Special Topics in Design I
DSL 810

Topic 4
uC programming

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IIT Delhi

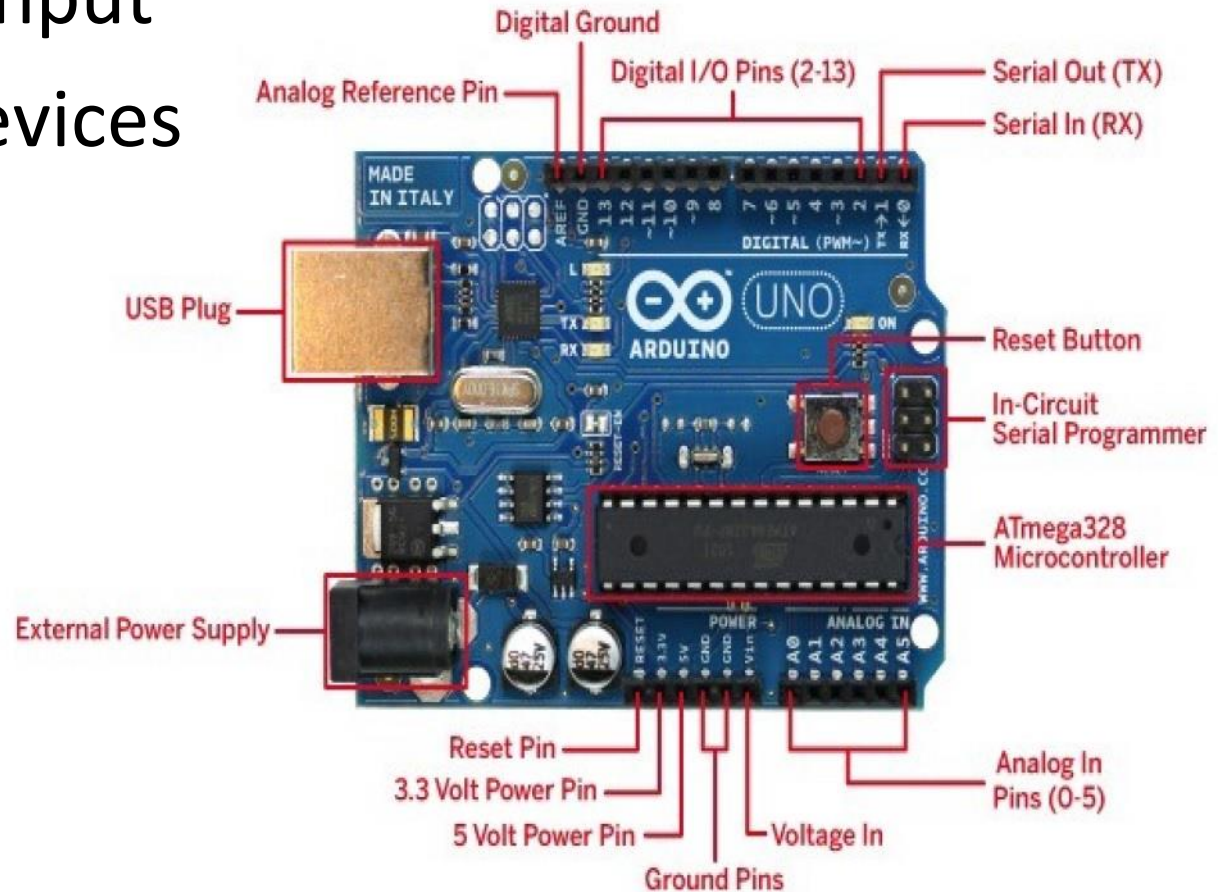13th August 2019

Announcements

- Assignment 1: Website Development deadline: 18th August (Please let us know your website through the google form so that we can evaluate.)
- Assignment 2: Project Proposal deadline: 21st August
- Project development till minor test 1: One slide and one video of up to 1 minute on your project page. Video editing with Kdenlive or Adobe Premier Pro or Quik mobile phone app or others. Start developing your project on the project page of your website. [Slide Video](#)
- Date: 3rd September is the presentation with the link to the slide (jpg image) and youtube video on your final project webpage on the top with the heading of Project Development till Minor Test 1. [Example](#)
- Please share website address using this [google form](#).
- Arduinos and other electronics to be given to students.

Introduction to uC

- uC vs uP, Arduino = single board uC, IDE, easy to work with input
  and output devices

Digital Ground

Digital I/O Pins (2-13)

Serial Out (TX)

Analog Reference Pin

Serial In (RX)

MADE IN ITALY

DIGITAL (PWM~)

USB Plug

Reset Button

In-Circuit Serial Programmer

ATmega328 Microcontroller

External Power Supply

POWER

ANALOG IN

Reset Pin

3.3 Volt Power Pin

Analog In Pins (0-5)

5 Volt Power Pin

Voltage In

Ground Pins

Arduino installation

- Download (Arduino kit pdf for instructions) from https://www.arduino.cc/en/main/software
- Lesson 0 of Elegoo Arduino Kit
- Open Arduino IDE (Check if the port is detected)
- Blink sketch with pin 13
- Blink sketch initialize pin 13
- Lesson 2 of Elegoo Arduino Kit

LED is a diode

LED is a diode which makes the current flow only in one direction
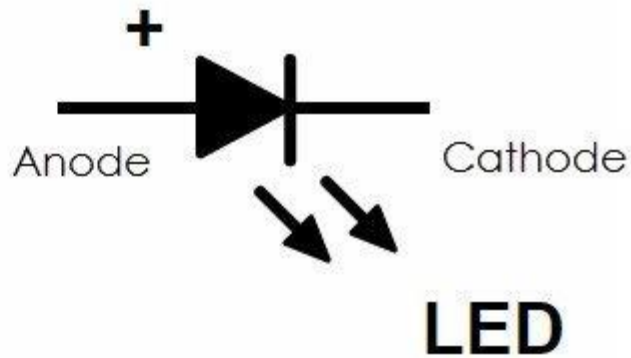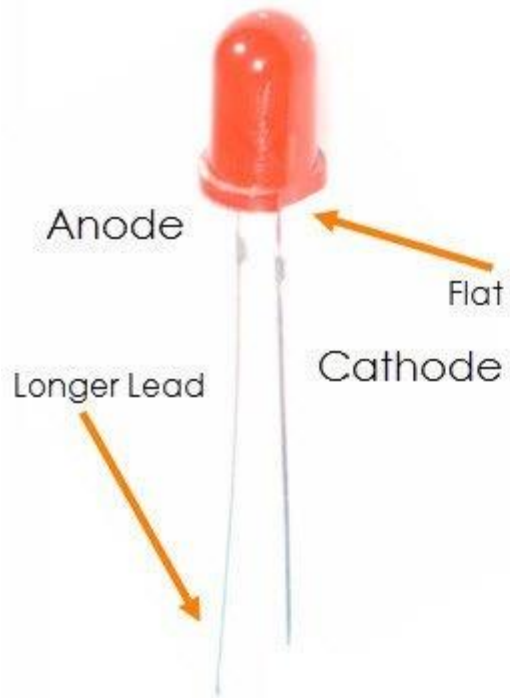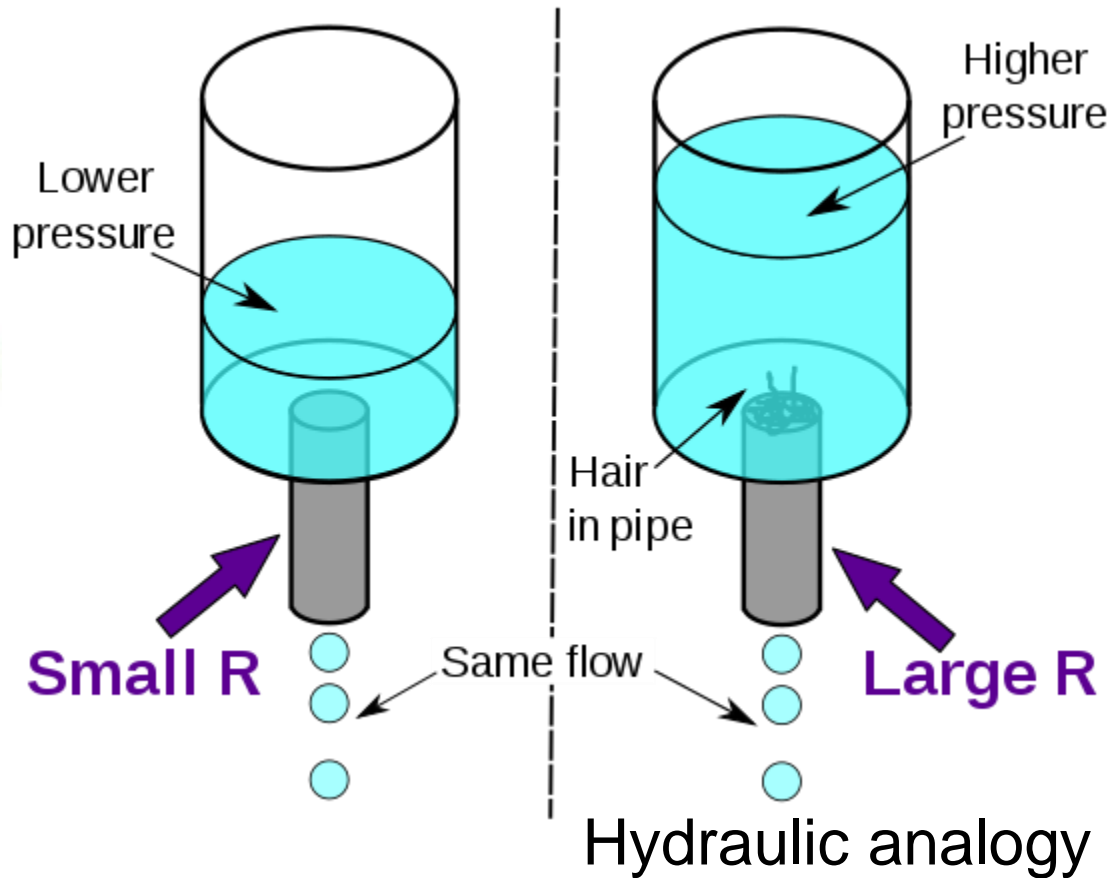

Diode is like a one-way valve of electronics

Source: Quora

Blinking LEDs

- Blink sketch (pin 12) with own LEDs and resistors (+ Lesson 3 of Elegoo Arduino Kit)

- Breadboard

Ohm's Law, V=IR

Hydraulic analogy

Thermal analogy, Q = dT/R
I = V/R
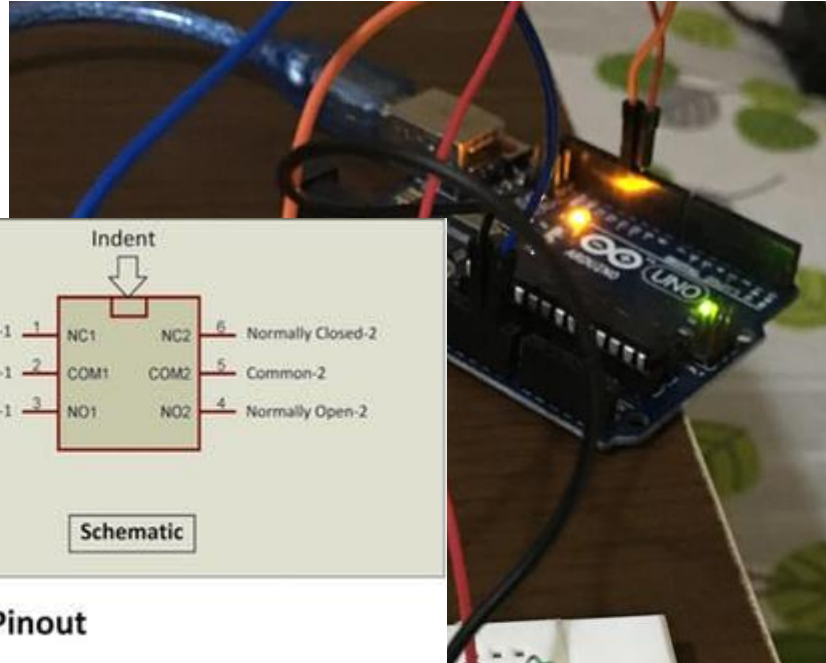

Source: Google Image,
Diode circuit

Kirchoff's Voltage Law

Blinking LEDs

- Blink sketch (pin 12) with own LEDs and resistors

- Blink sketch (pin 12) with own LEDs and resistors and pin 13. (Sequentially on and off vs. Both on and Both off.) Arduino code
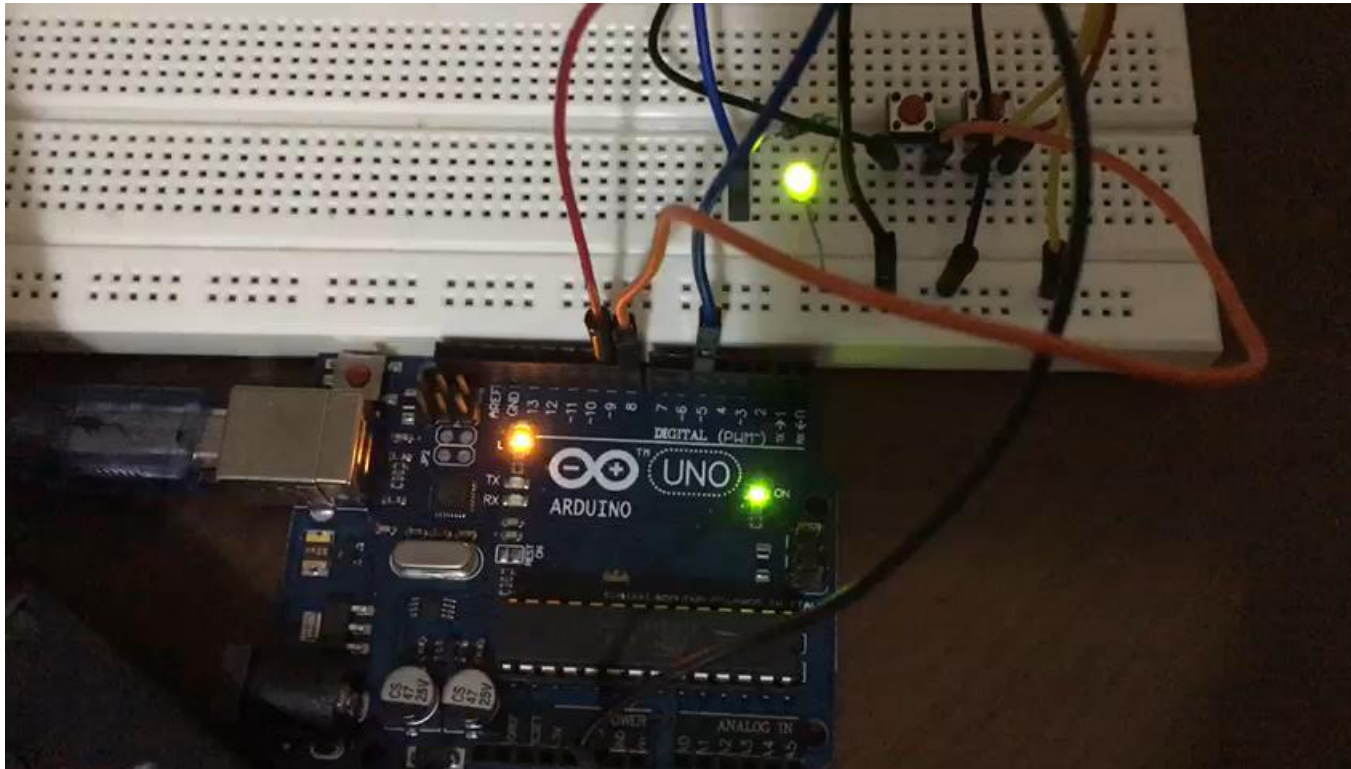
Buttons

- Push buttons and LEDs

- [DPDT]

6 Pin Push Switch (Mini DPDT Push Switch) Pinout

- [Arduino code]

Push buttons (Input Pullup) – Lesson 5

- By default, input pullup pin is High, when push button pressed, it gets to Low. Video

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Announcements

- Minor test 1: 3rd Sept. ppt, everyone know what to do?

- Minor test 2: date October 9th?

Arduino features

- PWM with RGB LED with common anode (Lesson 4). Longest leg of RGB LED goes to 5V pin. RGB_basic RGB_favorite_color

- If then else

- function

- for loop

- serial communication, serial monitor

- Other examples

Assignment 4

- In groups of two, write your first name by switching 9 LEDs on/off and push buttons such that:

1) With press of one push button, the letters of the name blink every 1000 ms

2) With press of another push button, all LEDs blink ON and then OFF with a delay of 1000 ms five times.

3) Extra credit: Also, print the letter typed on the Serial Monitor

Hello Akhil   Hi Jay   Hi Jay v2
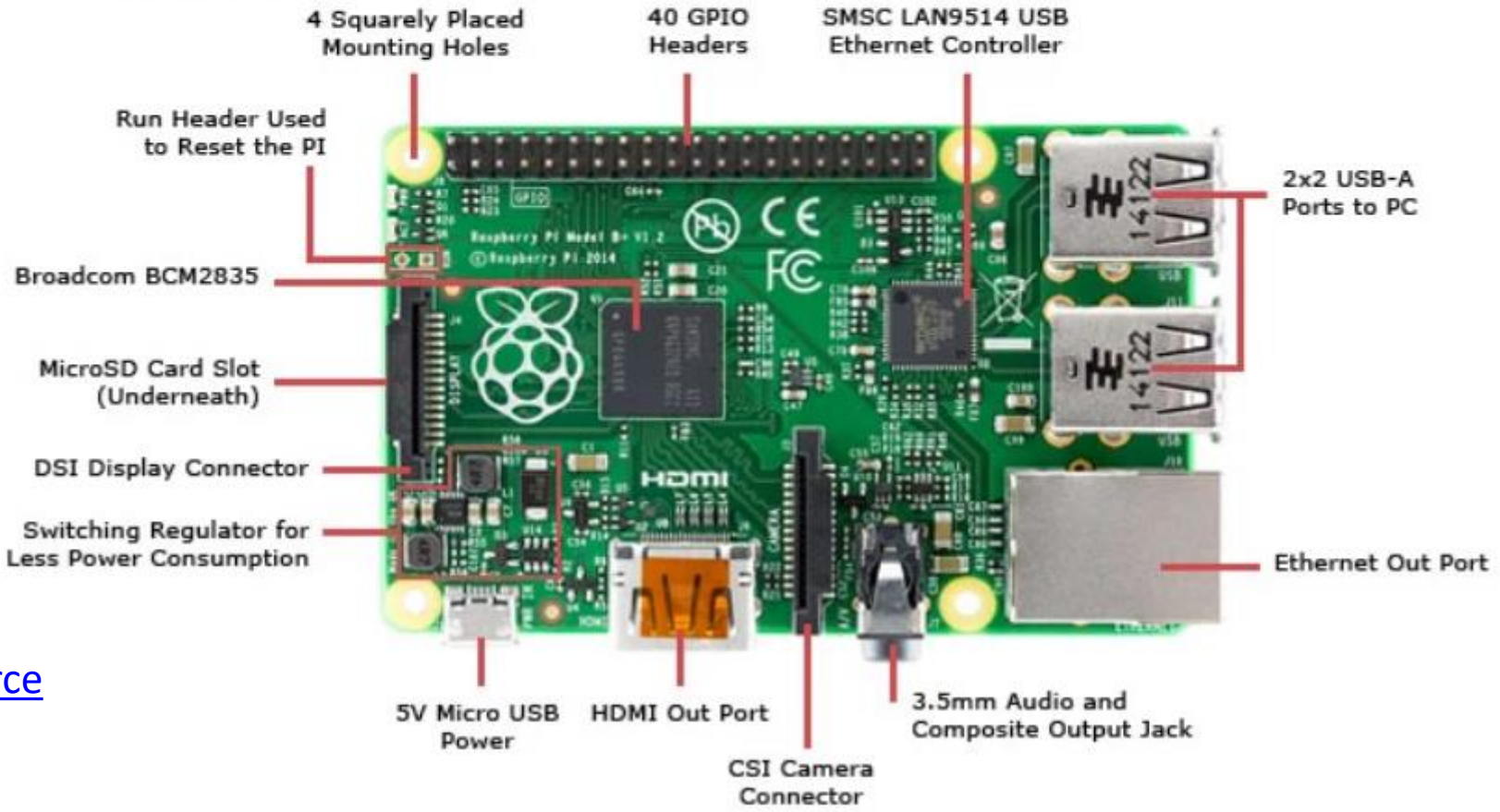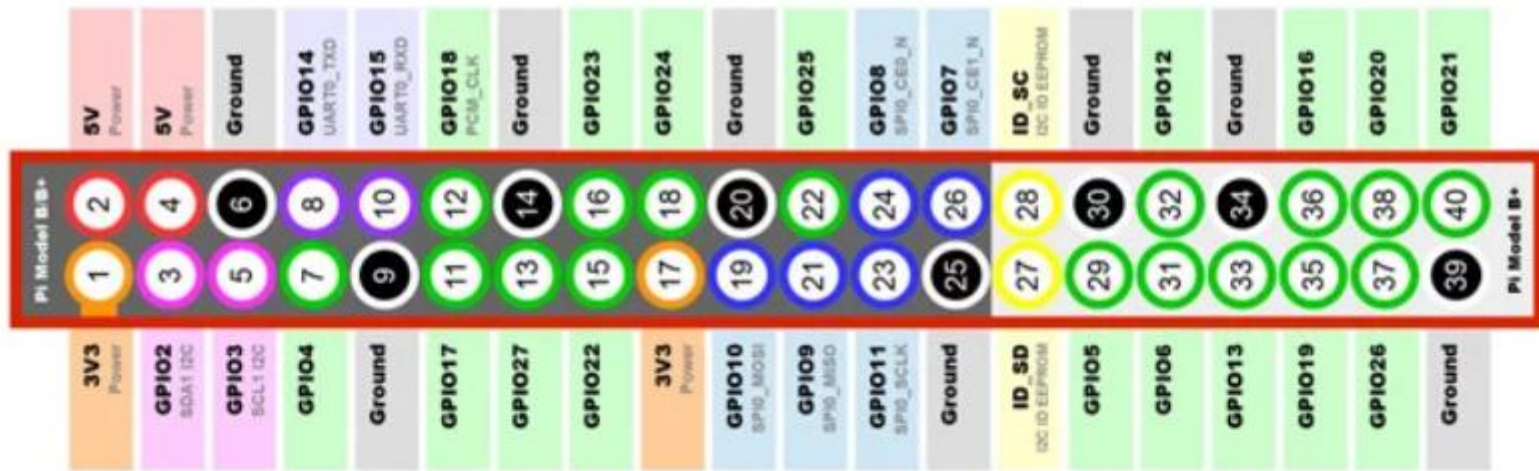
Introduction to Raspberry Pi

- RPi is a mini-computer. Arduino is just a uC.

- Raspberry Pi 3B.

- [Installation instructions](#)

- Starting RPi

- Running a python program

- [Blinking an LED](#)
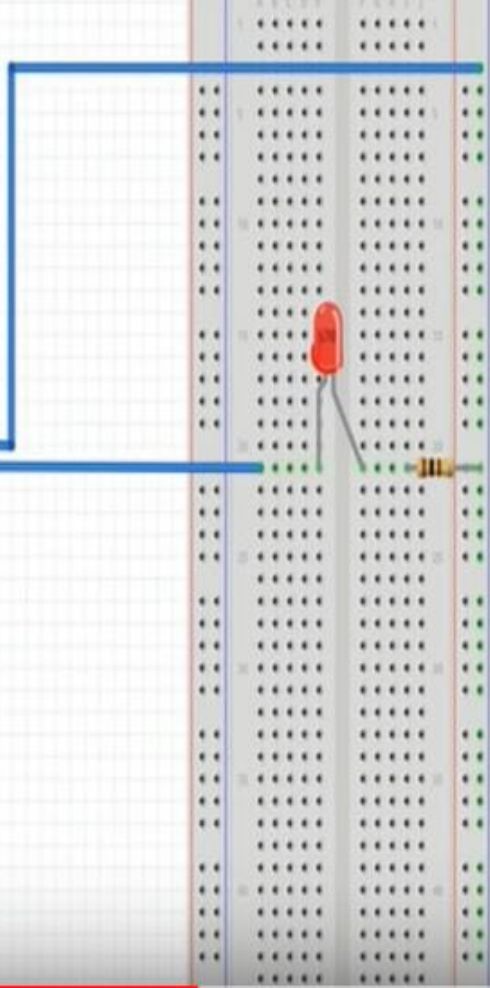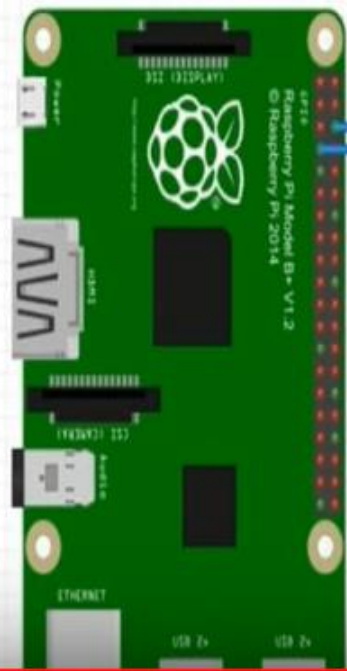
- Buy a Raspberry Pi 3 or higher

GPIO Pinout Diagram

Pin	Name	Description
5V	Power	
5V	Power	
Ground		
GPIO14	UART0_TXD	
GPIO15	UART0_RXD	
GPIO18	PCM_CLK	
Ground		
GPIO23		
GPIO24		
Ground		
GPIO25		
GPIO8	SPI0_CE0_N	
GPIO7	SPI0_CE1_N	
ID_SC	I2C ID EEPROM	
Ground		
GPIO12		
Ground		
GPIO16		
GPIO20		
GPIO21		

Pi Model B B+

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40

1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39

Pi Model B+

Pin	Name	Description
3V3	Power	
GPIO2	SDA1 I2C	
GPIO3	SCL1 I2C	
GPIO4		
Ground		
GPIO17		
GPIO27		
GPIO22		
3V3	Power	
GPIO10	SPI0_MOSI	
GPIO9	SPI0_MISO	
GPIO11	SPI0_SCLK	
Ground		
ID_SD	I2C ID EEPROM	
GPIO5		
GPIO6		
GPIO13		
GPIO19		
GPIO26		
Ground		

4 Squarely Placed Mounting Holes

40 GPIO Headers

SMSC LAN9514 USB Ethernet Controller

Run Header Used to Reset the PI

Broadcom BCM2835

MicroSD Card Slot (Underneath)

DSI Display Connector

Switching Regulator for Less Power Consumption

2x2 USB-A Ports to PC

Ethernet Out Port

5V Micro USB Power

HDMI Out Port

CSI Camera Connector

3.5mm Audio and Composite Output Jack

[Source](#)

Pin connections for Blinking LED

BLINK.py file

```python
import RPi.GPIO as GPIO
import time
GPIO.setwarnings(False)
GPIO.setmode(GPIO.BCM)
GPIO.setup(4,GPIO.OUT) #Define pin 7 as an output pin
while True:
        GPIO.output(4,True) #Outputs digital HIGH signal (5V) on pin 7
        time.sleep(2) #Time delay of 2 second
        print( ' Hello ' ) #Print when the LED turn ON
        GPIO.output(4,False) #Outputs digital LOW signal (0V) on pin 7
        time.sleep(2) #Time delay of 2 second
```

Source: Python Code

Electrical Safety and handling

- [Video](#) (1:30 - 4:00 minutes)
- Take utmost care of the electronics that we have provided. Shouldn't be exposed to water. Keep in Ziploc bags. Delicate stuff.

Suggestions

- Buy a [digital multimeter](#)
- Few components such as LEDs, resistors, basic sensors and actuators
- Arduino Kits
- [Micro Soldering Iron kit](#)
- Amazon, element14
- Red fort – Lajpat Rai Market = Shop no. 595, 614, 625, etc.