ENERGY SPARING SMART CABIN SYSTEM
USING YOLO ALGORITHM AND DEEP
LEARNING ON RASPBERRY PI

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Abstract

- Smart cabins system work by detecting the presence of humans inside the cabin using YOLO algorithm.

- It automates the lights/ electric appliances on detecting the presence of human inside the cabin/room.

- They are more efficient than previous home automation techniques using PIR sensor.

Introduction

- In commercial buildings, many times the offices and cabins have electrical devices left switched on though people were not present in the room and this is a common occurrence in all our daily lives too.
- So this becomes of utmost importance that this energy being wasted is conserved as much as possible.
- The proposed energy saving home /cabin automation system could be used to detect the presence of a person inside the cabin and automatically adjust the state of electrical appliances to reduce power consumption.

Project Motivation

There are several previous works done on Home Automation systems using Raspberry Pi and PIR sensors.

Many among them are related to home security, but are either very little related to electricity conservation or are not efficient enough.

Features

- Detect the presence of human inside the room.

- Automate the lights according to presence of human inside the room.

- Using PIR sensor to switch on lights for some time so that our camera can detect person in case of low lights.
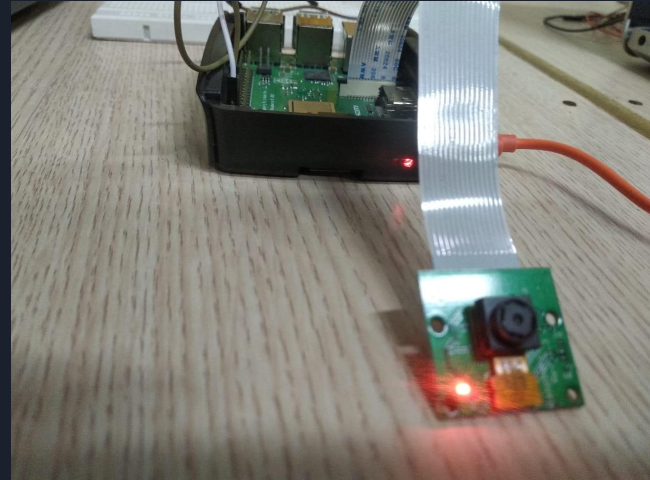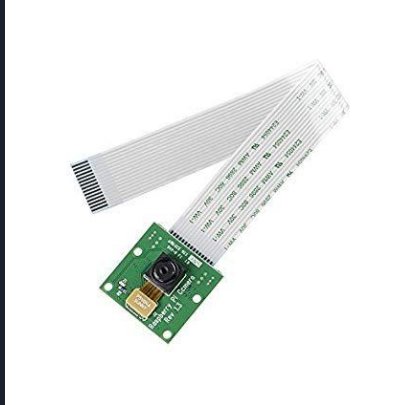
Tools Description

Raspberry Pi

The Raspberry Pi is low cost small sized computer CPU that plugs in to screen and by the use of keyboard and mouse, it enables the computing opportunity.

Pi Camera Module

The Raspberry Pi camera is a high quality 5 megapixel camera compatible with raspberry pi.
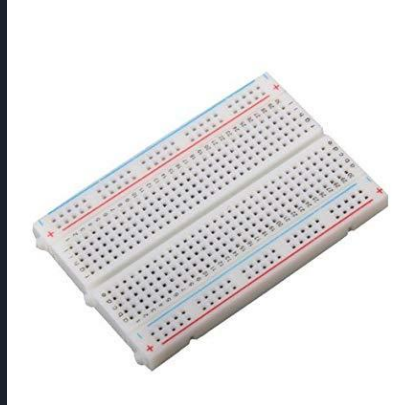
Pir Sensor

A passive infrared sensor(PIR) is an electronic sensor the read infrared radiations and output signal on detecting motion of an object in its file of view.

Breadboard

A Breadboard is an electronic board that is used to design and test the circuit.

LED

A light emitting diode(LED) is a semiconductor that emits lights of different colors when passed electricity to it.
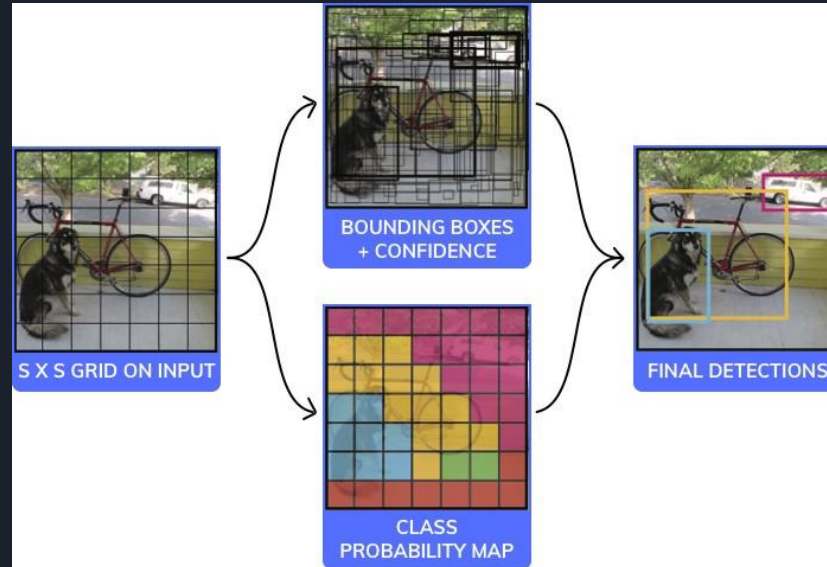
Register

 Resistors are the components used to reduce the flow of current in the circuit.

Algorithm Used

- **You Only Look Once (YOLO)**
  - YOLO is an extremely fast real time multi object detection algorithm. YOLO stands for You Only Look Once.
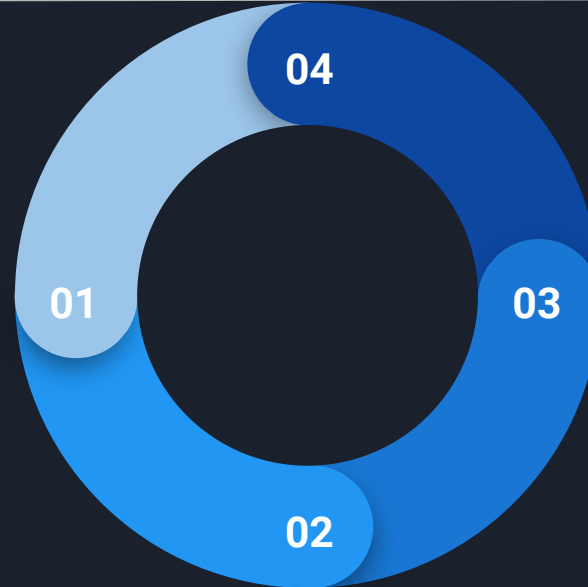
Working Process

Lights on for 20 seconds

PIR sensor detecting the movement of the door.

Object detection

If a person has entered the room or not ?

04

01

03

02

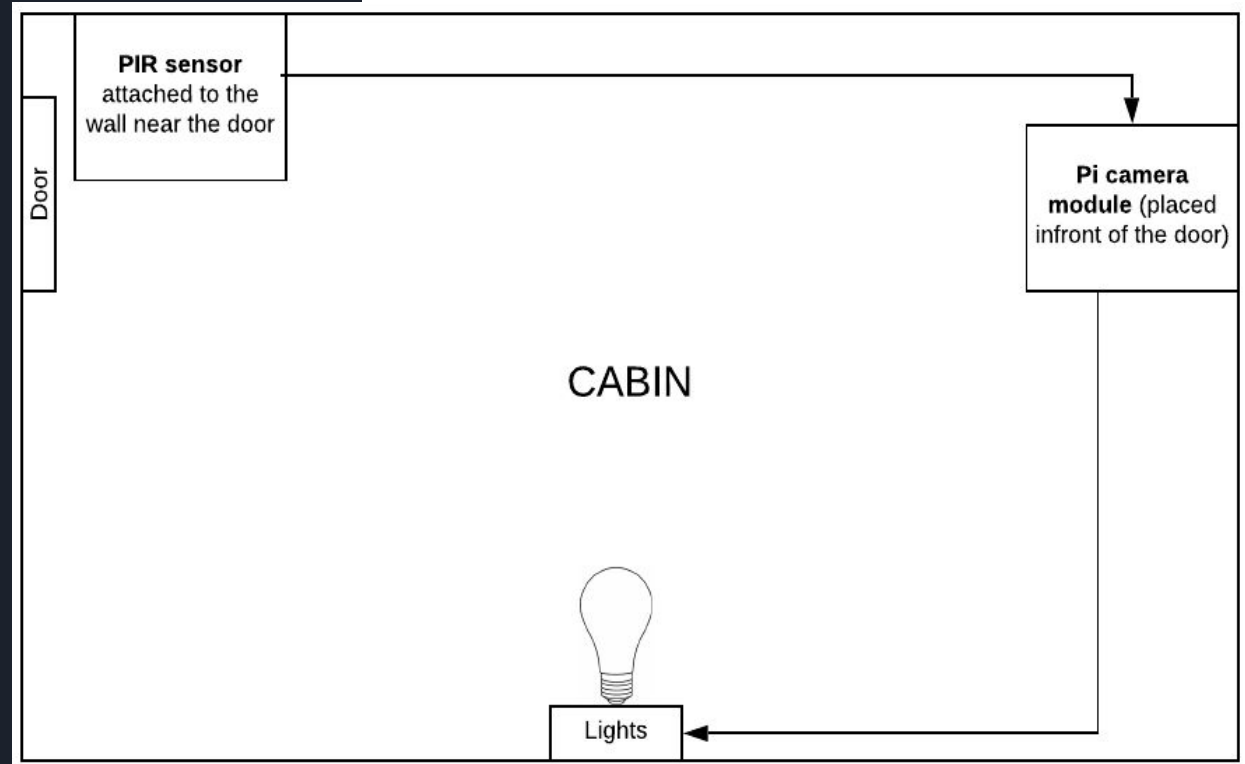**If no-**

Lights go off.

If yes-

Lights will stay switched on.

Working-

- The basic working would comprise of PIR sensor detecting the movement of the door, which would allow Raspberry Pi to switch on the light for a specified time, say 20 seconds.
- This would be enough for the camera attached with Raspberry Pi to detect if a person has entered the cabin or not.
- If yes, then the system would keep the lights on until the person is present in the room.
- The lights then go off when the person leaves the cabin.
- If no, then system would switch off the lights.

Circuit Diagram

PIR sensor
attached to the
wall near the door

Door

Pi camera
module (placed
infront of the door)

CABIN

Lights

Progress made so far

- At first we implemented YOLO on laptop, but problem was latency and speed (frames per second).
- Then we tried to implement tiny-version of yolo which instead of classifying 9000 objects only classify 20 objects.
- We also made several installations of OS on Raspberry Pi and checked the working of camera of Raspberry Pi by capturing some photos.
- Installed the deep learning libraries on Raspberry Pi.
- Implemented the Object Detection Model on Raspberry pi.
- Made the Raspberry Pi model to switch on the lights and bulbs on detecting a person.
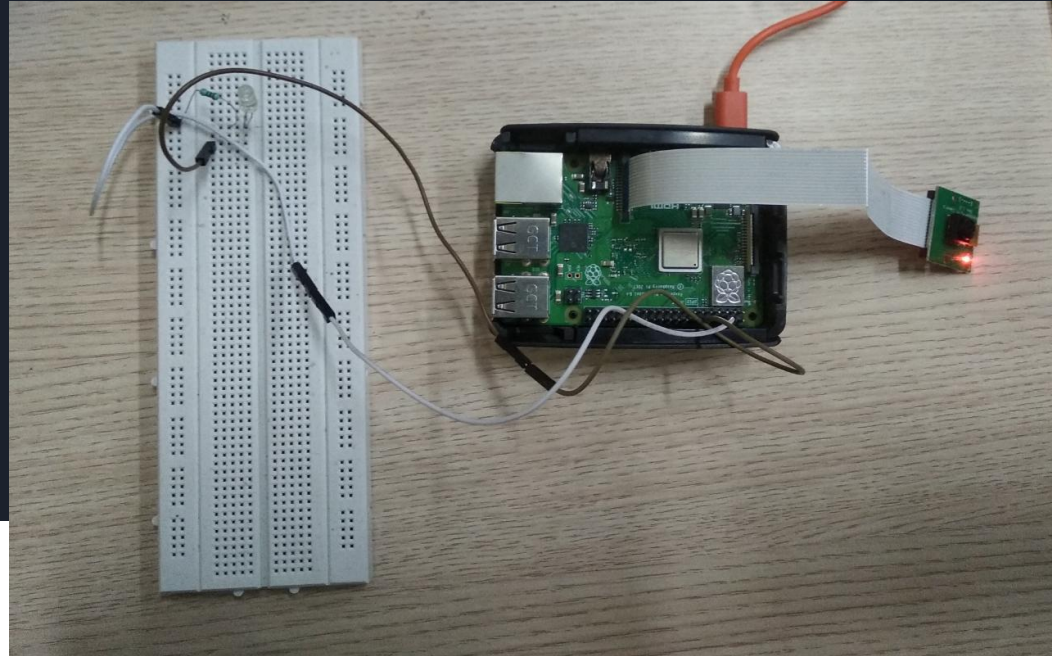- Implemented this system as a room/cabin setting.

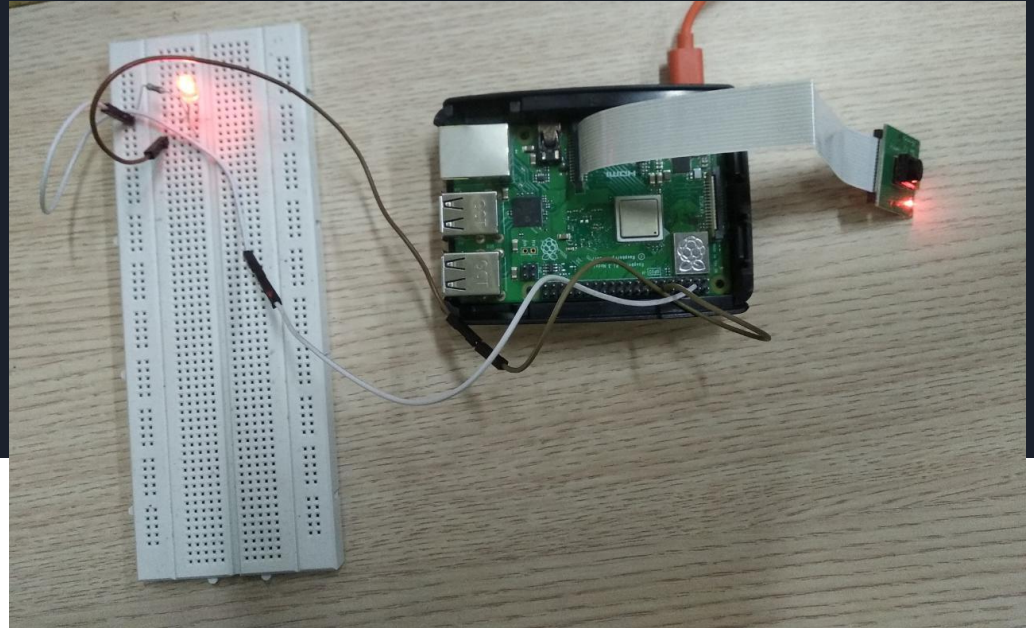# Implementation results

When no human is detected via the camera.

LED off when no human is detected.

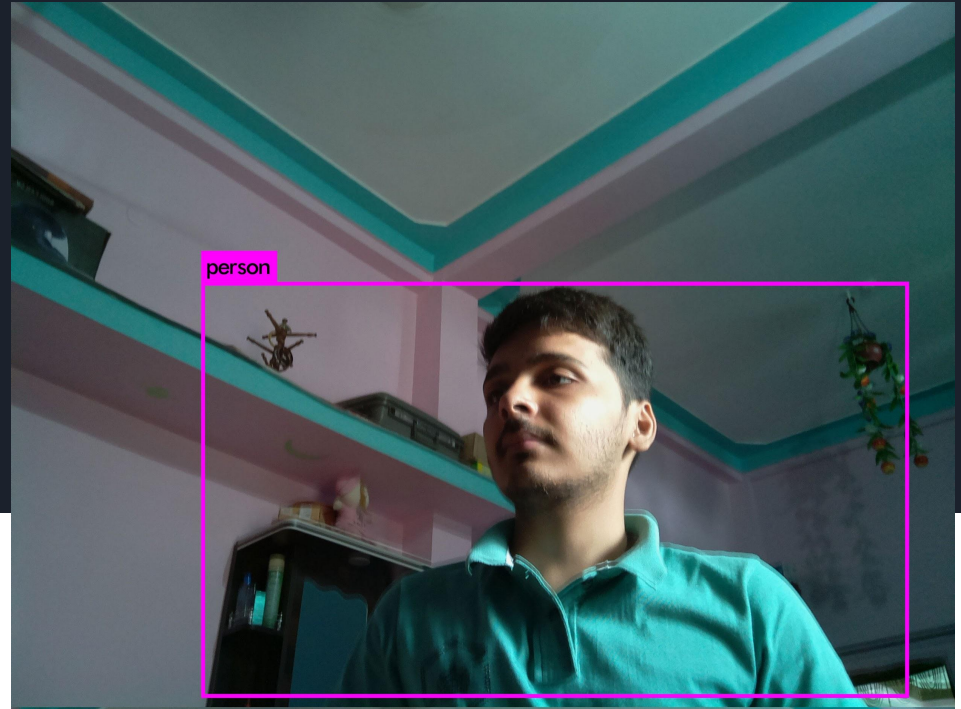When a human is detected via the camera.

LED goes on when human is detected.

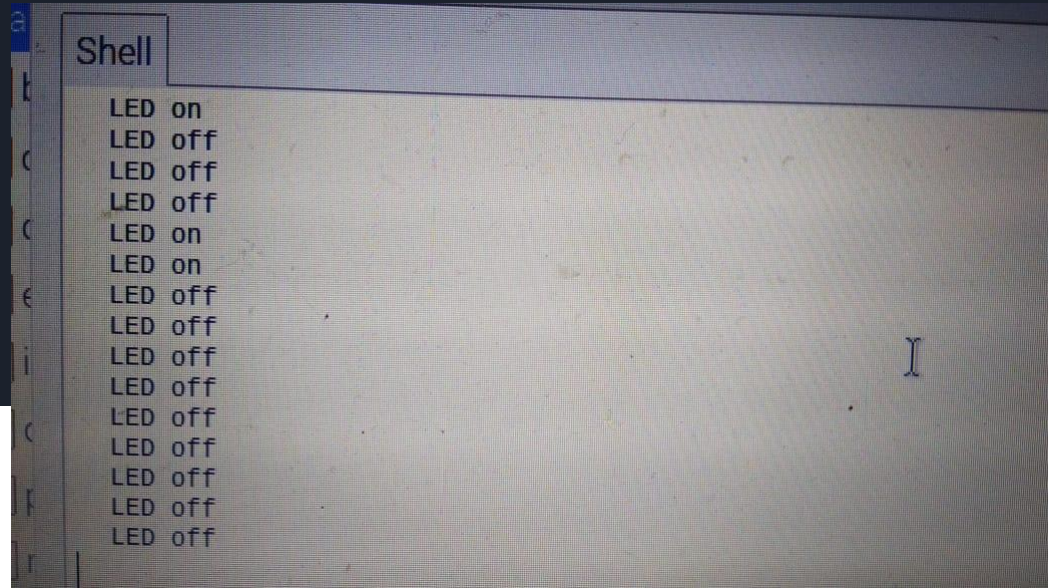# Screenshots from the project

Human detection done by YOLO algorithm.

Person detected by camera module.

Output of the LED on Pi IDE

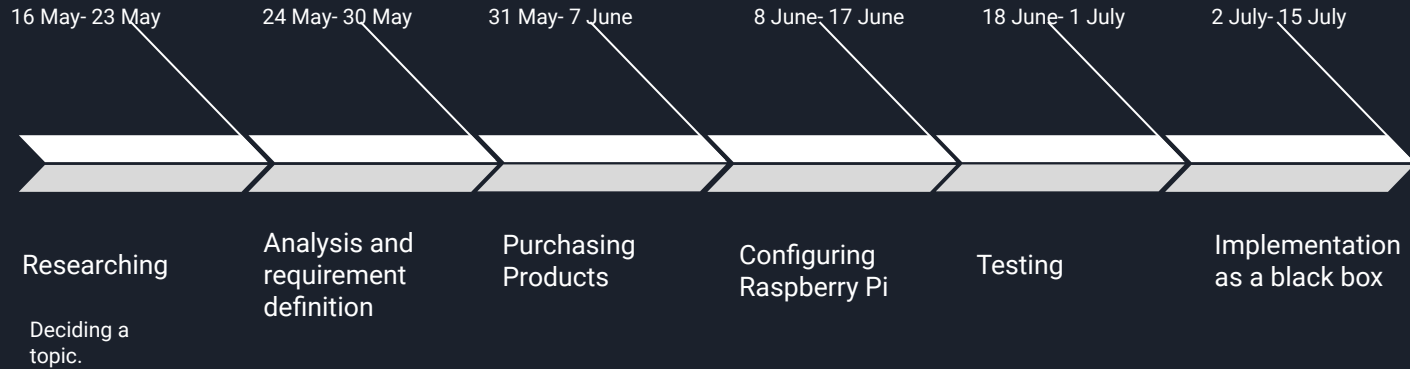Every 7 seconds an image is processed and evaluated and the status of LED is displayed as in the given figure.

Project timeline

16 May- 23 May

24 May- 30 May

31 May- 7 June

8 June- 17 June

18 June- 1 July

2 July- 15 July

Researching

Deciding a
topic.

Analysis and
requirement
definition

Purchasing
Products

Configuring
Raspberry Pi

Testing

Implementation
as a black box

References

- B. Kaur, P. K. Pateriya and M. K. Rai, "An Illustration of Making a Home Automation System Using Raspberry Pi and PIR Sensor", *in Proc. International Conference on Intelligent Circuits and Systems (ICICS), Phagwara, 2018,* pp. 439-444.
- A. Pawar and V. M. Umale, "Internet of Things Based Home Security Using Raspberry Pi", *in Proc. Fourth International Conference on Computing Communication Control and Automation (ICCUBEA), Pune, India, 2018,* pp. 1-6.
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THANK YOU !