisy sound irrespective of the voltage variation applied to it. It consists of piezo crystals between two conductors. When a potential across these crystals they push on one conductors and pull on the other. This, push and pull action, results in a sound wave. The most buzzers produce sound in the range 2 to 4 KHz.

CHAPTER 4

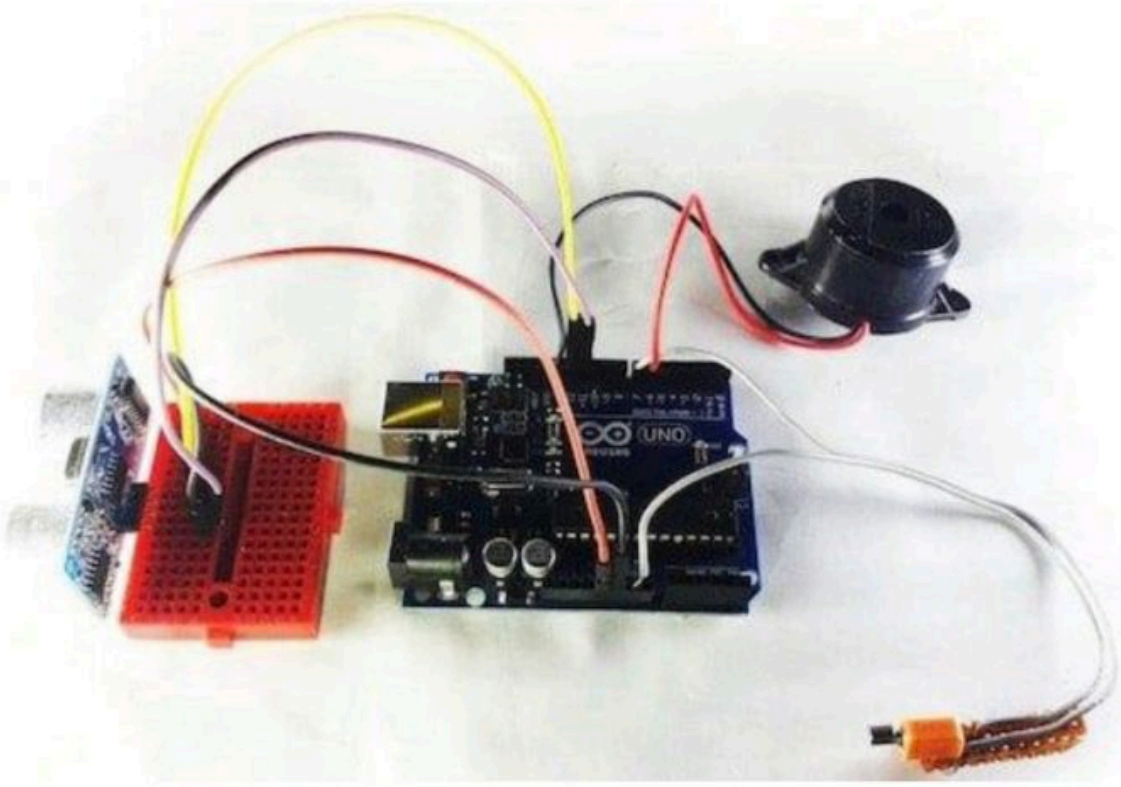
Interfacing the Arduino

Now it's time to wire the Arduino! This is pretty easy and doesn't have any complicated wiring. See the schematics below and carefully connect all parts to the Arduino. I used a mini breadboard to connect the ultrasonic sensor to the Arduino using jumper wires. Other parts, like the buzzer and motor, are directly connected to the Arduino. You can see the wiring diagram below.



Here are the connections for each part:

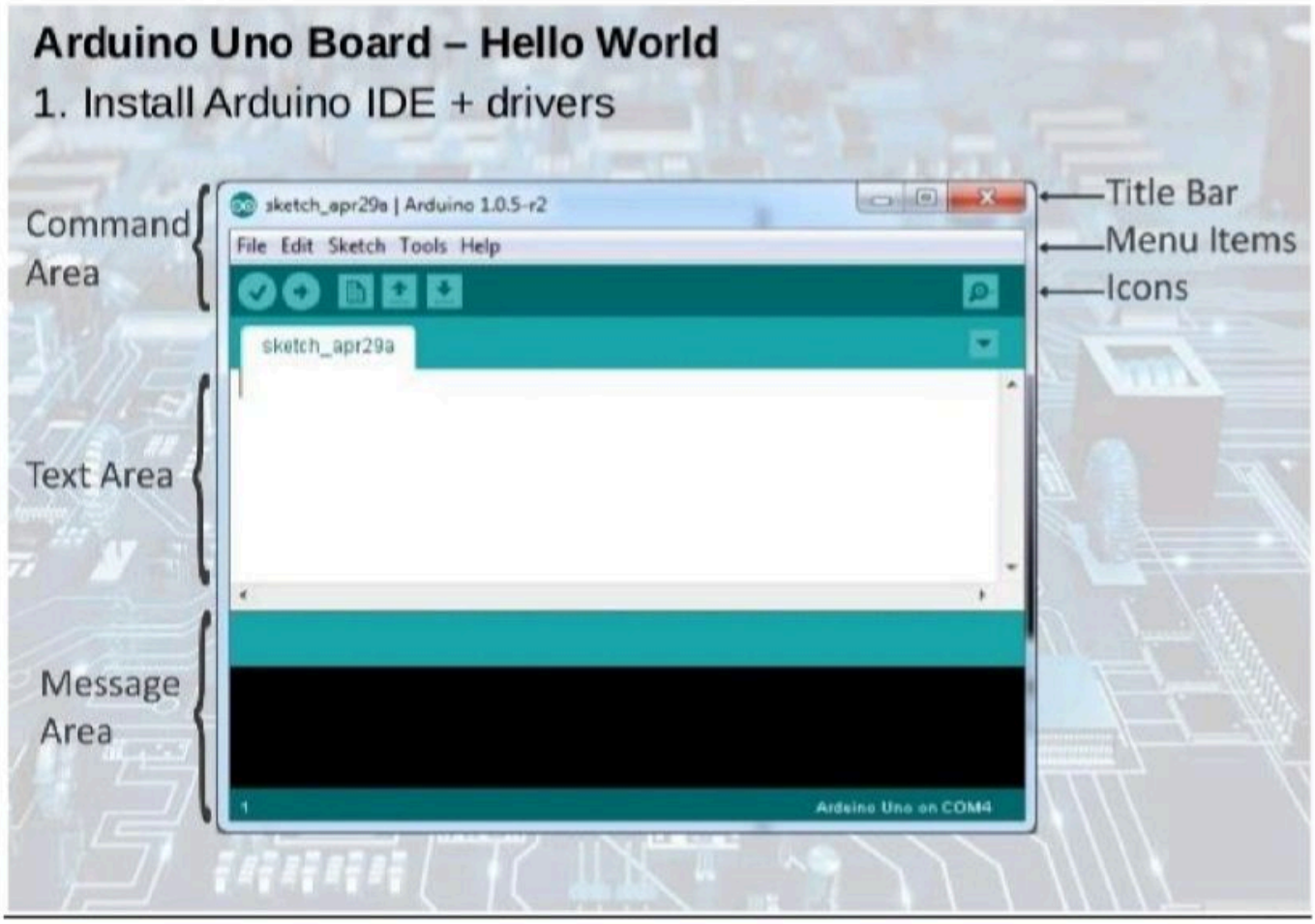
- Ultrasonic VCC to Arduino 5V.
- Ultrasonic GND to Arduino GND.
- Ultrasonic TRIG to Arduino D13.
- Ultrasonic ECHO to Arduino D12.
- Buzzer RED to Arduino D6.
- Buzzer BLACK to Arduino GND.
- Vibrating motor pin 1 to Arduino D7.
- Vibrating motor pin 2 to Arduino GND
- 9 volt battery RED to Toggle switch pin 1.
- 9 volt battery BLACK to DC male power jack(-).
- Toggle switch pin 2 to DC male power jack (+).



Now we finished the wiring!

CHAPTER 5

SOFTWARE USED



Uploading the Sketch for the Arduino Smart Cane

Now it's time to upload the sketch. Copy this into your Arduino IDE, then upload it to your Arduino board.

```
#define trigPin 13
#define echoPin 12
#define motor 7
#define buzzer 6

void setup()
{ pinMode(trigPin,
OUTPUT);
pinMode(echoPin, INPUT);
pinMode(motor, OUTPUT);
pinMode(buzzer,OUTPUT);
}

void loop()
{ long duration, distance;
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin,
HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);

duration = pulseIn(echoPin,
HIGH); distance = (duration/2) /
```

```
digitalWrite(motor,HIGH); // When the the distance below
100cm digitalWrite(buzzer,HIGH);
} else
{
digitalWrite(motor,LOW);// when greater than
100cm digitalWrite(buzzer,LOW);
} delay(500);
}
```

CHAPTER 6

Assembly of Stick

I used a PVC pipe to make the walking stick. If you have a walking stick lying around your home, you can use that, otherwise, you can follow this step. I used a 3/4-inch diameter PVC pipe and an 'L' shaped elbow to make the walking stick. Take a look at the above image to make the walking stick and follow these instructions:

- First, take a PVC pipe (3/4-inch diameter) and cut a piece of it that is about 1 1/2 meters long.
- Take an L-shaped elbow and attach it to one end of the pipe.
- Take another small piece of PVC pipe (about 4 inches long), then attach it to the other end of the elbow and glue it.
- I wrapped the walking stick with white insulation tape because I like how it looks. You could even paint it.

Attaching the Components to the Smart Cane

This is the hardest step in this project. It took me hours to design and fix the parts onto the walking stick. Find a box that you can use to put all your electronics together. I used plastic to make a box myself. You can do that easily.

Fix your Arduino in the box using screws. Now make two holes for fixing the ultrasonic sensor on the lid of the box. I attached the buzzer inside of the box for better sound. Next, I attached the toggle switch at the side of the box and made a small hole for connecting the vibration motor to the Arduino. Fix the battery inside of the box and connect the power jack to the Arduino.

Now attach the box to the walking stick. You can either use screws or glue. I used an instant adhesive because it's quite strong. After attaching the box to the walking stick, take out the vibrating motor and fix it below the elbow. I used insulation tape for this.

That's it! We just made an Arduino smart cane for assisting blind individuals.

CHAPTER 7

CONCLUSION

The project proposed the design and architecture of a new concept of smart electronic stick for blind people. The advantages of the system lies in the fact that it can prove to be very low cost solution to millions of blind person worldwide. The proposed combination of various working units makes a real –time system that monitors position of the obstacles and provides feedback making navigation more safe and secure.

It aims to solve the problems faced by the blind people in their daily life. The system also takes measures to ensure their safety.

1. This device will help the blind person be more alert about the obstacles.

2. This project is mainly for the blind people to avoid obstacles by themselves.

3. This project provide efficient and a economical security system.

CHAPTER 8

FUTURE SCOPE

It can be further enhanced by using VLSI technology to design the PCB unit. This makes the system further more compact. Also, use of active RFID tags will transmit the location information automatically to the PCB unit, when the intelligent stick is in its range. The RFID sensor doesn't have to read it explicitly.

The global position of the user is obtained using the global positioning system (GPS), and their current position and guidance to their destination will be given to the user by voice.

CHAPTER 9

Reference

1. https://electronicsforu.com/electronics-projects/smart-stick-using-arduino- ultrasonic

2. https://circuitdigest.com/microcontroller-projects/arduino-smart-blind - stick

3. https://maker.pro/arduino/projects/arduino-smart-cane-for-the-blind

4. https://www.engineersgarage.com/contribution/arduino-based-smart-blind- stick

5. https://www.irjet.net/archives/V5/i3/IRJET-V5I3586.pdf