

Indian Institute of Technology, Jodhpur

Lab Manual

Sensors and IoT

LAB - 3

Date: 23 Sept, 2024

Lab Objective

In this lab we will go through the basics of Raspberry Pi 4 and using its on-board GPIO pins

Part 1 : Setting Up Raspberry Pi

- In order to use the on-board GPIO pins of the Raspberry Pi we need to enable support for interfaces using the configurator. In order to open the configurator run

```
sudo raspi-config
```

- Use arrow keys to select Interface Options

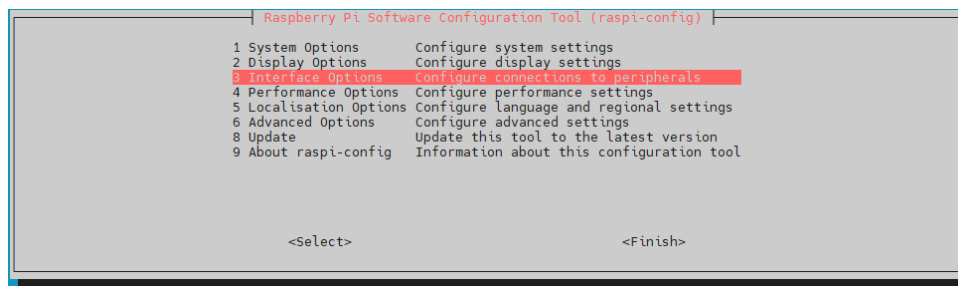


Figure 1: Select Interface Options

- Select I2C

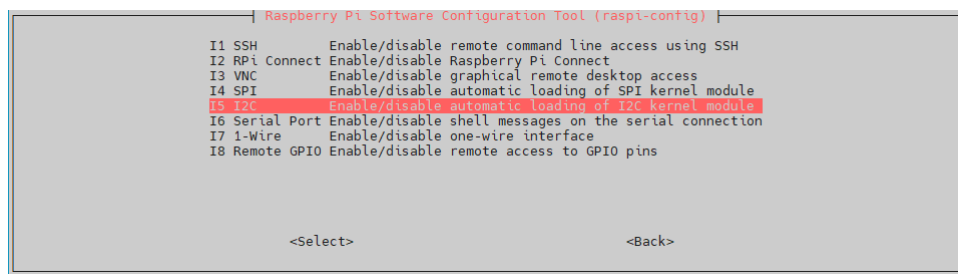


Figure 2: Select I2C

- Select Yes to enable I2C interface

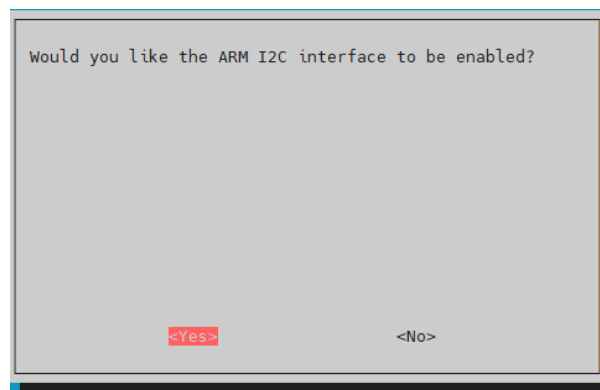


Figure 3: Enter Caption

- Use Right arrow key to select Finish

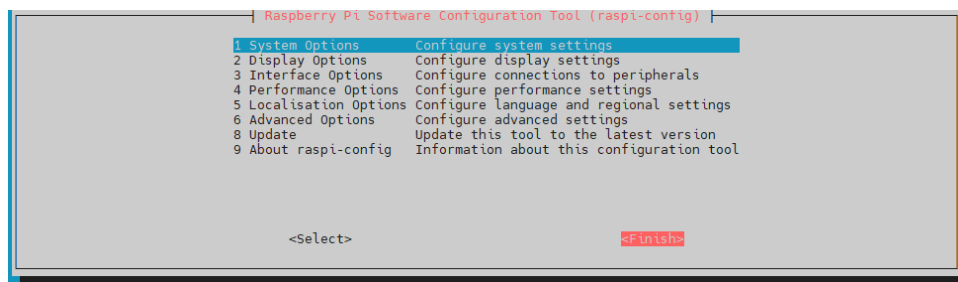


Figure 4: Enter Caption

- Open a Terminal window by pressing "CTRL + ALT + T" together or by pressing this icon on top right corner

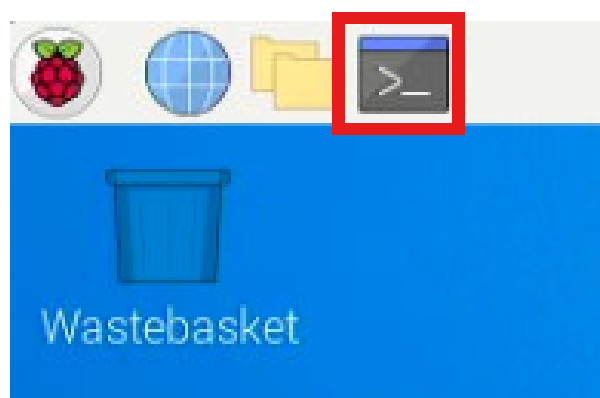


Figure 5: Open Terminal

- Go to Documents directory by entering the following command.

```
cd Documents/
```

- Once in the Documents directory enter the following command to create a virtual environment for Python

```
python -m venv IOT_LAB
```

- To activate the virtual environment run

```
source IOT_LAB/bin/activate
```

(IOT_LAB) should be visible before the username on the terminal prompt

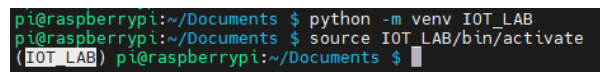
A terminal window on a Raspberry Pi. The prompt is 'pi@raspberrypi:~/Documents'. The user enters 'python -m venv IOT_LAB'. The prompt changes to 'pi@raspberrypi:~/Documents'. The user enters 'source IOT_LAB/bin/activate'. The prompt changes to '(IOT_LAB) pi@raspberrypi:~/Documents'.

Figure 6: Virtual Environment activation

- Copy the provided files in the Documents directory.
- Check the requirements.txt by entering the following command

```
cat requirements.txt
```

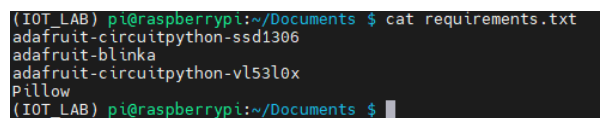
A terminal window on a Raspberry Pi. The prompt is '(IOT_LAB) pi@raspberrypi:~/Documents'. The user enters 'cat requirements.txt'. The output is: 'adafruit-circuitpython-ssd1306', 'adafruit-blinka', 'adafruit-circuitpython-vl53l0x', 'Pillow'. The prompt returns to '(IOT_LAB) pi@raspberrypi:~/Documents'.

Figure 7: Check the requirements for the LAB

- Run the following commands to install all the python dependencies.

```
pip install -r requirements.txt
```

Part 2 : Using Lidar Sensor with raspberry pi 4

- In order to use the vl53l0x sensor we will make the connections as per the following diagram :-

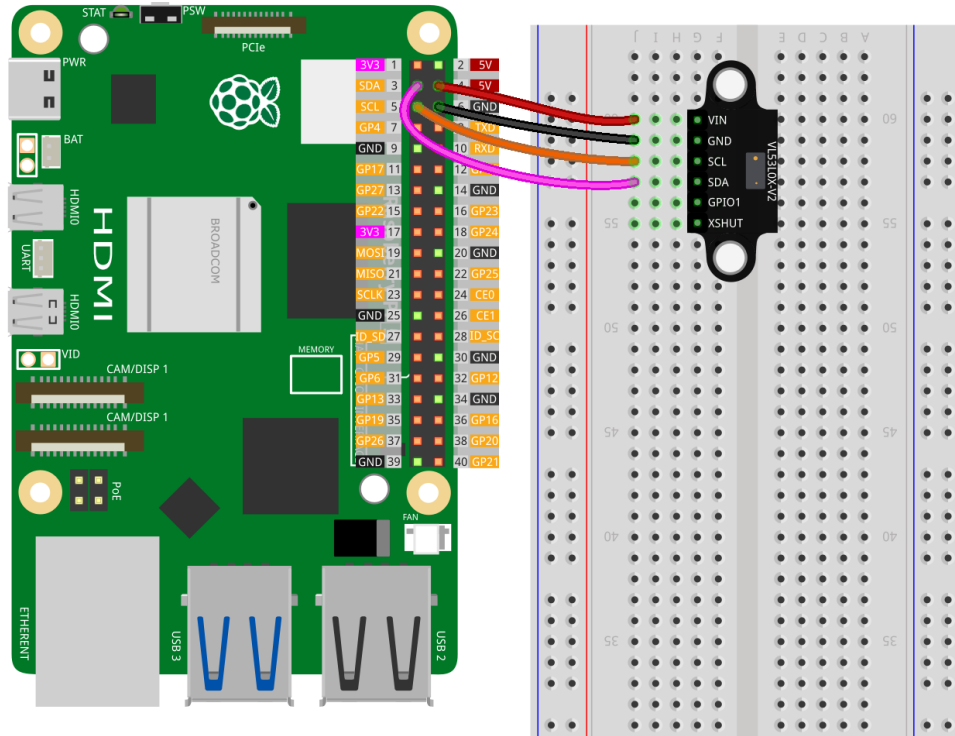


Figure 8: Lidar Connections

- Once the connections are done ensure that the environment is active in the terminal by checking the (IOT_LAB) prefix.
- Run the Lidar program by executing :-

```
python lidar.py
```

- Expected output :-

```
Range: 8190mm
Range: 8190mm
Range: 8190mm
Range: 27mm
Range: 23mm
Range: 23mm
Range: 149mm
Range: 177mm
Range: 8190mm
```

- If the error of device not found comes up, please check the connections and ensure the SDA and SCL connections are not swapped

```
Traceback (most recent call last):
  File "/home/pi/Documents/lidar.py", line 18, in <module>
    VL53 = adafruit_VL53L0X.VL53L0X(i2c)
    ~~~~~^^^^^^^^^^^^^^^^^^^^^^^^^^^^
  File "/home/pi/Documents/IOT_LAB/lib/python3.11/site-packages/adafruit_vl53l0x.py", line 157, in __init__
    self._device = i2c_device.I2CDevice(i2c, address)
    ~~~~~^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
  File "/home/pi/Documents/IOT_LAB/lib/python3.11/site-packages/adafruit_bus_device/i2c_device.py", line 62, in __init__
    self._probe_for_device()
  File "/home/pi/Documents/IOT_LAB/lib/python3.11/site-packages/adafruit_bus_device/i2c_device.py", line 184, in _probe_for_device
    raise ValueError("No I2C device at address: 0x%x" % self.device_address)
ValueError: No I2C device at address: 0x29
(IOT_LAB) pi@raspberrypi:~/Documents $
```

Figure 9: I2C Error

Part 3 : Using OLED with raspberry pi 4

- In order to use the OLED display we will use the same I2C bus now to send the data. Please make connections as per the following diagram.

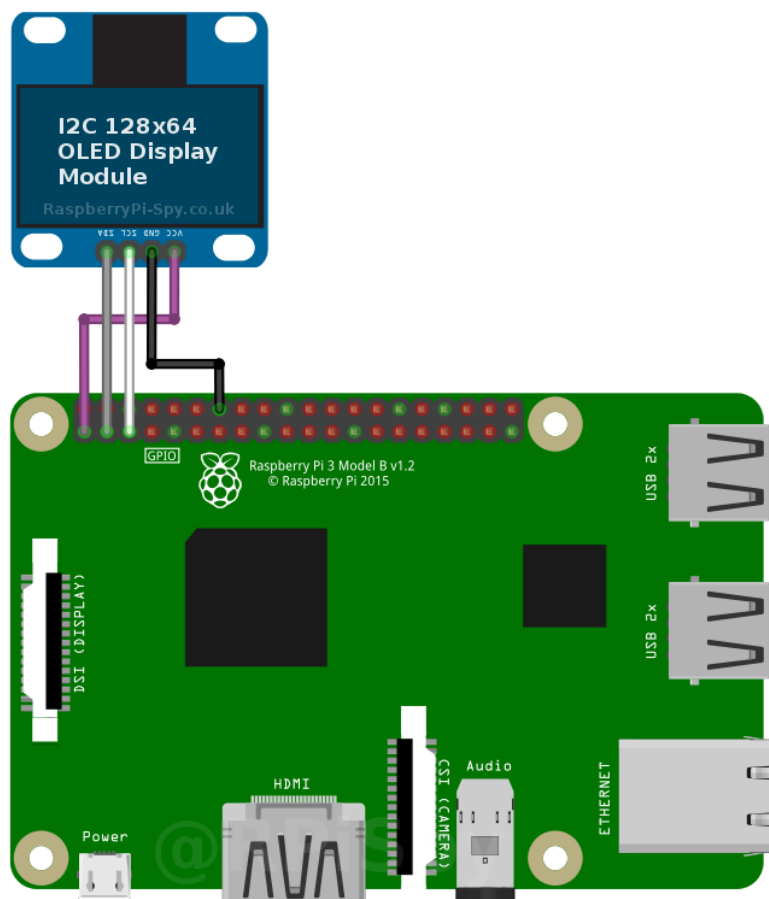


Figure 10: OLED connections

- Run the oled.py to use the display and show output

```
(IOT_LAB) pi@raspberrypi:~/Documents $ python oled.py
Enter text to display :- WELCOME TO IOT_LAB-2
Enter text to display :- █
```

Figure 11: OLED input



Figure 12: OLED output

Assignment : Show Lidar data on OLED display

- In the LAB submission use the data from the Lidar sensor as the input to the OLED display.
- NOTE:In I2C you can use multiple devices on the same bus.
- In the final submission the display should show your roll number followed by the distance measured. EG :-

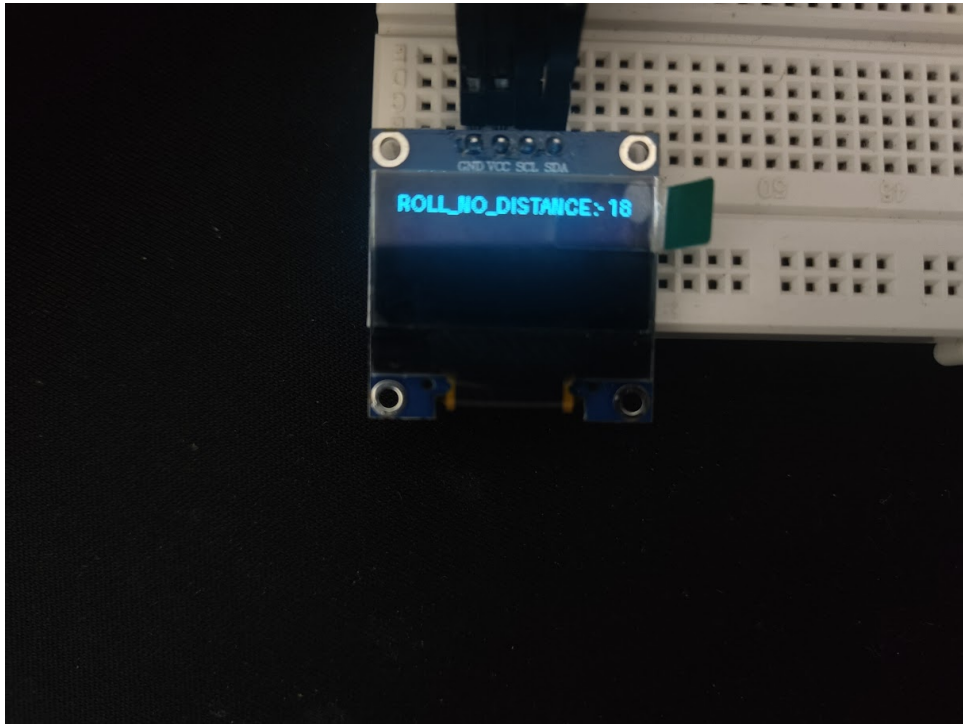


Figure 13: Example output

- In the LAB report please include the output from the provided examples, code written as part of the assignment, output images(if any).
 - LAB report can be prepared on ANY platform of your choice.
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