Internet Of Things (IoT)

SHEKHAR SUMAN

CERTIFICATE

Class: **T.Y.B.Sc.I.T.**   Year: **2025 - 2026**

This is to certify that work entered in this Journal is the work of

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Required number of practical and worked for the __**5TH**__ Semester

Of the year __**2025 - 2026**__ in the college laboratory as laid down

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Head of the   External   Internal Examiner

Department   Examiner   Subject teacher

Date:

NAME: SHEKHAR SUMAN		INDEX
CLASS: T.Y.B.Sc.I.T.	ROLL No: 47	
SUBJECT: INTERNET OF THINGS (IoT)		
COLLEGE: ST. ROCK'S DEGREE COLLEGE		

PRACTICAL – 1

AIM: Understanding Raspberry Pi and its pins.

Raspberry Pi GPIO Pins Overview
- **Physical Pins:** The header on the Raspberry Pi consists of 40 pins, numbered from 1 to 40 (top left to bottom right in the image).
- **Types of Pins:**
  - **Power Pins:**
    - 3.3V (Pins 1, 17): Orange blocks.
    - 5V (Pins 2, 4): Red blocks.
    - Ground/GND (Pins 6, 9, 14, 20, 25, 30, 34, 39): Black blocks.
  - **GPIO Pins:** Used for input/output operations. Named GPIO followed by a number (e.g., GPIO2, GPIO3).
  - **Special Function Pins:**
    - **I2C:** Pins for communication using Inter-Integrated Circuit protocol (Pins 3 (SDA), 5 (SCL), light blue).
    - **UART:** Pins for serial communication (Pins 8 (TX), 10 (RX), purple).
    - **SPI:** Pins for Serial Peripheral Interface (MOSI, MISO, SCLK, CE0, CE1; green blocks).
    - **PWM:** Pins for Pulse Width Modulation (PWM0, PWM1; light purple).

How to Use These Pins
- **Digital Input/Output:** Most pins labeled GPIO can be programmed to read digital sensors (input) or control devices like LEDs (output).

- **Communication Protocols:** Use the I2C, SPI, and UART specific pins to connect with modules that support these protocols.
- **Power Supply:** Use the 3.3V or 5V pins and GND pins to supply power to your connected components.

Example Practical: Blink an LED

1. **Connect:**
   - LED's positive leg to GPIO17 (Pin 11).
   - LED's negative leg to GND (Pin 6).
2. **Write a Simple Python Code:** Use GPIO17 in your code to turn the LED on/off.

Summary Table (Main Functions)

Pin No.	Function	Color Code
1, 17	3.3V Power	Orange
2, 4	5V Power	Red
6, 9...	Ground (GND)	Black
3, 5	I2C SDA/SCL	Light Blue
8, 10	UART TX/RX	Purple
19, 21, 23, 24	SPI (MOSI, MISO, SCLK...)	Green
11, 13, ...	GPIO Pins	Blue, Yellow

PRACTICAL – 2

AIM: Installing operating system NOOBS on SD card and burning it.

Downloading the **SD CARD** formatter.

Step 1: Browse the SD card formatter download in your browser and go with the original link.
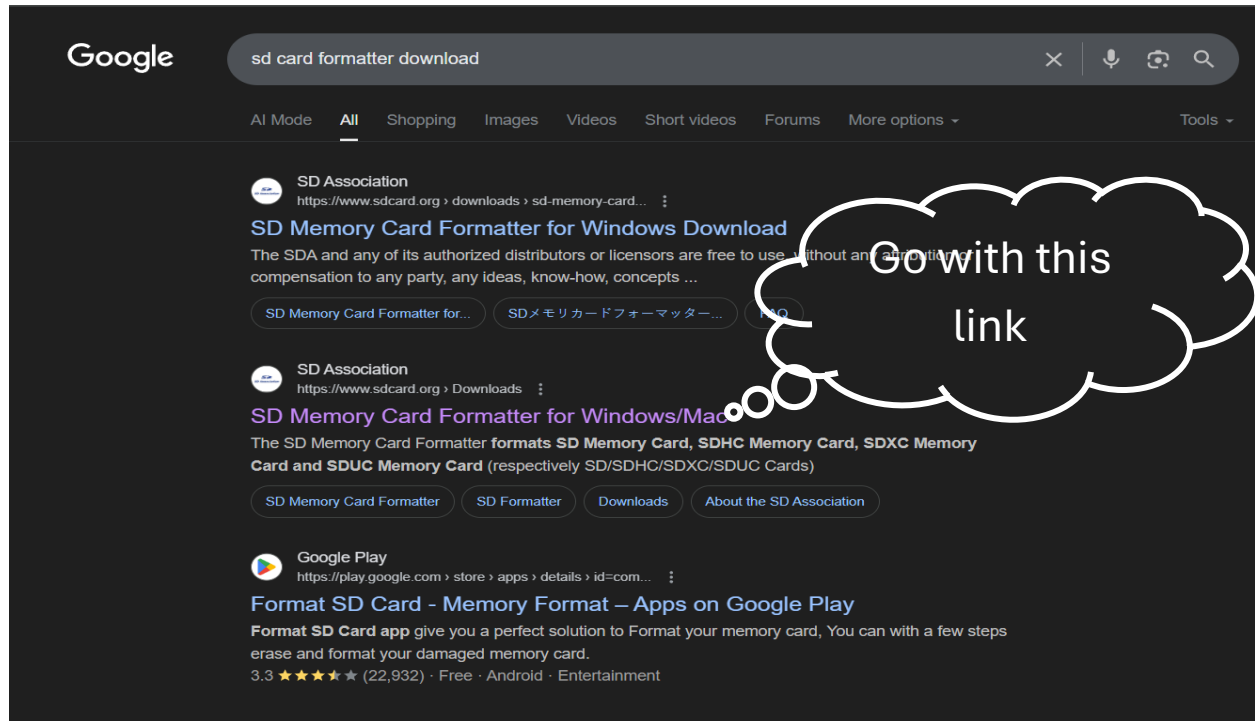
Step 2: After that scroll down and find this option then choose your operating system, here my operating system is Window so I prefer myself to choose Window option.

Step 3: On the clicking on Window option, you got the interface of SD card formatter user license and agreement with their notice. Read carefully and scroll down and find this option then click on Accept button. When you click on the Accept button then your file is automatically downloading in the ZIP format.

YOU ACKNOWLEDGE AND AGREE THAT YOU HAVE READ THIS AGREEMENT AND INTEND TO BE BOUND AS IF YOU HAD SIGNED THIS AGREEMENT IN WRITING. IF YOU ARE ACTING ON BEHALF OF AN ENTITY, YOU WARRANT THAT YOU HAVE THE AUTHORITY TO ENTER INTO THIS AGREEMENT ON BEHALF OF SUCH ENTITY AND BIND SUCH ENTITY TO THE TERMS OF THIS AGREEMENT.

Decline	>	Accept	>

Step 4: Once your download is complete then open your file explore and go to the download option find your downloaded file and extract that file.
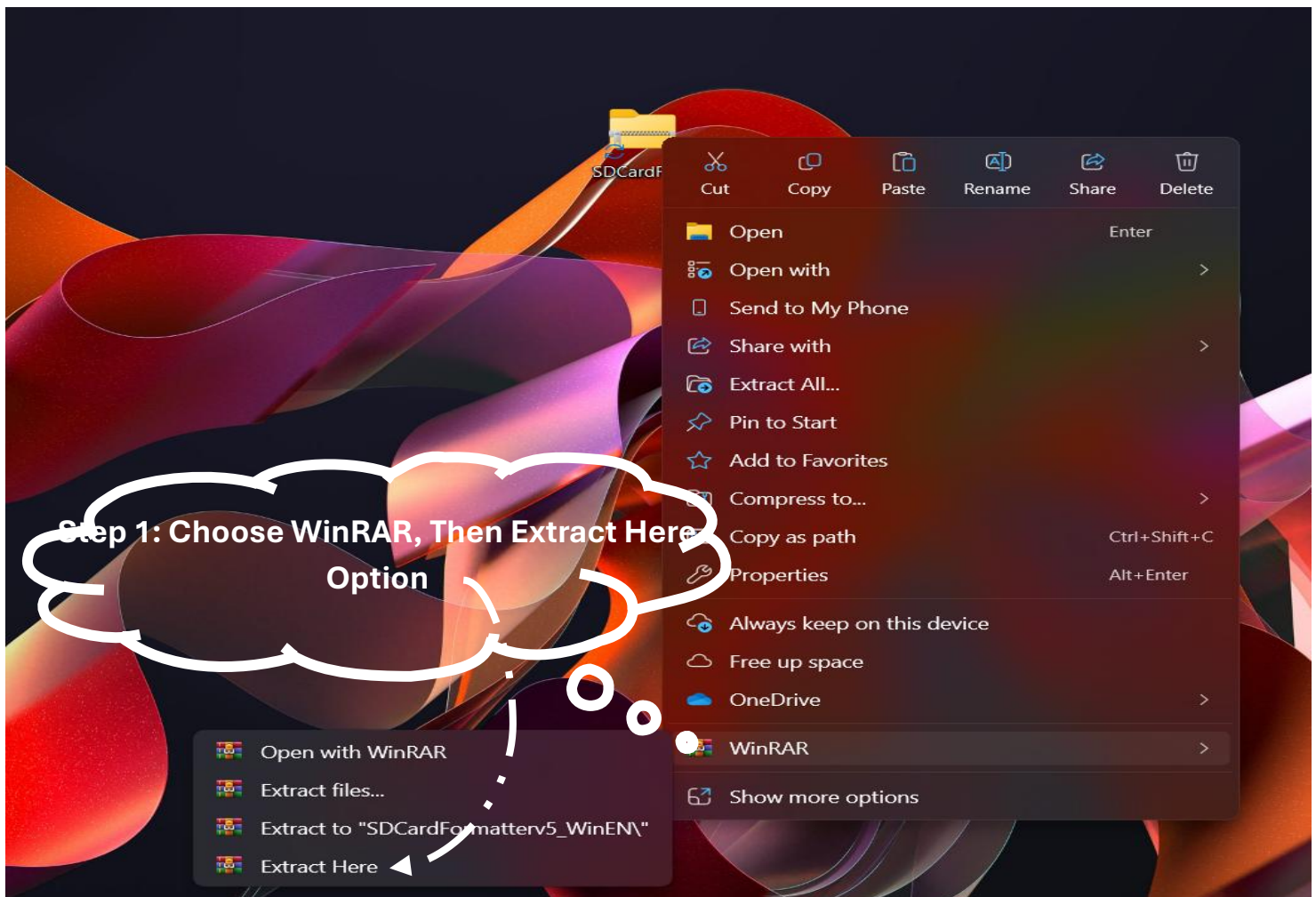
Step 5: When your extraction is complete then you got the new folder with the same name where you extract your folder. Go inside that folder you find the application file.
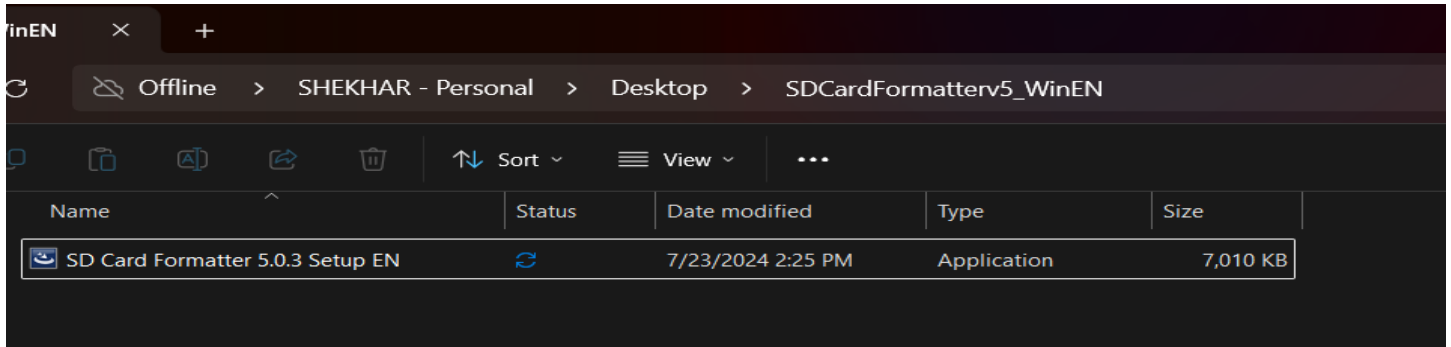

Step 6: Double click on it, it takes few seconds for the preparing your installation. Once your preparing is done then you got the interface of InstallShield Wizard, click on the next button for the next processing.


**Step 7:** Accept the terms and license agreement then click on the next button.

Step 8: Then it asks from you for the application destination, if you want to change your location / destination the browser your destination, here I don't need to change my destination so I go with the default location. Then I click on the next button.
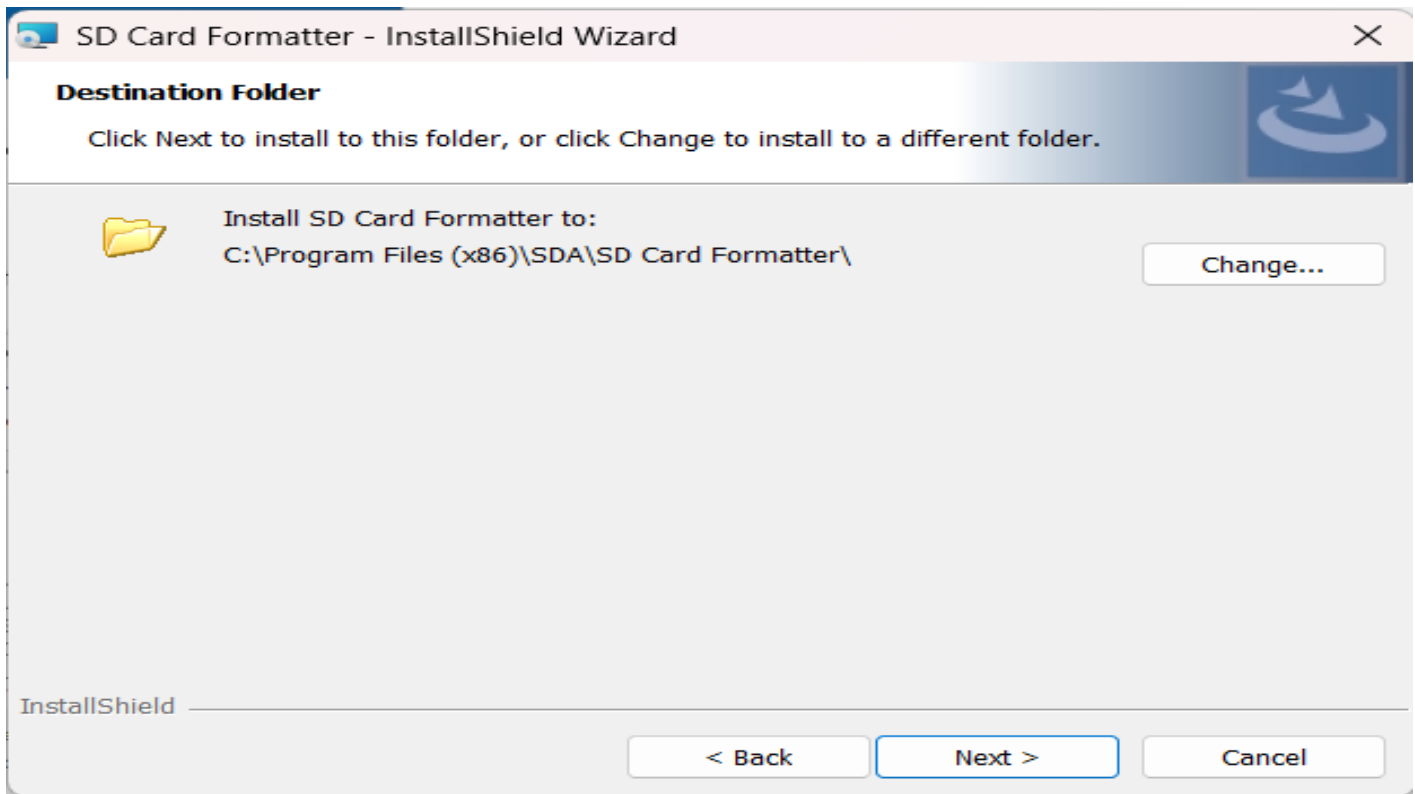

Step 9: Then your application is ready to install, you can see your information about this application click on the install button for the installing your application. When your click on the install button it takes some times for preparing your installation. Once your installation is done then click on the finish button here your SD card formatter in successfully download.
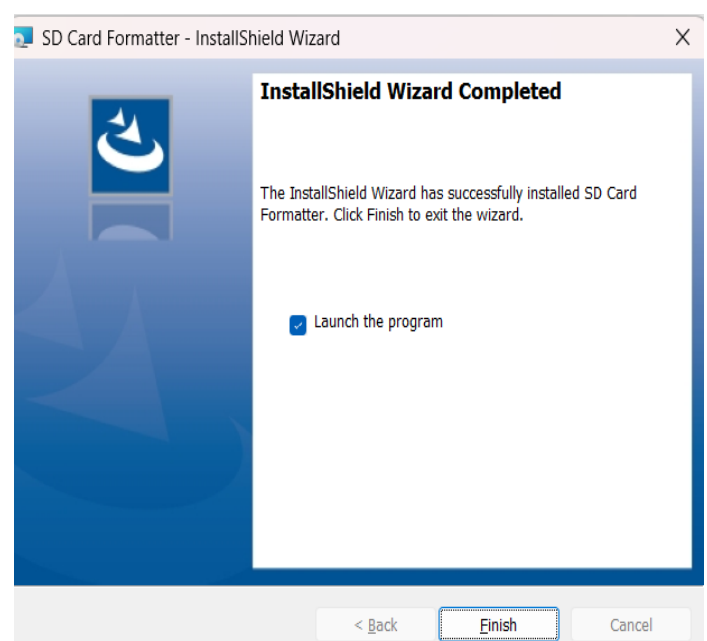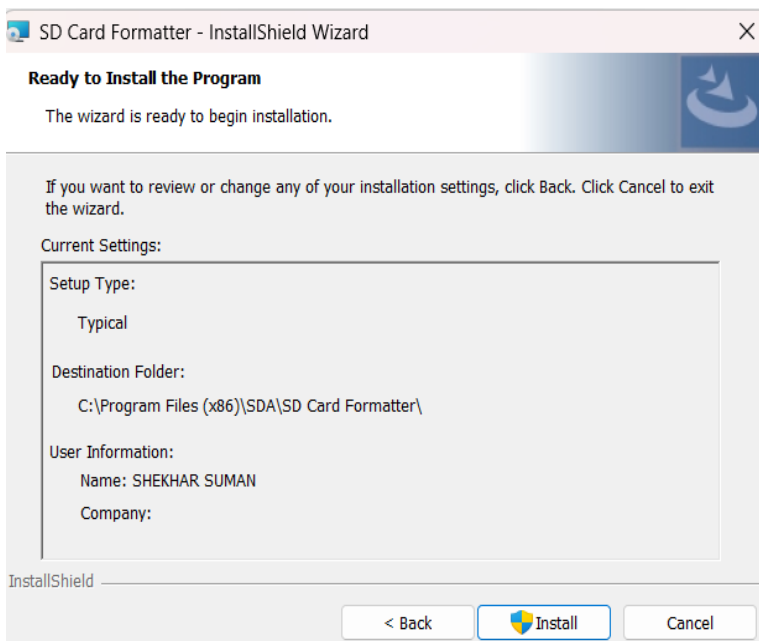
Step 10: Insert your SD card in your laptop / computer with the help of card reader then open the SD card formatter application it automatically detects your SD card. They're you can see your card information and formatting options. In formatting options, you have to choose Quick format, below the formatting options you can see the Volume label here you can give the name of your SD card whatever you want here I give my name "SHEKHAR SUMAN", at first time it detects automatically according to your SD card name. after this process click on the format button.
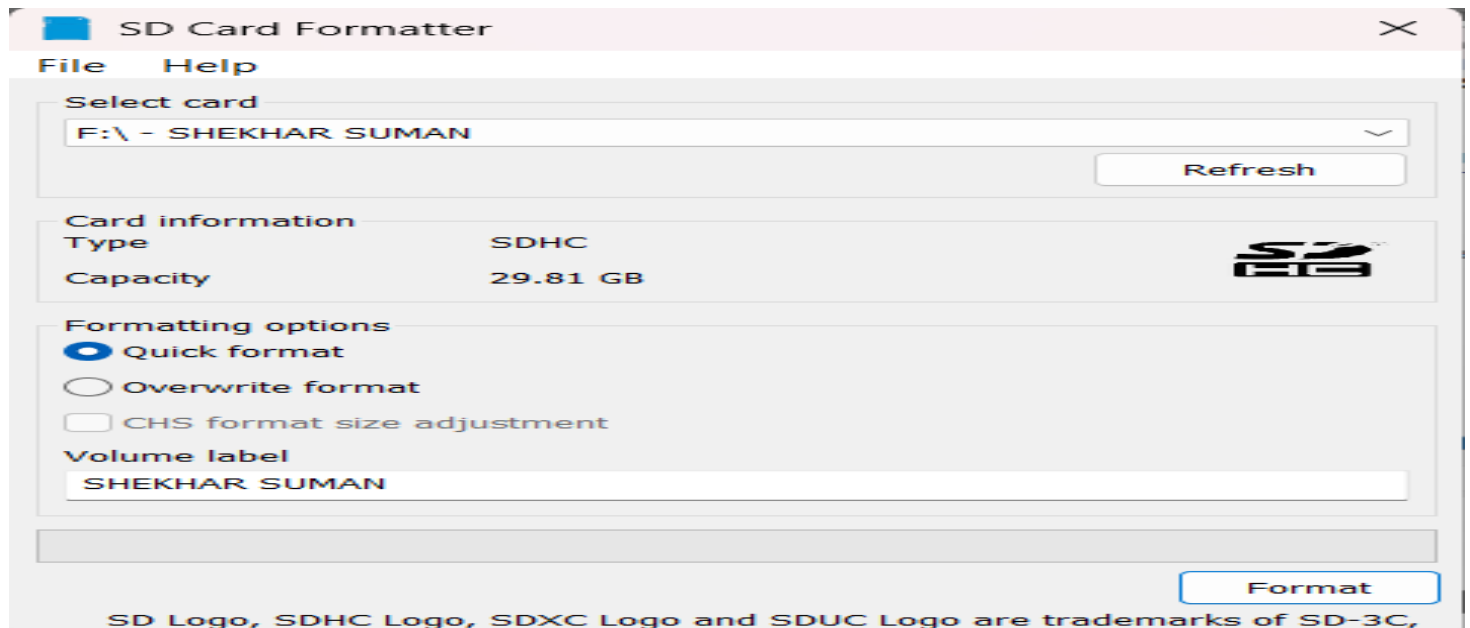
Step 11: Once your format is done then you see the interface of formatting was successfully completed.
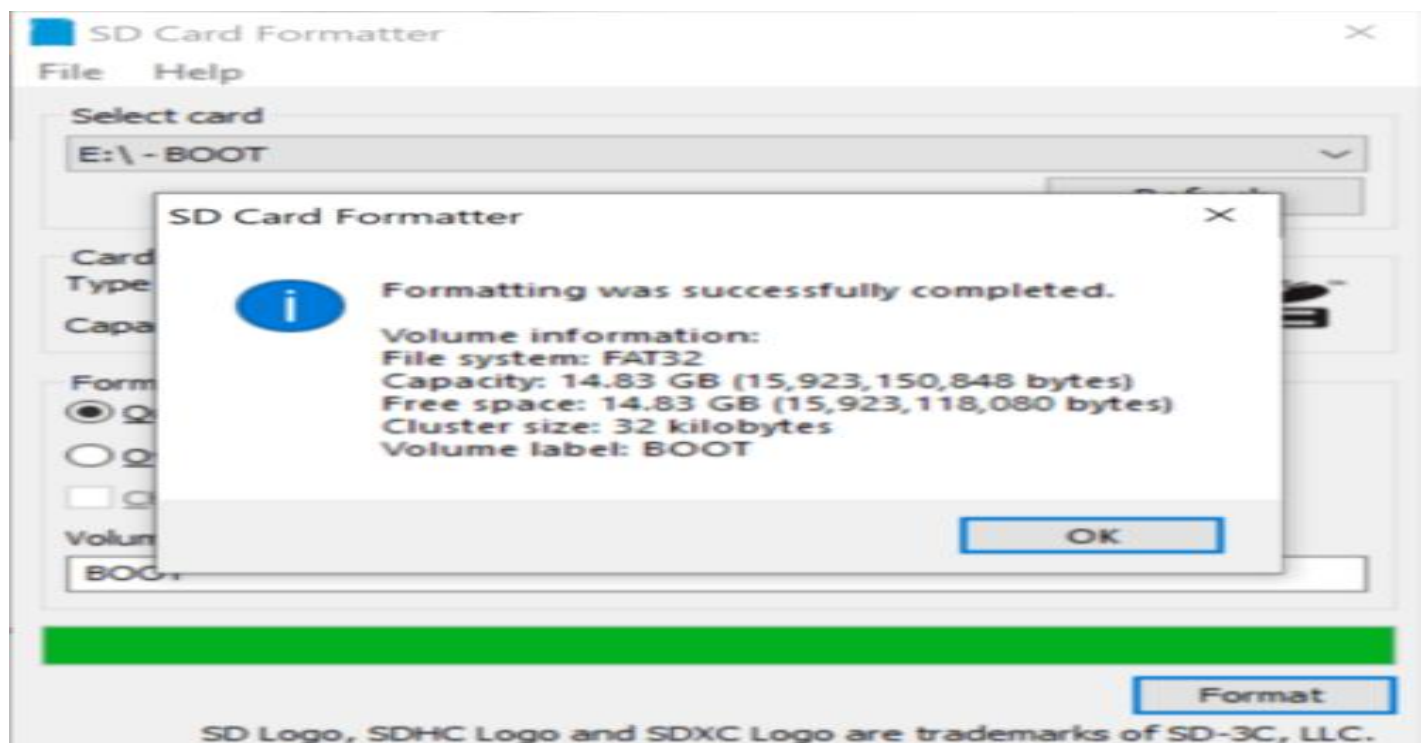
O.S Manager NOOBS Installation

Step 1: Browse in the browser Raspberry pi download go with the first link
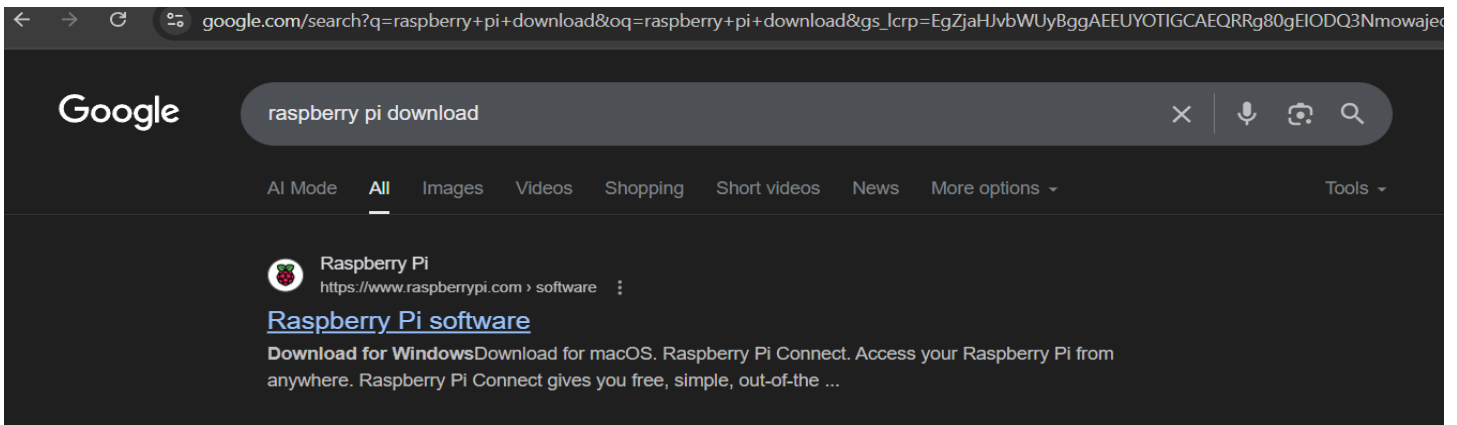
Step 2: Here we can see that raspberry pi software Raspberry pi Imager, then choose your Operating system. When you click on the Download for according to your operating system, then your exe file is start downloading.
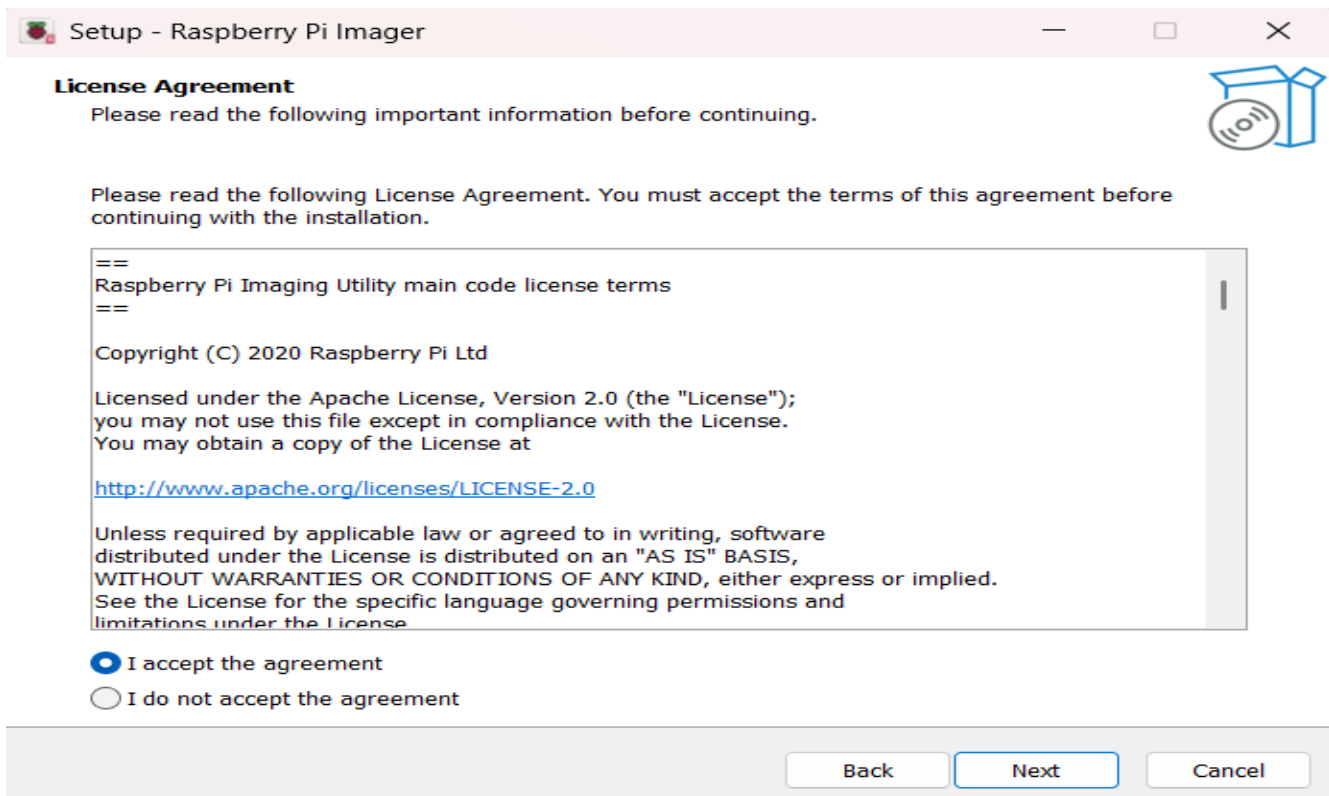

Step 3: After the downloaded of exe file then double click on that file and open it, then its ask from you choose your language then press on the ok button.
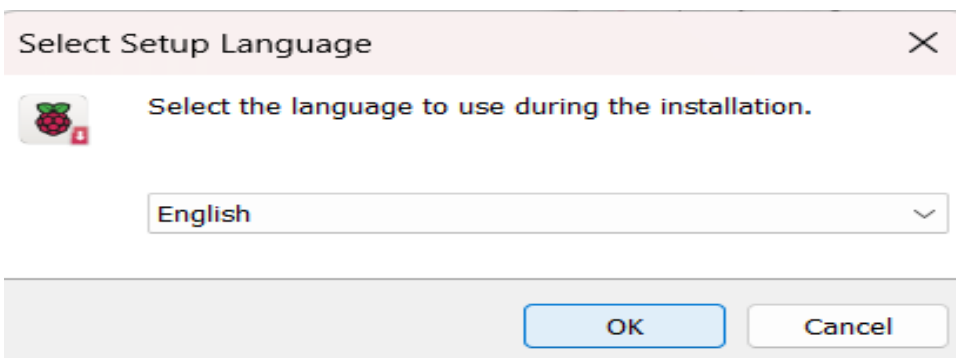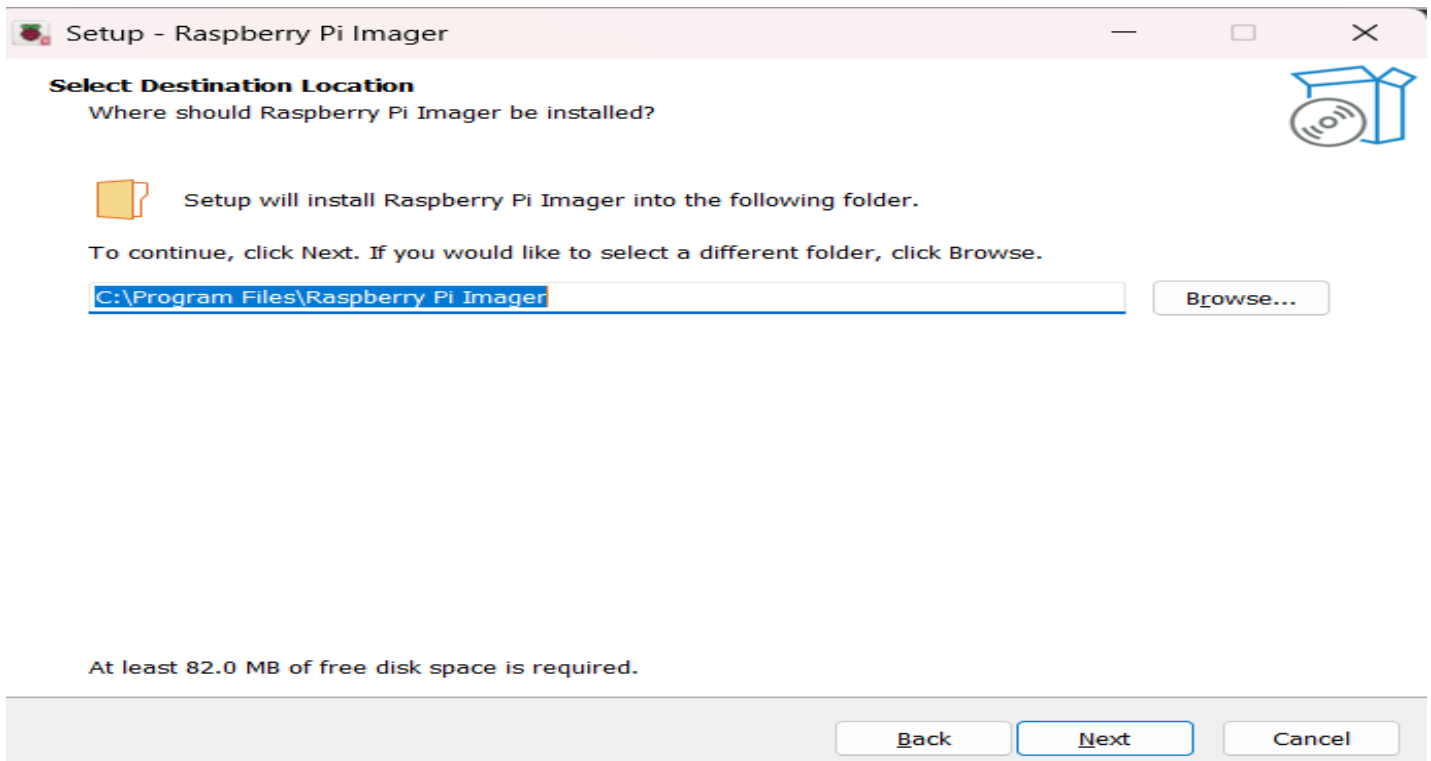
Step 4: Then you redirect on the set-up page on your raspberry imager click on the next button.
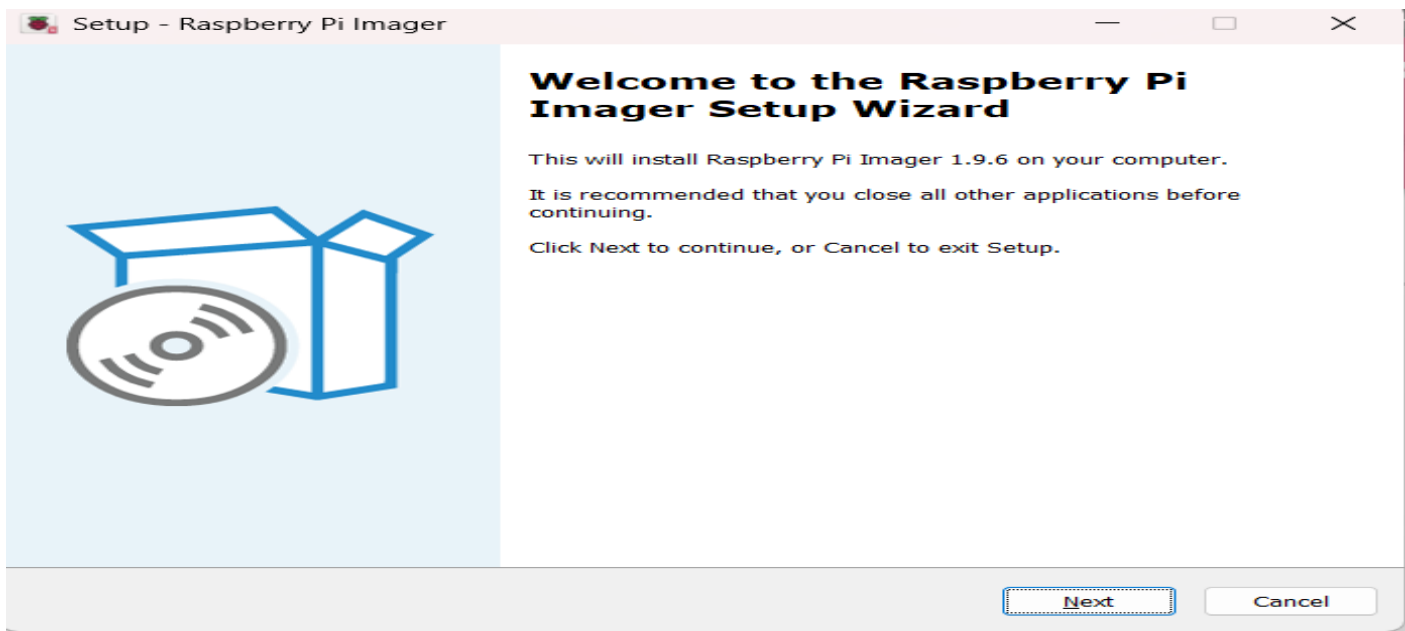
Step 5: Accept the agreement after that then click on the next button.

Step 6: Choose the destination location if you want otherwise make it default. Then click on the next button.

Setup - Raspberry Pi Imager

Select Destination Location
Where should Raspberry Pi Imager be installed?

Setup will install Raspberry Pi Imager into the following folder.

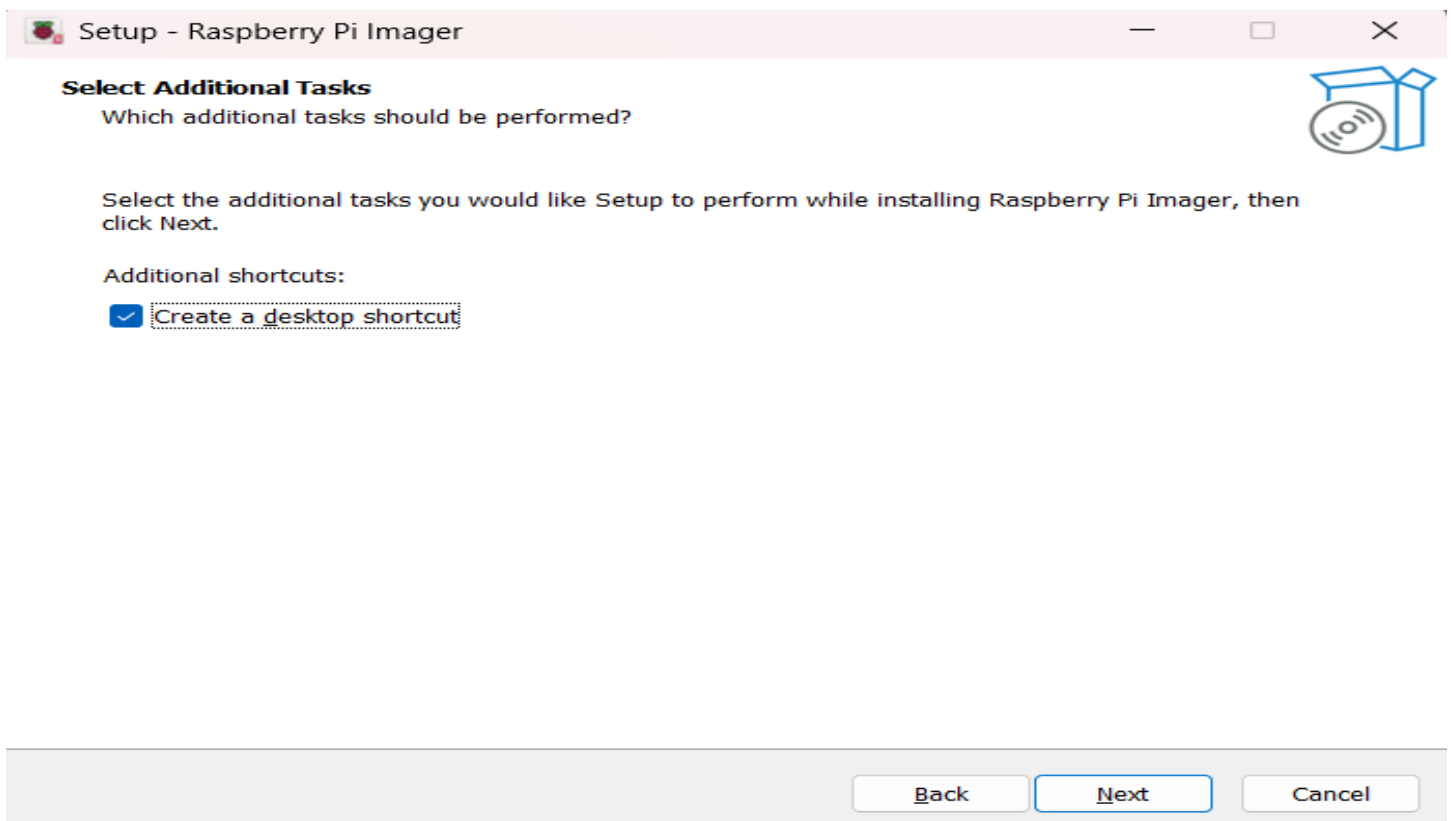To continue, click Next. If you would like to select a different folder, click Browse.

C:\Program Files\Raspberry Pi Imager   Browse...

At least 82.0 MB of free disk space is required.

Back   Next   Cancel

Step 7: Then you got the option for creating desktop shortcuts if you want then check on the checkbox otherwise make it unchecked and click on the next button.

Setup - Raspberry Pi Imager

Select Additional Tasks
Which additional tasks should be performed?

Select the additional tasks you would like Setup to perform while installing Raspberry Pi Imager, then click Next.

Additional shortcuts:

☑ Create a desktop shortcut

Back   Next   Cancel

Step 8: It is installing now when it successfully installed on your computer then you got, he completing the Raspberry pi imager set-up wizard. Then you have the click finish button to exit the setup.
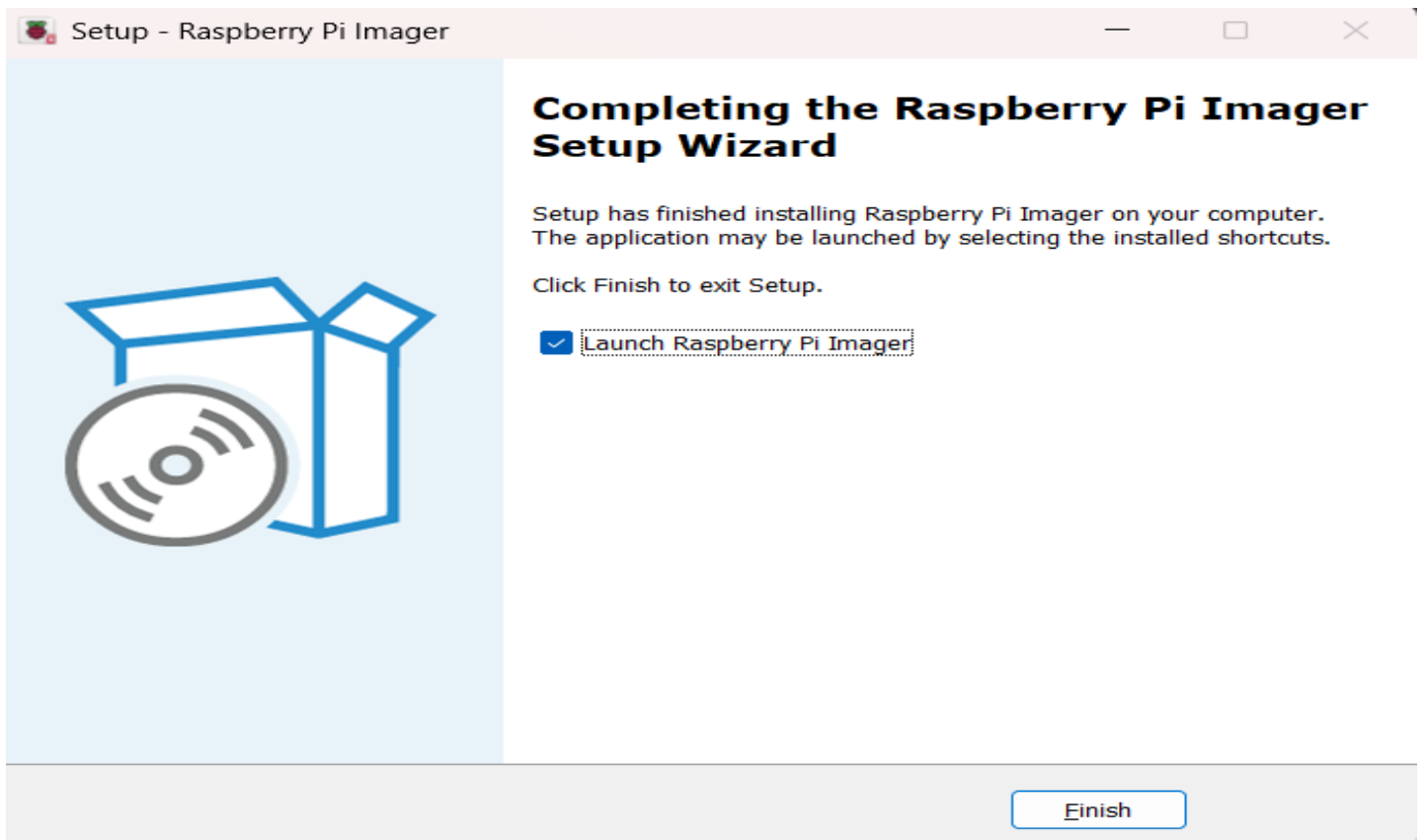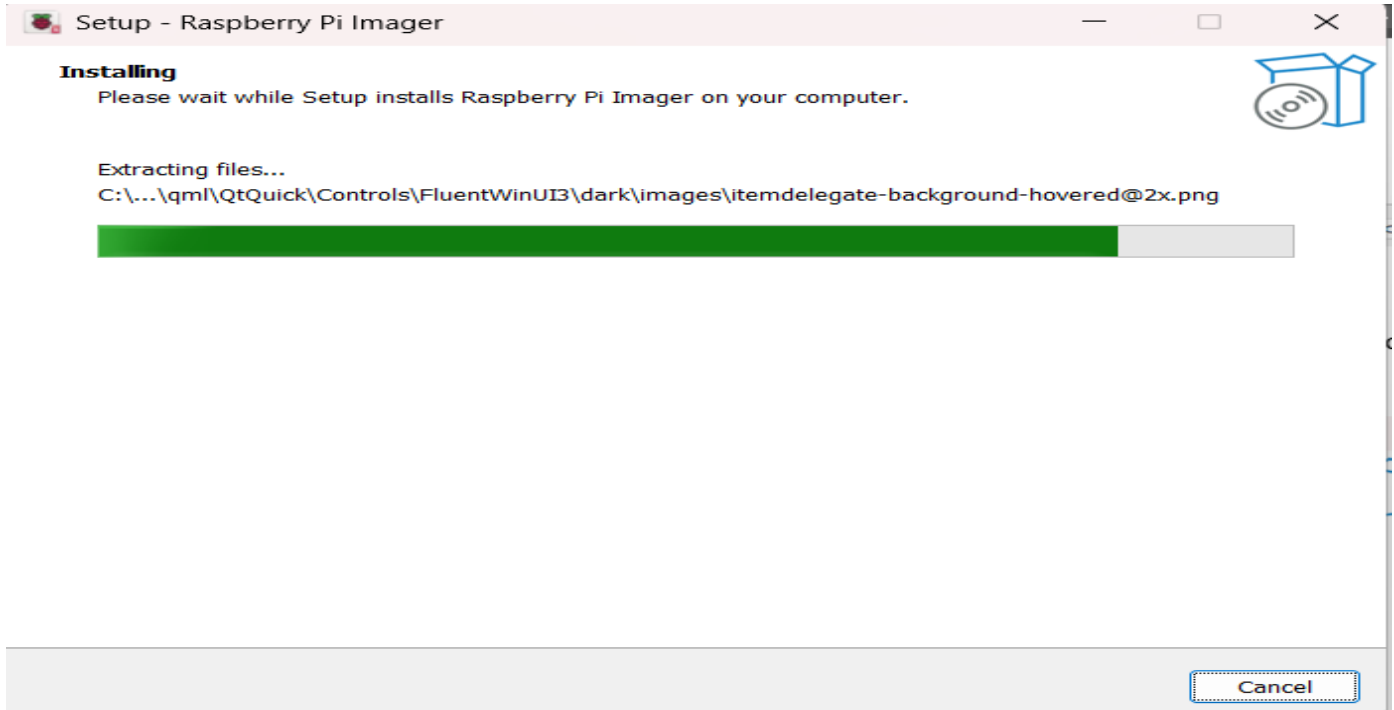
The final output of installation is this, this is the interface of the Raspberry Pi imager Application.
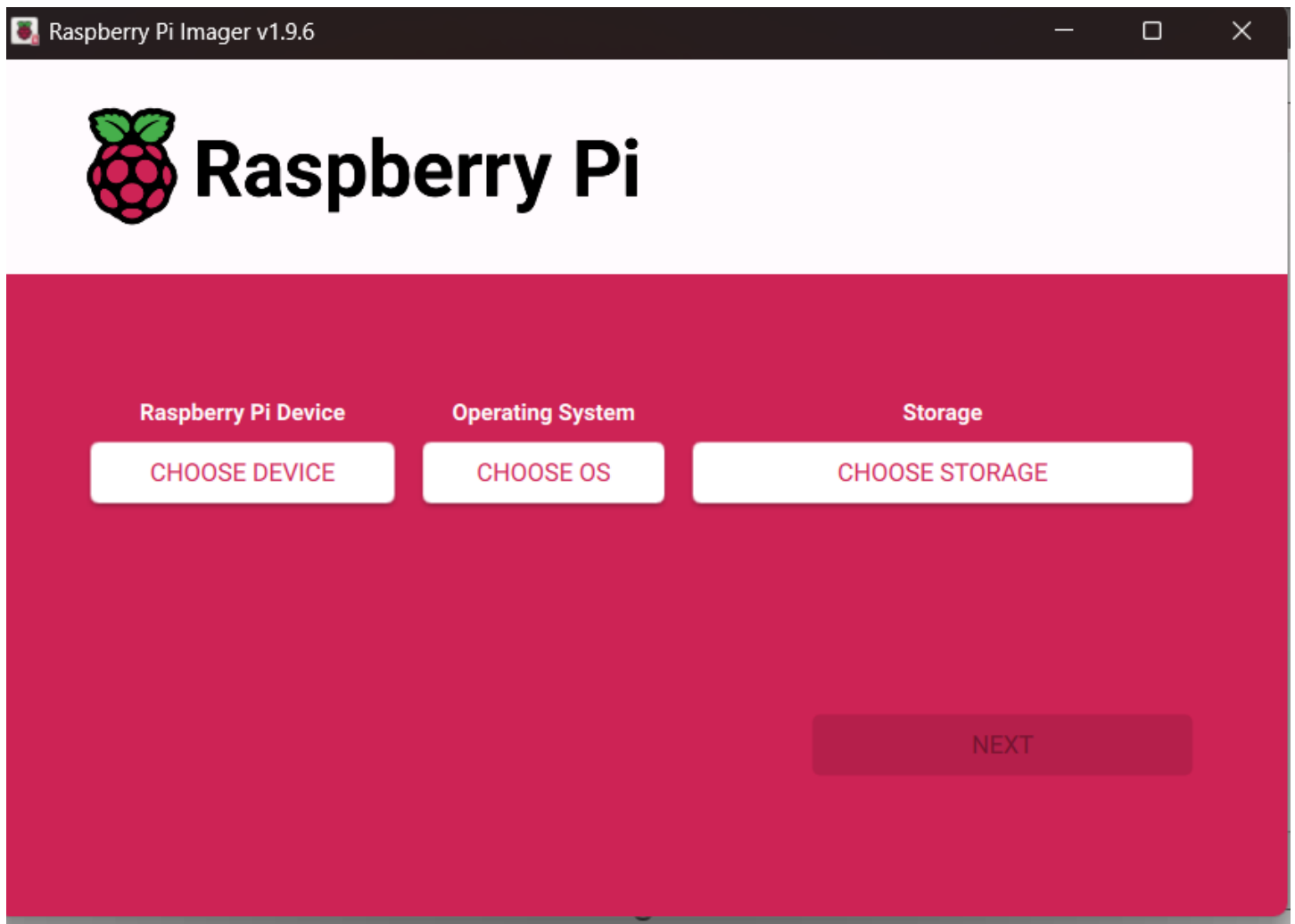
PRACTICAL 3A

**AIM:** Installing Raspbian OS on raspberry PI

| SR.No.	REQUIREMENTS	WORKS
1	Raspberry Pi	The main mini-computer where the OS runs.
2	SD card	Works as the storage drive to hold Raspberry Pi OS and files.
3	HDMI cable	Connects Raspberry Pi to a monitor/TV for display output.
4	Montier	Displays the Raspberry Pi OS interface.
5	Adaptor	Supplies stable power to the Raspberry Pi.
6	USB Type C cable	Provides power supply to the Raspberry Pi.
7	Key Board & Mouse	Used for input and controlling the Raspberry Pi.

About the Raspberry Pi.
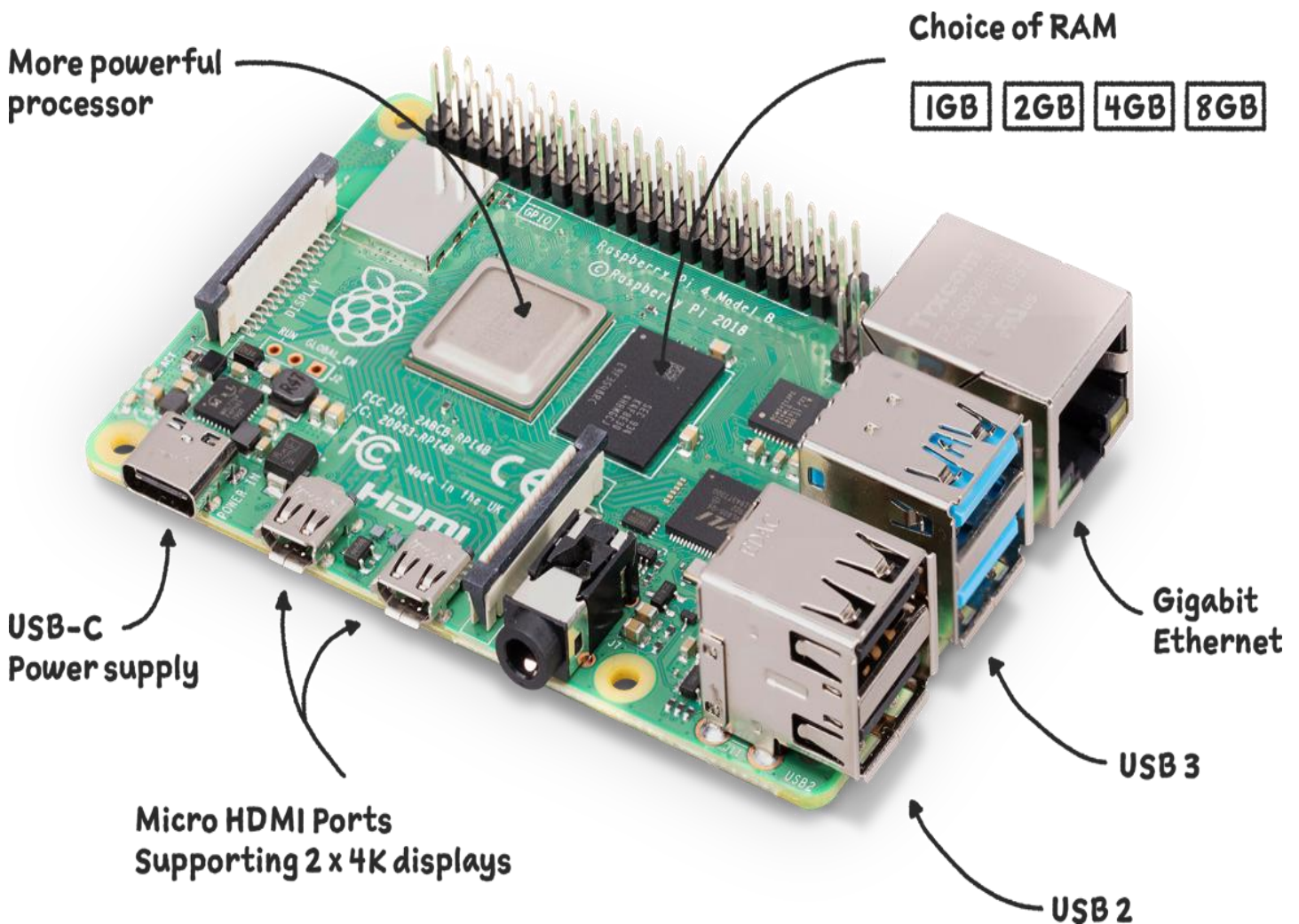
CONNECTION

Step 1: Insert the SD card into the Raspberry Pi, it acts as the main storage, containing the Raspberry Pi OS, and allows the system to boot and run applications properly.
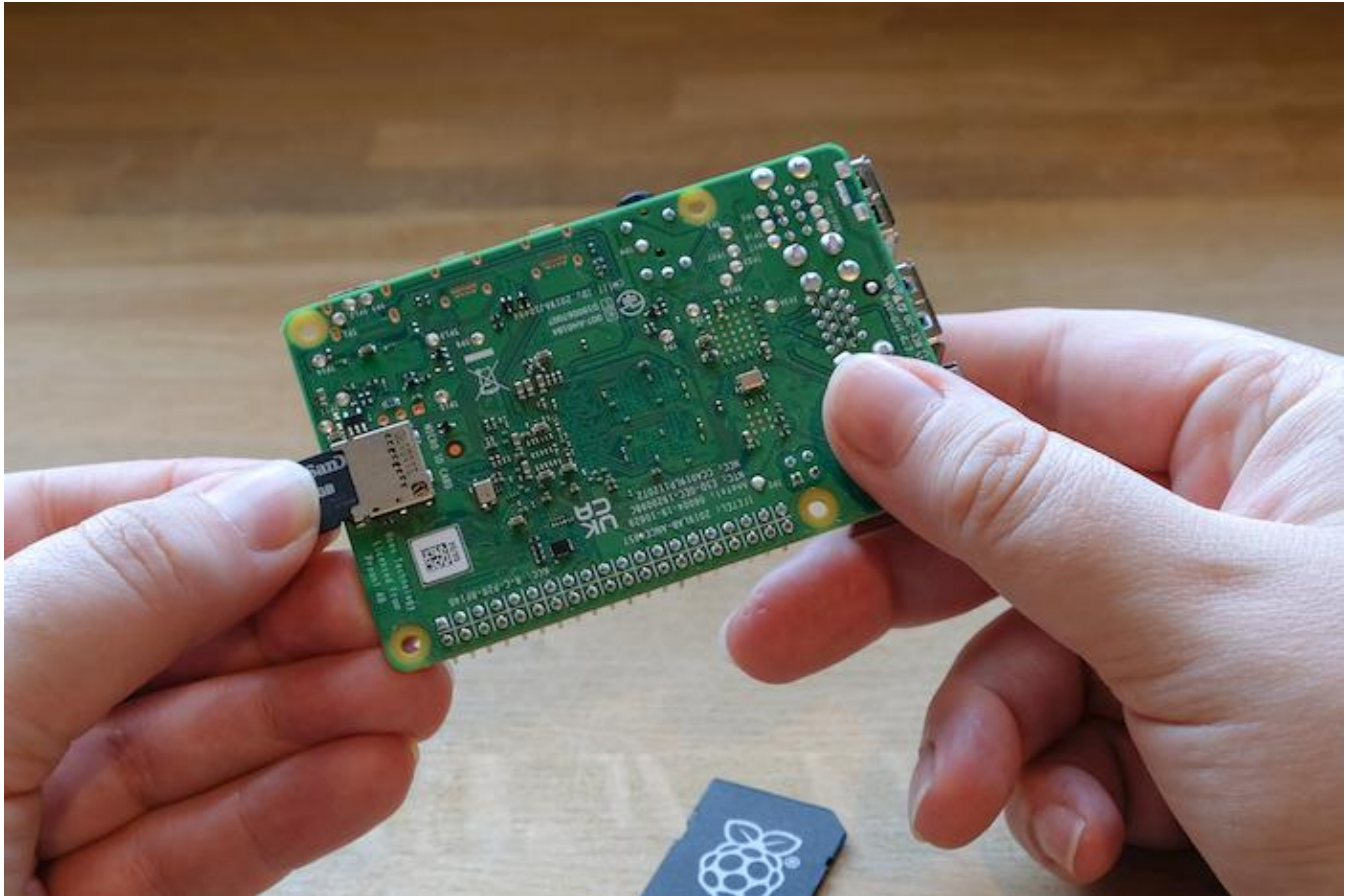

Step 2: Connect the keyboard and mouse to the Raspberry Pi, they provide input control, allowing us to type commands, navigate the desktop, configure settings, and interact with the operating system easily.
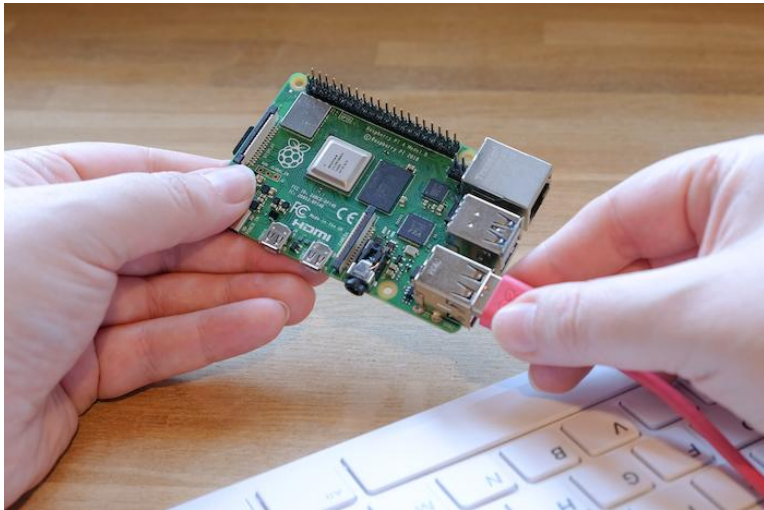
Step 3: Connect the HDMI cable to the Raspberry Pi, it transfers both video and audio signals, enabling the monitor or TV to display the operating system and user interface clearly.


Step 4: Connect the Type-C cable to the Raspberry Pi, it provides the required power supply, ensuring the board starts, runs the operating system, and functions properly for all tasks.
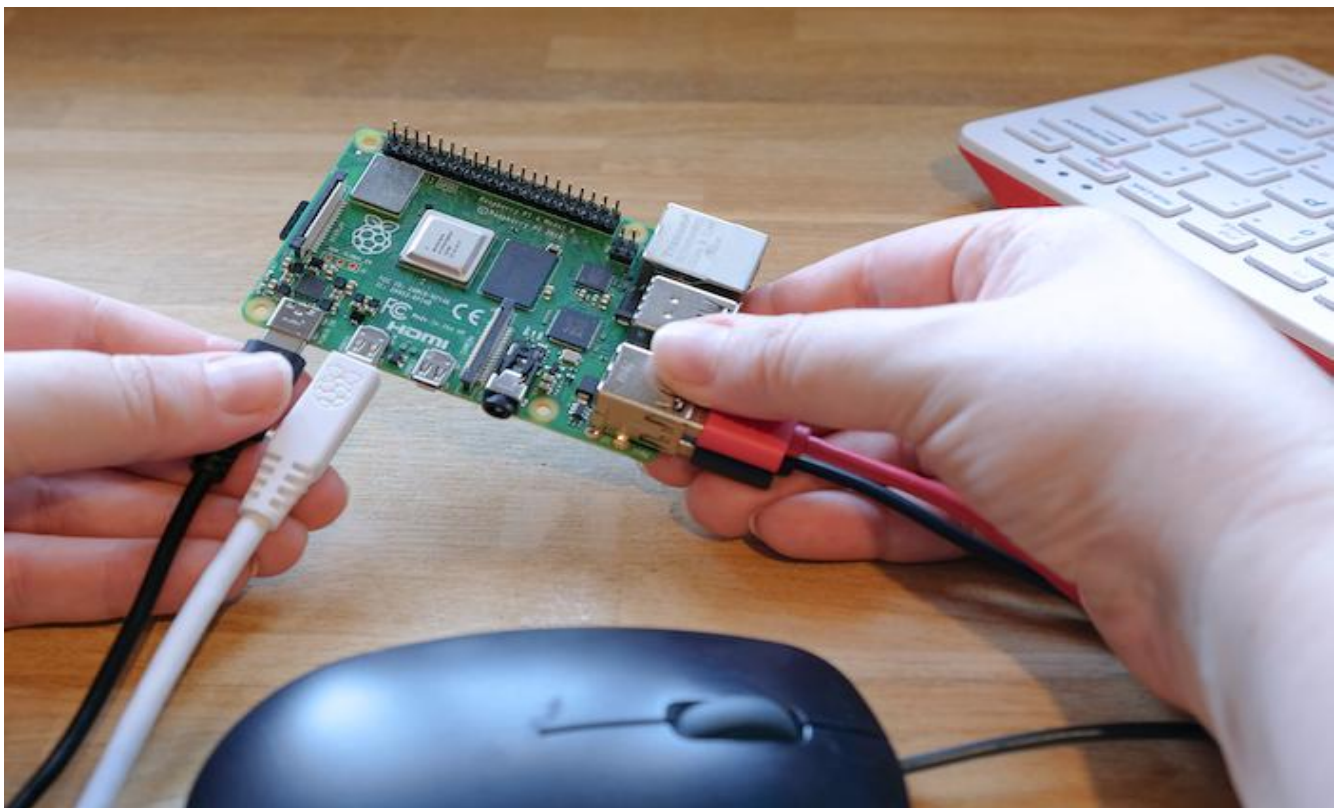
When all connections are done and we power the Raspberry Pi:

1. **Red LED lights up** → confirms power supply.
2. **Green LED blinks** → Raspberry Pi reads the SD card and boots the OS.
3. **Display appears on monitor via HDMI** → Raspberry Pi OS logo and boot process show up.
4. **Keyboard and mouse become active** → allow you to control and set up the system.
5. **Raspberry Pi is ready to use** → you can start programming, browsing, or running projects.
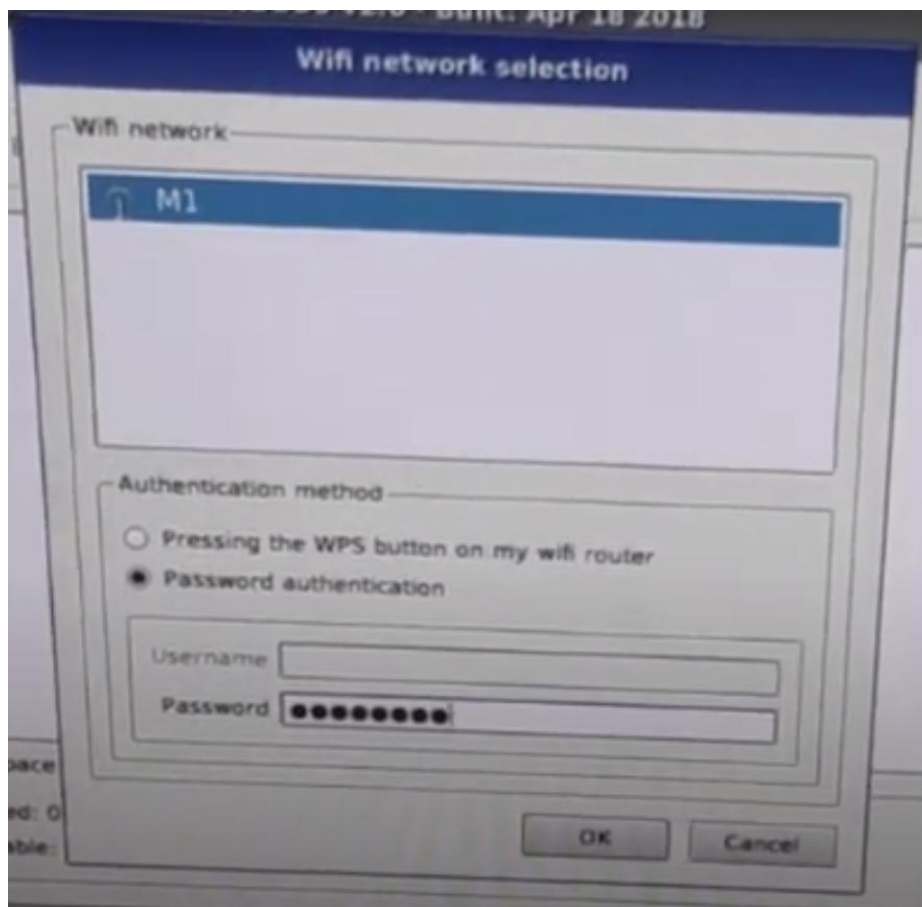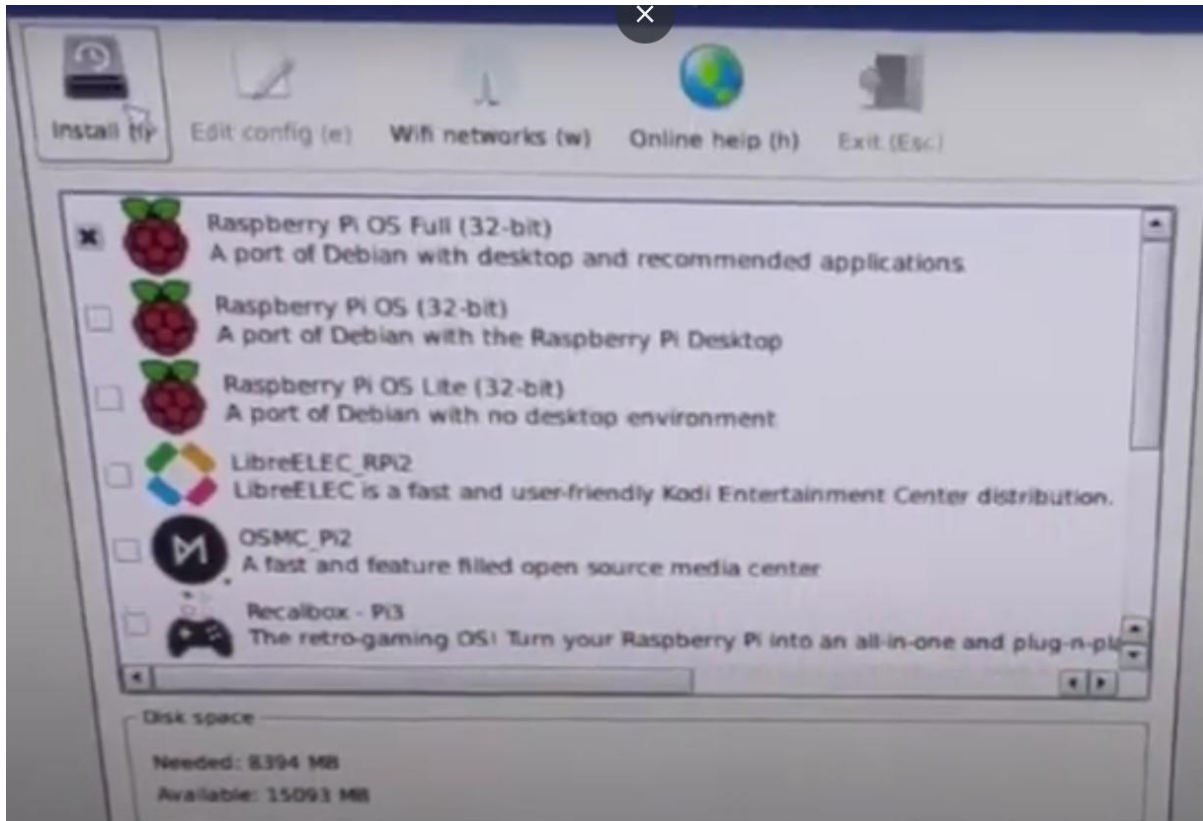
CONNECTION DIAGRAM
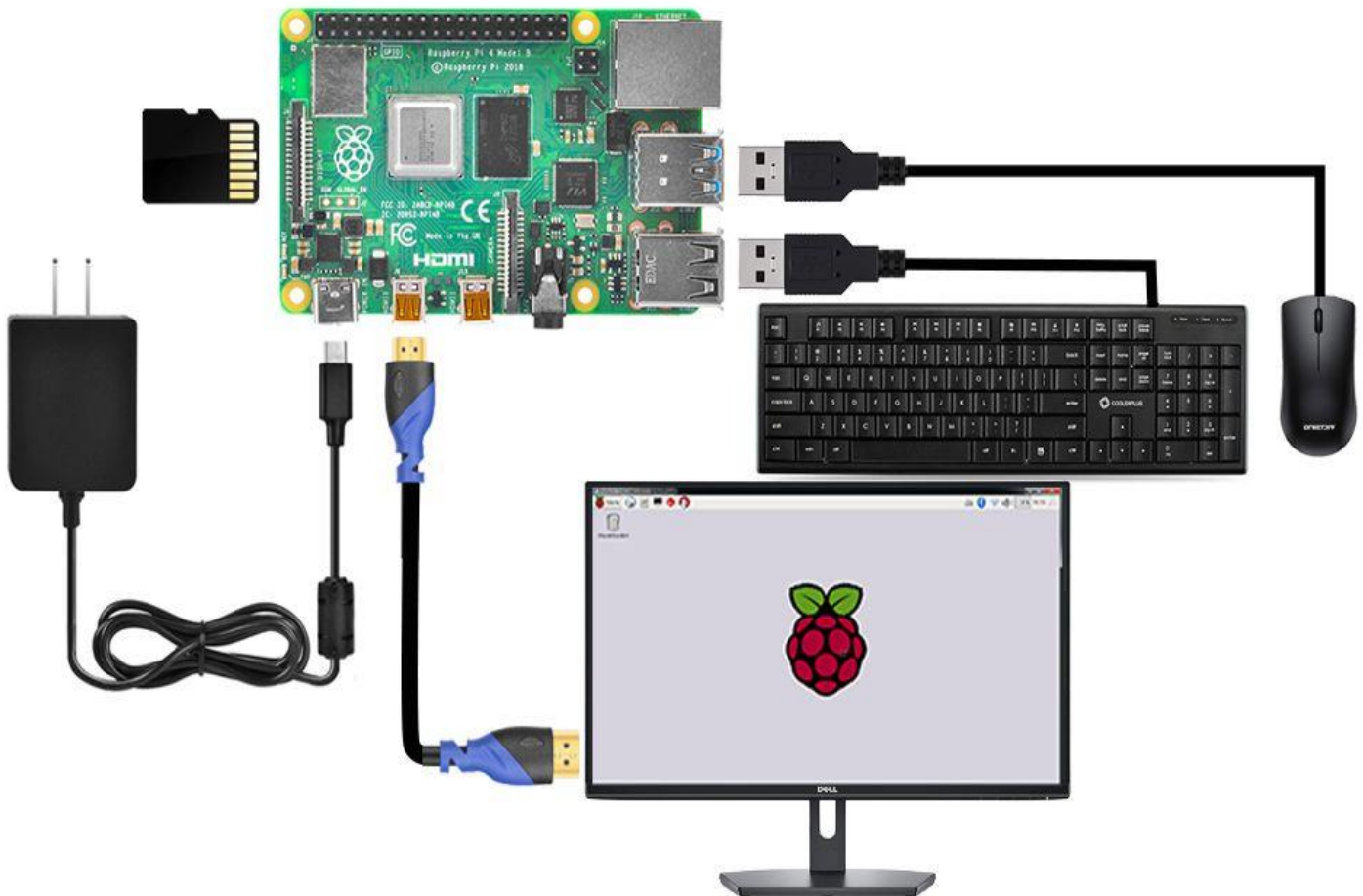
INSTALLATION

In the beginning it shows the error of the internet connection like this.
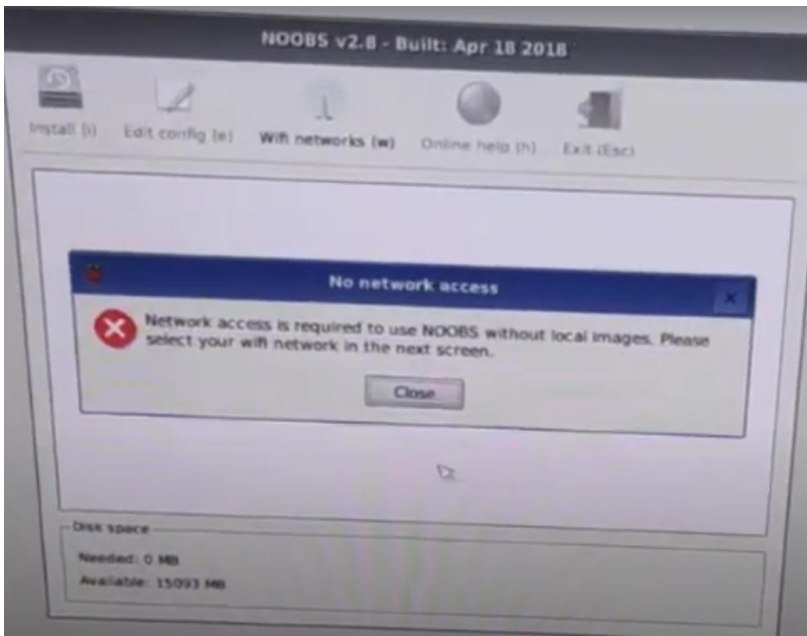
Step 1: Select your Wi-Fi name, after the selection of your Wi-Fi name then enter the password and hit the ok button.

Step 2: Select your preferred operating system from the NOOBS menu, then click "Install." The Raspberry Pi will automatically install it.
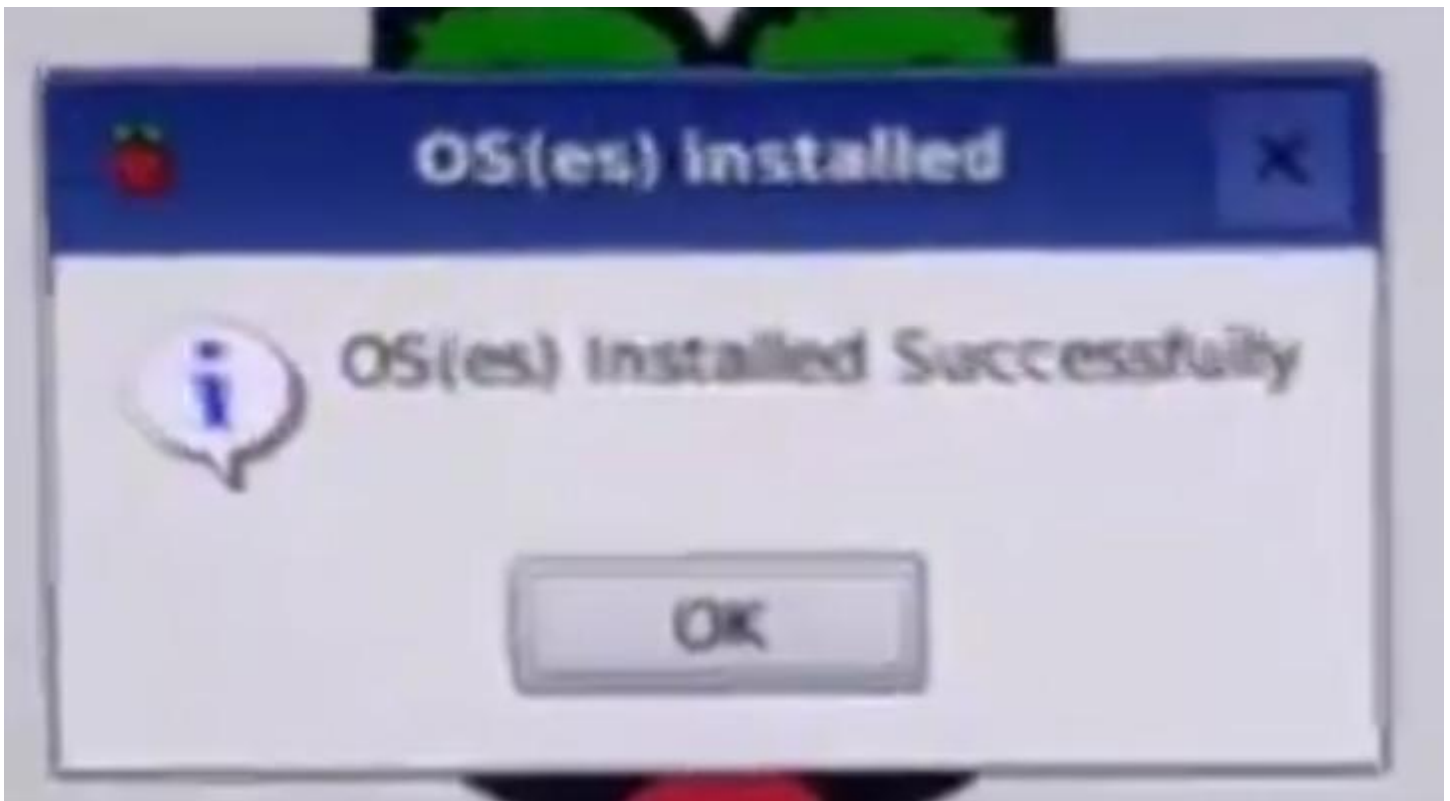

Step 3: After clicking on the install button, it shows a warning click on the Yes button.
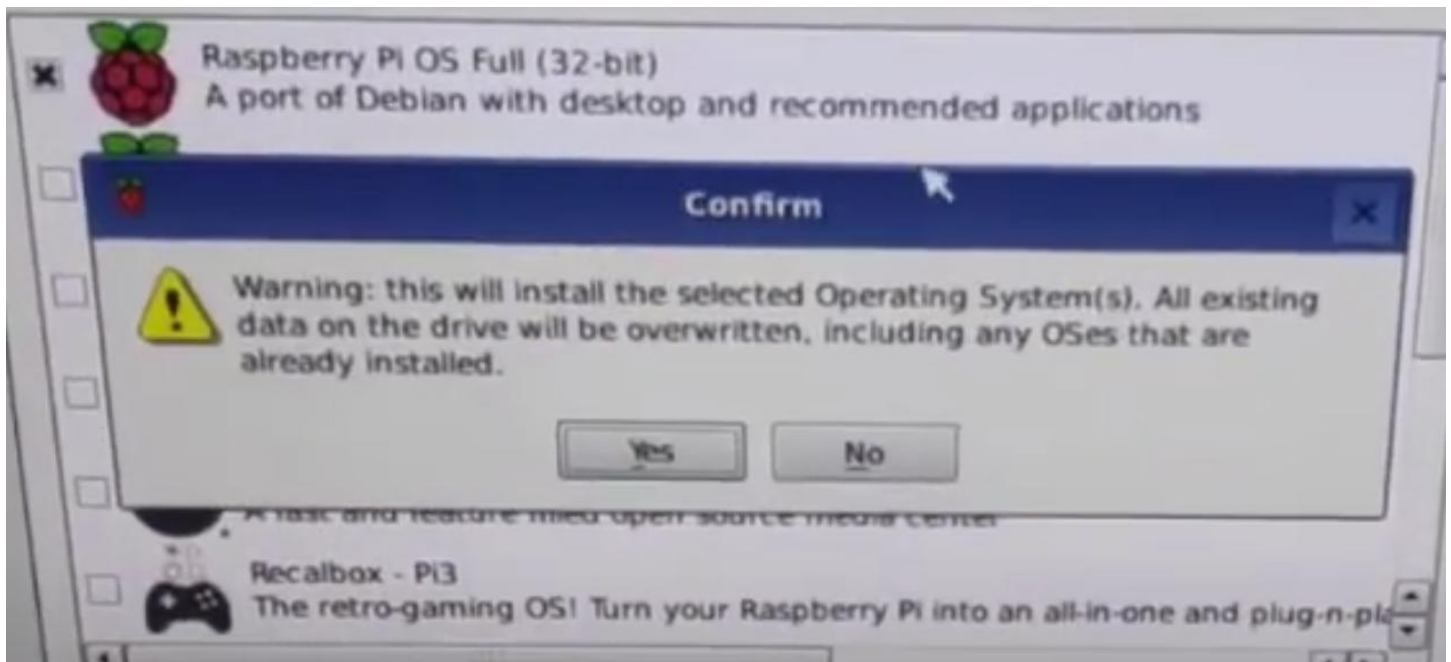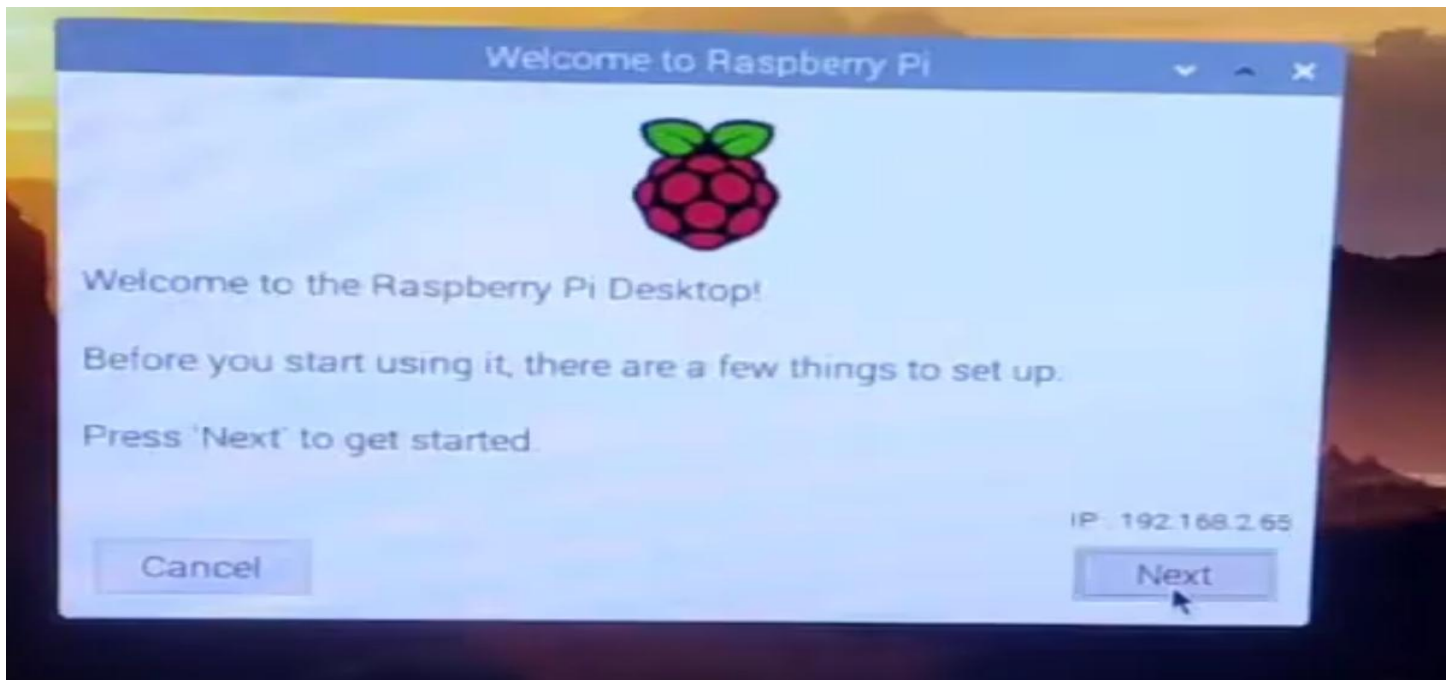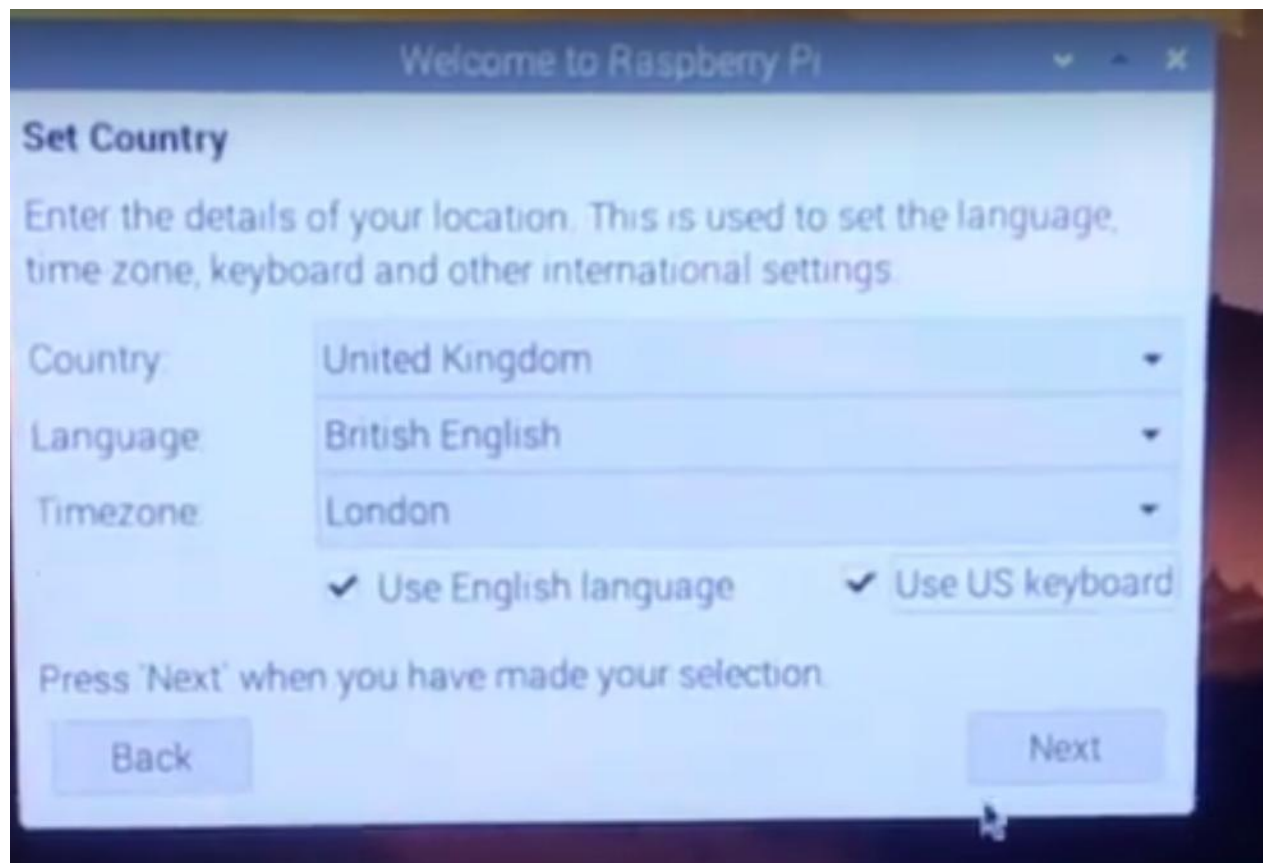
Step 4: Now it is Installing.

Step 5: When this is installed then you show the Installed successfully message, then click on OK button.

Step 6: After the successfully installation then we have to do some set-up, Now you see the set-up dialog click on the Next button.

**Step 7:** Then click on the checkbox of Use English Language and Use US Keyboard

Step 8: After clicking the next button then we show the change password interface, here no need to keep password, if you want then you can choose randomly otherwise the default password is "raspberry". Then click on the next button.
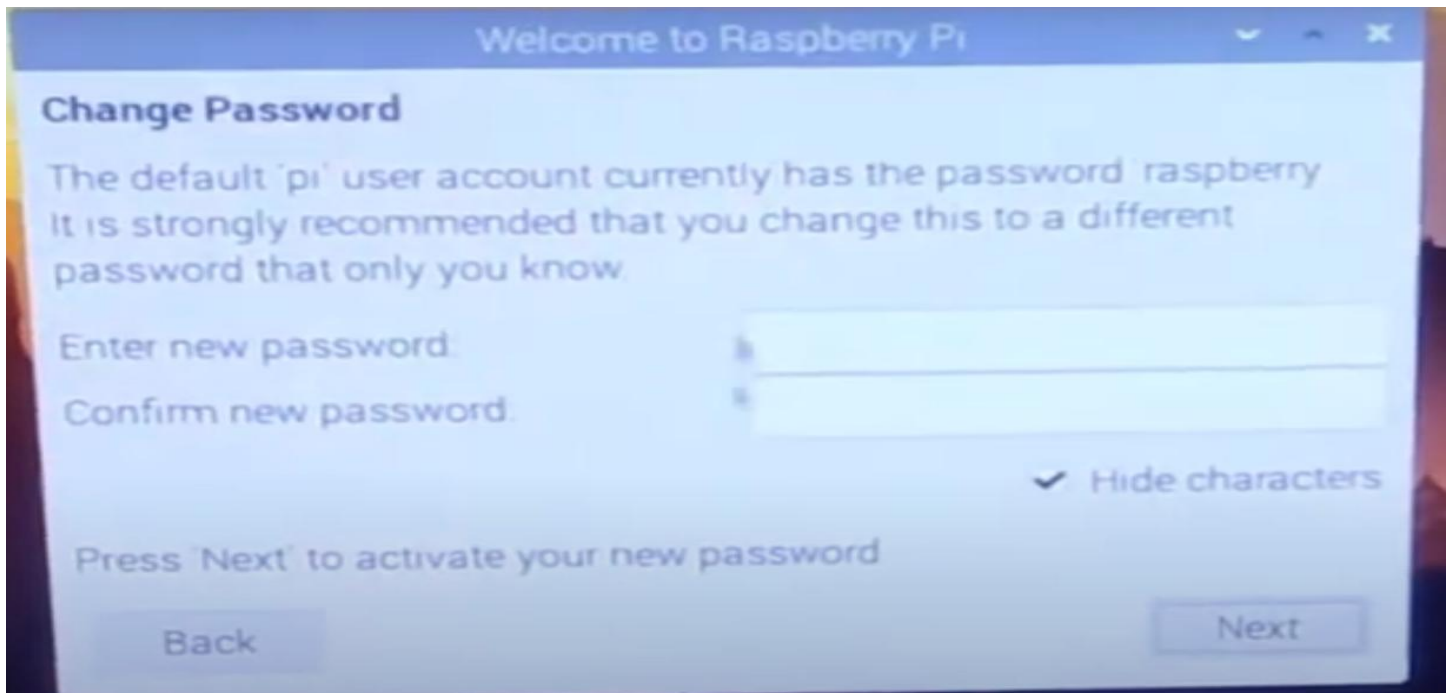
Step 9: Now we show the Setup screen interface, here nothing to do changes then click on the next button.
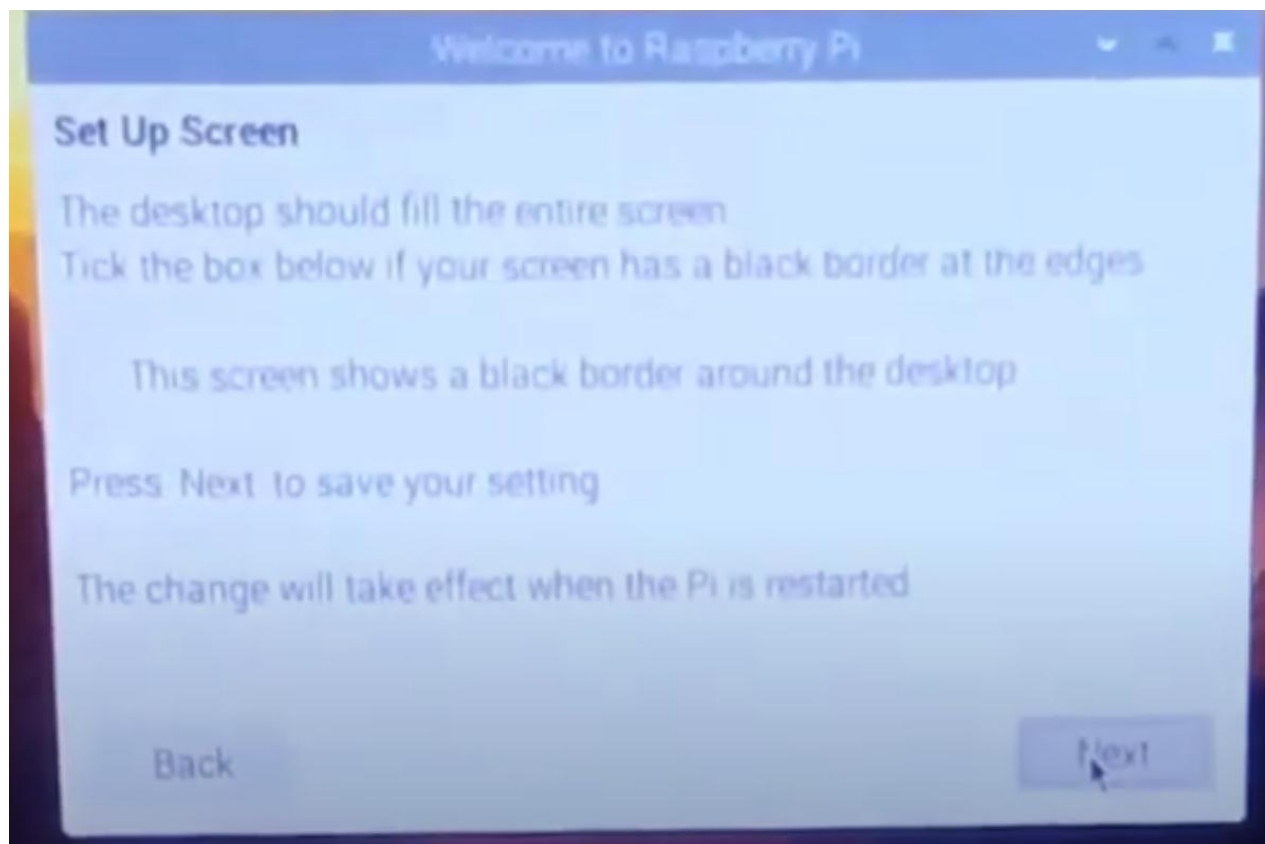
Step 10: Select your Wi-Fi and select Next button then Enter your Wi-Fi password again click on the Next button.
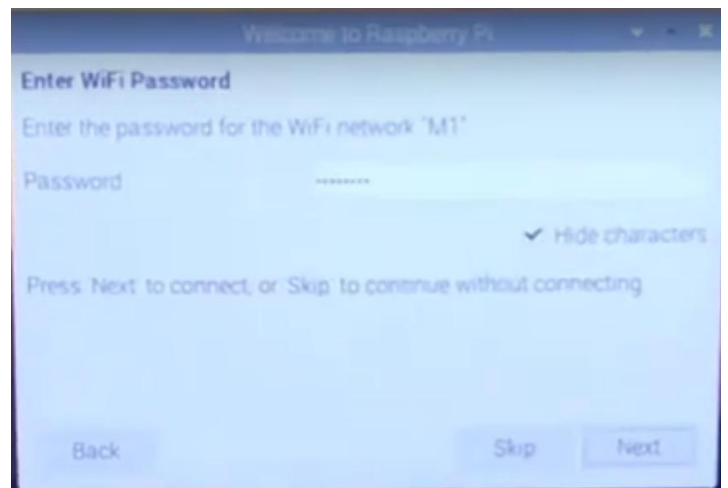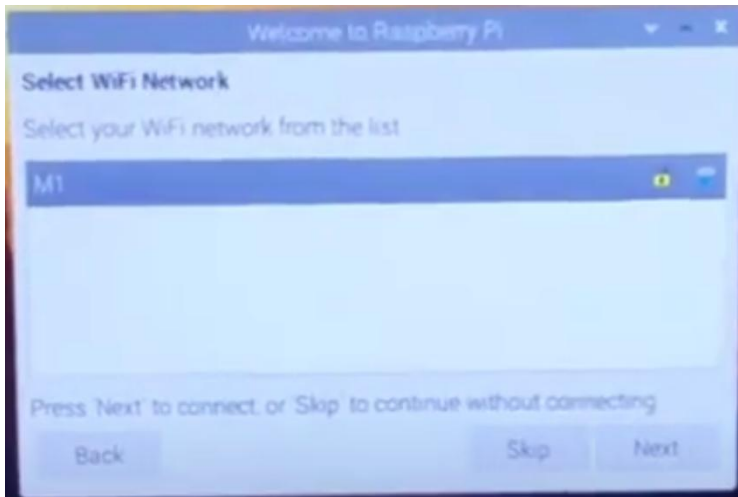
Step 11: Now you see the Update software at this time we don't need to update it takes so many times to update, so we click here **Skip.**
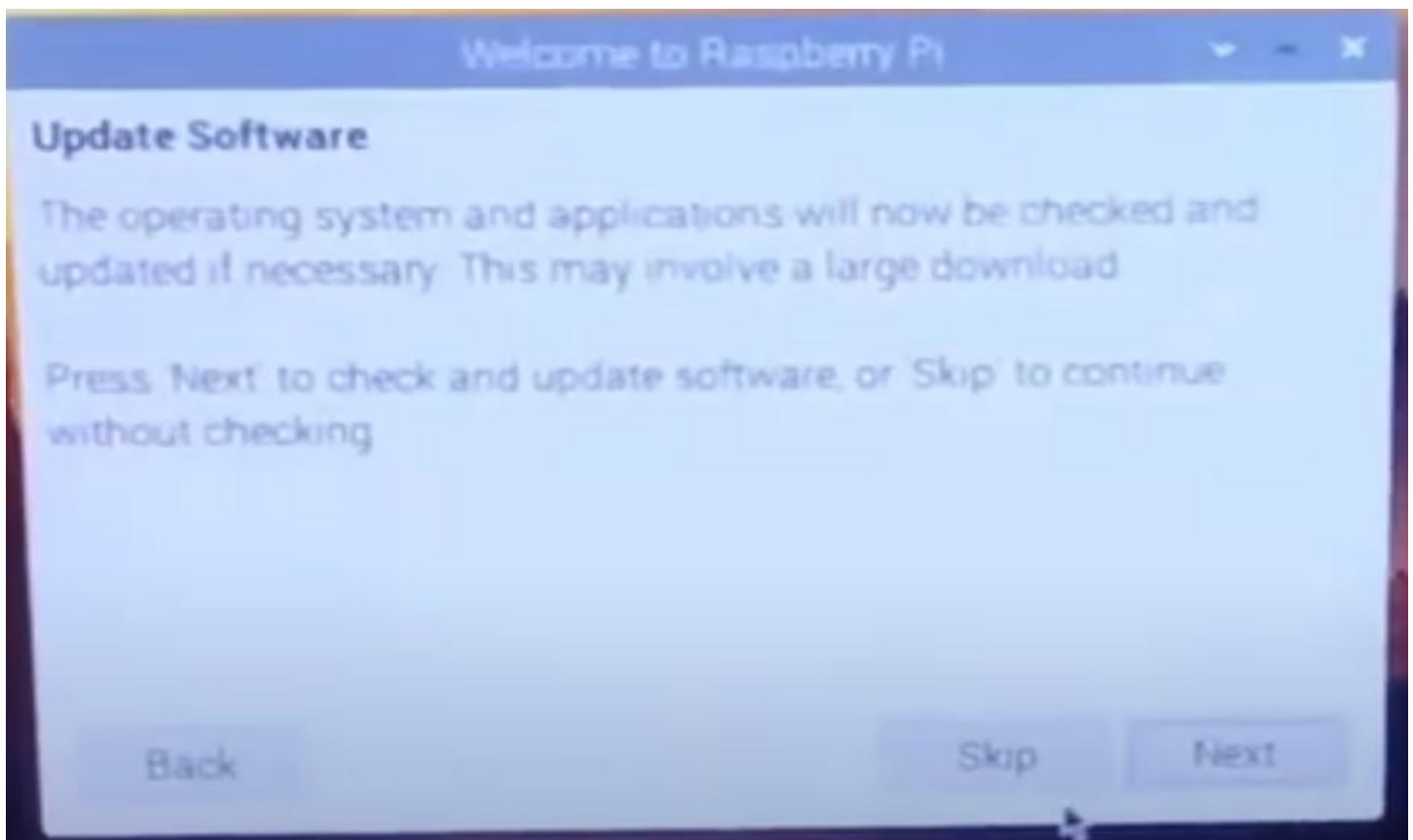
Step 12: Now we have the interface of Setup Complete and click on the Done button.
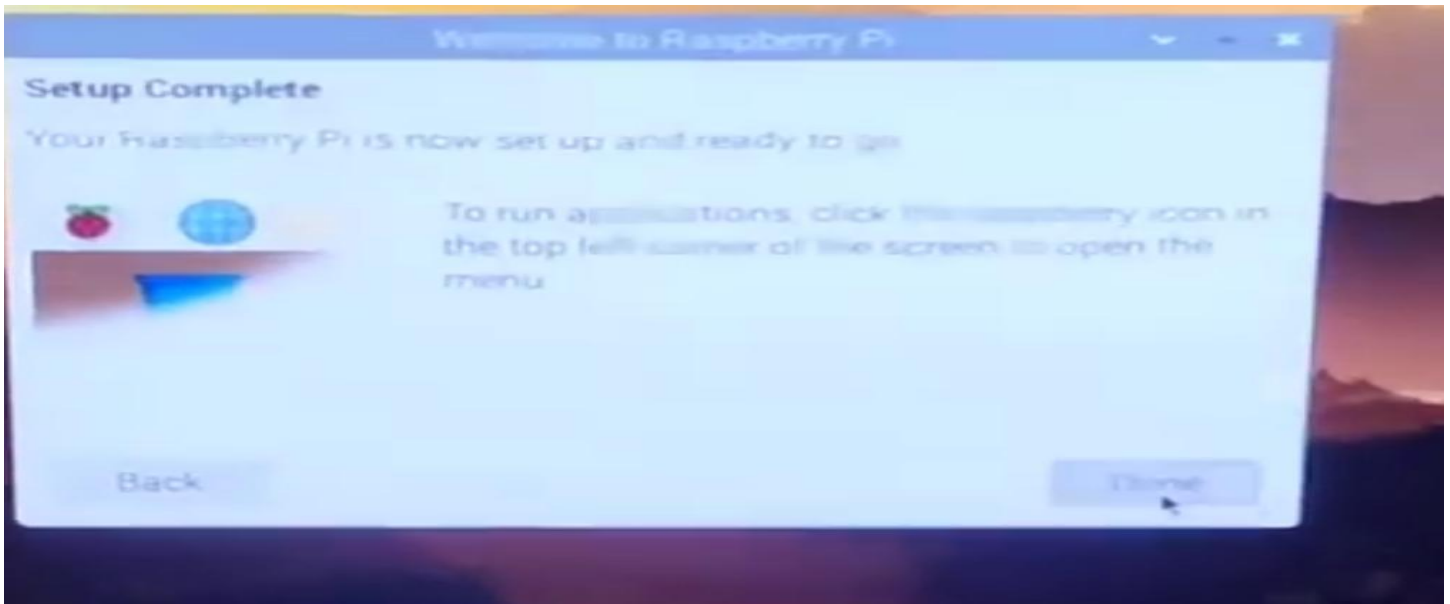
Step 13: Now we are good to go to run our raspberry pi. Here is the final Output of the raspberry pi display.
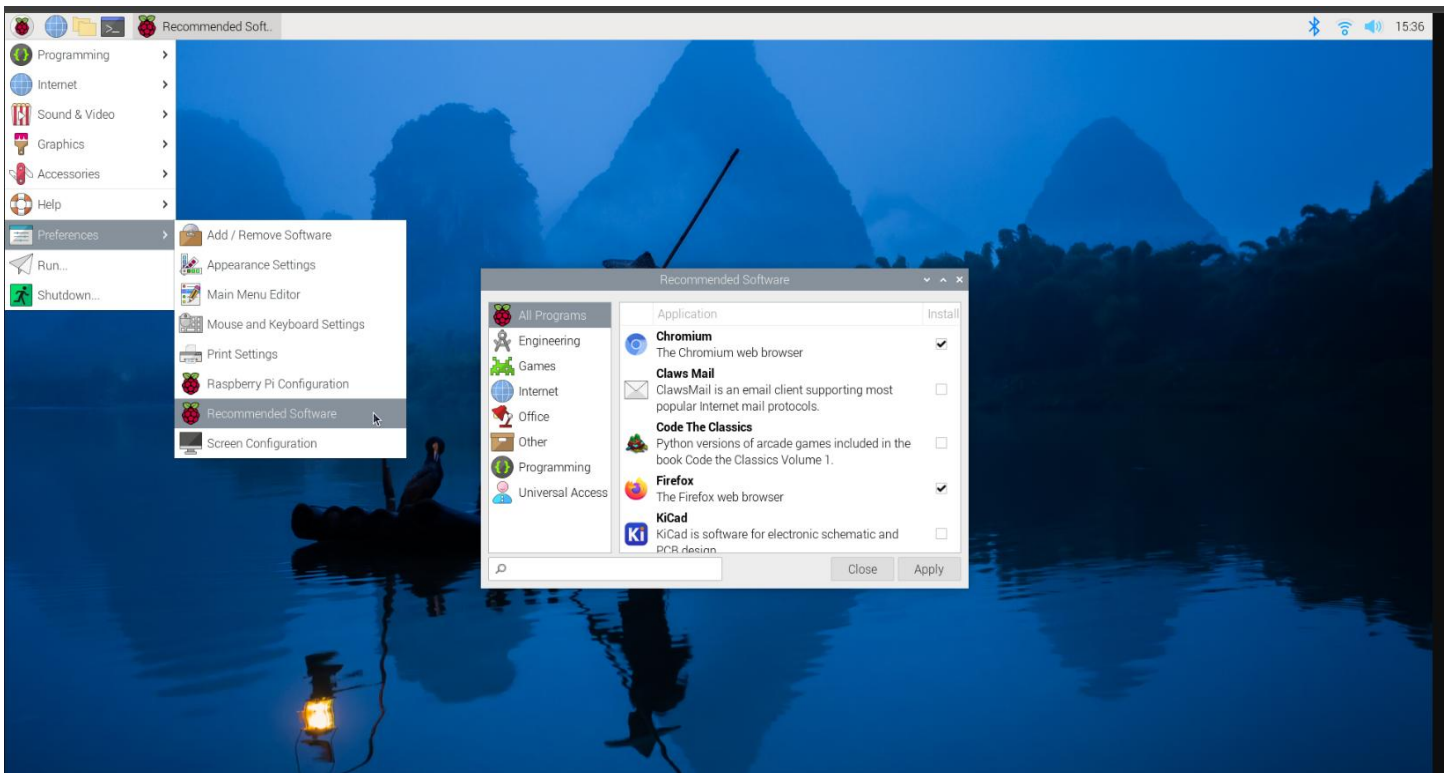
PRACTICAL – 3B

AIM: Installing Raspbian OS with the help of virtual Machine software.

Step 1: Open VMware and click on create new virtual machine
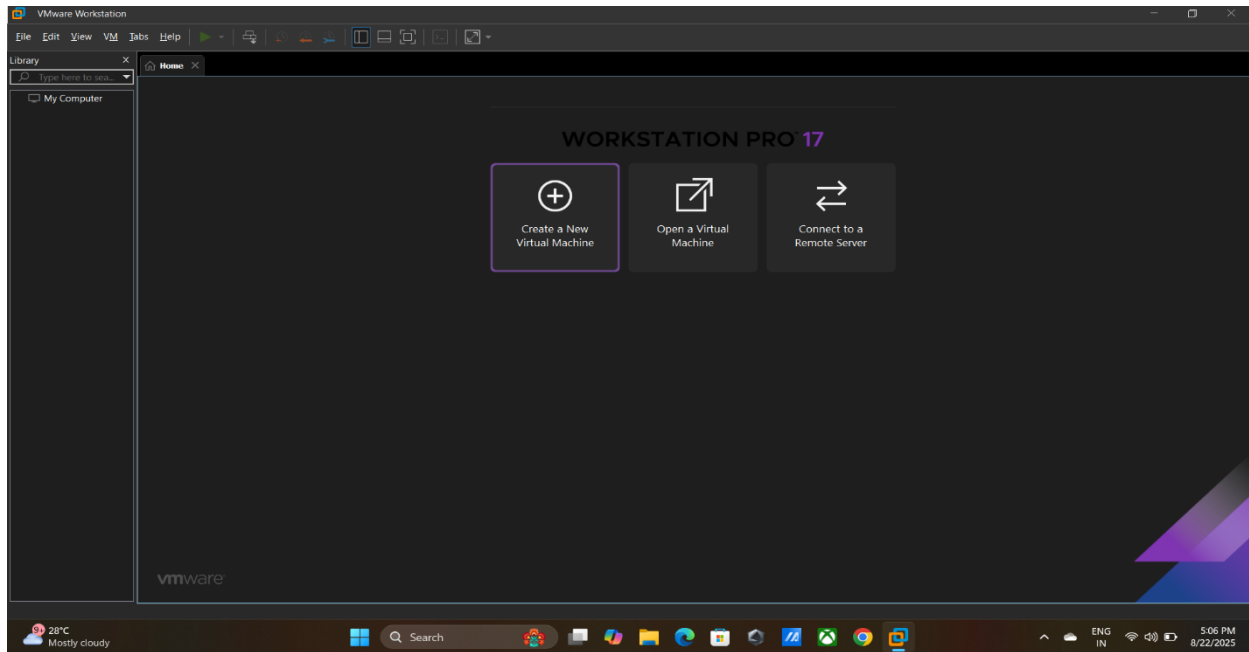
Step 2: Now click on Typical and click on the Next button.

Step 3: Then browse the **ISO** file and again hit the next button.

New Virtual Machine Wizard   ✕

Guest Operating System Installation
         A virtual machine is like a physical computer; it needs an operating
         system. How will you install the guest operating system?

Install from:

○ Installer disc:

         No drives available   ⌄

● Installer disc image file (iso):

         E:\COLLEGE\TYBSCIT\IOT\ISO FILE\2021-01-11-rasp ⌄   [Browse...]

         ⚠ Could not detect which operating system is in this disc image.
            You will need to specify which operating system will be installed.

○ I will install the operating system later.

         The virtual machine will be created with a blank hard disk.

[Help]   [< Back]   [Next >]   [Cancel]

Step 4: Click on the Microsoft window and click on the Next button.

New Virtual Machine Wizard   ✕

Select a Guest Operating System
         Which operating system will be installed on this virtual machine?

Guest operating system

● Microsoft Windows
○ Linux
○ VMware ESX
○ Other

Version

Windows 11 x64   ⌄

[Help]   [< Back]   [Next >]   [Cancel]

Step 5: Now the system asks the name of our virtual machine, here I don't want to change the name so I go with the default name then click on the next button.

Step 6: Then create your strong password then click on the next button.

Step 7: Nothing to change here and click on the next button.
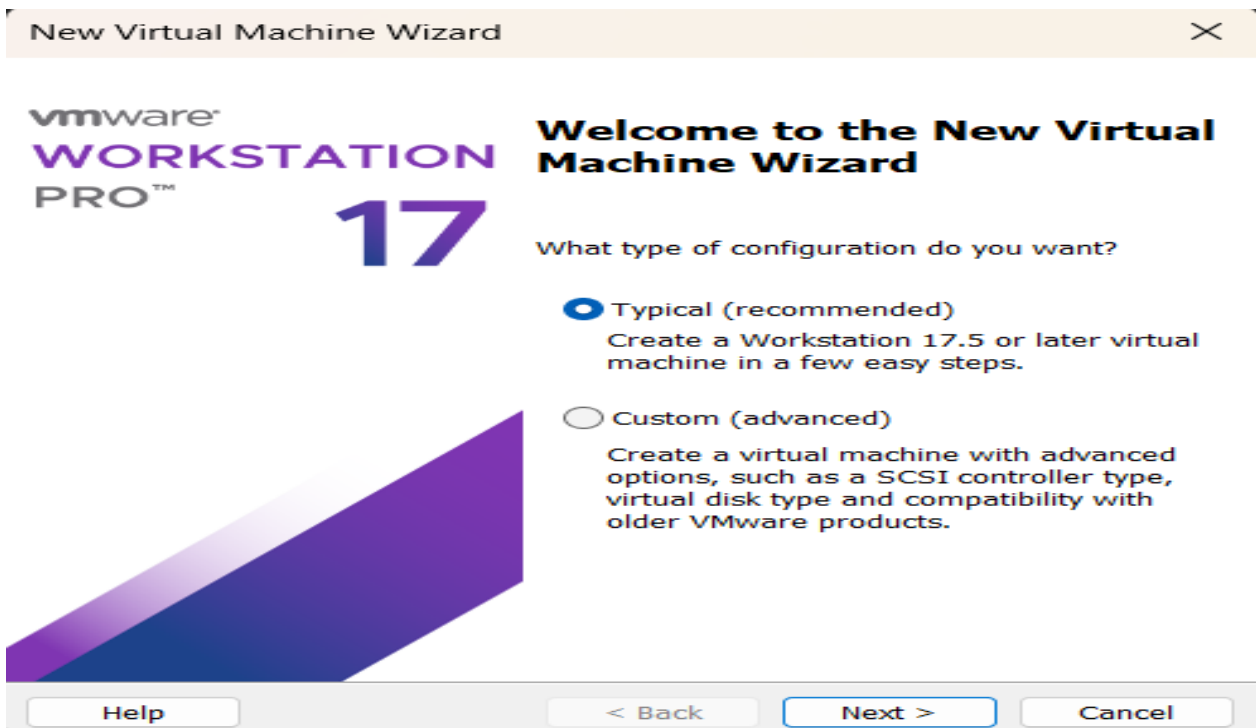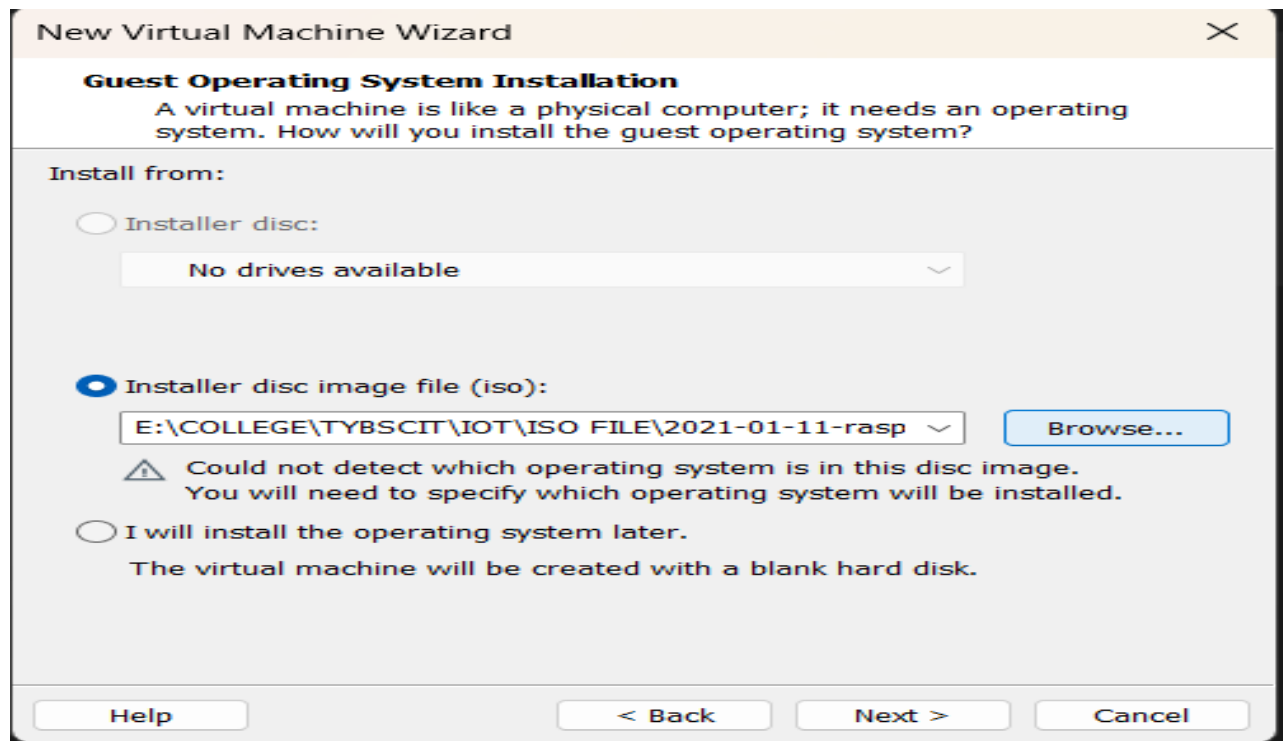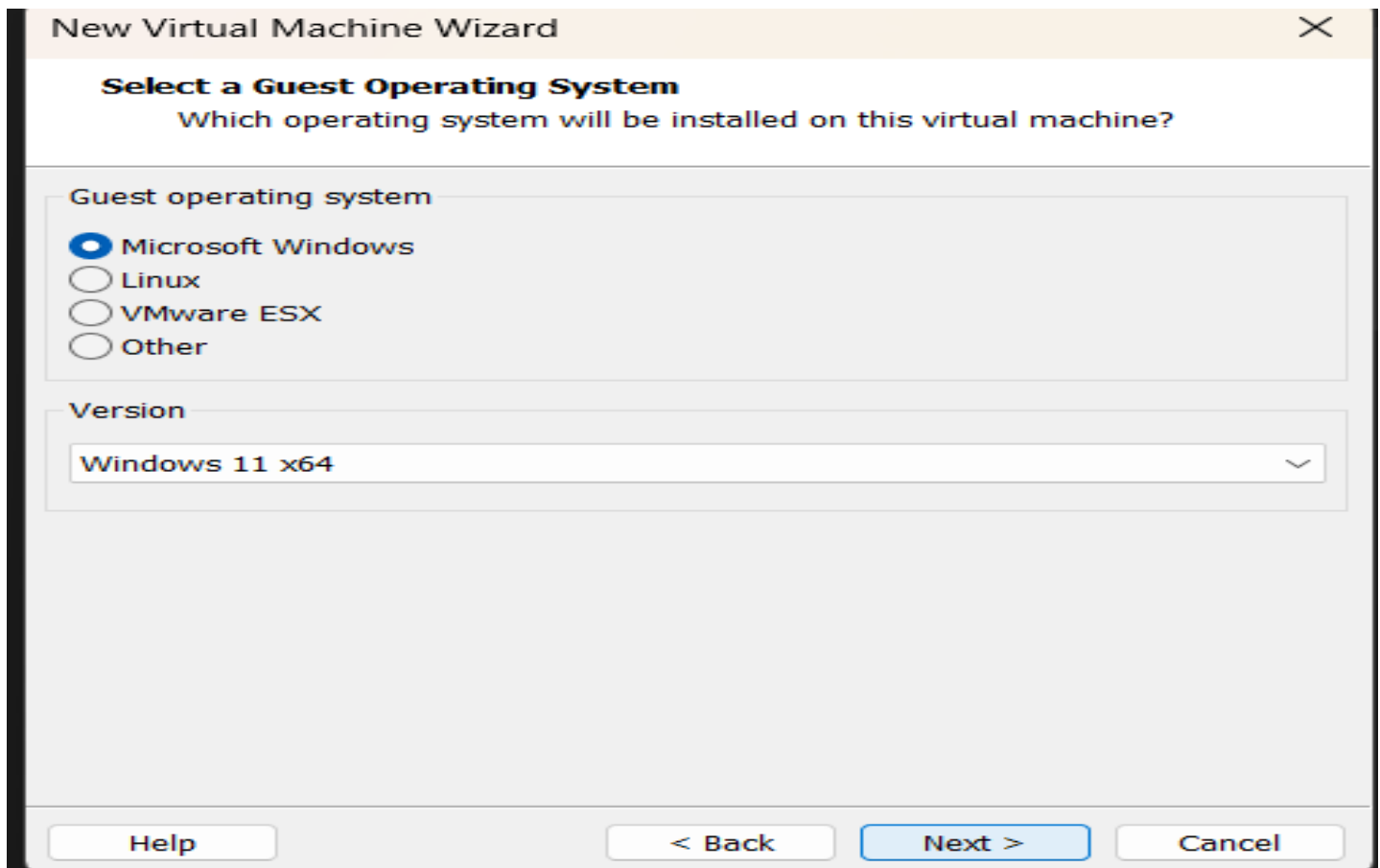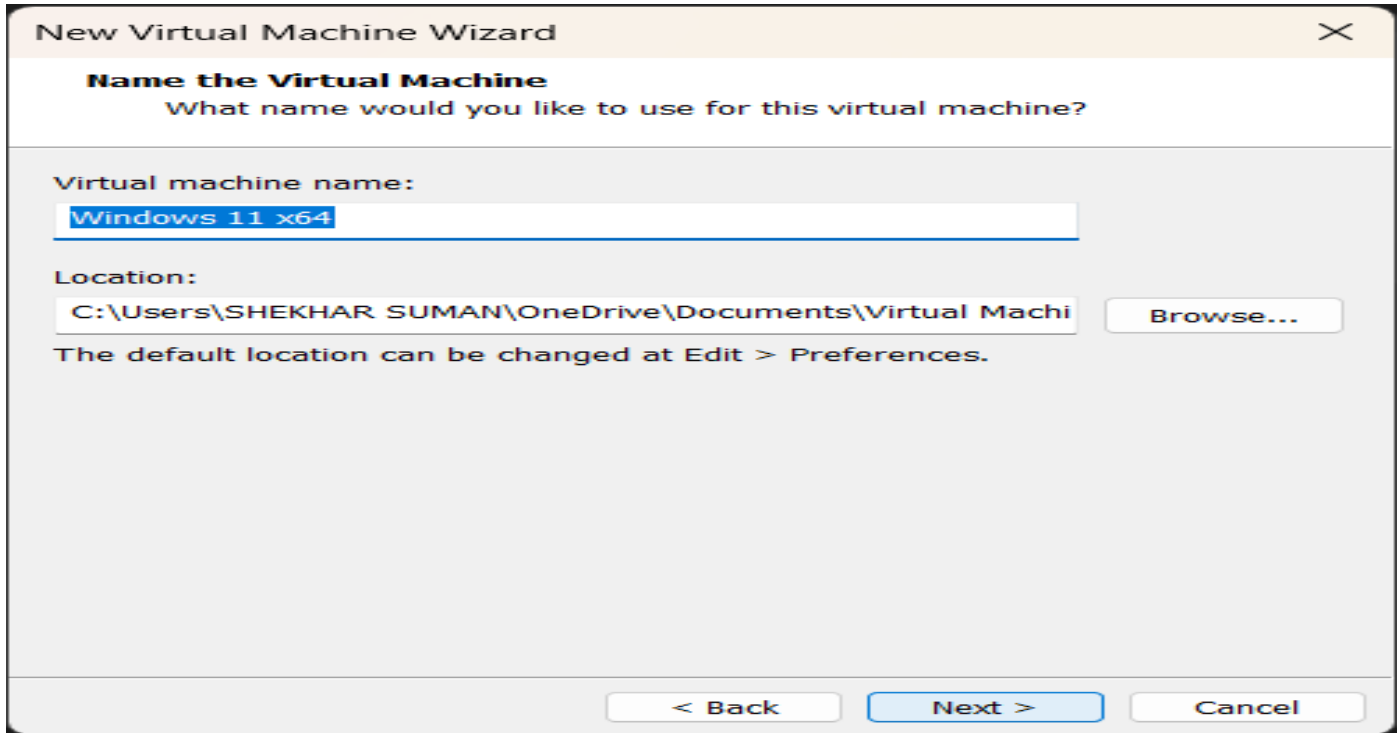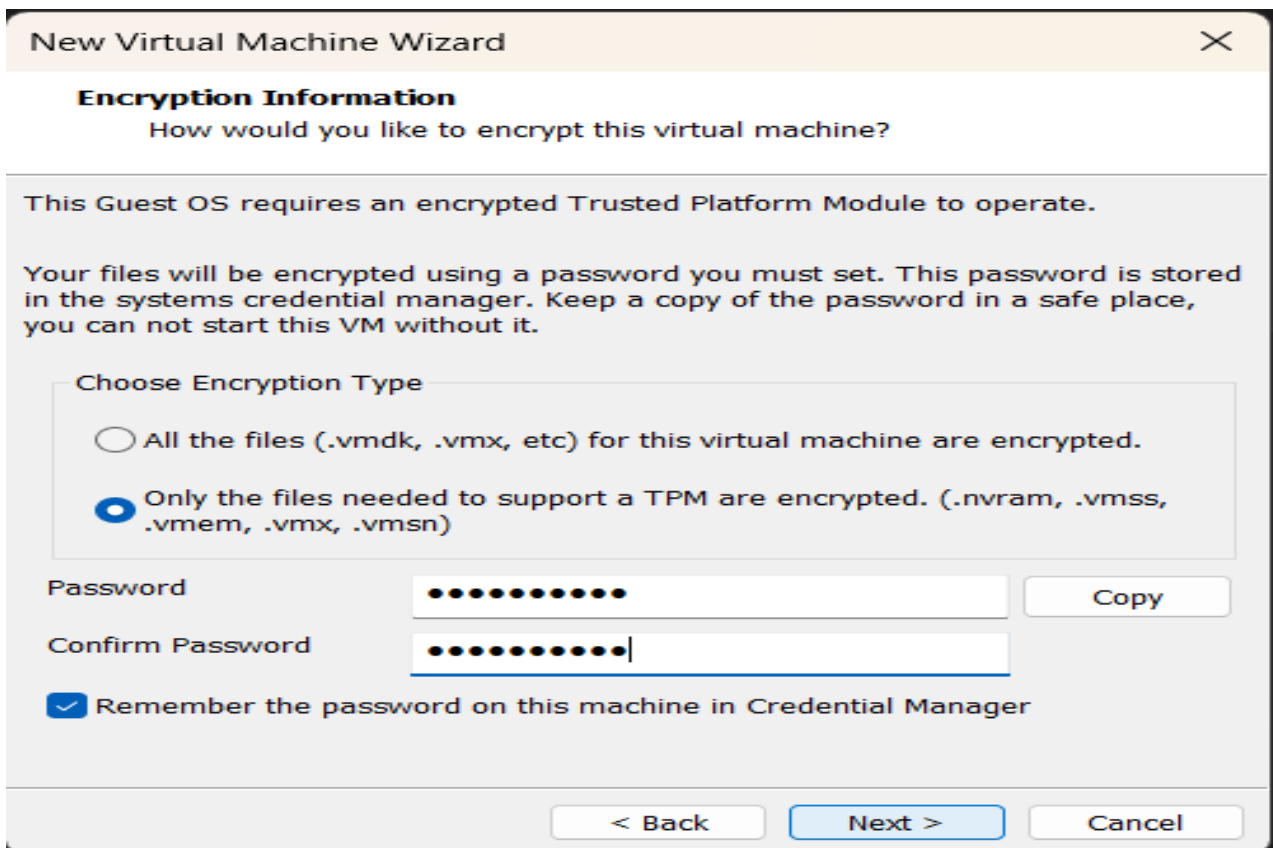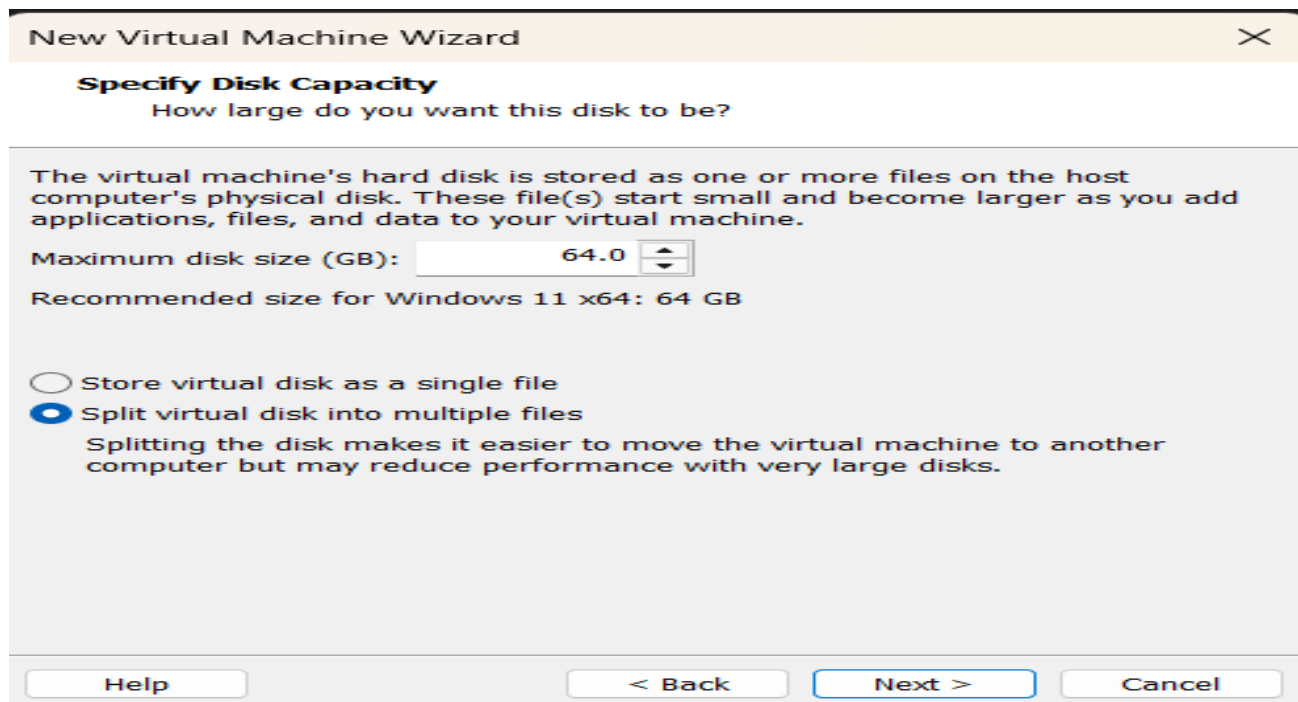
New Virtual Machine Wizard   ✕

Specify Disk Capacity
    How large do you want this disk to be?

The virtual machine's hard disk is stored as one or more files on the host computer's physical disk. These file(s) start small and become larger as you add applications, files, and data to your virtual machine.

Maximum disk size (GB):   64.0 ⬍
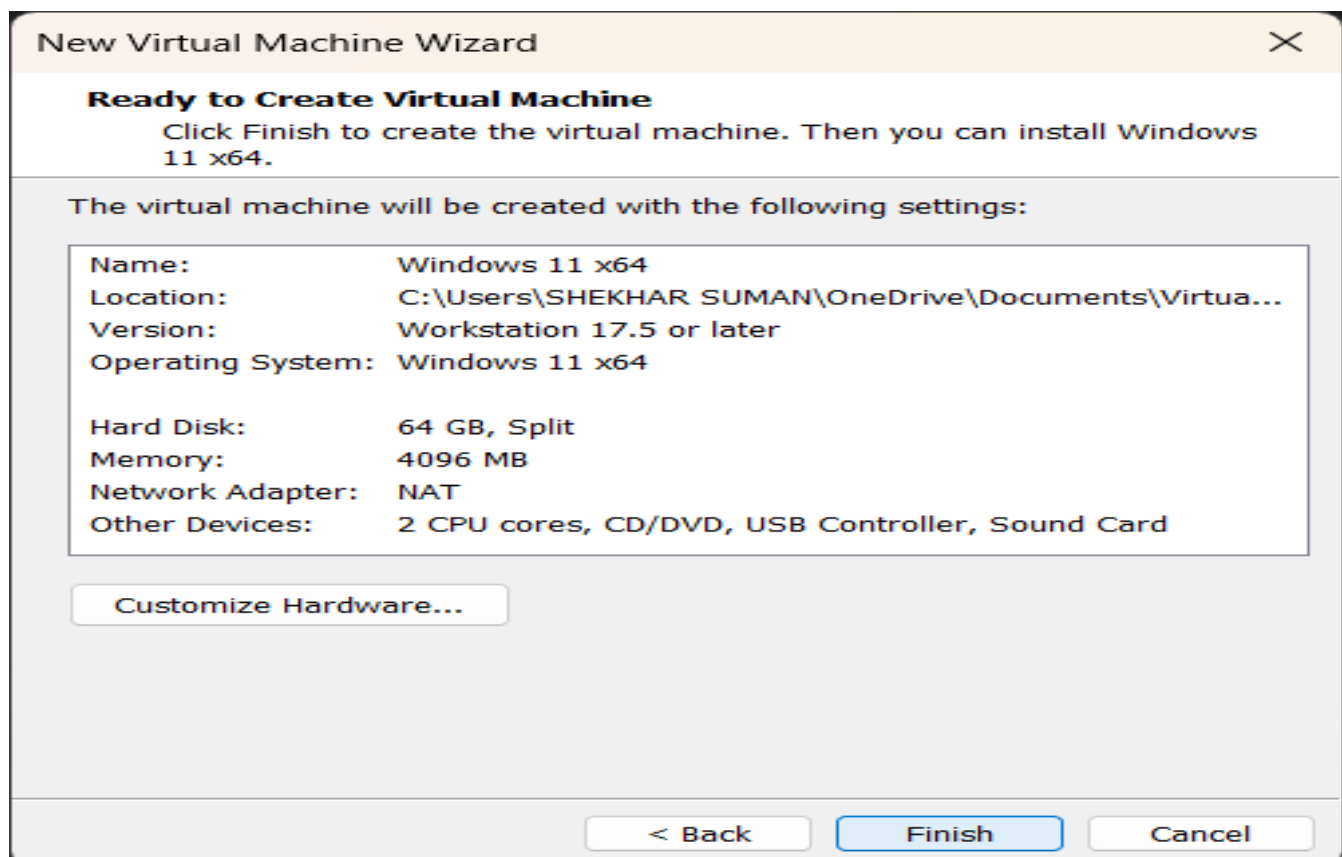
Recommended size for Windows 11 x64: 64 GB

○ Store virtual disk as a single file
● Split virtual disk into multiple files
    Splitting the disk makes it easier to move the virtual machine to another computer but may reduce performance with very large disks.

Help		< Back	Next >	Cancel

Step 8: Then click on the finish button to finish of the setup Raspbian **ISO** file.

New Virtual Machine Wizard   ✕

Ready to Create Virtual Machine
    Click Finish to create the virtual machine. Then you can install Windows 11 x64.

The virtual machine will be created with the following settings:

Name:	Windows 11 x64
Location:	C:\Users\SHEKHAR SUMAN\OneDrive\Documents\Virtua...
Version:	Workstation 17.5 or later
Operating System:	Windows 11 x64
Hard Disk:	64 GB, Split
Memory:	4096 MB
Network Adapter:	NAT
Other Devices:	2 CPU cores, CD/DVD, USB Controller, Sound Card

Customize Hardware...

< Back	Finish	Cancel

Step 9: Now we automatically redirect on the home interface of the VMware application. Select your machine name and click on the power on this virtual machine. This option is at top left hand side.
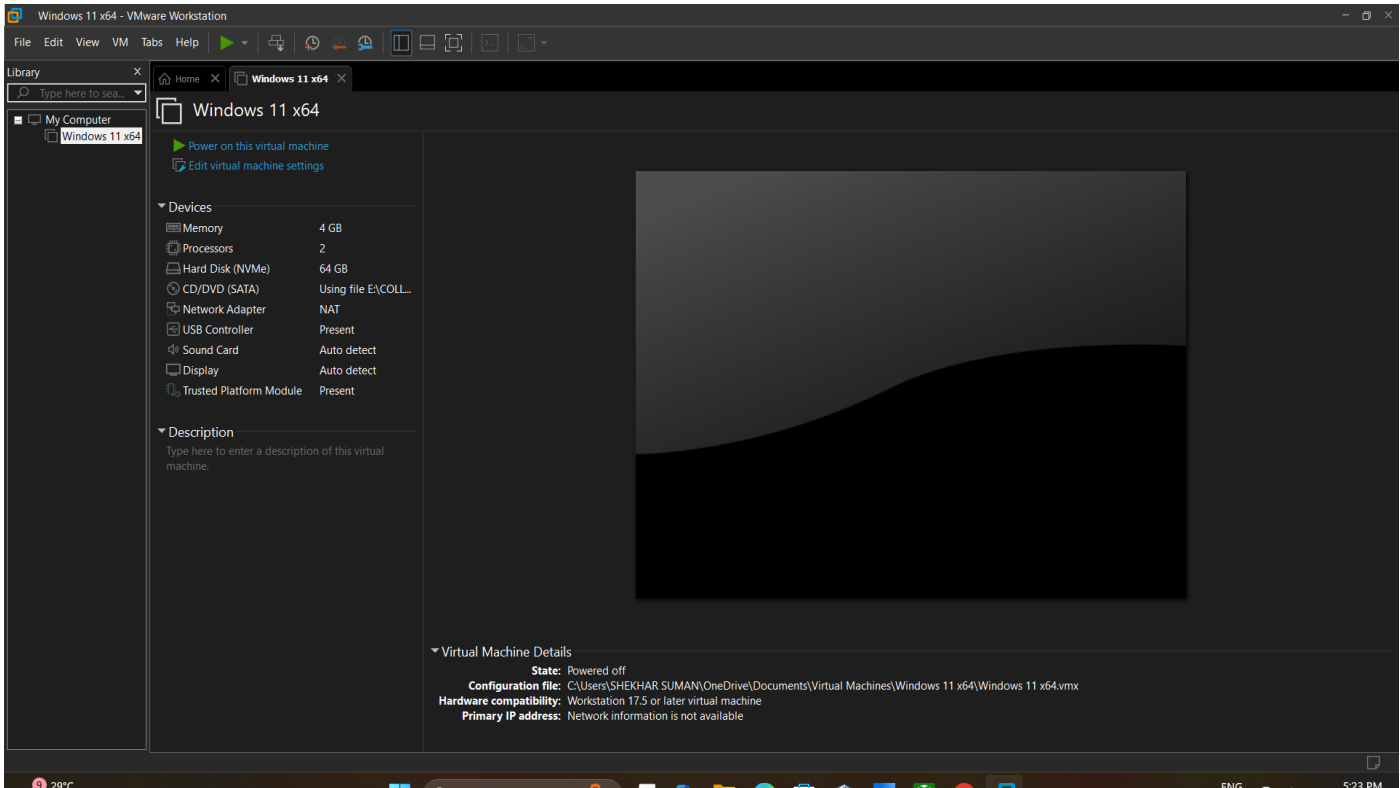
Step 10: Now here we show the unwanted option interface click on the OK button for the Next.
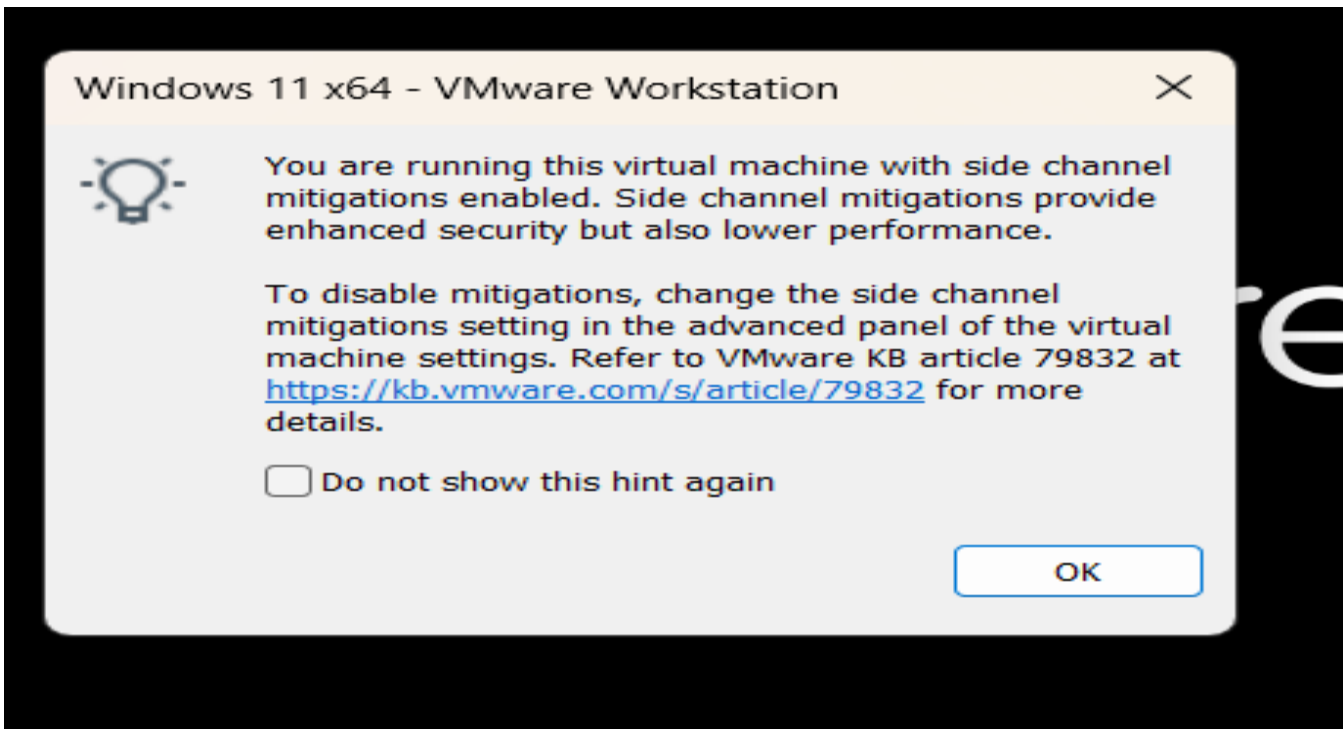
Step 11: Now we redirect to the Set-up the Raspbian O.S on the VMware software. Click on the next button.
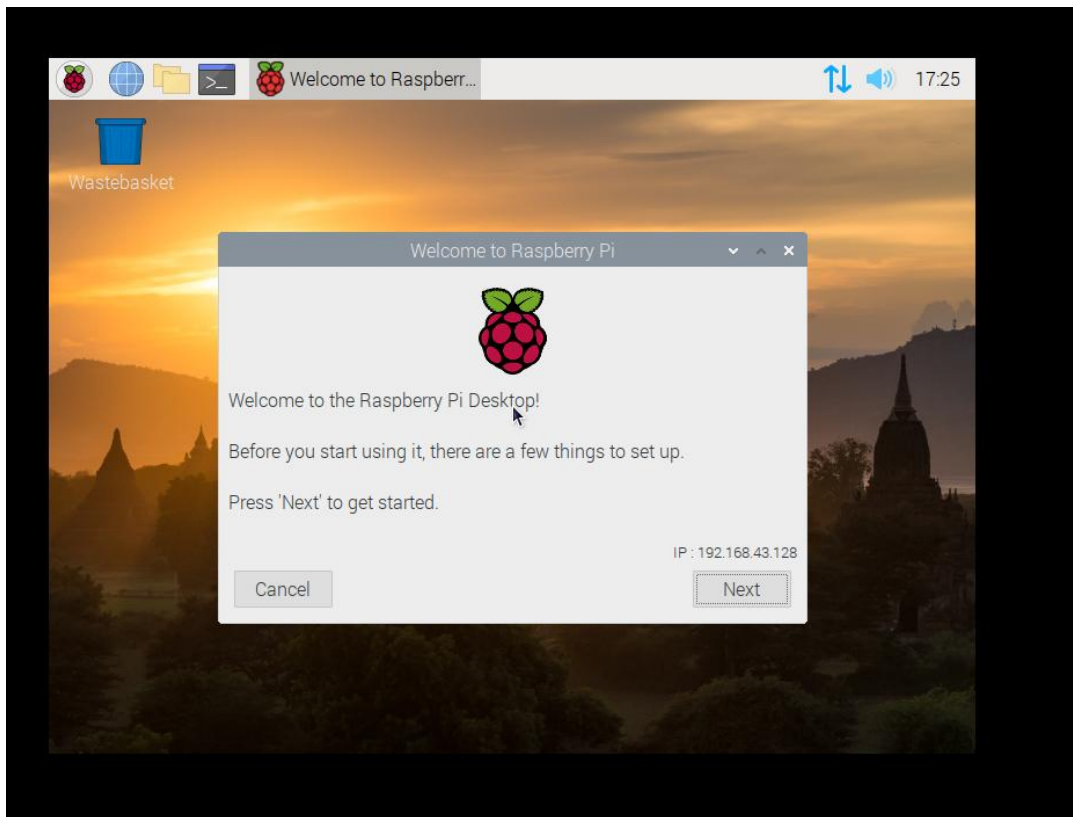
Step 12: After clicking on the Next button then click on the both option Use English language and Use U.S keyboard then click on the Next Button.

Step 13: I don't want password here so I kept it blanks, if you want your personal password then you can enter the password otherwise, they have their own default password "raspberry". Then click on the Next button.

Step 14: I don't want any update right now then I want to choose skip button for the skip the Updates.
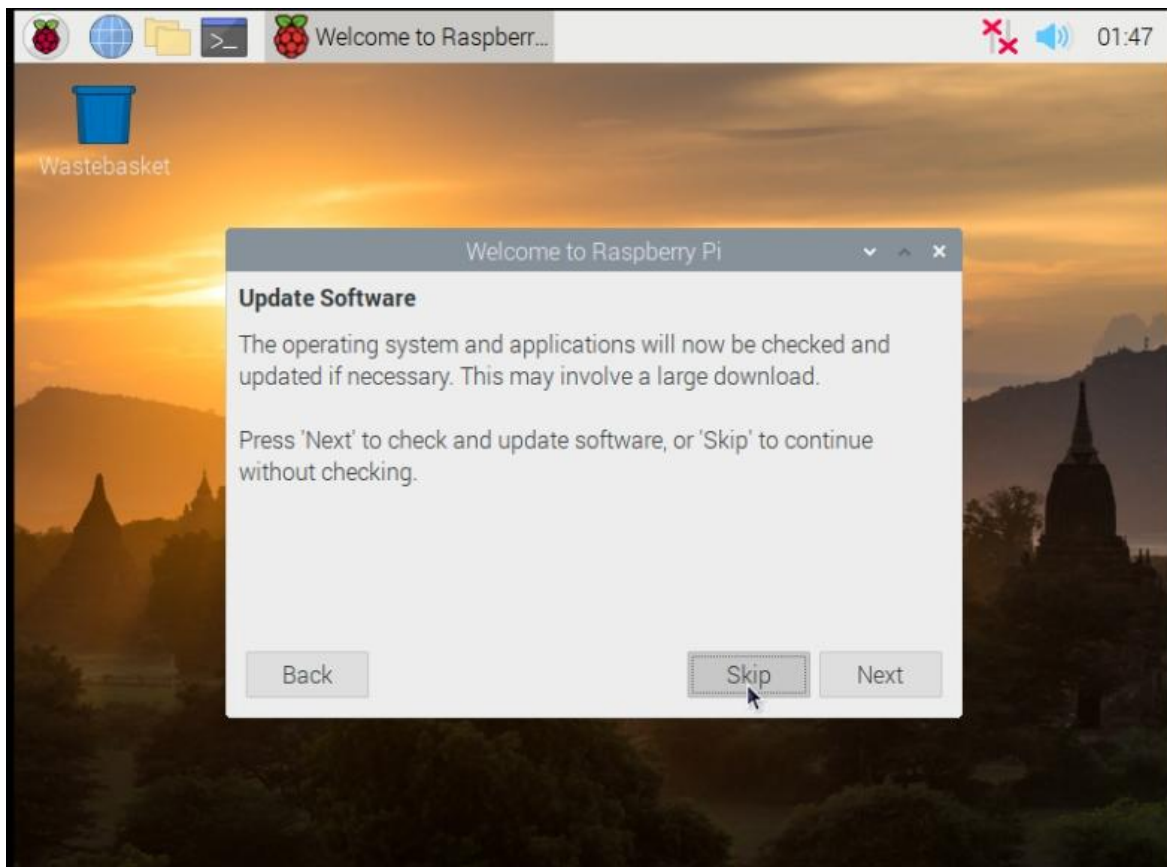
Step 15: This is the last and the final process of yours installing the Raspbian O.S on your VMware box. Now you get the interface of Setup complete. Click on done button and Enjoy your Raspbian O.S on your VMware box.
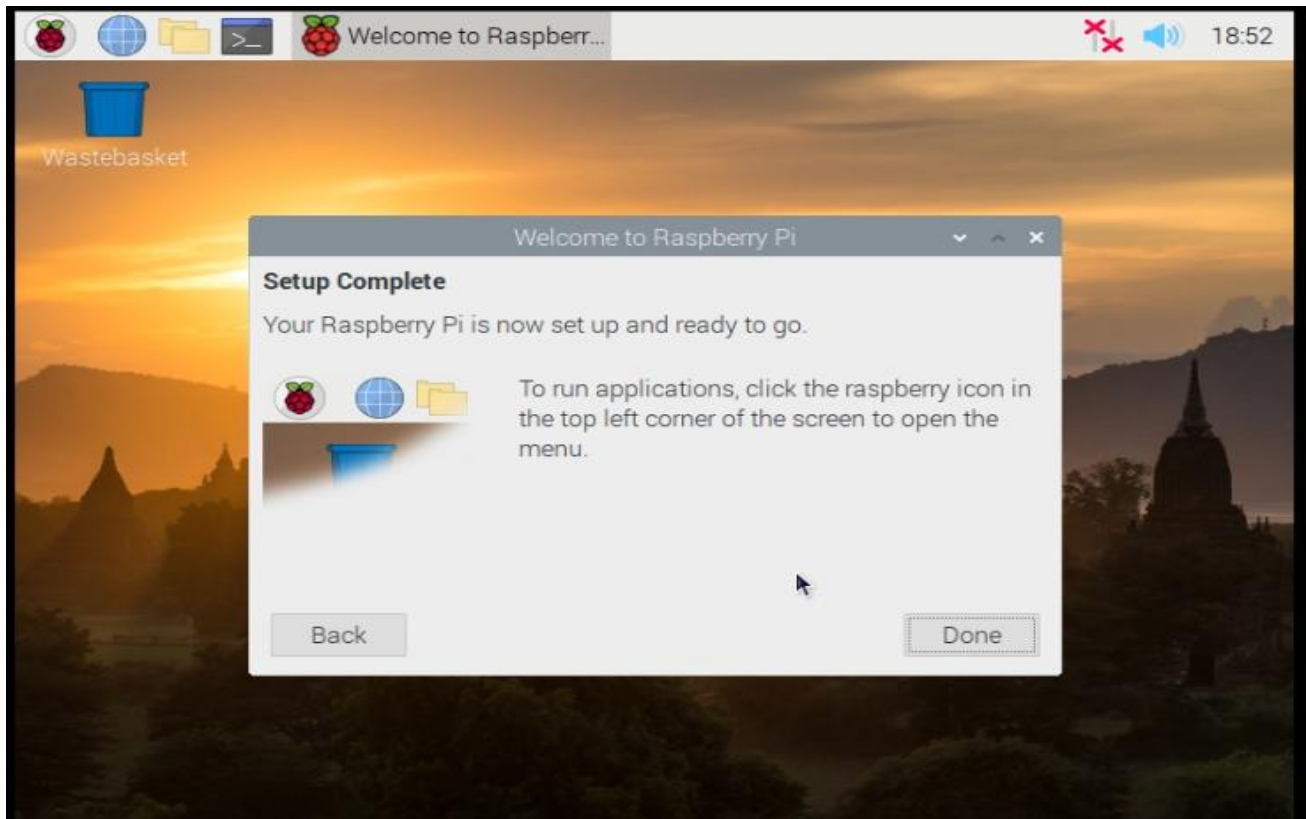
The final desktop of Raspbian O.S in the VMware workstation.

PRACTICAL – 4

AIM: Blinking LED using Raspberry Pi.

Step 1: Connect LED to breadboard.

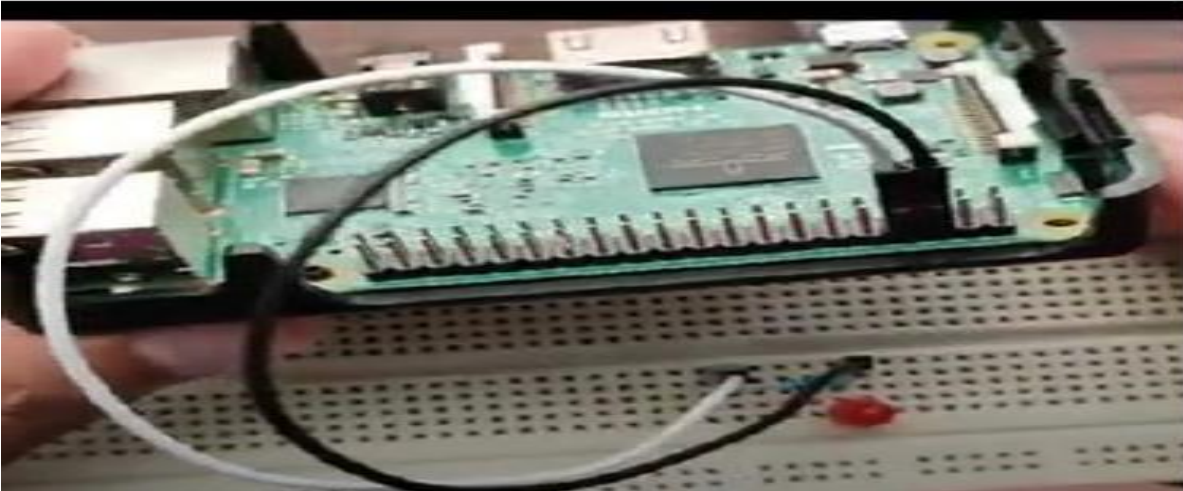**Step 2:** Connect Resistor on breadboard.

Step 3: Connect two jumper wire to breadboard of one leg is in register and another is in LED

Step 4: Connect these jumper wire to Pin 7 and Pin 9 of Raspberry Pi respectively.

Step 5: Open Thonny Python IDE on Raspberry Pi OS.

Step 6: Write a code on IDE to blink the LED and Run the code.


```python
import RPi.GPIO as GPIO
import time
GPIO.setmode(GPIO.BOARD)
GPIO.setup(7,GPIO.OUT)
for i in range(10):
        GPIO.output(7,True)
        print("LED IS FINALLY ON")

        time.sleep(1)

        GPIO.output(7,False)
        print("LED IS OFF")

        time.sleep(1)
print("PROGRAM COMPLETE!")
GPIO.cleanup()
```

PRACTICAL – 5

AIM: Capturing Images by connecting camera using Raspberry Pi.

Step 1: Insert Camera strip into CSI connector and power on the Raspberry Pi.

Step 2: Install Pip 3 on IDE.

Step 3: Install "Picamera" library on it

Syntax: - pip3 install picamera

Step 4: Write the Following code Thonny IDE and run the code.


```
import time
from picamera import PiCamera
camera = PiCamera()
camera.resolution = (1280,720)
camera.start_preview()
time.sleep(5)
camera.capture('/home/pi/Desktop/ty1.jpg')
camera.stop_preview()
```

PRACTICAL – 6

AIM: Capturing Images by connecting camera using Raspberry Pi.

Step 1: Insert Camera strip into CSI connector and power on the Raspberry Pi.

Step 2: Install Pip 3 on IDE

Syntax: - sudo apt-get install python3-pip

Step 3: Install "Picamera" library on it

Syntax: - pip3 install picamera

Step 4: Write the Following code Thonny IDE and run the code.

```
import time
from picamera import PiCamera
camera = PiCamera()
camera.start_preview()
camera.start_recording('/home/pi/Desktop/video1.h264')
camera.wait_recording(5)
camera.stop_recording()
print("Finished Recording")
```

PRACTICAL – 7

AIM: Interfacing seven segment display with Raspberry Pi.

Step1: Connect 4 jumper wires to 4 digit 7-segment display.

Pins of seven segment display:
  I.   CLK – Clock Pin
  II. DIO – Data Input Output Pin
       These two pins are used to transfer the data.
  I.   VCC
  II. GND
       These two pins are used to connect the power.

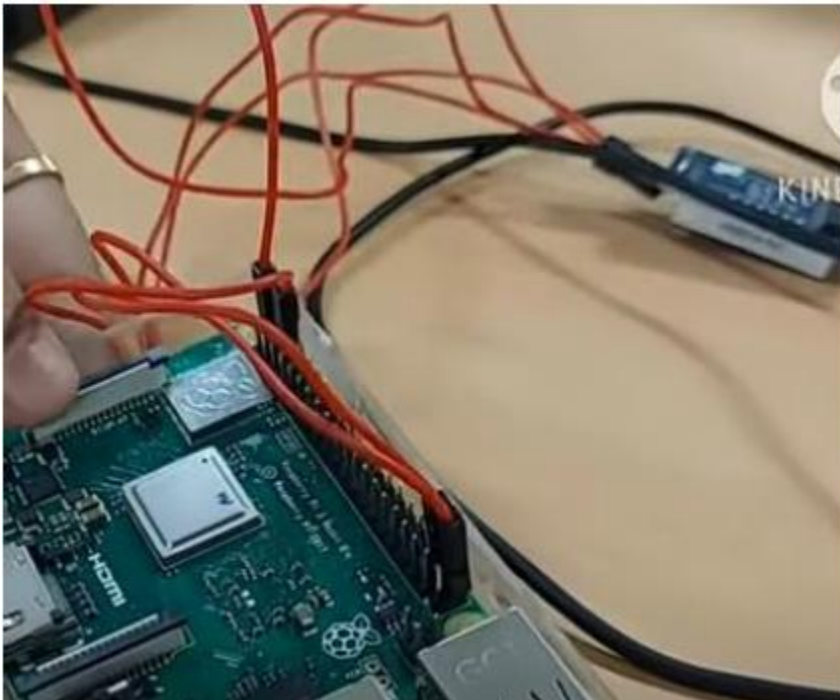**Step2:** Connect these pins to GPIO pin of raspberry pi with the help of jumper wire.

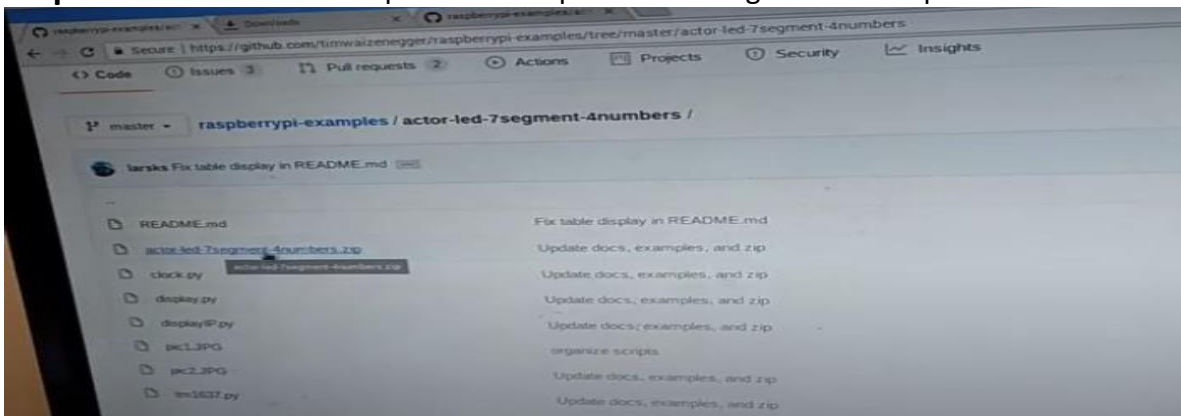**Connections are as follows:**
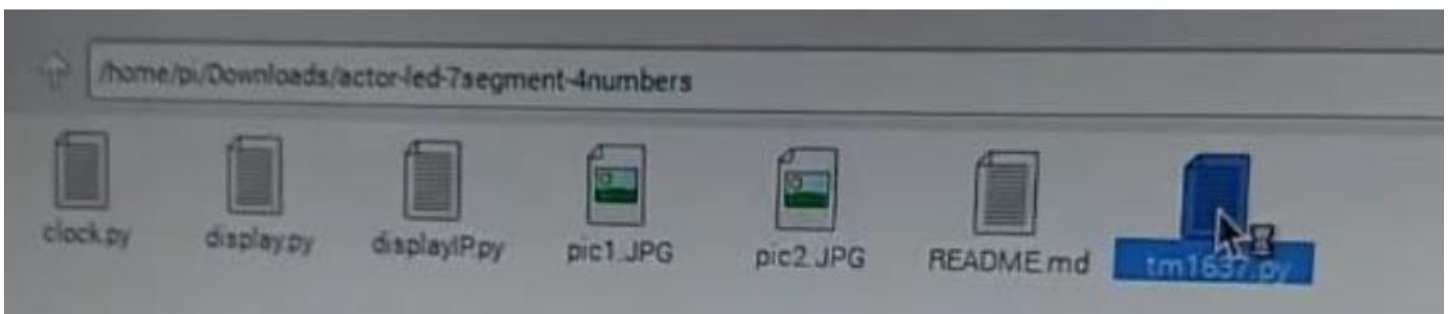CLK Pin to 40th GPIO pin
DIO Pin to 38th GPIO pin
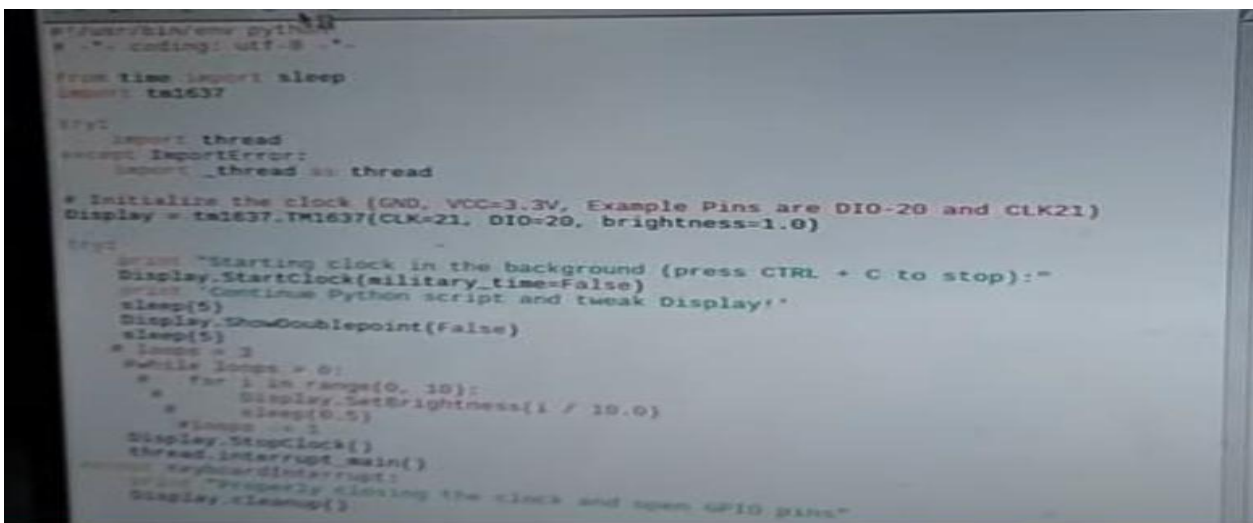VCC Pin to 2nd GPIO pin
GND Pin to 6th GPIO Pin

Step3: Download the file required to do operation from github desktop.

Step 4: In this folder use package "tm1637" to write the code.

Step 5: Write the following Code.

Step 6: Run the code the will display on seven segment display screen