A project report on

# HOME AUTOMATION AND HOME SECURITY AND SYSTEM

Submitted in partial fulfilment of the requirements for award of the degree of

**BACHELOR OF TECHNOLOGY**

in

ELECTRONICS & COMMUNICATION ENGINEERING

By


**M. Gowtham Reddy** (20A81A1427)

**K. Rajesh (**20A81A1415)

**K. Sharuk Kumar** (20A81A1417)

**T. Likitha** (20A81A1457)

**B. Trivedh** (20A81A1402)


Under the Esteemed guidance of


**Sri. P.V.V. RAJESH,**
**M. Tech (Ph.D)**
**Asst. Professor**
**Department of ECE.**



DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
SRI VASAVI ENGINEERING COLLEGE
**(Affiliated to JNTUK & Accredited by NBA & NACC 'A' Grade)**
Pedatadepalli, Tadepalligudem- 534101, WG. Dist, AP


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SRI VASAVI ENGINEERING COLLEGE


DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

## CERTIFICATE

This is to certify that the Final report entitled **"Home Automation and Security System"** submitted **by M.Gowtham Reddy(20A81A1427),K.Sharuk Kumar (20A81A1417),T.Likitha(20A81A1457),K.Rajesh(20A81A1415),B.Trivedh(20A81A1402)** in partial fulfilment of the requirements for the award of the Degree of Bachelor of Technology in **ELECTRONICS AND COMMUNICATION TECHNOLOGY** for the academic year **2022-2023** of **SRI VASAVI ENGINEERING COLLEGE, Tadepalligudem affiliated to JNTUK, and NAAC With 'A' Grade** is a record of bonafide final project work carried out by them under my guidance and supervision.

| **PROJECT GUIDE** | **HEAD OF THE DEPARTMENT** |
|---|---|
| Sri.P.V.V. Rajesh | Dr.E.Kusuma Kumari |
| M.Tech (Ph.d) | M.Tech,Ph.D |
| Assistant Professor | Professor& HOD |

**EXTERNAL EXAMINER**

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**PROJECT ASSOCIATES**

**M. Gowtham Reddy (20A81A1427)**

**K. Rajesh (20A81A1415)**

**K. Sharuk Kumar (20A81A1417)**

**T. Likitha (20A81A1457)**

**B. Trivedh (20A81A1402)**

# DECLARATION

We here by declare that the Project Report entititled **"HOME AUTOMATION AND HOME SECURITY SYSTEM"** submitted by us to **Sri Vasavi Engineering College (Autonomous), Tadepalligudem, affiliated to JNTU Kakinada** in partial fulfilment of the requirement for the award of the degree of **B. Tech in Electronics and Communication Technology** is a record of Bona-fide project work carried out by us under the guidance of **Sri.P.V.V.Rajesh M.Tech(Ph.D), Assistant Professor,Department of ECE.**

We further declare that the work reported in this project have not been submitted either in part or in full, for the award of any other degree in any other institute or University.

**PROJECT ASSOCIATES**

**M. Gowtham Reddy** (20A81A1427)

**K. Rajesh** (20A81A1415)

**K. Sharuk Kumar** (20A81A1417)

**T. Likitha** (20A81A1457)

**B. Trivedh** (20A81A1402)

# ABSTRACT

Our Project "**Home Automation and Security System**" aims to create the easiest wireless control of appliances as well as the alerts of safety precautions. Sensors like Gas Sensors, Flame sensors, Temperature and Humidity Sensors, and IR sensors will detect the physical parameters and send alerts immediately to the user through the GSM Module who can see the parameter values in the App.

It uses the GSM Module to send the alert to the user like an SMS and a phone call. Appliances like DC Fan, Bulb, RFID RC522, and Solenoid lock are installed in the project for the Home Automation purpose.

General Controlling of these Appliances will be done through the App which is created in MIT App Inventor and connecting to the same Network which is connected to the appliances.

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# CHAPTER-I

## INTRODUCTION:

## Overview:

Our Project "**Home Automation and Security System**" is with the advancement in our day-to-day life has increased to make life simpler. This is to achieve security, safety, convenience, power efficiency and control of a home. This system is a low-cost and attractive user-friendly interface that is independent. IoT devices manage the surveillance around the home along with keeping track of who has access to the doors they equipped with smart locks.This system provides alerts and attempts remote monitoring to keep you informed about every minute detail of your house in real time and raises the alarm if the IoT-connected devices detect any unusual activities

**Related Work:**

Home Automation is a very common topic around the world. Nowadays Home Automation and IoT are integrated together. Lots of real-life project and research is developed or currently developing based on IoT-based Home Automation system. The Internet of Things (IoT), also sometimes referred to as the Internet of Everything (IoE), consists of all the web-enabled devices that collect, send and act on data they acquire from their surrounding environments using embedded sensors, processors and communication hardware. These devices, often called "connected" or "smart" devices, can sometimes talk to other related devices, a process called machine-to-machine (M2M) communication main advantage of IoT based Home Automation is user can remotely control or integrate with the electric appliance and the devices.

## Objective of the Project:

- The main objective of this project is to remote controlling of any household device and ensure security.
- User can remotely switch off or on the any appliance through a web-based application.

- Save the waste of electricity by automatically controlling night light.
- Detect thieves in night and create siren.
- Detect LPG gas leak and make emergency sound which can prevent massive fire accident.
- User also sees the room temperature through the web application.
- SMS alert system that can send sms to enter if any security attack found.
- Makes system interface is so much interactive so that it can help to control electronics devices of elder people.
- Makes the web application is secured so that everyone cannot allow controlling devices.

## Scope of the Project:

This project is completely controls all home appliances remotely and some devices are controlled automatically.It can also work on office and large shopping malls. It's remotely accessible from the internet. If we buy real IP then it can accessible using the internet from anywhere in the world.
The project interface is very user friendly. It's a web application which is platform-independent. That's why this application runs on any browser in any smartphone or PCs.

## Problems:

**Compatibility Issues:** Ensuring that all devices and systems are compatible and can communicate effectively with each other can be a significant hurdle.
**Reliability:** Ensuring the reliability of the system, especially in critical situations such as emergencies or power outages, is crucial.
**Security Concerns:** Protecting the system from cyber threats and ensuring data privacy is essential, especially when dealing with sensitive information such as security camera footage or personal data.
**User Interface Design:** Designing a user-friendly interface that is intuitive for users of all ages and technical abilities can be challenging.
**Integration Complexity:** Integrating various devices, protocols, and technologies seamlessly can be complex and may require specialized knowledge.

**Cost:** Implementing a comprehensive home automation and security system can be costly, especially if high-quality devices and professional installation are required.

**Maintenance:** Regular maintenance and updates are necessary to ensure the continued functionality and security of the system.

Addressing these challenges requires careful planning, thorough testing, and ongoing maintenance to ensure the success of the project.

## The Solution :

Compatibility Testing: Before purchasing devices, ensure they are compatible with each other and the chosen automation platform. Choose devices that support widely used protocols like Zigbee, Z-Wave, or Wi-Fi for better compatibility.

Redundancy and Backup Systems Implement backup power sources and redundant communication channels to ensure system reliability during power outages or network failures. Encryption and Authentication Employ strong encryption and authentication mechanisms to secure communication between devices and the central hub. Regularly update firmware and software to patch vulnerabilities. User-Centric Design Prioritize user experience in the design process by conducting user testing and gathering feedback to create an intuitive interface. Provide clear instructions and tutorials for users.

Unified Integration Platforms Choose a centralized platform that supports integration with various devices and protocols, reducing complexity and ensuring interoperability. Cost-Effective Solutions Balance the need for quality with cost considerations by researching and comparing different products and services. Consider DIY options for simpler tasks to reduce installation costs. Scheduled Maintenance Establish a maintenance schedule for regular system updates, security patches, and device checks. Provide user education on basic troubleshooting and maintenance tasks.

### 1.3.1Core Components :

The project has interfaced the ESP32 microcontroller with sensors like DHT11, Flame sensor, Gas sensor, and IR sensor given home automation.

We interfaced the Solenoid lock and Touch Sensor for Alerting to prevent the threats.

We are using RFID RC522 and GSM Sim 800L interfaced with Arduino UNO cause of unmatched baud rates.

## Features and Benefits:

**Remote Access**: Control and monitor your home devices and security system remotely via smartphone apps or web portals.

**Smart Locks:** Lock and unlock doors remotely, grant access to visitors, and receive notifications when someone enters or exits.

**Motion Sensors:** Detect movement in and around your home, triggering alarms or notifications.

**Window and Door Sensors**: Alert you when windows or doors are opened or closed, enhancing security.

**Smart Lighting:** Control lights remotely, set schedules, or automate lighting based on motion or occupancy to enhance security and save energy.

**Smoke and Carbon Monoxide Detectors:** Receive alerts on your smartphone in case of smoke or carbon monoxide detection.

**Alarm Systems:** Set up intrusion alarms with sirens and notifications to deter intruders and alert you and authorities if a break-in is detected.

These features can be integrated into comprehensive home automation and security systems to provide convenience, safety, and peace of mind for homeowners.

## How It Works :

**Hardware Devices**: These include devices such as smart locks, security cameras, motion sensors, door and window sensors, smart thermostats, smart lighting, smoke detectors, carbon monoxide detectors, water leak detectors, and more. Each device is equipped with sensors and connectivity capabilities.

**Central Control Hub:** Most home automation systems have a central control hub or gateway that serves as the brain of the system. This hub connects to your home's Wi-Fi network and communicates with all the smart devices installed in your home.

**Wireless Connectivity:** The devices in your home communicate with the central control hub wirelessly, usually using protocols like Wi-Fi, Zigbee, Z-Wave, or Bluetooth. This allows them to send and receive commands, data, and alerts.

**Smartphone App or Web Portal:** Users interact with their home automation and security systems through a smartphone app or web portal. These interfaces allow you to control your devices remotely, monitor activity in your home, receive alerts, and adjust settings.

**Automation and Control:** Users can set up automation rules and schedules within the app to control how devices behave based on various triggers, such as time of day, sensor activity, or user input. For example, you can create a rule to turn on the lights and adjust the thermostat when you arrive home.

**Alerts and Notifications:** Home security systems can send alerts and notifications to your smartphone when triggered by events such as motion detection, door/window opening, smoke or carbon monoxide detection, water leaks, and more. This allows you to take immediate action or notify authorities if necessary.

### 1.5.1 Scope :

The scope of home automation and home security systems is broad and encompasses various aspects of residential living. Here are some key areas within the scope of these systems:

**Security:** Protecting the home from intruders, burglaries, and other security threats using devices such as security cameras, motion sensors, door/window sensors, smart locks, and alarm systems.

**Safety:** Ensuring the safety of occupants by monitoring for hazards such as smoke, carbon monoxide, and water leaks, with devices like smoke detectors, carbon monoxide detectors, and water leak detectors.

**Convenience:** Automating routine tasks and controlling home devices remotely for convenience and efficiency, including adjusting lighting, temperature, and appliances.

**Energy Efficiency:** Optimizing energy usage and reducing utility costs by monitoring and controlling heating, cooling, and lighting systems with smart thermostats and lighting controls.

**Remote Monitoring:** Allowing homeowners to remotely monitor their homes via smartphone apps or web portals, providing real-time alerts and notifications about security events, environmental conditions, and device status.

**Integration:** Integrating with other smart home devices and platforms to create a cohesive ecosystem, including voice assistants, entertainment systems, and smart appliances.

**Customization:** Providing flexibility for users to customize settings, automation rules, and schedules according to their preferences and lifestyle.

**Expandability:** Allowing for the addition of new devices and features over time to meet evolving needs and preferences, ensuring scalability and future-proofing.

**User Experience:** Offering intuitive interfaces and user-friendly experiences through smartphone apps, web portals, and voice commands to enhance usability and adoption.

**Privacy and Security:** Implementing robust security measures to protect user data and privacy, including encryption, secure authentication, and adherence to privacy regulations.

Overall, the scope of home automation and home security systems is aimed at enhancing comfort, convenience, safety, and security for homeowners while providing flexibility, customization.

# CHAPTER 2

## Literature Survey:

The methodology for Sigma-Home involved meticulous planning, selecting Node MCU for IoT functionality, integrating diverse sensors, programming Node MCU for automation and Wi-Fi communication, developing a user-friendly mobile app, implementing security features, rigorous testing, comprehensive documentation, and real- world deployment with user feedback to ensure a seamless and secure IoT-based home automation system.

Sigma-Home is an innovative IoT- based home automation system leveraging Node MCU, providing users with remote control over appliances and environmental monitoring. The project emphasizes security features, including intrusion detection and visual monitoring, while the user-friendly mobile application ensures seamless customization and control. [1]

The integration of IoT technology into smart home automation systems has revolutionized residential living, offering residents an intelligent and interconnected environment. By leveraging sensors, actuators, and internet connectivity, these systems enable seamless automation, control, and monitoring of diverse home devices and systems. The IoT-based smart home automation system not only enhances convenience by allowing remote access and control but also promotes energy efficiency through intelligent scheduling and optimization algorithms. Moreover, the integration of IoT technologies enhances home security through real-time monitoring and alerts, ensuring the safety of residents and their belongings. The system also contributes to overall comfort by enabling personalized settings and preferences, such as temperature control, lighting adjustments, and entertainment system management. Research in this field focuses on optimizing the interoperability and scalability of IoT-enabled devices and platforms to create a cohesive and adaptable smart home ecosystem. Additionally, studies explore the development of robust security protocols to protect sensitive data and prevent unauthorized access to smart home systems. Efforts are also directed towards improving user interfaces and user experiences to ensure ease of use and widespread adoption of smart home automation solutions. Real-world deployments and case studies evaluate the effectiveness and practicality of IoT-based smart home automation systems in diverse residential settings. Overall, the literature highlights the transformative potential of IoT-based smart home automation systems in enhancing

residential living standards and fostering a more connected and intelligent home environment. [2]

Home security systems have become imperative in modern times, owing to the rising concerns about safeguarding property and loved ones, especially during absences from home. Traditional methods of manual monitoring are ineffective, leading to heightened vulnerability to theft, burglary, and unforeseen accidents, particularly for those left alone at home, such as the elderly or children. The emergence of smart home security systems offers a viable solution by leveraging technology to enhance surveillance and detection capabilities, thus mitigating risks associated with unauthorized intrusion and emergencies. These systems enable remote monitoring of home activities, providing homeowners with real-time alerts and access to surveillance footage from anywhere at any time, thereby enhancing peace of mind and responsiveness to potential threats. With the proliferation of advanced technologies, the demand for sophisticated home security systems has surged, driven by the escalating incidents of burglary and fire-related mishaps. In response to this growing need, ongoing research endeavors aim to develop innovative models tailored to address evolving security challenges and optimize protection measures for residential premises. The proposed research seeks to fill this gap by introducing a novel home security system that integrates cutting-edge technologies to deliver comprehensive surveillance, detection, and response capabilities. By leveraging state-of-the-art sensors, artificial intelligence, and connectivity features, the envisioned model offers a proactive approach to home security, minimizing the likelihood of security breaches and enhancing overall safety. Moreover, the proposed system is designed to be user-friendly and adaptable, catering to the diverse needs and preferences of homeowners while ensuring seamless integration with existing smart home ecosystems. In conclusion, the adoption of advanced home security systems represents a crucial step towards fortifying residential premises against potential threats, thereby fostering a safer and more secure living environment for occupants. [3]

The rapid advancement of technology coupled with the ubiquitous presence of smartphones has underscored the need for efficient solutions to manage domestic and industrial tasks seamlessly. Recognizing this demand, our project delves into the realm of the Internet of Things (IoT), focusing on the development of a comprehensive "IOT Based Home Security System Using Arduino." Central to our system are various sensors including gas, temperature, motion, and a Wi-Fi module, all interfaced with an

Arduino board to facilitate real-time data acquisition and processing. Leveraging wireless connectivity, the status of household appliances is transmitted to a cloud platform, enabling remote monitoring and control via a mobile device sharing the same network. The inclusion of sensors capable of enabling or disabling functionalities ensures proactive surveillance and user engagement, empowering individuals to stay informed and responsive to their surroundings. A crucial component of our system is the relay module, tasked with regulating the On/Off operations of appliances, thereby enhancing energy efficiency and user convenience. Furthermore, the integration of a magnetic sensor serves to bolster the security of the premises by detecting and deterring potential intrusions through door breaking attempts. By harnessing the synergy between IoT principles and Arduino technology, our project aims to offer a robust and user-friendly solution for home security and automation. Through continuous innovation and refinement, we seek to address the evolving needs and challenges in the realm of smart home technology, prioritizing efficiency, reliability, and user empowerment. In conclusion, the "IOT Based Home Security System Using Arduino" project represents a significant stride towards realizing the vision of interconnected and intelligent living spaces, where technology serves to enhance safety, convenience, and peace of mind for users.

# CHAPTER 3

## HARDWARE DESCRIPTION

### 3.1 ESP32 Hardware Description:

ESP32 is a single 2.4 GHz Wi-Fi-and-Bluetooth combo chip designed with the TSMC low-power 40 nm technology. It is designed to achieve the best power and RF performance, showing robustness, versatility and reliability in a wide variety of applications and power scenarios.

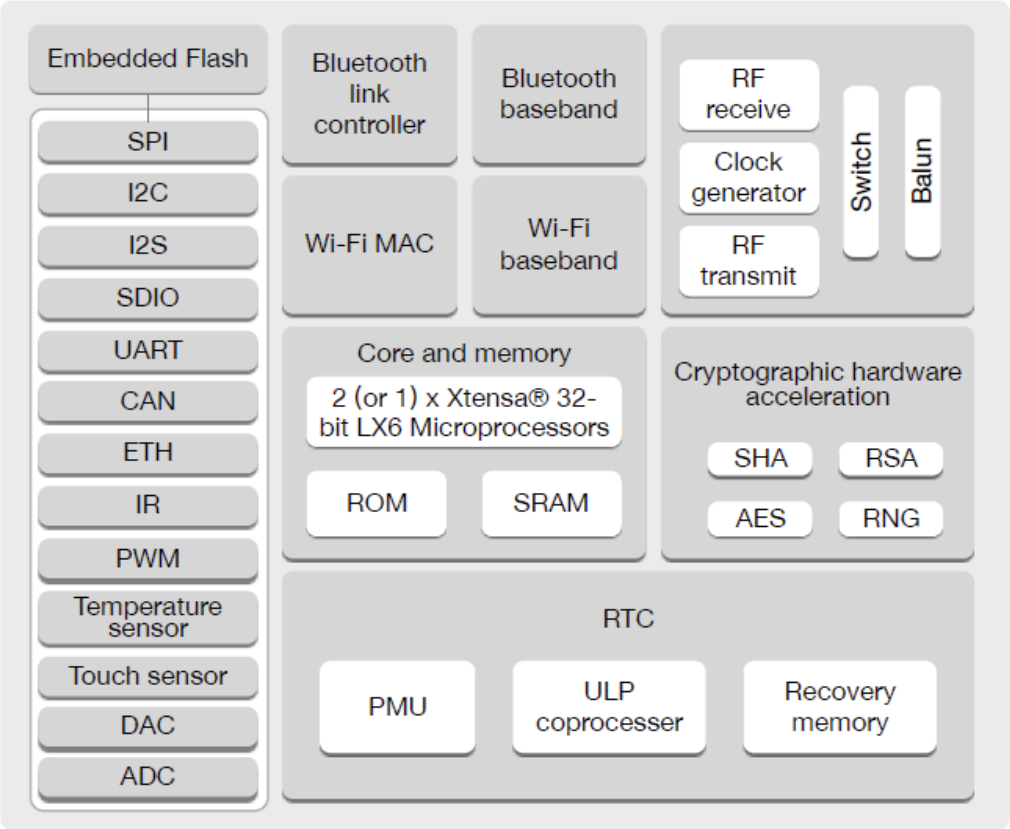



*Figure 1: ESP32 Functional Block Diagram*

### 3.1.1 Pinout of ESP32:

Although the ESP32 has 48 GPIO pins in total, only 25 of them are broken out to the pin headers on both sides of the development board. These pins can be assigned a variety of peripheral duties, including:

| | |
|---|---|
| 15 ADC channels | 15 channels of 12-bit SAR ADC with selectable ranges of 0-1V, 0-1.4V, 0-2V, or 0-4V |
| 2 UART interfaces | 2 UART interfaces with flow control and IrDA support |
| 25 PWM outputs | 25 PWM pins to control things like motor speed or LED brightness |
| 2 DAC channels | Two 8-bit DACs to generate true analog voltages |
| SPI, I2C and I2S interface | Three SPI and one I2C interface for connecting various sensors and peripherals, as well as two I2S interfaces for adding sound to your project |
| 9 Touch Pads | 9 GPIOs with capacitive touch sensing |

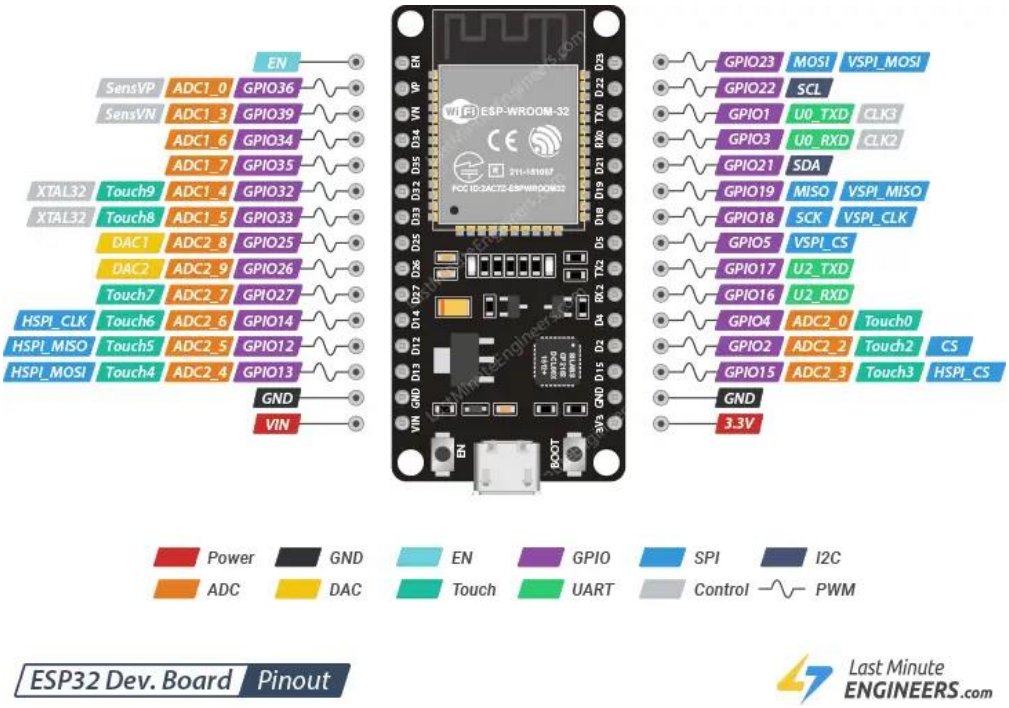



*Figure 2: Pinout of ESP32*

### 3.1.2 GPIO Pins:

The ESP32 development board has 25 GPIO pins that can be assigned different functions by programming the appropriate registers. There are several kinds of GPIOs: digital-only, analog-enabled, capacitive-touch-enabled, etc. Analog-enabled GPIOs and Capacitive-touch-enabled GPIOs can be configured as digital GPIOs. Most of these digital GPIOs can be configured with internal pull-up or pull-down, or set to high impedance.

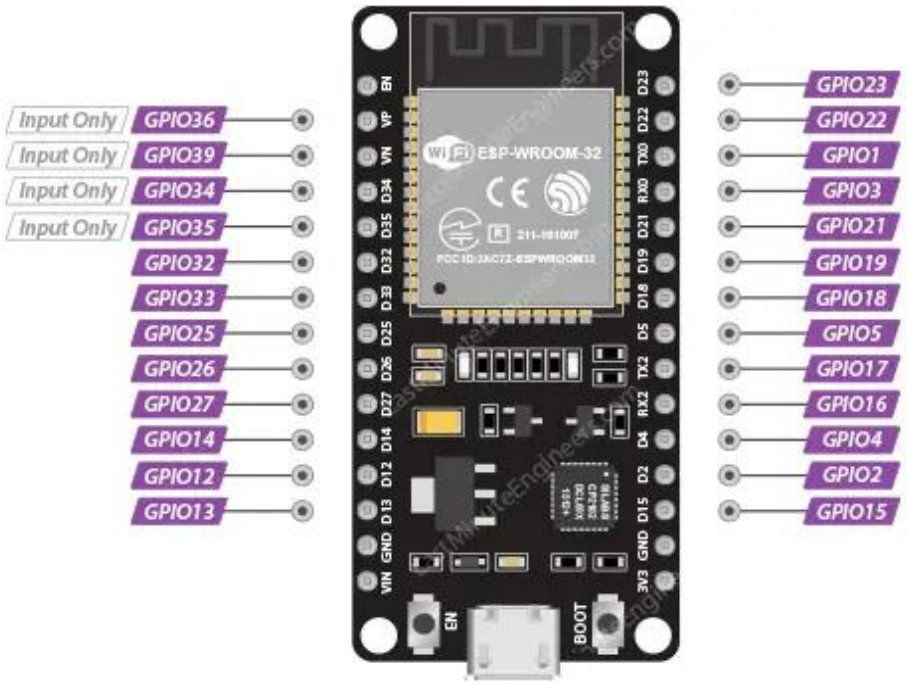



*Figure 3: GPIO pins of ESP32*

### 3.1.3 ADC pins

ESP32 integrates two 12-bit SAR ADCs and supports measurements on 15 channels (analog-enabled pins).

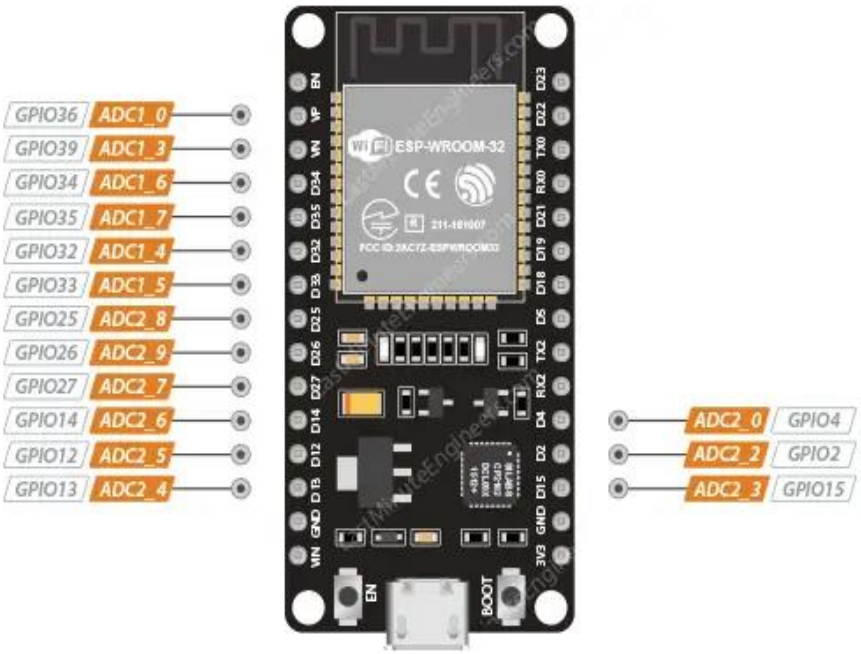



*Figure 4: ADC Pins of ESP32*

The ESP32's ADC is a 12-bit ADC, which means it can detect 4096 (2^12) discrete analog levels. In other words, it will convert input voltages ranging from 0 to 3.3V (operating voltage) into integer values ranging from 0 to 4095. This results in a resolution of 3.3 volts / 4096 units, or 0.0008 volts (0.8 mV) per unit.

### 3.1.4 DAC Pins:

The ESP32 includes two 8-bit DAC channels for converting digital signals to true analog voltages. It can be used as a "digital potentiometer" to control analog devices.These DACs have an 8-bit resolution, which means that values ranging from 0 to 256 will be converted to an analog voltage ranging from 0 to 3.3V.

### 3.1.5 Touch Pins:

The ESP32 has 9 capacitive touch-sensing GPIOs. When a capacitive load (such as a human finger) is in close proximity to the GPIO, the ESP32 detects the change in capacitance. You can make a touch pad by attaching any conductive object to these pins, such as aluminium foil, conductive cloth, conductive paint, and so on. Because of the low-noise design and high sensitivity of the circuit, relatively small pads can be

made.Additionally, these capacitive touch pins can be used to wake the ESP32 from deep sleep.

### 3.1.6 I2C Pins:


*Figure 5: I2C Pins of ESP32*

The ESP32 has two I2C bus interfaces, but no dedicated I2C pins. Instead, it allows for flexible pin assignment, meaning any GPIO pin can be configured as I2C SDA (data line) and SCL (clock line).However, GPIO21 (SDA) and GPIO22 (SCL) are commonly used as the default I2C pins to make it easier for people using existing Arduino code, libraries, and sketches.

### 3.1.7 SPI Pins:

ESP32 features three SPIs (SPI, HSPI, and VSPI) in slave and master modes. These SPIs also support the general-purpose SPI features listed below:

4 timing modes of the SPI format transfer

Up to 80 MHz and the divided clocks of 80 MHz

Up to 64-Byte FIFO

Only VSPI and HSPI are usable SPI interfaces, and the third SPI bus is used by the integrated flash memory chip. VSPI pins are commonly used in standard libraries.

### 3.1.8 UART Pins:

The ESP32 dev. board has three UART interfaces, UART0, UART1, and UART2, that support asynchronous communication (RS232 and RS485) and IrDA at up to 5 Mbps.UART0 pins are connected to the USB-to-Serial converter and are used for flashing and debugging. Therefore, the UART0 pins are not recommended for use.UART1 pins are reserved for the integrated flash memory chip.UART2, on the other hand, is a safe option for connecting to UART-devices such as GPS, fingerprint sensor, distance sensor, and so on.In addition, UART provides hardware management of the CTS and RTS signals and software flow control (XON and XOFF) as well.

### 3.1.9 PWM Pins:

The board has 21 channels (all GPIOs except input-only GPIOs) of PWM pins controlled by a PWM controller. The PWM output can be used for driving digital motors and LEDs.The PWM controller consists of PWM timers, the PWM operator and a dedicated capture sub-module. Each timer provides timing in synchronous or independent form, and each PWM operator generates a waveform for one PWM channel. The dedicated capture sub-module can accurately capture events with external timing.

### 3.1.10 Power and Enable Pins:

There are two power pins: the VIN pin and the 3V3 pin. The VIN pin can be used to directly power the ESP32 and its peripherals, if you have a regulated 5V power supply. The 3V3 pin is the output from the on-board voltage regulator; you can get up to 600mA from it. GND is the ground pin.

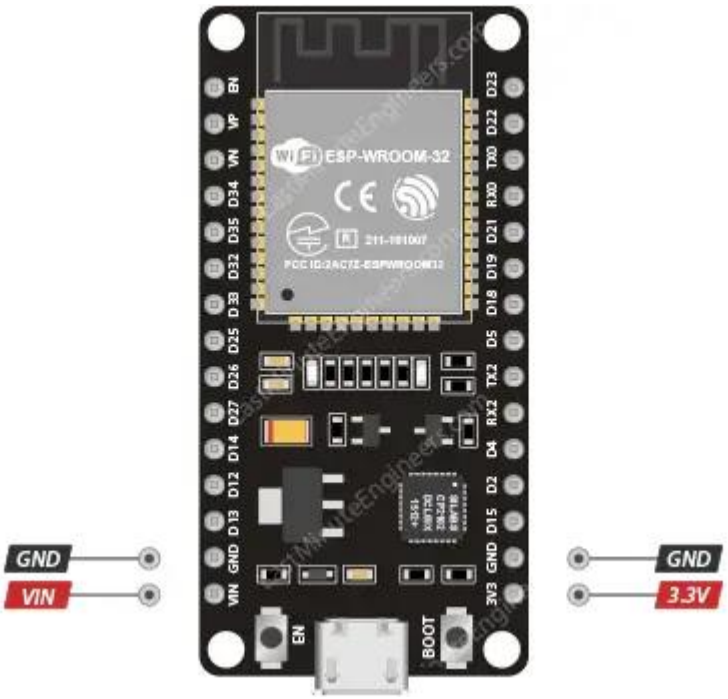



*Figure 6: I2C Pins of ESP32*

**Fig 2.1.5 Power Pins of ESP32**

**Enable pin:**

The EN pin is the enable pin for the ESP32, pulled high by default. When pulled HIGH, the chip is enabled; when pulled LOW, the chip is disabled.The EN pin is also connected to a pushbutton switch that can pull the pin LOW and trigger a reset.

## 2.2 Arduino Uno Board Hardware Description:

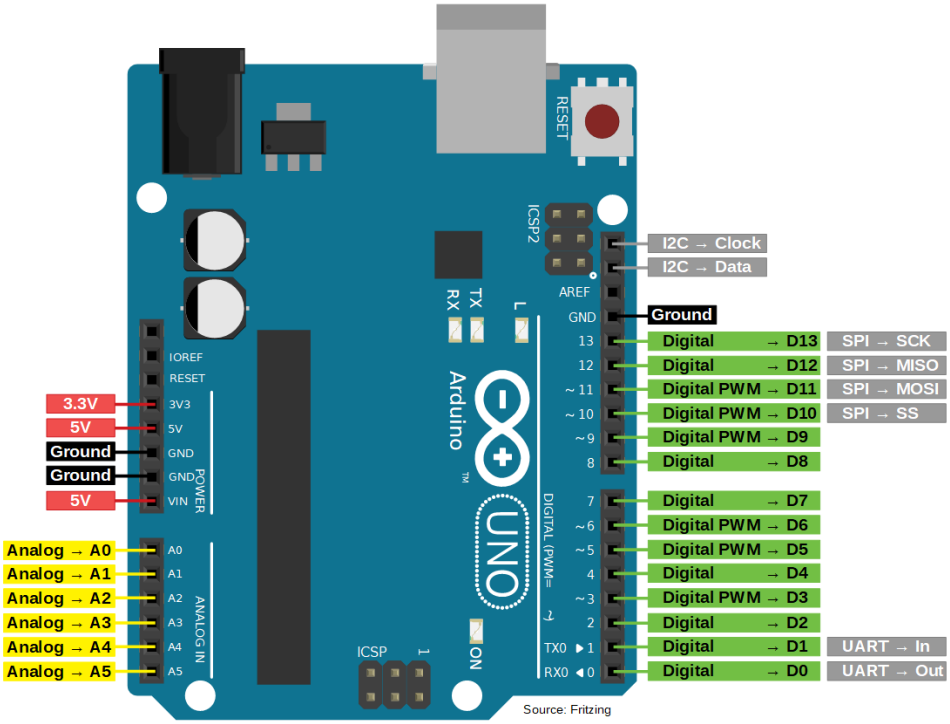



*Figure 7: Arduino uno board*

### 3.2.1 Operating Principle

The Arduino board is powered by a battery through this power jack. Digital Pins: The Arduino UNO board features 14 digital I/O pins, with 6 of them providing PWM output (Pulse Width Modulation). These pins can also be set up to function as digital input or output pins.

**Pin Configuration:**

**Vin:** This is the input voltage pin of the Arduino board used to provide input supply from an external power source.

**5V:** This pin of the Arduino board is used as a regulated power supply voltage and it is used to give supply to the board as well as onboard components.

**3.3V:** This pin of the board is used to provide a supply of 3.3V which is generated from a voltage regulator on the board

**GND:** This pin of the board is used to ground the Arduino board.

**Reset:** This pin of the board is used to reset the microcontroller. It is used to reset the microcontroller.

**Analog Pins:** The pins A0 to A5 are used as an analog input and it is in the range of 0-5V.

**Digital Pins:** The pins 0 to 13 are used as a digital input or output for the Arduino board.

**Serial Pins:** These pins are also known as a UART pin. It is used for communication between the Arduino board and a computer or other devices. The transmitter PIN 1 and receiver PIN 0 are used to transmit and receive the data resp.

**External Interrupt Pins:** This pin of the Arduino board is used to produce the External interrupt and it is done by PINs 2 and 3.

**PWM Pins:** These pins of the board are used to convert the digital signal into an analogue by varying the width of the Pulse. The PINs 3,5,6,9,10 and 11 are used as a PWM pin.

**SPI Pins:** This is the Serial Peripheral Interface pin, it is used to maintain SPI communication with the help of the SPI library. SPI pins include:

SS: PIN 10 is used as a Slave Select

MOSI: PIN 11 is used as a Master Out Slave In

MISO: PIN 12 is used as a Master In Slave Out

SCK: PIN 13 is used as a Serial Clock

**LED Pin:** The board has an inbuilt LED using digital pin-13. The LED glows only when the digital pin becomes high.

**AREF Pin:** This is an analogue reference pin of the Arduino board. It is used to provide a reference voltage from an external power supply.

### 3.2.2 sensors and description:


*Figure 8: GSM 800L Module*

The SIM800L module is a small, low-cost GSM/GPRS module that allows devices to communicate over GSM cellular networks. It's commonly used in IoT projects for tasks like sending SMS messages, making phone calls, and connecting to the internet. It operates on 2G networks and supports various communication protocols like UART, SPI, and I2C.

**Working:** A GSM module is a device that allows electronic devices to communicate with each other over the GSM network. GSM is a standard for digital cellular communications, which means that it provides a platform for mobile devices to communicate with each other wirelessly.

## Applications:

The GSM SIM800L module is compact Size and is used in various Projects. The gsm module operates in only 3.7v to 4.2v. It is commonly used to do almost anything that a normal cell phone can do, such as sending SMS messages, making phone calls, and connecting to the internet via GPRS Through.

**IR Sensor:**

*Figure 9:Fig 2.2.4*

An infrared sensor (IR sensor) is a radiation-sensitive optoelectronic component with spectral sensitivity in the infrared wavelength range 780 nm 50 µm. IR sensors are now widely used in motion detectors, which are used in building services to switch on lamps or in alarm systems to detect unwelcome guests.

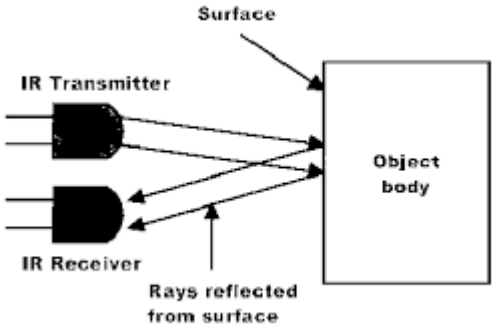



*Figure 10:Working of IR Sensor*

**Working:** The IR transmitter continuously emits the IR light and the IR receiver keeps on checking for the reflected light. If the light gets reflected by hitting any object in front of it, the IR receiver receives this light. This way the object is detected in the case of the IR sensor.

**RFID RC522:**

*Figure 11:Working of IR Sensor*

**Radio Frequency Identification (RFID)** is a technology that uses radio waves to passively identify a tagged object. It is used in several commercial and industrial applications, from tracking items along a supply chain to keeping track of items checked out of a library.

**Working:** Every RFID system consists of three components: a scanning antenna, a transceiver and a transponder. When the scanning antenna and transceiver are combined, they are referred to as an RFID reader or interrogator. There are two types of RFID readers fixed readers and mobile readers. The RFID reader is a network-connected device that can be portable or permanently attached. It uses radio waves to transmit signals that activate the tag. Once activated, the tag sends a wave back to the antenna, where it is translated into data. The transponder is in the RFID tag itself. The read range for RFID tags varies based on factors including the type of tag, type of reader, RFID frequency and interference in the surrounding environment or from other RFID tags and readers. Tags that have a stronger power source also have a longer read range.

**Solenoid Lock:**

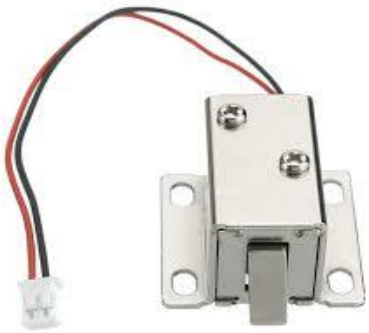


*Figure 12:Solenoid Lock*

Solenoid door locks are morticed into a door and take the place of a traditional morticed lock such as a solenoid lock or a deadlock. Solenoid locks are a type of electric lock that contains a small electromagnet known as a solenoid Lock.

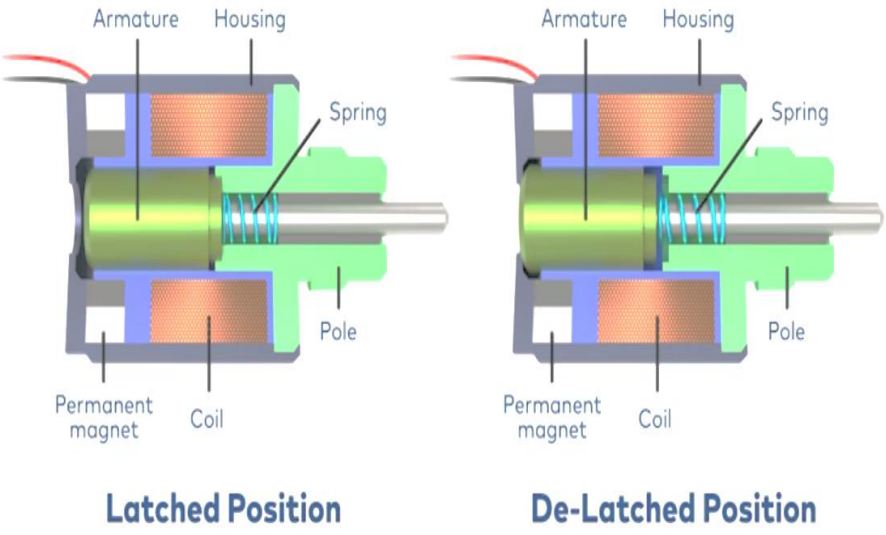



*Figure 13:Working of Solenoid Lock*

**Working:** The solenoid lock denotes a latch for electrical locking and unlocking. It is available in unlocking in the power-on mode type, and locking and keeping in the power-on mode type, which can be used selectively for situations. The power-on unlocking type enables unlocking only while the solenoid is powered on.

**DHT11 Sensor:**

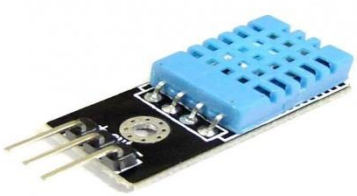


*Figure 14:DHT11 Sensor*

DHT11 is a low-cost digital sensor for sensing temperature and humidity. This sensor can be easily interfaced with any microcontroller such as Arduino, Raspberry Pi etc… to measure humidity and temperature instantaneously. DHT11 humidity and temperature sensor is available as a sensor and as a module.

**Working:**

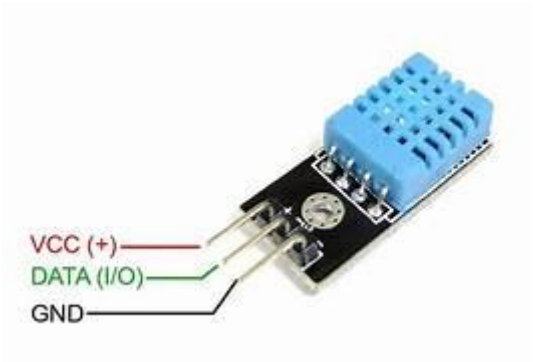



*Figure 15:Working of DHT11 Sensor*

DHT11 sensor consists of a capacitive humidity sensing element and a thermistor for sensing temperature. The humidity sensing capacitor has two electrodes with a moisture-holding substrate as a dielectric between them. Change in the capacitance value occurs with the change in humidity levels. The IC measures, and processes these changed resistance values and changes them into digital form.

For measuring temperature this sensor uses a Negative Temperature coefficient thermistor, which causes a decrease in its resistance value with an increase in temperature. To get a larger resistance value even for the smallest temperature change, this sensor is usually made up of semiconductor ceramics or polymers. The temperature range of DHT11 is from 0 to 50 degrees Celsius with a 2-degree

accuracy. The humidity range of this sensor is from 20 to 80% with 5% accuracy. The sampling rate of this sensor is 1Hz .i.e. it gives one reading for every second. DHT11 is small in size with operating voltage from 3 to 5 volts. The maximum current used while measuring is 2.5 mA.

## Flame Sensor:

*Figure 16:Flame Sensor*

A flame-sensor is one kind of detector that is mainly designed for detecting as well as responding to the occurrence of a fire or flame. The flame detection response can depend on its fitting. It includes an alarm system, a natural gas line, propane & a fire suppression system.

**Working:** Flame Sensor Working Principle Flame sensors use UV (Ultraviolet) or IR (infrared) or UV-IR technology to identify flames below a second. These sensors react to a detected flame based on the installation, although it includes sounding an alarm, disabling a fuel line & activating a fire control system.

**Gas Sensor:**

*Figure 17:Gas Sensor*

Gas sensors are devices that detect the presence of various gases in the surrounding

environment. They work by measuring the concentration of target gases and generating

electrical signals proportional to the gas concentration. Gas sensors are essential for monitoring air quality, detecting hazardous gases, and ensuring safety in various applications.

Carbon Monoxide.

Methane (CH4).

Hydrogen Sulfide.

Carbon Dioxide.

Liquefied Petroleum Gas (LPG)

**Working:**

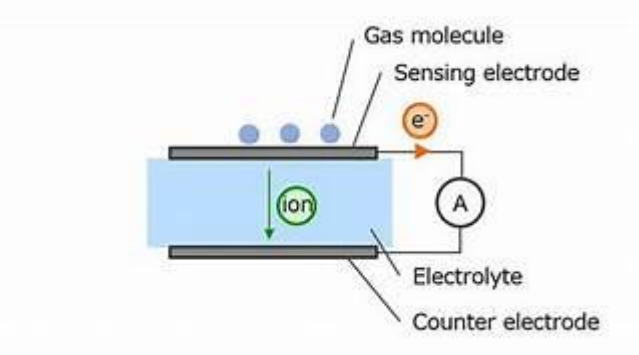



*Figure 18:Working of GAS Sensor*

Concentrations of gas in the gas are measured using a voltage divider network present in the sensor. This sensor works on 5V DC voltage. It can detect gases in the concentration of range 200 to 10000ppm. This sensor contains a sensing element, mainly aluminium-oxide-based ceramic, coated with Tin dioxide, enclosed in a stainless steel mesh.

**Touch Sensor:**


*Figure 19:Working of GAS Sensor*

Nowadays, we are coming across user interfaces that are operated on a single touch. There is a wide range of applications that use this sensing criterion. Examples in which the touch sensor is used are mobile phones, monitor screens, control panels, etc…

**Working:**

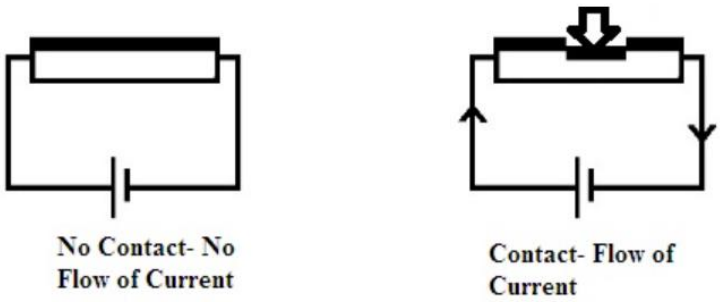



*Figure 20:Working of Touch Sensor*

These sensors are sensitive to any pressure or force applied or touched. The principle of touch is similar to that of a switch. When the switch is closed, the current flows otherwise there is no chance of the current to flow. Similarly, when the touch sensor senses the touch or proximity is captured then it acts like a closed switch otherwise it acts as an open switch. These sensors are also known as 'Tactile Sensors'.

**Buzzer:**

*Figure 21:Buzzer*

A buzzer is an efficient component to include the features of sound in our system or project. It is an extremely small & solid two-pin device thus it can be simply utilized on breadboard or PCB. So in most applications, this component is widely used. There are two kinds of buzzers commonly available simple and readymade.

**Working:**

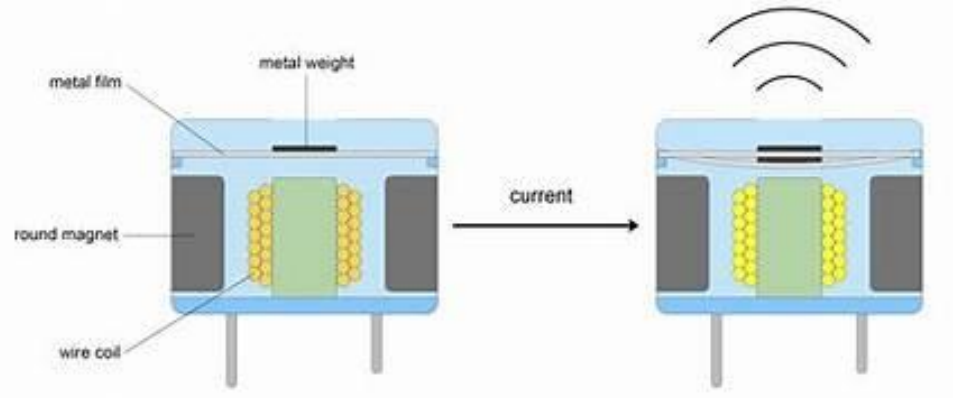



*Figure 22:Buzzer working*

The working principle of a buzzer depends on the theory that, once the voltage is given across a piezoelectric material, then a pressure difference is produced. A piezo type includes piezo crystals among two conductors.

## 3.2.1 LCD DISPLAY

LCD (Liquid Crystal Display) modules are ubiquitous components in modern electronic devices, providing clear and readable information displays. These modules consist of several key components, including a glass substrate with liquid crystal material sandwiched between electrodes, colour filters for creating vibrant displays, and a backlight to illuminate the screen. LCDs come in various types,

including passive matrix and active matrix displays, each offering different performance characteristics such as resolution and refresh rate.

LCD modules further simplify integration into electronic projects by packaging the LCD panel, driver circuitry, and other components into a single unit. Interfacing these

modules with microcontrollers typically involve parallel or serial communication protocols, enabling seamless integration into a wide range of applications.


*Figure 23:LCD Display*

LCDs can show real-time vital signs such as heart rate, blood pressure, oxygen saturation levels, and temperature. These vital signs can be measured using wearable sensors or medical devices attached to the patient's body. The LCD provides immediate feedback to healthcare providers, allowing them to assess the patient's condition quickly.

LCDs can be programmed to show alerts and alarms for abnormal vital signs or other critical events. For example, if a patient's heart rate or blood pressure exceeds safe levels, the LCD can alert healthcare providers to take immediate action. This real-time feedback helps ensure timely intervention and patient safety.

LCDs can be used to provide educational content to patients and caregivers about their medical conditions, treatment plans, and self-care instructions. This information can help empower patients to manage their health more effectively and improve treatment adherence.

Overall, integrating LCDs into mobile health monitoring systems for bedridden patients enhances real-time monitoring, improves patient outcomes, and provides greater convenience for healthcare providers and caregivers

### 3.3.1 Pinout of LCD Display:

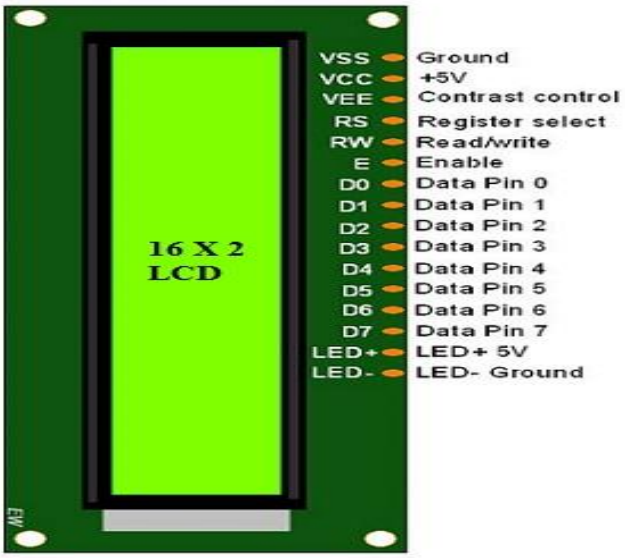



*Figure 24: Pinout of LCD Display*

LCD (Liquid Crystal Display) modules come in various configurations, but a common one might have the following pinout:

VSS (Ground): Connect this pin to the ground of your circuit.

VDD (Power): Connect this pin to the power supply voltage, usually +5V or +3.3V.

VO (Contrast Voltage): This pin controls the contrast of the display. Connect it to a voltage source (typically a potentiometer) to adjust the contrast.

RS (Register Select): This pin selects between data and command modes. When RS is high, data is being sent; when it's low, commands are being sent.

RW (Read/Write): This pin selects the read or write mode. Connecting it to ground (LOW) sets the module to write mode.

E (Enable: This pin triggers the reading or writing of data. A falling edge is typically used to latch data.

D0-D7 (Data Lines): These pins are used for sending data or commands to the display. Depending on the interface mode (4-bit or 8-bit), you may not use all of these pins.

A (Backlight Anode): Connect the anode of the backlight LED to this pin.

K (Backlight Cathode): Connect the cathode of the backlight LED to this pin.

## 2.3.2 FEATURES OF LCD DISPLAY:

LCD (Liquid Crystal Display) displays offer several features that make them a popular choice for a wide range of applications. Here are some key features:

**High Resolution:** LCDs are capable of providing high-resolution images and text, making them suitable for displaying detailed information.

**Wide Viewing Angle:** Many LCDs offer wide viewing angles, allowing users to view the screen clearly from various positions without experiencing significant distortion or colour shift.

**Low Power Consumption:** Compared to traditional cathode ray tube (CRT) displays, LCDs typically consume less power, making them more energy-efficient and suitable for battery-powered devices.

**Thin and Lightweight**: LCDs are thin and lightweight, making them ideal for applications where space and weight are critical factors, such as laptops, tablets, and smartphones.

**Flexible Size and Shape:** LCDs are available in various sizes and shapes, ranging from small screens used in wearable devices to large screens used in televisions and monitors.

**Backlighting Options:** LCDs can be illuminated using various backlighting technologies, including LED (Light Emitting Diode) backlighting, which offers brightness control and energy efficiency.

**Color Options**: LCDs can display images in full colour or grayscale, depending on the display technology and configuration.

**Fast Response Time:** LCDs typically have fast response times, reducing motion blur and ghosting effects during fast-moving scenes in videos and games.

**Durability:** LCDs are often more durable than CRT displays, with no risk of phosphor burn-in and resistance to external impacts and vibrations.

**Integrated Touchscreen:** Many LCDs come with integrated touchscreen functionality, allowing users to interact directly with the display using touch gestures.

**Compatibility:** LCDs can be easily interfaced with various devices, including microcontrollers, computers, and multimedia players, using standard interfaces such as HDMI, DisplayPort, VGA, and DVI.

**Customizable:** LCDs can be customized to meet specific requirements, including screen size, resolution, aspect ratio, and input/output options.

Overall, the combination of high resolution, low power consumption, thin form factor, and versatility makes LCDs a popular choice for a wide range of applications, including consumer electronics, automotive displays, medical devices, industrial control systems, and more.

## LED Bulb:


*Figure 25:LED Bulb*

The lighting emitting diode is a p-n junction diode. It is a specially doped diode made up of a special type of semiconductor. When the light emits in the forward bias, then it is called a light-emitting diode.

**Working:**

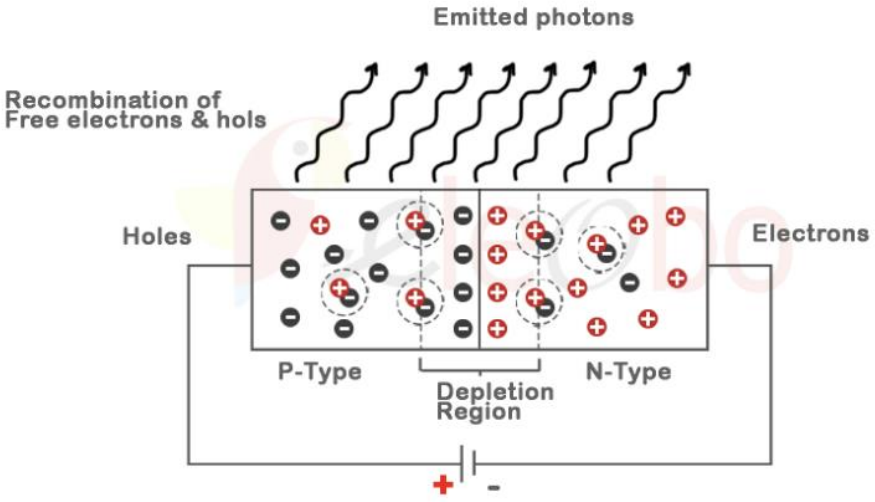



*Figure 26:LED Working*

The light-emitting diode is simply, known as a diode. When the diode is forward biased, then the electrons & holes are moving fast across the junction and they are combined constantly, removing one another out. Soon after the electrons move from the n-type to the p-type silicon, it combines with the holes, and then it disappear. Hence it makes the complete atom & more stable and it gives the little burst of energy in the form of a tiny packet or photon of light.

# CHAPTER 4

# SOFTWARE IMPLEMENTATION

## 4.1 Arduino IDE

### 4.1.1 What is Arduino IDE

The Arduino Integrated Development Environment (IDE) is an open-source software platform used for writing, compiling, and uploading code to Arduino-compatible microcontroller boards. It provides a convenient interface for both beginners and experienced developers to create projects with Arduino hardware.

The Arduino IDE is based on the Processing programming language and the Wiring framework. It features a simple text editor for writing code, along with tools for compiling and uploading code to Arduino boards. Additionally, it includes a built-in library manager for easily adding and managing libraries that extend the functionality of Arduino projects.

Overall, the Arduino IDE serves as a central hub for developing projects with Arduino, making it accessible to hobbyists, students, and professionals alike.

### 4.1.2 Implementation of Arduino IDE

Get the latest version from the download page. You can choose between the Installer (.exe) and the Zip packages. We suggest you use the first one that installs directly everything you need to use the Arduino Software (IDE), including the drivers. With the Zip package, you need to install the drivers manually. The Zip file is also useful if you want to create a portable installation.

When the download finishes, proceed with the installation and please allow the driver installation process when you get a warning from the operating system.

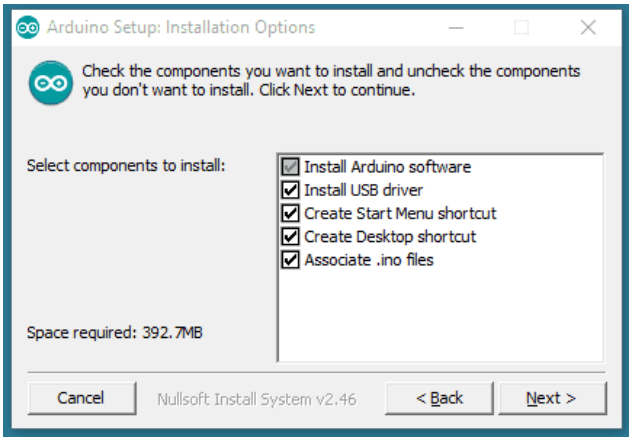



*Figure 27:Choose the components to install.*

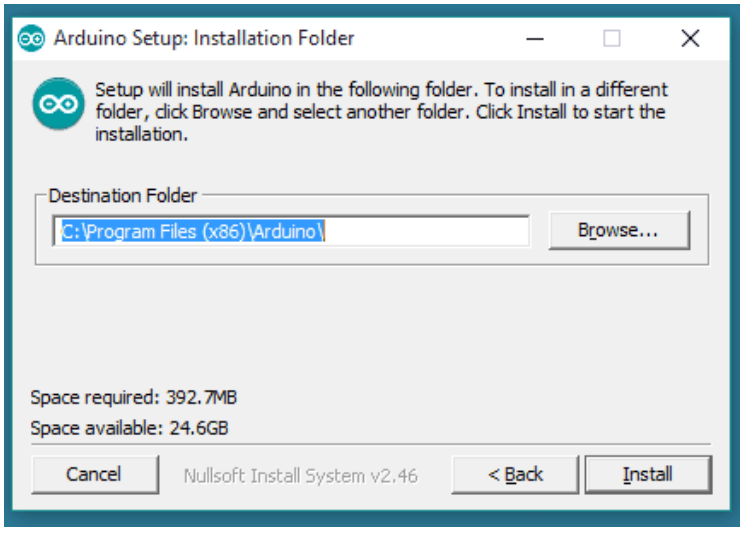



*Figure 28 :Choose the installation directory*

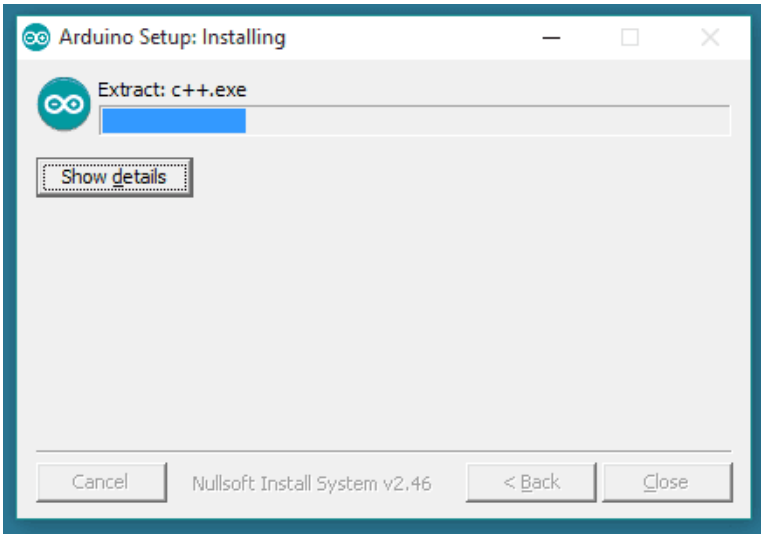



*Figure 29:Installation in progress*

The process will extract and install all the required files to execute properly the Arduino Software (IDE).

## 4.2 Installing ESP32 Add-on in Arduino IDE

To install the ESP32 board in your Arduino IDE, follow these next instructions:

In your Arduino IDE, go to File> Preferences

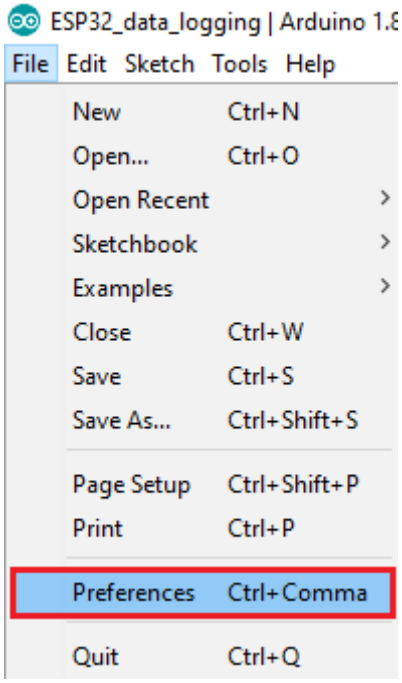



*Figure 30:Preference*

Enter the following into the “Additional Board Manager URLs” field:

https://raw.githubusercontent.com/espressif/arduino-esp32/gh-pages/package_esp32_index.json

Then, click the “OK” button:

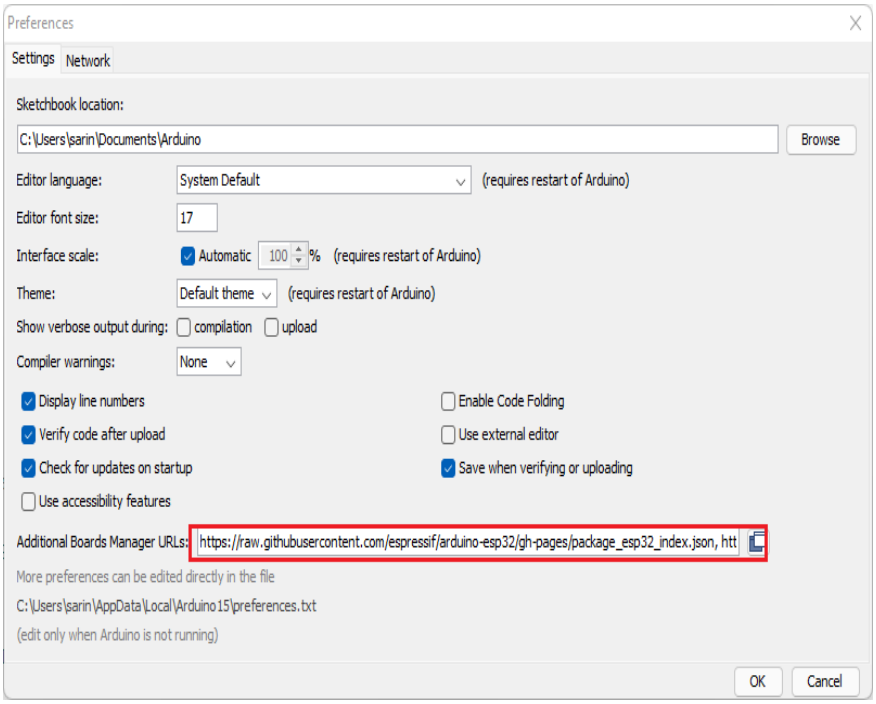



*Figure 31:Managing Additional Boards*

**Note:** if you already have the ESP8266 board URL, you can separate the URLs with a comma as follows:

https://raw.githubusercontent.com/espressif/arduino-esp32/gh-pages/package_esp32_index.json,
http://arduino.esp8266.com/stable/package_esp8266com_index.json

Open the Boards Manager. Go to **Tools** > **Board** > **Boards Manager…**

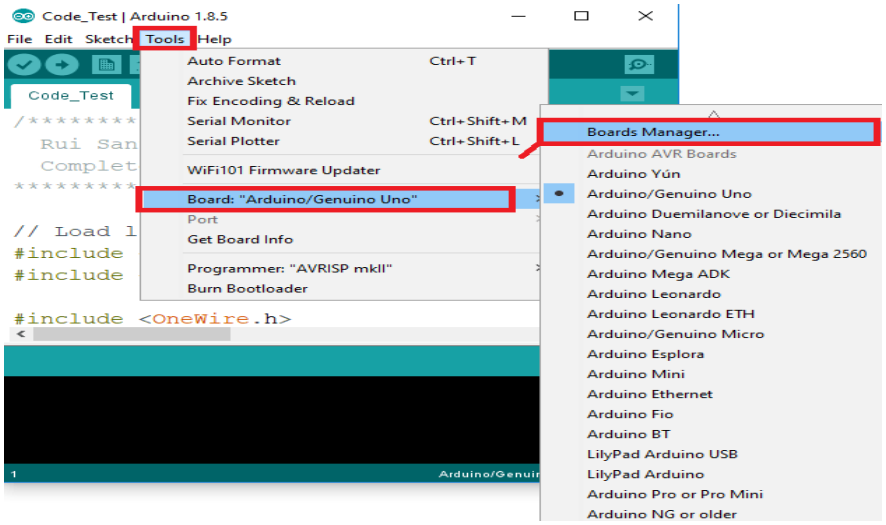



*Figure 32:Searching Board*

Search for **ESP32** and press the install button for the "**ESP32 by Espressif Systems**":

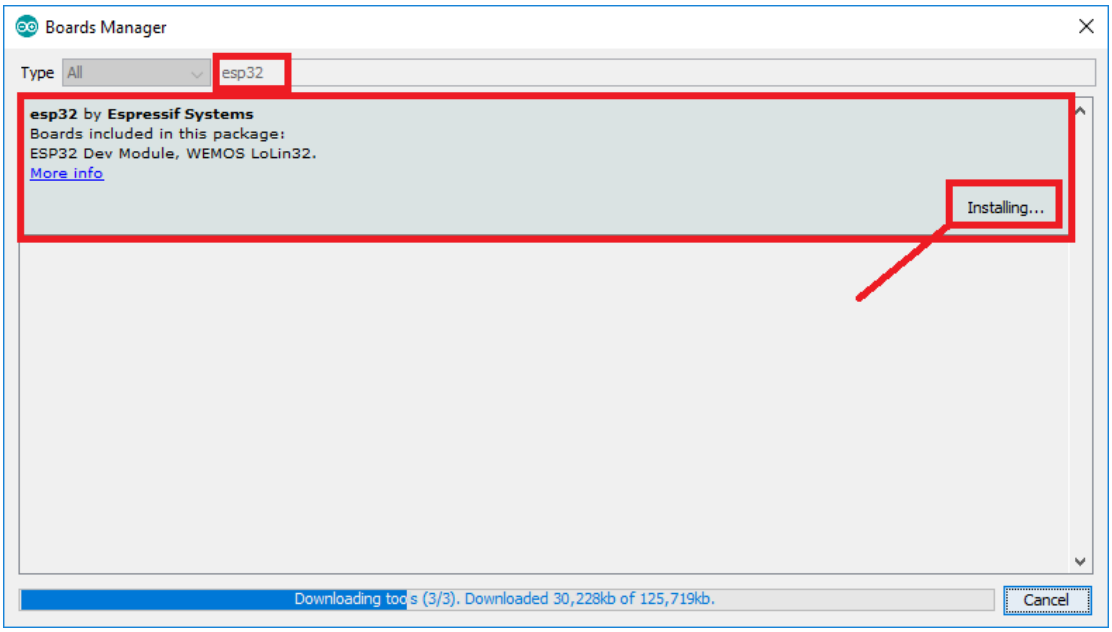



*Figure 33:Installing the Board*

That's it. It should be installed after a few seconds.

### 4.2.1 Testing the Installation

Plug the ESP32 board into your computer. With your Arduino IDE open, follow these steps:

Select your Board in **Tools** > **Board** menu (in my case it's the **DOIT ESP32 DEVKIT V1**)

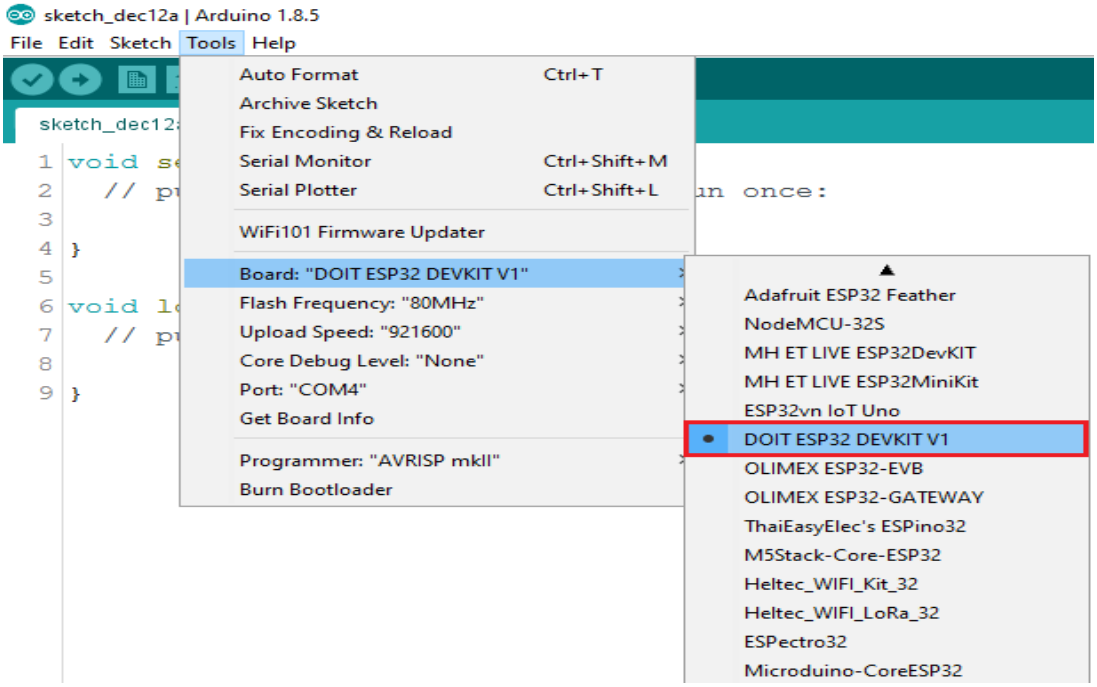



*Figure 34:Selecting the Board*

Select the Port (if you don't see the COM Port in your Arduino IDE, you need to install the CP210x USB to UART Bridge VCP Drivers):

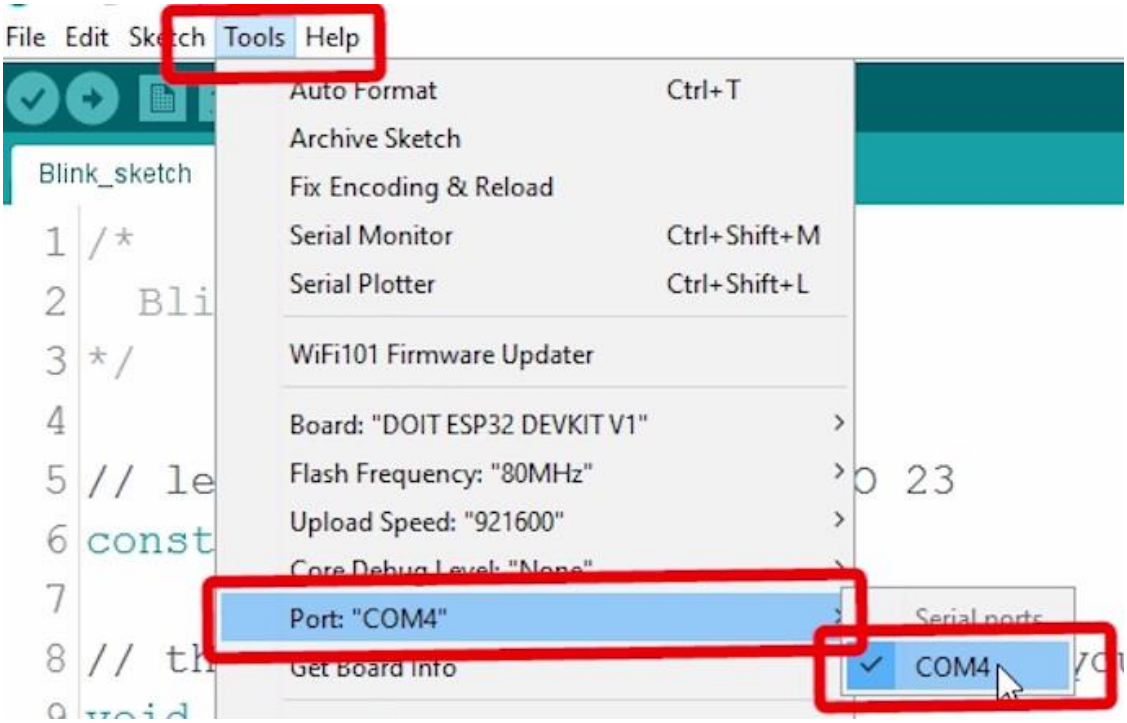



*Figure 35:Selecting the Port*

Open the following example under **File** > **Examples** > **WiFi (ESP32)** > **WiFiScan**

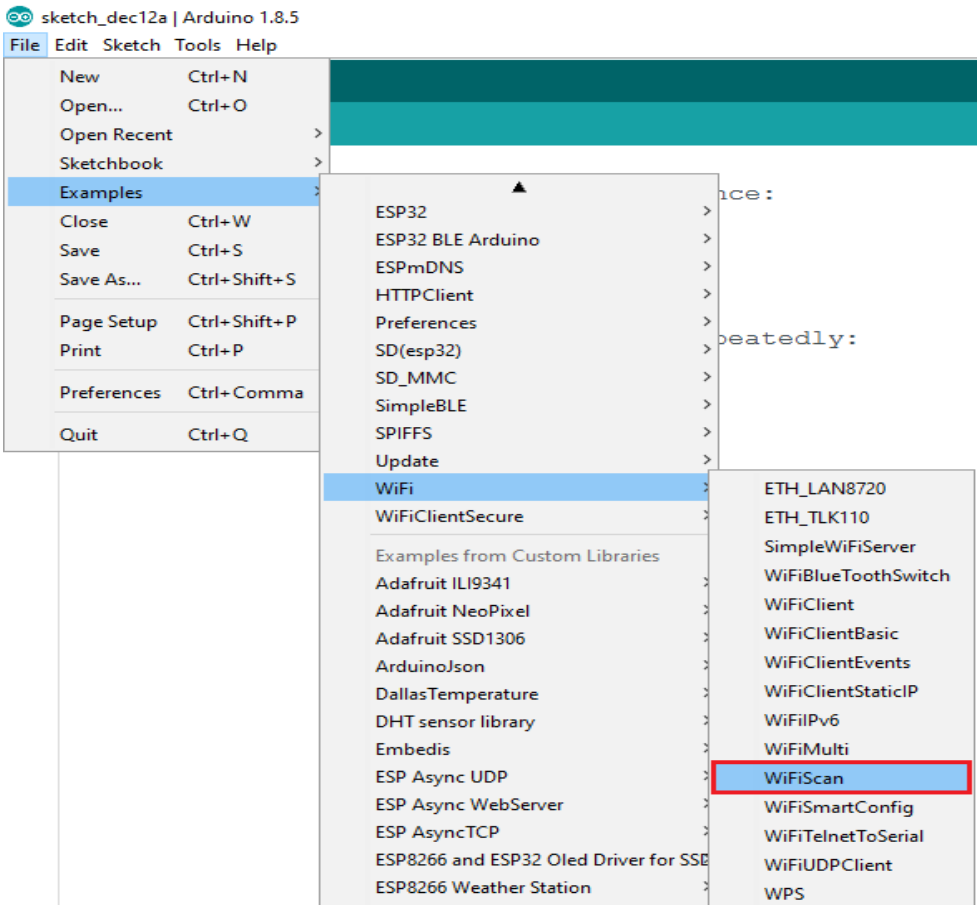
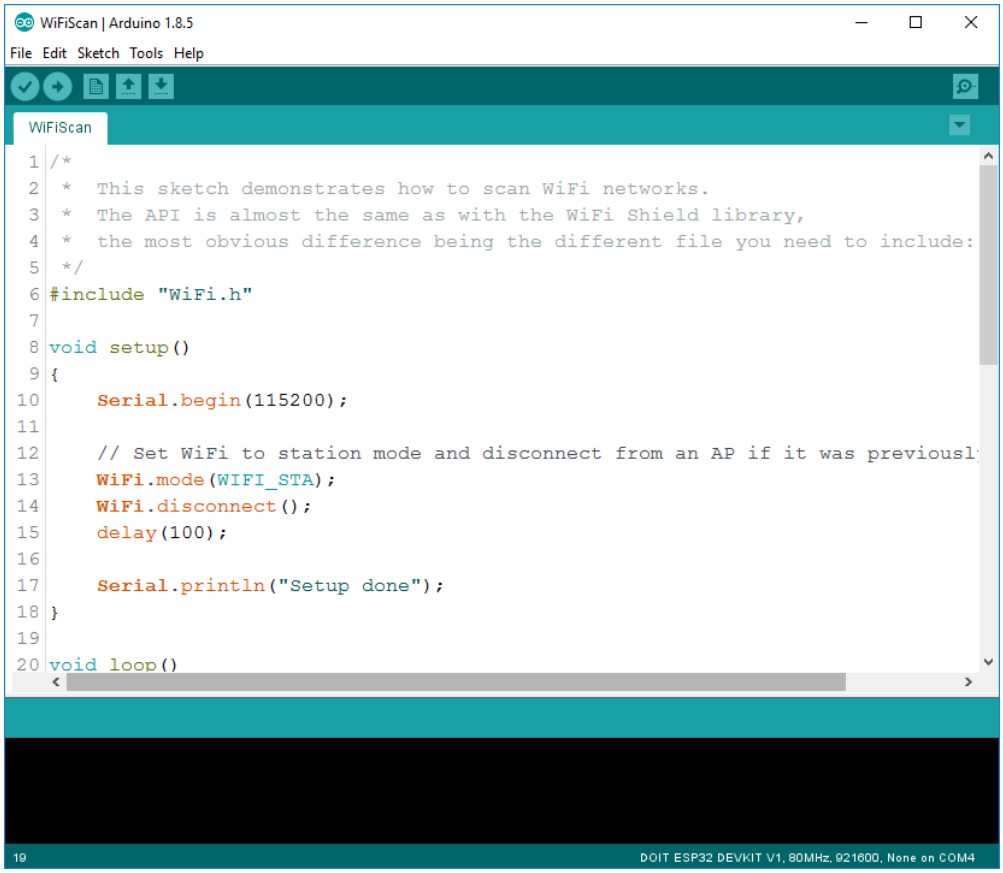



*Figure 36:Texting with the Example*

A new sketch opens in your Arduino IDE:




Press the Upload button in the Arduino IDE. Wait a few seconds while the code compiles and uploads to your board.

*Figure 37:Upload Button*

If everything went as expected, you should see a “Done uploading.” message.

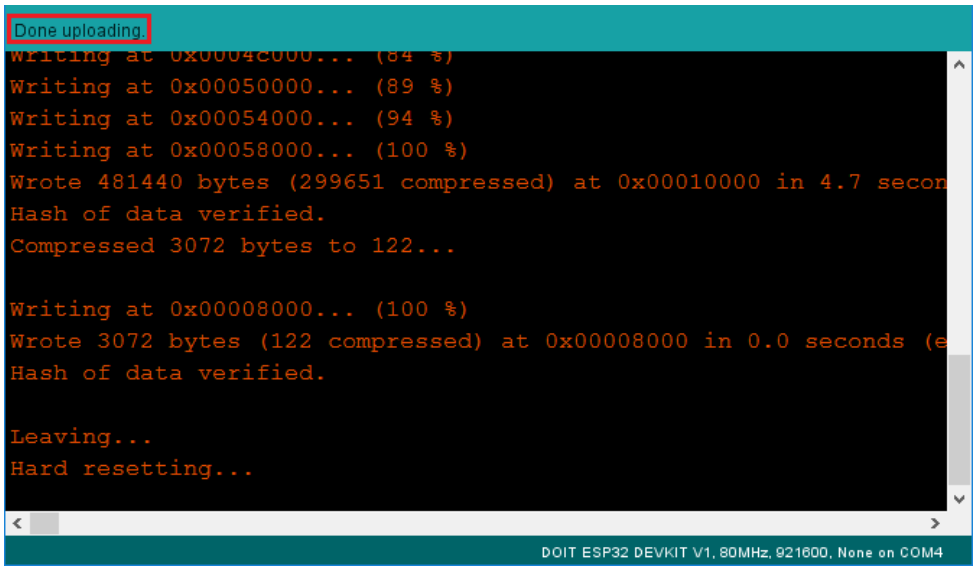



*Figure 38:Uploading Code*

Open the Arduino IDE Serial Monitor at a baud rate of 115200:

*Figure 39:Serial Monitor*

Press the ESP32 on-board Enable button and you should see the networks available near your ESP32:

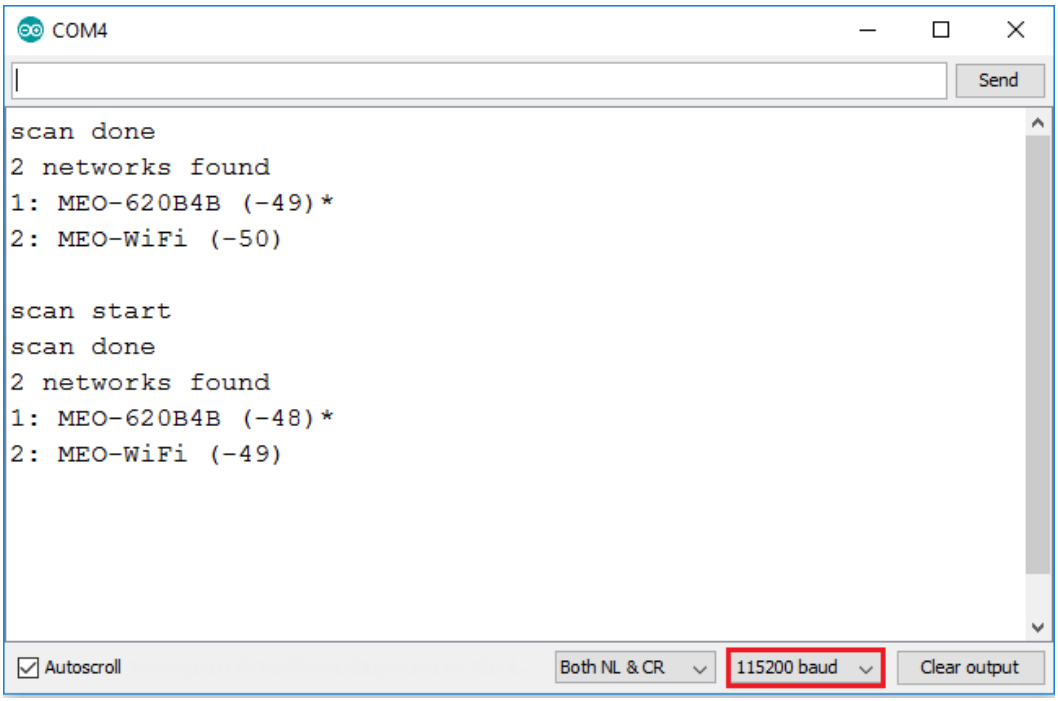



*Figure 40:Output In Serial Monitor*

### 4.2.2 Troubleshooting

If you try to upload a new sketch to your ESP32 and you get this error message "*A fatal error occurred: Failed to connect to ESP32: Timed out... Connecting....* It means that your ESP32 is not in flashing/uploading mode.

Having the right board name and COM port selected, follow these steps:

Hold down the "BOOT" button on your ESP32 board

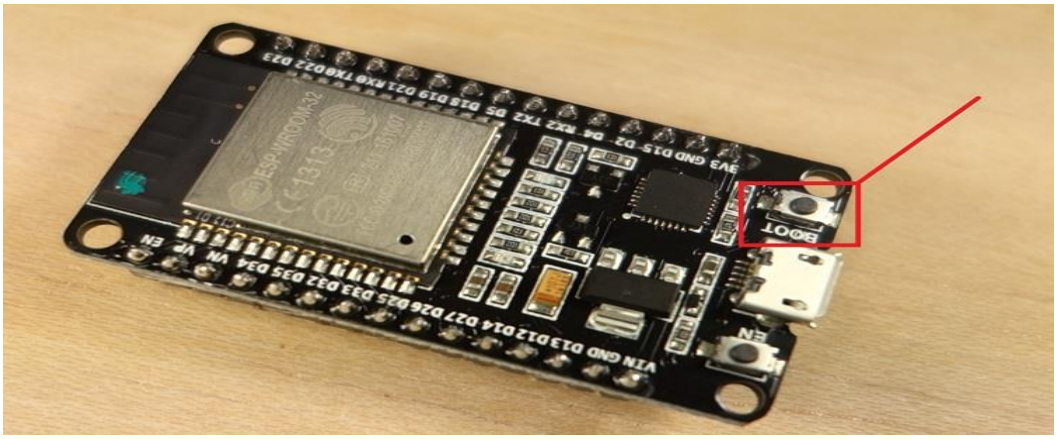



*Figure 41:BOOT Button*

Press the “Upload” button in the Arduino IDE to upload your sketch:

After you see the “Connecting**….**” message in your Arduino IDE, release the finger from the “BOOT” button:

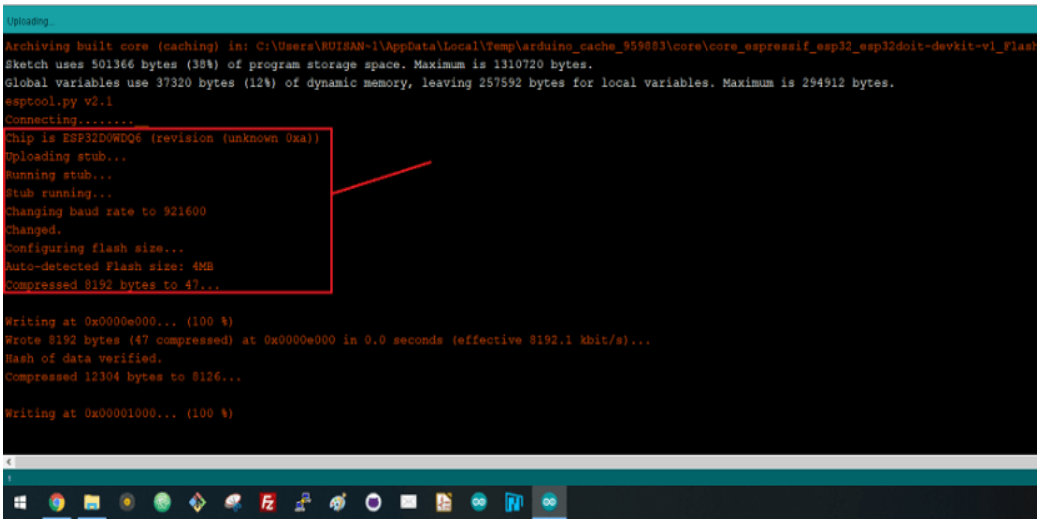



*Figure 42:Compiling Of Code*

After that, you should see the “Done uploading” message

That’s it. Your ESP32 should have the new sketch running. Press the “ENABLE” button to restart the ESP32 and run the newly uploaded sketch.

You’ll also have to repeat that button sequence every time you want to upload a new sketch. But if you want to solve this issue once and for all without the need to press the **BOOT** button, follow the suggestions in the next guide:

[SOLVED] Failed to connect to ESP32: Timed out waiting for packet header

**2)** If you get the error “COM Port not found/not available”, you might need to install the CP210x Drivers:

Install USB Drivers – CP210x USB to UART Bridge (Windows PC)

Install USB Drivers – CP210x USB to UART Bridge (Mac OS X)

## 4.3 Software Implementation of Thingspeak

### 4.3.1 Connect and Send Data to ThingSpeak

Once you have your ESP32 connected to Wi-Fi, you can send data to external services to keep track of them. One of those is ThingSpeak.

In a nutshell, ThingSpeak allows you to send data to their cloud. They'll store it and they visualize it for you in a handy dashboard. It's free if you send less than 3 million messages per year, that's about 8,200 messages per day. That should be sufficient for DIY projects.

### 4.3.2 Creating a channel

To get started you will need to sign up for a free Thingspeak account.

Thingspeak is organized simply: you can create channels that contain data fields. A simple example: if you're building a temperature sensor, you probably want to create 1 channel for your device with two fields: a temperature field and a humidity field.

To create a channel, go to Channels, My Channels and click on "New Channel".

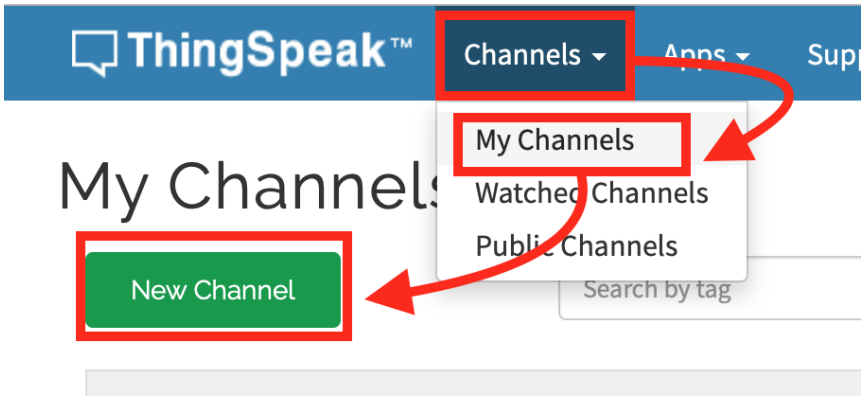



*Figure 43:Channels in Thingspeak*

Name the Channel and select the as per the project requirement, it also sends the current Wi-Fi signal strength. Just so we have some data to visualize.

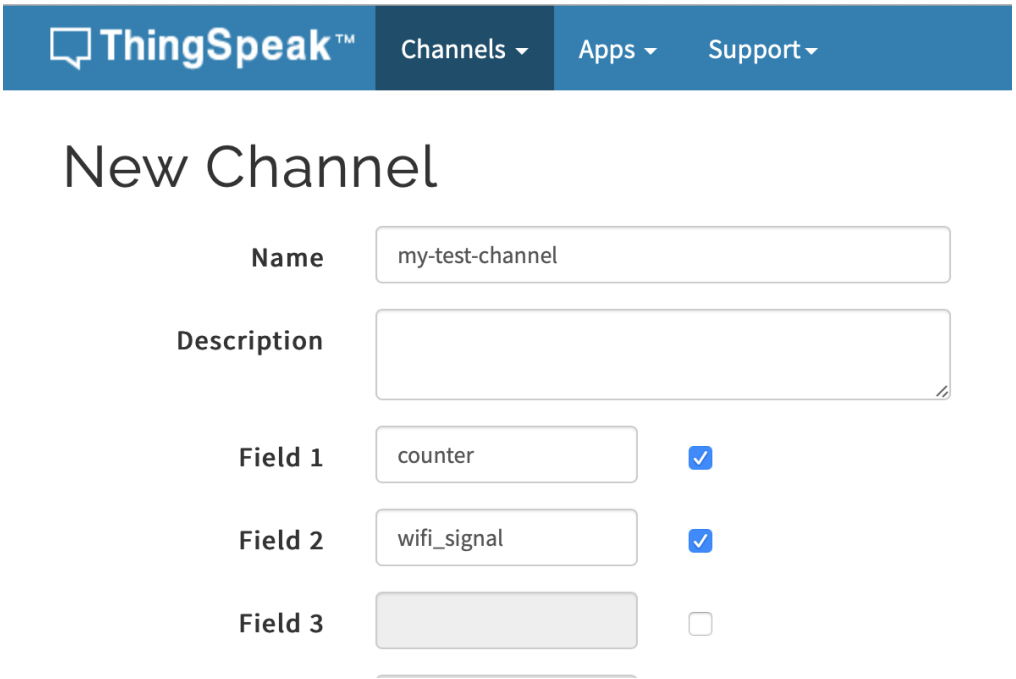



*Figure 44:Fields in Thingspeak*

You can fill out some other details as well as per your requirement of the project, Thingspeak now shows you the dashboard of your channel, with a graph for each of the fields that we just defined, which are counter and wifi_signal.

### 4.3.3 Installing ThingSpeak library

To send sensor readings to ThingSpeak, we'll use the thingspeak-arduino library. You can install this library through the Arduino Library Manager. Go to Sketch > Include Library > Manage Libraries… and search for "ThingSpeak" in the Library Manager. Install the ThingSpeak library by MathWorks.

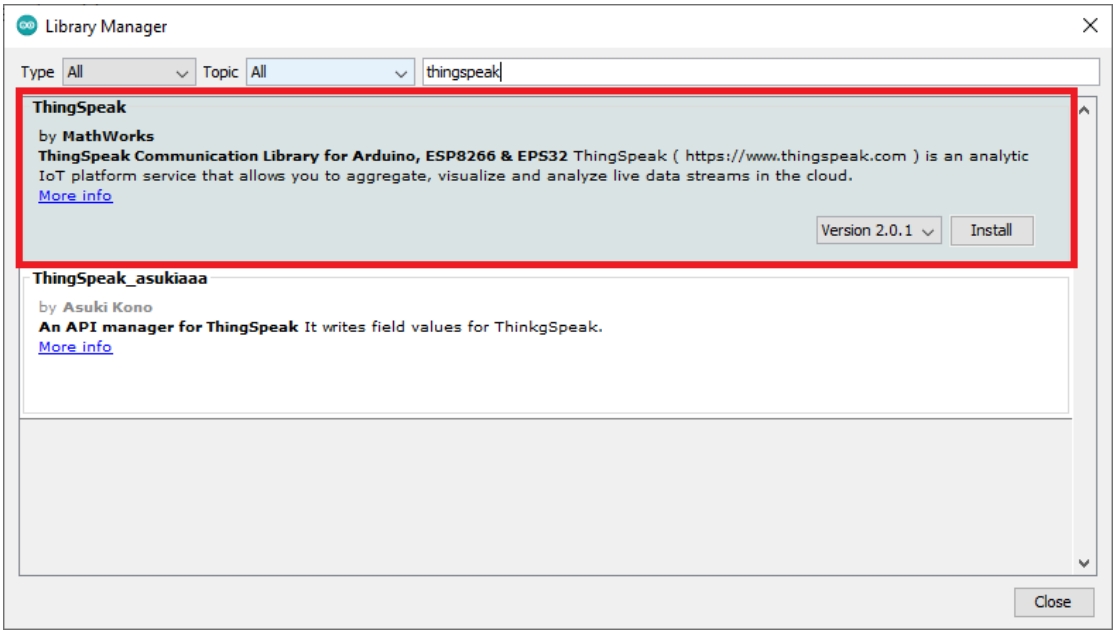



*Figure 45Library For Thingspeak*

### 4.3.4 Sending Data to Thingspeak Cloud

Develop a software code using Arduino IDE to program my ESP32 to send data from sensors to the Thingspeak cloud.

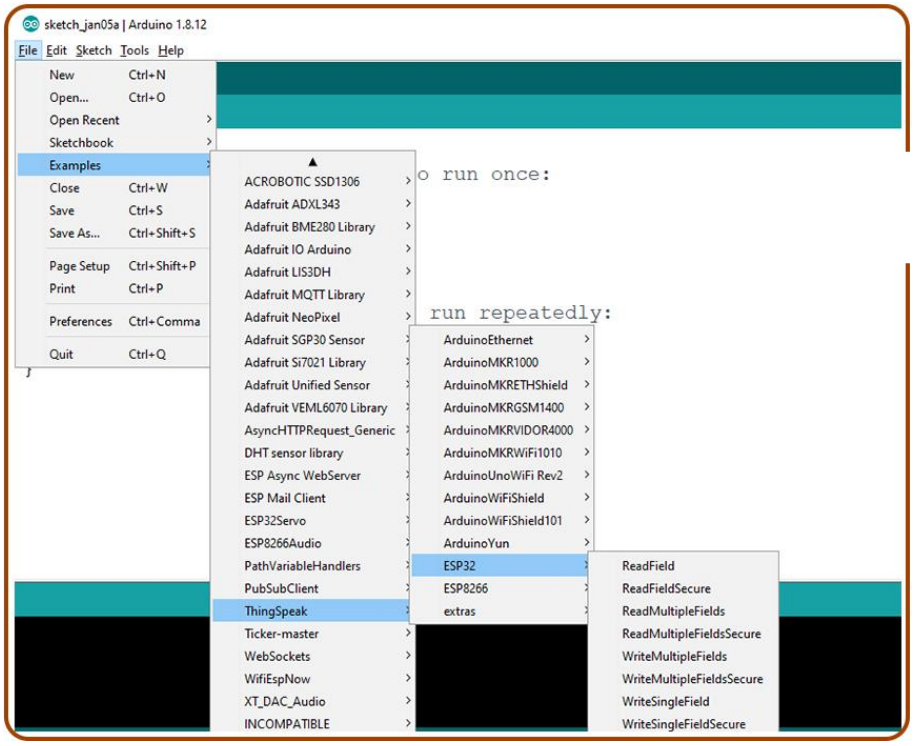



*Figure 46:Example Of Thingspeak*

## Software Implementation of MIT App

### 4.4.1 MIT App Inventor

MIT App Inventor (App Inventor or MIT AI2) is a high-level block-based visual programming language, originally built by Google and now maintained by the Massachusetts Institute of Technology. It allows newcomers to create computer applications for two operating systems: Android and iOS, which, as of 25 September 2023, are in beta testing. It is free and open-source and released under dual licensing: a Creative Commons Attribution ShareAlike 3.0 Unported license and an Apache License 2.0 for the source code. Its target is primarily children and students studying computer programming, similar to Scratch.

The web interface consists of a graphical user interface (GUI) very similar to Scratch and StarLogo, allowing users to drag-and-drop visual objects to create an application that can be tested on Android and iOS devices and compiled to run as an Android app. It uses a companion mobile app named MIT AI2 Companion providing live testing and debugging.


*Figure 47:MIT App Inventor*

App Inventor provides integration with different online services, such as Google Sheets and Firebase.

When creating App Inventor, Google drew upon significant prior research in educational computing, and work done within Google on online development environments.

### 4.4.2 Design of App in MIT App Inventor

Designing an app in MIT App Inventor involves creating the user interface (UI) and programming the app's behaviour using a visual block-based programming approach.

**Start a New Project:**

Log in to MIT App Inventor and start a new project. Give it a meaningful name.

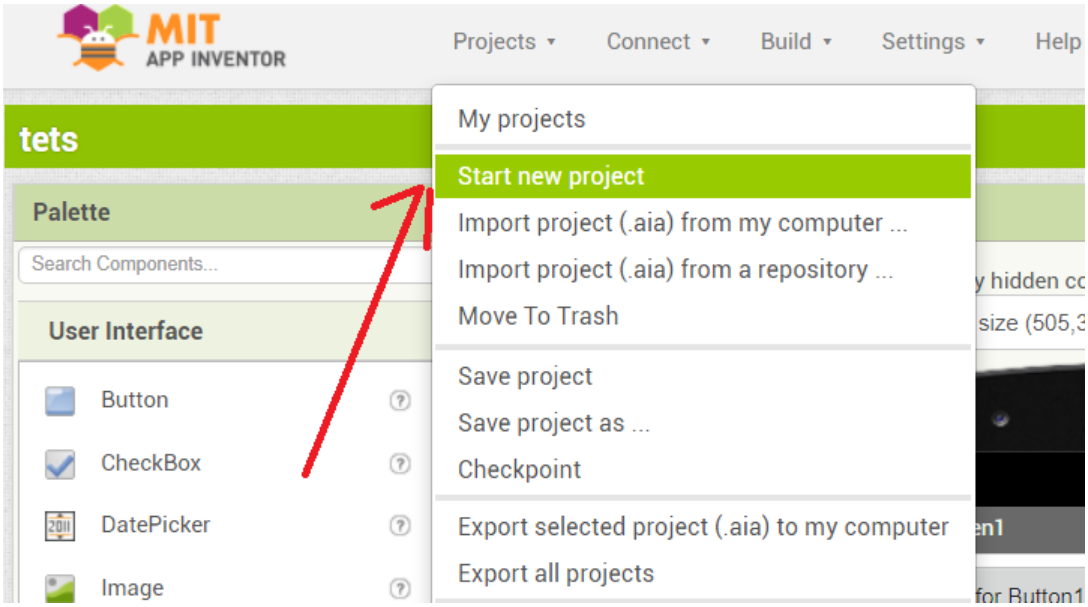



*Figure 48:Project in MIT App*

**Design the User Interface:**

Palette: In the Designer view, use the Palette on the left side to select components to add to your app's UI. Components include Buttons, Labels, text boxes, Sliders, and Charts, among others.

Drag and Drop: Drag and drop components from the Palette to the Viewer in the middle of the screen to create the UI layout. Arrange the components as desired.

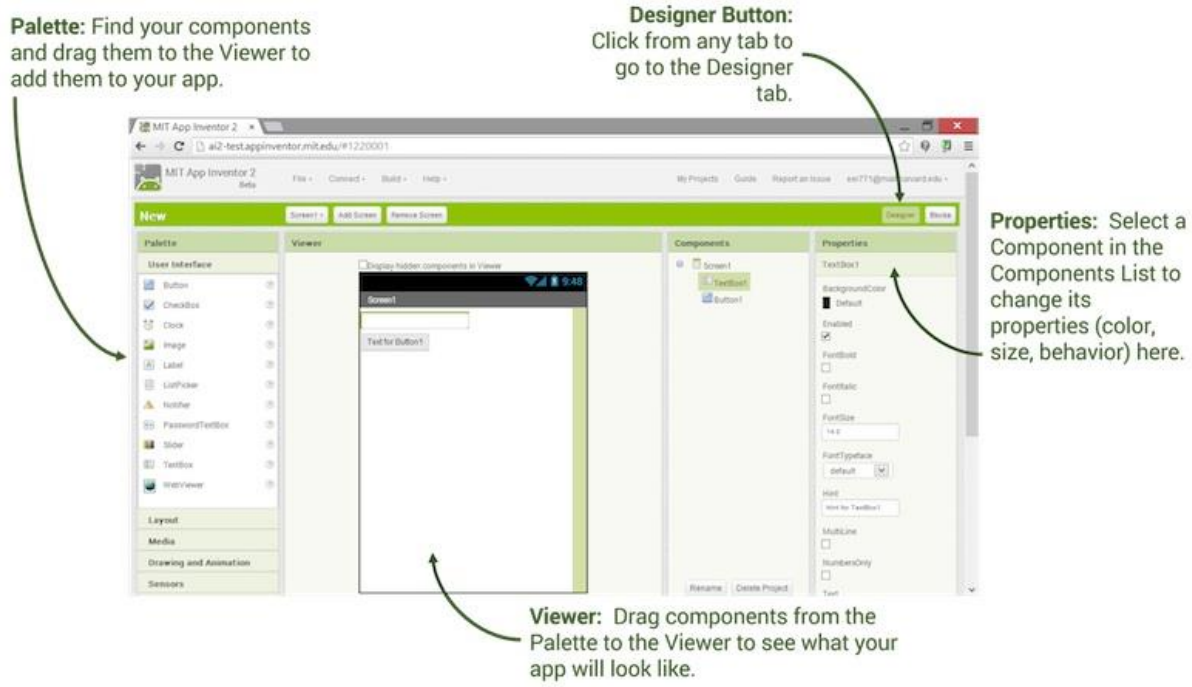



*Figure 49:User interface in MIT App*

Properties: On the right side, the Properties panel allows you to customize the appearance and behaviour of each component (e.g., text, colour, font size, etc.).

Layouts: Use layout components (e.g., Horizontal Arrangement, Vertical Arrangement, Table Arrangement) to organize other components within your app's UI.

**Add Components:**

User Interface: Add UI components such as Labels to display text, Buttons for user interaction, text boxes for user input, etc.

Media: Add media components such as Sound, Video Player, or Image components if your app needs to handle multimedia content.

Drawing and Animation: Add components such as Canvas for custom graphics and animations.

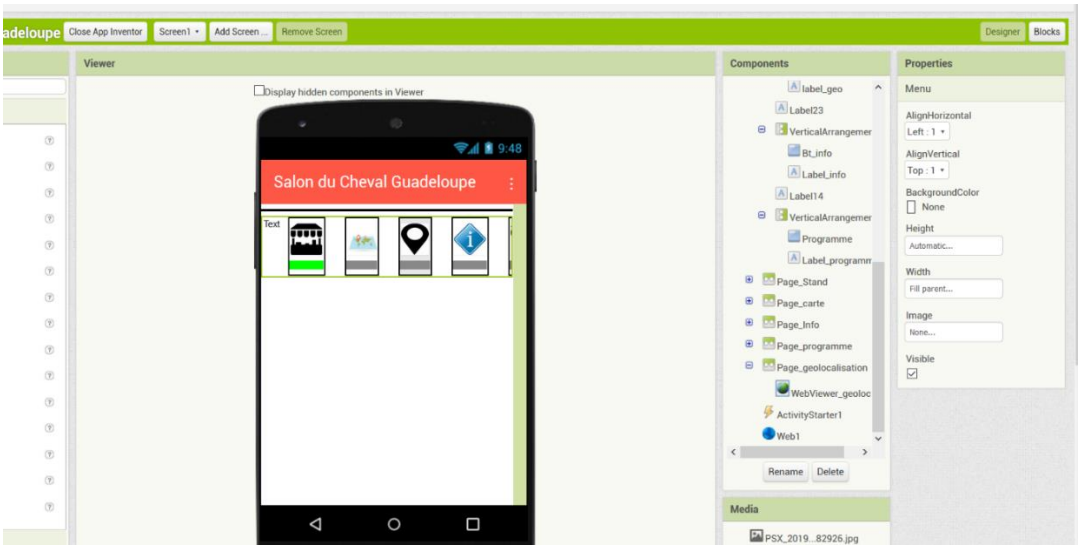



*Figure 50:Components in MIT App*

**Add Web Components:**

Add web components like the Web Viewer or Web API to interact with external web services like ThingSpeak. These components allow you to make HTTP requests to fetch or send data.

**Program App Behaviour:**

Switch to Blocks Editor: In the Blocks view, program your app's behaviour using visual blocks.

Blocks: Drag and connect blocks representing different functions, logic, and data manipulation tasks.

Events: Handle events like Button clicks or data received from a web request.

Control Logic: Use control blocks (e.g., if, while, for) to create the app's logic flow.

Data Handling: Use data blocks to process, manipulate, and display data.

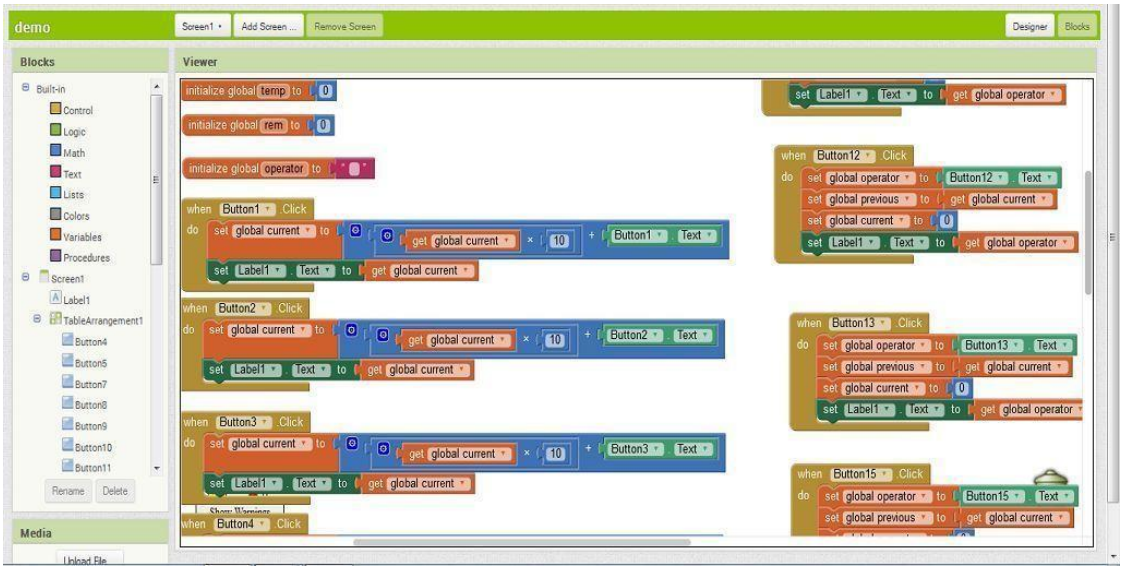



*Figure 51:Codes for MIT App*

**Test and Debug:**

Live Testing: Use the Companion app to test your app live on a device.

Debugging: Check for errors and unexpected behaviour in your app. Debug using the Blocks Editor and the Companion app.

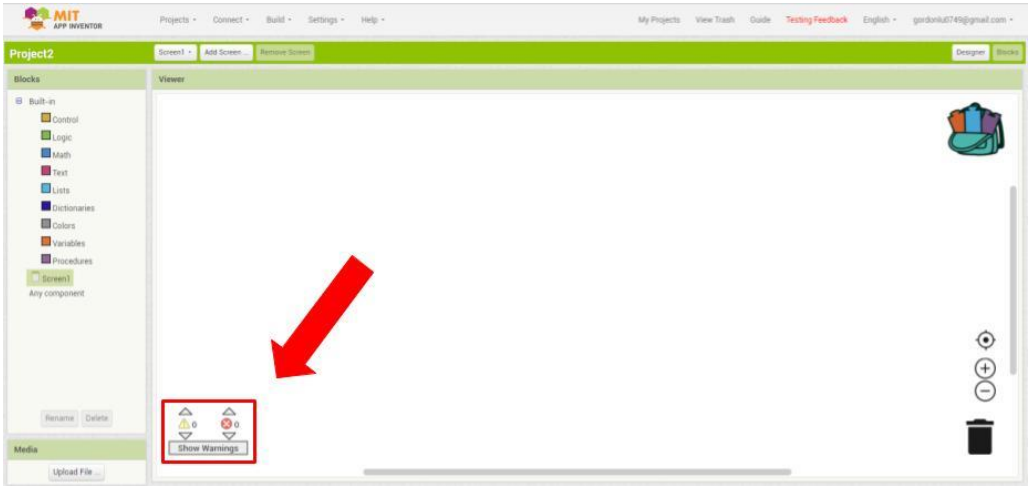



*Figure 52:Testing in MIT App*

**Finalize and Export:**

Once your app works as intended, finalize your design and blocks.

Export the app as an APK file to install and run on Android devices.

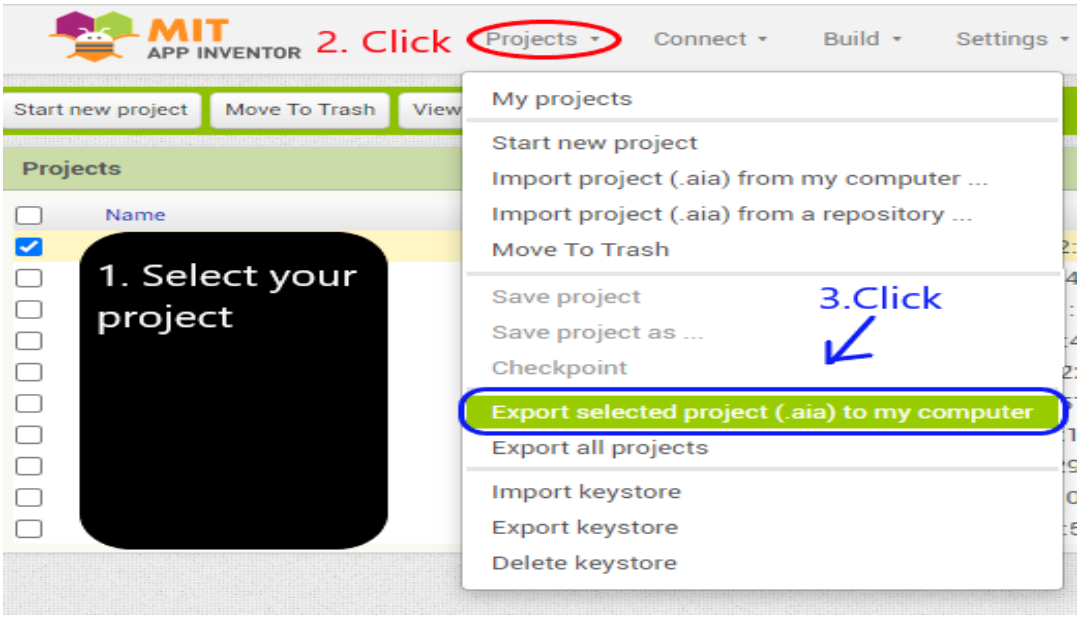



*Figure 53:Exporting of MIT App*

# CHAPTER 5

# IMPLEMENTATION:

# Simulation and Implementation of ESP 32 and Arduino uno with Sensors:

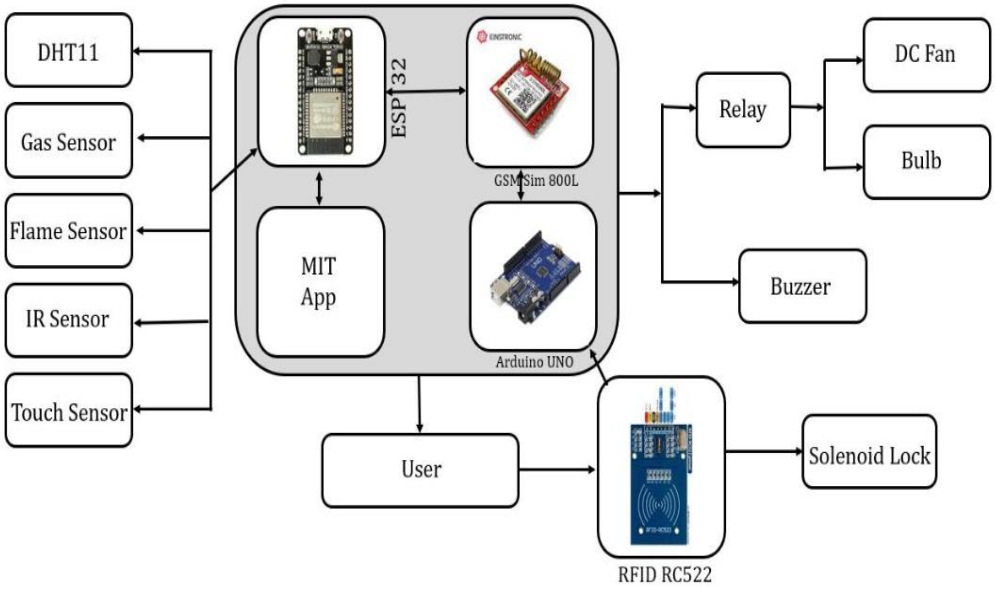



*Figure 54:Block Diagram*

## 4.2 Interfacing of ESP 32 with Mobile Application

### 4.2.1 Interfacing with MIT APP

**Set Up a ThingSpeak Account:**

Go to the ThingSpeak website and create a free account. Create a new channel and set up the fields for your flex sensors. For example, you can set up 5 fields to store the data from each of the 5 flex sensors, Once the channel is created, take note of the Channel ID and Write API Key.

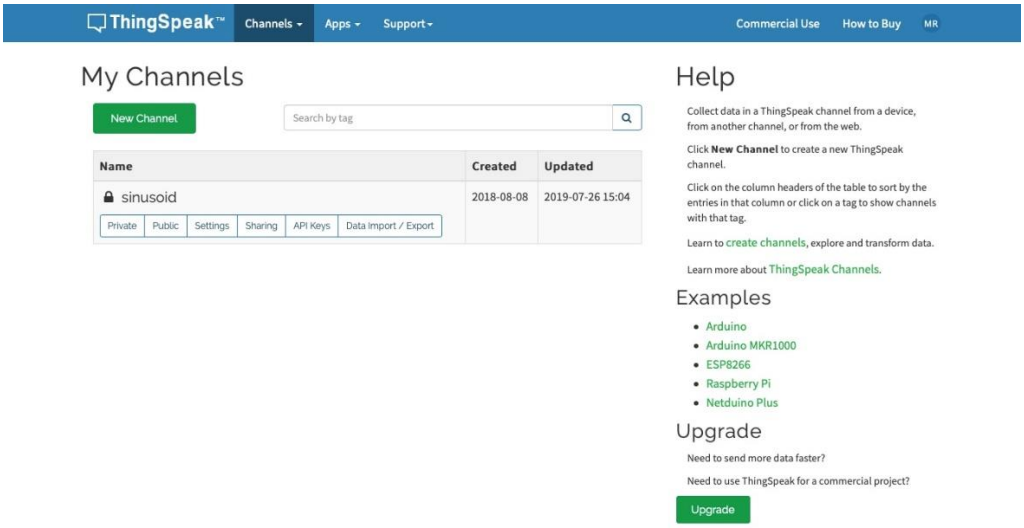



*Figure 55:Creating Channels*

**ESP32 Code:**

In your ESP32 code, you need to include libraries for Wi-Fi and HTTP requests and connect the ESP32 to your Wi-Fi network in the setup function. In the loop function, read the sensor values and send them to ThingSpeak using an HTTP POST request.

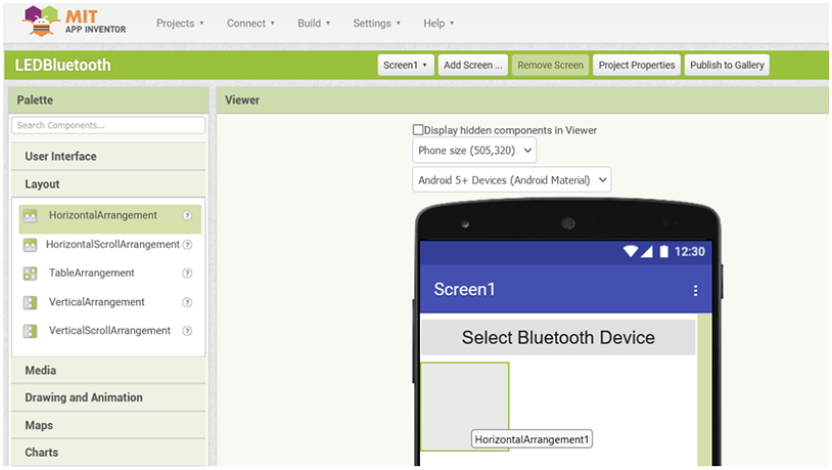



*Figure 56:Creating User Interface in MIT App*

**MIT App Inventor:**

In MIT App Inventor, create a new project and add a Web component to your project, then configure the Web component with the base URL. Add buttons or labels to fetch and display the data from ThingSpeak to Retrieve Data from ThingSpeak in MIT App Inventor. In the blocks editor, use the Web component to make a GET request to the ThingSpeak API URL. Display the values in your app.

**RFID Reader:**

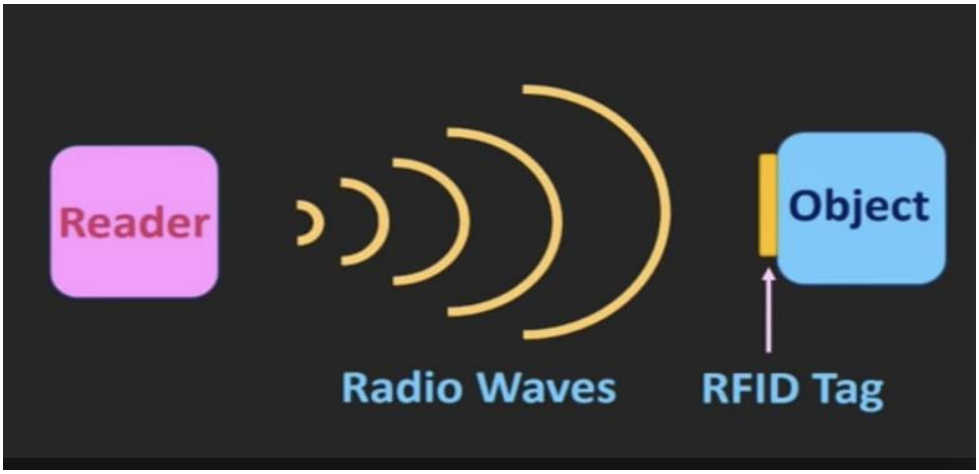



*Figure 57:RFID Reader*

It is a device that consists of an antenna, a transceiver and a decoder.

Transceiver: It can be used either as a transmitter or a receiver. It consists of an oscillator to generate a continuous signal which is modulated to a required frequency and then transmitted into air through an antenna.

Antenna: It is a device that converts the electrical signal into an electromagnetic signal which is efficient in propagating the signal in the air.

Decoder: When an RF signal is detected at the antenna from a tag, the decoder helps in retrieving the data.

**RFID Tag:**

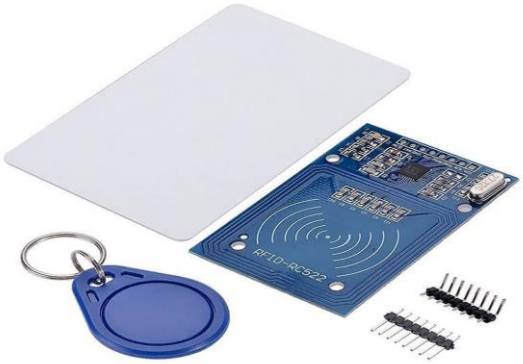


*Figure 58:RFID Tag*

It consists of 2 components (in the case of a passive tag). They are microchips and an antenna. You can learn more about RIFD Tags here.

**Microchip:** It is a semiconductor device that consists of a circuit etched in it with some KB of memory storage, capable of storing data and transmitting it whenever needed.

**Antenna**: It is used to transmit the data that is present in the chip into the air so that it can be detected by a reader. In case of an active tag, it consists of a Microchip, battery and an antenna.

### 4.2.2.Methodology:

**Needs Assessment:**

Understand the specific requirements and preferences of the homeowners, such as the size of the property, number of rooms, desired features, and security concerns.

**Research and Planning:**

Explore available technologies and products in the market, considering factors like compatibility, reliability, scalability, and cost-effectiveness.

**System Architecture**:

Design the overall architecture of the system, including components like sensors, actuators, controllers, communication protocols, and user interfaces.

**Hardware Selection:** Choose the appropriate hardware components based on the system requirements, considering factors like sensor types (motion, door/window, smoke, etc.), cameras, smart locks, lighting controls, and central processing units.

**Software Development:** Develop the necessary software components for controlling and monitoring the system, including firmware for devices, server-side applications, mobile apps, and web interfaces.

**Integration:** Integrate all hardware and software components into a unified system, ensuring seamless communication and interoperability among different devices.

**Installation:** Install the hardware components throughout the home according to the system design, ensuring proper placement and connectivity.

**Configuration and Calibration**: Configure and calibrate the system settings, including device parameters, automation rules, user preferences, and security settings.

**Testing and Debugging:** Conduct comprehensive testing of the system to ensure functionality, reliability, and security, addressing any issues or bugs that arise during the testing phase.

**Training and Documentation:** Provide training to the homeowners on how to use the system effectively and provide comprehensive documentation, including user manuals and troubleshooting guides.

**Maintenance and Support:** Offer ongoing maintenance and support services to address any issues, update software/firmware, and expand the system as needed over time.

# CHAPTER 6

# RESULTS:

## Result of Thingspeak Cloud from sensors:

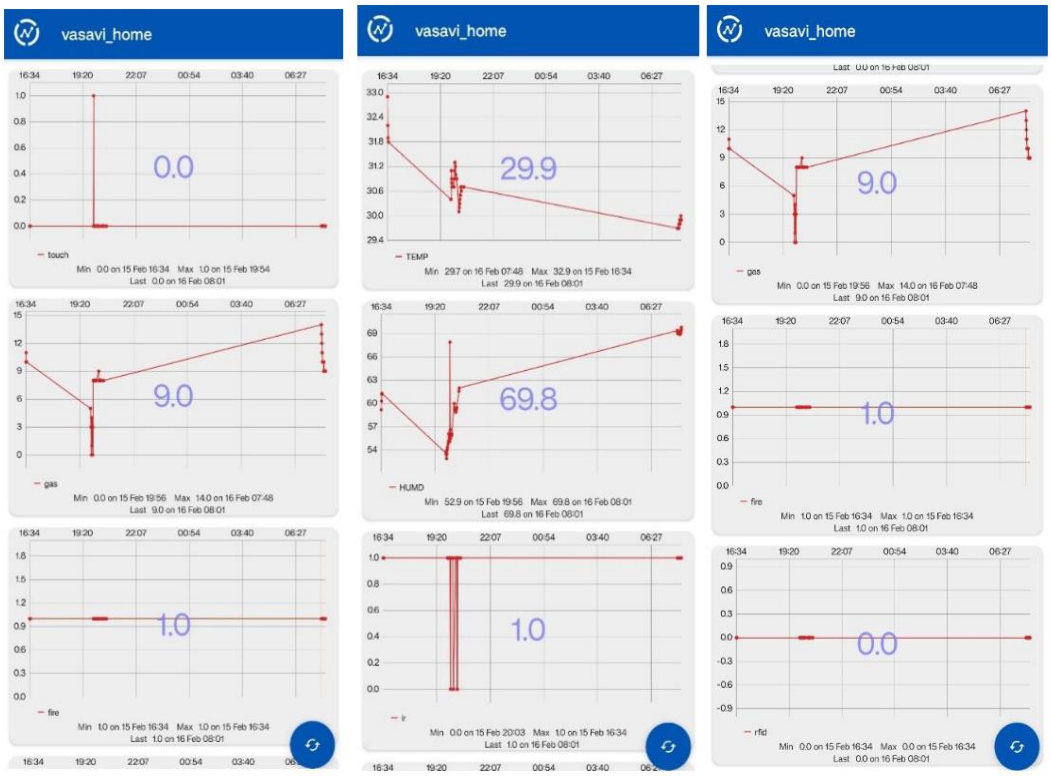



*Figure 59:Output Readings in Thingspeak*

- This application is used to track the readings from the sensors( Ir Sensor,DHT11,Flame Sensor, Gas Sensor, Touch Sensor, Solenoid Lock,RfID )placed In the ESP32.The Received data shown in Graphical form.

## Result of MIT App:

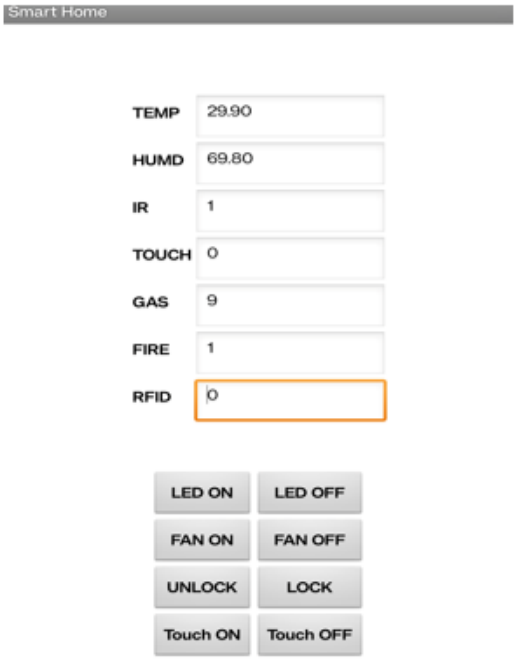



*Figure 60:Output in MIT App*

- By using MIT app inventor we invented a application called Smart Home Which is used to control and monitor the appliances and sensor information. We can able to control appliances when wifi connected to same wifi at a time( like Light, Fan ,Door Lock and Touch Sensor used to Prevent unknown touches when user went out from the House this feature enchances the additional security to the important things).

## Result (Message and Call Alert):

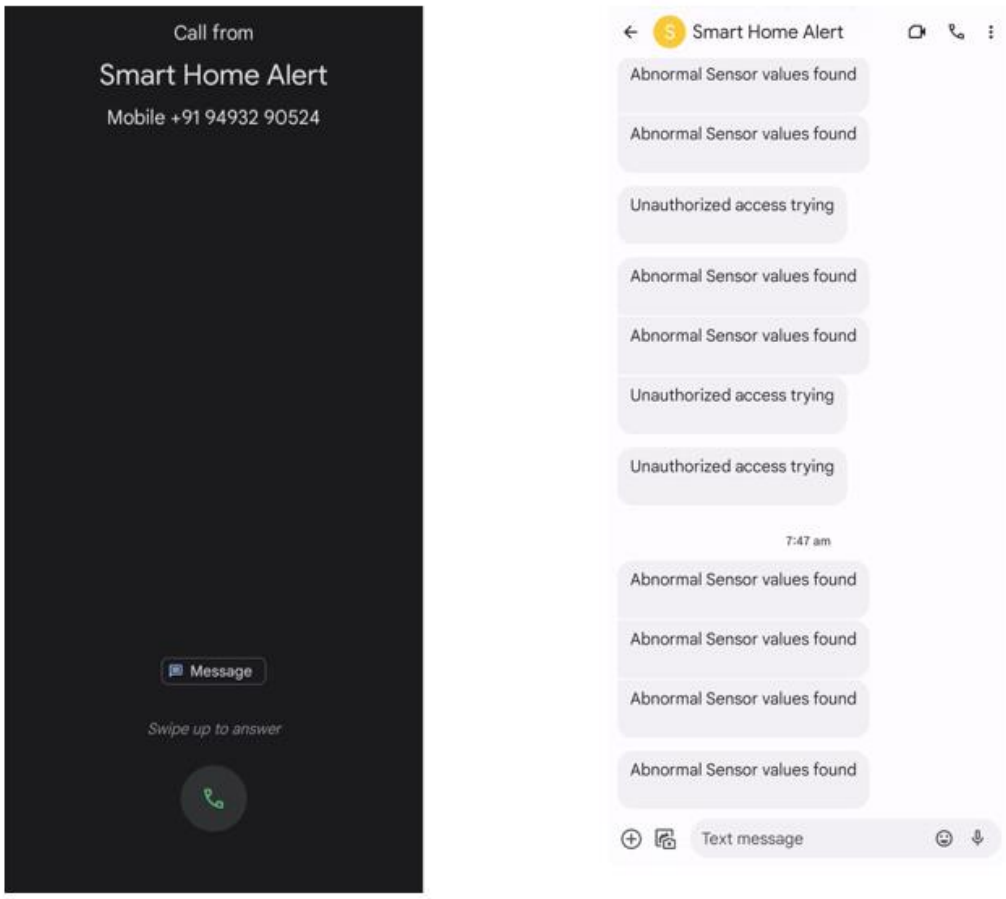



*Figure 61:Alerting Through call and Message*

- When RFID Detects any fake card and fire Sensor , IR sensors detects any abnormal sensor values the buzzer will alert and by providing the additional security and safety of the user.We implemented a GSM module to send the Massage and Call Alerts to the user.

## Prototype:

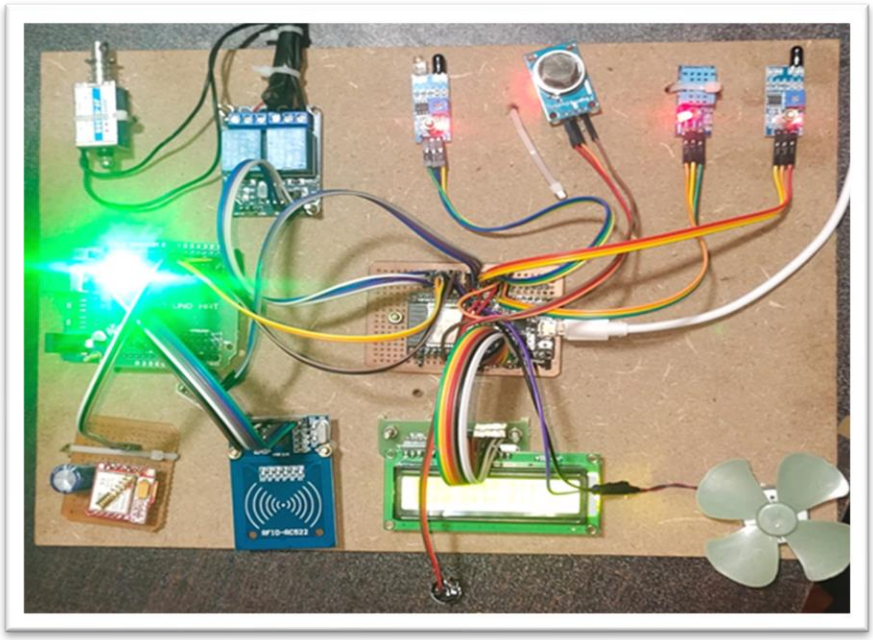


*Figure 62:Prototype*

- The Above Figure Shows that Integrated of Both Home Automation and Home Security By Implementing the Various Sensors in to the Prototype. Which Provides the additional Security and Safety to the user and also user can able to Monitor And Control.
- The Appliances From Any where While Connected to the same WIFI and this is user Friendly and Provides Peace of Mind to the User.

# CHAPTER 7

## 7.1Future Scope:

The future scope of our IoT-Based Home Automation and Security System is promising and encompasses several avenues for enhancement. Firstly, incorporating advanced machine learning algorithms could enable the system to learn and adapt to user preferences over time, optimizing energy consumption and automation responses. Integration with emerging IoT protocols and technologies, such as 5G connectivity, could enhance the system's speed and reliability. Exploring the potential integration of voice recognition and natural language processing interfaces could further enhance user interaction and accessibility. Additionally, expanding the system's compatibility with a wider array of smart devices and platforms would contribute to its interoperability. Enhancing security features through biometric authentication or blockchain technology could elevate the system's robustness against cyber threats. Collaborations with energy providers could lead to the development of dynamic energy management features, allowing users to optimize electricity consumption based on real-time utility data. Furthermore, potential partnerships with home insurance providers could leverage the system's security features for potential discounts or incentives. In the evolving landscape of smart homes, our project paves the way for ongoing research and development, positioning itself as a foundation for innovations in the realm of home automation and security. Continuous updates and adaptations to emerging technologies will ensure that our system remains at the forefront of the smart home revolution..

## 7.2Conclusion:

In conclusion, our IoT-Based Home Automation and Security System has successfully integrated cutting-edge technologies like Node MCU and a diverse range of sensors to create a responsive and secure living environment. The project's

robust methodology ensured effective communication between devices, enabling users to remotely control home appliances and monitor security. With a user-friendly mobile application and emphasis on scalability, our system not only enhances convenience and energy efficiency but also lays the ground work for the future evolution of smart homes. Overall, the project represents a significant stride towards creating intelligent, connected living spaces that prioritize both efficiency and security. Moreover, our project's implementation of security features, including intrusion detection and real-time alerts, enhances the safety of the smart home ecosystem. The integration of a variety of sensors, such as DHT series for environmental monitoring and PIR motion sensors for security, contributes to the system's versatility. Through meticulous testing and refinement, we have ensured the reliability of the entire system under diverse conditions. The deployment of our system has garnered positive user feedback, highlighting its seamless functionality and ease of use. Additionally, the scalability of the project allows for future expansions, accommodating emerging IoT technologies and evolving user needs.

## 7.3 References:

[1] Navjot Rathour, Monika, Vivek Kumar, Sankha Subhra Kundu, Yash Gehlot, Aditya Gurung "Sigma- Home: An IoT-Based Home Automation Using Node MCU", 2023 2nd International Conference on Edge Computing and Applications.

[2] Vivek Kadiyan, Mandeep Singh, Adarsh Kumar, Ashu Saini, Himanshu Singh "Smart Home Automation System based on IoT", May 2023, International Journal for Scientific Research in Engineering and Management, Volume 07, Issue 05.

[3] Pavan Kumar Sattaru, Khasim Vali Burugala, Rajasree Channagiri, S. Kavitha "Smart Home Security using IoT and ESP8266", 2023 5th International Conference on Smart Systems and Inventive Technologies (ICSSIT), 14 March 2023.

[4] M H Hemanth Kumar, Ravi Pratap Singh, Nishu Sharma, Pragya Singh "IoT Based Smart Security System Using Arduino", Journal of Emerging Technologies and Innovative Research, August 2021, Volume 8, Issue 8.