EMBT-ESE 4009

Major components required for the project.

Project topic:Health monitoring device using IOT -connected headphone.

Group:2

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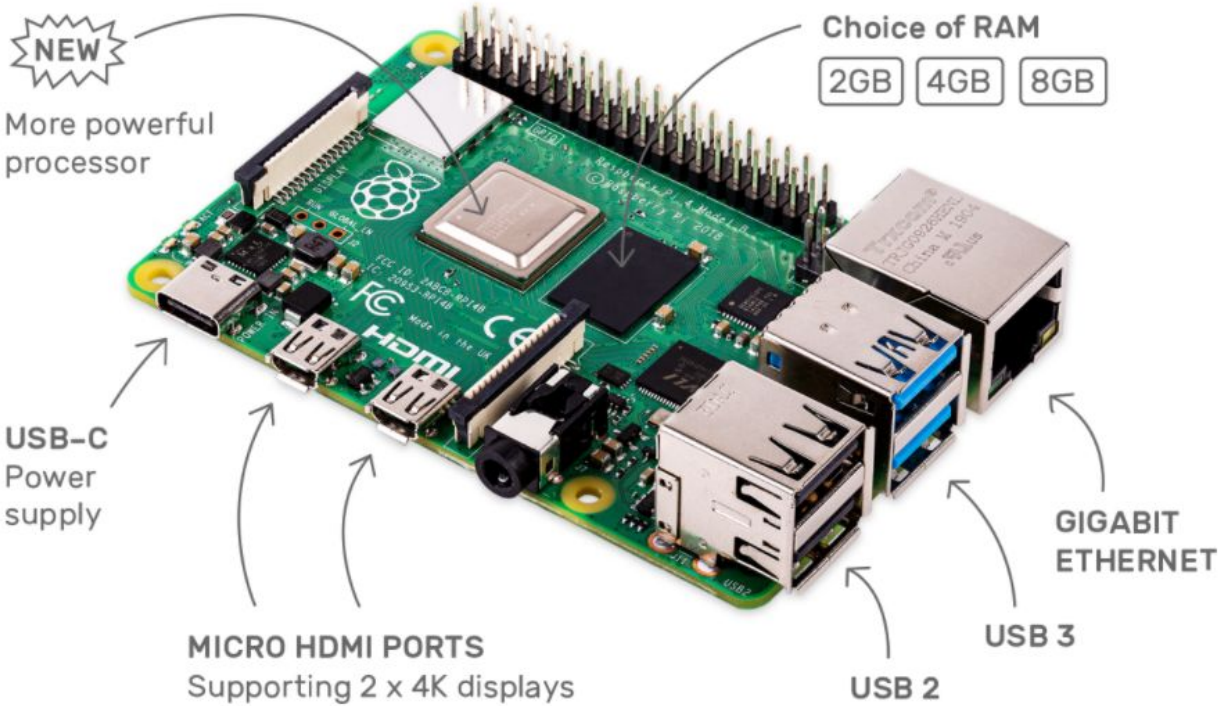
Major Hardware components Required

1. Raspberry pi
2. Thermistor (Temperature sensor)
3. Pulse Oximeter/Spo2 Sensor
4. Surface Electrode/ECG Sensor
5. Battery
6. GSM Module
7. GPS Module

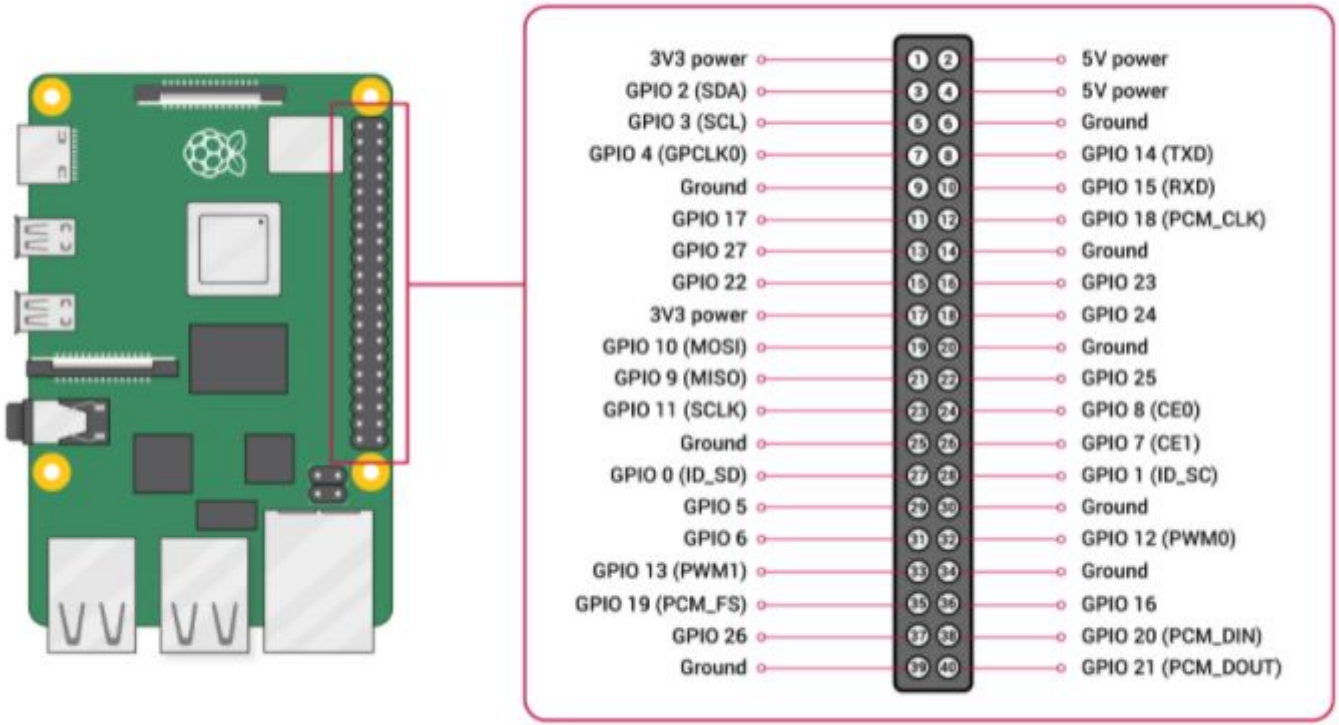
1. Raspberry Pi 4



Raspberry Pi 4 Main Features

- This new Raspberry Pi also has a new processor. A 1.5GHz 64-bit quad-core ARM Cortex-A72 CPU (ARM v8) sits on the BCM2837 SoC (System-on-Chip) marking a significant move away from previous generations of Raspberry Pi.
- 1GB, 2GB, or 4GB RAM
- 2x USB 3.0 ports
- 2x USB 2.0 ports
- the Ethernet port was on the USB hub. This reduced the speed of the port, but this time around, the Ethernet port is full Gigabyte, ensuring superior speed.
- Power-over-Ethernet (this will require a PoE HAT)
- 40-pin GPIO header
- 2× micro-HDMI ports (up to 4Kp60 supported)
- CSI camera port
- Micro-SD card slot
- USB-C power
- the Raspberry Pi 4 has built in wireless networking (LAN) and Bluetooth 5.0 BLE support.

A powerful feature of the Raspberry Pi is the row of GPIO (general-purpose input/output) pins along the top edge of the board. A 40-pin GPIO header is found on all current Raspberry Pi boards (unpopulated on Pi Zero and Pi Zero W). Prior to the Pi 1 Model B+ (2014), boards comprised a shorter 26-pin header.



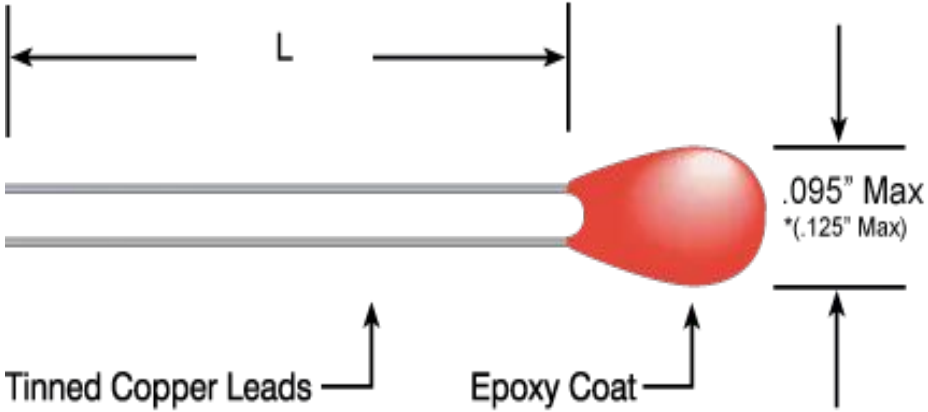
As well as simple input and output devices, the GPIO pins can be used with a variety of alternative functions, some are available on all pins, others on specific pins.

- PWM (pulse-width modulation)
  - Software PWM available on all pins
  - Hardware PWM available on GPIO12, GPIO13, GPIO18, GPIO19
- SPI
  - SPI0: MOSI (GPIO10); MISO (GPIO9); SCLK (GPIO11); CE0 (GPIO8), CE1 (GPIO7)
  - SPI1: MOSI (GPIO20); MISO (GPIO19); SCLK (GPIO21); CE0 (GPIO18); CE1 (GPIO17); CE2 (GPIO16)
- I2C
  - Data: (GPIO2); Clock (GPIO3)
  - EEPROM Data: (GPIO0); EEPROM Clock (GPIO1)
- Serial
  - TX (GPIO14); RX (GPIO15)

2. Thermistor (Temperature sensor)

A Thermistor is a special kind of resistor that changes its resistance value when exposed to temperature changes. They are made using ceramic material such as oxides of nickel, cobalt or manganese coated in glass. (AspenCore Inc, 2019)

The reason why we choose thermistors is their speed of response to any change of temperature.

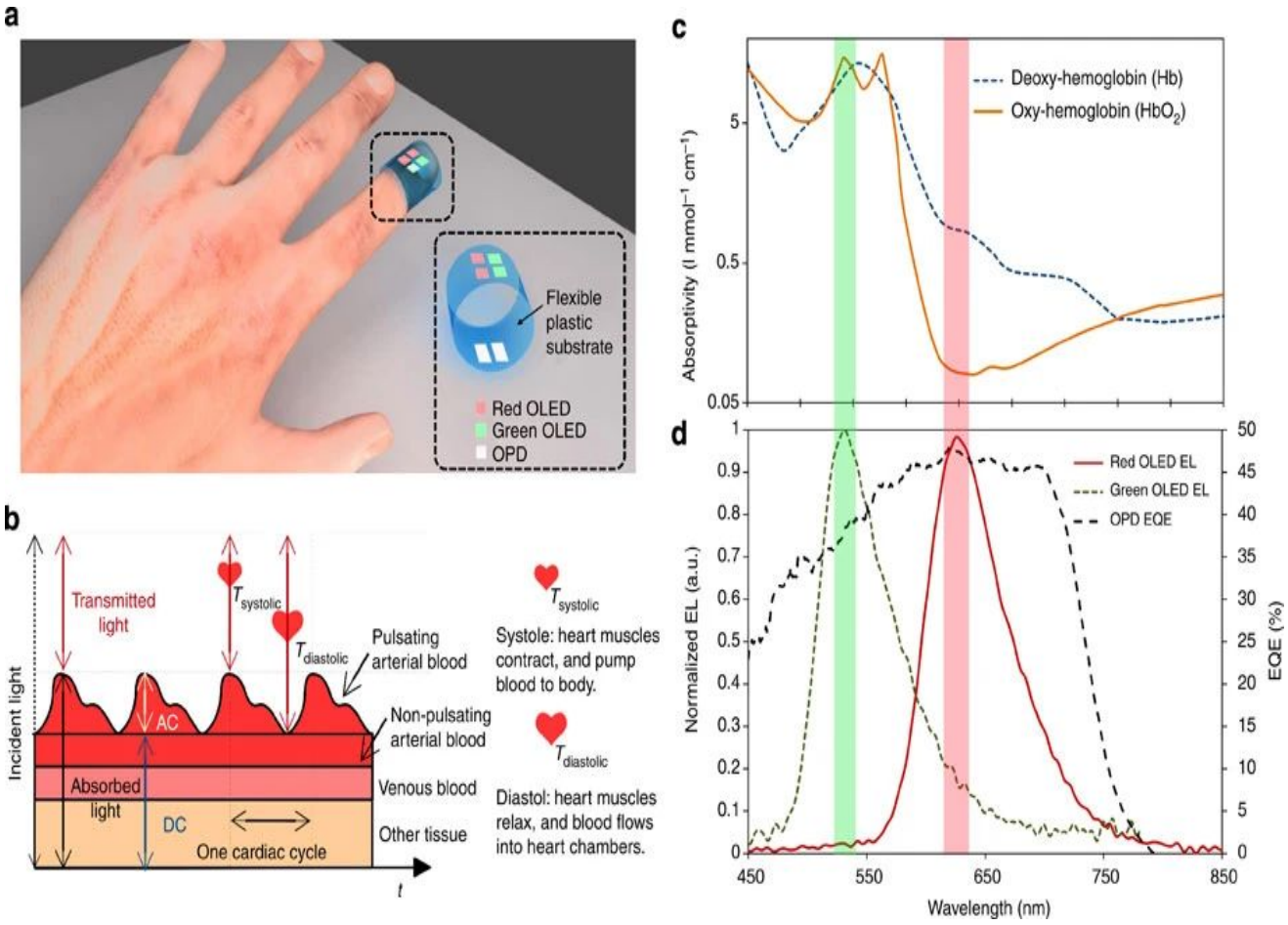


3. Pulse Oximeter/Spo2 Sensor

Optical SpO2 sensors use red and infrared light sensors to detect your oxygen levels, sensing changes in those levels by looking at the colour of your blood.

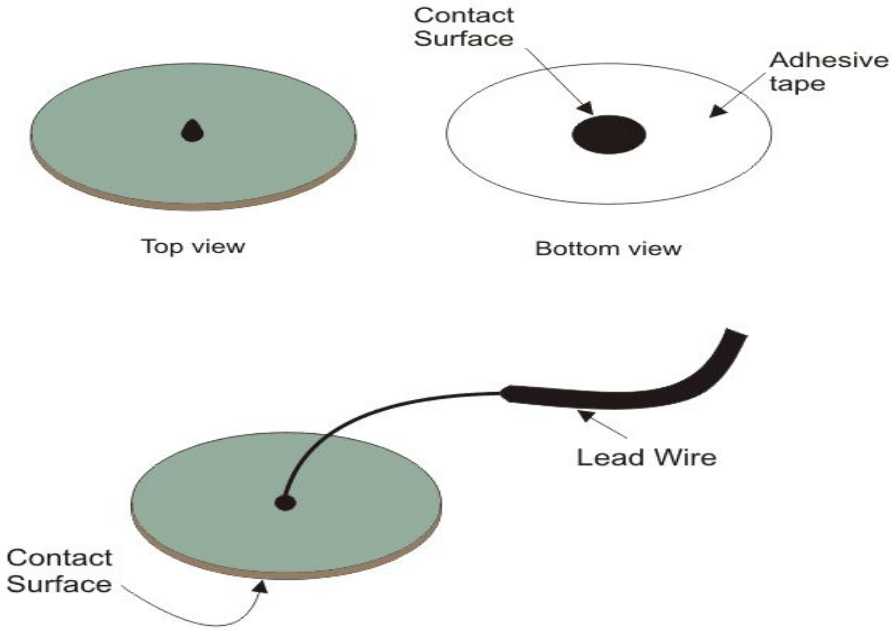
It measures the volume of oxygen based on how the light passes through your finger and delivers the data to set priority? the device's screen, which will tell you the percentage of oxygen in your blood. (*WAREABLE*, 2020)

By Detecting the Blood Oxygen level, we can determine whether the patient suffers any Breathing Difficulties. This will help people suffering from various conditions, including asthma, pneumonia, heart failure and lung cancer.


a
Flexible plastic substrate
Red OLED
Green OLED
OPD
b
Transmitted light
$T_{systolic}$
$T_{diastolic}$
Pulsating arterial blood
Non-pulsating arterial blood
Venous blood
Other tissue
AC
DC
Absorbed light
Incident light
One cardiac cycle
t
$T_{systolic}$
Systole: heart muscles contract, and pump blood to body.
$T_{diastolic}$
Diastol: heart muscles relax, and blood flows into heart chambers.
c
Deoxy-hemoglobin (Hb)
Oxy-hemoglobin (HbO_2)
Absorptivity (l mmol^{-1} cm^{-1})
5
0.5
0.05
d
Red OLED EL
Green OLED EL
OPD EQE
Normalized EL (a.u.)
EQE (%)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
50
45
40
35
30
25
20
15
10
5
0
450
550
650
750
850
Wavelength (nm)

4. Surface Electrode/ECG Sensor

Surface electrodes are types of electrodes applied to the skin of the subject. Primary applications include electrocardiography (ECG/EKG), electromyography (EMG), or electroencephalography (EEG), which are techniques for recording and evaluating the electrical activities of the heart, skeletal muscles and neurons of the brain, respectively, from the surface of the skin (Zhang & Hoshino, 2019).



5. Battery

The lithium-Ion battery is the most commonly used. We are also planning to use that. Here the challenge is the size of the battery.

- A lithium-ion battery or Li-ion battery is a type of rechargeable battery.
- In the batteries, lithium ions move from the negative electrode through an electrolyte to the positive electrode during discharge, and back when charging. Li-ion batteries use an intercalated lithium compound as the material at the positive electrode and typically graphite at the negative electrode.

6. GSM Module

GSM (Global System for Mobile Communications, originally Groupe Spécial Mobile), is a standard developed by the European Telecommunications Standards Institute.

A GSM module or a GPRS module is a chip or circuit that will be used to establish communication between a mobile device or a computing machine and a GSM or GPRS system. The modem (modulator-demodulator) is a critical part here.

These modules consist of a GSM module or GPRS modem powered by a power supply circuit and communication interfaces (like RS-232, USB 2.0, and others) for computer. A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, or it can be a mobile phone that provides GSM modem capabilities.

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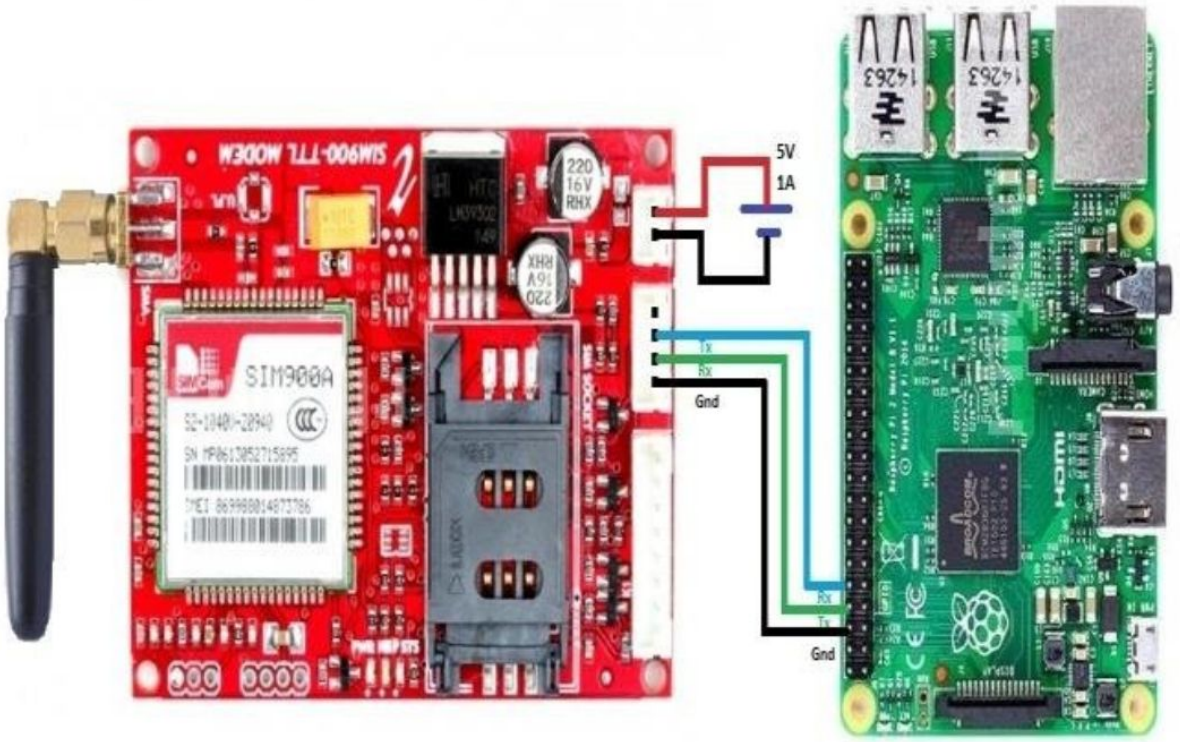
GSM Interfacing with Raspberry Pi



7. GPS Module

- **G**lobal **P**ositioning **S**ystem (GPS) makes use of signals sent by satellites in space and ground stations on Earth to accurately determine their position on Earth.
- Radio Frequency signals sent from satellites and ground stations are received by the GPS. GPS makes use of these signals to determine its exact position.
- The GPS itself does not need to transmit any information.
- The signals received from the satellites and ground stations contain time stamps of the time when the signals were transmitted. By calculating the difference between the time when the signal was transmitted and the time when the signal was received. Using the speed of the signal, the distance between the satellites and the GPS receiver can be determined using a simple formula for distance using speed and time.

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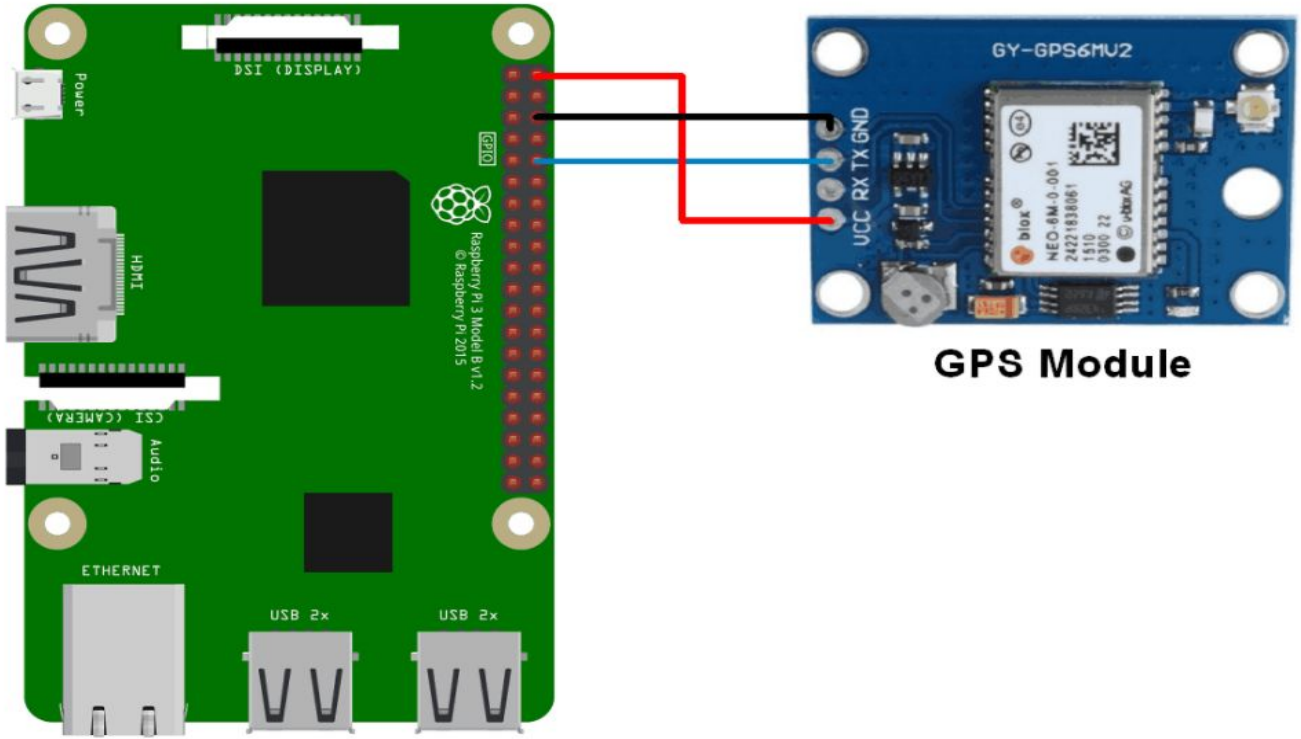
GPS Interfacing with Raspberry Pi



Major Software Requirements

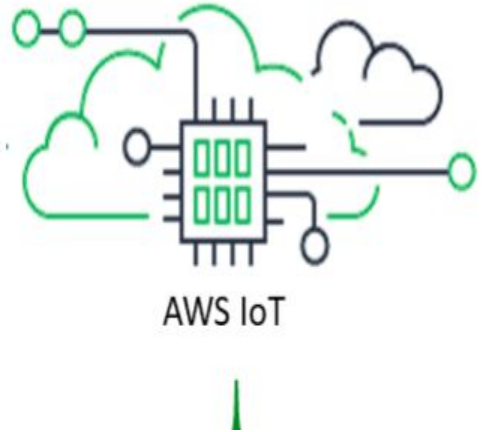
1. KiCad
2. Amazon Web Services
3. Raspberry Pi IDE

1. Kicad

- Kicad is an software used for electronic design automation.
- In this project we use Kicad to design schematic of our circuit and for prototyping.
- A PCB can be designed using the schematic that we obtained from KiCad.
- It features an integrated environment for schematic capture and PCB layout design.

2. Amazon Web Services

Amazon Web Services offers a broad set of global cloud-based products including compute, storage, databases, analytics, networking, mobile, developer tools, management tools, IoT, security and enterprise applications. These services help organizations move faster, lower IT costs, and scale.



3.Raspberry Pi IDE

It is a 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.

We can use different kind of IDE in Raspberry pi.Among those the top IDE are

- BlueJ IDE
- Geany IDE
- Lazarus IDE
- Lazarus IDE

We can use C,C++ and Python for programming Raspberry pi.

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- GPS and Raspberry pi interfacing, Electronic Wings, https://www.electronicwings.com/raspberry-pi/gps-module-interfacing-with-raspberry-pi

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Thank You