American Journal of Botany and Bioengineering
https://biojournals.us/index.php/AJBP
ISSN: 2997-9331

Health Care System for Alzuhaimer Patient Using Arduino

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Received: 2024 19, Sep
Accepted: 2024 28, Sep
Published: 2024 18, Oct

Annotation: We have recently noticed an increase in Alzheimer's disease in the elderly, especially the elderly This has led to companies competing to help people afflicted with this disease So in this project a system was designed to help patients with Alzheimer's disease. This project aims to design a watch that contains some sensors to monitor the patient's status such as position by using GPS sensor, in addition to some sensor use to monitering any suddenly events by gyroscope sensor such as Direct fall or fainting. These data are send to monitoring person or center to tell the emergency in case event any thing.

Introduction

We have recently noticed an increase in Alzheimer's disease in the elderly, especially the elderly. This has led to companies competing to help people afflicted with this disease. So in this project a system was designed to help patients with Alzheimer's disease. The project has been completed, tested and the results are shown accurately. Where the project was linked by way with the application by the Blynk platform The temperature is sent instantaneously. Gyroscope sensor is used to monitor the velocity of the Zuhaimer patient. GPS sensor is connect continues to limit the location of the patient . Gyroscope sensor and GPS sensor are connected to IoT Blynk platform.

In the event that the temperature rises more than the specified value, a warning message is sent to the monitored person informing him that the temperature has risen in order to take the necessary action. Heart rate sensor is connected to V2 in IoT Blynk platform read the patient heart rate

countinously.Spo2 sensor is connected to V3 in IoT Blynk platform read the patient heart rate continuously.

The Aim of Project

- This project aims to design a device that contains some sensors to monitor the Alzheimer's patient's status such as location and temperature in addition to if the patient has He is subjected to a sudden fall.
- The device is Send continuously or in an emergency situation to the person observing the patient's status.

Propose of Project

- The purpose of is to design a device that contains some sensors to measure patiets behavior such as location, sudden fall, teperature.
- In the same time send it continuously a copy of these information on nurse or doctor phone by using IoT
- Using Blynk cloud for sending the data thorgh the internet

Project Organization

This project is organized into five chapters including this chapter.

- ✓ Chapter One is General introduction
- ✓ Chapter Two explain theory about the Arduino and its Features
- ✓ Chapter Three explain the Hardware structure connectivity of our project circuit.
- ✓ Chapter Four explain the practical side of our Project.
- ✓ Chapter Five presents conclusions and suggestion for future work

Introduction:

Arduino is an open-source hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices. Its hardware products are licensed under a CC BY-SA license, while software is licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially from the official website or through authorized distributors. [1]

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards ('shields') or breadboards (for prototyping) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs. The microcontrollers can be programmed using the C and C++ programming languages, using a standard API which is also known as the Arduino language, inspired by the Processing language and used with a modified version of the Processing IDE. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) and a command line tool developed in Go. [2]

The Arduino project began in 2005 as a tool for students at the Interaction Design Institute Ivrea, Italy, aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats and motion detectors.[3]

Types of Arduino

There are more than 40 types of Arduino Boards, differing in capacity, shape, size and price in order to suit all ideas and designs, but the most important and widespread are:

Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328 It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDIUSB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.[4]

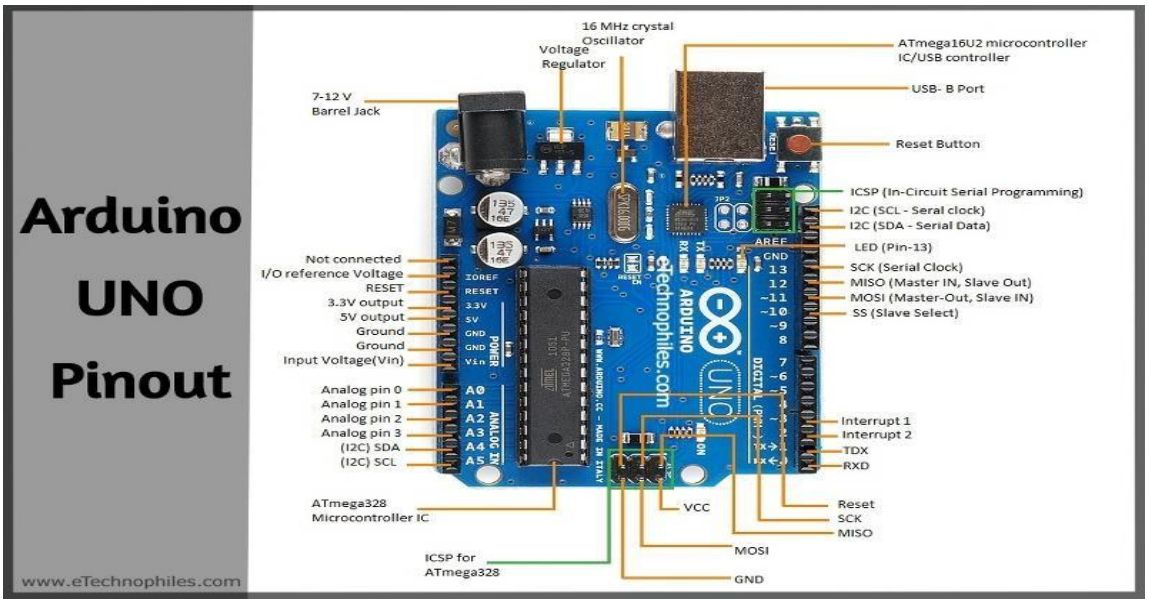


Fig.(2.1) Arduino Uno Pinout

Table (2-1): Arduino Uno Specifications

Microcontroller:	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Inout Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA

Arduino Mega

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560 . It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC - DC adapter or battery to get started. The Mega is compatible with most shields designed for the Arduino Duemilanove or Diecimila. [5]

The Arduino Mega can be powered via the USB connection or with an external power supply. The power source is selected automatically. The Mega2560 differs from all preceding boards in that it does not use the FTDI USB-to serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.[5]

Fig. (2-2): Arduino Mega

Table (2-2): Arduino Mega 2560 Specification

Microcontroller	ATmega2560.
Operating Voltage	5V.
Input Voltage (recommended)	7-12V.
Input Voltage (limit)	6-20V.
Digital I/O Pins	54 (of which 15 provide PWM output)
Analog Input Pins	16.
DC Current per I/O Pin	20 mA.

Arduino Nano

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.0) or ATmega168 (Arduino Nano 2.x). It has more or less the same functionality of the Arduino Due milanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.[6]

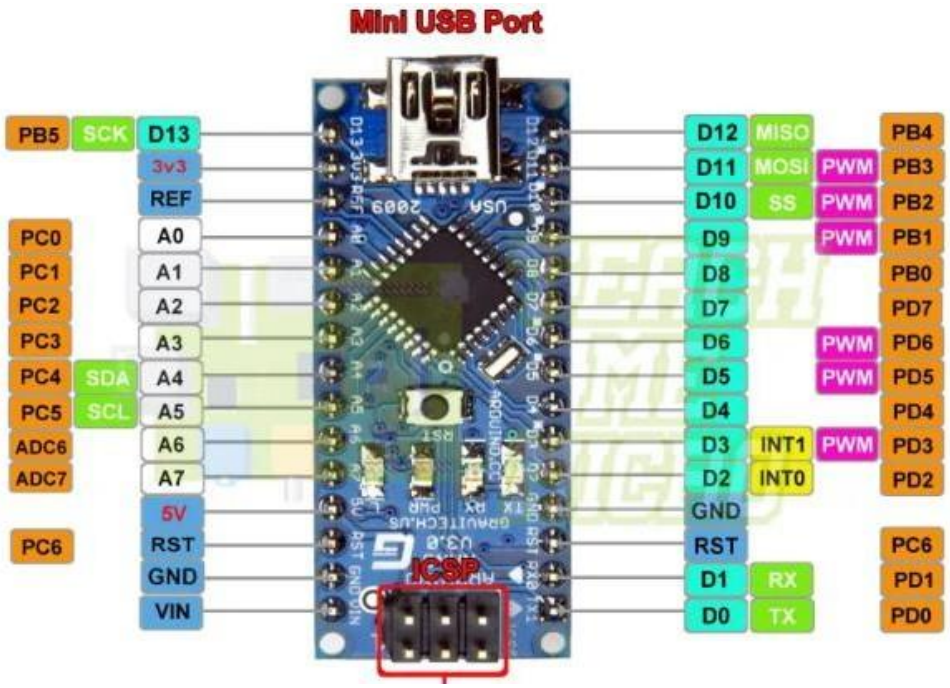


Fig. (2-3): Arduino Nano

Table (2-3): The Arduino Nano specifications

Microcontroller	ATmega328
Operating Voltage (logic level)	5 V
Input Voltage (recommended)	7-12 V
Input Voltage (limits)	6-20 V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	8
DC Current per I/O Pin	40 mA

Arduino Micro

The Arduino Micro is a microcontroller board based on the ATmega32u4 (datasheet), developed in conjunction with Adafruit. It has 20 digital input/output pins (of which 7 can be used as PWM outputs and 12 as analog inputs), a 16 MHz crystal oscillator, a micro USB connection, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a micro USB cable to get started. It has a form factor that enables it to be easily placed on a breadboard. The Micro is similar to the Arduino Leonardo in that the ATmega32u4 has built-in USB communication, eliminating the need for a secondary processor. This allows the Micro to appear to a connected computer as a mouse and keyboard, in addition to a virtual (CDC) serial / COM port. It also has other implications for the behavior of the board.[7]

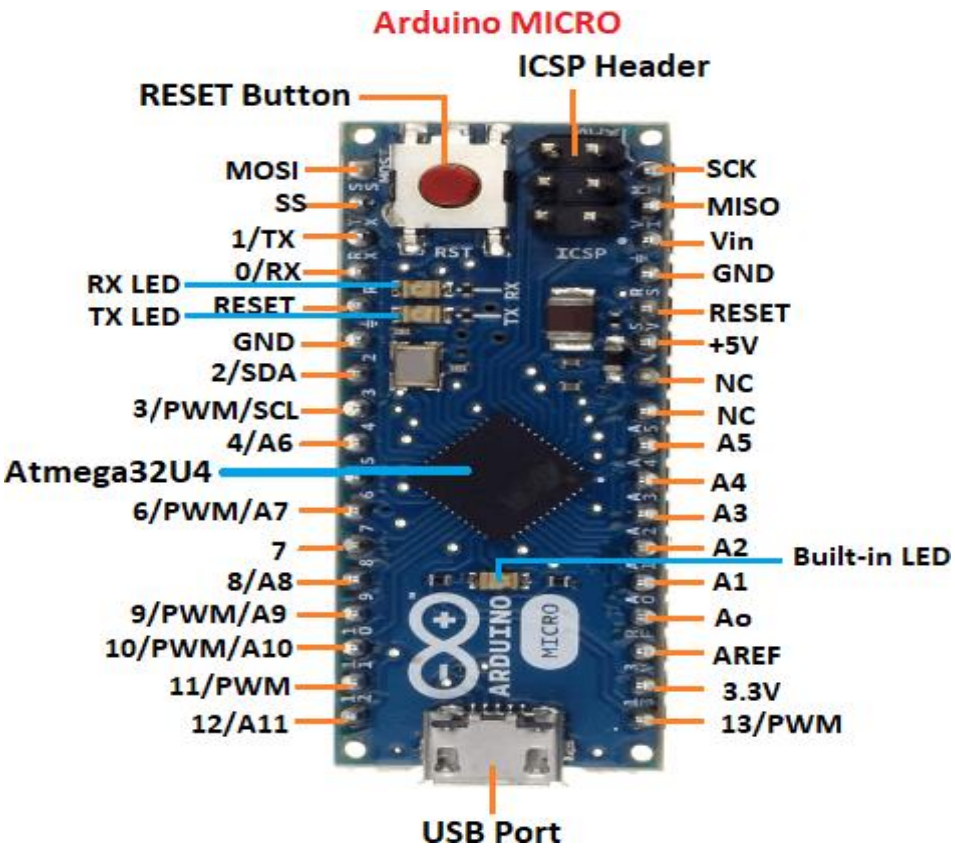


Fig. (2-4): Arduino Micro pinout

Table (2-4): The specifications of the Arduino Micro

Microcontroller	ATmega32u4
Operating voltage	5 V
Input voltage	6–20 V
Digital pins	20
Analogue input pins	8 (including 4 connected pins)
Direct current per I/O pin	40 mA
Flash Memory	32 k
Analog Input Channel	12
Clock Speed	16 MHz

Gyroscope sensor

Vibration gyro sensors sense angular velocity from the Coriolis force applied to a vibrating element. For this reason, the accuracy with which angular velocity is measured differs significantly depending on element material and structural differences. Here, we briefly describe the main types of elements used in vibration gyro sensors.

Gyroscope sensor is a device that can measure and maintain the orientation and angular velocity of an object. These are more advanced than accelerometers. These can measure the tilt and lateral orientation of the object whereas accelerometer can only measure the linear motion.

Gyroscope sensors are also called as Angular Rate Sensor or Angular Velocity Sensors. These sensors are installed in the applications where the orientation of the object is difficult to sense by humans. Measured in degrees per second, angular velocity is the change in the rotational angle of the object per unit of time. Besides sensing the angular velocity, Gyroscope sensors can also measure the motion of the object. For more robust and accurate motion sensing, in consumer electronics Gyroscope sensors are combined with Accelerometer sensors. Depending on the

direction there are three types of angular rate measurements. Yaw- the horizontal rotation on a flat surface when seen the object from above, Pitch- Vertical rotation as seen the object from front, Roll- the horizontal rotation when seen the object from front. In this sensor to measure the angular rate, the rotation rate of the sensor is converted into an electrical signal. Working principle of Gyroscope sensor can be understood by observing the working of Vibration Gyroscope sensor.

This sensor consists of an internal vibrating element made up of crystal material in the shape of a double – T- structure. This structure comprises a stationary part in the center with 'Sensing Arm' attached to it and 'Drive Arm' on both sides. This double-T-structure is symmetrical. When an alternating vibration electrical field is applied to the drive arms, continuous lateral vibrations are produced. As Drive arms are symmetrical, when one arm moves to left the other moves to the right, thus canceling out the leaking vibrations. This keeps the stationary part at the center and sensing arm remains static. When the external rotational force is applied to the sensor vertical vibrations are caused on Drive arms. This leads to the vibration of the Drive arms in the upward and downward directions due to which a rotational force acts on the stationary part in the center.

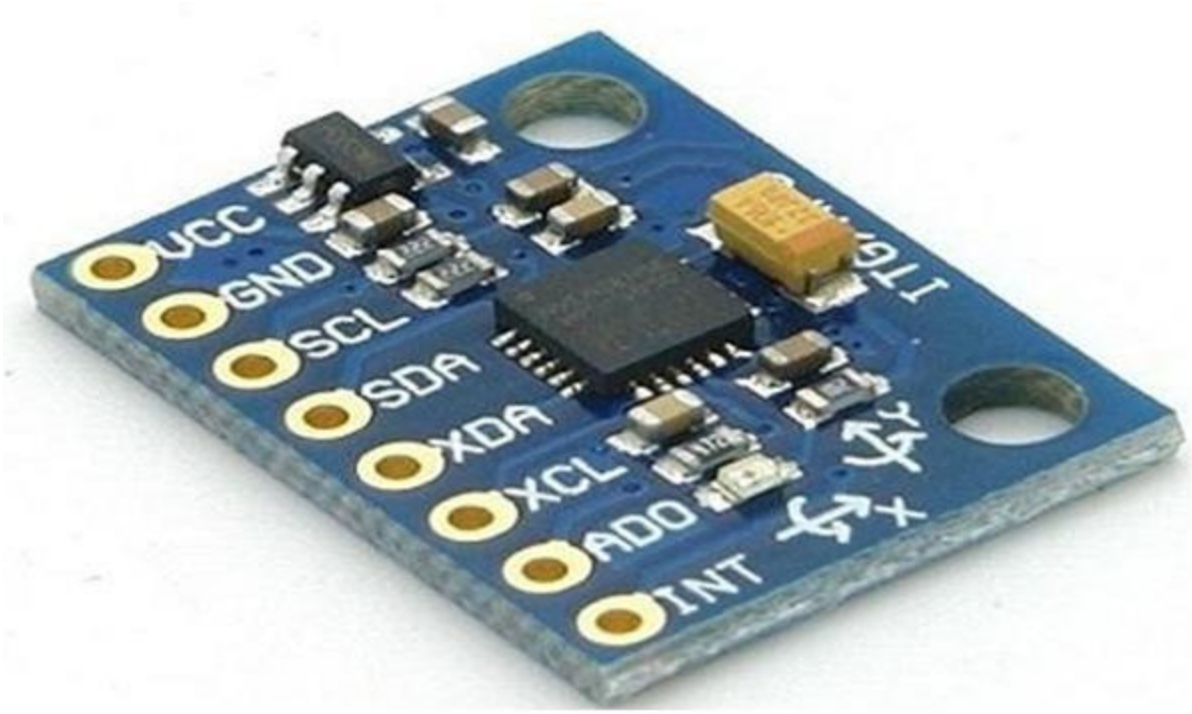


Fig (2-5): Gyroscope sensor

The Global Positioning System (GPS)

The UBLOX NEO-6M GPS Module with the included antenna is fully compatible with the Arduino development platform . Based on the UBLOX NEO-6M-0- 001 architecture chip can be integrated into a device and receiver such as a PND, GPS Mouse, Auto Tracker, Speed Detector and many other applications.

Fig (2-6): The Global Positioning System (GPS)

GPS satellites circle the Earth twice a day in a precise orbit. Each satellite transmits a unique signal and orbital parameters that allow GPS devices to decode and compute the precise location of the satellite. GPS receivers use this information and trilateration to calculate a user's exact location. Essentially, the GPS receiver measures the distance to each satellite by the amount of time it takes to receive a transmitted signal. With distance measurements from a few more satellites, the receiver can determine a user's position and display it.

To calculate your 2-D position (latitude and longitude) and track movement, a GPS receiver must be locked on to the signal of at least 3 satellites. With 4 or more satellites in view, the receiver can determine your 3 -D position (latitude, longitude and altitude). Generally, a GPS receiver will track 8 or more satellites, but that depends on the time of day and where you are on the earth.

Once your position has been determined, the GPS unit can calculate other information, such as: Speed, Bearing, Track, Trip dist, Distance to destination GPS satellites transmit at least 2 low-power radio signals. The signals travel by line of sight, meaning they will pass through clouds, glass and plastic but will not go through most solid objects, such as buildings and mountains. However, modern receivers are more sensitive and can usually track through houses.

A GPS signal contains 3 different types of information:

- Pseudorandom code is an I.D. code that identifies which satellite is transmitting information. You can see which satellites you are getting signals from on your device's satellite page.
- Ephemeris data is needed to determine a satellite's position and gives important information about the health of a satellite, current date and time.
- Almanac data tells the GPS receiver where each GPS satellite should be at any time throughout the day and shows the orbital information for that satellite and every other satellite in the system.

2.5 LM35

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1/4°C at room temperature and ±3/4°C over a full -55 to +150°C temperature range The MLX90614 is built from 2 chips developed and manufactured by Melexis.[8]

Fig. (2-7): ML35temperature Sensors

2.5 Node MCU ESP 8266

NodeMCU is an open source platform based on ESP8266 which can connect objects and let data transfer using the Wi-Fi protocol. In addition, by providing some of the most important features of microcontrollers such as GPIO, PWM, ADC, and etc. the following picture explain the Pinout of the NodeMCU

The NodeMCU controller is the most famous microcontroller in the field of IoT applications with a wireless connection. It can be programmed on its own via the Arduino program, or it can be linked with the Arduino to work as a communication chip and is used in many applications that need a connection with the Internet, where a complete system can be made to control electrical devices or monitor certain sensors via through this controller.[10]

Fig. (2-8): Node MCU ESP8266 Wi-Fi

Introduction:

The implementation of the electronic circuit that is used to control the temperature in addition to patient location, and sudden patient falling. Blynk platform The temperature is sent instantaneously. Gyroscope sensor is used to monitor the velocity of the Zuhaimer patient. GPS sensor is connect continues to limit the location of the patient . Gyroscope sensor and GPS sensor are connected to IoT Blynk platform.

Node MCU ESP8266

NodeMCU is an open source platform based on ESP8266 which can connect objects and let data transfer using the Wi-Fi protocol. In addition, by providing some of the most important features of microcontrollers such as GPIO, PWM, ADC, and etc. the following picture explain the Pinout of the NodeMCU. The NodeMCU controller is the most famous microcontroller in the field of IoT applications with a wireless connection.

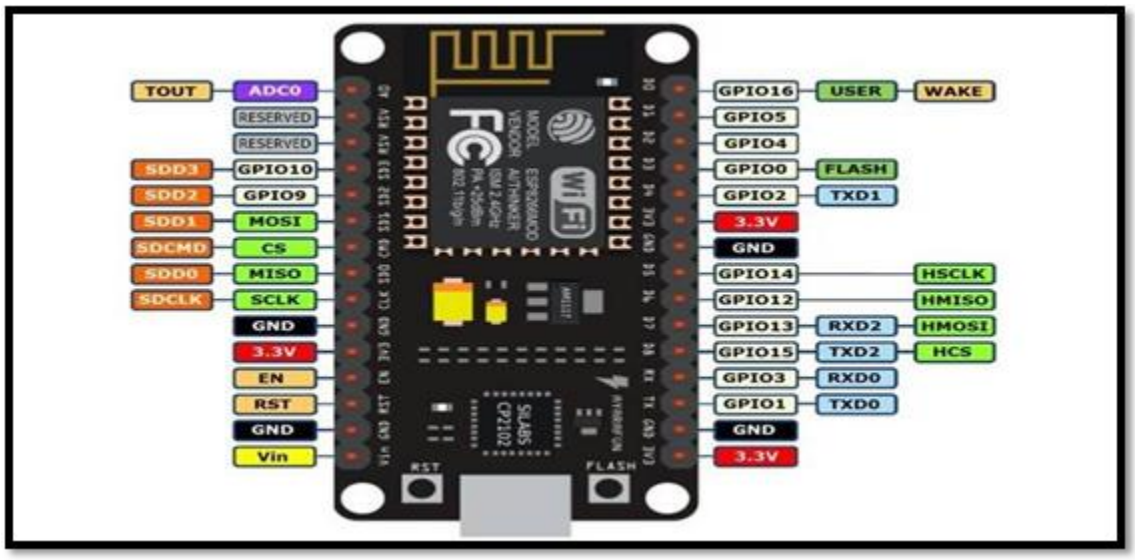


Fig. (3-1): Node MCU Wi-Fi pinout

NodeMCU ESP8266 Specifications & Features

There are several specification and features of Node MCU ESP8266

Table (3.1): Node MCU Specification and Feature

Item	Specification and Feature
Microcontroller:	**Tensilica 32-bit RISC CPU Xtensa LX106**
Operating Voltage:	**3.3V**
Input Voltage:	**7-12V**
Digital I/O Pins (DIO):	**16**
Analog Input Pins (ADC):	**1**
UARTs:	**1**
SPIs:	**1**
I2Cs:	**1**
Flash Memory:	**4 MB**
SRAM:	**64 KB**
Clock Speed:	**80 MHz**
Power pins:	**(3.3 V)**
Ground pins:	**(GND)**
Analog pins:	**(A0)**
Digital pins:	**(D0 – D8, SD2, SD3, RX, and TX – GPIO XX)**

LM35 temperature Board

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ˚ Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling.

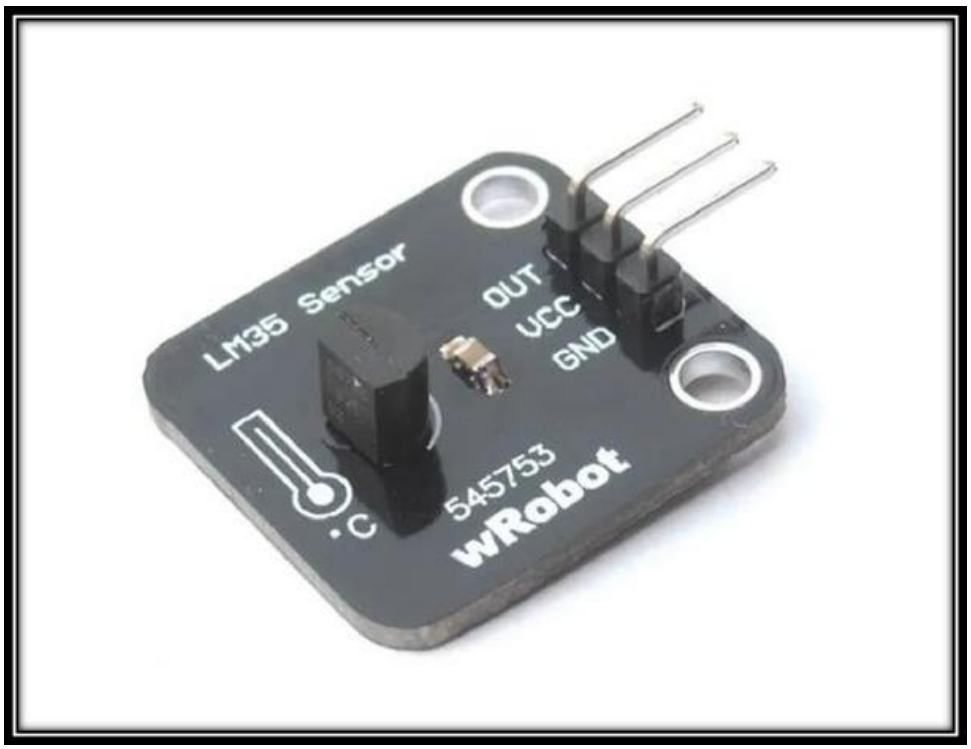


Fig.(3.2): LM35 sensor

Specifications of LM35 sensor

This LM35 sensor infrared thermometer has several specification as explained below:

Description

- ✓ Calibrated directly in Celsius
- ✓ Linear 10mV/°C scale factor
- ✓ 0.5°C ensured accuracy (at 25°C)
- ✓ Rated for full −55°C to 150°C range
- ✓ Operating voltage: DC 4V to 30V
- ✓ Current drain: Less than 60μA
- ✓ Low self-heating, 0.08°C in still air
- ✓ Non-Linearity : ±¼°C
- ✓ Low-Impedance Output, 0.1Ω for 1mA load
- ✓ Measurement resolution of 0.02°C

LM35 sensor interface with Node MCU

The following circuit explain the connection Non-contact infrared thermometer with Node MCU ESP 8266

- ✓ Connect Out of sensor to A0 in Node MCU

- ✓ Connect GND of sensor to GND in Node MCU
- ✓ Connect VCC of sensor to 3.3 volt Node MCU

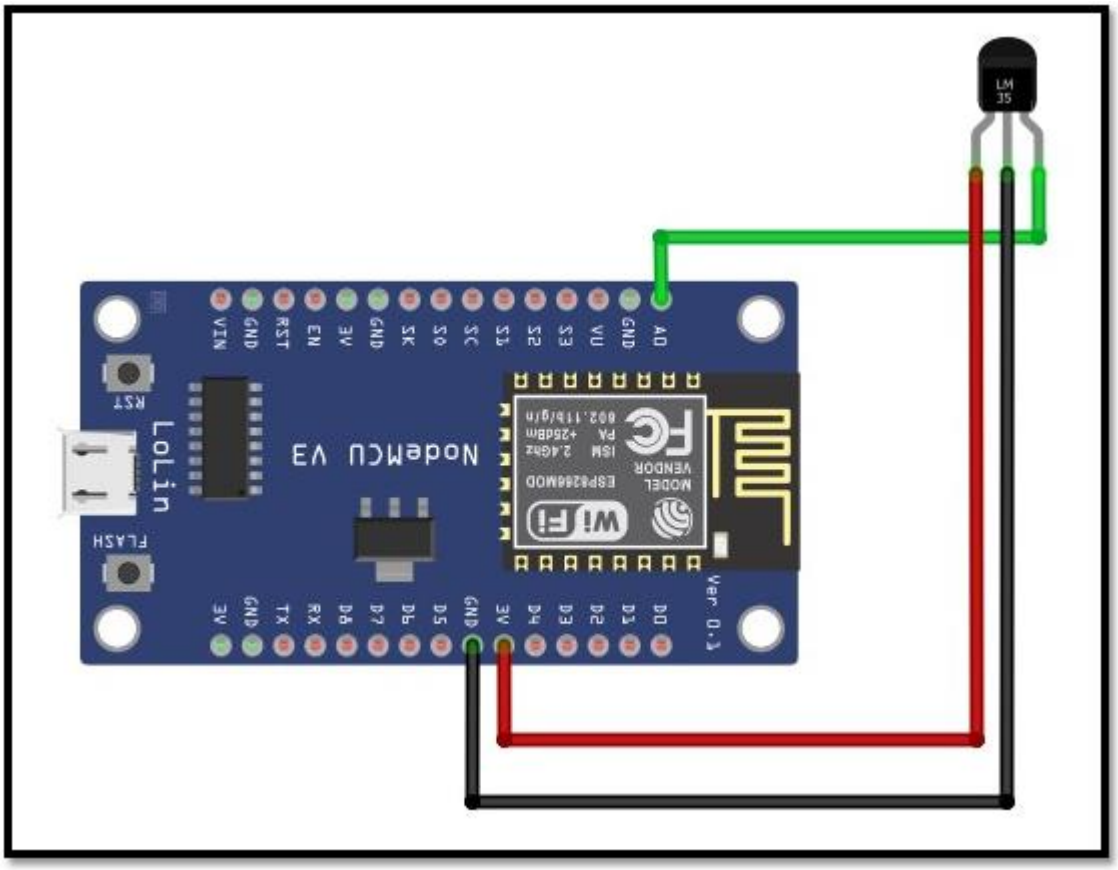


Fig.(3.3): Connect LM35 with Node MCU 8266

Connect Gyroscope with NodeMCU8266

The gyroscope measures rotational velocity (rad/s), this is the change of the angular position over time along the X, Y and Z axis (roll, pitch and yaw). This allows us to determine the orientation of an object. The MPU-6050 measures acceleration over the X, Y and Z axis. Ideally, in a static object the acceleration over the Z axis is equal to the gravitational force, and it should be zero on the X and Y axis

A gyroscope sensor has the following basic specifications:

- ➢ ***Measurement range***

This parameter specifies the maximum angular speed with which the sensor can measure, and is typically in degrees per second.

- ➢ ***Number of sensing axes***

Gyroscopes are available that measure angular rotation in one, two, or three axes. Multi-axis sensing gyros have multiple single-axis gyros oriented orthogonal to one another.

- ➢ ***Nonlinearity***

Gyroscopes output a voltage proportional to the sensed angular rate.

Most electronics only work in some range of temperatures. Operating temperatures for gyroscopes are quite large; their operating temperatures range from roughly - 40˚C to anywhere between 70 and 200˚C and tend to be quite linear with temperature.

➢ **Bandwidth**

The bandwidth of a gyroscope typically measures how many measurements can be made per second. Thus the gyroscope bandwidth is usually quoted in Hz.

Gyroscope sensor interface with Node MCU

The following step explain the connection between the node MCU 8266 and gyroscope sensor.

✓ Connect SCL of sensor to D1 in Node MCU

✓ Connect SDA of sensor to D2 in Node MCU

✓ Connect GND of sensor to GND in Node MCU

✓ Connect VCC of sensor to 3.3 volt Node MCU

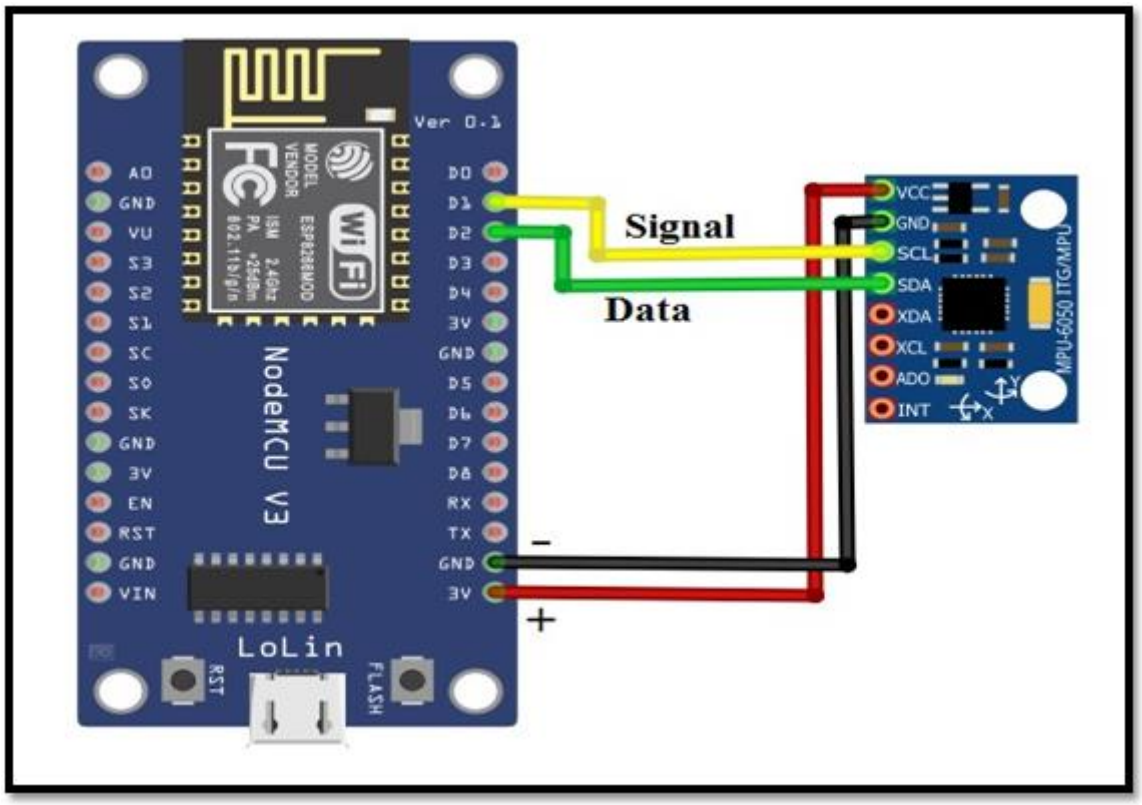


Fig.(3.4): Connect Gyroscope with Node MCU 8266

GPS NEW-8M

The GY-NEO-8M module is an advanced GPS module based on uBlox m8N that supports UART communication protocol with active antenna. You can interface this module easily with a microcontroller. This module has a rechargeable battery and can also be connected directly to a computer using a USB to TTL converter.

The NEO-M8 modules utilize concurrent reception of up to three GNSS systems (GPS/Galileo together with BeiDou or GLONASS), recognize multiple constellations simultaneously and provide outstanding positioning accuracy in scenarios where urban canyon or weak signals are involved. For even better and faster positioning improvement, the NEO-M8 series supports augmentation of QZSS, GAGAN and IMES together with WAAS, EGNOS, and MSAS. The NEO- M8 series also supports message integrity protection, geofencing, and spoofing detection with configurable interface settings to easily fit to customer applications.

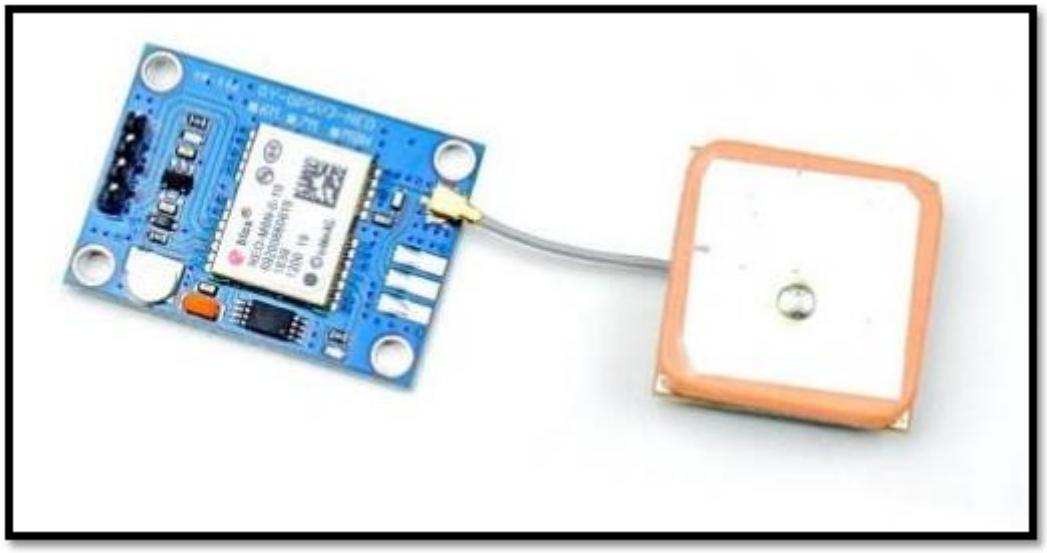


Fig.(3.5): GPS NEO-8M

GPS NEW-8M Features

- 72-channel u-blox M8 engine GPS/QZSS L1 C/A
- Super Sense Indoor GPS, -167dBm
- On-board Ultra low noise 3.3V voltage regulator and RF filter for noise blocking
- I2C (SDA,SCL) and Uart (Tx,Rx)
- Triple band GPS, Glonass and BeiDou antenna
- Triple band Band Pass filter
- Triple Band LNA
- u-center GPS Evaluation Software
- Extensive visualization and evaluation features
- Supports AssistNow Online and AssistNow Offline A-GPS services
- Time pulse LED
- Battery for HOT module start and settings storage
- Dimensions: 33*33mm hole distance 22x22mm
- Weight 8.5 gram
- Fully assembled and ready to use

GPS NEW-8M to Node MCU connection

Step1: Connect Tx of GPS sensor to Rx in Node MCU **Step2:** Connect Rx of GPS sensor to Tx in Node MCU **Step3:** Connect Vcc of GPS sensor to 3.3 volt in Node MCU **Step4:** Connect GND of GPS sensor to GND in Node MCU

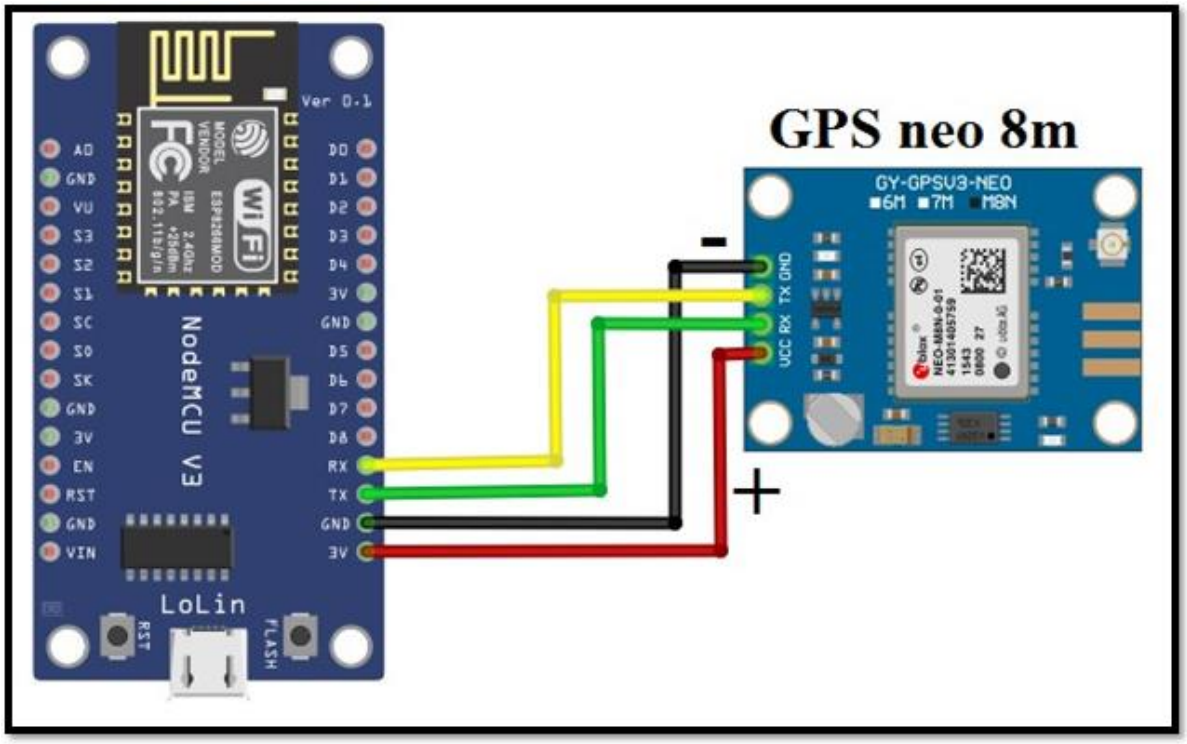


Fig.(3.6): GPS NEW-8M to Node MCU connection Diagram

System Connection

The circuit below shows the connection of our system,

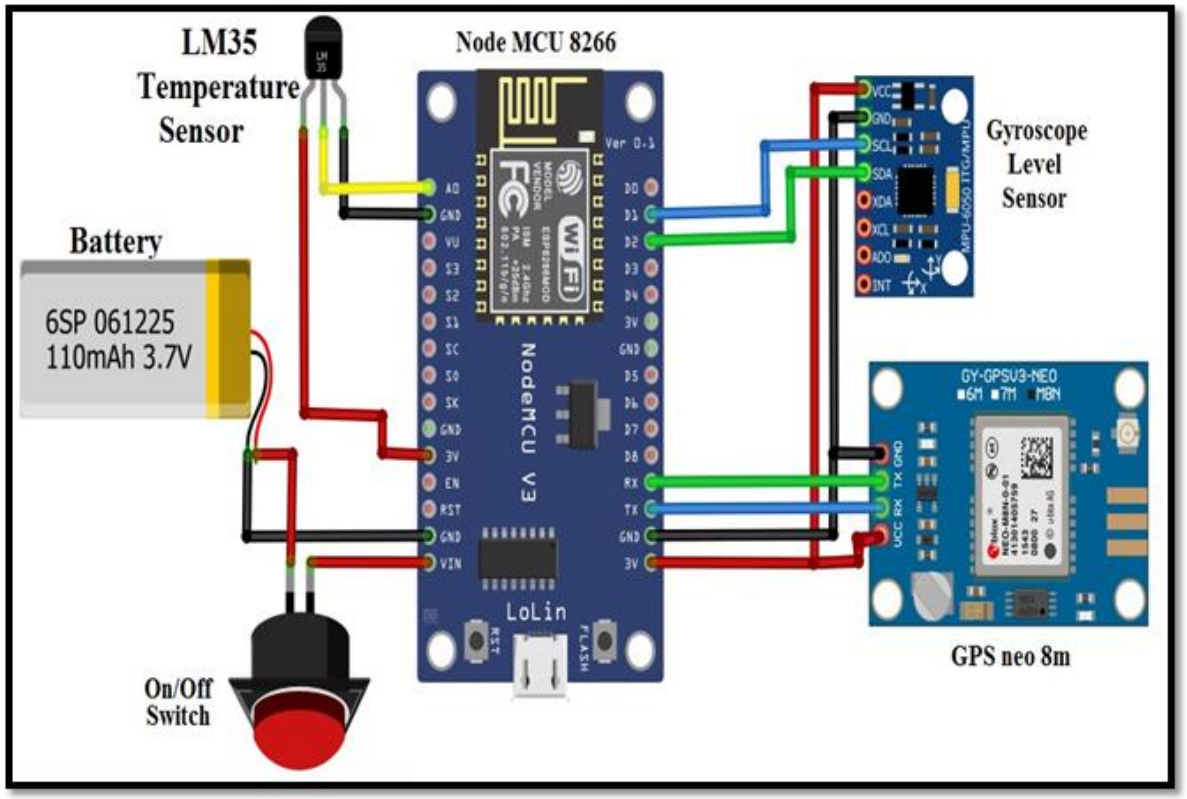
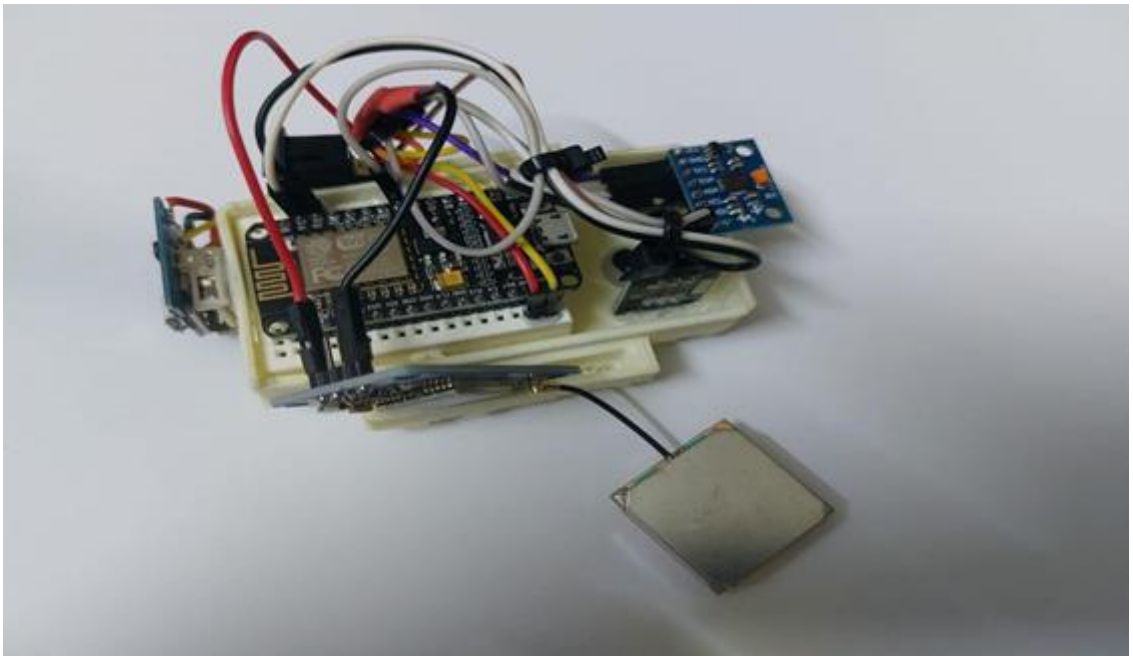


Fig (3.7): Connect Sensors with Node MCU

1. Connect SCL of Gyroscope sensor to D1 in Node MCU
2. Connect SDA of Gyroscope sensor to D2 in Node MCU
3. Connect GND of Gyroscope sensor to GND in Node MCU
4. Connect VCC of Gyroscope sensor to 3.3 volt Node MCU
5. Connect Tx of GPS sensor to Rx in Node MCU
6. Connect Rx of GPS sensor to Tx in Node MCU
7. Connect Vcc of GPS sensor to 3.3 volt in Node MCU
8. Connect GND of GPS sensor to GND in Node MCU
9. Connect Vcc of LM35 sensor to GND in Node MCU 10.Connect GND of LM35 sensor to GND in Node MCU 11.Connect Out pin of LM35 sensor to A0 in Node MCU 12.Connect GND of Battery to GND in Node MCU 13.Connect Vcc of Battery to First side of switch
10. Connect the second side of switch to Vin in Node MCU

Physical connection of project diagram

The pictures below shows the physical connection of the project



Fig(3.8): Physical project

Introduction

This chapter will cover the experimental work such as the Arduino code that is used and IoT platform

Programming NodeMCU ESP8266 with Arduino IDE

The NodeMCU Development Board can be easily programmed with Arduino IDE since it is easy to use. Programming NodeMCU with the Arduino IDE will hardly take 5-10 minutes. All you need is the Arduino IDE, a USB cable and the NodeMCU board itself. You can check this Getting Started Tutorial for NodeMCU to prepare your Arduino IDE for NodeMCU.

Download NodeMCU1.0 Library

Once Arduino IDE is installed on the computer, we need to download NodeMCU ESP 8266 library in IDE, therefore type the nodeMCU link as references **File>references>additional board manage URL: as shown in figure below**

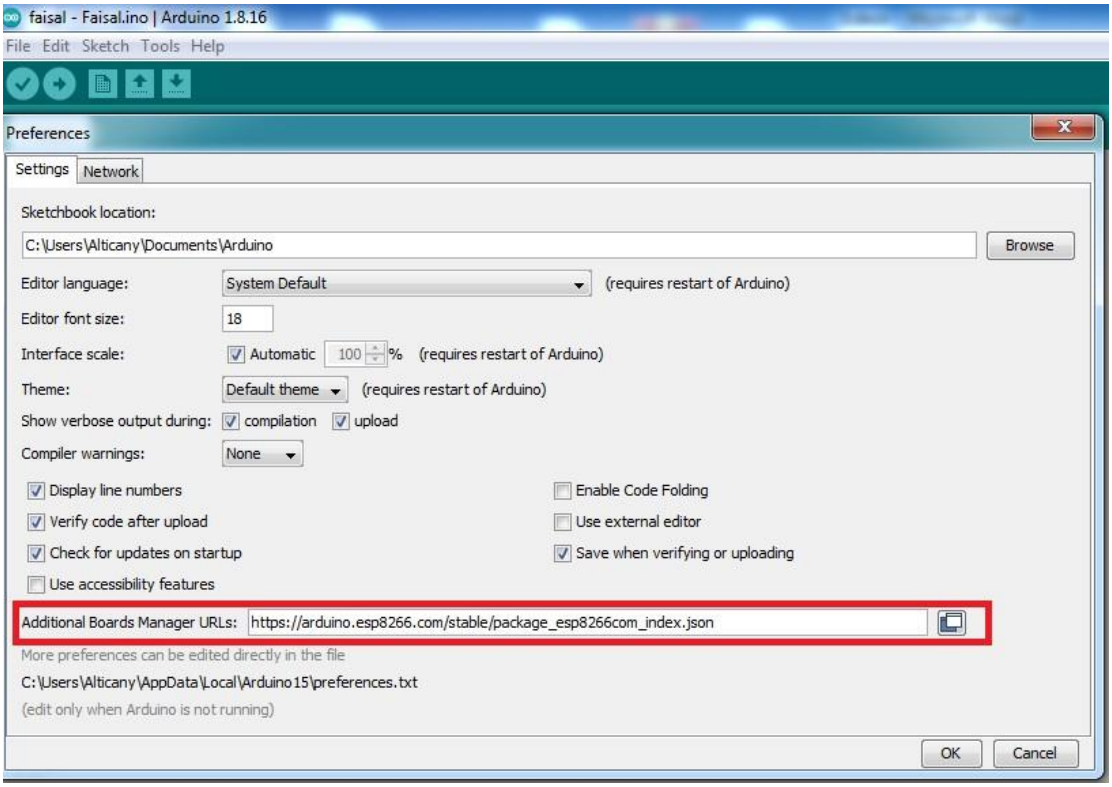


Fig. (4-1): Copy Node MCU reference link

After that go to **Tools>Boards>type** (ESP8266) to download library as shown in figure below , after the installation process is finished, go to **Tools>Boards>NodeMCU1.0** and choose the correct Port by selecting **Tools>Port**. To get it started with the NodeMCU board and blink the built-in LED, Once the code is loaded into our IDE, click on the 'upload' button given on the top bar. Once the upload is finished, you should see the built-in LED of the board blinking.

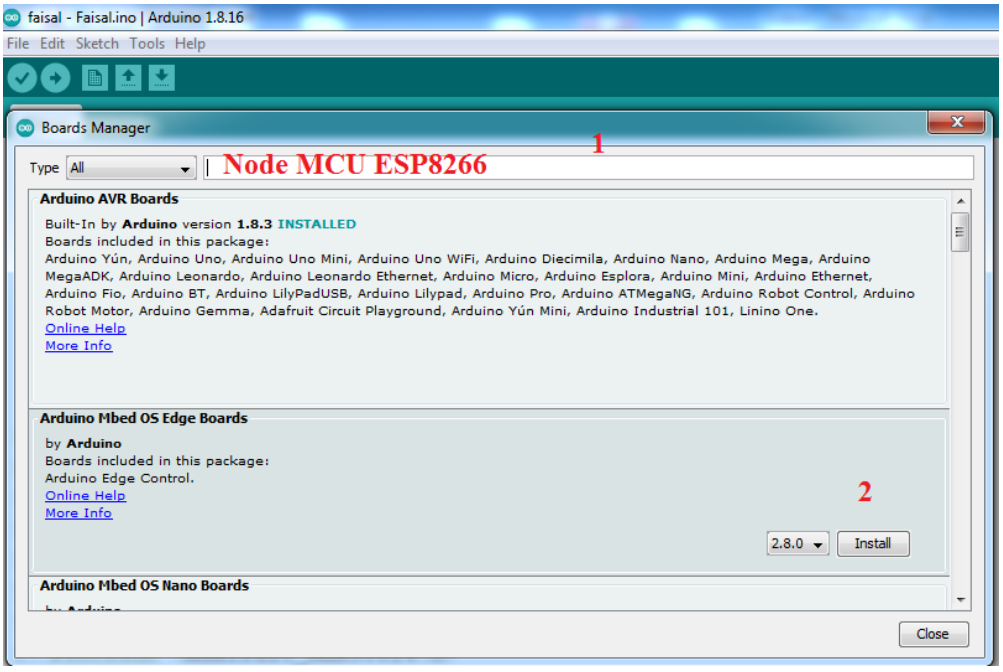


Fig. (4-2): download Node MCU library

Blynk Platform Types

There are three major components in the platform:

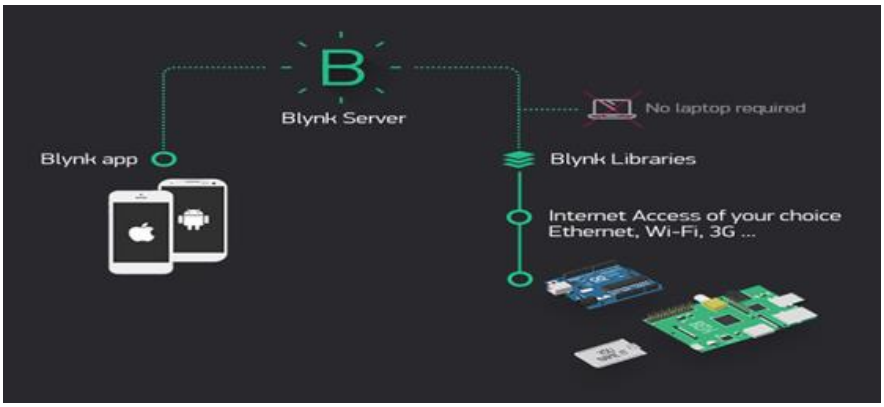


Fig.(4-3): Component of Blynk Platform

Create a Blynk Account

After you download the Blynk App, you'll need to create a New Blynk account. This account is separate from the accounts used for the Blynk Forums, in case you already have one. We recommend using a real email address because it will simplify things later. An account is needed to save your projects and have access to them from multiple devices from anywhere. It's also a security measure.

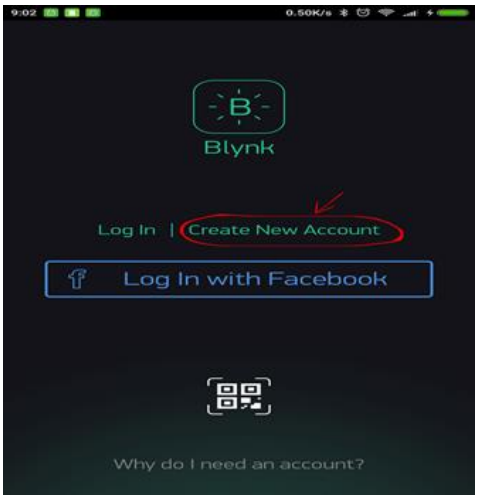


Fig.(4-4): Create Blynk Account

Create a New Project

After you've successfully logged into your account, start by creating a new project

Fig (4-5): Create new account

Authentication Token

Authentication Token is a unique identifier which is needed to connect your hardware to your smartphone. Every new project you create will have its own Authentication Token. You'll get Authentication Token automatically on your email after project creation. You can also copy it manually. Click on devices section and selected required device:

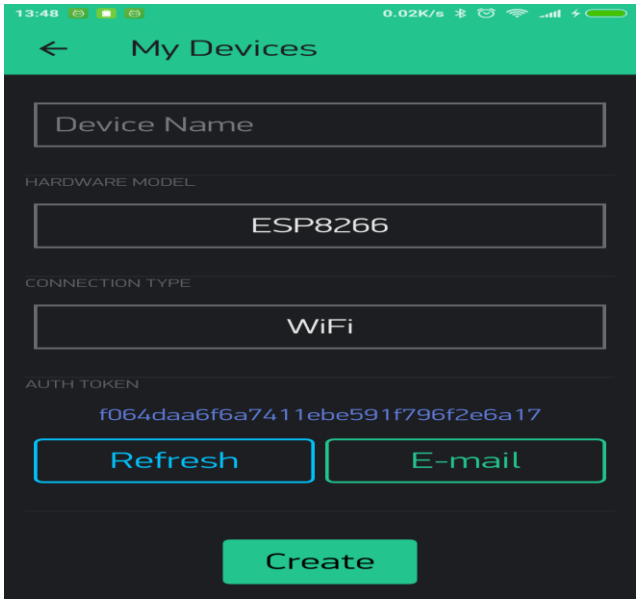


Fig. (4-6): choose Hardware board

Add a Widget

Your project canvas is empty, let's add a button to control our LED. Tap anywhere on the canvas to open the widget box. All the available widgets are located here.

Now pick a button. Widget Box

Fig. (4-7): choose widget

Drag-n-Drop - Tap and hold the Widget to drag it to the new position.

Widget Settings - Each Widget has it's own settings.

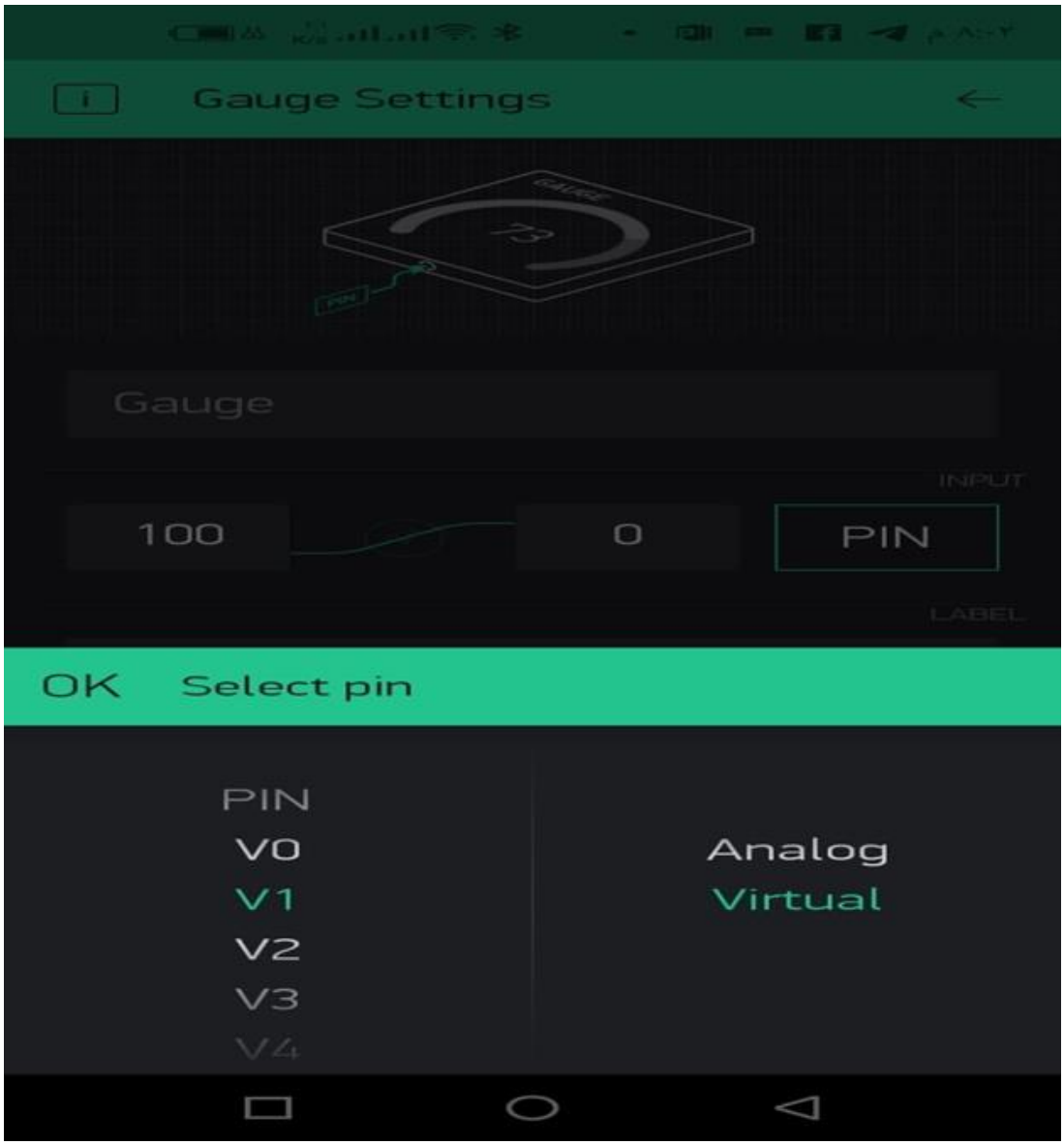


Fig. (4-8): choose pin for Temperature Gauge sensor

Tap on the widget to get to them, The most important parameter to set is **PIN**. The list of pins reflects virtual pins defined by project hardware.

Temperature sensor connect is connected to vitual Pin V0. X-Axis sensor connect is connected to vitual Pin V1.

Y-Axis sensor connect is connected to vitual Pin V2. Z-Axis sensor connect is connected to vitual Pin V3.

Conclusion

In conclusion,

1. The project has been completed, tested and the results are shown accurately. Where the project was linked by way with the application by the Blynk platform The temperature is sent instantaneously
2. Gyroscope sensor is used to monitor the velocity of the Zuhaimer patient
3. GPS sensor is connect continues to limit the location of the patient

4. Temperature sensor is connected to V0 in IoT Blynk platform In the event that the temperature rises more than the specified value, a warning message is sent to the monitored person informing him that the temperature has risen in order to take the necessary action
5. X-Axis is is connected to V1 in IoT Blynk platform read the patient heart rate countinously.
6. Y-Axis is is connected to V2 in IoT Blynk platform read the patient heart rate countinously
7. Z-Axis is is connected to V3 in IoT Blynk platform read the patient heart rate countinously

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