

# Aavishkar(2k18)

## Smart audio navigation and reading system for blinds

Dheeraj Ram(B17081),Dhruv Arora(B17082),Divyanshu Kumawat(B17084),Hitesh Kanodia(B17044),  
Madipelly Anurag(B17015) ,Mandadi Pavan Kumar(B17016)

B17081students.iitmandi.ac.in  
B17082students.iitmandi.ac.in  
B17084students.iitmandi.ac.in  
B17044students.iitmandi.ac.in  
B17015students.iitmandi.ac.in  
B17016students.iitmandi.ac.in

**Abstract—**The objective of this project is to empower the visually impaired person and the persons that have visual defects.The goal of this project is smart audio navigation and reading system for blind person by which they can navigate properly in the surrounding and they are also able to read novels,stories,books that they want.The basic idea behind it to visualize the surrounding by voice.We have integrated an ultrasonic band,image recognition camera and a automatic book reading setup.All setup have output in audio format.

**Index Terms -** Arduino Mega, Camera, Image Recognition, Internet, Matlab, Raspberry Pi, Ultrasonic Sensor

### I. INTRODUCTION

Our project consists of three gadgets for blind and vision impairment person.Each gadget works on different technology.Here we are describing one by one each gadgets.

#### A. Image recognition

In this gadget we used a mobile camera and a speaker. At first we save the database of common objects that we use in our daily life and some common person that we meet daily. By matlab software we trained these images with the help of pretrained neural network. After training it split in two parts namely, training part and testing part so that it can recognise the images that we save in our database. Then by connecting our phone camera by droidcam software and voice by soundwire software it will give us output in audio format.

#### B. Ultrasonic Belt

In this gadget we used a raspberry pi 3,two ultrasonic sensor and four resistors and some jumper wires .This belt is very comfortable to wear.In this one sensor is in horizontal direction that measures the distance and the velocity and second sensor is tilted at some angle facing downwards so that it can measures the height of the object,depth of the pits and height of the steps.Then by using a earphone or a headset, person can listen the commands.This belt is very useful for a blind person for their navigation.

#### C. Automatic Book reading

In this setup we used four servo motors,one dc motor ,arduino mega,jumper wires,breadboard,tyre and a mechanical setup. Person have to put his phone on the slot and the book that he/she wants to read. We made a code in matlab that use google api At first we made a automatic and cheap page flipper setup by dc motor connected to tyre that have grip used to lift the paper in upward direction and then by using a arm connected to servo motor flip the page and then an another arm hold the page.

### II. COMPONENTS USED

Sr.no	Components used	Quantity
1	Raspberry pi	1
2	Ultrasonic Sensor	2
3	Resistors	4
4	Servo Motors	4
5	Dc Motor	1
6	Motor Driver	1
7	Arduino MEGA 2560	1
8	Usb Cable	1
9	Battery	4
10	Jumper wires	50
11	Tyre	1
12	Mechanical Setup for book reading	1
13	Mobile Camera	1
14	Matlab Software	1

### III. COMPONENTS SPECIFICATION

#### A. Raspberry pi 3 model B

Raspberry pi 3 is a small motherboard. This model have 1 GB RAM, 4 USB 2 ports ,Micro SD port,40 GPIO pins,wireless LAN,Bluetooth Low Energy ,Full size HDMI and CSI camera port.Raspbian oas is installed in micro sd card. We connected this to monitor or Tv and used it by standard keyboard and mouse for programming in python.

### B. Ultrasonic Sensor

This sensor is used to detect the object distance, height and velocity. The range of this sensor is "2cm to 500cm". It needed 5v power supply. Resolution of the sensor is up to 3mm. Operating current required is less than 15mA. It covers an angle of less than 15 degree.

### *C. Resistors*

We used 1k ohm and 2k ohm resistors in our ultrasonic band circuit. Resistors are used for dividing the voltage across echo pin and ground pin on ultrasonic sensor. Resistors increase the accuracy of this sensor by 2 or 3 times.

#### *D. Servo Motor*

We used two MG90S and two MG995 servo motor for controlling the book reading setup.

- 1) MG90S consists of metal gear with one bearing. Its a tiny servo can rotate approx 180 degrees (90 in each direction). It can produce a torque in a range of "1.8kgf-cm to 2.2kgf-cm" depending on the operating voltage range from "4.8V to 6.0V". Its weight is approx 13.4g and dimension is approx "22.5mmx12mmx35.5mm". Operating speed varies with range "0.1 s/90 degree (4.8 V) to 0.08 s/90 degree (6 V)".
  - 2) MG995 consists of high speed metal gear with dual ball bearing. It can produce a torque in a range of 8.5kgf-cm to 10kgf-cm depending on the operating voltage range from "4.8V to 6.0V". Its weight is 55g and dimension is "40.7mmx19.7mmx42.9mm" approx. Operating speed varies with range "0.2 s/90 degree (4.8 V) to 0.16 s/90 degree (6 V)".

### E. DC Motor

We used high speed Dc Motor to give a torque to page by a wheel.The operating voltage of this motor is approx 12V.The RPM of this motor is 2000.We used motor driver to control the speed and the polarity of this motor.

F. L298N DC Motor Driver

We used this motor driver to control the speed and polarity of dc motor. The operating current range of logical part is "0mA to 36mA" and the peak current of driven part is 2A. We connected two pins of motor driver to arduino to control speed and polarity and the pin 12V and ground to external battery.

#### *G. USB Cable*

We used a USB cable to power the arduino so that arduino give power to servo motors.

#### *H. Arduino Mega 2560*

We used arduino Mega to control all the servo and DC motors in our reading setup.Arduino mega is a microcontroller board that have 54 digital pins,16 analog inputs,USB port and a reset button.We used power bank to give power to this board to get started.

### *I. Jumper Wires*

We used male to male, male to female, and female to female jumper wires to make our circuit for ultrasonic belt and automatic reading setup.

J. Tyre

We used a tyre to provide a torque to a page to lift in upward direction so that page turning motor can flip the page.

### *K. Mechanical setup for book reading*

We used a GI sheet of dimension 120cm\*120cm to make the whole setup for automatic book reading.

### *L. Matlab Software*

We used matlab software for image detection and recognition .At first we saved the database of the common person and objects that we used in our daily life and then by train pretrained network we recognise the object.

```

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);
        allImages = ImageDatabase.getInstance(getApplicationContext()).getImageList();
        if(allImages.size() == 0)
            Toast.makeText(getApplicationContext(), "No Images",Toast.LENGTH_SHORT).show();
        else
            start();
    }

    private void start() {
        Intent intent = new Intent(this, CameraActivity.class);
        startActivityForResult(intent, 1);
    }

    @Override
    protected void onActivityResult(int requestCode, int resultCode, Intent data) {
        super.onActivityResult(requestCode, resultCode, data);
        if(resultCode == RESULT_OK) {
            Bitmap image = (Bitmap) data.getExtras().get("data");
            if(image != null) {
                image = rotateImage(image);
                if(image != null) {
                    addImageToDatabase(image);
                    if(allImages.size() == 1)
                        start();
                    else
                        showImage();
                }
            }
        }
    }

    private void addImageToDatabase(Bitmap image) {
        String id = String.valueOf(allImages.size());
        String name = "Image " + id;
        String path = Environment.getExternalStorageDirectory().getAbsolutePath() + "/Image";
        File file = new File(path);
        if(!file.exists())
            file.mkdirs();
        String fileName = id + ".jpg";
        String fullpath = path + "/" + fileName;
        try {
            FileOutputStream fos = new FileOutputStream(fullpath);
            image.compress(Bitmap.CompressFormat.JPEG, 100, fos);
            fos.close();
        } catch (IOException e) {
            e.printStackTrace();
        }
        ImageDatabase.getInstance(getApplicationContext()).addImage(id, name, fullpath);
    }

    private void showImage() {
        Intent intent = new Intent(this, ShowImageActivity.class);
        intent.putExtra("image", allImages.get(0));
        startActivity(intent);
    }

    private Bitmap rotateImage(Bitmap image) {
        Matrix matrix = new Matrix();
        matrix.postRotate(90);
        return Bitmap.createBitmap(image, 0, 0, image.getWidth(), image.getHeight(), matrix, true);
    }
}

```

Fig. 1. Code for image recognition

### *M. Mobile Camera*

We used our mobile camera to take snapshots of objects in front of blind person to recognise object.

#### IV. CIRCUIT DIAGRAM

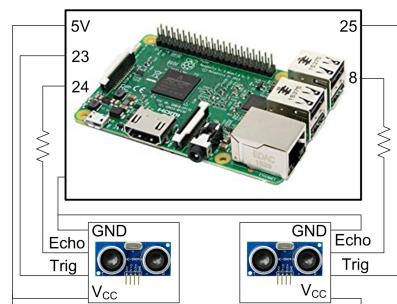


Fig. 2. Circuit diagram for ultrasonic belt

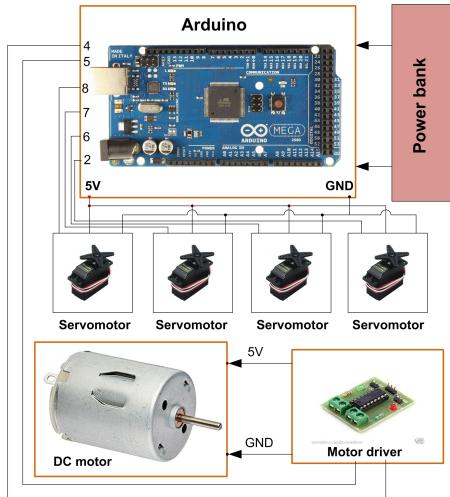


Fig. 3. Circuit diagram for book reading setup

## V. MOTIVATION OF THE PROJECT

We had seen the world health organisation report of blind person then we find that more than 39 million people in the world are blind and approx 254 million have vision impairment and vision loss .This impairment creates many difficulties towards them.This data motivated us for doing something for them which will help them to face barriers and to overcome the inequality with a normal person.Many of them wants to read ,wants to visualize the world and wants to independent,thats why we make automatic audio navigation and reading setup for them.

## VI. DISCUSSION

We the group members discussed about that why a blind person kept a phone with him/her.After discussion we reached to a result that why a blind person cannot kept an android phone.In todays world android mobile have many features by which a blind person can call ,play music and almost do anything by the help of OK Google,TalkBack,Shortcut Keys and Select to Speak.

## VII. PREREQUISITES

In our project the person should have some prerequisites that is required before using these gadgets:

- 1) Person should have a laptop for training the database using matlab for image recognition.
- 2) Person should have high speed internet for using Google API.
- 3) Person should have an headset or earphone for using ultrasonic belt and book reading setup.
- 4) Person should have an android mobile for book reading and image recognition.

## VIII. MODIFICATIONS

To make this project more accurate ,velocity sensor can be used instead of ultrasonic sensor.For automatic page flipping,vacuum or suction can be used to lift up the page .

Raspberry pi camera module can be used instead of mobile camera.

## IX. CONCLUSIONS

This project was made by our group mainly for blind person aimed to their happiness,curiosity about the world, and to visualize the world so that they can live a better life.Our book reading setup can be used by anyone .It can also act like a book scanner that converts the book into pdf file.

## X. ACKNOWLEDGEMENT

We would like to thanks Sanidhya Aggarwal,Ayush Meghwani,Kushagra singhal,Hitesh Ramchandani,Suryavanshi VirendraSingh for their valuable guidance.We also very grateful to Padmanabhan Rajan sir for their guidance.

## XI. GADGETS PHOTOS



Fig. 4. Book reading setup

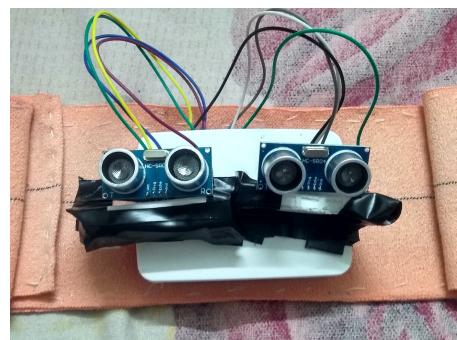


Fig. 5. Ultrasonic Belt

## XII. REFERENCES

- 1) <https://www.arduino.cc/>
- 2) <https://www.raspberrypi.org>
- 3) [www.towerpro.com.tw/product/mg90s-3/](http://www.towerpro.com.tw/product/mg90s-3/)
- 4) <https://components101.com/ultrasonic-sensor-working-pinout-datasheet>
- 5) <https://www.electronicshub.org/arduino-dc-motor-control-using-l298n/>