



## Experiment 1.1

**Student Name: Harshit Raj**

**UID: 20BCS9266**

**Branch: BE-CSE**

**Section/Group: DM\_608-A**

**Semester: 6**

**Date of Performance: 20/2/22**

**Subject Name: Internet of Things Lab**

**Subject Code: 20CSP-358**

**1. Aim: Familiarization with Arduino/Raspberry Pi hardware and perform necessary software installation.**

**2. Objective:**

- To study hardware and software related to IoT.
- To understand the function of Node MCU, Arduino Uno and Raspberry Pi

**3. Script and Output:**

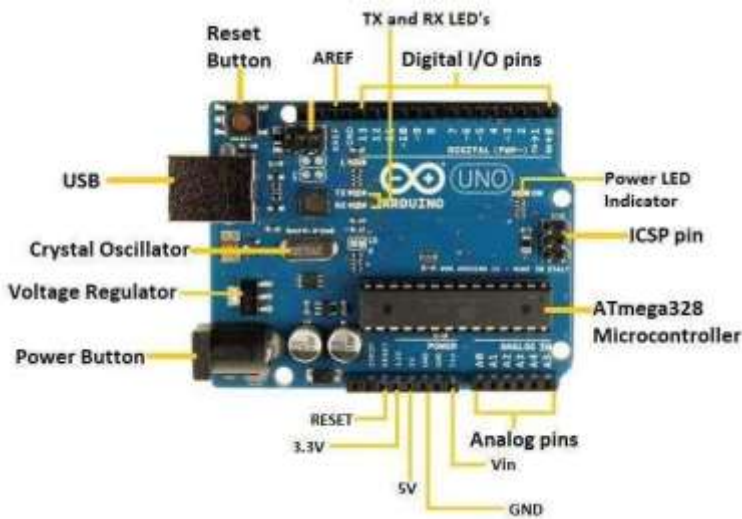
### About Arduino

An Arduino is actually a micro controller based kit. It is basically used in communications and in controlling or operating many devices. Arduino UNO board is the most popular board in the Arduino board family. In addition, it is the best board to get started with electronics and coding.

It consists of two memories- Program memory and the data memory.

The code is stored in the flash program memory, whereas the data is stored in the data memory.

Arduino Uno consists of 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button



## Components of Arduino

- USB: can be used for both power and communication with the IDE □ Barrel Jack: used for power supply
- Voltage Regulator: regulates and stabilizes the input and output voltages
- Crystal Oscillator: keeps track of time and regulates processor frequency
- Reset Pin: can be used to reset the Arduino Uno
- 3.3V pin: can be used as a 3.3V output
- 5V pin: can be used as a 5V output
- GND pin: can be used to ground the circuit
- Vin pin: can be used to supply power to the board
- Analog pins(A0-A5): can be used to read analog signals to the board
- Microcontroller (ATMega328): the processing and logical unit of the board
- ICSP pin: a programming header on the board also called SPI
- Power indicator LED: indicates the power status of the board
- RX and TX LEDs: receive(RX) and transmit(TX) LEDs, blink when sending or receiving serial data respectively
- Digital I/O pins: 14 pins capable of reading and outputting digital signals; 6 of these pins are also capable of PWM
- AREF pins: can be used to set an external reference voltage as the upper limit for the analog pins

## Steps to install Arduino IDE:

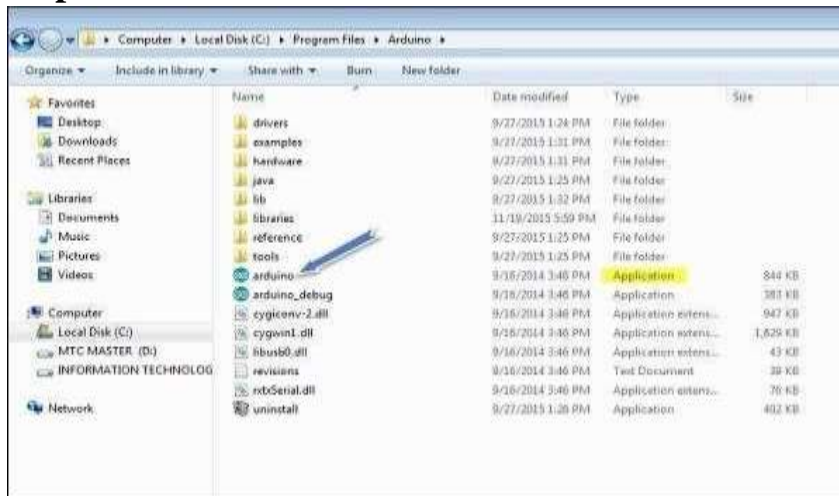
**Step 1** – First you must have your Arduino board connected using standard USB cable.

**Step 2** – Download Arduino IDE Software.



**Step 3** – Power up your Arduino board, the powering up takes place automatically by the board either from the USB connection to the computer or an external power.

**Step 4** – Launch Arduino IDE



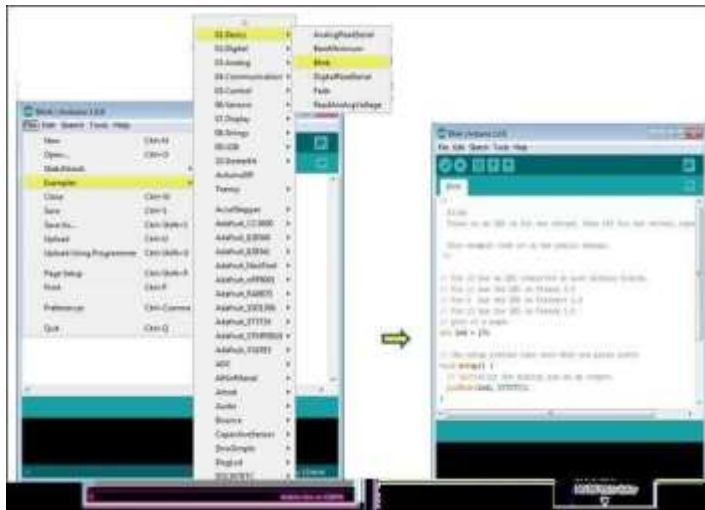
**Step 5** – Open your first project.

Once the software starts, you have two options –

- Create a new project.
- Open an existing project example. To create a new project select File → **New**.



To open an existing project example, select File → Example → Basics → Blink

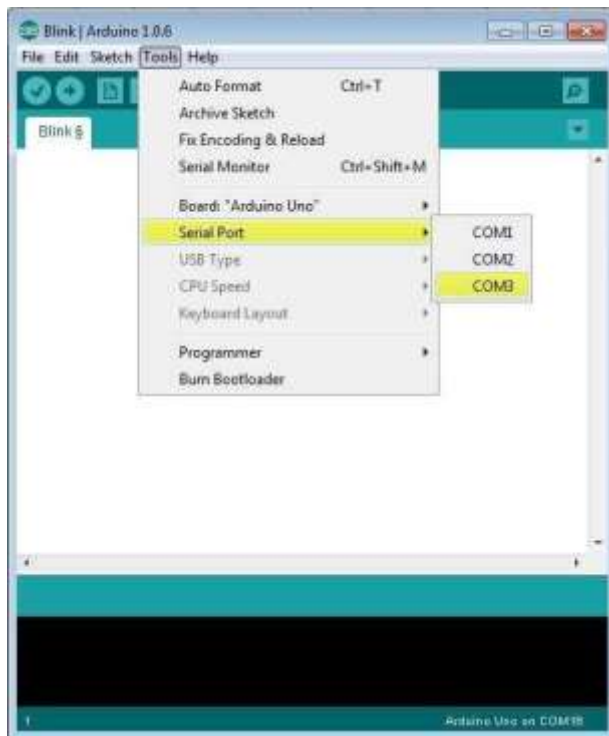


**Step 6 – Select your Arduino board.**



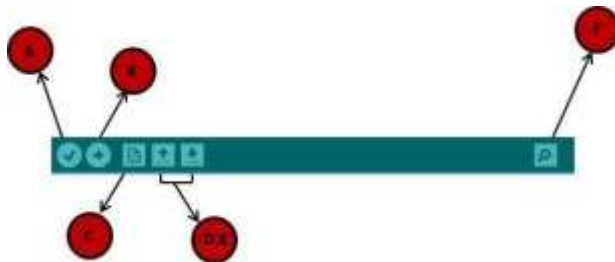
**Step 7 – Select your serial port.**

Select the serial device of the Arduino board. Go to **Tools** → **Serial Port** menu. This is likely to be COM3 or higher



**Step 8** – Upload the program to your board.

Before explaining how we can upload our program to the board, we must demonstrate the function of each symbol appearing in the Arduino IDE toolbar.



**A** – Used to check if there is any compilation error. **B** – Used to upload a program to the Arduino board. **C** – Shortcut used to create a new sketch.

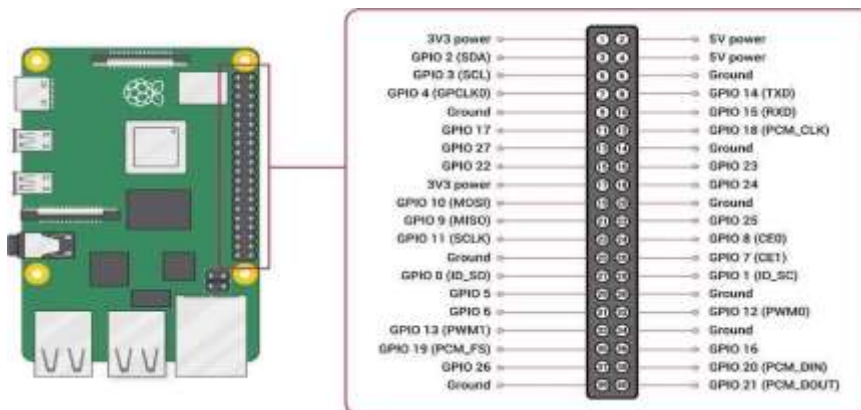
**D** – Used to directly open one of the example sketch.

**E** – Used to save your sketch.

**F** – Serial monitor used to receive serial data from the board and send the serial data to the board.

## About Raspberry Pi

The Raspberry Pi is a very cheap computer that runs Linux, but it also provides a set of GPIO (general purpose input/output) pins that allow you to control electronic components for physical computing and explore the Internet of Things (IoT). Raspberry Pi was basically introduced in 2006. It is particularly designed for educational use and intended for Python. A Raspberry Pi is of small size i.e., of a credit card sized single board computer, which is developed in the United Kingdom (U.K) by a foundation called Raspberry Pi. There have been three generations of Raspberry Pis: Pi 1, Pi 2, and Pi 3. The first generation of Raspberry (Pi 1) was released in the year 2012, that has two types of models namely model A and model B. Raspberry Pi can be plugged into a TV, computer monitor, and it uses a standard keyboard and mouse. It is user friendly as can be handled by all the age groups. It does everything you would expect a desktop computer to do like word-processing, browsing the internet spreadsheets, playing games to playing high definition videos.



## Downloading and Installing Raspberry Pi OS

Once you have all the components you need, use the following steps to create the boot disk you will need to set up your Raspberry Pi. These steps should work on a using a Windows, Mac or Linux-based PC (we tried this on Windows, but it should be the same on all three).

1. **Insert a microSD card / reader** into your computer.



2. **Download and install the official Raspberry Pi Imager.** Available for Windows, macOS or Linux, this app will both download and install the latest Raspberry Pi OS. There are other ways to do this, namely by downloading a Raspberry Pi OS image file and then using a third-party app to “burn it,” but the Imager makes it easier.

3. **Click Choose OS.**

4. **Select Raspberry Pi OS (32-bit)** from the OS menu (there are other choices, but for most uses, 32-bit is the best).

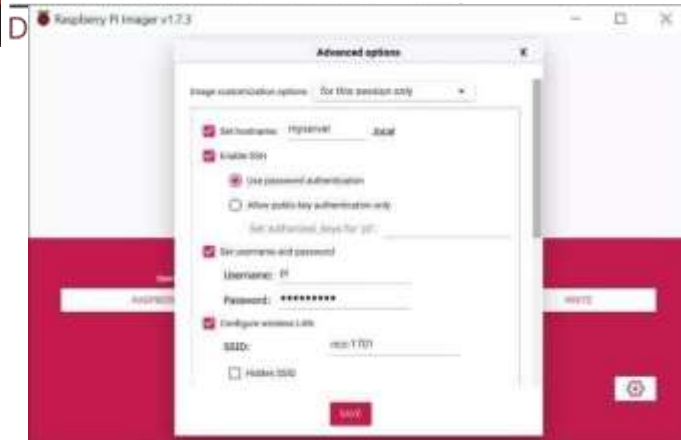
**Click Choose storage and pick the SD card you’re using.**



5. **Click the settings button** or hit CTRL + SHIFT + X to enter settings.

6. **Fill in settings fields** as follows and then **hit Save**. All of these fields are technically optional, but highly recommended so that can get your Raspberry Pi set up and online as soon as you boot it. If you don't set a username and password here, you'll have to go through a setup wizard that asks you to create them on first boot.





- **Set hostname:** the name of your Pi. It could be "raspberrypi" or anything you like.
- **Enable SSH:** Allow SSH connections to the Pi. Recommended.
- **Use password authentication / public key:** method of logging in via SSH
- **Set username and password:** Pick the username and password you'll use for the Pi
- **Configure wireless LAN:** set the SSID and password of Wi-Fi network ☐ **Wireless LAN country:** If you're setting up Wi-Fi, you must choose this.
- **Set locale settings:** Configure keyboard layout and timezone (probably chosen correctly by default)

7. **Click Write.** The app will now take a few minutes to download the OS and write to your card.







## Booting Your Raspberry Pi for the First Time

After you're done writing the Raspberry Pi OS to a microSD card, it's time for the moment of truth.

1. **Insert the microSD card** into the Raspberry Pi.
2. **Connect the Raspberry Pi** to a monitor, keyboard and mouse.
3. **Connect an Ethernet cable** if you plan to use wired Internet.
4. **Plug the Pi in** to power it on.

## Components of Raspberry Pi

**Voltages:** Two 5V pins and two 3V3 pins are present on the board, as well as a number of ground pins (0V). The remaining pins are all general purpose 3V3 pins

A GPIO pin designated as an output pin can be set to high (3V3) or low (0V). A GPIO pin designated as an input pin can be read as high (3V3) or low (0V).

**Processor & RAM:** Raspberry based on ARM11 processor. Latest version supports 700MHz processor and 512MB SDRAM. The Central processing unit is the brain of

the raspberry pi board and that is responsible for carrying out the instructions of the computer through logical and mathematical operations.

**Ethernet:** The Ethernet port of the raspberry pi is the main gateway for communicating with additional devices. The raspberry pi Ethernet port is used to plug your home router to access the internet.

**USB Ports:** It has 2 USB ports. USB port provide current upto 100mA. For connecting devices that draw current more than 100mA, an external USB powered hub is required.

**Ethernet Port:** It has standard RJ45 Ethernet port. Connect Ethernet cable or USB wifi adapter to provide internet connectivity.



# DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

**HDMI Output:** It supports both audio and video output. Connect raspberry Pi to monitor using HDMI cable.

**Composite video Output:** Raspberry comes with a composite video output with an RCA jack that supports both PAL and NTSC video output.

**Audio Output:** It has 3.5mm audio output jack. This audio jack is used for providing audio output to old television along with RCA jack for video.

**GPIO Pins:** It has a number of general purpose input/output pins. These pins are used to connect other electronic components. For example, you can connect it to the temperature sensor to transmit digital data.

**Display Serial Interface (DSI):** DSI interface are used to connect an LCD panel to Raspberry PI.

**Cameral Serial Interface(CSI):** CSI interface are used to connect a camera module to Raspberry PI.

**SD Card slot:** Raspberry does not have built in OS and storage. Plug in an SD card loaded with Linux to SD card slot.

**Power Input:** Raspberry has a micro USP connector for power input.

**Memory:** The raspberry pi model A board is designed with 256MB of SDRAM and model B is designed with 512MB. Raspberry pi is a small size PC compare with other PCs. The normal PCs RAM memory is available in gigabytes. But in raspberry pi board, the RAM memory is available more than 256MB or 512MB

**Status LEDs:** Raspberry has 5 status LEDs.

1. ACT SD card Access
2. PWR 3.3V power is present
3. FDX Full duplex LAN Connected
4. LNK Link/Network Activity
5. 100 100 Mbit LAN connected