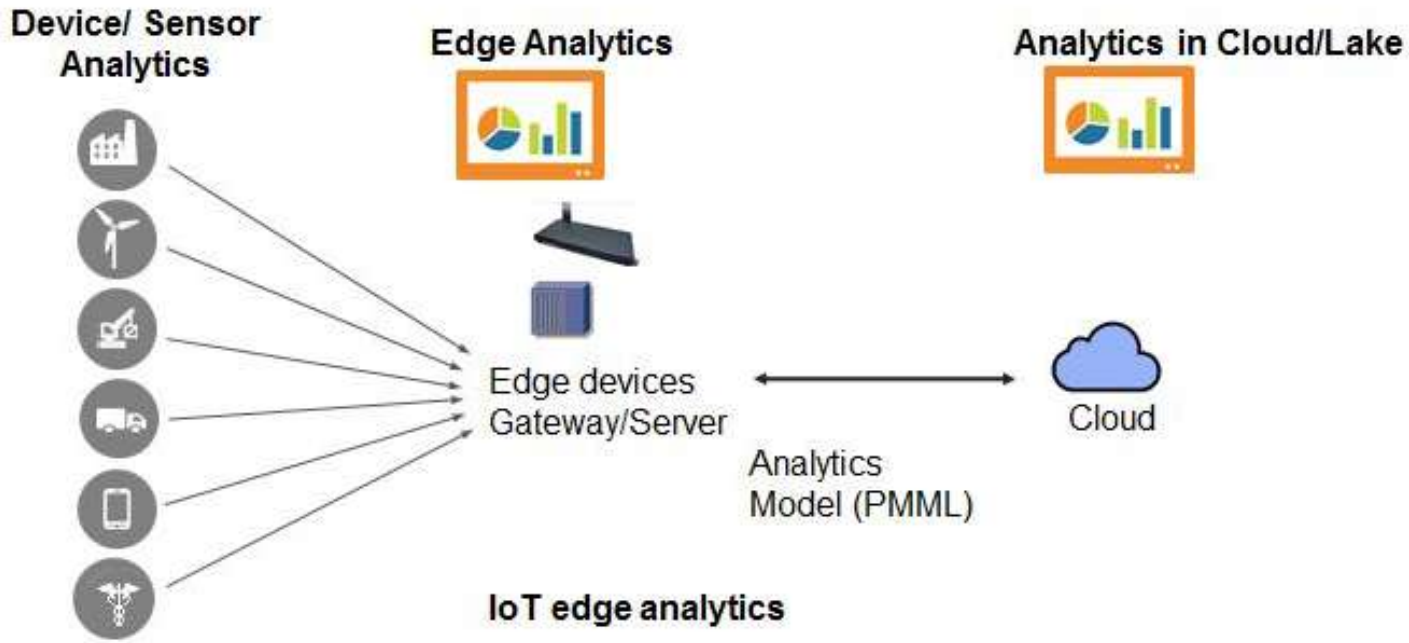
Day 1 :

IoT - Overview
IoT Gateways - Intel & ARM Architecture
Raspberry pi 3

Hands On :

Start Up – HTML , PHP, Python programming
MySQL Database Connection - Python
Configuration – Wi-Fi , Ethernet
Sending Email ,Tweet & SMS
LED Blinking – python, Webserver

Introduction - IoT



IoT edge analytics

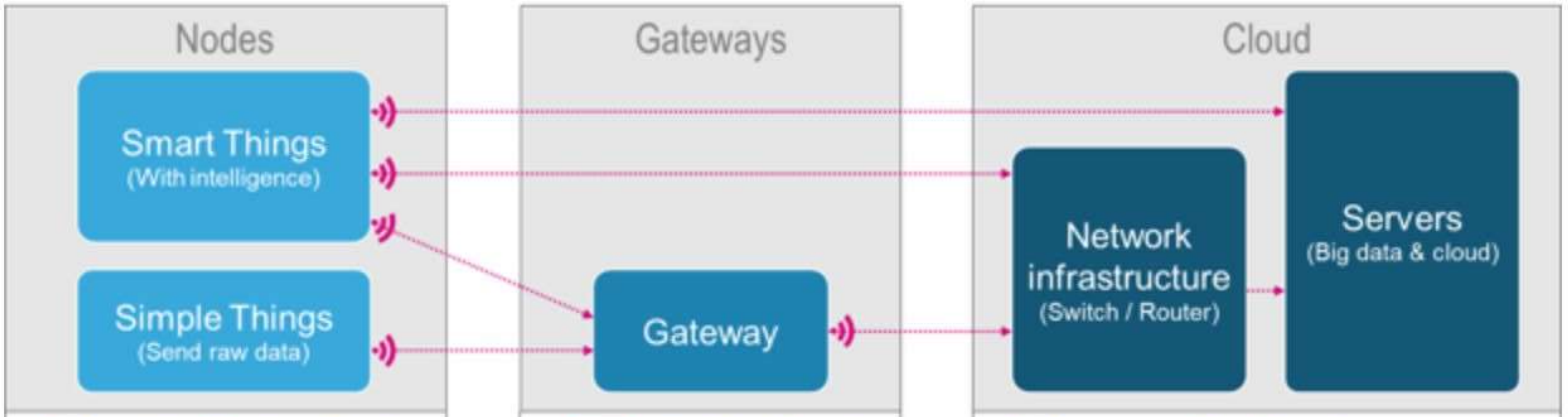
Technology & Qualities :

- Software Aspects
- Hardware Aspects
- Cloud Aspects


Hardware design and integration
Embedded software development
Communications services and networking
Ideas
IoT platforms and cloud services
Business strategy
Vision
Enterprise IT integration
Security / privacy
Ancillary apps, e.g., on mobiles

Layers :

- Smart/Simple things with Sensors & Actuators
- Cloud Platform
- Gateways


Nodes
Smart Things
(With intelligence)
Simple Things
(Send raw data)
Gateways
Gateway
Cloud
Network
infrastructure
(Switch / Router)
Servers
(Big data & cloud)

Wireless Protocols :

- Zigbee
- Wi-Fi
- Bluetooth
- LoRaWAN
- GSM/GPRS
- Thread

IoT Cloud Platform :

- IBM BlueMix & Watson
- Amazon Web Services
- ThingSpeak
- ThingWrox
- Microsoft Azure

IoT Gateways

Intel Architecture :

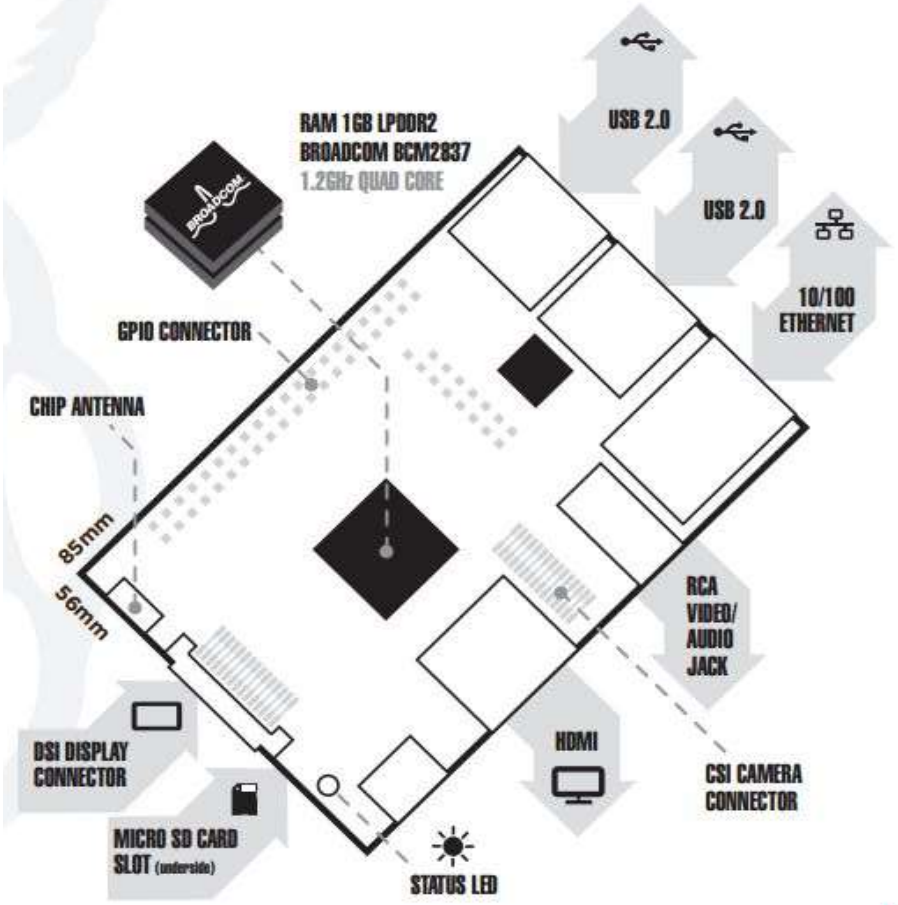
- Intel Galileo / Intel Edison
- SIMATIC IoT2000 series
- AAEON
- NEXCOM
- ADLINK

ARM Architecture :

- Broadcom
- Texas Instruments
- ST Micro electronics
- QUALCOMM
- NX

Raspberry Pi3

Raspberry Pi3



Raspberry Pi3

Specifications

Processor	Broadcom BCM2387 chipset. 1.2GHz Quad-Core ARM Cortex-A53 802.11 b/g/n Wireless LAN and Bluetooth 4.1 (Bluetooth Classic and LE)
GPU	Dual Core VideoCore IV® Multimedia Co-Processor. Provides Open GL ES 2.0, hardware-accelerated OpenVG, and 1080p30 H.264 high-profile decode. Capable of 1Gpixel/s, 1.5Gtexel/s or 24GFLOPs with texture filtering and DMA infrastructure
Memory	1GB LPDDR2
Operating System	Boots from Micro SD card, running a version of the Linux operating system or Windows 10 IoT
Dimensions	85 x 56 x 17mm
Power	Micro USB socket 5V1, 2.5A

Connectors:

Ethernet	10/100 BaseT Ethernet socket
Video Output	HDMI (rev 1.3 & 1.4 Composite RCA (PAL and NTSC)
Audio Output	Audio Output 3.5mm jack, HDMI USB 4 x USB 2.0 Connector
GPIO Connector	40-pin 2.54 mm (100 mil) expansion header: 2x20 strip Providing 27 GPIO pins as well as +3.3 V, +5 V and GND supply lines
Camera Connector	15-pin MIPI Camera Serial Interface (CSI-2)
Display Connector	Display Serial Interface (DSI) 15 way flat flex cable connector with two data lanes and a clock lane
Memory Card Slot	Push/pull Micro SDIO

GPIO Diagram

Pin#	NAME		NAME	Pin#
01	3.3v DC Power		DC Power 5v	02
03	GPIO02 (SDA1 , I²C)		DC Power 5v	04
05	GPIO03 (SCL1 , I²C)		Ground	06
07	GPIO04 (GPIO_GCLK)		(TXD0) GPIO14	08
09	Ground		(RXD0) GPIO15	10
11	GPIO17 (GPIO_GEN0)		(GPIO_GEN1) GPIO18	12
13	GPIO27 (GPIO_GEN2)		Ground	14
15	GPIO22 (GPIO_GEN3)		(GPIO_GEN4) GPIO23	16
17	3.3v DC Power		(GPIO_GEN5) GPIO24	18
19	GPIO10 (SPI_MOSI)		Ground	20
21	GPIO09 (SPI_MISO)		(GPIO_GEN6) GPIO25	22
23	GPIO11 (SPI_CLK)		(SPI_CE0_N) GPIO08	24
25	Ground		(SPI_CE1_N) GPIO07	26
27	ID_SD (I²C ID EEPROM)		(I²C ID EEPROM) ID_SC	28
29	GPIO05		Ground	30
31	GPIO06		GPIO12	32
33	GPIO13		Ground	34
35	GPIO19		GPIO16	36
37	GPIO26		GPIO20	38
39	Ground		GPIO21	40

The GPIO connector has a number of different types of connection:

- True GPIO (General Purpose Input Output) pins that you can use to turn LEDs on and off etc.
- I2C interface pins that allow you to connect hardware modules with just two control pins
- SPI interface with SPI devices, a similar concept to I2C but uses a different standard
- Serial Rx and Tx pins for communication with serial peripherals

GPIO pins can be used as both digital outputs and digital inputs.

Output: turn a particular pin HIGH or LOW.

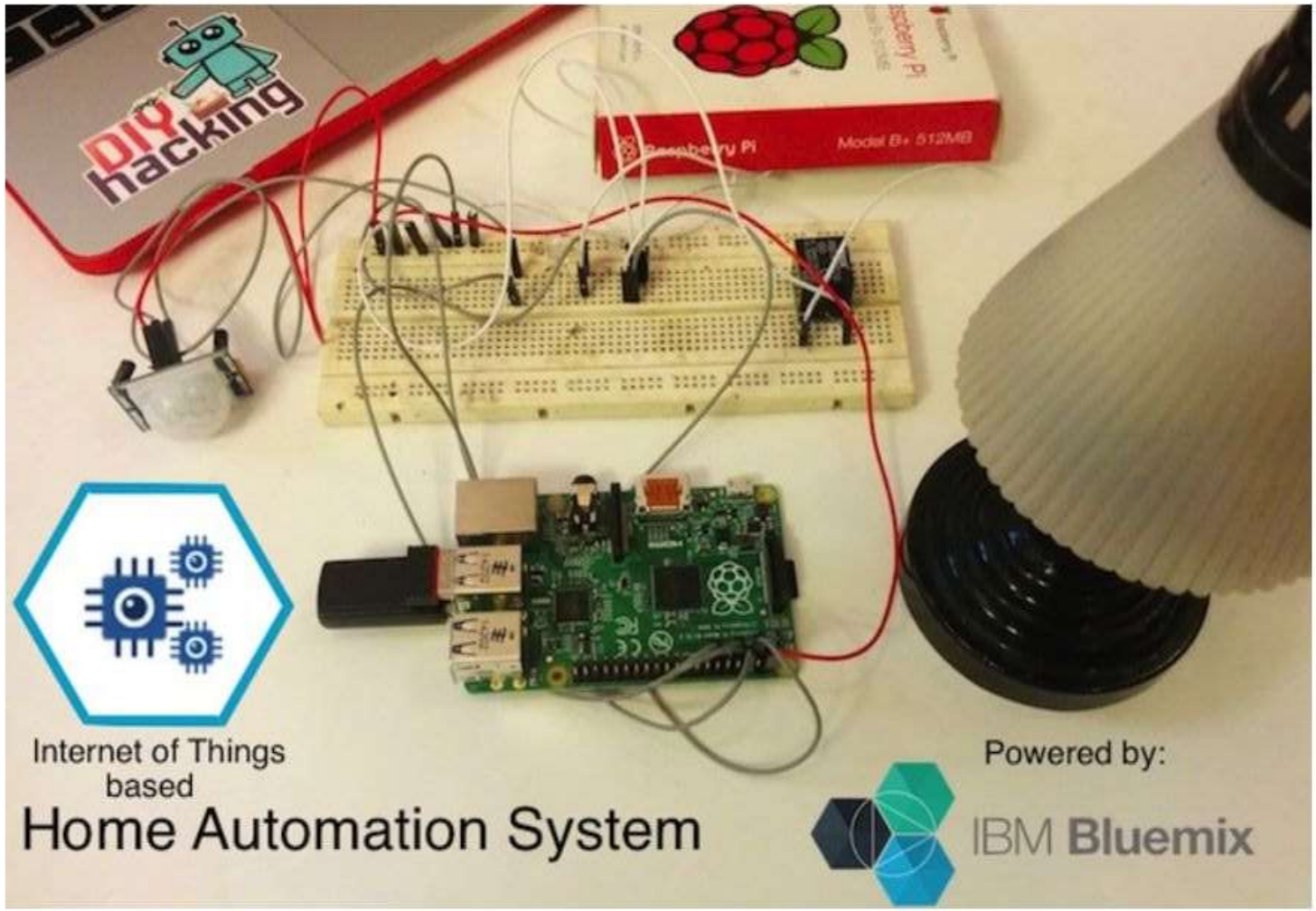
- Setting it HIGH sets it to 3.3V; setting it LOW sets it to 0V.

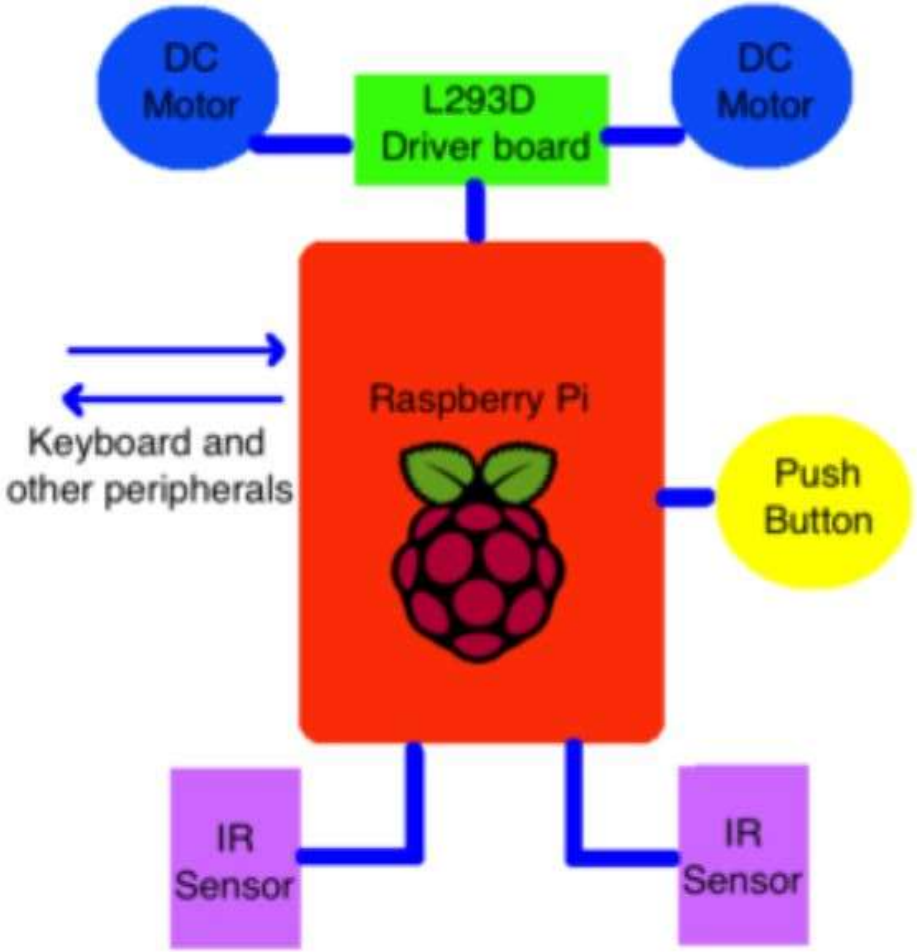
Input: detect the pin being at HIGH or LOW

- we can connect switches and simple sensors to a pin and check whether it is open or closed (that is, activated or not)

Applications :

- Academic projects
  - Robotics
  - Webserver
  - IoT Applications
  - Cluster Computing
  - Cloud Computing


DIY hacking
Model B+ 512MB
Internet of Things
based
Home Automation System
Powered by:
IBM Bluemix


DC
Motor
L293D
Driver board
DC
Motor
Raspberry Pi
Keyboard and
other peripherals
Push
Button
IR
Sensor
IR
Sensor

Raspberry pi webcam robot

Webserver :

- Linux
- Apache Webserver
- MySQL
- PHP
- Python

LAMP:

Hands – on

Programming techniques :

- HTML
- PHP
- Python

HTML :

/var/www/html/ - File System

- .html ,.htm , .php

Sudo nano welcome.html

Simple HTML Program :

```
<!DOCTYPE html>
<html>
<body>

<h1>My First Heading</h1>
<p>My first paragraph.</p>

</body>
</html>
```

Web-browser :

http://localhost/welcome.html

PHP :

/var/www/html/ - File System
- .html ,.htm , .php

Simple PHP Program :

sudo nano welcome.php

```
<?php
        $user = “NITTTR – CHENNAI & Vi Microsystems”;
        $msg  = “ IoT WorkShop”;
        echo “Welcome to ”.$msg.” Conducted by” .$user;
?>
```

Web-browser :

http://localhost/welcome.php

Python :

sudo nano welcome.py

Simple python Program :

```
user  = “Your Name”
num  = 1
print “hai ”+user+str(num)
```

Output :

python welcome.py

MySQL Database Connection :

- MySQL Server
- Database & Table Creation
- Python Programming

SQL Columns :

DataBase Name : test
Table Name : Employee

ID	int	auto	primarykey
Name	char(50)		

Database & Table Creation command

mysql –u root –p

Database :

>> Create database test;

>> Use test;

Table :

>> CREATE TABLE test (id int NOT NULL AUTO_INCREMENT, name CHAR(50) NOT NULL, PRIMARY KEY (id));

```
>> show Database;

>>  show Tables;

>>  select * from employee;

>>  select * from employee where ID = 1;
```

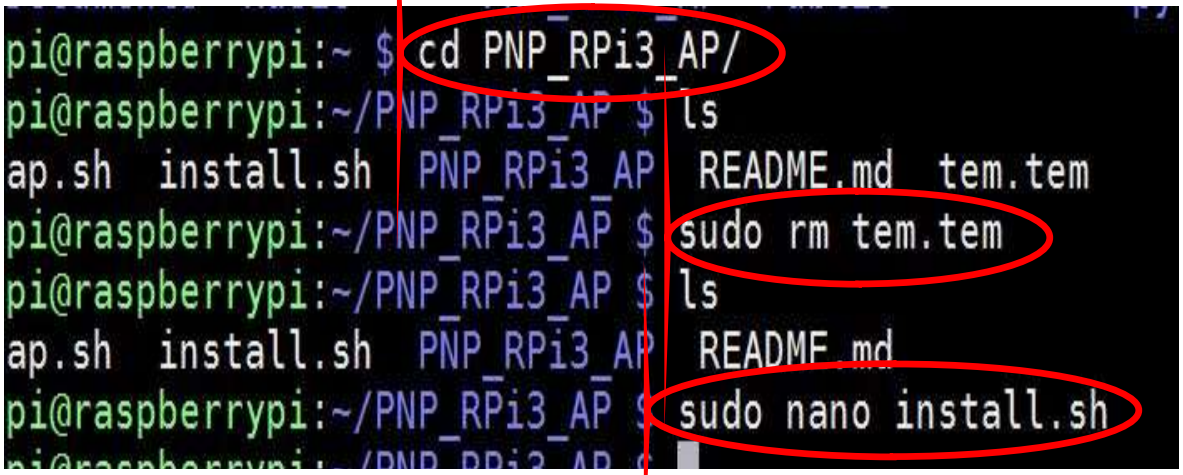
Python :

```
#!/usr/bin/python
import MySQLdb
db = MySQLdb.connect("localhost","testuser","test123",“test" )
cursor = db.cursor()
sql = "INSERT INTO employee(id,name) VALUES (null, 'Mohan')“
 try:
      cursor.execute(sql)
      print “Record Inserted ….”
      db.commit()
except:
      db.rollback()
db.close()
```

Network Configuration :

- Wi-Fi
- Ethernet

Wi-Fi AP Mode



Chmod 777 install.sh

./install.sh

Set SSID and Password of your AP :

sudo ap RPI3_HOTSPOT password123

Wi-Fi □ ST Mode

nano /etc/wpa_supplicant/wpa_supplicant.conf

```
country=GB
ctrl_interface=DIR=/var/run/wpa_supplicant GROUP=netdev
update_config=1

network {
        ssid="your-ssid-name"
        psk="your-wifi-password"

}
```

Interface file configuration – Wi-Fi

```
# interfaces(5) file used by ifup(8) and ifdown(8)
# Please note that this file is written to be used with dhcpcd
# For static IP, consult /etc/dhcpcd.conf and 'man dhcpcd.conf'

# Include files from /etc/network/interfaces.d:
source-directory /etc/network/interfaces.d

auto lo
iface lo inet loopback


iface eth0 inet static
        address 192.168.0.7
        netmask 255.255.255.0
        gateway 192.168.0.1

iface wlan0 inet dhcp
        wpa-conf /etc/wpa_supplicant/wpa_supplicant.conf
```

Ethernet

```
pi@raspberrypi:~ $ cat /etc/network/interfaces
# interfaces(5) file used by ifup(8) and ifdown(8)

# Please note that this file is written to be used with dhcpcd
# For static IP, consult /etc/dhcpcd.conf and 'man dhcpcd.conf'

# Include files from /etc/network/interfaces.d:
source-directory /etc/network/interfaces.d

auto lo
iface lo inet loopback

iface eth0 inet manual

allow-hotplug wlan0
iface wlan0 inet manual
    wpa-conf /etc/wpa_supplicant/wpa_supplicant.conf

allow-hotplug wlan1
iface wlan1 inet manual
    wpa-conf /etc/wpa_supplicant/wpa_supplicant.conf
pi@raspberrypi:~ $
```

Ethernet

```
# interfaces(5) file used by ifup(8) and ifdown(8)
# Please note that this file is written to be used with dhcpcd
# For static IP, consult /etc/dhcpcd.conf and 'man dhcpcd.conf'

# Include files from /etc/network/interfaces.d:
source-directory /etc/network/interfaces.d

auto lo
iface lo inet loopback

iface eth0 inet static
        address 192.168.0.7
        netmask 255.255.255.0
        gateway 192.168.0.1
```

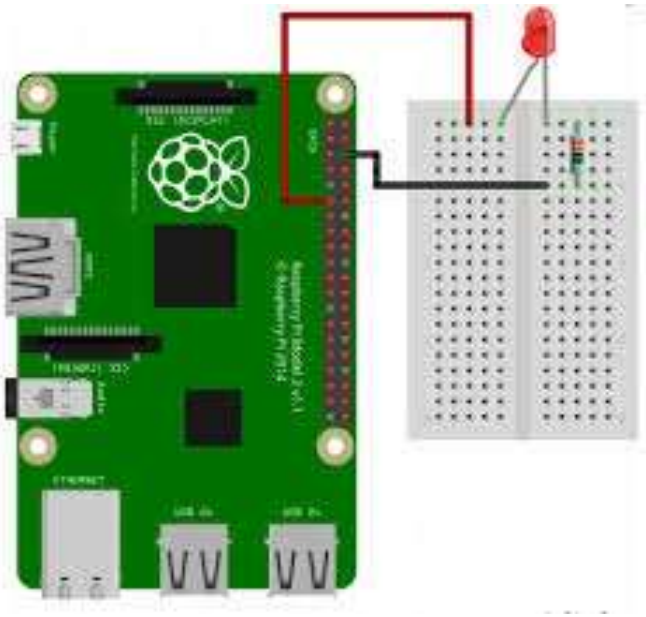
Alerts :

- SMS
- Email
- Tweet

LED Blink :

- python
- Webpage

Digital Output



Requirements :

1. LED
2. Resistor
3. Breadboard
4. Jumper Wires
5. Raspberry pi board

LED Blink

```
pi@raspberrypi:~/python/wiringPi $
pi@raspberrypi:~/python/wiringPi $
```

```
<html>
<head>
<meta name="viewport" content="width=device-width" />
<title>LED Control</title>
</head>
        <body><font size="6" color="blue">
        LED Control Through Raspberry Pi3 GPIO:</br></br>
        <form method="get" action="LED.php">
                <input type="submit" value="ON" name="on">
                <input type="submit" value="OFF" name="off"></br></br>
        </form>
        <?php
        $setmode17 = shell_exec("/usr/local/bin/gpio -g mode 17 out");
        if(isset($_GET['on'])){
                $gpio_on = shell_exec("/usr/local/bin/gpio -g write 17 1");
                echo "LED is on";
        }
        else if(isset($_GET['off'])){
                $gpio_off = shell_exec("/usr/local/bin/gpio -g write 17 0");
                echo "LED is off";
        }
        ?></font>
        </body>
</html>
```

Thank You