PROJECT TITLE

AIRBAG ALERT DEPLOYMENT USING CAN AND GPS (ADA-SYSTEM)

A project report submitted in partial fulfilment of requirements to

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For the award of the degree of

POST GRADUATE DIPLOMA

In

EMBEDDED SYSTEM AND DESIGN

Under the esteemed guidance of

A ABRAR

Submitted by

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ABSTRACT

An innovative Airbag Deployment Alert System designed to enhance vehicle safety through the fusion of **Controller Area Network (CAN)** communication and **Global Positioning System (GPS) technology.** The system utilizes an ESP board in conjunction with an **impact sensor** to detect collisions accurately. Upon collision detection, the system triggers the rapid deployment of airbags to mitigate potential injuries to vehicle occupants. Simultaneously, the integrated GPS module transmits the vehicle's precise location to emergency responders, enabling swift and targeted assistance. By leveraging CAN for internal communication and GPS for external coordination, this system ensures efficient and reliable transmission of critical data in emergency situations. The seamless integration of CAN and GPS technology offers a robust solution for improving emergency response and reducing the severity of accidents on roadways.

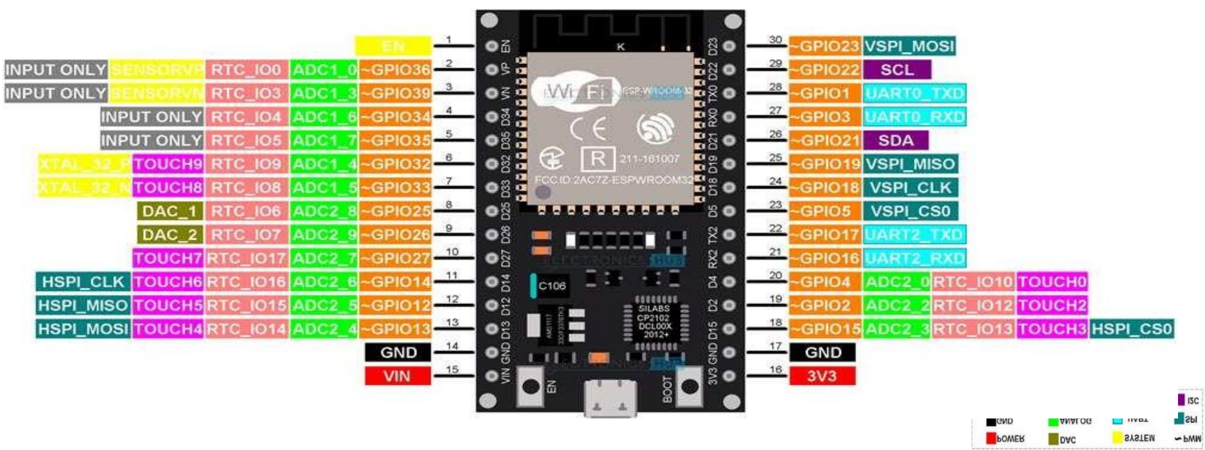
2.1 ESP32 PINOUT | ESP-WROOM-32 PINOUT

The 30-pin ESP32 Development Board will be used to demonstrate the ESP32 Pinout.

4 MB of flash memory is included with every ESP32 board to store the programmers. As a result, six GPIO pins in total are attached to SPI Flash ICs and cannot be utilized as standard GPIO pins.

ESP32 PINOUT

The 30-pin version of the ESP32 Development Board seen above is one of the more widely used models currently on the market. It is comprised of the baseboard, ESP-WROOM-32, as well as a few additional pins and parts for convenient ESP32 interaction.



As you can see from the figure, each pin has multiple potential uses. Always double-check a pin's secondary uses before using it for a task.

ESP32 PERIPHERALS

Now that we have seen a little bit about ESP32 Pinout. Let us now focus on some of the important peripherals of ESP32 and their associated pins. ESP32 Microcontroller has:

- 34 Programmable GPIOs
- 15 12-bit ADC Channels
- 2 8-bit DAC Channels
- 16 PWM Channels
- 4 UART Interfaces
- 3 SPI Interfaces
- 2 I^2C Interfaces
- 2 I^2S Interfaces
- 10 Capacitive Touch Sensing GPIOs
- 16 RTC GPIOs

GPIO

GPIOs are the most commonly utilized peripherals. The 34 GPIO pins of the ESP32 can each perform many functions, albeit only one of them will be active at a time. Within the programmed, you can set up a pin to function as a GPIO, ADC, or UART.

The pins designated by the manufacturer must be used because ADC and DAC are predetermined. However, a programmed can designate any GPIO pin to do various functions like PWM, SPI, UART, I2C, etc.

RTC GPIO

The RTC Low-Power subsystem consists of 16 RTC GPIOs on the ESP32. The ESP32 can be awakened from deep sleep using these pins as an external wake-up source.

ADC

Two 12-bit SAR Analogue to Digital Converter Modules with eight and ten channels each are available on the ADC ESP32. Consequently, the combined ADC1 and ADC2 blocks have 18 channels of 12-bit ADC. The resulting digital numbers with a 12-bit resolution will fall between 0 and 4093.

DAC

Two separate 8-bit digital-to-analog converter channels on the ESP32 Microcontroller are available for converting digital values to analogue voltage signals. The power supply serves as the input reference voltage for the DAC, which includes an internal resistor network.
The DAC functions are connected to the next two GPIO Pins.

DAC2 — GPIO26

DAC1 — GPIO

Ten capacitive-sensing GPIOs on the ESP32 SoC are able to identify changes in capacitance on a pin as a result of contact or proximity to the pin with a finger or stylus. Capacitive touch pads can be implemented using these Touch GPIOs without the need for extra hardware.

SPI

Three SPI blocks (SPI, HSPI, and VSPI) are available in both slave and master modes on the ESP32 Wi-Fi chip. Flash Memory is interfaced with using SPI. You therefore possess two SPI

I2C

The ESP32 has two I2C interfaces, and the user has total control over which pins to assign. SDA and CLK pins for each I2C interface can be set in the programmer. The default I2C pins, if you're using the Arduino IDE, are: SDA SCL

PWM

The 16 separate PWM waveform channels with programmable duty cycle and frequency are part of the ESP32 PWM Controller. LEDs and motors can be driven by the PWM waveform. It is possible to adjust the duty cycle, GPIO pin, frequency, and channel of the PWM signa

GPIOS CONNECTED TO CAN CONTROLLER

If you look at the schematic of ESP-WROOM-32 Module, then you will see that. GPIO's pins are connected to CAN Controller.

ESP32 Pins	CAN Controller Pins
VCC	VCC
GND	GND
18	SCK
23	SI
19	SO
21	CS

INPUT ONLY GPIO

There are 6 GPIO pins which can act as Digital Input only pins. They are GPIO34,GPIO22, GPIO16 and GPIO21.

INTERRUPTS

All GPIO pins are capable of interrupts.

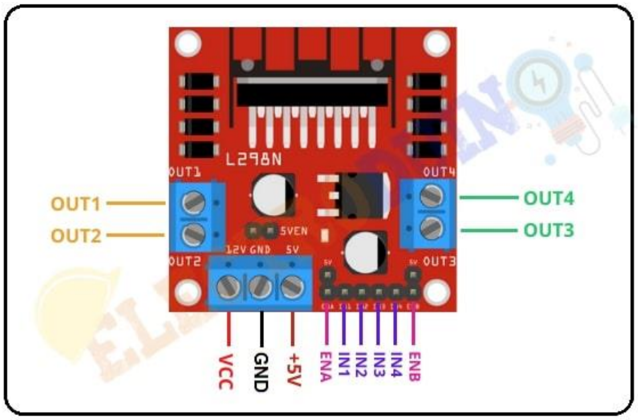
BOOT STRAPPING PINS

ESP32 SoC has 5 boot strapping pins. They are:

- GPIO0 (HIGH during BOOT)
- GPIO2 (LOW during BOOT)
- GPIO5 (HIGH during BOOT)
- GPIO12 (LOW during BOOT)
- GPIO15 (HIGH during BOOT)
-

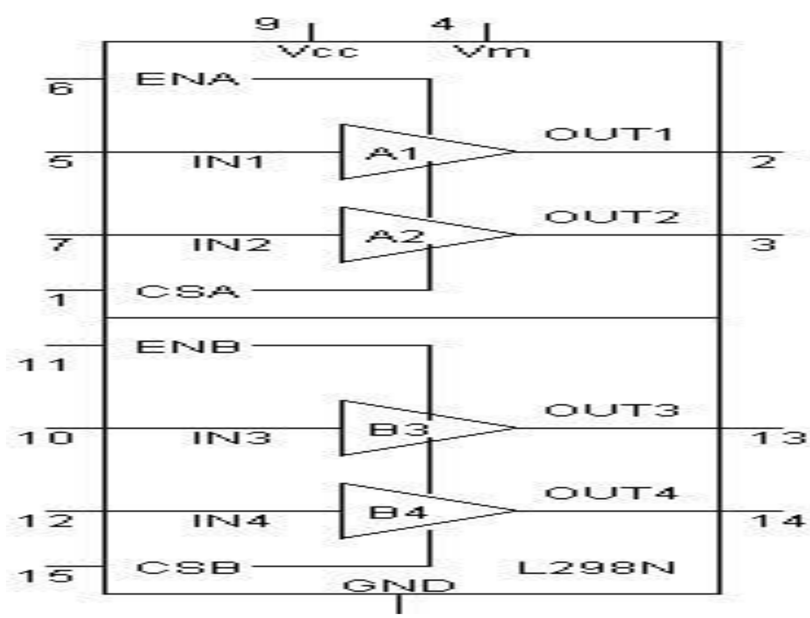
These pins are used to put the microcontroller in to flashing mode or bootloader mode.

2.2 L298N MOTOR DRIVER MODULE



DC and stepper motors can be driven by this high-power motor driver module, the L298N. An L298 motor driver integrated circuit and a 78M05 5V regulator make up this module. Up to four DC motors or two DC motors with directional and speed control can be operated by the L298N Module. MOTOR

DRIVER INTERNAL CIRCUIT



L298N MODULE PINOUT CONFIGURATION

Pin Name	Description
IN1 & IN2	Motor A input pins. Used to control the spinning direction of Motor A
IN3 & IN4	Motor B input pins. Used to control the spinning direction of Motor B
ENA	Enables PWM signal for Motor A
ENB	Enables PWM signal for Motor B
OUT1 & OUT2	Output pins of Motor A
OUT3 & OUT4	Output pins of Motor B
12V	12V input from DC power Source
5V	Supplies power for the switching logic circuitry inside L298N IC
GND	Ground pin

Four separate power amplifiers make up the L298N. While the remaining two create H-bridge B, the other two form H-bridge A. The polarity of a DC motor is switched using a single H bridge to control its motion. An H Bridge pair is utilized to regulate a bi-polar stepper motor.

- Amp A1 and A2 => H Bridge A
- Amp B1 and B2 => H Bridge B

Voltage spikes in the output are possible because the L298N is essentially employed to drive inductive or magnetic loads. Flywheel or internal parasitic diodes should be present to prevent voltage spikes. But they are absent from it. These flywheel diodes are used externally.

Each bridge is provided with enable pins (ENA, ENB) and current sense pins (CSA, CSB). Current sense pins can be tied to ground but we can also insert low value resistor and its voltage reading is proportional to current. Both enable pins can be used at the same time which makes all for outputs active at the same time. All the four inputs and Enable pins workon 5v TTL logic which makes the connection easy with microcontrollers.

- ENA=5v, High logic (Amplifier A1 and A2 on)
- ENA=0v, Low logic (Amplifier A1 and A2 off)
- ENB=5v, High logic (Amplifier B1 and B2 on)
- ENB=0v, Low logic (Amplifier B1 and B2 off)

L298N MOTOR DRIVER MODULE WORKING

Now consider an example. We will use H bridge motor diver IC L298N and two DC motors. This IC is used to control these motors. What we want to do is to change the polarityof motors so they can run in either direction depending upon logic.

INPUTS: Four inputs are provided to the four power amplifiers of L298N. We canuse push buttons and whenever specific push button is pressed; specific motor will startrunning. Two inputs will monitor each motor. Instead of push button, we can use logic togglein proteus simulation for our ease.

Enable bits are used to select specific amplifier. ENA can select two amplifiers A1, A2 and similarly ENB can select two amplifiers B1, B2. While using as a bridge circuit, ENA selects bridge A and ENB selects bridge B. To drive both the motors by using H bridges, both enable bits are set high.

OUTPUTS: There are four outputs. The output for motor A is obtained from out1out2 pins and similarly for motor B output is obtained from out3 out4 pins. L298N does not have built in protection diodes we used external diodes to prevent the IC from getting damaged.

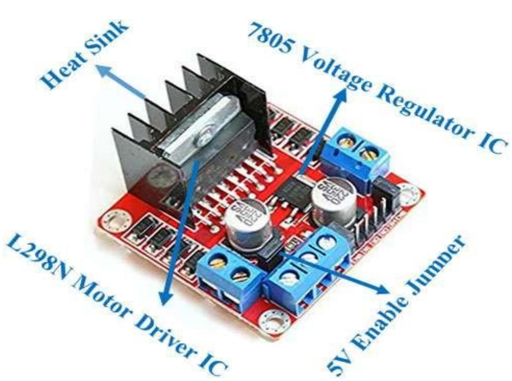
This IC is using two different voltages. On input side, 5v is given to the pin 9 (Vss), push buttons and enable bits. On output side, pin 4 (Vs) supplies the motors and it can be up to 46 volts. Here we are not using the current sensing scheme, so we have grounded those pins 1 & 15. Motors speed will be lower if low voltages are on output side.

FEATURES & SPECIFICATIONS

- Driver Model: L298N 2A
- Driver Chip: Double H Bridge L298N
- Motor Supply Voltage (Maximum): 46V
- Motor Supply Current (Maximum): 2A
- Logic Voltage: 5V
- Driver Voltage: 5-35V
- Driver Current:2A
- Logical Current:0-36mA
- Maximum Power (W): 25W
- Current Sense for each motor
- Heatsink for better performance
- Power-On LED indicator

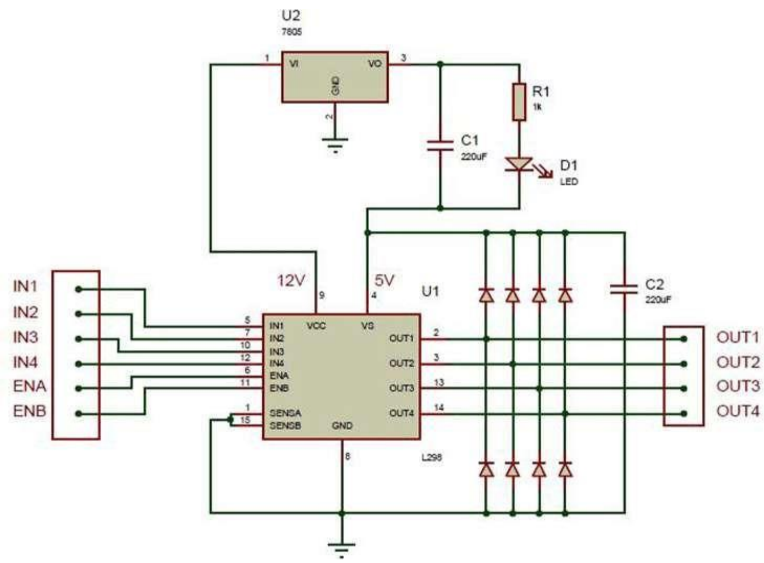
BRIEF ABOUT L298N MODULE

The L298N Motor Driver module consists of an L298 Motor Driver IC, 78M05 Voltage Regulator, resistors, capacitor, Power LED, 5V jumper in an integrated circuit. 78M05 Voltageregulator will be enabled only when the jumper is placed. When the power supply is less than or equal to 12V, then the internal circuitry will be powered by the voltage regulator and the 5V pin can be used as an output pin to power the microcontroller. The jumper should not be placed when the power supply is greater than 12V and separate 5V should be given through 5V terminal to power the internal circuitry.



ENA & ENB pins are speed control pins for Motor A and Motor B while IN1& IN2 and IN3 & IN4 are direction control pins for Motor A and Motor B.

Internal circuit diagram of L298N Motor Driver module is given below:



APPLICATIONS

- Drive DC motors.
- Drive stepping motors
- In Robotics

2.3 VIBRATION SENSOR SW 420

The SW-420 vibration sensor is a commonly used module in electronic projects, especially those involving vibration detection and monitoring. Here's some introductory information about the SW-420 vibration sensor:

1. Basic Functionality: The SW-420 is a simple vibration sensor that can detect vibrations or shocks. It typically consists of a spring-mounted metal ball and a metal casing with electrical contacts. When the sensor experiences vibration or movement, the metal ball inside contacts the casing, closing an electrical circuit.

2. Operating Principle: The sensor works on the principle of conductivity. When at rest, the metal ball does not touch the casing, so the circuit remains open. However, when there's sufficient vibration, the ball contacts the casing, completing the circuit and signaling the presence of vibration.

3. Output Signal: The SW-420 vibration sensor usually provides a digital output signal. When vibration is detected, the output goes high (usually 5V), and when there's no vibration, the output remains low (usually 0V).

4. Sensitivity Adjustment: Some versions of the SW-420 sensor come with a sensitivity adjustment potentiometer. This allows users to adjust the sensor's sensitivity according to their specific requirements.

5. Interface: The sensor typically has three pins: VCC (power supply), GND (ground), and OUT (signal output). It can be easily interfaced with microcontrollers like Arduino, Raspberry Pi, or other digital circuits.

6. Applications: Common applications of the SW-420 vibration sensor include burglar alarms, earthquake detectors, impact detection systems, vibration-activated switches, and industrial equipment monitoring.

7. Limitations: While the SW-420 is a simple and affordable sensor, it may not be suitable for high-precision applications or scenarios where very subtle vibrations need to be detected. Additionally, it may not distinguish between different types of vibrations.

SPECIFICATION

Here are the technical specifications of the SW-420 vibration sensor in a concise, pointwise format:

1. Operating Voltage: Typically operates at DC 3.3V - 5V.
2. Output Type: Digital output signal (High or Low) indicating vibration presence.
3. Detection Method: Conductivity-based; metal ball contacts casing upon vibration.
4. Sensitivity: Adjustable sensitivity on some versions.
5. Response Time: Fast response time for real-time detection.
6. Power Consumption: Low power consumption suitable for battery-powered applications.
7. Operating Temperature: Wide operating temperature range for versatility.
8. Dimensions: Compact size for easy integration into projects.
9. Material: Metal ball and casing construction for durability.

These specifications provide a comprehensive overview of the SW-420 vibration sensor's technical capabilities, enabling informed decisions regarding its usage in various electronic projects and applications.

WORKING

When there's no vibration, the metal ball remains suspended, keeping the circuit open. However, upon detecting vibration or movement, the ball strikes the casing, closing the circuit momentarily. This change in circuit status is swiftly detected by the sensor's electronics, which then output a signal indicating the occurrence of vibration. The sensitivity of the sensor can often be adjusted to suit different applications, allowing for fine-tuning of its responsiveness. Overall, this conductivity-based mechanism offers a simple yet effective means of detecting vibrations in various electronic systems and applications.

INTERFACING VIBRATION SENSOR MODULE WITH ESP32

This is an SW-420 vibration module**,** which can work from 3.3V to the 5V. The sensor uses LM393 comparator to detect the vibration over a threshold point and provide digital data, Logic Low or Logic High, 0 or 1**.** During normal operation, the sensor provides Logic Low and when the vibration is detected, the sensor provides Logic High. There are three peripherals available in the module, two LEDs, one for the Power state and other for the sensor's output. Additionally, a potentiometer is available which can be further used to control the threshold point of the vibration. In this project, we will use 5V to power the module.

SW-420 VIBRATION SENSOR COMPONENTS

The SW-420 vibration sensor module is integrated with the SW-420 vibration sensor, LM393 voltage comparator, a potentiometer, current limiting resistors to act as voltage dividers, therefore, control the current and capacitors as biasing elements and for noise filtering.

LM393 VOLTAGE COMPARATOR IC

It is a high-precise integrated circuit that compares the reference voltage and the input vibration signal. Pin 2 of the LM393 IC is connected to the adjustable potentiometer while its pin 3 is connected to the vibration sensor. The IC compares both the voltages and passes them to the digital output pin in the form of binary states.

POTENTIOMETER

A 10K potentiometer is placed on the module to adjust the sensitivity of the sensor. The sensitivity can either be increased or decreased depending on the requirement. It is done by setting a pre-set or a threshold value which is given to the LM393 as a reference to compare.

SW-420 VIBRATION SWITCH

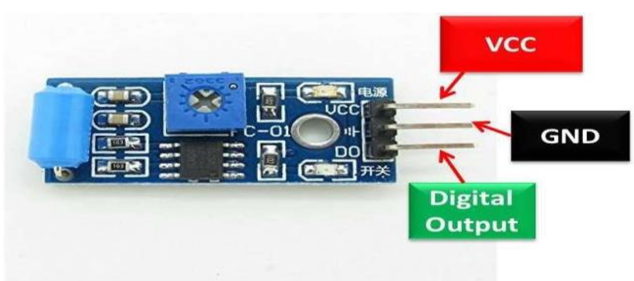
The SW-420 vibration switch senses the magnitude of the vibration in its environment. It responds to the exposed vibration either through the opening or closing of the electrical contact. The trigger switch can be an electromechanical or relay or semiconductor component.

INBUILT LEDS

The module has two LEDs. One is to light up when the module is energized and the other is to indicate the digital output.

SW-420 VIBRATION SENSOR PINOUT

The SW-420 vibration sensor module is available in 3.2cm x 1.4cm dimensions. The pinout of the Vibration Sensor module is as shown:



SW-420 PIN CONFIGURATION

It has three headers for interfacing with any microcontroller. The pin configuration in tabular are detailed below:

Pin Name	Function
VCC	Positive power supply pin. It gives power to the sensor.
GND	Ground connection pin
D0	Digital output pin. It passes the digital output of the built-in comparator circuit.

FEATURES & SPECIFICATIONS

- Operating Voltage: 3.3 Volts – 5.0 Volts DC
- Current driving Capability: 15 mA
- Vibration Sensor module dimensions: 3.2cm x 1.4cm
- The vibration sensor is a close type switch by default.
- An internal 10K potentiometer is given to calibrate the sensitivity of the sensor.
- A low-power voltage LM393 comparator chip to binarize the analog signal and has a driving ability of 15 mA is provided in the sensor.
- SW-420 also has two status LEDs for power and output indication.
- The module has a fixed bolt for easy installation.
- It is microcontroller-friendly and can be interfaced with any of them.

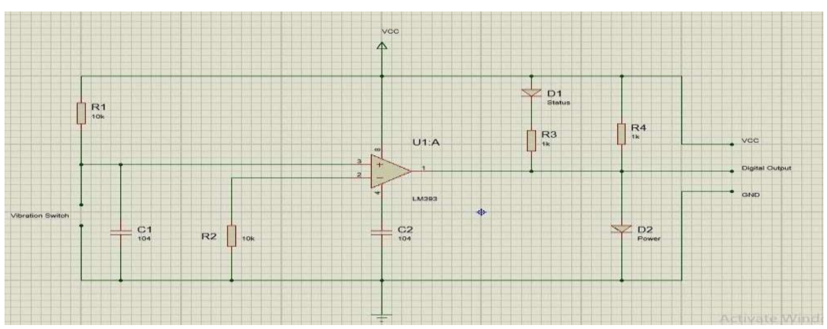
SW-420 WORKING PRINCIPLE

The SW-420 is a switch that operates by the opening and closing of the electrical contact. By default, the vibration sensor is in a closed state. When no vibrations are sensed, it remains closed or in a conduction state. As soon as vibration is detected by the sensor, the contacts open and the resistance rises. Due to this, a pulse is produced and triggers the circuit. It is passed on to the LM393 voltage comparator IC that digitizes the signal and further makes it available on the digital output pin of the module.

CIRCUIT DIAGRAM

The concerned SW-420 vibration module has three connections i.e., VCC, GND, and D0. The power pins of the microcontroller are connected to these pins while the digital output pin which is internally connected to the output pin of the comparator is joined to one of the output pins of the microcontroller.

The functional diagram of the SW-420 Vibration Sensor module for grasping the knowledge of the internal connections of the module is provided below:



2.4 OLED SSD1306

An OLED (organic light-emitting diode) is used frequently in displaying texts, bitmap images, shapes, and different types of clocks. They offer good view angles and pixel density in a cost-effective manner. At first, we will look at the 0.96-inch OLED display, its pinout, connections with the ESP32 board, and then use Arduino IDE to program our module to display texts, different shapes, and bitmap images on the OLED display.

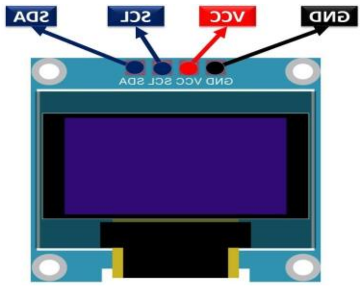
SSD1306 0.96-INCH OLED DISPLAY

OLED stands for organic light-emitting diode. Its name shows that it is a flat light emitting technology that is developed when two organic thin films are connected in series between two electric conductors. When an electric current is supplied to these conductors then the organic compound is made which emits the bright light. Typically, one conductor is the transparent conductor between these two conductors therefore there is no need for any backlight to emits the light. Therefore, this OLED display has improved image quality, full viewing angle, high brightness, better contrast, wide colour range, low power consumption, more efficient and reliable as compared to a simple LCD display. It is mainly used in digital display devices such as computer monitors, mobile phones, handheld games, and televisions screens, etc.

Although there are several types of OLED displays available in the market the one which we will be using is the SSD1306 0.96-inch OLED display. The main component of all different types of OLED displays is an SSD1306 controller which uses I2C or SPI protocol to communicate with the microcontrollers. The OLED performs faster in SPI communication but it is popular with I2C communication. The reason for the popularity is the lower number of pins. The OLED displays can vary in size, colour, and shape but are primarily programmed in a similar way.

Let us look at the OLED display which we will be using in this article. It is called SSD 1306 0.96-inch OLED display which has 128×64 pixels and communicates only via I2C protocol with the ESP development boards. It is cheap and readily available in the market.

Below you can see the pinout of this OLED Display



Pinout of 0.96-inch OLED (I2C only)

Recommended Reading: Monochrome 0.96" OLED Display

SSD1306 OLED PINOUT

There are four pins in this display. Imprinted as VCC, GND, SCL, and SDA respectively. The VCC and GND pins will power the OLED display and will relate to the ESP board's power supply pins as they require a driving voltage of 3.3-5V. The SCL and SDA pins are necessary for generating the clock signal and in the transmission of data respectively. Both pins will relate to the I2C pins of the ESP32 board.

Now let us have a look at the specifications for this model:

Specification	Value
Size	0.96 inch
Terminals	4
Pixels	128×64
Communication	I2C only
VCC	3.3V-5V
Operating Temperature	-40℃ to +80℃

SSD 1306 OLED DISPLAY SPECIFICATION

2.5 CAN CONTROLLER (MCP2515)

CAN PROTOCOL

The CAN (Controller Area Network) protocol is a communication standard used primarily in automotive, industrial, and other embedded systems. It enables microcontrollers and other devices to communicate with each other without needing a host computer. Here's a breakdown of its key features:

1. Serial Communication: CAN uses a serial communication method, meaning data is transmitted bit by bit over a single wire or pair of wires. This simplifies wiring and reduces costs compared to parallel communication methods.

2. Message-Based Communication: Communication in CAN is message-oriented. Devices send messages, which contain data and identifiers, onto the CAN bus. Other devices on the bus can then receive and interpret these messages.

3. Deterministic Communication: CAN provides deterministic communication, meaning devices can predict when they'll be able to transmit data based on the priority of their messages. This allows for real-time control and ensures critical messages are transmitted promptly.

4. Collision Avoidance: CAN employs a mechanism called Carrier Sense Multiple Access with Collision Detection (CSMA/CD) to prevent data collisions. Before sending a message, a device checks if the bus is busy. If it's clear, the device sends its message. If multiple devices attempt to send messages simultaneously, the protocol detects the collision and retransmission is attempted.

5. Error Detection and Handling: CAN has robust error detection and handling mechanisms built-in. It can detect errors such as bit errors, frame errors, and acknowledge errors. Additionally, it supports error checking through cyclic redundancy check (CRC), ensuring data integrity.

6. Flexible Data Rates: CAN supports different data rates, allowing for communication in both high-speed and low-speed applications. This flexibility makes it suitable for various use cases, from high-speed automotive networks to low-speed industrial control systems.

MCP2515

The MCP2515 is a popular CAN (Controller Area Network) controller chip developed by Microchip Technology. It serves as a crucial interface component in embedded systems, facilitating communication between microcontrollers and CAN networks. Here's an introductory overview:

1. Purpose: The MCP2515 is designed to enable devices to communicate over a CAN bus, which is commonly used in automotive, industrial, and other embedded systems. It acts as a bridge between a microcontroller (or other host device) and the CAN network, handling the low-level details of CAN communication.

2. Functionality: This chip provides features essential for CAN communication, including sending and receiving messages, message filtering, prioritization, error detection, and handling. It essentially manages the transmission and reception of data packets on the CAN bus, ensuring reliable and efficient communication between devices.

3. Interface: The MCP2515 typically interfaces with a microcontroller using SPI (Serial Peripheral Interface), a common communication protocol for connecting integrated circuits. This allows the microcontroller to configure the MCP2515 and exchange data with it.

4. Flexibility: One of the advantages of the MCP2515 is its flexibility. It can be configured to operate at different CAN bus speeds, making it suitable for various applications. Additionally, it offers features such as message filtering, allowing users to customize the behavior of the controller based on their specific requirements.

5. Reliability: Microchip Technology is known for producing high-quality and reliable semiconductor components, and the MCP2515 is no exception. Its robust design and built-in error detection mechanisms ensure stable operation in demanding environments.

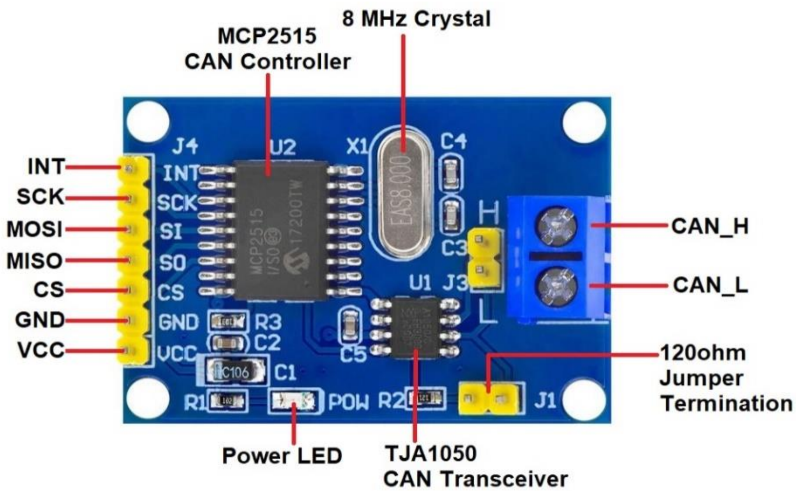
6. Applications: The MCP2515 is widely used in automotive systems for tasks such as engine management, vehicle diagnostics, and communication between various control units within a vehicle. It's also employed in industrial automation, home automation, and other embedded systems where CAN communication is required

In summary, the MCP2515 is a versatile and reliable CAN controller chip that simplifies the integration of CAN communication into embedded systems, making it a preferred choice for engineers and developers working on applications that rely on CAN networks.

SPEFICICATION OF MCP2515

- Uses High-speed CAN transceiver TJA1050
- Dimension: 40×28mm
- SPI control for expanding Multi CAN bus interface
- 8MHZ crystal oscillator
- 120Ω terminal resistance
- Has independent key, LED indicator, Power indicator
- Supports 1 Mb/s CAN operation
- Low current standby operation
- Up to 112 nodes can be connected

MCP2515 PINOUT



Here are the specifications of the MCP2515 with pin numbers and descriptions:

1. Supply Voltage (VDD):
   - Pin: 1 (VDD)
   - Description: Power supply pin. Typically connected to +5V.

2. Ground (VSS):
   - Pin: 8 (VSS)
   - Description: Ground connection pin.

3. SPI Interface:
   - Pins:
   - 2 (SI): Serial Data Input. Connects to the microcontroller's SPI MOSI (Master Out Slave In) pin.
   - 3 (SO): Serial Data Output. Connects to the microcontroller's SPI MISO (Master In Slave Out) pin.
   - 4 (SCK): Serial Clock. Connects to the microcontroller's SPI clock pin.
   - 5 (CS): Chip Select. Connects to the microcontroller's SPI chip select pin.

4. Interrupt Output (INT):
   - Pin: 6 (INT)
   - Description: Interrupt output pin. Used to indicate when a message has been received or when a transmission has completed.

5. CAN Interface:
   Pins:
   - 7 (CANH): CAN Bus High. Connects to the high side of the CAN bus.
   - 9 (CANL): CAN Bus Low. Connects to the low side of the CAN bus.

6. Crystal Oscillator Connections:
   Pins:
   - 10 (OSC1): Crystal oscillator input pin.
   - 11 (OSC2): Crystal oscillator output pin.

7. Mode Control Pins:
   Pins:
   - 12 (MODE): Mode control pin. Used to select between Normal and Configuration modes.
   - 13 (RESET): Reset pin. Active low. Used to reset the MCP2515.

8. Transmission Control Pins:
   - Pins:
   - 14 (TX0RTS): Transmit buffer 0 request to send pin.
   - 15 (TX1RTS): Transmit buffer 1 request to send pin.
   - 16 (TX2RTS): Transmit buffer 2 request to send pin.

9. Receive Buffer Pins:
   Pins:
   - 17 (RX0BF): Receive buffer 0 full pin.
   - 18 (RX1BF): Receive buffer 1 full pin.

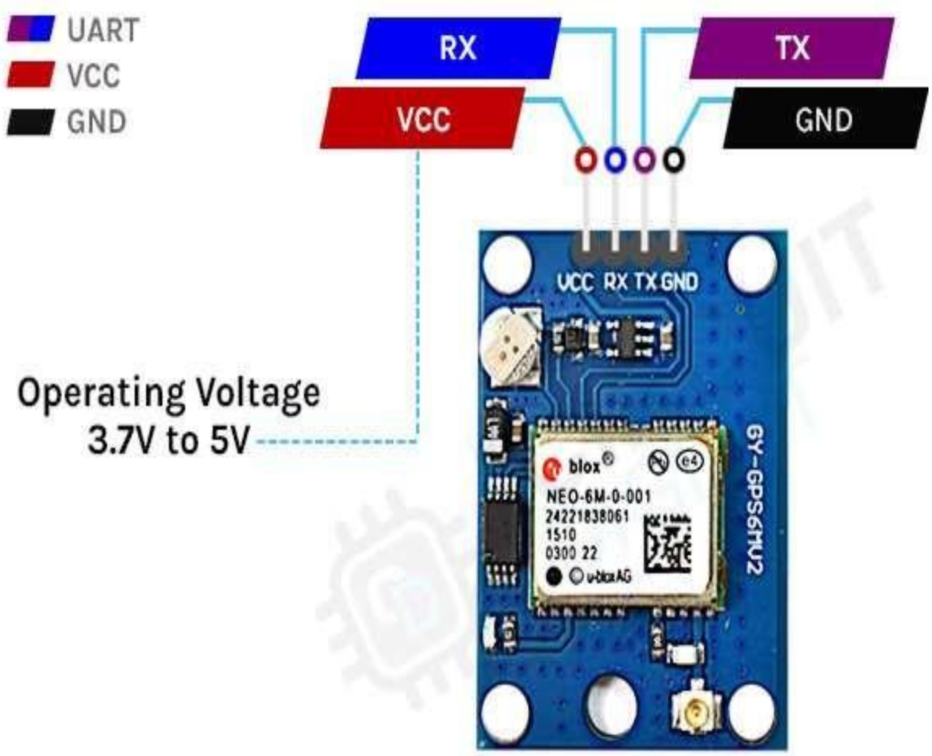
10. Package Type: Available in various package types including PDIP (Plastic Dual Inline Package) and SOIC (Small Outline Integrated Circuit).

These specifications outline the pinout and functions of the MCP2515, providing a detailed overview of its connections and capabilities.

2.6 NEO-6M GPS MODULE

NEO-6M GPS Module Pinout

The NEO-6M GPS module has four pins: GND, TxD, RxD, and VCC. The TxD and RxD pins are used to communicate with the microcontroller.



GND is the ground pin of the GPS Module and it should be connected to the ground pin of the ESP32.

TXD is the transmit pin of the GPS module that needs to connect to the RX pin of the ESP32.

RXD is the receive pin of the GPS module that needs to connect to the TX pin of the ESP32.

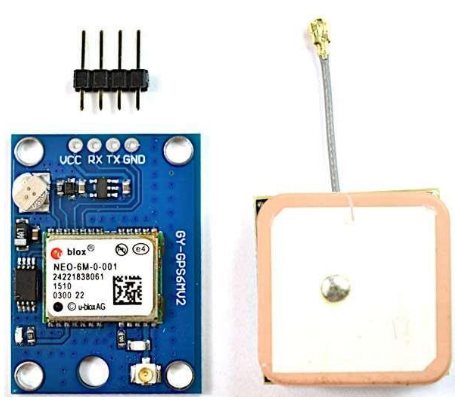
VCC is the power pin of the GPS module and needs to connect to the 3.3V pin of the ESP32.

NEO-6M GPS MODULE – PARTS

The NEO-6M module is a ready-to-use GSM module that can be used in manydifferent applications. The parts on the NEO-6M GPS module are shown below

The NEO-6M GPS module has five major parts on the board, the first major part is the NEO-6M GPS chip in the heart of the PCB. Next, we have a rechargeable battery and a serial EEPROM module. An EEPROM together with a battery helps retain the clock data, latest position data (GNSS orbit data), and module configuration but it's not meant for permanent data storage. Without the battery, the GPS always cold-starts so the initial GPS lock takes more time. The battery is automatically charged when power is applied and maintains data for up to two weeks without power. Next, we have our LDO, because of the onboard LDO, the module can be powered from a 5V supply. Finally, we have our UFL connector where we need to connect an external antenna for the GPS to properly work.

OVERVIEW OF THE NEO-6M GPS MODULE



The Global Positioning System (GPS) is a system consisting of 31 satellites orbiting earth. We can know their exact location because they are constantly transmitting position information with time through radio signals. At the heart of the breakout board, there is the NEO-6M GPS module that is designed and developed by u-box. This is very small but it packs a lot of features. It can track up to 22 satellites over 50 channels while consuming only

45mA of current and has an operating voltage of 2.7V ~ 3.6V. One of the most interesting features of this module is its power-saving mode. This allows a reduction in system power consumption. With power-saving mode on, the current consumption of the module reduces to 11MA only.

<u>NEO-6M Module datasheet</u>

Position Fix LED Indicator:

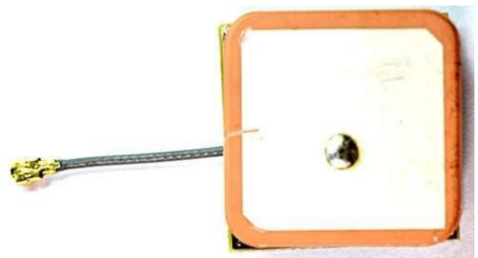
If you take a close look at the NEO-6M GPS module board, you can find a small LED that is used to indicate that the GPS module is able to communicate with the satellites.

- No blinking – it is searching for satellites.

- Blink every 1s – Position Fix is found (the module can see enough satellites).

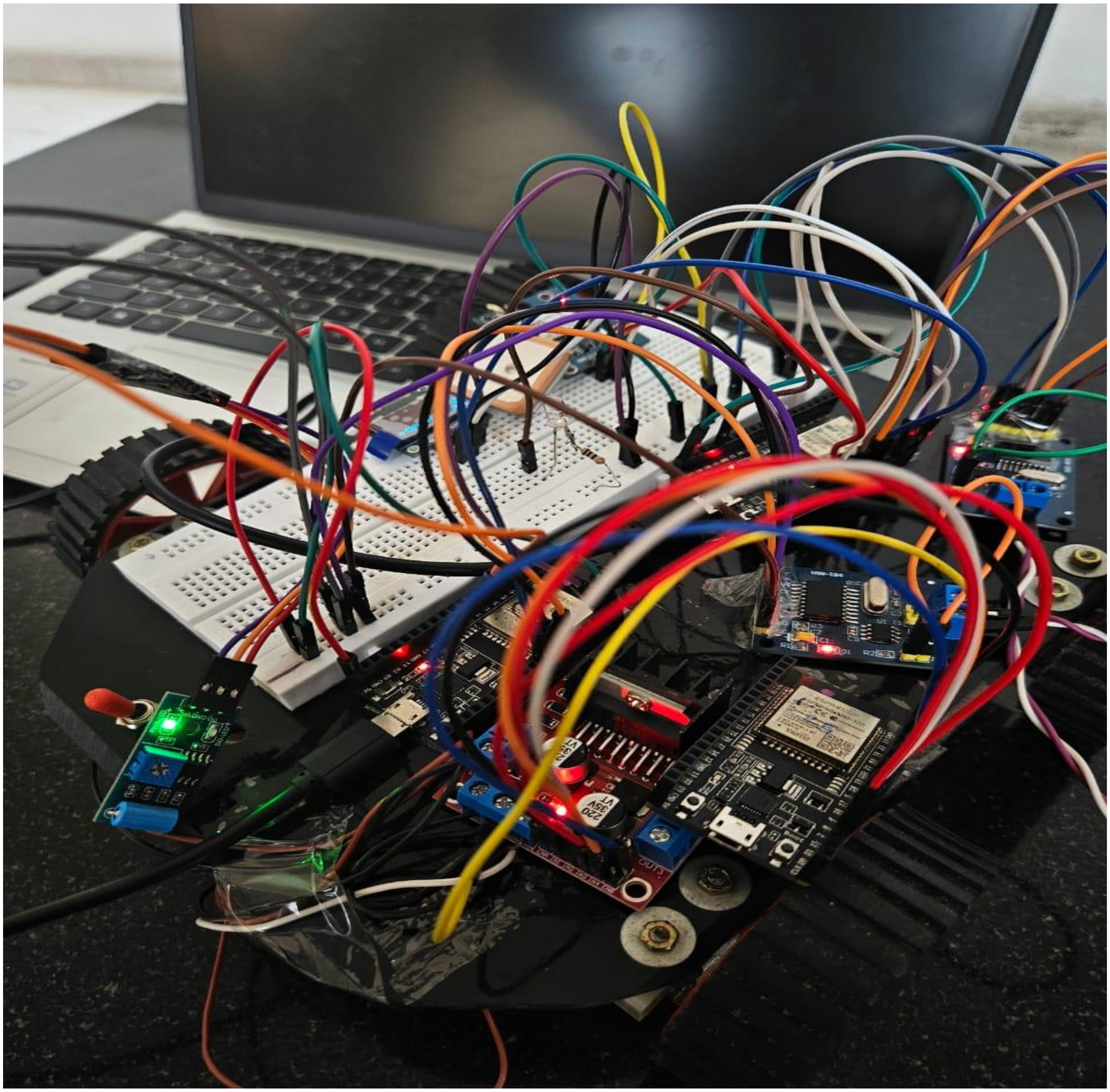
ANTENNA:

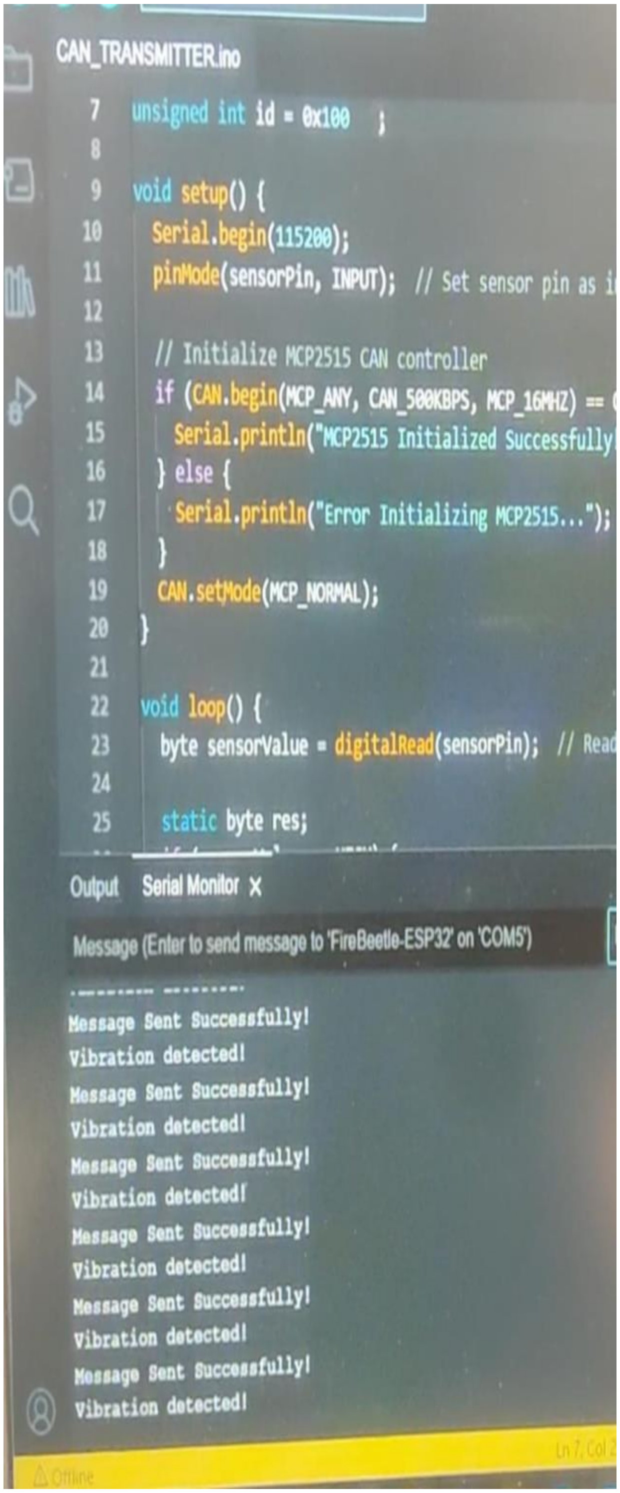
The module comes with a -161 dBm sensitive patch antenna that can receive radio signals from GPS satellites. You can connect the antenna to a small UFL connector which we have mentioned in the parts marking section of this article.

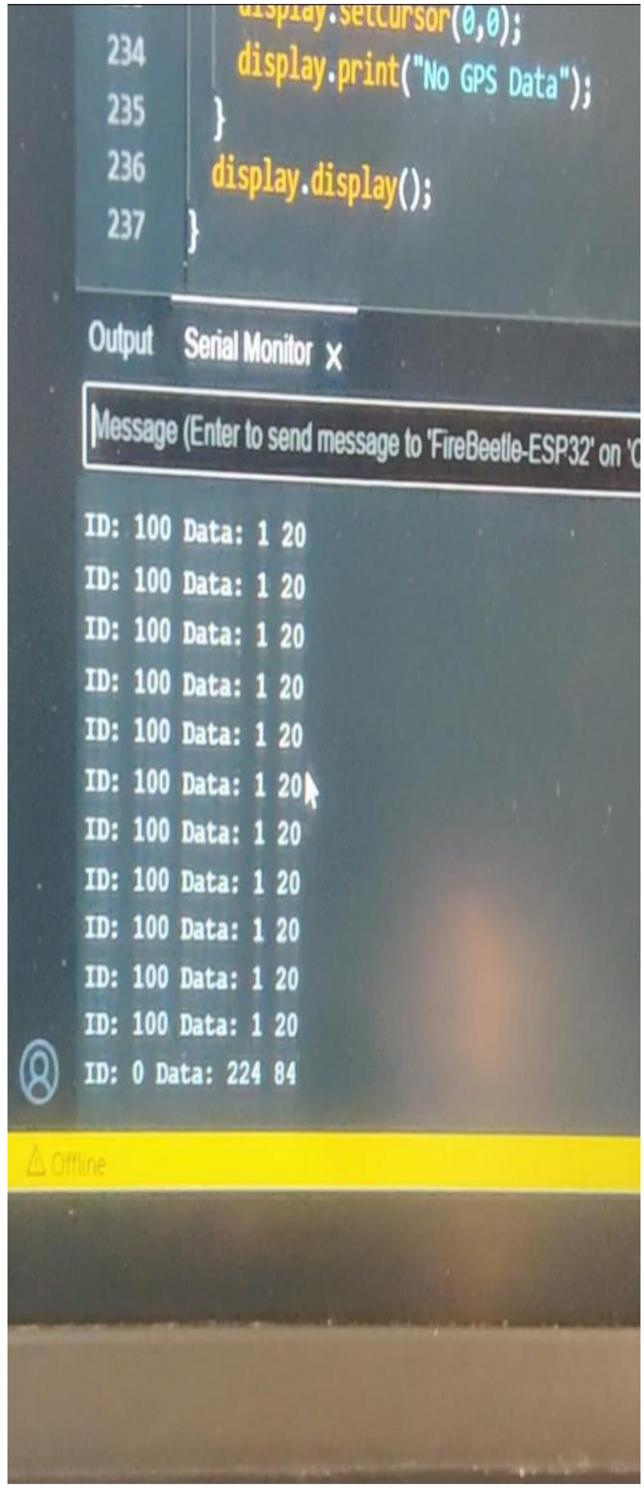


For most outdoor applications, the patch antenna will work just fine but for more demanding or indoor applications it is advised to use a 3V active GPS antenna.

RESULT




CAN_TRANSMITTER.ino
unsigned int id = 0x100 ;
void setup() {
Serial.begin(115200);
pinMode(sensorPin, INPUT); // Set sensor pin as i
// Initialize MCP2515 CAN controller
if (CAN.begin(MCP_ANY, CAN_500KBPS, MCP_16MHZ) ==
Serial.println("MCP2515 Initialized Successfully
} else {
Serial.println("Error Initializing MCP2515...");
}
CAN.setMode(MCP_NORMAL);
}
void loop() {
byte sensorValue = digitalRead(sensorPin); // Read
static byte res;
Output
Serial Monitor
Message (Enter to send message to 'FireBeetle-ESP32' on 'COM5')
Message Sent Successfully!
Vibration detected!
Message Sent Successfully!
Vibration detected!
Message Sent Successfully!
Vibration detected!
Message Sent Successfully!
Vibration detected!
Message Sent Successfully!
Vibration detected!
Message Sent Successfully!
Vibration detected!


display.print("No GPS Data");
}
display.display();
}
Output
Serial Monitor
Message (Enter to send message to 'FireBeetle-ESP32' on
ID: 100 Data: 1 20
ID: 100 Data: 1 20
ID: 100 Data: 1 20
ID: 100 Data: 1 20
ID: 100 Data: 1 20
ID: 100 Data: 1 20
ID: 100 Data: 1 20
ID: 100 Data: 1 20
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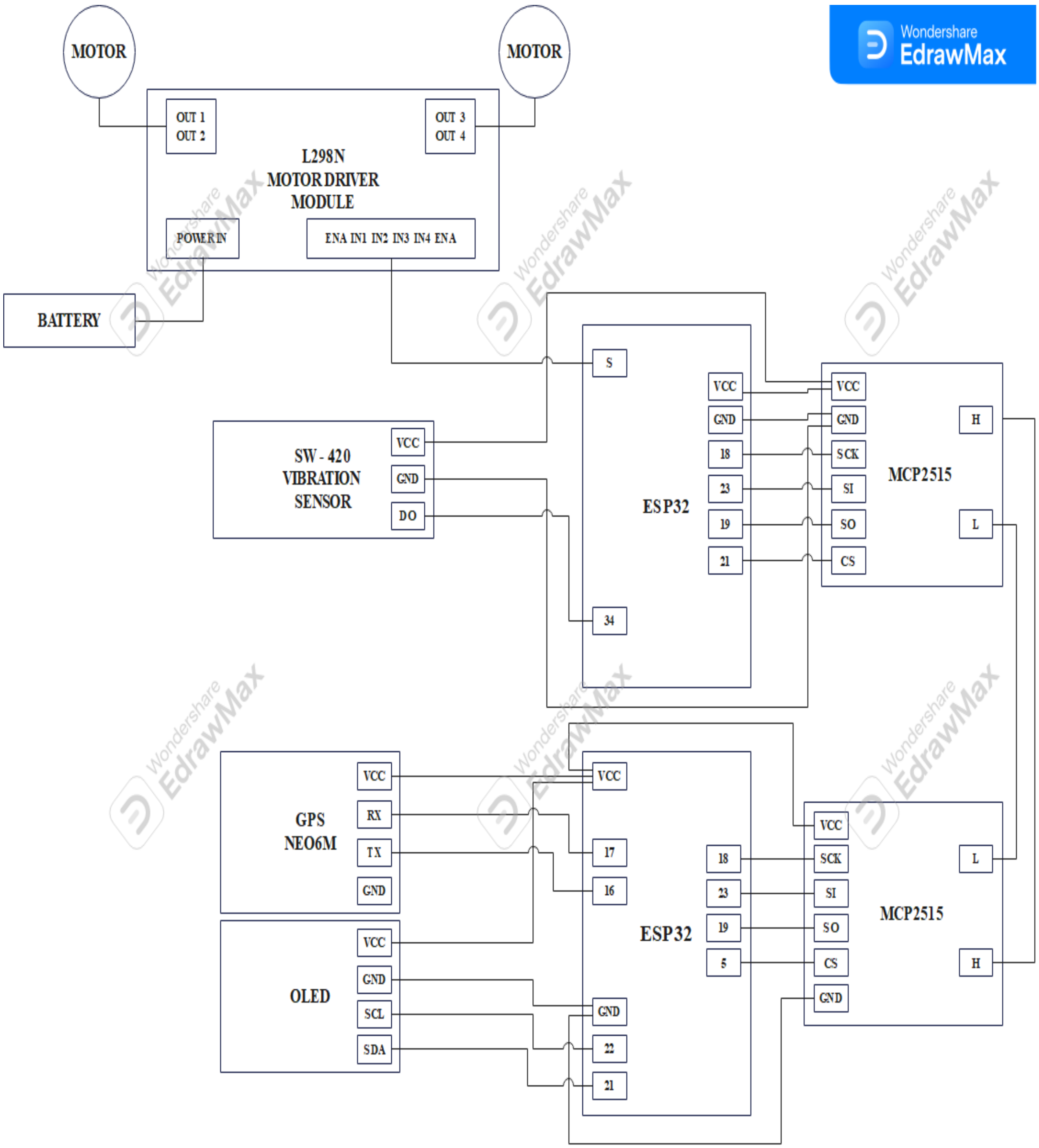
ID: 100 Data: 1 20
ID: 100 Data: 1 20
ID: 0 Data: 224 84
Offline

CIRCUIT DIAGRAM



CONCLUSION

In conclusion, the project utilizes an ESP32 microcontroller interfaced with various components including the L298N driver, SW-420 Vibration sensor, GPS module, and MCP1525 CAN controller. Upon detecting a car accident, the vibration sensor triggers an interrupt to the ESP32, prompting the GPS module to transmit the location to designated recipients such as hospitals and family members. The OLED display then presents pertinent information such as GPS longitude. The MCP1525 CAN controller facilitates data exchange using the CAN protocol, enabling seamless communication between components in the system, ensuring effective coordination and response in critical situations.

FUTURE SCOPE

The future scope of airbag deployment systems utilizing Controller Area Network (CAN) and Global Positioning System (GPS) technologies is promising, with several potential advancements and applications on the horizon. Here are some key areas of future development and enhancement:

1. Advanced Collision Detection Algorithms
2. Predictive Deployment Strategies
3. Occupant Position and Biometric Sensing
4. Adaptive Deployment Control
5. Integration with Vehicle-to-Infrastructure (V2I) Communication
6. Enhanced Post-Collision Analysis and Reporting
7. Integration with Autonomous Driving Systems

Overall, the future scope of airbag deployment systems utilizing CAN and GPS technologies encompasses a wide range of advancements aimed at enhancing collision detection accuracy, optimizing deployment strategies, improving occupant protection, and integrating with emerging vehicle technologies for enhanced safety and collision avoidance capabilities.