IOT based Gas Leakage Detection System

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INNOVATION AND DESIGN THINKING FOR ELECTRONICS ENGINEERS

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BONAFIDE CERTIFICATE

Certified that this project report titled **"IOT based Gas Leakage Detection System"** is the bonafide work of "**Hemanth. R (190801064), Manikandan. R (190801099) & Hariprasad. R (190801504)"** who carried out the project work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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ABSTRACT

There have been many incidents like explosions and fire due to LPG gas leakage. Such incidents can cause dangerous effects if the leakage is not detected at an early stage. Arduino and IOT based LPG leakage detection system is a project which will help in determining gas leakage in the surrounding and send data to an IOT module. Internet of Things (IoT) is the networking of 'things' by which physical things can communicate with the help of sensors, electronics, software, and connectivity. These systems do not require any human interaction and same is the case with IOT based gas detection system, it does not require human attention.

In the proposed system, the sensor which is used to sense many gases is MQ-2 sensor. After the detection of leakage in the gas, the sensor sends the signal to the Arduino UNO for the further process where other hardware components are connected to each other. Through Arduino UNO, it sends the signal to the LCD display for displaying the alert message as GAS Detected, accordingly, the buzzer be on so that the surrounding people will the alerted. When the gas/air level in a room exceeds 50, the detection system's buzzer and servo motor will be activated. With the use of the IFTTT (If That Then This) services, user will receive the message via Node MCU.

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CHAPTER 1
INTRODUCTION

Gas leakage is a serious problem and nowadays it is observed in many places like residences, industries, and vehicles like Compressed Natural Gas (CNG), buses, cars, etc. It is noticed that due to gas leakage, dangerous accidents occur. The Liquefied petroleum gas (LPG), or propane, is a flammable mixture of hydrocarbon gases used as fuel in many applications like homes, hostels, industries, automobiles, and vehicles. When a leak occurs, the leaked gases may lead to an explosion. Gas leakage leads to various accidents resulting in both material loss and human injuries. Home fires have been occurring frequently and the threat to human lives and properties has been growing in recent years. The number of deaths due to the explosion of gas cylinders has been increasing in recent years.

The Bhopal gas tragedy is an example of accidents due to gas leakage. On the night of December 2, 1984, chemical, Methyl Isocyanate (MIC) spilt out from Union Carbide India Ltd.'s (UCIL's) pesticide factory turned the city of Bhopal into a colossal gas chamber. It was India's first major industrial disaster. At least 30 tons of methyl isocyanate gas killed more than 15,000 people and affected over 600,000 workers. Bhopal gas tragedy is known as world's worst industrial disaster.

Recently, the Visakhapatnam gas leak, also referred to as the Vizag gas leak, was an industrial accident that occurred at the LG Polymers chemical plant in the R. R. Venkatapuram village of the Gopalapatnam neighborhood, located at the outskirts of Visakhapatnam, Andhra Pradesh, India, during the early morning of 7 May 2020. The resulting vapor cloud spread over a radius of around 3km (1.86 mi), affecting the nearby areas and villages. As per the National Disaster Response Force (NDRF), the death toll was 11, and more than 1,000 people became sick after being exposed to the gas. In order to address these issues, a low-cost advanced sensor-based gas leakage detector, alert and control system is proposed and discussed.

1.1 Objectives

The detection of LPG is done by using Arduino and the alert is given using GSM module. In addition to the existing work, control of the harmful gas leakage is done. A working prototype is built, which has the ability to detect the gas leakage and to control the regulator automatically.

Some of the safety actions which are the implementation of alarm system to alert users like, an alarm which triggers as soon as the Arduino has shown a positive detection when the leakage of LPG had occurred, the stepper motor is also activated to close the LPG cylinder regulator is included. Once the air valve has fully-closed, an alarm will be disabled.

1.2 Technology Stack Used

- **Arduino IDE**: It contains a text editor for writing code and it connects to the Arduino hardware to upload programs and communicate with them.
- **IFTTT**: IFTTT is short for If This Then That, and is the best way to integrate apps, devices, and services. It helps devices, services, and apps work together in new and powerful ways.

CHAPTER 2
REVIEW OF LITERATURE

Raeesa, Navashree et al. (2021), in the paper titled, **"Gas Detection System using Arduino"** used a Gas detection system which can monitor and warn about harmful chemicals in the air at workplaces such as factories, and it may also be used in households by alerting through an LCD display and by sending a message to a registered phone number.

S. Karthick et al. (2019), in the paper titled, **"LPG Gas Leakage Detection and Prevention System using NodeMCU"** implemented an LPG gas detector is used to detect the leakage of gas as fast as it can, and it will be used as trigger for the whole system. Then it will send an email to the specified user and it will glow the hazard indicating lights and used for blowing the horn and a message will be shown on the LCD display.

Aastha Singh et al. (2018), in the paper titled, **"Detection of Liquefied petroleum gas using sensor through Arduino UNO microcontroller"** implemented a gas leakage detection project based on Arduino UNO. The installation generates a sound alert using buzzer on detection of a dangerous leakage, with the help of the GSM module it can broadcast messages to the stakeholders about the LPG leak.

Arun Raj et al. (2015), in the paper titled, **"LPG Gas Monitoring System"** detects the amount of LPG in atmosphere and alerts the consumer about the gas leakage if any by sending SMS to a particular mobile number. Now a days the booking of the LPG cylinders is by sending SMS to the booking agent. In this system the GSM module which automatically books the cylinder by SMS to the agent booking number. This will help the owner to get the new cylinders in time without any fail.

Rohith Naidu V et al. (2020), in the paper titled, **"Smart LPG Gas Level Detection and Safety System using IoT"** deals with percentage of gas remaining in the cylinder is found using a sensor called a load cell, and the percentage of gas remaining in the cylinder is updated continuously to the app that the user is using, and when the gas level is less than the threshold value, an alert will be given to the user via the buzzer and notified in the mobile app. Another aspect of this home automation system is the safety feature, which warns the user through mobile application as well as a buzzer when a gas leak is detected. Simultaneously, the gas regulator knob is turned off to prevent future leaks from the source.

Dr.Suma Christal Mary et al. (2021), in the paper titled, **"IOT based home safety gas leakage detection and automatic booking system"** are not only capable of sensing or detecting gas leakages, but also of alerting the user about the gas leakage via a buzzer alarm and displaying an alert message on an LCD display, while simultaneously switching on the exhaust fan and starting the stepper motor, and turning off the gas regulator via an external coupling. PIR sensor also placed in the home to notify about the human presence. If no person, automatically power off at the same time the notification will be sent to user through mobile by warning calls and SMS.

CHAPTER 3
EXISTING METHODOLOGY

3.1 Existing System

"Gas leakage detection system" provides the information such as when a gas leakage is noticed and immediately turns ON the buzzer for the danger indication. By the detection of the hazardous gas the alerting message reached to the person who has control over it from the GSM. This project system is to detect gas leakage and also warn people around by buzzer beep sound and an SMS is been send to the responsible person for preparatory safety calculations.

Pros:

- The user can view the message without having to be connected to the internet. because the leaking message would be sent to the user's mobile number.
- Low cost.

Cons:

- Only detection and alarm methods were used. There is no way to stop the gas from leaking.

"LPG Gas Monitoring System" provides the amount of LPG in the atmosphere and notifies the customer of any gas leaks by sending an SMS to a specific cellphone number. The GSM module in this system sends an SMS to the agent's booking number, which automatically books the cylinder. This will assist the owner in receiving the new cylinders on schedule and without fail.

Pros:

- Detection and alerting of gas leaks.
- Can book new LPG gas cylinder.

Cons:

- There is no way to prevent gas leaks.

“LPG Gas Leakage Detection and Prevention System using NodeMCU”

In this existing system, LPG gas detector is used to detect the leakage of gas as fast it can, and it will be used as trigger for the whole system. Then it will send an email to the specified user, buzzer will be turned ON and gives trigger to the DC motor fan to remove the gas.

Pros:

- ❖ This model is capable of detecting, alerting, and preventing gas leaks.
- ❖ Gas leaks can be removed from the room using a DC motor.

Cons:

- ❖ There is no way to control gas leaks

3.2 Proposed overview

In the existing system, there is no way to control the gas leaks. As a modification to this, in the proposed system of gas detection system, the application contains both the detection and control of the gases that are very harmful for the surrounding. If there are any gas leaks, the gas regulator can be closed using a stepper motor.

CHAPTER 4
PROPOSED METHODOLOGY

4.1 Proposed System

In the proposed system of gas detection system, the application contains both the detection and control of the gases which are very harmful for the surrounding which was a draw back in the above mentioned existing system.

In the detection of the gas, the sensor which is used to sense many gases is MQ-2 sensor. After the detection of leakage in the gas, the sensor sends the signal to the Arduino UNO for the further process where other hardware components are connected to each other. Through Arduino UNO, it send the signal to the LCD display for displaying the alert message as GAS Detected, accordingly, the buzzer be on so that the surrounding people will the alerted.

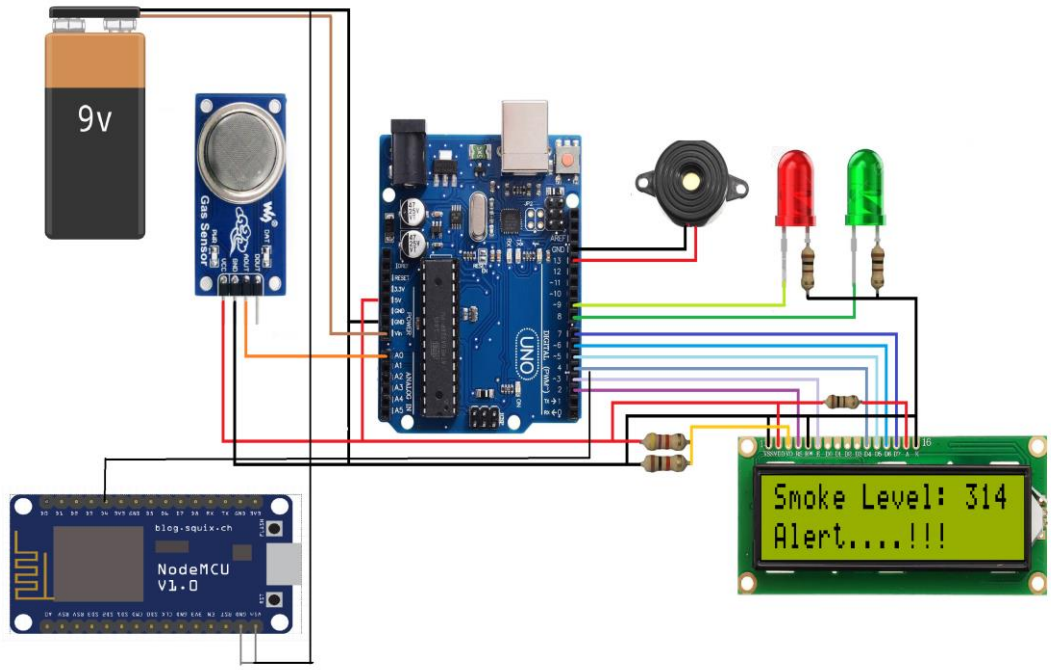
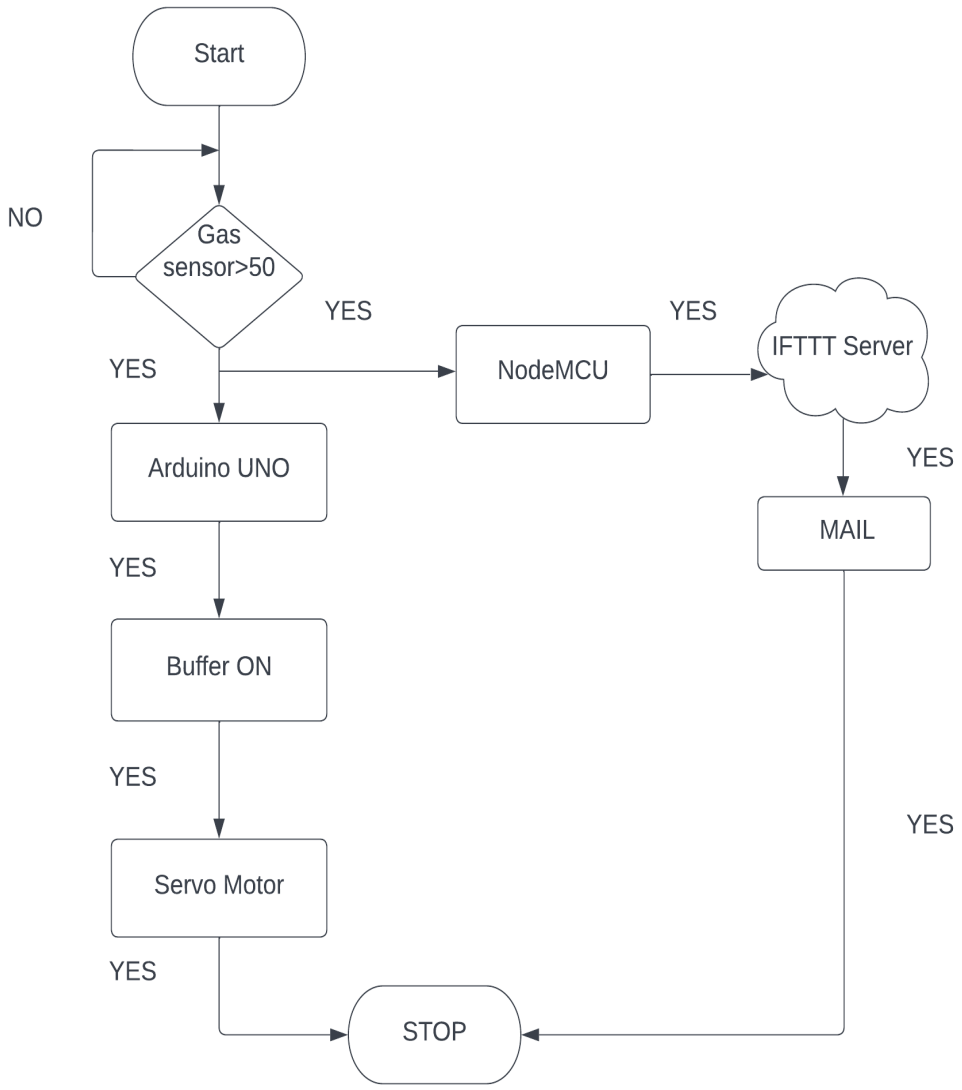


Fig.4.1. Gas Leakage Detection with NodeMCU

When the gas/air level in a room exceeds 50, the detecting system's buzzer will activate. With the use of the IFTTT (If That Then This) services, owner will receive the message via Node MCU. The MQ-2 Sensor is directly connected to the Node MCU. In the control of the gas, When the gas reaches above the threshold level, the detection system’s buzzer and servo motor will be activated. Servo motor is used to regulate the LPG cylinder regulator as soon as the gas is detected. The Servo motor is connected to the Arduino UNO. When the Arduino Digital pin goes high, the servo motor rotates 90 degrees to close the regulator and then returns to its original position.

In the proposed system once, this project is about detecting gas leaks and automatically closing down the gas valve if one is detected. When a gas leak is detected, the sensor's output is sent to the Arduino UNO, the buzzer is triggered, the information is displayed on the LCD display, and the stepper motor rotates to 90 degrees to lock the gas regulator and then returns to its original position. The gas sensor sends a signal to NodeMCU as well. It uses the IFTTT server to send an alert email to the user about the gas leak.

FLOW CHART:


Start
NO
Gas sensor>50
YES
YES
YES
NodeMCU
YES
IFTTT Server
YES
MAIL
Arduino UNO
YES
Buffer ON
YES
Servo Motor
YES
YES
STOP

CHAPTER 5
PROPOSED SYSTEM'S ATTRIBUTES

This project is about detecting gas leaks and automatically closing down the gas valve whenever one is discovered, according to the proposed system. When a gas leak is detected, the sensor's output is transmitted to the Arduino UNO, the buzzer is activated, the information is shown on the LCD display, and the stepper motor rotates to 90 degrees to lock the gas regulator The gas sensor also provides a signal to the NodeMCU. It sends an alert email to the user about the gas leak using the IFTTT server.

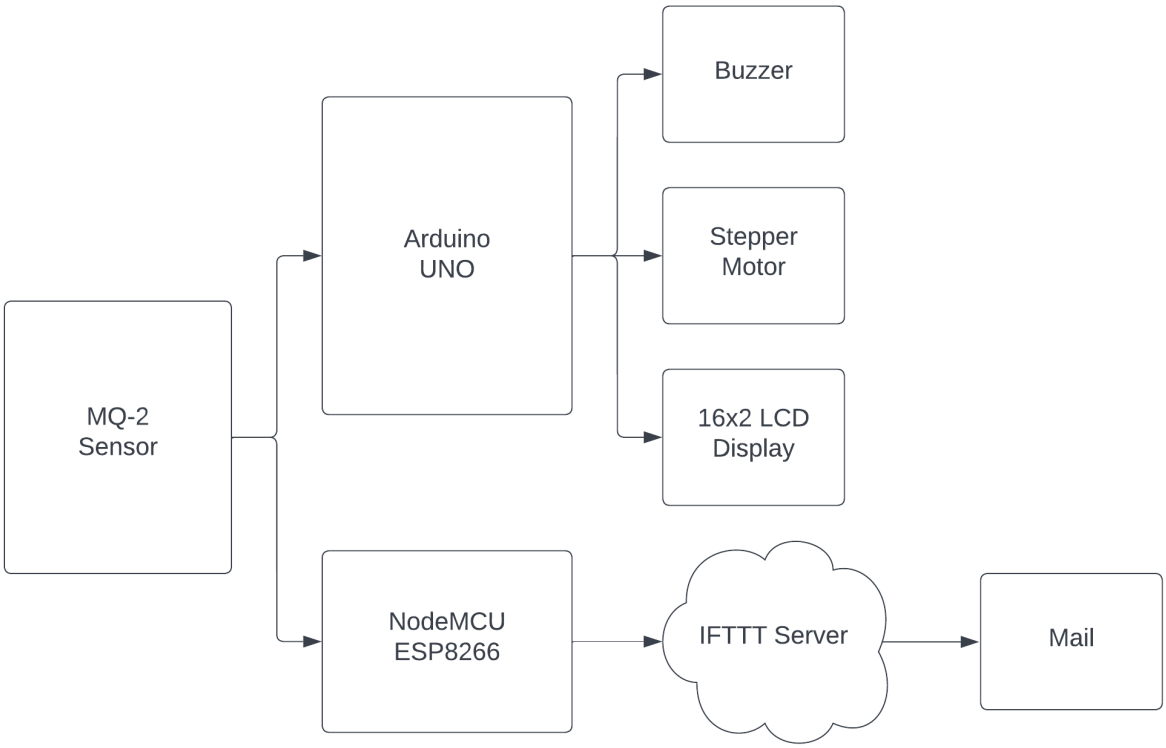


Fig.5.1 Block Diagram

5.1 Hardware Requirements

5.1.1 MQ2 Sensor

MQ-2 gas sensor has high sensitivity to Propane, Butane and LPG, also response to Natural gas. The sensor could be used to detect different combustible gas, especially Methane, it is with low cost and suitable for different application.

Fig.5.2.MQ2 Sensor.

MQ2 Gas sensor works on 5V DC and draws around 800mW. It can detect LPG, Smoke, Alcohol, Propane, Hydrogen, Methane and Carbon Monoxide concentrations anywhere from 200 to 10000ppm.

Here are the complete specifications

Operating voltage	5V
Load resistance	20 KΩ
Heater resistance	33Ω ± 5%
Heating consumption	<800mw
Sensing Resistance	10 KΩ – 60 KΩ
Concentration Scope	200 – 10000ppm
Preheat Time	Over 24 hours

Internal Structure

The sensor is actually enclosed in two layers of fine stainless steel mesh called Anti-explosion network. It ensures that heater element inside the sensor will not cause an explosion, as it senses flammable gases.

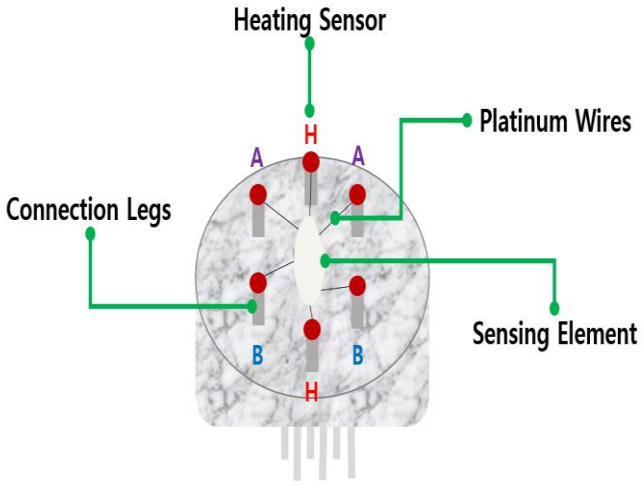


Fig.5.3. Internal Structure of MQ2 Sensor

This is how the sensor looks like when outer mesh is removed. The star-shaped structure is formed by the sensing element and six connecting legs that extend beyond the Bakelite base. Out of six, two leads (H) are responsible for heating the sensing element and are connected through Nickel-Chromium coil, well known conductive alloy.

The remaining four leads (A & B) responsible for output signals are connected using Platinum Wires. These wires are connected to the body of the sensing element and convey small changes in the current that passes through the sensing element.

Working:

When tin dioxide (semiconductor particles) is heated in air at high temperature, oxygen is adsorbed on the surface. In clean air, donor electrons in tin

dioxide are attracted toward oxygen which is adsorbed on the surface of the sensing material. This prevents electric current flow.

In the presence of reducing gases, the surface density of adsorbed oxygen decreases as it reacts with the reducing gases. Electrons are then released into the tin dioxide, allowing current to flow freely through the sensor.

5.1.2 ESP8266 NODEMCU

NodeMCU is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.

Brief About NodeMCU ESP8266

The NodeMCU ESP8266 development board comes with the ESP-12E module containing the ESP8266 chip having Tensilica Xtensa 32-bit LX106 RISC microprocessor. This microprocessor supports RTOS and operates at 80MHz to 160 MHz adjustable clock frequency. NodeMCU has 128 KB RAM and 4MB of Flash memory to store data and programs. Its high processing power with in-built Wi-Fi / Bluetooth. NodeMCU can be powered using a Micro USB jack and VIN pin (External Supply Pin). It supports UART, SPI, and I2C interface.

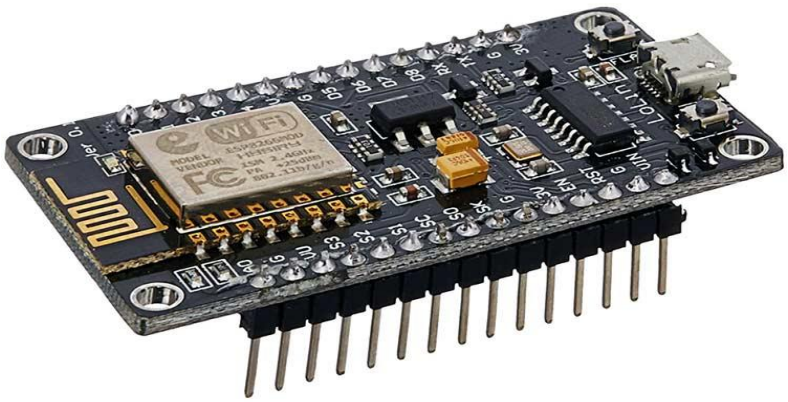


Fig.5.4. Node MCU

Procedure to Upload

Once Arduino IDE is installed on the computer, connect the board with the computer using the USB cable. Now open the Arduino IDE and choose the correct board by selecting Tools>Boards>NodeMCU1.0 (ESP-12E Module), and choose the correct Port by selecting Tools>Port. To get it started with the NodeMCU board and blink the built-in LED, load the example code by selecting Files>Examples>Basics>Blink. Once the example code is loaded into your IDE, click on the 'upload' button given on the top bar. Once the upload is finished, you should see the built-in LED of the board blinking.

Applications

- Prototyping of IoT devices
- Low power battery operated applications
- Network projects
- Projects requiring multiple I/O interfaces with Wi-Fi and Bluetooth

5.1.3 16X2 LCD Display

Fig.5.5. LCD Display

A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. The I2C is a type of serial bus developed by Philips, which uses two bidirectional lines, called SDA (Serial Data Line) and SCL (Serial Clock Line). Both must be connected via pulled-up resistors. The usage voltages are standard as 5V and 3.3V. I2C connector: VCC, GND, SCL, SDA.

Specifications & Features: -

A 16×2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5×7-pixel matrix. This LCD has two registers, namely, Command and Data. The command Arduino IIC/I2C interface was developed to reduce the IO port usage on Arduino board I2C adapter allows flexibility in connections and reduces the overall wirings.

Command registers stores various commands given to the display. Data register stores data to be displayed. The process of controlling the display involves putting the data that form the image of what you want to display into the data registers, then putting instructions in the instruction register. In your Arduino project Liquid Crystal Library simplifies this for you so you don't need to know the low-level instructions. Contrast of the display can be adjusted by adjusting the potentiometer to be connected across VEE pin.

5.1.4 Buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

Fig.5.6. Buzzer

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. Once a potential disparity is given across these crystals, then they thrust one conductor & drag the additional conductor through their internal property. So, this continuous action will produce a sharp sound signal.

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 like simple and readymade. Once a simple type is power-driven then it will generate a beep sound continuously. A readymade type looks heavier & generates a Beep. Beep. Beep. This sound is because of the internal oscillating circuit within it. This buzzer uses a DC power supply that ranges from 4V – 9V. To operate this, a 9V battery is used but it is suggested to utilize a regulated +5V/+6V DC supply. Generally, it is connected through a switching circuit to switch ON/OFF the buzzer at the necessary time interval.

5.1.5 Servo Motor

A servo motor is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision. If you want to rotate an object at some specific angles or distance, then you use a servo motor. It is just made up of a simple motor which runs through a servo mechanism. If motor is powered by a DC power supply then it is called DC servo motor, and if it is AC-powered motor then it is called AC servo motor.

Servo Motor Working Principle

A servo consists of a Motor (DC or AC), a potentiometer, gear assembly, and a controlling circuit. First of all, with the use of gear assembly to reduce RPM and to increase torque of the motor. Say at initial position of servo motor shaft, the position of the potentiometer knob is such that there is no electrical signal generated at the output port of the potentiometer. Now an electrical signal is given to another input terminal of the error detector amplifier. Now the difference between these two signals, one comes from the potentiometer and another comes from other sources, will be processed in a feedback mechanism and output will be provided in terms of error signal. This error signal acts as the input for motor and motor starts rotating. Now motor shaft is connected with the potentiometer and as the motor rotates so the potentiometer and it will generate a signal. So as the potentiometer's angular position changes, its output feedback signal changes. After sometime the position of potentiometer reaches at a position that the output of potentiometer is same as external signal provided. At this condition, there will be no output signal from the amplifier to the motor input as there is no difference between external applied signal and the signal generated at potentiometer, and in this situation motor stops rotating.

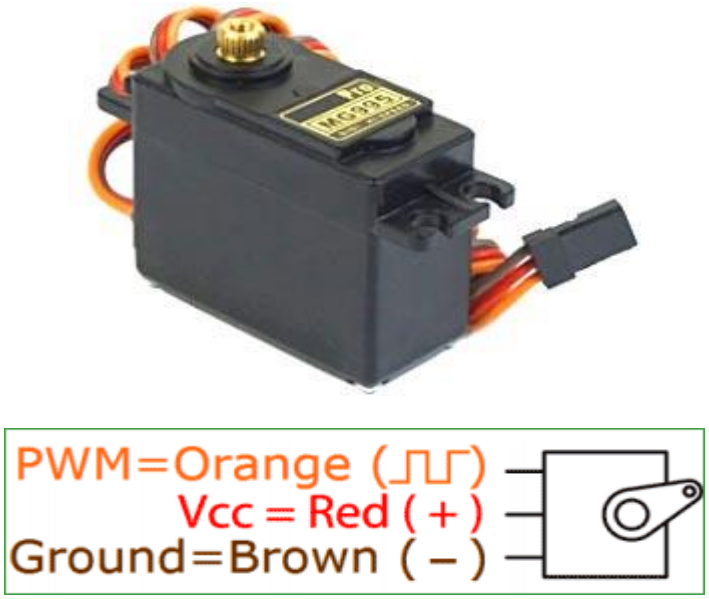
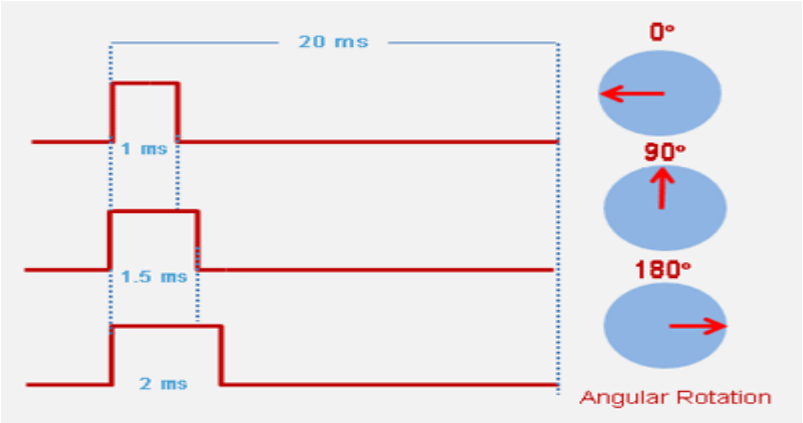


Fig.5.7. Servo Motor

Controlling Servo Motor

Servo motor is controlled by PWM (Pulse with Modulation) which is provided by the control wires. There is a minimum pulse, a maximum pulse and a repetition rate. Servo motor can turn 90 degrees from either direction form its neutral position. The servo motor expects to see a pulse every 20 milliseconds (ms) and the length of the pulse will determine how far the motor turns. For example, a 1.5ms pulse will make the motor turn to the 90° position, such as if pulse is shorter than 1.5ms shaft moves to 0° and if it is longer than 1.5ms than it will turn the servo to 180°.



Servo motor works on PWM (Pulse width modulation) principle, means its angle of rotation is controlled by the duration of applied pulse to its Control PIN. Basically, servo motor is made up of DC motor which is controlled by a variable resistor (potentiometer) and some gears. High speed force of DC motor is converted into torque by Gears. WORK= FORCE X DISTANCE, in DC motor Force is less and distance (speed) is high and in Servo, force is High and distance is less. The potentiometer is connected to the output shaft of the Servo, to calculate the angle and stop the DC motor on the required angle.

Servo motor can be rotated from 0 to 180 degrees, but it can go up to 210 degrees, depending on the manufacturing. This degree of rotation can be controlled by applying the Electrical Pulse of proper width, to its Control pin. Servo checks the pulse in every 20 milliseconds. The pulse of 1ms (1 millisecond) width can rotate the servo to 0 degrees, 1.5ms can rotate to 90 degrees (neutral position) and 2ms pulse can rotate it to 180 degree.

All servo motors work directly with your +5V supply rails but have to be careful about the amount of current the motor would consume if you are planning to use more than two servo motors a proper servo shield should be designed.

5.1.6 Arduino UNO

The Arduino UNO is a standard board of Arduino. Here UNO means 'one' in Italian. It was named as UNO to label the first release of Arduino Software. It was also the first USB board released by Arduino. It is considered as the powerful board used in various projects. Arduino.cc developed the Arduino UNO board.

Arduino UNO is based on an ATmega328P microcontroller. It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consists of digital and analog Input/Output pins (I/O), shields, and other circuits.

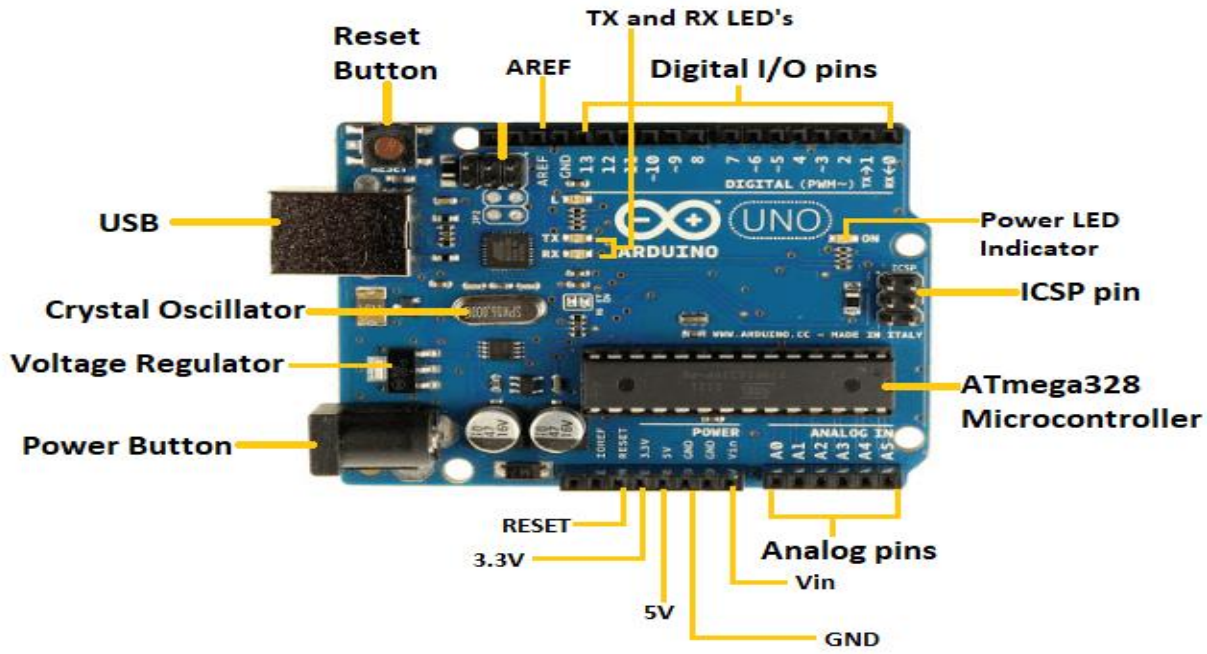


Fig.5.8. Arduino UNO

The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and an ICSP (In-Circuit Serial Programming) header. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms. The IDE is common to all available boards of Arduino.

ATmega328 Microcontroller- It is a single chip Microcontroller of the Atmel family. The processor code inside it is of 8-bit. It combines Memory (SRAM, **EEPROM**, and Flash), Analog to Digital Converter, SPI serial ports, I/O lines, registers, timer, external and internal interrupts, and oscillator.

ICSP pin - The In-Circuit Serial Programming pin allows the user to program using the firmware of the Arduino board.

Power LED Indicator- The ON status of LED shows the power is activated. When the power is OFF, the LED will not light up.

Digital I/O pins- The digital pins have the value HIGH or LOW. The pins numbered from D0 to D13 are digital pins.

TX and RX LED's- The successful flow of data is represented by the lighting of these LED's.

AREF- The Analog Reference (AREF) pin is used to feed a reference voltage to the Arduino UNO board from the external power supply. Reset button- It is used to add a Reset button to the connection.

USB- It allows the board to connect to the computer. It is essential for the programming of the Arduino UNO board.

Crystal Oscillator- The Crystal oscillator has a frequency of 16MHz, which makes the Arduino UNO a powerful board.

Voltage Regulator- The voltage regulator converts the input voltage to 5V.

GND- Ground pins. The ground pin acts as a pin with zero voltage.

Vin- It is the input voltage.

Analog Pins- The pins numbered from A0 to A5 are analog pins. The function of Analog pins is to read the analog sensor used in the connection. It can also act as GPIO (General Purpose Input Output) pins.

Technical Specifications of Arduino UNO

The technical specifications of the Arduino UNO are listed below:

- There are 20 Input/Output pins present on the Arduino UNO board. These 20 pins include 6 PWM pins, 6 analog pins, and 8 digital I/O pins.
- The PWM pins are Pulse Width Modulation capable pins.
- The crystal oscillator present in Arduino UNO comes with a frequency of 16MHz.
- It also has a Arduino integrated WIFI module. Such Arduino UNO board is based on the Integrated WIFI ESP8266 Module and ATmega328P microcontroller.
- The input voltage of the UNO board varies from 7V to 20V.

- Arduino UNO automatically draws power from the external power supply. It can also draw power from the USB.

Procedure

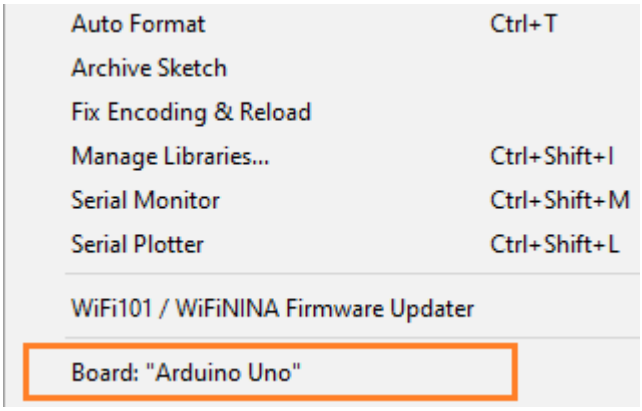
The Arduino UNO can be programmed using the Arduino IDE. The Arduino IDE is the Integral Development program, which is common to all the boards.

Arduino Web Editor, which allows us to upload sketches and write the code from our web browser (Google Chrome recommended) to any Arduino Board. It is an online platform.

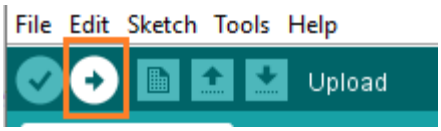
The USB connection is essential to connect the computer with the board. After the connection, the PWR pins will light in green. It is a green power LED.

The steps to get started with Arduino UNO are listed below:

- Install the drivers of the board.
- As soon as the board is connected to the computer, Windows from XP to 10 will automatically install the board drivers.
- But, if you have expanded or downloaded the zip package, follow the below steps:
- Click on **Start** -> **Control Panel** -> **System and Security.**
- Click on System -> Device Manager -> Ports (COM &LPT) -> Arduino UNO (COMxx). If the COM &LPT is absent, look Other Devices -> Unknown Device.
- Right-click to Arduino UNO (COMxx) -> Update Driver Software -> Browse my computer for driver software.
- Select the file "inf" to navigate else, select "ArduinoUNO.inf".
- Installation Finished.
- Open the code or sketch written in the Arduino software.
- Select the type of board.
- Click on 'Tools' and select Board, as shown below:



- Select the port. Click on the Tools -> Port (select the port). The port likely will be COM3 or higher. For example, COM6, etc. The COM1 and COM2 ports will not appear, because these two ports are reserved for the hardware serial ports.
- Now, upload and run the written code or sketch.
- To upload and run, click on the button present on the top panel of the Arduino display, as shown below:



- Within the few seconds after the compile and run of code or sketch, the RX and TX light present on the Arduino board will flash.
- The 'Done Uploading' message will appear after the code is successfully uploaded. The message will be visible in the status bar.

5.2 Software Requirements

The following software requirements are:

- Coding Language: C/C++
- IDE: Arduino
- Operating System: Windows 7 and above

5.2.1 Arduino IDE

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards. The source code for the IDE is released under the GNU General Public License, version. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub

main () into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. By default, avrdude is used as the uploading tool to flash the user code onto official Arduino boards]. With the rising popularity of Arduino as a software platform, other vendors started to implement custom open-source compilers & tools (cores) that can build and upload sketches to other MCUs that are not supported by Arduino's official line of MCUs. In October 2019 the Arduino organization began providing early access to a new Arduino Pro IDE with debugging and other advanced feature.

5.2.2 IFTTT

IFTTT derives its name from the programming conditional statement "if this, then that." What the company provides is a software platform that connects apps, devices and services from different developers in order to trigger one or more automations involving those apps, devices and services.

Here are just three If This, Then Those automations you can run with IFTTT:

- If you make a call on your Android phone, then a log of that call is added to a Google spreadsheet.
- If you add a new task to your Amazon Alexa to-dos, then it will be added to your iOS Reminders app.
- If the International Space Station passes over your house, then you'll get a smartphone notification about it. (Yes, this is an actual IFTTT applet.)

  Currently, there are 90 million activated applet connections, according to IFTTT.

And for the record, Tibbets' favorite applets include one that lets you quickly email notes to yourself and another that notifies you whenever a new Craigslist post matches your search terms.

The history of IFTTT

Tibbets and Jesse Tane co-founded IFTTT in 2010 and officially launched the service in 2011. Based in San Francisco, IFTTT has raised $63 million in venture capital funding from investors that include the firm Andreesen Horowitz, according to IFTTT. The latest funding round of $24 million, led by Salesforce Ventures with participation from IBM, Chamberlain Group, and Fenox Venture Capital, will help hire new staff and expand the platform.

How IFTTT works

The automations are accomplished via applets which are sort of like macros

that connect multiple apps to run automated tasks. You can turn on or off an applet using IFTTT's website or mobile apps (and/or the mobile apps' IFTTT widgets). You can also create your own applets or make variations of existing ones via IFTTT's user-friendly, straightforward interface.

Services

IFTTT currently supports hundreds of services. You'll find integrations for everything from robot vacuums to Facebook.

- To see all the services on IFTTT, go to the IFTTT search page.
- To manage all your IFTTT services, go here.

Note: Services were once called "channels."

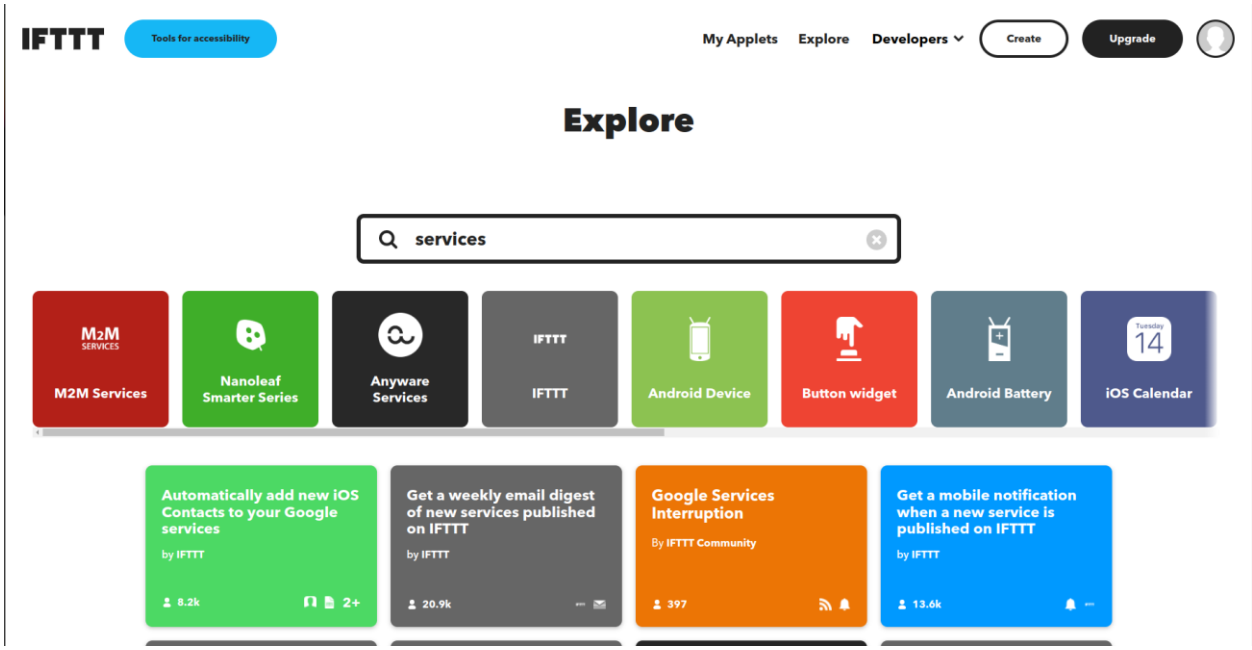


Fig.5.9. IFTTT Services

Applets

Applets are specific things that can happen when you connect services. For instance, you could use an Applet to sync Amazon Alexa to-dos with your Google

Calendar, or you could use one that lets you create events in your iPhone Calendar via Google Assistant. There are tons of Applets to choose from; IFTTT says there are 18 million users running more than a billion Applets a month.

- To find already-created Applets on IFTTT, go to the IFTTT search page.
- To manage all your IFTTT Applets, go here.

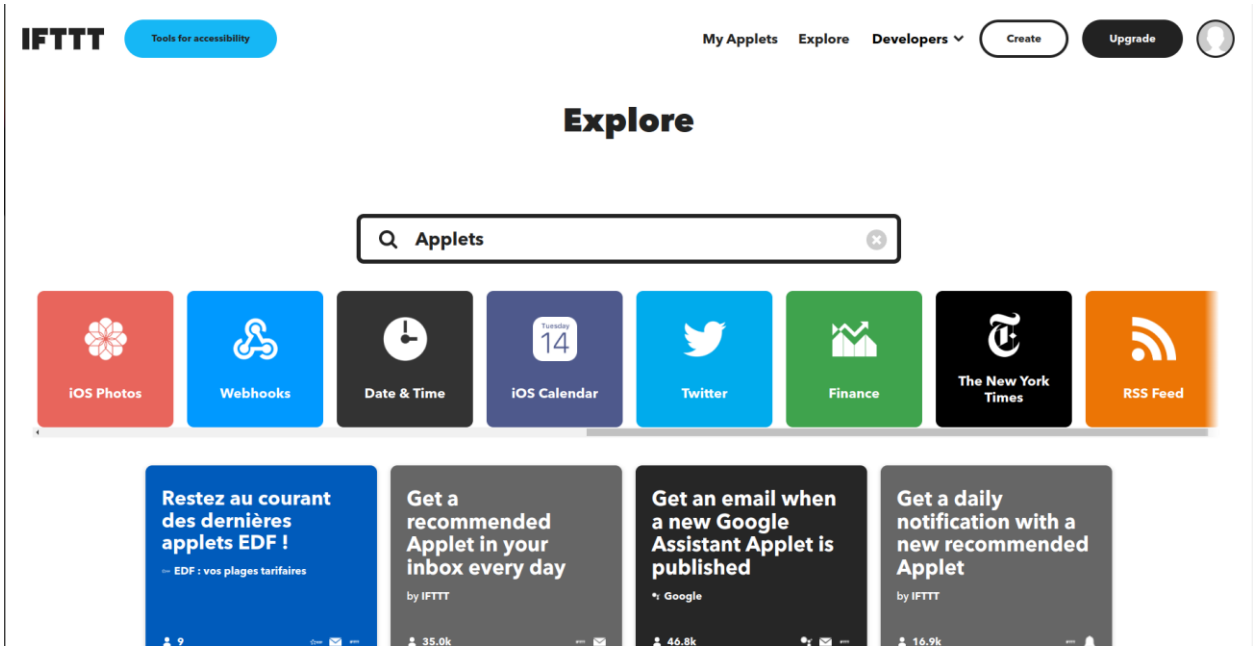


Fig.5.10. IFTTT Applets

CHAPTER 6
RESULTS AND DISCUSSION

6.1 NodeMCU Results

The connections of NodeMCU are shown in fig.11. The code has to uploaded to NodeMCU using the Arduino IDE after verifying the code. After uploading, it will show the "no gas" phrase is in a loop in Fig.12 If the Gas sensor detects a leak, it sends a signal to the NodeMCU, which then exits the loop as shown in Fig.13 and sends an email to the user via the IFTTT server, as shown in Fig.14.

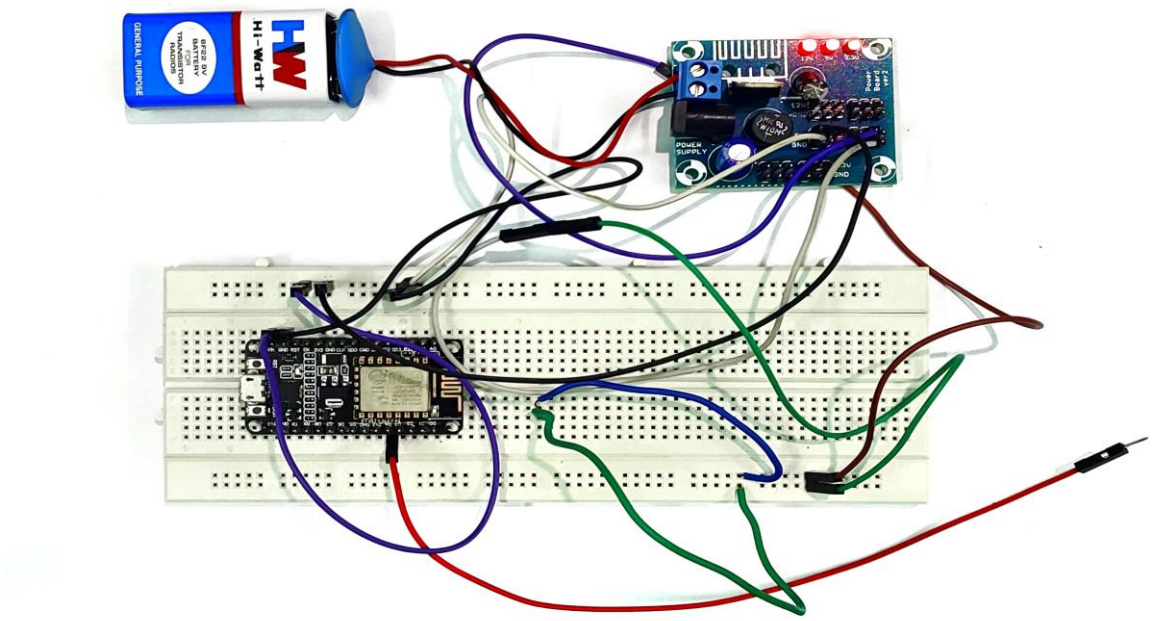


Fig.6.1. NodeMCU Circuit

6.1.1 Arduino IDE Results

In the Arduino IDE, the "no gas" phrase is in a loop after uploading the code to NodeMCU, as shown in Fig 12.

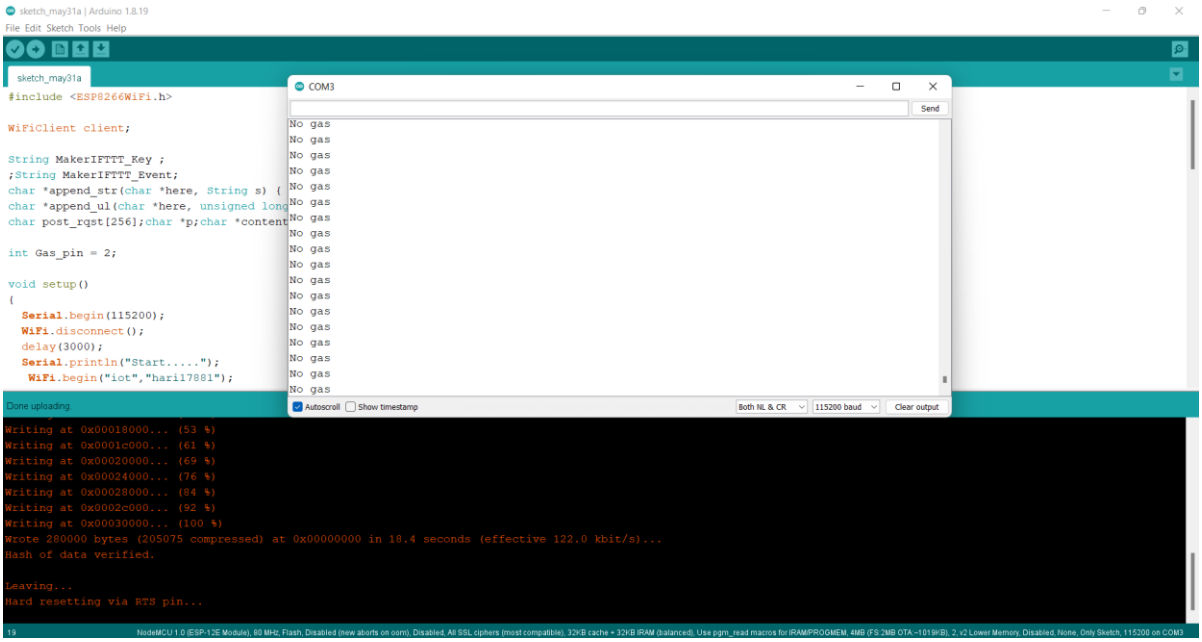


Fig.6.2. When gas leakage is not detected.

The gas sensor sends a signal to NodeMCU when it senses a leak. It then exits the for loop as shown in Fig.13 and sends an email using the IFTTT server.

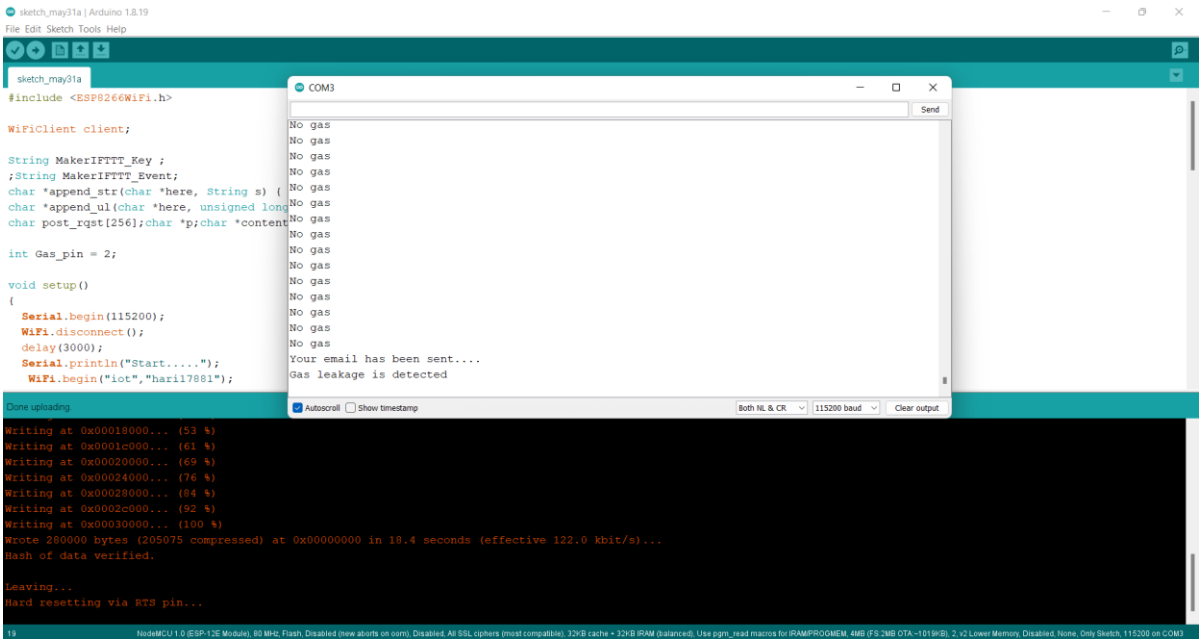


Fig.6.3. When gas leakage is detected.

6.1.2 Gmail Results

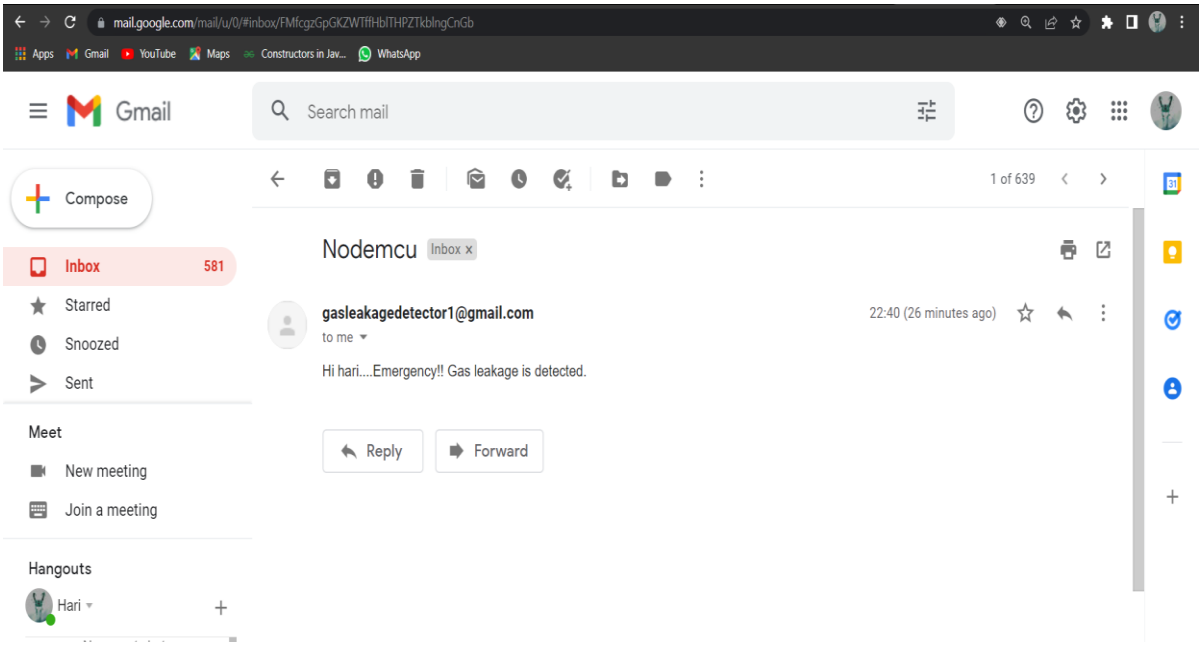


Fig.6.4. Output of NodeMCU

6.2 Arduino Results

The detection and control sections have been setup in the Arduino uno setup. When the read value from the gas sensor gets over the value 50, the buzzer will be activated and a message will be displayed in the LCD as shown in the Fig.16. Similarly, When the read value from the gas sensor goes above the value 50, the servo motor will be triggered, and it will rotate to 90 degrees. The servo motor returns to its initial position 0 when the read value from the gas sensor falls below 50.

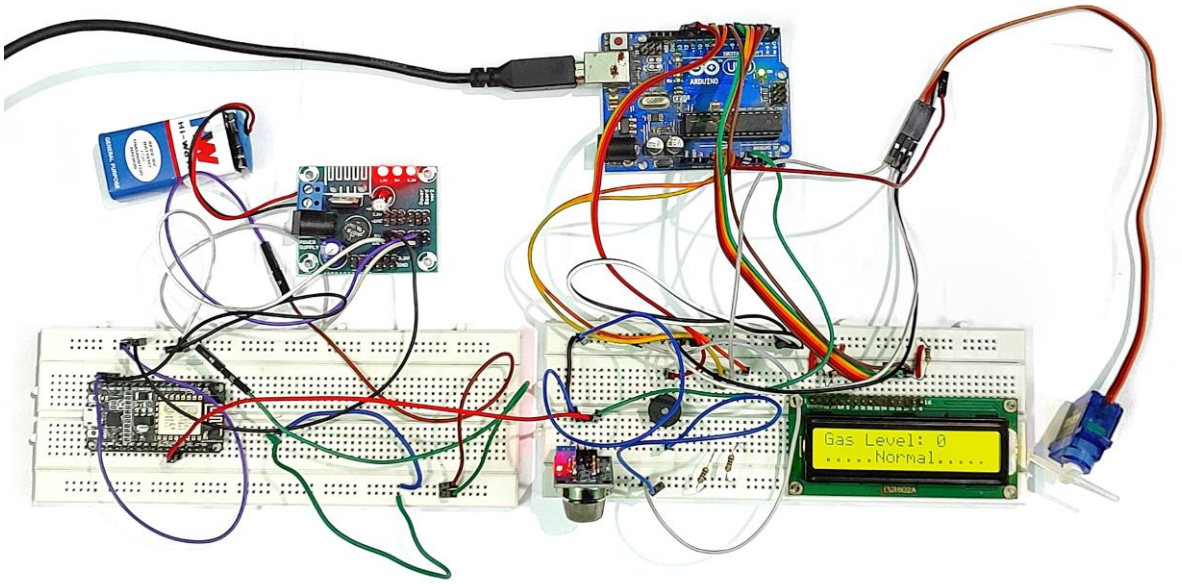


Fig.6.5. Gas Leakage Detection System using Arduino UNO and NodeMCU

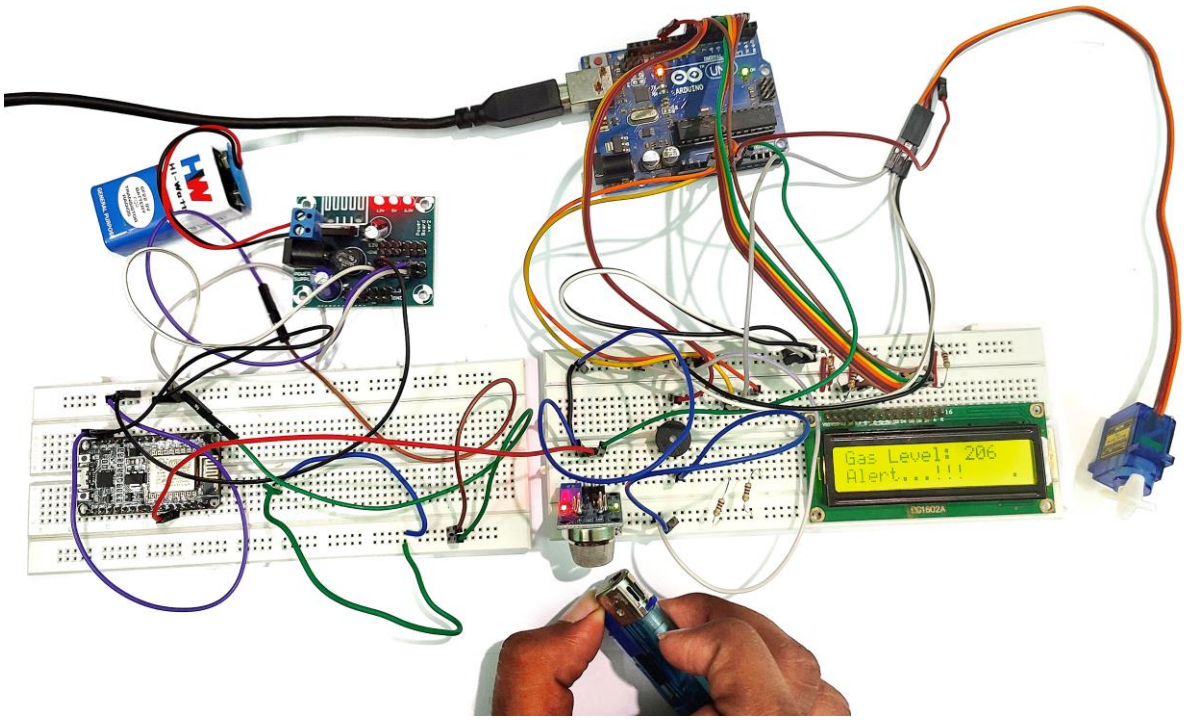


Fig.6.6. Gas leakage detected

CHAPTER 7

CONCLUSION & FUTURE SCOPE

7.1 Conclusion

Therefore, it can be concluded that the proposed Gas leakage detection system using Arduino and NodeMCU outperforms other models with its leakage control system. Though, several techniques is existing for the same, yet gas leakage detection is one major concern and a challenge always. The sensor used in this model can sense and detect the leakage of the gas and the user gets notification regarding gas leakage and can also control the LPG regulator automatically. This system can be used in marketing sectors like hotels, shop etc. The main intention of this work is to ensure safe and easier way for leakage detection and control method to avoid disasters that may occur due to negligence.

7.2 Future Scope

Overall, software and hardware parts of the systems have been developed and tested by introducing a small amount of LPG near gas sensor module. The system will support a variety of functions that can be developed and implemented. One of the notable future functions of this system is to add a sub system where wastage of gas and the uses of gas can be monitored using this system.

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RAJALAKSHMI ENGINEERING COLLEGE

DEPARTMENT OF ECE

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: An ability to carry out research in different areas of Electronics and Communication Engineering fields resulting in journal publications and product development.

PSO2: To design and formulate solutions for industrial requirements using Electronics and Communication engineering

PSO3: To understand and develop solutions required in multidisciplinary engineering fields.

COURSE OUTCOMES (COs)

CO1	To acquire practical knowledge within the chosen area of technology for project development.
CO2	To identify, analyze, formulate and handle projects with a comprehensive and systematic approach.
CO3	To contribute as an individual or in a team in development of technical projects.

EC19611 – INNOVATION AND DESIGN THINKING FOR ELECTRONICS ENGINEERS

Project Title: IOT based Gas Leakage Detection System

Batch Members **:** Hemanth R (190801066)
Manikandan R (190801099)
Hariprasad R (190801504)

Name of the Supervisor **:** Mrs. T. Helan Vidhya, M.E., (Ph.D)
Assistant professor (S.G)

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Average	3	3	3	3	2.5	3	3	3	3	2.5	3	3	3	3	3

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High), If there is no correlation, put '- '

Signature of the Supervisor