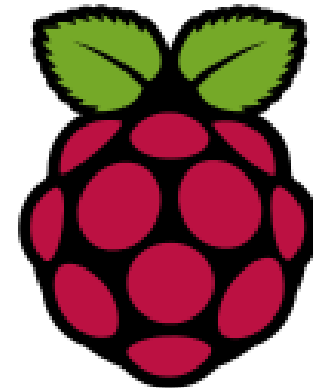
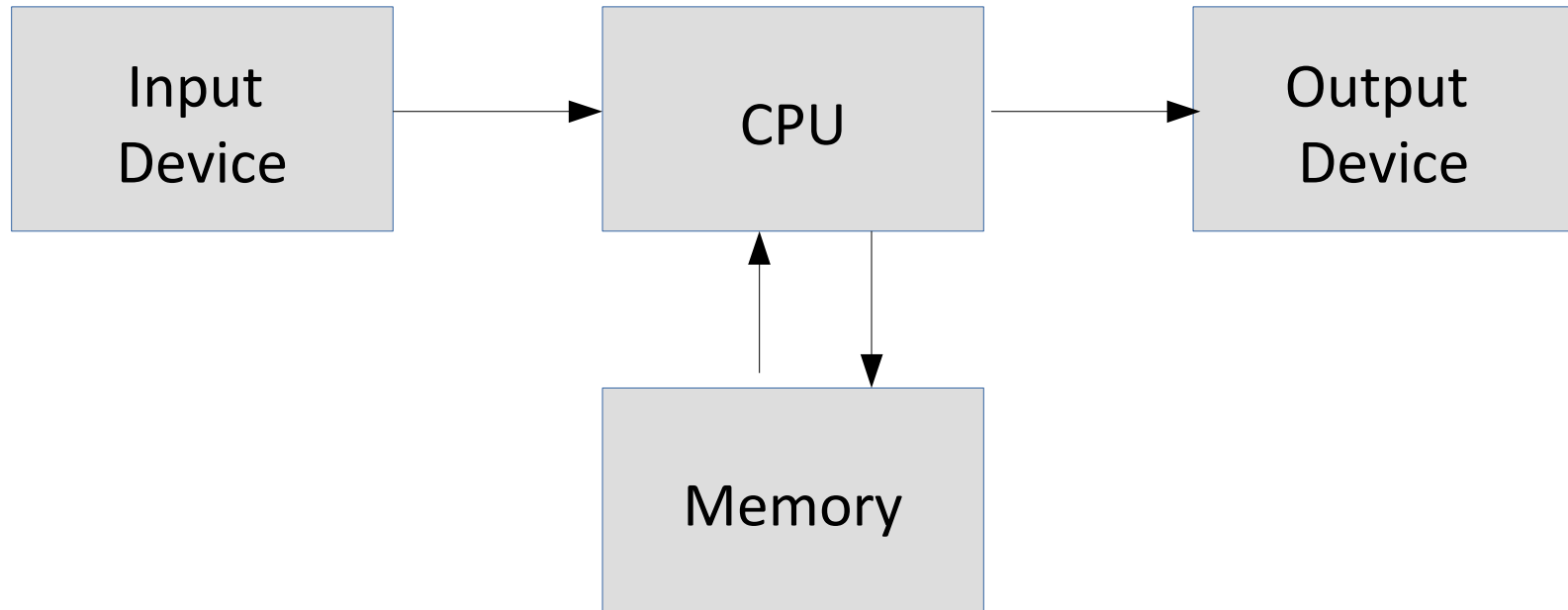


Basic Interfacing using RPi

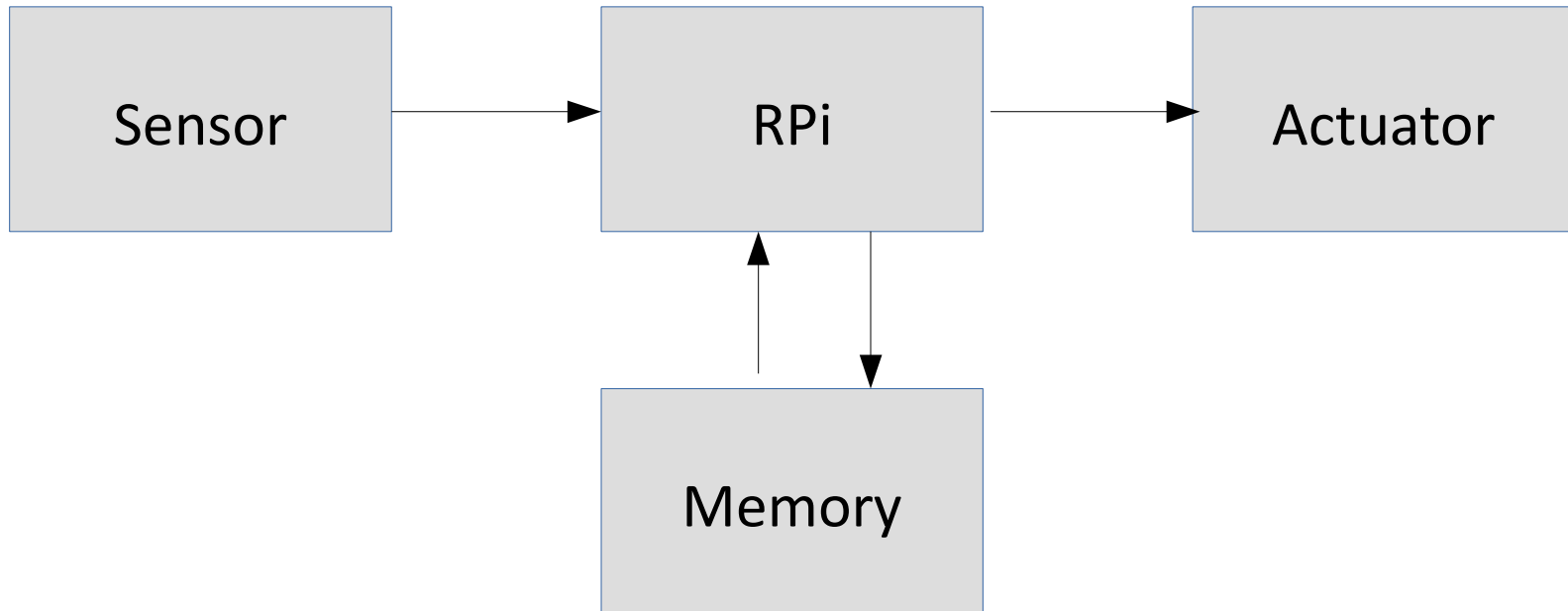
Tushar B. Kute,
<http://tusharkute.com>



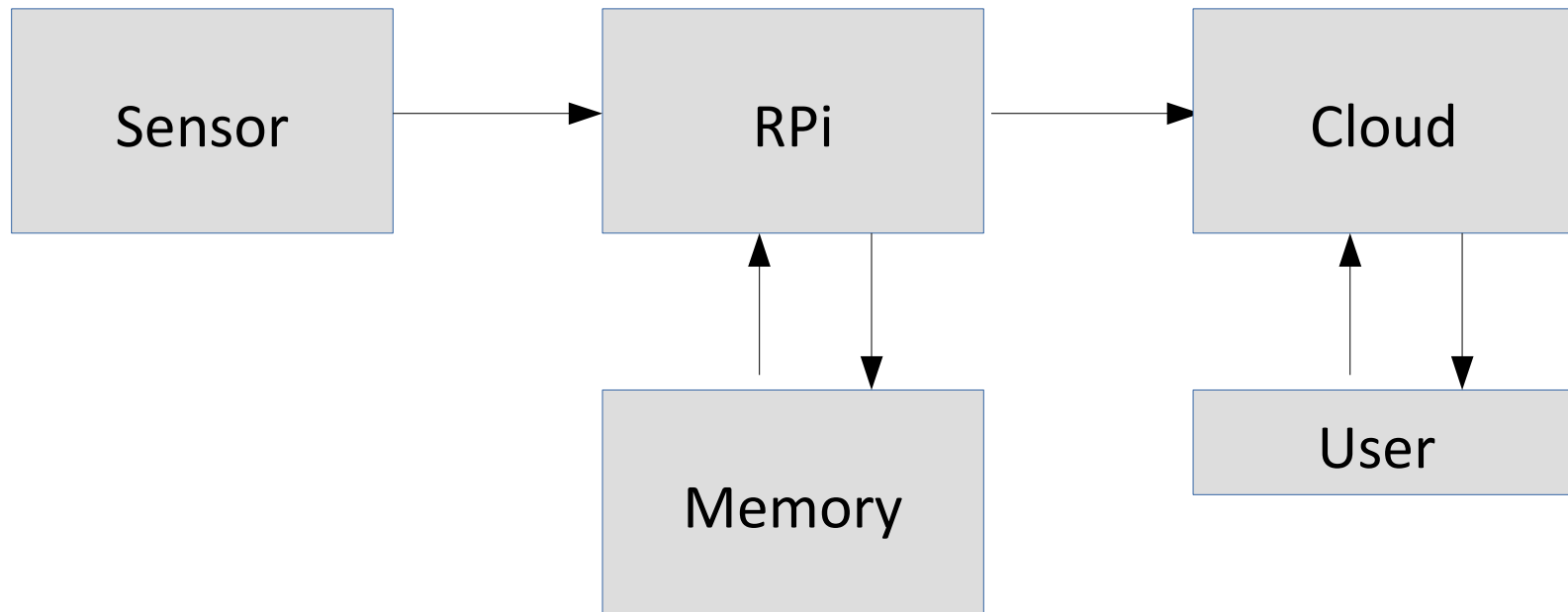
General Computer Architecture



RPi Embedded System Architecture



Simple IOT Architecture



Sensor

- A Sensor or a Detector is a device that is used to convert a physical parameter into a signal that can be measured or monitored.
- For example a GAS Sensor monitors gas concentration (PPM) and converts it into electrical signal that can be measured.
- The input parameter can be different like Light, Temperature, Humidity pressure etc but the output is generally a human readable or electrically monitorable.

Sensor Definition

- According to Oxford Dictionaries definition of Sensor is "A device which detects or measures a physical property and records, indicates, or otherwise responds to it."
- Meaning of Sensor as per Wikipedia "A sensor is an object whose purpose is to detect events or changes in its environment, and then provide a corresponding output"

Types of Sensors

- A sensor is classified based on various aspects such as-
 - Application Based: Industrial Sensor, Automotive Sensor etc.
 - Output Based : Resistive output, Differential Output, Differential output, Voltage Output etc.
 - Parameter Sensing Based: Light, Temperature Sound, Gas etc.

Commonly used sensors

- Light Sensor
- Temperature Sensor
- Proximity Sensor
- Pressure Sensor
- GAS Sensors
- Current Sensor
- Magnetic Sensor
- Sound Sensor
- Tilt Sensor
- Hall effect Sensor
- Accelerometer Sensor
- Color Sensor
- Flow Sensor
- Humidity Sensor
- Level Sensor
- Motion Sensor
- Speed Sensor
- RPM Sensor
- Force Sensor
- Flame Sensor

Actuators

- An actuator is a component of a machine that is responsible for moving or controlling a mechanism or system.
- An actuator requires a control signal and a source of energy. The control signal is relatively low energy and may be electric voltage or current, pneumatic or hydraulic pressure, or even human power.
- When the control signal is received, the actuator responds by converting the energy into mechanical motion.

Actuators

- Following basic actuators are used for signaling and output purpose:
 - LED
 - RGB LED
 - Buzzer
 - Servo Motor
 - DC Motor
 - Relay



GPIO Pins

Models A & B

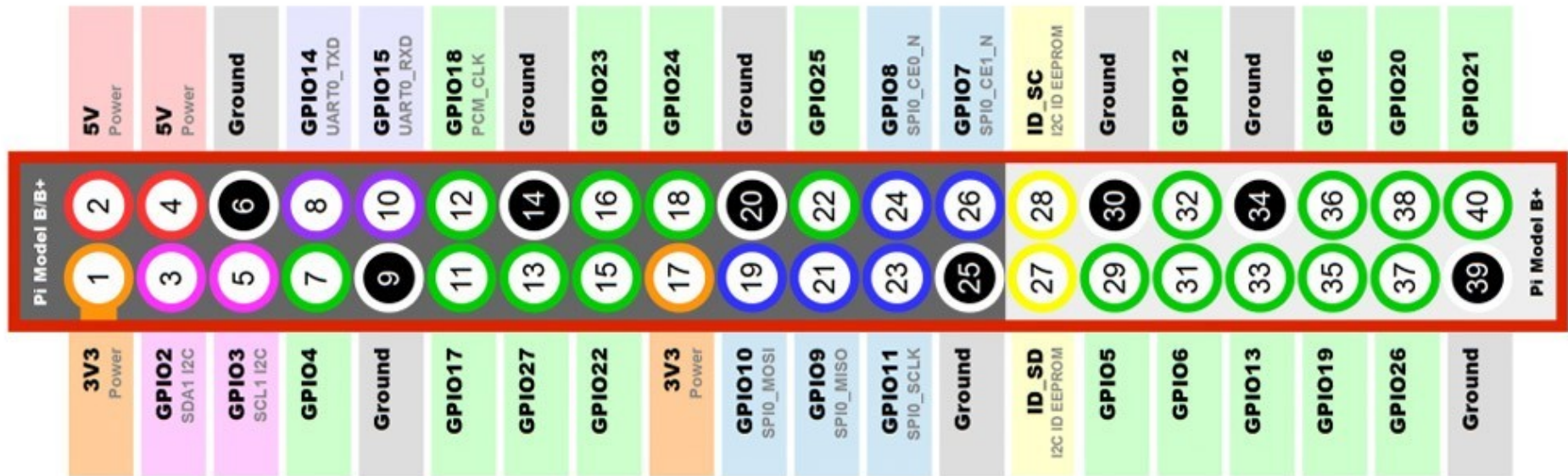
3V3	5V		
2 SDA	5V		
3 SCL	GND		
4	14 TXD		
GND	15 RXD		
17	18		
27	GND		
22	23		
3V3	24		
10 MOSI	GND		
9 MOSI	25		
11 SCLK	8 CS0		
GND	7 CS1		

Models A+, B+ & Pi2

3V3	5V		
2 SDA	5V		
3 SCL	GND		
4	14 TXD		
GND	15 RXD		
17	18		
27	GND		
22	23		
3V3	24		
10 MOSI	GND		
9 MOSI	25		
11 SCLK	8 CS0		
GND	7 CS1		
EPROM	EPROM		
5	GND		
6	12		
13	GND		
19 MISO	16		
26	20 MOSI		
GND	21 SCLK		

GPIO Pins

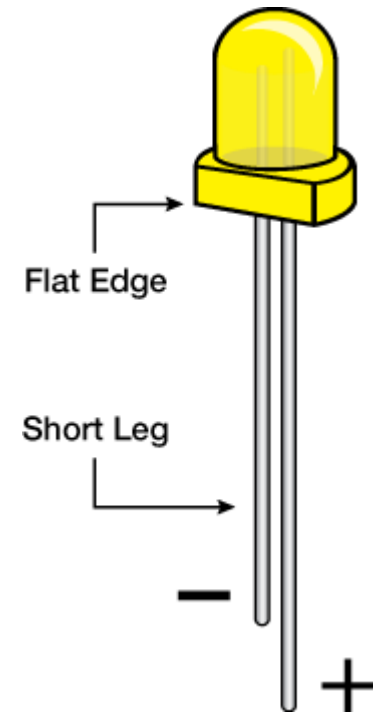
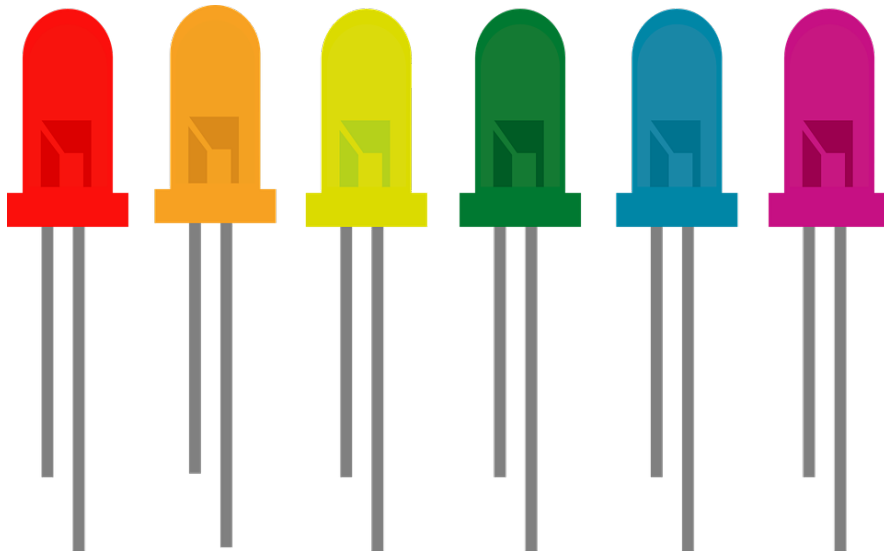
GPIO Pinout Diagram



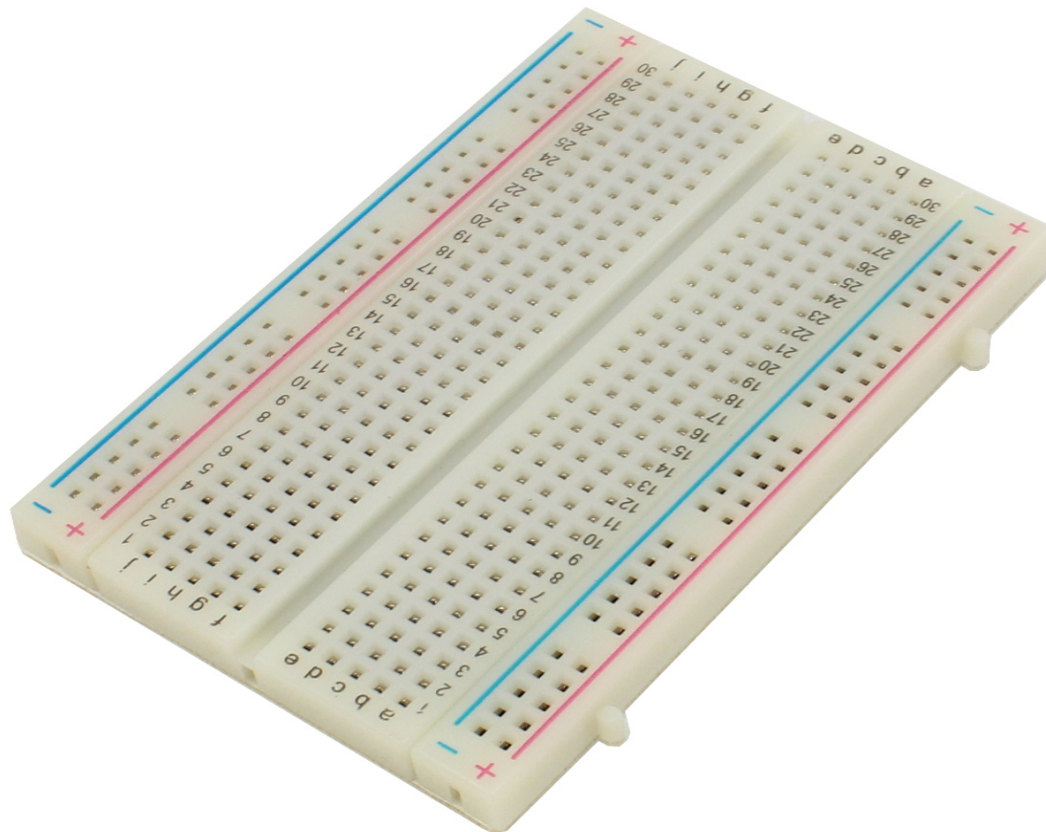
GPIO Modes

- The **GPIO.BOARD** option specifies that you are referring to the pins by the number of the pin the the plug - i.e the numbers printed on the board (e.g. P1) and in the middle of the diagrams below.
- The **GPIO.BCM** option means that you are referring to the pins by the "Broadcom SOC channel" number, these are the numbers after "GPIO" in the green rectangles around the outside of the below diagrams:
- Unfortunately the **BCM** numbers changed between versions of the Pi1 Model B.
 - The Model B+ uses the same numbering as the Model B r2.0, and adds new pins (board numbers 27-40).
 - The Raspberry Pi Zero, Pi 2B and Pi 3B use the same numbering as the B+.

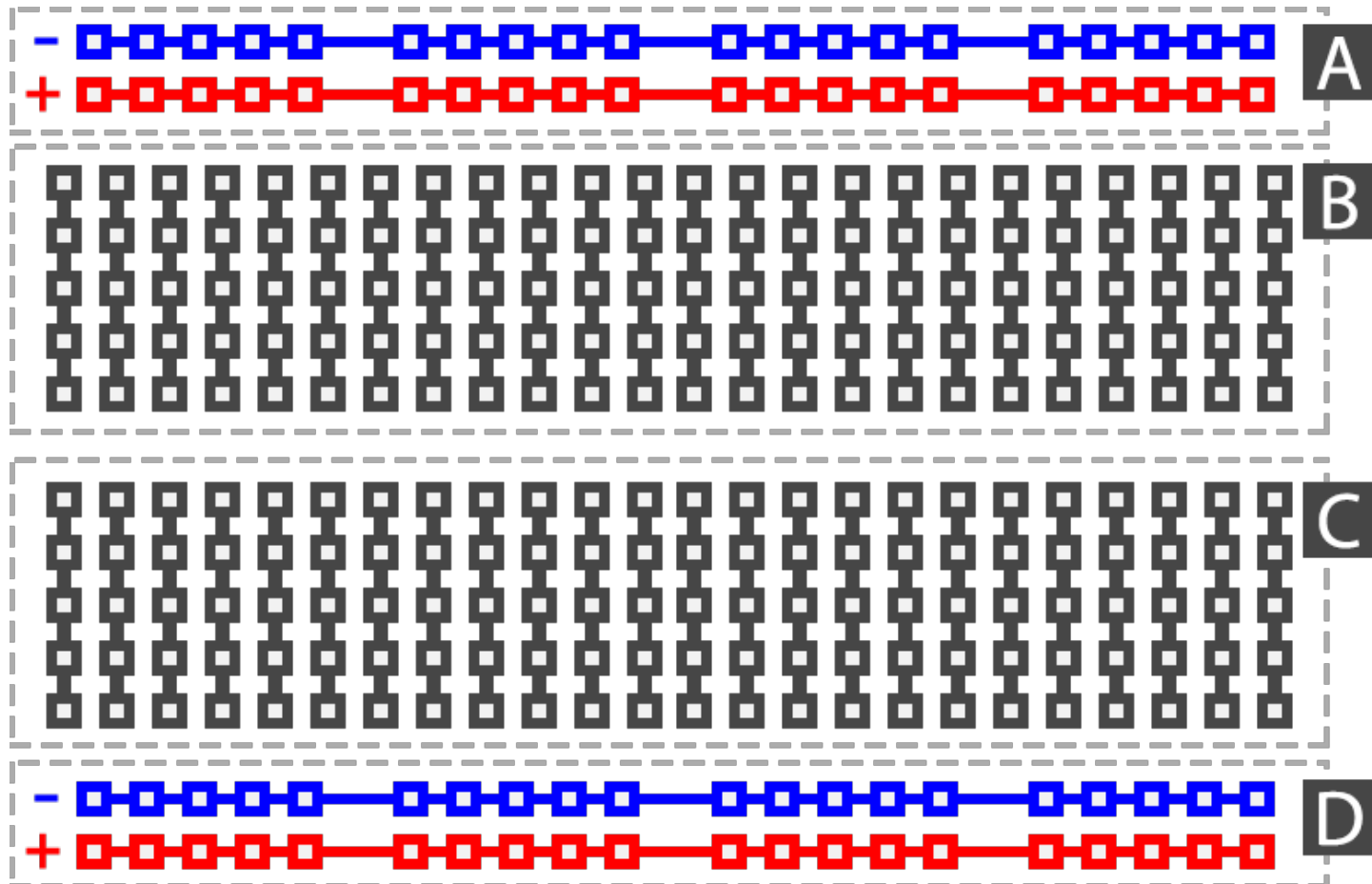
LED



Breadboard



Breadboard internals



Resister

- You must ALWAYS use resistors to connect LEDs up to the GPIO pins of the Raspberry Pi. The Raspberry Pi can only supply a small current (about 60mA). The LEDs will want to draw more, and if allowed to they will burn out the Raspberry Pi. Therefore putting the resistors in the circuit will ensure that only this small current will flow and the Pi will not be damaged.
- Resistors are a way of limiting the amount of electricity going through a circuit; specifically, they limit the amount of 'current' that is allowed to flow. The measure of resistance is called the Ohm (Ω), and the larger the resistance, the more it limits the current. The value of a resistor is marked with coloured bands along the length of the resistor body.

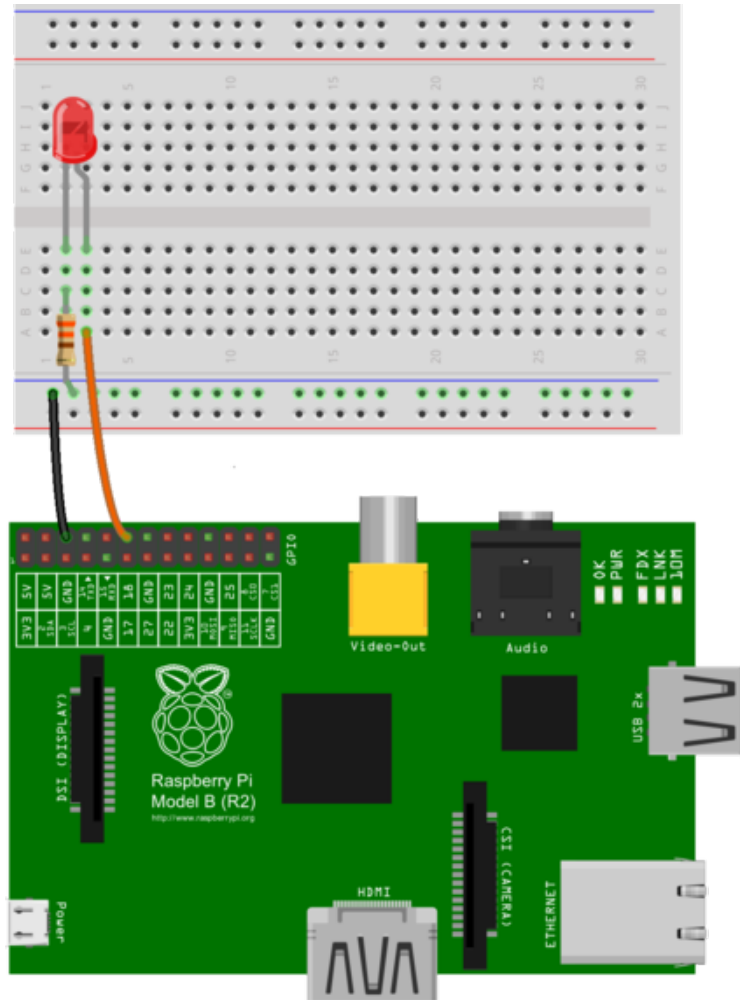


Jumper Wires

- Jumper wires are used on breadboards to 'jump' from one connection to another.
- The ones you will be using in this circuit have different connectors on each end.
- The end with the 'pin' will go into the Breadboard.
- The end with the piece of plastic with a hole in it will go onto the Raspberry Pi's GPIO pins.



Lets start the connections



fritzing

Program:

```
import RPi.GPIO as GPIO
import time
GPIO.setmode(GPIO.BCM)
GPIO.setwarnings(False)
GPIO.setup(18, GPIO.OUT)
while True:
    print("LED on")
    GPIO.output(18, GPIO.HIGH)
    time.sleep(1)
    print("LED off")
    GPIO.output(18, GPIO.LOW)
    time.sleep(1)
```

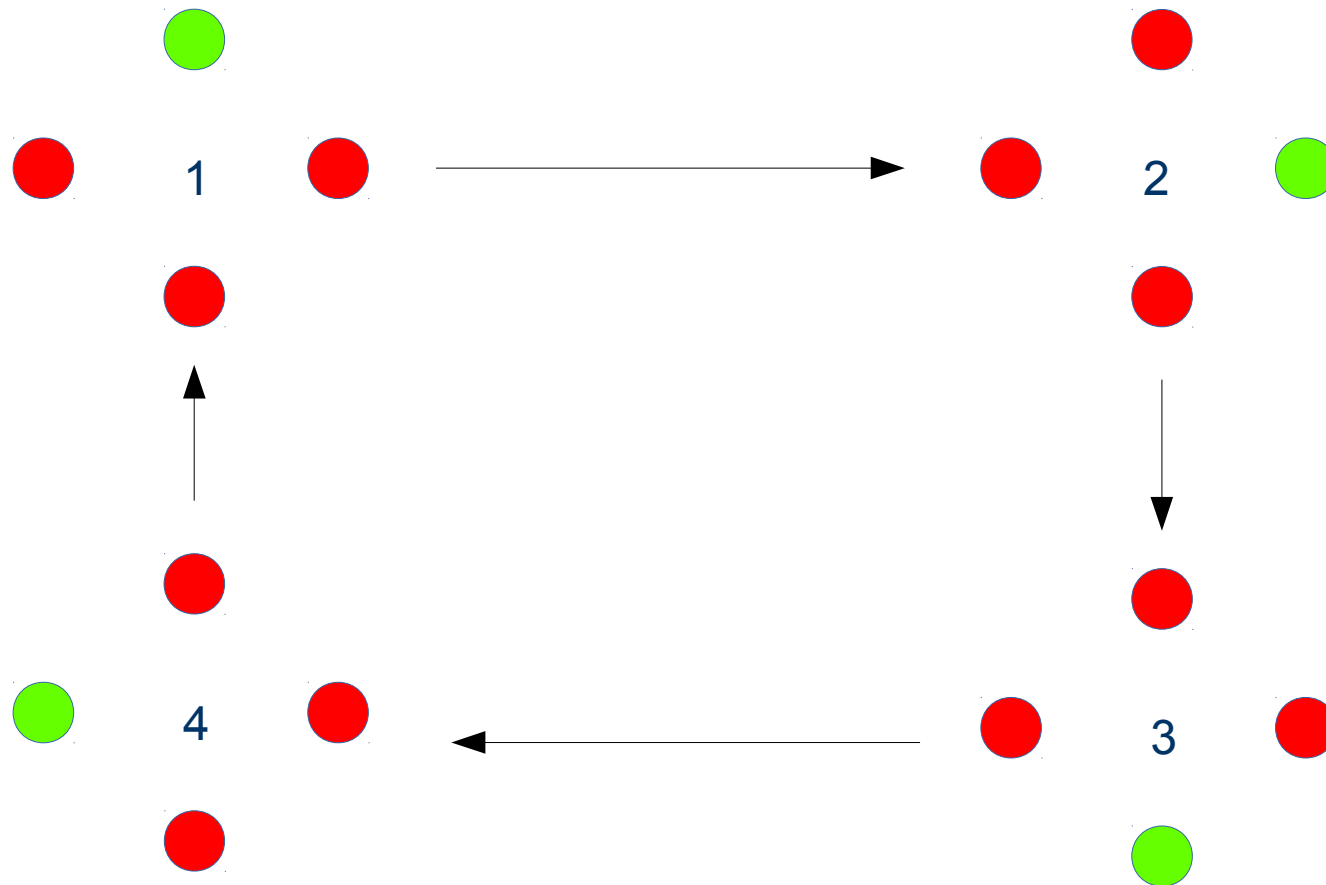
Fading the LEDs

```
import RPi.GPIO as GPIO
import time
GPIO.setmode(GPIO.BCM)
GPIO.setup(18, GPIO.OUT)
p = GPIO.PWM(18, 50)
p.start(0)
try:
    while True:
        for i in range(100):
            p.ChangeDutyCycle(i)
            time.sleep(0.02)
        for i in range(100):
            p.ChangeDutyCycle(100-i)
            time.sleep(0.02)
except KeyboardInterrupt:
    pass
p.stop()
GPIO.cleanup()
```

Assignment

- Connect two LEDs on the breadboard and glow them parallelly.
- Connect two LEDs on the breadboard and glow them alternatively.

Assignment- Create Traffic Signal



Thank you

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Web Resources

<http://mitu.co.in>
<http://tusharkute.com>

Blogs

<http://digitallocha.blogspot.in>
<http://kyamputar.blogspot.in>

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