

# **ASSISTANCE FOR DIFFERENTLY ABLED PEOPLE**

REPORT SUBMITTED

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UNDER THE GUIDANCE OF

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DEPARTMENT OF INFORMATION TECHNOLOGY

B. P. PODDAR INSTITUTE OF MANAGEMENT AND TECHNOLOGY

FOR THE AWARD OF THE DEGREE OF

Bachelor of Technology

In

Information Technology



**DEPARTMENT OF INFORMATION TECHNOLOGY**

**B. P. PODDAR INSTITUTE OF MANAGEMENT AND TECHNOLOGY**

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# **ASSISTANCE FOR DIFFERENTLY ABLED PEOPLE**

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# **CERTIFICATE**

This is to certify that the Project Report entitled, **ASSISTANCE FOR DIFFERENTLY ABLED PEOPLE** submitted by **Sayan Mukherjee (11500216016), Rohan Karmakar (11500216025) Rahul Manna (11500216028)** to B. P. Poddar Institute of Management and Technology, is a record of Project work carried out by them under my supervision and guidance and is worthy of consideration for the award of the degree of Bachelor of Technology in Information Technology of the Institute.

.....  
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Assistant Professor, Dept. of Information Technology

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Countersigned by

.....  
[**Dr. Sabnam Sengupta**]

Head of Dept. of Information Technology

**B. P. PODDAR INSTITUTE OF MANAGEMENT & TECHNOLOGY**

# **CONTENTS**

	#
1. ACKNOWLEDGEMENT	04
2. ABSTRACT	05
3. PROJECT ANALYSIS	05
3.1. PURPOSE OF THE PROJECT	05
3.2. EXISTING SYSTEM	05
4. SYSTEM REQUIREMENT	06-04
4.1. TECHNOLOGIES USED	06
4.2. SOFTWARE USED	07
4.3. HARDWARE USED	07-13
5. ALGORITHMS	14
5.1. SMILEAR: IQIYI'S MOBILE AR SOLUTION BASED ON TENSORFLOW LITE	14
5.2. IMAGE COMPARISON USING HAMMING DISTANCE METHOD	14
6. FEATURES & ADVANTAGES	15
7. SCREEN SHOTS	16-19
7.1 GPIO LAYOUT	16
7.2 HOW TO RUN	16
7.3 OBJECT DETECTION	17 - 19
8. WORKING PRINCIPLE	20
9. LOCOMOTION	21
10. FUTURE SCOPE	22
11. CONCLUSIONS	23
12. REFERENCES	24

## **1. ACKNOWLEDGEMENT**

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We are grateful to the Software lab of the Department of Information Technology, B. P. Poddar Institute of Management and Technology for providing an excellent environment for carrying out the project work.

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## **2. ABSTRACT**

According to Cambridge English Dictionary. The action of helping someone by sharing work. By convention when we think about the word “assistance” we generally think about a human being. But in the era of IT industry this convention should move to an automated robot which can do the same but, in some case, better than a human being. Our idea is to make an automated robot to help the persons who are physically incapable to do their daily stuff to some extent. Suppose a blind person is incapable to find something which is laying around their floor. Our BOT will find that item, pick it, and take it to the person.

An automated personal assistant or an Intelligent Personal Assistant is a mobile software agent that can perform tasks, or services, on behalf of an individual based on a combination of user input, location awareness, and the ability to access information from a variety of online sources such as weather conditions, traffic congestion, news, stock prices, user schedules, retail prices, etc.

There are two types of automated personal assistants: intelligent automated assistants for example, Apple’s Siri and Tronton’s Cluzee, which perform concierge-type tasks e.g., making dinner reservations, purchasing event tickets, making travel arrangements or provide information based on voice input or commands; and smart personal agents, which automatically perform management or data-handling tasks based on online information and events often without user initiation or interaction.

According to Chi-Hua Chien of Kleiner Perkins Caufield & Byers, examples of tasks that may be performed by a smart personal agent-type of automated personal assistant include schedule management e.g., sending an alert to a dinner date that a user is running late due to traffic conditions, update schedules for both parties, and change the restaurant reservation time and personal health management e.g., monitoring caloric intake, heart rate and exercise regimen, then making recommendations for healthy choices.

Both types of automated personal assistant technology are enabled by the combination of mobile computing devices, application programming interfaces (APIs), and the proliferation of mobile apps. However, intelligent automated assistants are designed to perform specific, one-off tasks specified by user voice instructions, while smart personal agents perform ongoing tasks e.g., schedule management autonomously

We are developing a robot which is capable of identifying and picking up an object described by user or the incapable person and lead back to the person

### **3. PROJECT ANALYSIS**

#### **3.1. PURPOSE OF THE PROJECT**

According to Cambridge English Dictionary. The action of helping someone by sharing work. By convention when we think about the word “assistance” we generally think about a human being. But in the era of IT industry this convention should move to an automated robot which can do the same but, in some case, better than a human being. Our idea is to make an automated robot to help the persons who are physically capable to do their daily stuff to some extent. Suppose a blind person is incapable to find something which is laying around their floor. Our BOT will find that item, pick it, and take it to the person.

#### **3.2. PROBLEM IN EXISTING SYSTEM**

- Existing system is not providing enough support to this type of person.
- Existing system is not providing facilities for voice input for differently abled people

### **4. SYSTEM REQUIREMENTS**

#### **4.1. TECHNOLOGIES USED**

The key software implementation behind this project is

Real Time Image Processing using OPENCV in Python environment

- What is Image Processing?

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image

- What is OpenCV?

OpenCV (Open source computer vision) is a library of programming functions mainly aimed at real-time computer vision. Originally developed by Intel, it was later supported by Willow Garage then Itseez (which was later acquired by Intel). The library is cross-platform and free for use under the open-source BSD license.

## 4.2. SOFTWARE USED

- There is nothing special needed for this project. Customer should have an AC power supply to charge the battery of the robot as this is battery operated.
- For the voice command, strong internet connectivity is required.
- Minimum light in the room is mandatory, as we are optical sensor rather than an IR sensor.
- **Raspberry Pi OS** is a Debian-based operating system for Raspberry Pi. Since 2015 it has been officially provided by the Raspberry Pi Foundation as the primary operating system for the Raspberry Pi family of compact single-board computers

## 4.3. HARDWARE USED

### 4.3.1. READYMADE HARDWARE

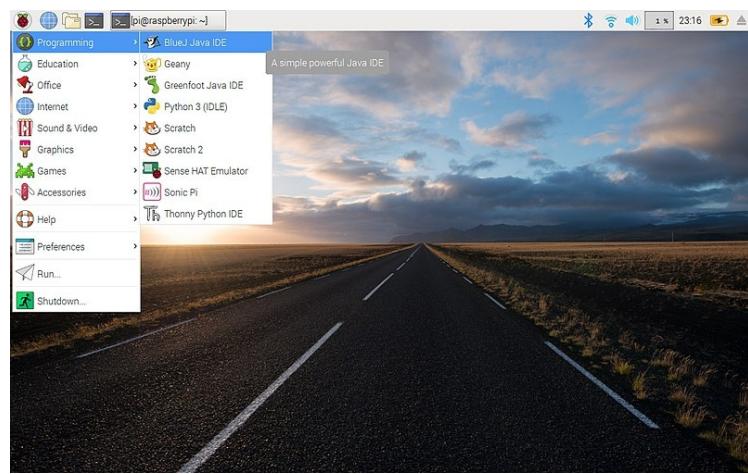
- **Raspberry PI 3** – Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation. Early on, the Raspberry Pi project leaned towards the promotion of teaching basic computer science in schools and in developing countries. Later the original model became far more popular than anticipated selling outside its target market for uses such as robotics. It is now widely used in many areas, such as for weather monitoring, because of its low cost and high portability. After the release of the second board type, the Raspberry Pi Foundation set up a new entity, named Raspberry Pi Trading, and installed Eben Upton as CEO, with the responsibility of developing technology. The Foundation was rededicated as an educational charity for promoting the teaching of basic computer science in schools and developing countries. The Raspberry Pi is one of the best-selling British computers. As of December 2019, more than thirty million boards have been sold. Most Pis are made in a Sony factory in Pencoed, Wales, while others are made in China and Japan.



Specifications:

- ❖ Quad Core 1.2GHz Broadcom BCM2837 64bit CPU
- ❖ 1GB RAM
- ❖ BCM43438 wireless LAN and Bluetooth Low Energy (BLE) on board
- ❖ 100 Base Ethernet
- ❖ 40-pin extended GPIO
- ❖ 4 USB 2 ports
- ❖ 4 Pole stereo output and composite video port
- ❖ Full size HDMI
- ❖ CSI camera port for connecting a Raspberry Pi camera
- ❖ DSI display port for connecting a Raspberry Pi touchscreen display
- ❖ Micro SD port for loading your operating system and storing data
- ❖ Upgraded switched Micro USB power source up to 2.5A

- **Raspbian OS** – Raspberry Pi OS (formerly Raspbian) is a Debian-based operating system for Raspberry Pi. Since 2015 it has been officially provided by the Raspberry Pi Foundation as the primary operating system for the Raspberry Pi family of compact single-board computers. The original Raspbian OS was created by Mike Thompson and Peter Green as an independent project. The initial build was completed in June 2012. Previous Pi OS versions have been 32bit and based on Raspbian core, taking the name Raspbian. Since recent 64bit versions no longer use the Raspbian core, the name has been changed to Raspberry Pi OS for both 64bit and 32bit versions. As of 1 August 2020, the 64-bit version is a beta and is not suitable for general use.

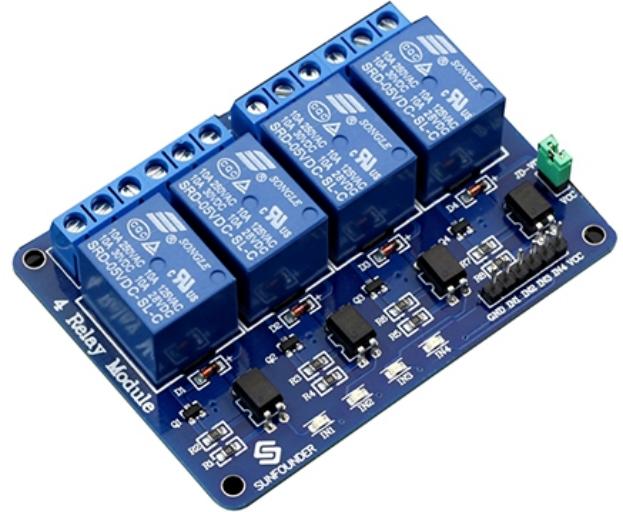


Raspberry Pi OS is highly optimized for the Raspberry Pi line of compact single-board computers with ARM CPUs. Raspberry Pi OS uses a modified LXDE as its desktop environment with the Open box stacking window manager plus a new theme and few other changes. The distribution is shipped with a copy of the algebra program Wolfram Mathematica and a version of Minecraft called Minecraft Pi as well as a lightweight version of Chromium as of the latest version.

- **16 GB Class 10 Micro SD card** – Secure Digital, officially abbreviated as SD, is a proprietary non-volatile memory card format developed by the SD Association (SDA) for use in portable devices. The standard was introduced in August 1999 by joint efforts between SanDisk, Panasonic (Matsushita Electric) and Toshiba as an improvement over Multimedia Cards (MMCs), and has become the industry standard. The three companies formed SD-3C, LLC, a company that licenses and enforces intellectual property rights associated with SD memory cards and SD host and ancillary products. The companies also formed the SD Association (SDA), a non-profit organization, in January 2000 to promote and create SD Card standards. SDA today has about 1,000 member companies. The SDA uses several trademarked logos owned and licensed by SD-3C to enforce compliance with its specifications and assure users of compatibility.



- **4 Channel 5-volt Relay Module** – A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof. Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations. The traditional form of a relay uses an electromagnet to close or open the contacts, but other operating principles have been invented, such as in solid-state relays which use semiconductor properties for control without relying on moving parts. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called protective relays.



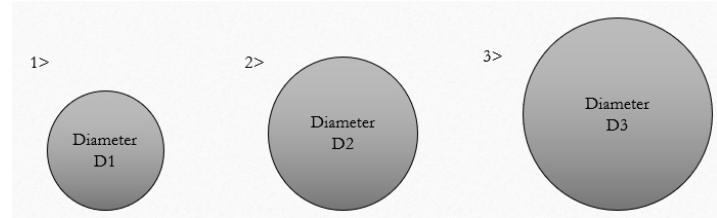
- **12-volt 300 RPM motor (4 pc)** – A DC motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic to periodically change the direction of current in part of the motor. DC motors were the first form of motor widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight brushed motor used for portable power tools and appliances. Larger DC motors are currently used in propulsion of electric vehicles, elevator and hoists, and in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications



- **Wheels** - There are different kinds of wheels available in the market, with various widths, diameters and grip patterns. Keeping these things in mind, and depending on the utility of the bot, wheels should be chosen carefully.

Let us take an example:

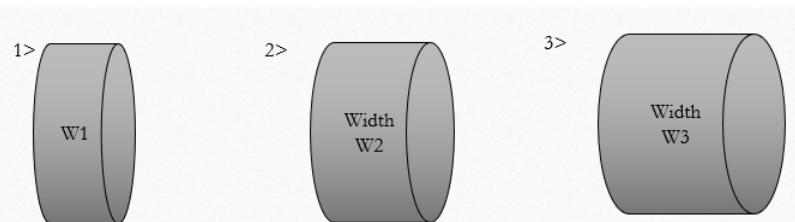
3 wheels are given with 3 different diameters  $D_1$ ,  $D_2$  and  $D_3$ , but with same width. From the figure, it is clear that  $D_1 < D_2 < D_3$ .



For each rotation of the motors, the distance covered by the bot will be equal to the circumference of the wheel. So higher the Circumference of the wheel, higher will be the distance covered for each rotations of the motors. In the given case, keeping other factors normal, choosing the wheel no.3 will be most profitable, as wheel no.3 has the longest diameter or circumference.

Let us take another example

3 wheels are given with 3 different widths  $W_1$ ,  $W_2$  and  $W_3$ , But with same diameter. From the figure, it is clear that  $W_1 < W_2 < W_3$ .



Higher the width of the wheels, higher will be the area of contact of the bot with the ground. This will give the bot an edge for traversing over uneven soft ground, especially in areas, covered with sand. This will also help the bot to prevent slipping while the bot is climbing along an edge.

So here, choosing the 3rd wheel will be a good choice.

**Caterpillar track**, also called **tank thread** or **Continuous track**, is a system of vehicle propulsion in which a continuous band of treads or track plates is driven by two or more wheels.

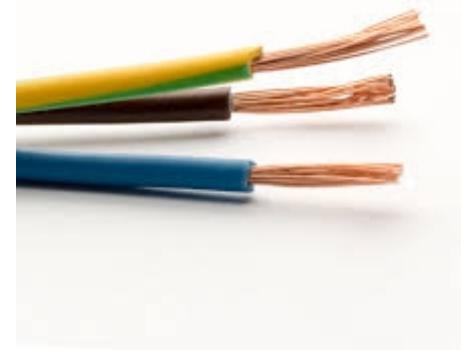
The large surface area of the tracks distributes the weight of the vehicle better than steel or rubber tires on an equivalent vehicle, enabling a continuous tracked vehicle to traverse soft ground with less likelihood of becoming stuck due to sinking.



- **Motor Clamp** - A DC motor clamp or a bracket is used to mount the motor tightly on any solid surface, thus it increases the usability of the motor and makes motor mounting very convenient. This clamp or mount bracket is designed for DC geared motors.



- **Wires** - A wire is a single usually cylindrical, flexible strand or rod of metal. Wires are used to bear mechanical loads or electricity and telecommunications signals. Wire is commonly formed by drawing the metal through a hole in a die or draw plate. Wire gauges come in various standard sizes, as expressed in terms of a gauge number. The term 'wire' is also used more loosely to refer to a bundle of such strands, as in "multistranded wire", which is more correctly termed a wire rope in mechanics, or a cable in electricity. Wire comes in solid core, stranded, or braided forms. Although usually circular in cross-section, wire can be made in square, hexagonal, flattened rectangular, or other cross-sections, either for decorative purposes, or for technical purposes such as high-efficiency voice coils in loudspeakers. Edge-wound coil springs, such as the Slinky toy, are made of special flattened wire.



- **Soldering station** - A soldering station is a multipurpose power soldering device designed for electronic components soldering. This type of equipment is mostly used in electronics and electrical engineering. Soldering station consists of one or more soldering tools connected to the main unit, which includes the controls (temperature adjustment), means of indication, and may be equipped with an electric transformer. Soldering stations may include some accessories – holders and stands, soldering tip cleaners, etc.

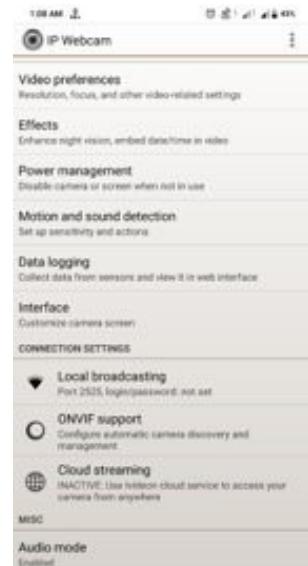


Soldering stations are widely used in electronics repair workshops, electronic laboratories, in industry. Sometimes simple soldering stations are used for household applications and for hobbies.

#### 4.3.2. IMPROVISED HARDWARE

- Mobile phone along with IP-Webcam - We have used a Mobile app named IP Webcam for visual input as well as audio input. IP Webcam is an app developed by Pavel Khlebovich available in play store. This app has a full control over resolution, quality of video and audio stream. This also have an option of cloud streaming, so that it can be accessed over web.

- ✓ This app has an option of start server.
- ✓ After connecting to a same network as of the bot, server needs to be started which will produce a direct link of video and audio stream.



- Speaker – We have used an external speaker to interact with the user.



- Power Bank - A power bank is a portable device that can supply power from its built-in battery through a USB port.

Power banks are popular for charging smaller battery-powered devices with USB ports such as mobile phones and tablet computers and can be used as a power supply for various USB-powered accessories such as lights, small fans and external digital camera battery chargers. They usually recharge with a USB power supply. The power bank includes a control circuit that both regulates charging of the battery and converts the battery voltage to 5.0 volts for the USB port. Some power banks are able to deliver power wirelessly.

Some power banks have a pass-through charging feature which allows providing power through their USB ports while being charged themselves simultaneously.

Some larger power banks have DC connector (or barrel connector) for higher power demands such as laptop computers.



- 12V-10A Battery charger - We started the work at the time of lockdown, so we cannot acquire Li-Po Battery for our main power source for locomotion, so we are using car battery charger as our main power supply.



## 5. ALGORITHMS

### 5.1. SmileAR: iQIYI's Mobile AR solution based on TensorFlow Lite

Introduction: SmileAR is a TensorFlow Lite-based mobile AR solution developed by iQIYI's. It has been deployed widely in iQIYI's many applications, including the iQIYI's flagship video app (100+ million DAU), Qibabu (popular app for children), Gingerbread (short video app) and more.

### 5.2. IMAGE COMPARISON USING HAMMING DISTANCE METHOD

This comparison method returns the difference between two image files in terms of hamming distance. The hamming distance determines how similar two images are. A value of 0 indicates a likely similar picture. A value between 1 and 10 is potentially a variation. A value greater than 10 is likely a different image.

```
1  <?php
2  include_once 'core/init.php';
3  dept_protect_page();
4  class compareImages
5  {
6      private function mimeType($i)
7      {
8          $mime = getimagesize($i);
9          $return = array($mime[0],$mime[1]);
10         switch ($mime['mime'])
11         {
12             case 'image/jpeg':
13                 $return[] = 'jpg';
14                 return $return;
15             case 'image/png':
16                 $return[] = 'png';
17                 return $return;
18             default:
19                 return false;
20         }
21     }
22     private function createImage($i)
23     {
24         /*returns image resource or false if its not jpg or png*/
25         $mime = $this->mimeType($i);
26
27         if($mime[2] == 'jpg')
28         {
29             return imagecreatefromjpeg ($i);
30         }
31         else if ($mime[2] == 'png')
32         {
33             return imagecreatefrompng ($i);
34         }
35         else
36         {
37             return false;
38         }
39     }
40     private function resizeImage($i,$source)
41     {
42         /*resizes the image to a 8x8 square and returns as image resource*/
43         $mime = $this->mimeType($source);
44         $t = imagecreatetruecolor(8, 8);
45         $source = $this->createImage($source);
46         imagecopyresized($t, $source, 0, 0, 0, 0, 8, 8, $mime[0], $mime[1]);
47         return $t;
48     }
49     private function colorMeanValue($i)
50     {
51         /*returns the mean value of the colors and the list
52         of all pixel's colors*/
53         $colorList = array();
54         $colorSum = 0;
55         for($a = 0;$a<8;$a++)
56         {
57             for($b = 0;$b<8;$b++)
58             {
59                 $rgb = imagecolorat($i, $a, $b);
60                 $colorList[] = $rgb & 0xFF;
61                 $colorSum += $rgb & 0xFF;
62             }
63         }
64         return array($colorSum/64,$colorList);
65     }
66     private function bits($colorMean)
67     {
68         /*returns an array with 1 and zeros. If a color is bigger
69         than the mean value of colors it is 1*/
70         $bits = array();
71         foreach($colorMean[1] as $color) {$bits[] = ($color>=$colorMean[0])?1:0;}
72         return $bits;
73     }
74     public function compare($a,$b)
75     {
76         /*main function. returns the hammering distance of
77         two images' bit values*/
78         $il = $this->createImage($a);
79         $il2 = $this->createImage($b);
80         if(!$il || !$il2){return false;}
81         $il = $this->resizeImage($il,$a);
82         $il2 = $this->resizeImage($il2,$b);
83         imagefilter($il, IMG_FILTER_GRAYSCALE);
84         imagefilter($il2, IMG_FILTER_GRAYSCALE);
85         $colorMean1 = $this->colorMeanValue($il);
86         $colorMean2 = $this->colorMeanValue($il2);
87         $bits1 = $this->bits($colorMean1);
88         $bits2 = $this->bits($colorMean2);
89         $hammeringDistance = 0;
90         for($a = 0;$a<64;$a++)
91         {
92             if($bits1[$a] != $bits2[$a])
93             {
94                 $hammeringDistance++;
95             }
96         }
97     }
98     return $hammeringDistance;
99 }
100 ?>
```

## **6. FEATURES & ADVANTAGES**

### **REDUCE COST**

Our System is very pocket friendly so affordable to every income level peoples, from low to high.

### **REDUCE AND ELIMINATE MANUAL ERRORS**

As discussed earlier there is always a possibility of human error in this type of work. There is also tiredness, boredom associated with this type of work. This can be fully omitted by this system.

### **AVAILABILITY**

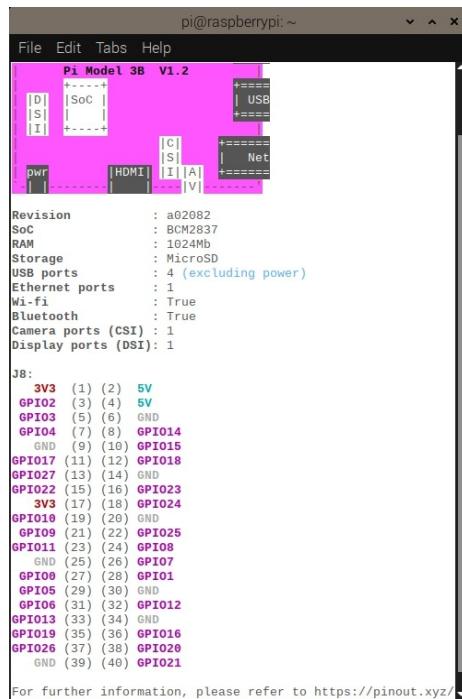
Users of this system can have their assistant at anywhere anytime.

### **PRODUCTIVITY**

Increases productivity and decrease dependency over other who need it most.

# 7. Screenshots

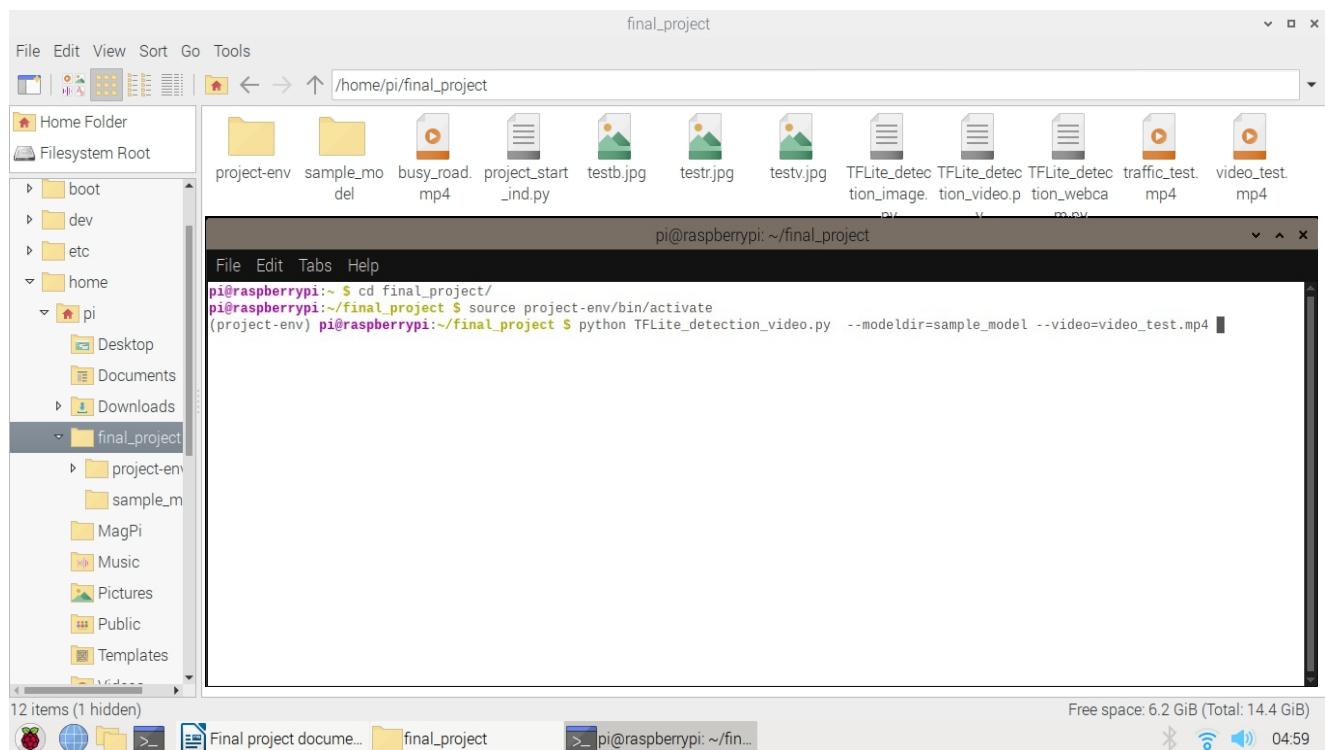
## 7.1 GPIO layout:



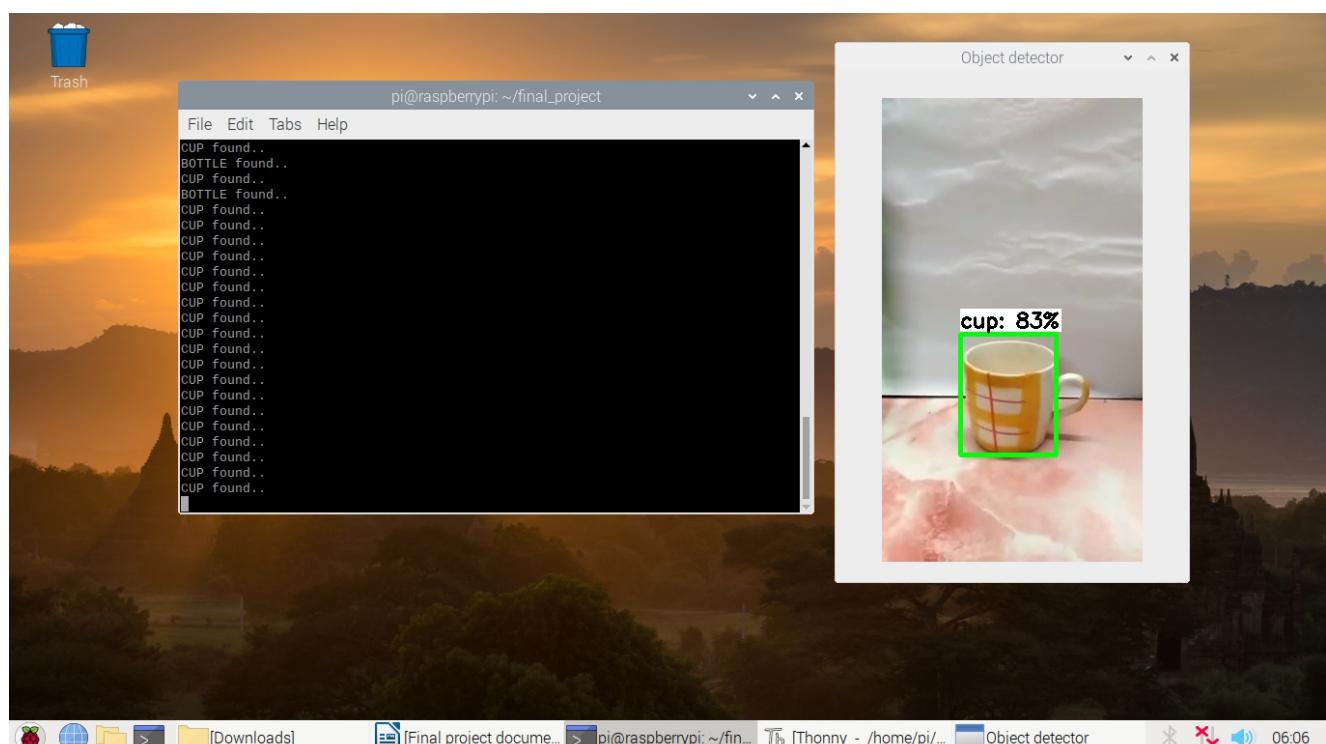
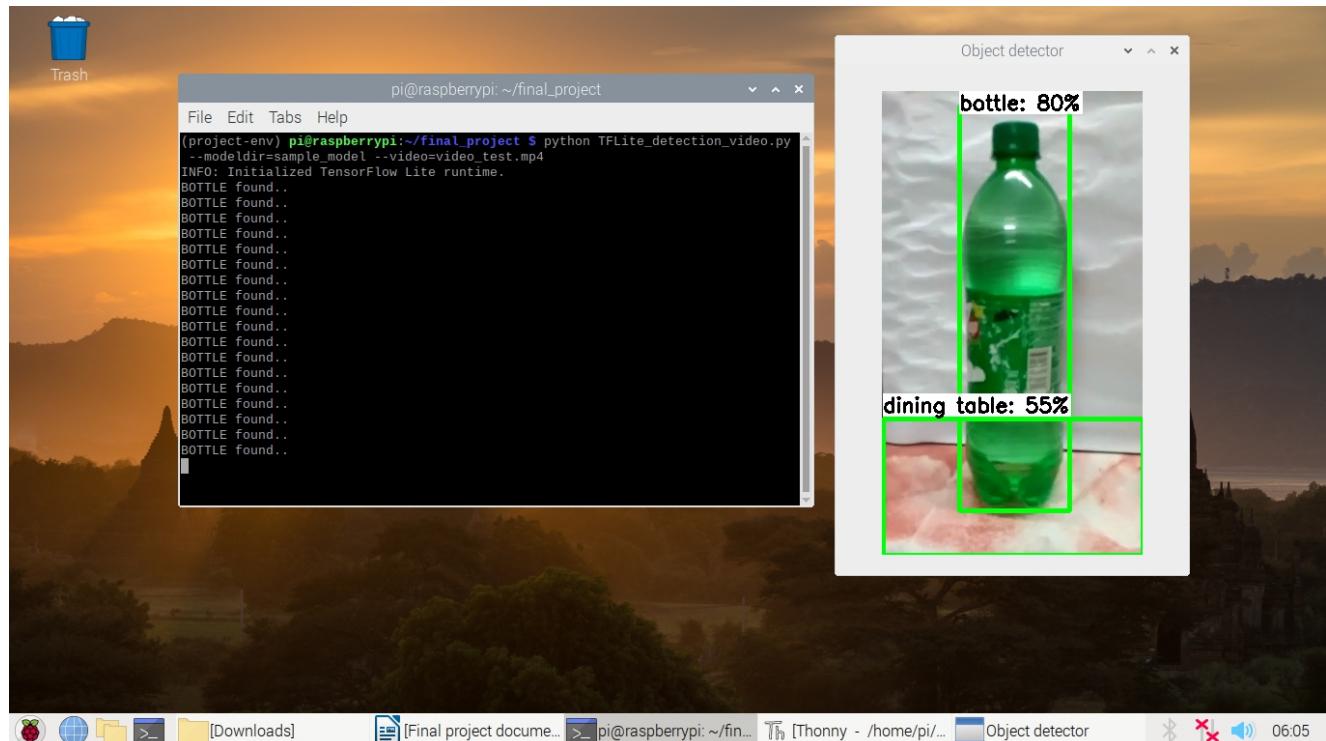
- GPIO 3 – Indicator led
- GPIO 10 – Bottle Indicator
- GPIO 5 – Cup Indicator
- GPIO 27 – Remote Indicator

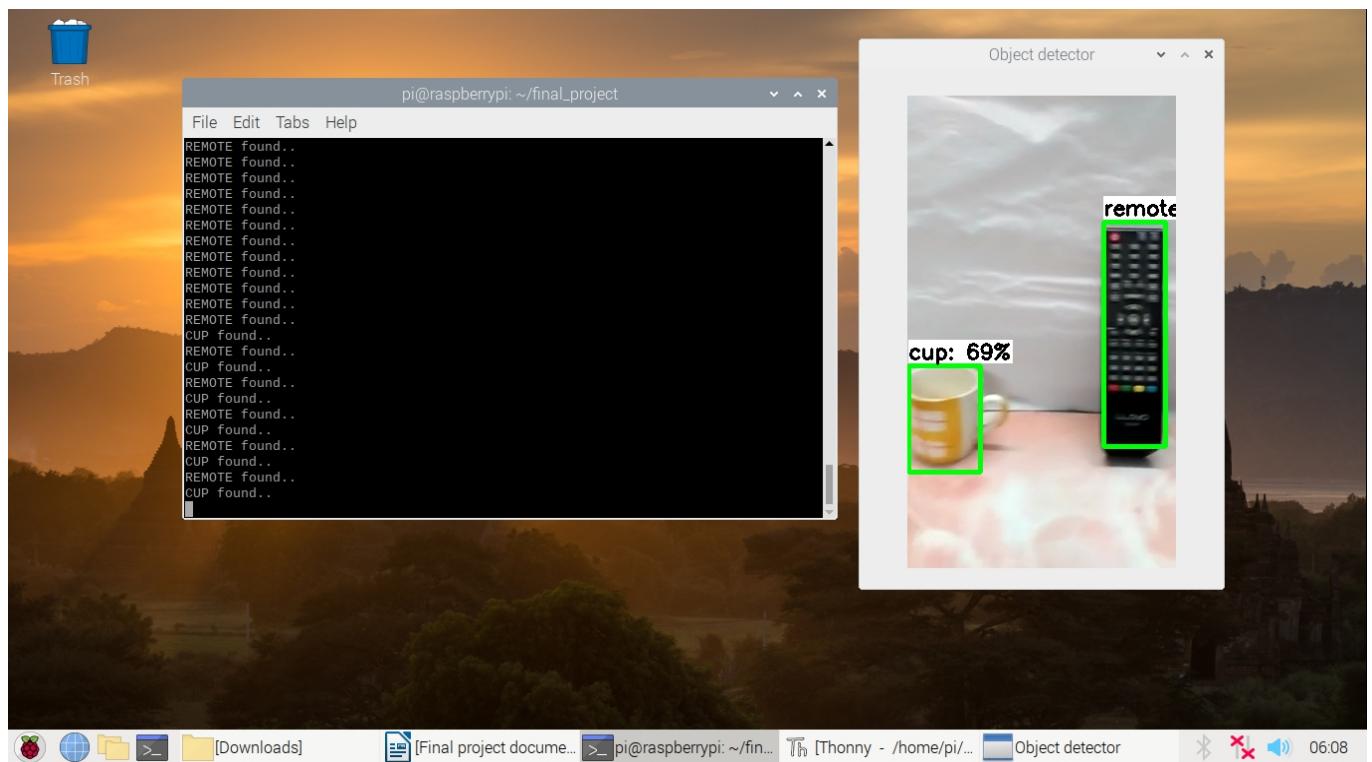
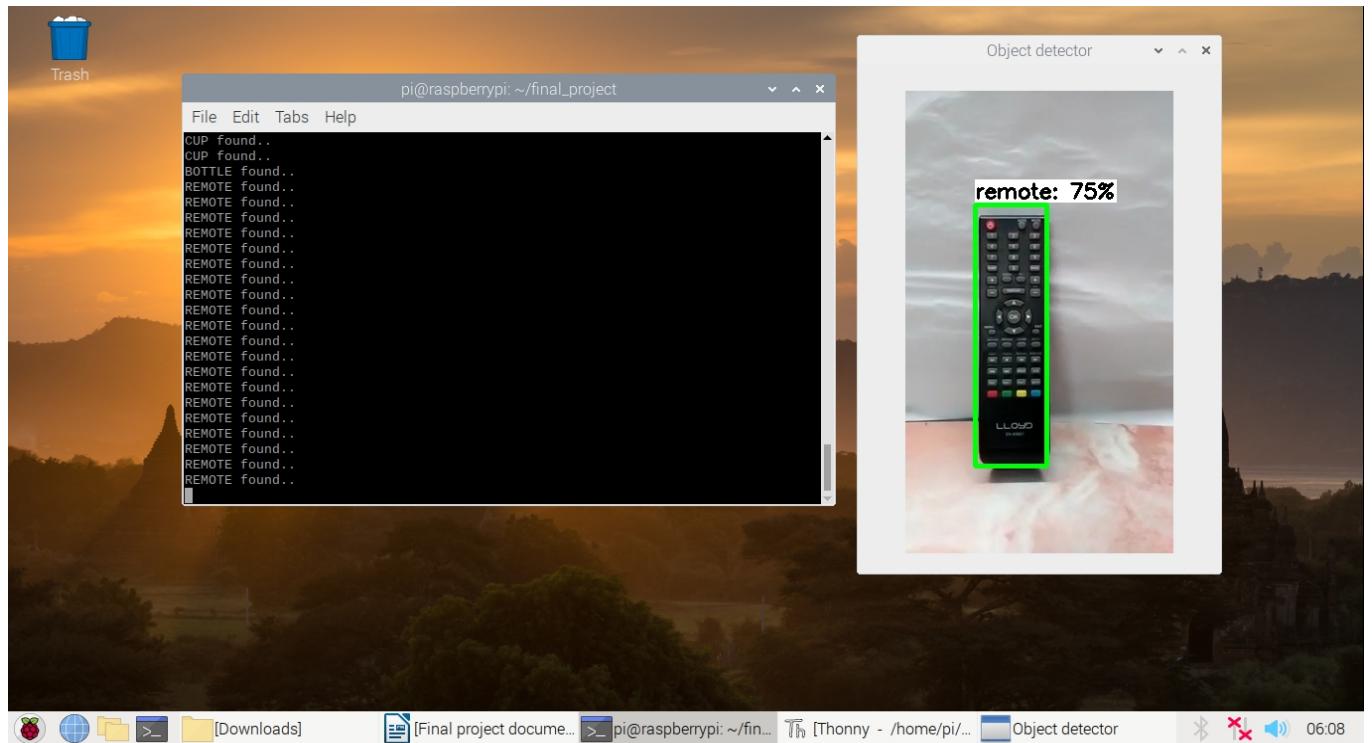
## 7.2 How to run:

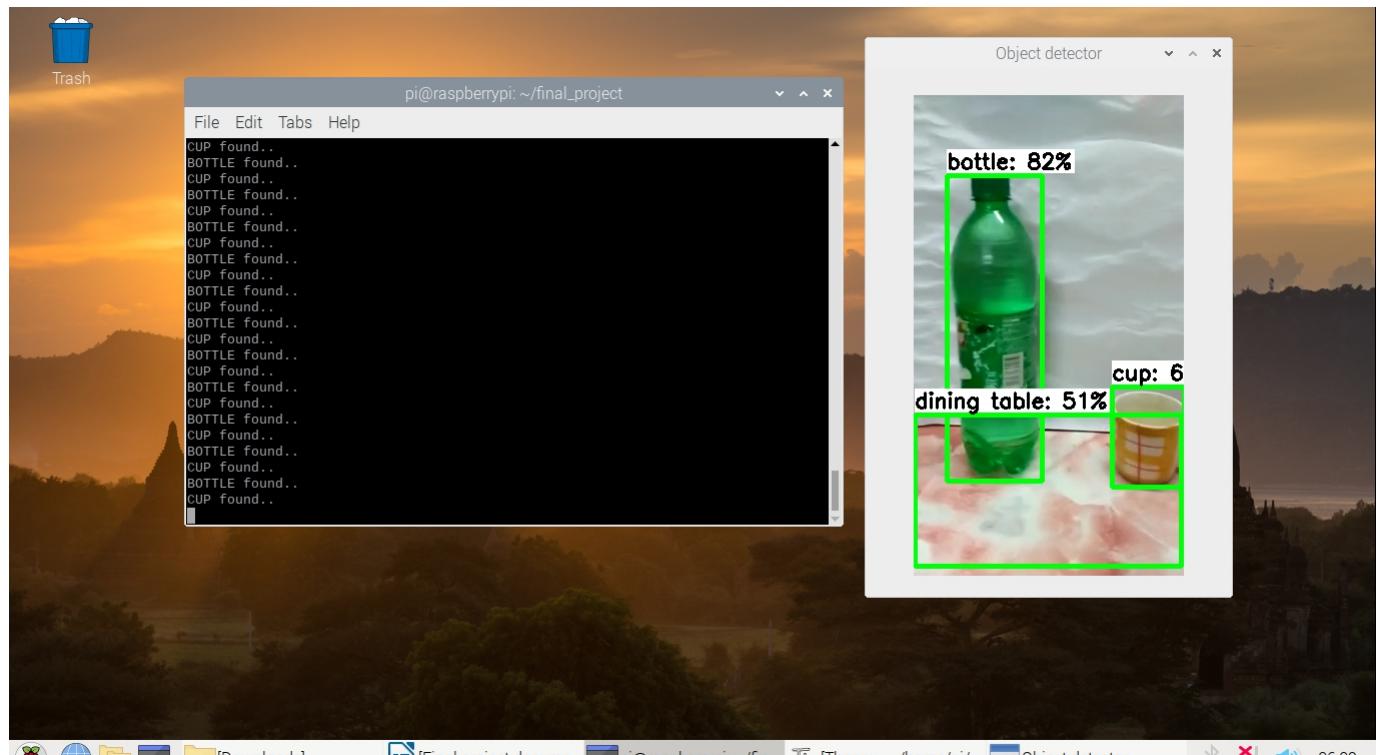
- Navigate to folder where the project files are situated
- Activate virtual environment which was created earlier for smooth and conflict free running.
- Enter **python Tflite\_detection\_video.py --modeldir=sample\_model --video=test.mp4**  
(python file name) (directory where model was kept) (name of video file)



## 7.3 Object Detection:







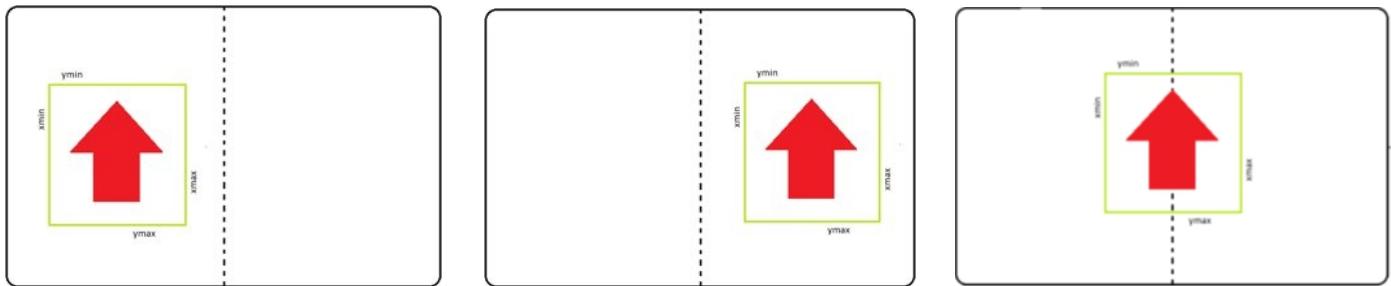
[Downloads] [Final project docume... pi@raspberrypi: ~fin... Thonny - /home/pi/... Object detector 06:09

## **8. WORKING PRINCIPLE:**

- At the boot time it will start a voice command identifier code.
- For example, if we say: “FIND ME A CUP” it will then start the object finding module with argument object\_to\_be\_found = ‘cup’.
- Object finding module consist of object identification, move towards object, indication of reaching and return back to the human.
- But during this condition we don’t have the tools and resources to build the hand, so it will only blink a led as indication.
- After that it will search and return to human present in the room.

## 9. LOCOMOTION:

1. We have split the frame vertically.
2. If the center line of object lies at the left then the bot will turn in left direction.
3. If the center line of object lies at the right then the bot will turn in right direction.
4. If the center line of object lies at the center then the bot will move in forward direction.
5. This thing will be continued until it reaches to the object.
6. Then it will change the object\_to\_be\_found to person and same procedure will be followed.



Whenever the output voltage of IN1 is low then Relay 1 will be activated and so on.

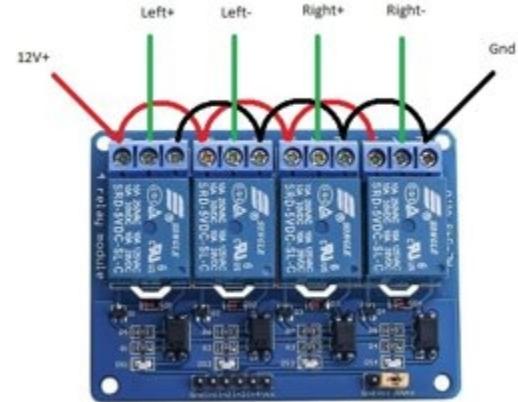
As the position of the object moves in the frame we have to activate and deactivate relays as follows in order to move the bot

Forward = GPIO 26 and GPIO 23

Backward = GPIO 6 and GPIO 17

Left = GPIO 23 and GPIO 6

Right = GPIO 17 and GPIO 26



IN1 = GPIO 26  
IN2 = GPIO 6  
IN3 = GPIO 23  
IN4 = GPIO 17

## 10. FUTURE SCOPE

- We can replace the mobile with suitable Pi-camera and Bluetooth headset for audio in and out.
- Later we can add the hand mechanism so that it can be a fully operational project.
- Later **we can add some more features** at voice module so it can be a perfect informative companion for any lonely person.
- Later we can add LiPo battery so that it can be truly wireless bot.
- We can add infrared camera for better low-light compatibility.
- We can apply face recognition while returning to commanding person.

## **11. CONCLUSION**

The project titled as Assistant for Differently Abled Person is an Image processing based mechanical and robotics solution. This project is on a progress. So, we have a plan for ready for future work. This project was started with lots of scalability factor keeping in mind. Extra modules and some extra expertise can also be added with this project. Thus, the system has fulfilled all the objectives identified and is able to replace the existing system.

## 12. REFERENCES

YouTube Channel: EdjeElectronics GitHub repository:

<https://github.com/EdjeElectronics/TensorFlow-Lite-Object-Detection-on-Android-and-Raspberry-Pi>

Online Image Processing Website:

<https://www.pyimagesearch.com/>

TensorFlow, Free Open-Source Software library:

<https://www.tensorflow.org/>

Sample Model by TensorFlow:

[https://storage.googleapis.com/download.tensorflow.org/models/tflite/coco\\_ssd\\_mobilenet\\_v1\\_1.0\\_quant\\_2018\\_06\\_29.zip](https://storage.googleapis.com/download.tensorflow.org/models/tflite/coco_ssd_mobilenet_v1_1.0_quant_2018_06_29.zip)