

Raspberry Pi 4 Setup with BNO055 IMU and ROS 2 Humble

1 Introduction

This document provides a step-by-step guide for setting up a Raspberry Pi 4 from scratch, including operating system installation, configuration, BNO055 IMU setup, and ROS 2 Humble installation.

2 Required Hardware

- Raspberry Pi 4
- microSD card (64 GB or more)
- microSD card reader
- Power supply
- PC or Laptop

3 Preparing the microSD Card

1. Download and open the Raspberry Pi Imager on your PC or laptop
2. Choose OS: **Ubuntu Server 22.04.5 LTS (64-bit)**
3. Choose Storage: select your microSD card
4. Set hostname: `raspberrypi.local`
5. Create a username and password
6. Configure WiFi (use a stable network)
7. Enable SSH
8. Click **Write Image** and confirm erase

4 First Boot

1. Insert the microSD card into the Raspberry Pi
2. Power on the Raspberry Pi

5 Connecting via SSH

Open Command Prompt and run:

```
ssh <username>@<hostname>
```

Enter the password when prompted.

6 System Update

Run the following command:

```
sudo apt update && sudo apt upgrade -y
```

7 Enable I2C and VNC

```
sudo apt install raspi-config  
sudo raspi-config
```

Navigate to:

- Interface Options → I2C → Enable
- Interface Options → VNC → Enable

Reboot:

```
sudo reboot
```

8 Install I2C Tools

```
sudo apt install -y i2c-tools  
sudo apt install -y python3-smbus python3-pip
```

9 Connect via VNC

1. Download and open VNC Viewer
2. Enter hostname
3. Log in with username and password

10 Wiring the BNO055 IMU

BNO055	Raspberry Pi 4
3V	3.3V (Pin 1)
GND	GND (Pin 6)
SDA	SDA1 (Pin 3)
SCL	SCL (Pin 5)

11 Detect BNO055 on I2C Bus

```
i2cdetect -y 1
```

Expected output: 0x28 or 0x29

12 Install BNO055 Python Library

```
sudo pip3 install adafruit-circuitpython-bno055
```

13 BNO055 Test Code

```
import board
import busio
import adafruit_bno055
import time

i2c = busio.I2C(board.SCL, board.SDA)
sensor = adafruit_bno055.BNO055_I2C(i2c)

print("BNO055 IMU Test")

while True:
    print("Temperature:", sensor.temperature)
    print("Euler:", sensor.euler)
```

```
print("Acceleration:", sensor.acceleration)
print("Gyro:", sensor.gyro)
print("Magnetic:", sensor.magnetic)
print("Calibration:", sensor.calibration_status)
print("-" * 30)
time.sleep(1)
```

14 Installing ROS 2 Humble

14.1 System Preparation

```
sudo apt update
sudo apt install curl
```

14.2 Add ROS 2 GPG Key

```
sudo curl -sSL https://raw.githubusercontent.com/ros/rosdistro/
  master/ros.key \
-o /usr/share/keyrings/ros-archive-keyring.gpg
```

14.3 Add ROS 2 Repository

```
echo "deb [arch=arm64 signed-by=/usr/share/keyrings/ros-archive-
  keyring.gpg] \
http://packages.ros.org/ros2/ubuntu jammy main" | \
sudo tee /etc/apt/sources.list.d/ros2.list > /dev/null
```

14.4 Install ROS 2

```
sudo apt update
sudo apt install ros-humble-desktop
```

14.5 Source ROS 2

```
source /opt/ros/humble/setup.bash
echo "source /opt/ros/humble/setup.bash" >> ~/.bashrc
source ~/.bashrc
```

15 Test ROS 2

Terminal 1:

```
ros2 run demo_nodes_cpp talker
```

Terminal 2:

```
ros2 run demo_nodes_cpp listener
```

16 Install Build Tools

```
sudo apt install python3-colcon-common-extensions  
sudo apt install python3-rosdep  
sudo rosdep init  
rosdep update
```

17 Install BNO055 ROS 2 Package

```
sudo apt install ros-humble-bno055
```

18 Run BNO055 ROS 2 Node

```
ros2 run bno055 bno055
```

19 Verify IMU Topics

```
ros2 topic list
```