

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python.

Also, in addition the Sense HAT is an add-on board for Raspberry Pi, made especially for the Astro Pi mission – it launched to the International Space Station in December 2015 – and is now available to buy. The Sense HAT has an 8×8 RGB LED matrix, a five-button joystick and includes the sensors like Temperature, Humidity, Barometric pressure, Gyroscope, Accelerometer, and Magnetometer. As we are interested in Development of Weather station module, we will consider only sensors like: Temperature, Humidity, and Barometric Pressure to link it with Time-Series.

The Hardware Devices used are described as follows:

### **1. Raspberry Pi 3 Model B.**



Fig.1 Raspberry pi 3 Model B

#### **Specifications:**

- A 1.2GHz 64-bit quad-core ARMv8 CPU
- 802.11n Wireless LAN
- Bluetooth 4.1
- Bluetooth Low Energy (BLE)
- 1GB RAM
- 4 USB ports
- 40 GPIO pins
- Full HDMI port

- Ethernet port
- Combined 3.5mm audio jack and composite video
- Micro SD card slot (now push-pull rather than push-push)
- VideoCore IV 3D graphics core.

## 2. Sense Hat

### Specifications:

The Raspberry Pi Sense HAT is attached on top of the Raspberry Pi via the 40 GPIO pins to create an 'Astro Pi'. The Sense HAT has several integrated circuit based sensors can be used for many different types of experiments, applications, and even games. And it's being used in conjunction with the Raspberry Pi Foundation to perform science experiments aboard the International Space Station (ISS).

The 8x8 LED Matrix enables you to display the data from the various sensors, it can show you which way is geomagnetic North by programming a compass using the magnetometer, or simply be used to play games like Tetris, Pong and Snake with the joystick. The joystick can also be used to enable a human user to interact with the programs running on the Raspberry Pi Sense HAT.

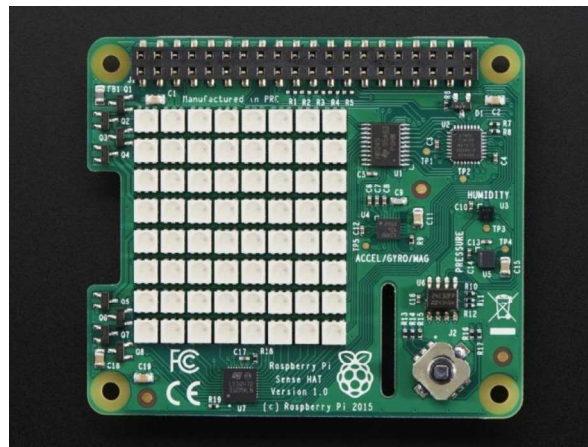


Fig.2 Sense Hat Module

### TECHNICAL DETAILS

- Gyroscope.
- Angular rate sensor (dps): ~245/500/2000.
- Accelerometer.
- Linear acceleration sensor (g): ~2/4/8/16.
- Magnetometer.

- Magnetic sensor (gauss): ~4/8/12/16.
- Barometer: 260 - 1260 hPa absolute range (accuracy depends on the temperature and pressure, ~0.1 hPa under normal conditions).
- Temperature sensor: Accurate to ~2°C in the 0-65°C range.
- Relative humidity sensor: Accurate to ~4.5% in the 20-80%rH range, accurate to ~0.5°C in 15-40°C range.
- 8x8 LED matrix display.
- Small 5 button joystick.

## Working:

First of all we have installed raspbian debian OS on raspberry pi which is a free operating system based on Debian optimized for the Raspberry Pi hardware.

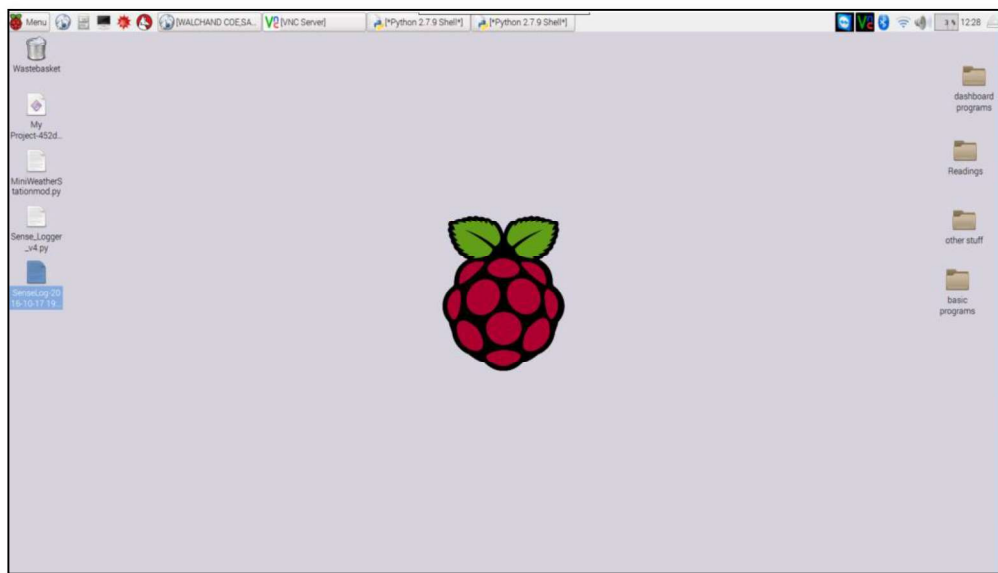


Fig. Raspbian Debian Os

An operating system is the set of basic programs and utilities that make your Raspberry Pi run. Raspbian comes pre-installed with plenty of software for education, programming and general use. It has Python, Scratch, Sonic Pi, Java, Mathematica and more. Then we install Sense Hat on top of Raspberry pi board.

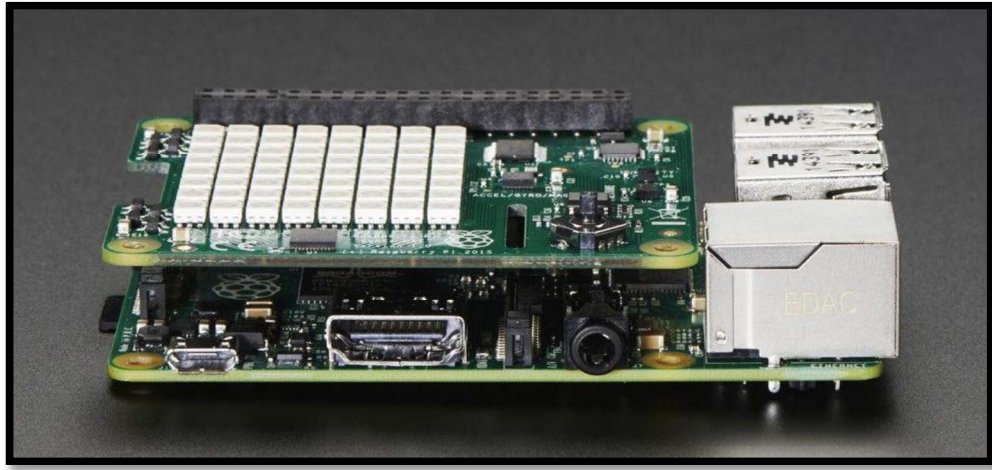


Fig. Sense Hat Setup.

After that the software configuration steps over raspbian are as mentioned below:

In order to work correctly, the Sense HAT requires an up-to-date kernel, I2C to be enabled, and a few libraries to get started.

1. Ensure your APT package list is up-to-date:

```
sudo apt-get update
```

2. Next, install the sense-hat package which will ensure the kernel is up-to-date, enable I2C, and install the necessary libraries and programs:

```
sudo apt-get install sense-hat
```

3. Finally, a reboot may be required if I2C was disabled or the kernel was not up-to-date prior to the install:

```
sudo reboot
```

4. RTIMULIB

RTIMULib is a C++ and Python library that makes it easy to use 9-dof and 10-dof IMUs with embedded Linux systems. A pre-calibrated settings file is provided in `/etc/RTIMULib.ini`, which is also copied and used by sense-hat. The included examples look for `RTIMULib.ini` in the current working directory, so you may wish to copy the file there to get more accurate data.

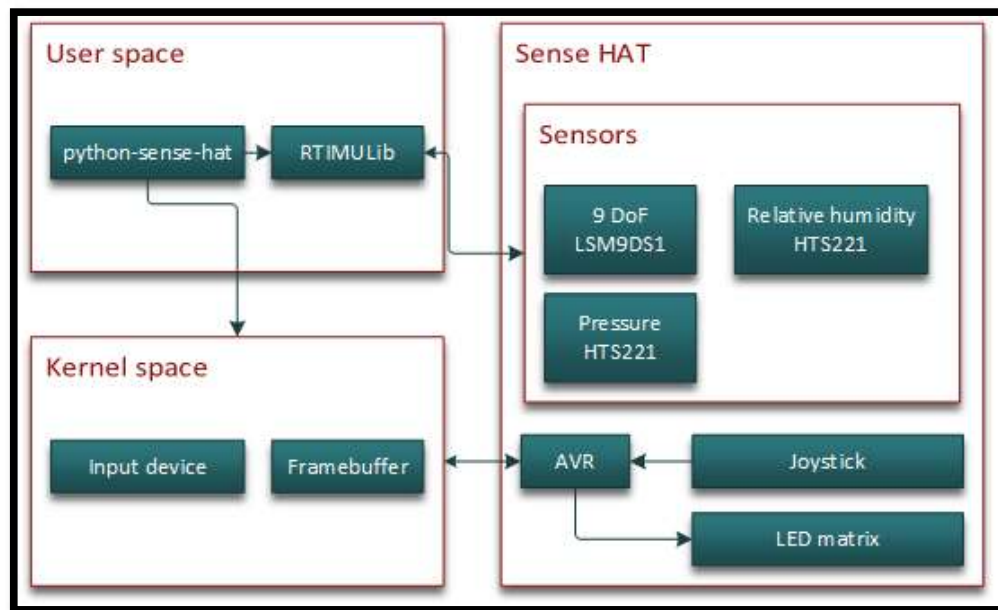


Fig. Sense Hat Architecture.