Technical Support

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- TIP Organization: PBOPlus
- Industry Mentor: Mr. Karunesh Jha
- Faculty Mentor: Prof Mohini Reddy

Roadmap

- Introduction
- About the Organization
- About the Department
- Project Details
- Learning and Experience
- Comments and Future Plan

Introduction

Project Problem Definition

- PBOPlus, a pioneer consulting firm in the field of business process management, offers services which include Industrial Automation, Robotics, and IoT.
- Being manufacturing experts, the driving reason for leaders at PBOPlus to foray into Robotics was to diversify into the manufacturing domain. I was able to contribute for the organization and learn about the Robotics field and the industry standards and requirements.
- I was required to learn Python and understand vision detection and how different techniques and execution takes place.
- I was tasked to understand the Raspberry Pi and how different components can be used with it like camera, LEDs, gyroscopes, motion sensors etc.

About the Organization

- PBOPlus' aim is to help our customers achieve reduction in business costs and increase in value for their clients thereby increasing profitability and/or business growth.
- We reduce departmental silos within organizations through cross-functional processes and horizontal organizational structure changes that leads to increased customer alignment and improved organizational effectiveness.
- Automation and Robotics have become key integrations as doing so, we were able to further align ourselves with the organization's vision of helping businesses to stay free of repetitive tasks and focus on profitability.

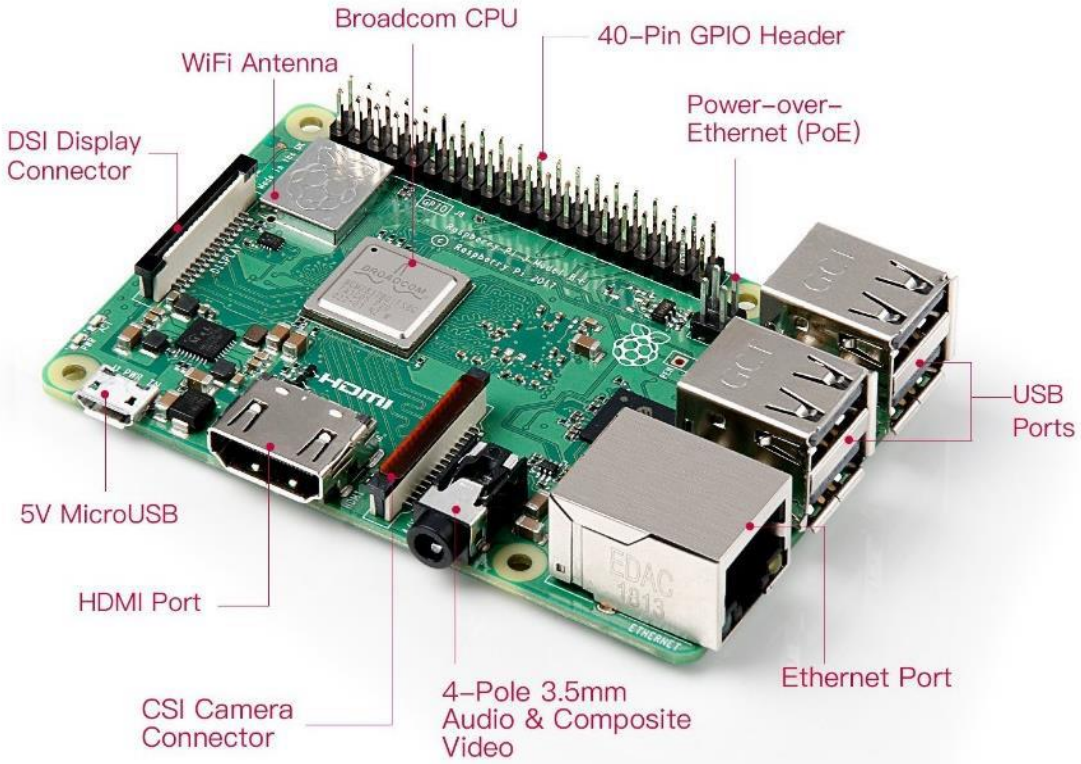
About the Department

- The main purpose of an industrial robot is to replicate human motions/actions. Specific industrial functions require very high levels of precision or repeatability.
- We are supported by extensive knowledge of how the manufacturing industry operates. We understand the intricacies of:
  - How to place a factory?
  - How to run a factory smoothly?
  - What parts need to be produced in-house and what needs to be outsourced?
- The 'Robotics and Automation' department headed by Mr. Karunesh Jha aim to provide the best solutions and high efficiency for clients. We aim to reduce labor and had automation for increase in revenue and help achieve greater production rates.

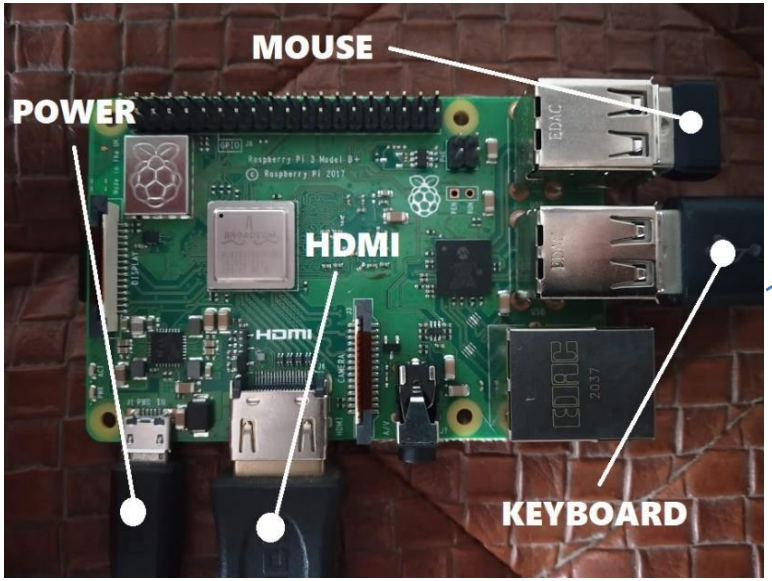
Project Details

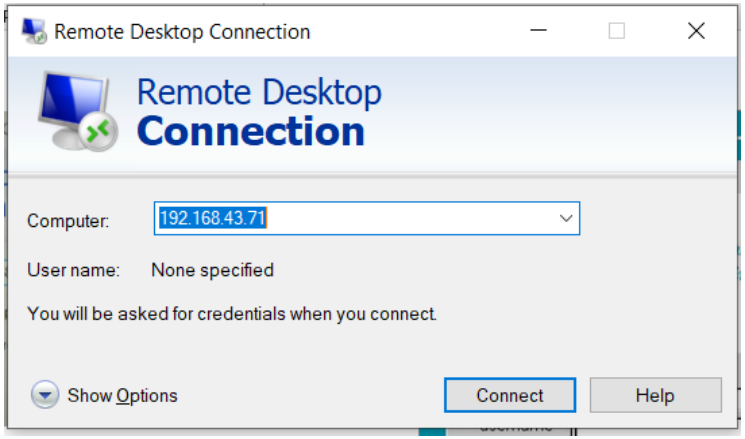
- Learning Python and understanding Vision Detection
- Understanding and connecting the Raspberry Pi 3 B+
- Part 1: LED Control with GUI
- Part 2: Face Detection
- Part 3: Security System
- Part 4: Gyroscope System

Understanding Raspberry Pi 3 B+



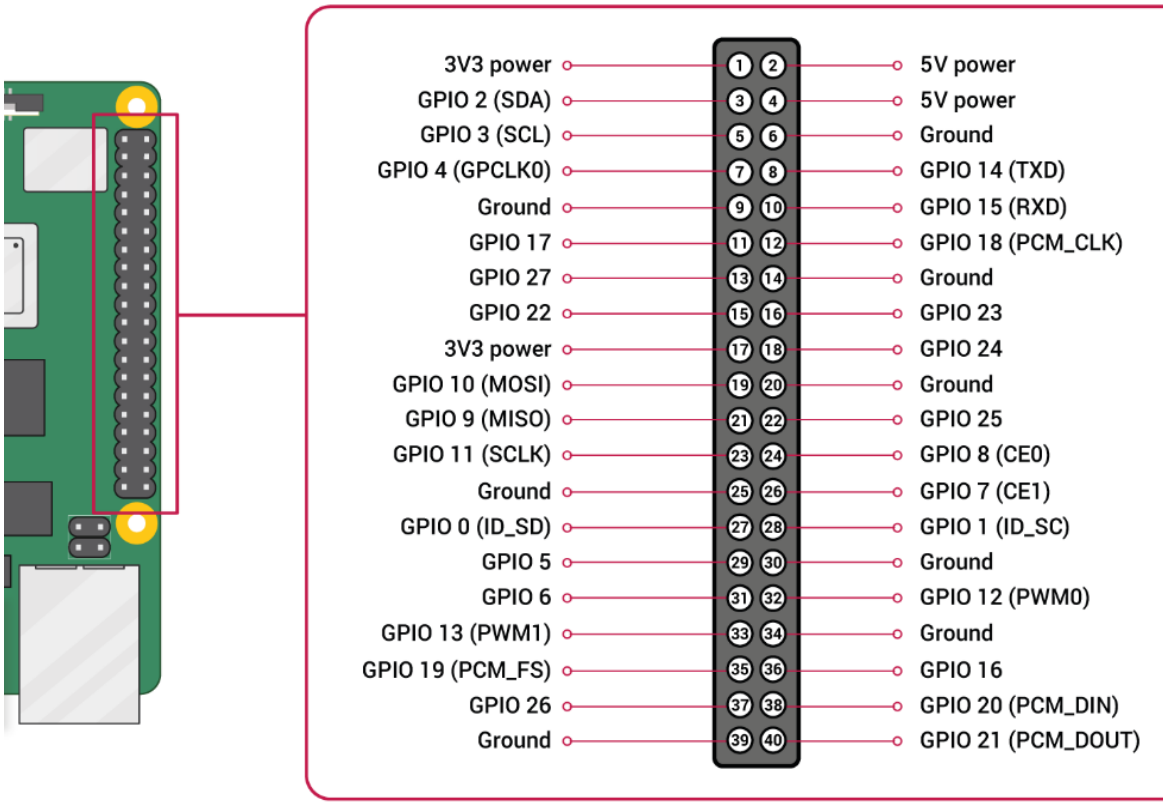
Connecting the Raspberry Pi

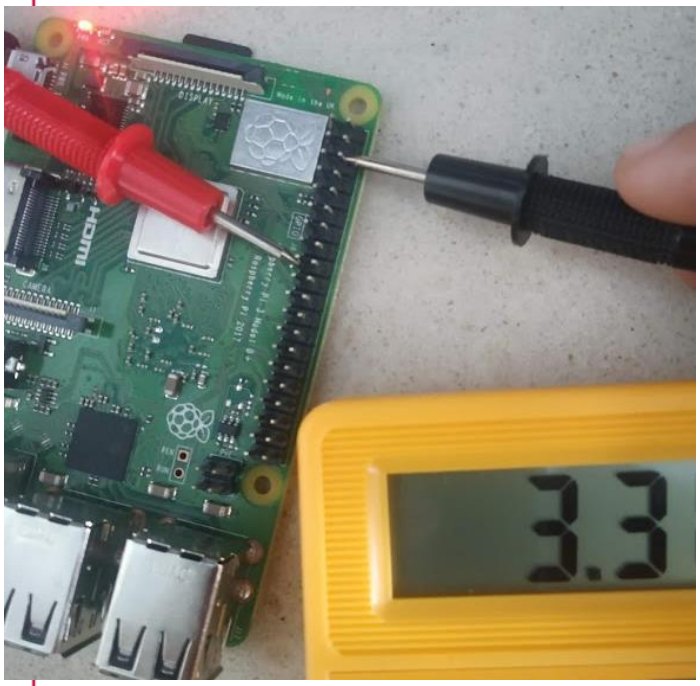




Enable SSH and Install XRDP for Remote Command Line and GUI access respectively.

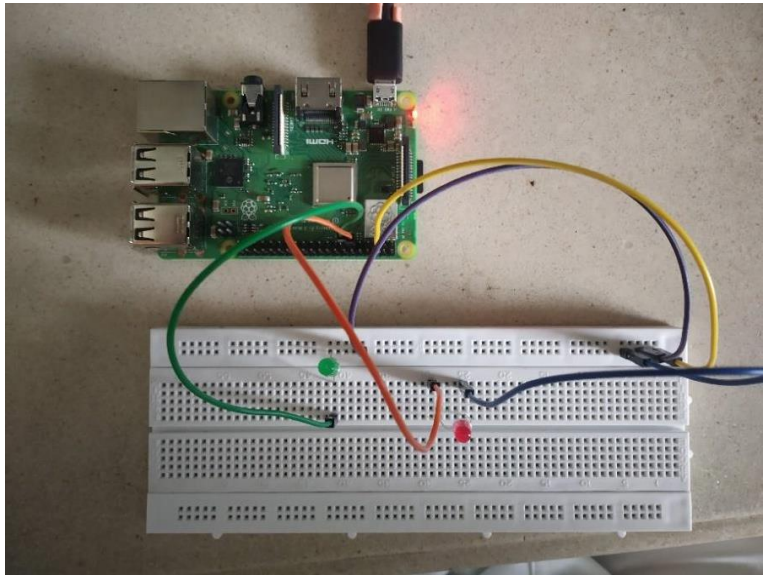
GPIO Pins

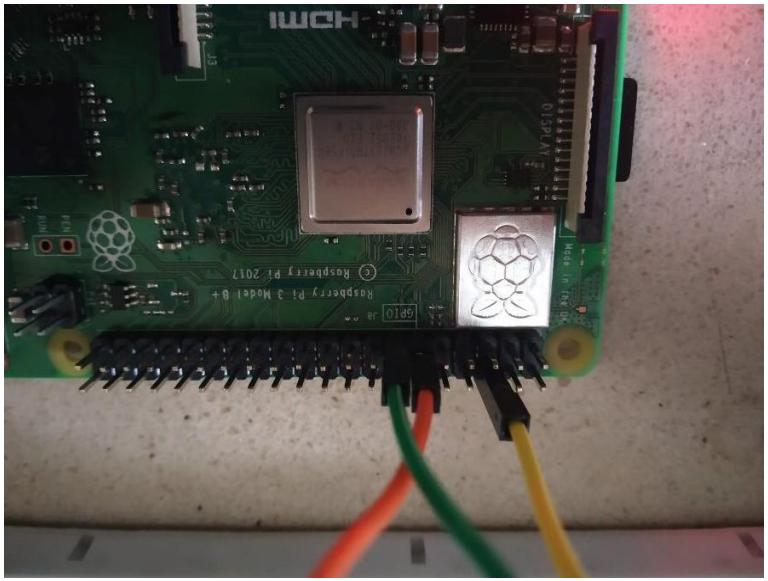

3V3 power 1 2 5V power
GPIO 2 (SDA) 3 4 5V power
GPIO 3 (SCL) 5 6 Ground
GPIO 4 (GPCLK0) 7 8 GPIO 14 (TXD)
Ground 9 10 GPIO 15 (RXD)
GPIO 17 11 12 GPIO 18 (PCM_CLK)
GPIO 27 13 14 Ground
GPIO 22 15 16 GPIO 23
3V3 power 17 18 GPIO 24
GPIO 10 (MOSI) 19 20 Ground
GPIO 9 (MISO) 21 22 GPIO 25
GPIO 11 (SCLK) 23 24 GPIO 8 (CE0)
Ground 25 26 GPIO 7 (CE1)
GPIO 0 (ID_SD) 27 28 GPIO 1 (ID_SC)
GPIO 5 29 30 Ground
GPIO 6 31 32 GPIO 12 (PWM0)
GPIO 13 (PWM1) 33 34 Ground
GPIO 19 (PCM_FS) 35 36 GPIO 16
GPIO 26 37 38 GPIO 20 (PCM_DIN)
Ground 39 40 GPIO 21 (PCM_DOUT)

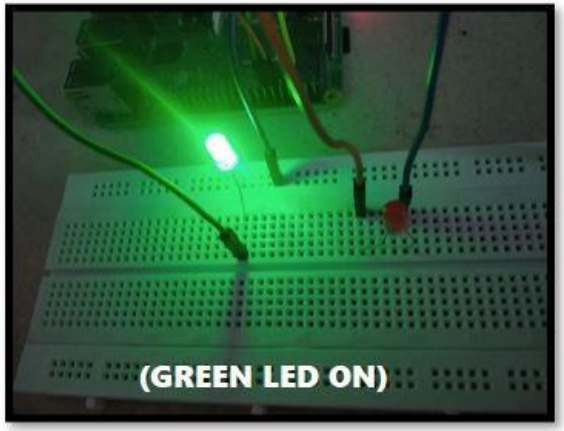

3.3

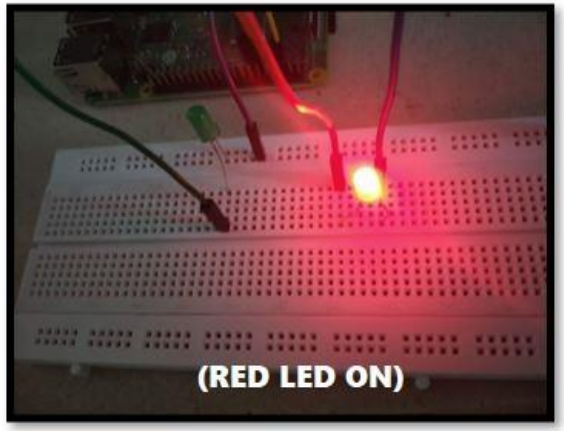
Part 1: Smart Lights (LEDs)

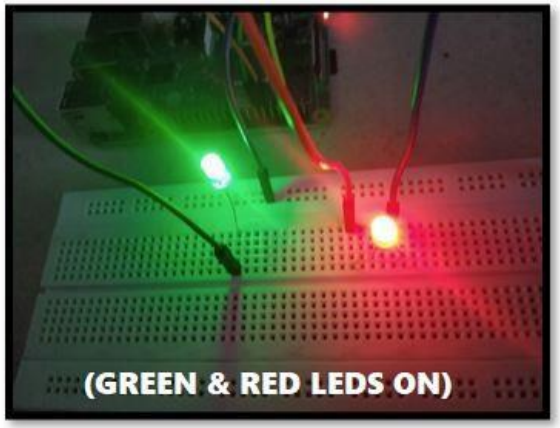
- Basic LED module connected to a Raspberry Pi can easily control the status (ON / OFF) of the LED, its behaviors (BLINKING) and its illumination (BRIGHTNESS) from simple code. These help in Smart IoT Lights implementation.

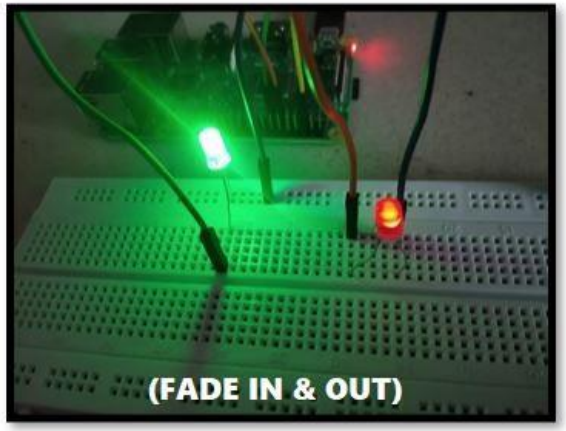








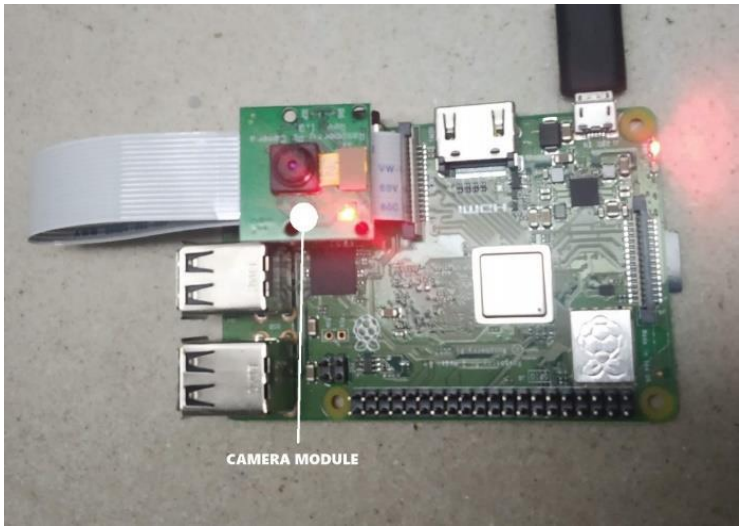




Blinking Lights could not be captured on pictures

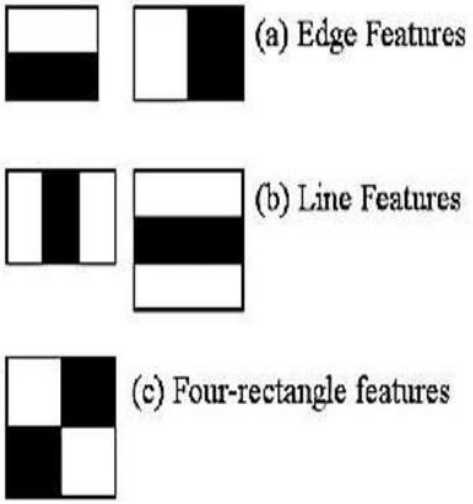
Part 2: Face Detection (Camera Module)

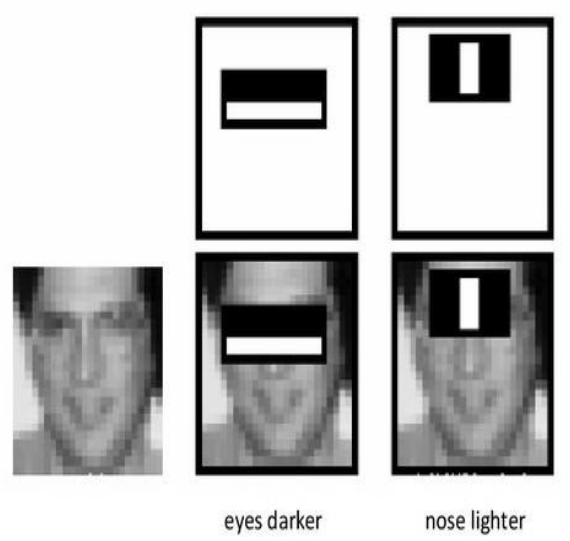
- The aim of this part is to connect the camera module to capture pictures and detect the no. of faces. The execution is done using Haar Cascade methodology. Using the *haarcascade_frontalface_default.xml*, we will attempt to detect the faces of persons in this use-case




```
>>> %Run face_detection.py
No. of Faces found: 1
```

Haar-Cascade Methodology





1	2	2	4	1
3	4	1	5	2
2	3	3	2	4
4	1	5	4	6
6	3	2	1	3

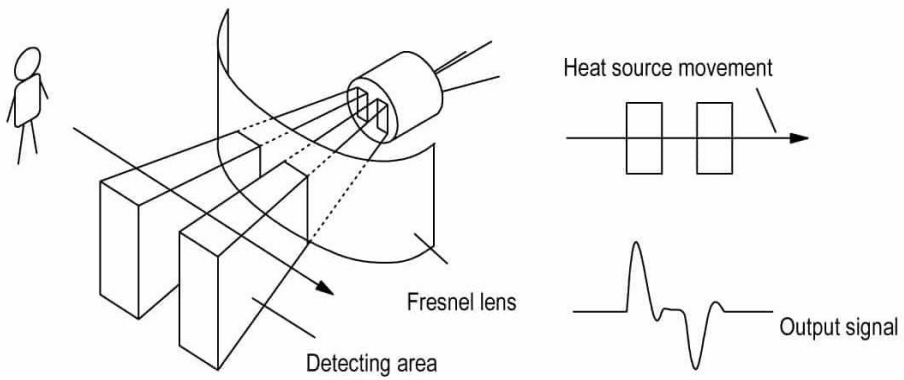
input image

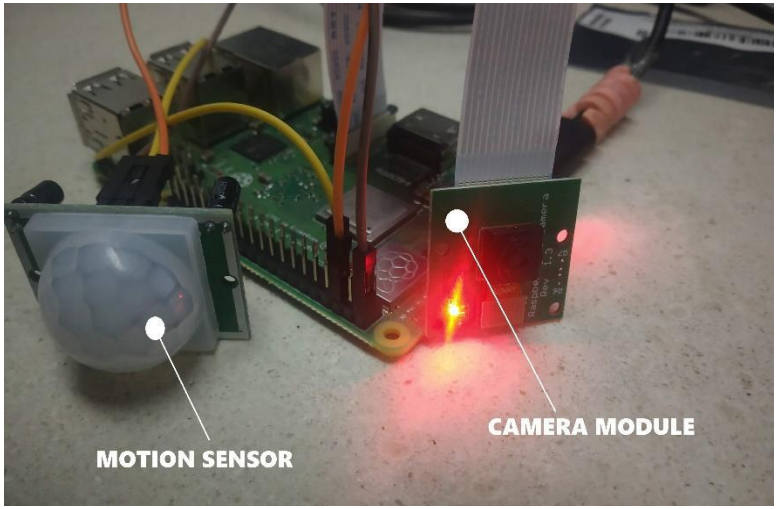
0	0	0	0	0	0
0	1	3	5	9	10
0	4	10	13	22	25
0	6	15	21	32	39
0	10	20	31	46	59
0	16	29	42	58	74

integral image

Part 3: Security System (PIR Motion Sensor)

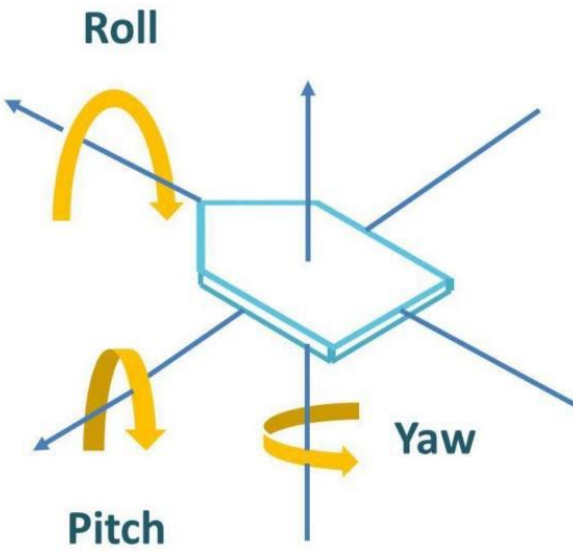
- With the help on a camera and a motion sensor connected to a Raspberry Pi, it is possible to capture images when motion is detected. These systems act as security systems to help prevent from theft and burglary.

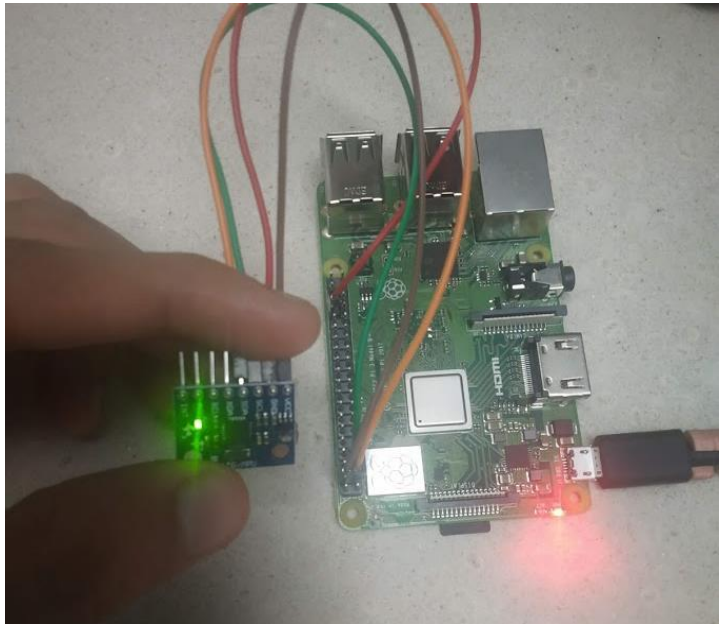


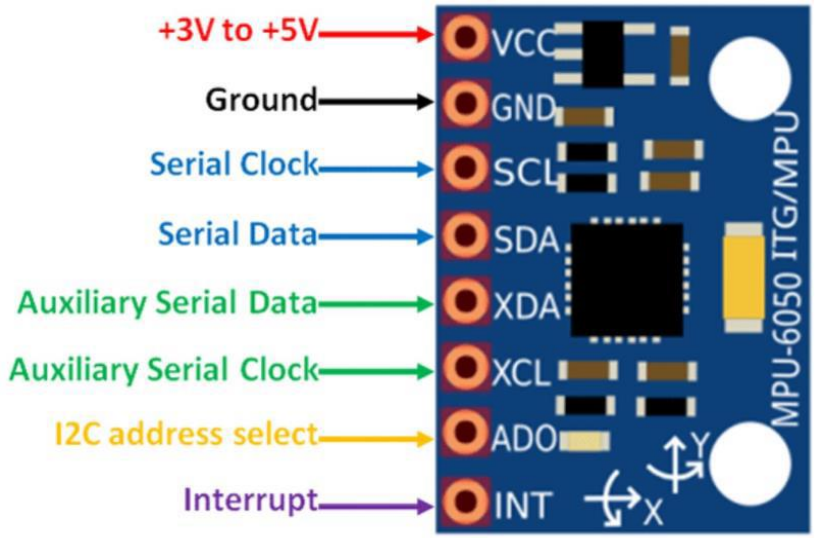


Part 4: Gyroscope System

- The MPU6050 is a Micro Electro-Mechanical Systems (MEMS) with a three-axis accelerometer and three-axis gyroscope. This allows us to measure a system's or object's acceleration, velocity, direction, displacement etc.








```
Temp : 36.53

Acc X : 0.0
Acc Y : 0.0
Acc Z : 0.0

Gyro X : 0.0
Gyro Y : -5.030534351145038
Gyro Z : 6.297709923664122

--------------------------------
Temp : 35.353529411764704

Acc X : -6.433219860839843
Acc Y : 2.7246014892578123
Acc Z : 7.5153990112304685

Gyro X : 1.6641221374045803
Gyro Y : -3.8091603053435112
Gyro Z : 0.12213740458015267

--------------------------------
Temp : 35.49470588235294

Acc X : -6.399701037597656
Acc Y : 2.6336218261718747
Acc Z : 7.314286071777343

Gyro X : 1.549618320610687
Gyro Y : -2.5419847328244276
Gyro Z : -1.465648854961832
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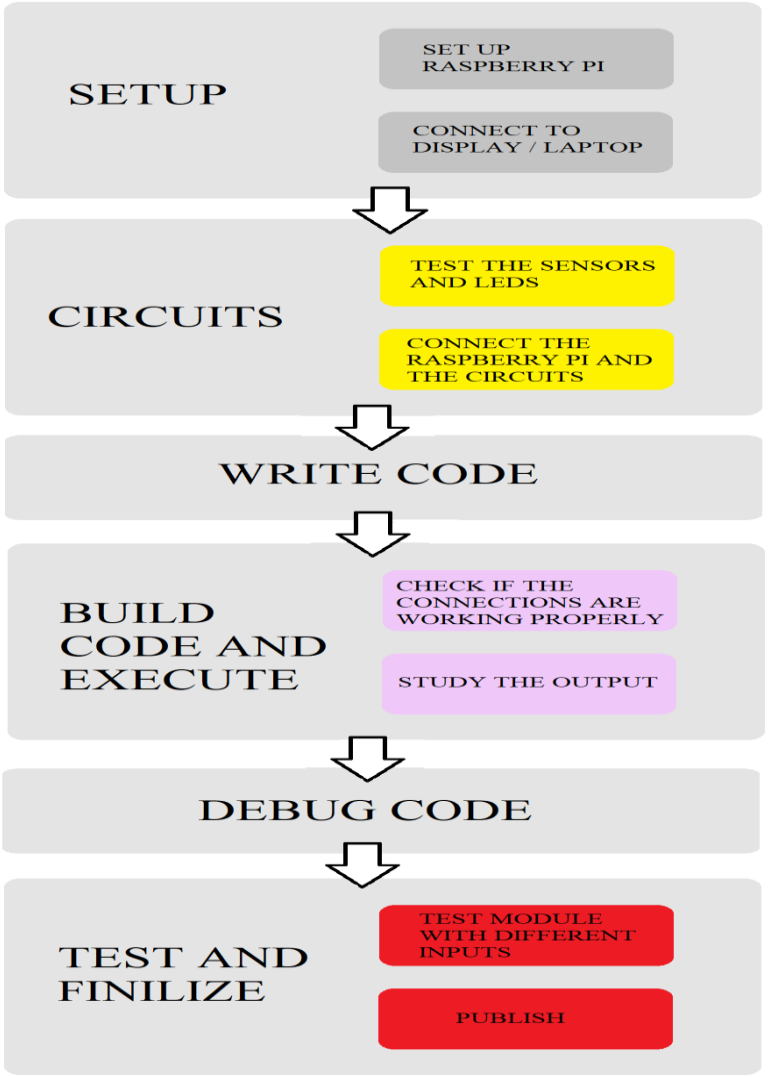
Development Cycle



Learning and Experience

- After the completion of my **8 weeks** internship tenure, I have learnt basic Python and Vision Detection concepts. I have also gained insights about the working and use of the Raspberry Pi with different components as addition.
- The technical internship at PBOPlus Ltd has been a professionally satisfying experience. The opportunity helped me to greatly expand my knowledge base and gain insights about working in the Robotics domain. It enabled me to interact with individuals displaying profound intellect and professionalism.
- Work from Home has been a challenge for me during the internship because of the work including hardware but being able to maximize my output has also been a challenge I have learnt from.

Comments and Future Scope

- After the completion of my TIP internship tenure, I have understood how different groups and roles integrate together to deliver the final required task.
- These mini projects and components of actual complex robotic machines. Therefore, to incorporate and combine all these small modules together to form a better and more reliable integrated machine will be an advancement and future scope.
- Also, to upgrade the sensors to the ones with high precision and accuracy is a must. This adds more reliability and gives more control to the programmer to achieve the required targets through these projects.
- This internship has led me to integrate hardware in my next project with higher complexity.

THANK YOU !

Questions ?