Project Lab Automation using Raspberry PI
(ETOK p373872 module)

Aim: To control the devices of home or a classroom or laboratory through internet protocols or an app in the mobile.

Purpose: The purpose of this Project is to build a lab automated lamp controlled remotely from a mobile phone and/or controlled by Motion Sensor as a second option providing the customer more options.

Customer Feature List: The Customer will be able to turn on/off a Lamp or any end appliance connected to the Relay with the click of a button on a Smartphone application at will. This will provide a quick and more efficient way to turn off/on any appliance so long as it is connected to what we call a relay. Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit. As relay diagrams show, when a relay contact is normally open, there is an open contact when the relay is not energized. The Customer will also be able to set the sequence of the Lamp turning on/off to be automated when someone is walking by with the touch of a button also, which will activate a Sensor that is dedicated to motion called a PIR Sensor (Passive Infrared Sensor). A PIR Sensor is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors.

Introduction:

IoT

The Internet of Things (IoT) describes the network of physical objects— "things"—that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. These devices range from ordinary household objects to sophisticated industrial tools. IoT or internet of things is an upcoming technology that allows us to control hardware devices through the internet. Here we propose to use IoT in order to control home appliances, thus automating modern homes through the internet.
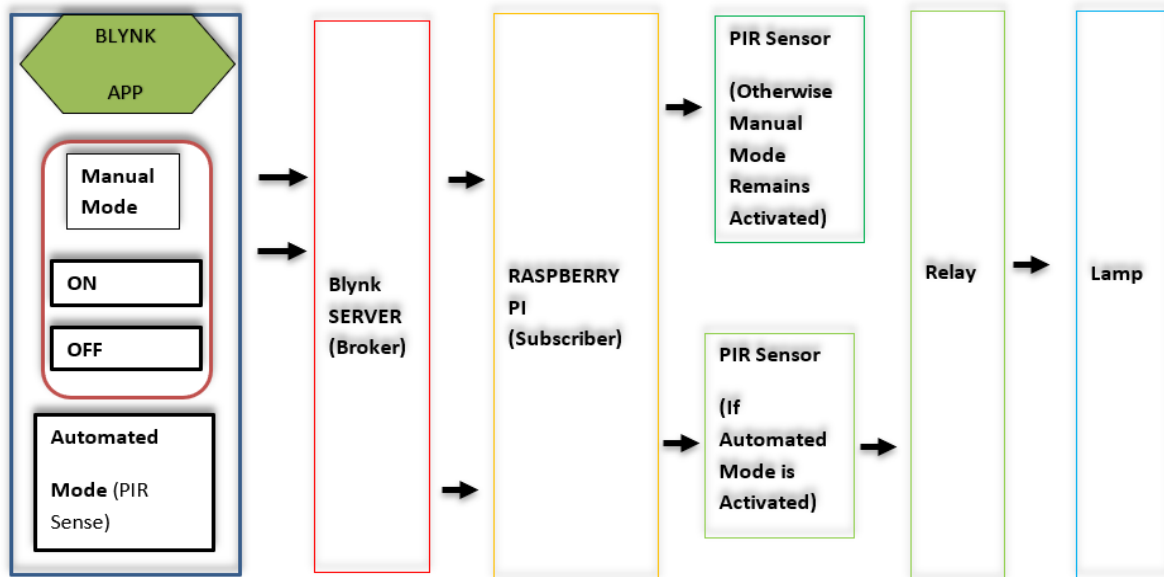

Raspberry Pi

Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation in association with Broadcom. The Raspberry Pi project originally leaned towards the promotion of teaching basic computer science in schools. The Raspberry Pi hardware has evolved through several versions that feature variations in the type of the central processing unit, amount of memory capacity, networking support, and peripheral-device support.
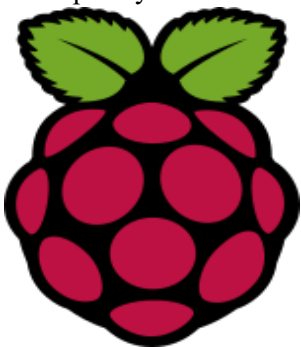
Major features in this Project include:

- Switching ON/OFF the Lamp
- Smartphone interface
- Blynk Server
- Wi-Fi
- Blynk App
- PIR Sensor

Context Diagram

Systematic Functionality:

When an ON signal is published, the data (1 Binary Signal) is sent to the Blynk Server, which receives it and send it to the virtual pin event in the code on the raspberry pi which will trigger the relay which is connected via GPIO Pin which will then turn on the Lamp. When an OFF signal is published, the data (0 Binary Signal) is sent to the Blynk Server, which receives it and sends to the virtual pin event in the code on the raspberry pi and turn the relay which is connected via GPIO Pin back off. This turns the Lamp off as a result because there's any voltage passing through that specified pin. My Application contains a Token key of my Blynk Account, this is how it knows exactly what to connect to. The events are written in JavaScript in which my virtual pins that listen for once it's connected to the Server once the program is run. The PIR Sensor works differently, I've written it in Python and that is called by the JavaScript program using by using a module called a 'child process'. Since Node.js runs in a single thread, the child process module allows to me to create a child processes in Node.js. Those processes can easily communicate with each other using a built-in messaging system. There are four different ways to create a child process in Node: spawn(), fork() , exec() , and execFile(), but you can read more on it in which you will find a link provided on my Readme.md File.

What will my Project depend on?

My Project will depend on its performance and latency in terms of getting a reply from the Blynk Server and publishing the data values the subscriber (raspberry pi). It will also depend on the connectivity such as the input signals that is passed from the Smartphone.

Language used:

JavaScript, Python

Python code:

- Sensor reads in Motion Data
- While process is true, turn on Relay
- Python Based Program

```python
import RPi.GPIO as GPIO
import time
GPIO.setwarnings(False)
GPIO.setmode(GPIO.BCM)
GPIO.setup(21,GPIO.IN)  #Read input from PIR motion sensor
GPIO.setup(24,GPIO.OUT) #RED LED
GPIO.setup(25,GPIO.OUT) #GREEN LED
GPIO.setup(4,GPIO.OUT)  #RELAY
try:
        while True:
            input=GPIO.input(21)
            if input==0:  #When output from motion sensor is LOW
                    print("No intruders",input)
                    GPIO.output(24,1)  #RED LED LIVE
                    GPIO.output(25,0)  #GREEN LED IS OFF
                    GPIO.output(4,0)   #RELAY IS OFF
                    time.sleep(0.1)
            elif input==1:  #When output from motion sensor is HIGH
                    print("Intruder detected",input)
                    GPIO.output(24,0)  #RED LED IS OFF
                    GPIO.output(25,1)  #GREEN LED IS LIVE
                    GPIO.output(4,1)   #RELAY IS LIVE
                    time.sleep(0.1)
finally:
        GPIO.cleanup()
```

RELAY

❖ Electrically Operated Switch
❖ Many operate using an electromagnetic switch
❖ Other use solid-state relays

Node.js Code for Relay Switch

```
var Gpio=require('onoff').Gpio;//include onoff to interact with the
GPIO
var LAMP = new Gpio(4, 'out'); /*use GPIO pin 2, and specify that it
is output*/
var Blynk = require("blynk-library");
var AUTH = 'INSERT-YOUR-TOKEN-HERE';
var blynk = new Blynk.Blynk(AUTH);
var v0 = new blynk.VirtualPin(0);
 v0.on('write', function(param){
if(param[0] ==='1')
    LAMP.writeSync(1); //1 (turn LAMP ON)
else LAMP.writeSync(0);
console.log('V0:',param[0]);
})
//    LAMP.writeSync(0); //set pin state to 0 (turn LED off)
```

Node.js Code for Relay Switch & python script launch

▪ ON/OFF controls the Relay
▪ Activate/Deactivate controls the PIR Sensor
▪ Node.js Based Program
▪ Running Child process module to launch Python Script (PIR Sensor)

Code:

```
var util = require("util");
var spawn = require("child_process").spawn;
//var process = spawn('python',["pirTest.py"], {detached: true});
var Gpio = require('onoff').Gpio; //include onoff to interact with the GPIO
var RELAY = new Gpio(4, 'out'); //use GPIO pin 7 (ON BOARD) and specify that
it is this pin
var SENSORSTATE = new Gpio(21, 'out'); //sets the state of the PIR Sensor to
0 ... only necessary if the PIR DOESNT SHUT DOWN ON COMMAND
var Blynk = require("blynk-library");
var AUTH = 'INSERT-YOUR-TOKEN-HERE';
var blynk = new Blynk.Blynk(AUTH);
```

```
var v0 = new blynk.VirtualPin(0);
var v1 = new blynk.VirtualPin(1);
 v0.on('write', function(param){
if(param[0] ==='1')
    RELAY.writeSync(1); //1 (turn LAMP ON)
else RELAY.writeSync(0); //0 (turn LAMP OFF)
console.log('V0:',param[0]);
})
var process = spawn('python',["pirTest.py"], {detached: true});
 v1.on('write', function(param){
if(param[0] ==='1')
    spawn('python',["pirTest.py"]);
    RELAY.writeSync(0);
//var process = spawn('python',["pirTest.py"], {detached: true});
//else(param[0] ==='0')
if(param[0] ==='0')
     // process.kill(-'python',["pirTest.py"], {detached: true});
      process.kill(-process.pid);
console.log('V1:',param[0]);
})
```

Technology/Tools:

- o Raspberry Pi 3B board
- o SD Card
- o Raspbian Operating System
- o 1 x 5V Relays
- o 1 x Lamp
- o 2 x Resistors 150 to 220 ohms (Optional)
- o 2 x Different Colour LEDs (Optional)
- o Alarm Speaker (Optional)
- o Wi-Fi
- o PIR Motion Sensor
- o Smartphone Device
- o Jumper Wires
- o Raspberry Pi 3 Model B
- o Blynk Application

Major Components in Use
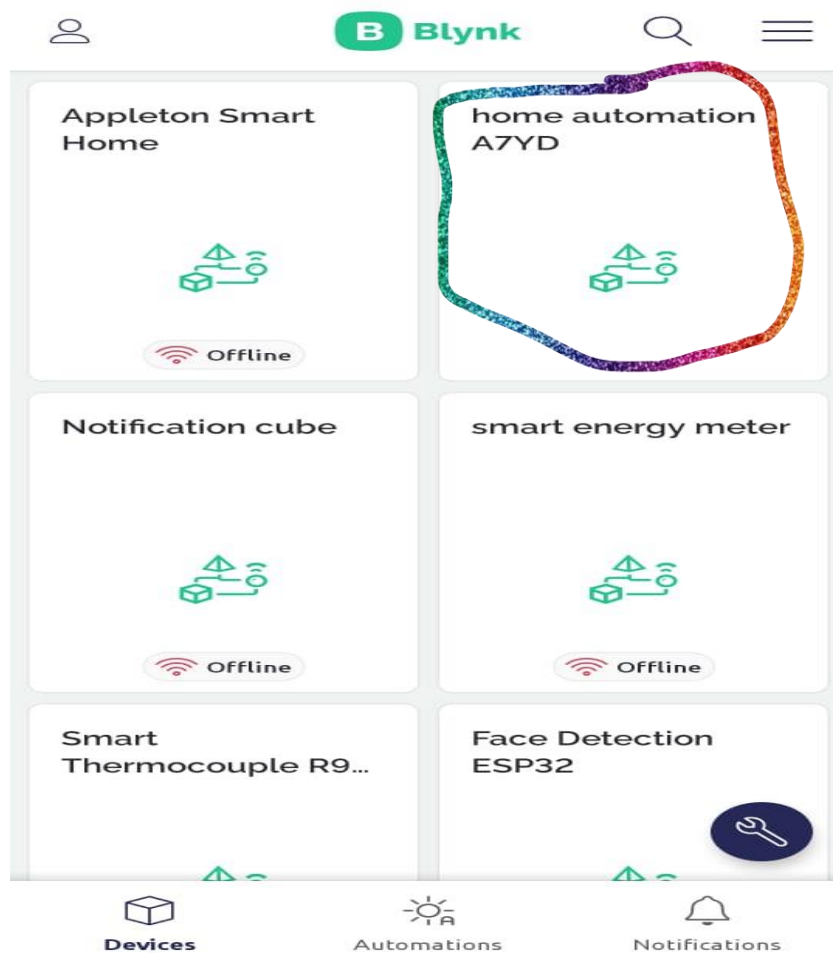
- • Blynk Application
- • Raspberry Pi

Process
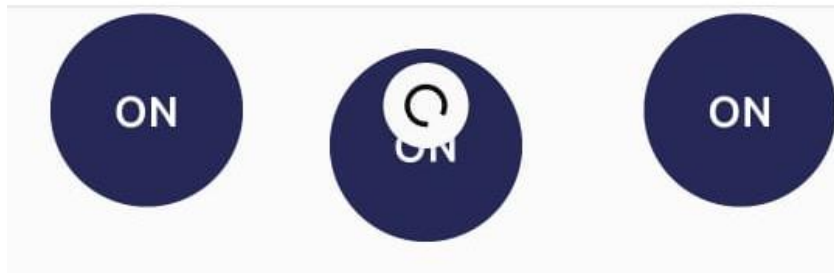
Step-1   Open the Blynk IoT Application.
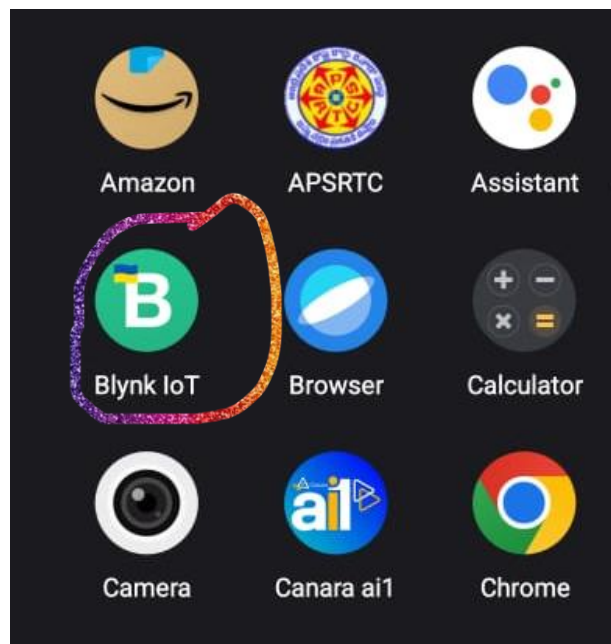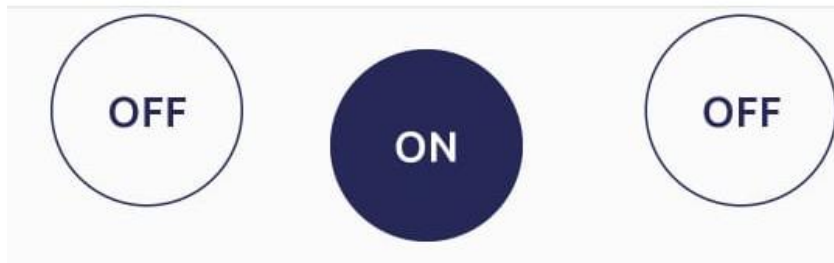

Step-2   Now open home automation A7YD

Step-3   Now you can operate whether you want to off or on

✕ **Home Automation A7YD**   ∘∘∘

ON   Q
         ON   ON

✕ **Home Automation A7YD**   ∘∘∘

OFF   ON   OFF

Photos: