Design & Implementation of GSM Based CNG Station



SONARGAON UNIVERSITY (SU)

Supervised By

Md. Ashikur Rahman

Lecturer
Department of EEE
Sonargaon University (SU)

Submitted By

Md. Azizul Haque	**ID: EEE2101022110**
Md. Al Islam	**ID: EEE2101022028**
Al- Rakib	**ID: EEE2101022058**
Md. Roni Haque	**ID: EEE1901016046**
Md. Abo Seyde	**ID: EEE2101022124**

Department of Electrical & Electronic Engineering (EEE)
Sonargaon University (SU)
147/I, Panthapath,
Dhaka-1215, Bangladesh

Date of Submission: May 2024

Declaration

It is declared hereby that this thesis paper or any part of it has not been submitted to anywhere else for the award of any degree.

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Md. Azizul Haque **Md. Al Islam**

---------- ----------

Al- Rakib **Md. Roni Haque**

Md. Abo seyde

Under Supervision of

.....

Md. Ashikur Rahman

Lecturer

Department of EEE

Sonargaon University (SU)

Certification

This is to certify that this project entitled "**Design & Implementation of GSM Based CNG Station**" is done by the following students under my direct supervision. This project work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering, Sonargaon University (SU) in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering.

Supervisor

.....

Md. Ashikur Rahman

Lecturer

Department of Electrical and Electronic Engineer (EEE)

Sonargaon University (SU)

ACKNOWLEDGEMENT

The report titled as on "**Design & Implementation of GSM Based CNG Station**" has been prepared to fulfill the requirement of our practicum program. In the process of doing and preparing our practicum report, we would like to pay our gratitude to some persons for their enormous help and vast co-operation.

At first, we would like to show our gratitude to the University authority to permit us to do our practicum. Specially, we would like to thank to our honorable teacher **Md. Ashikur Rahman,** Lecturer, Department of Electrical & Electronics Engineering, SU Sonargaon University, Dhaka, for his valuable and patient advice, sympathetic assistance, co-operation, contribution of new idea. Deep theoretical and hardware knowledge & keen interest of our supervisor in this field influenced us to carry out this project. His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior draft and correcting them at all stage have made it possible to complete this project.

Finally, we would like to thanks again to the respected **Vice- Chancellor of SU, Professor Shamim Ara Hassan** also thanks to **Head of Department of SU , Electrical & Electronics Engineering, Md. Rais Uddin Mollah** because they are designated such an environment for learning through which we got the opportunity to acquire knowledge under Bsc in EEE program, and that will be very helpful for our prospective career.

We are, indeed, grateful to all those from whom we got sincere cooperation and help for the preparation of this report

ABSTRACT

"GSM-Based CNG Station Using Gas Sensor and Fire Sensor" describes a system designed to enhance the safety and efficiency of Compressed Natural Gas (CNG) stations. This system integrates gas sensors and fire sensors with GSM (Global System for Mobile Communications) technology to provide real-time monitoring and immediate alerts to station operators and relevant authorities.

Gas sensors are employed to detect any leakage of CNG, a potentially hazardous situation. These sensors continuously monitor the gas levels in the station area and trigger an alarm if they detect a significant increase in gas concentration. Additionally, fire sensors are incorporated to swiftly identify any fire outbreak, another critical safety concern at CNG stations.

The GSM technology plays a pivotal role in this setup. When gas leakage or a fire event is detected, the system sends instant alerts or notifications through SMS messages to predefined recipients, such as station operators, maintenance personnel, and emergency services. This rapid communication ensures that appropriate actions can be taken promptly to mitigate potential dangers.

By combining gas and fire sensors with GSM-based communication, this system improves the overall safety of CNG stations. It enables quick response times to emergencies, reducing the risk of accidents and providing peace of mind to both station operators and users. This technology-driven approach underscores the importance of harnessing modern innovations to safeguard critical infrastructure and enhance operational efficiency.

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List of ABBREVIATION

DC	Direct Current
AC	Alternating Current.
LCD	Liquid Crystal Display
ADC	Analog-to-Digital Converter
IR	Infrared Receiver
IC	Integrated Circuit
LED	Light Emitting Diode
PCB	Printed Circuit Boar

CHAPTER I

INTRODUCTION

1.1. Introduction

Fire accident is a common incident in factories, houses, markets in every country. Due to poor fire extinguishing arrangement, lack of adequate fire alarm and emergency exit, it increases death and wreck. When it comes to security issues, we cannot take it for granted. Security is the level of protection against danger and loss. Nowadays, in a world that full of technology, people needs the help of technology to provide early warning alert to ensure they have enough time to avoid danger. In designing this project, the dangerous sources that have been highlighted are about gas leakage and fire. This is because both of these can become a huge disaster if the security procedure is not taken early. To minimize fire accident our project will act as a sentinel which is control from a central console room. For detection we used a high sensitive smokedetector by which microcontroller will get high pulse at input pin which is preprogrammed for our desired output signal.

This project is about producing an alert warning system based on Global System for Mobile (GSM) network. It will be used to detect the presence of natural gases as well as fire. Whenever gas leakage or fire occurs, the sensors used in the circuit will detect it and the GSM modem will send out an SMS alert to the user and also to the nearest fire station. With the system that provides a real-time notification, it increases the response time of the owner. This will provide the immediate aid to the situation occur. This system can be installed in kitchens, Liquefied Petroleum Gas (LPG) storage rooms, near the Natural Gas Vehicle (NGV) tank in mobile cars or any places thinks required

1.2. Background Study

Few works have been done to combat this challenge and a lot of research went down on this. Ashish Shrivastava et.al. suggested system which can find gas leaks using the GSM technology. In this system, gas spillage is detected at a low fixation; and furthermore it disconnects the mains supply and stops the gas supply, and makes the user aware of the situation by making a beep and also sends a text message [1]

Prof.M.Amsaveni et.al. proposed the GSM based LPG spillage detection and controlling system. In this system, after a gas discharge is found, the valve closes by design. Hence the outflow of gas is halted. To add to that, the user is notified of this by a text message and also the mains supply is detached to prevent additional adversity [2]

Halavva Patil et.al. put forward a very smart approach to book a gas cylinder in the case that the gas cylinder has emptied below a certain level and also showed a way to combat gas leaks. This system ensures the control in circumstances of leakages by shutting the outflow in a short time period; then the user and the nearest fire station is warned by a message to make the situation favorable hastily. And as mentioned of the rebooking option becomes very helpful for the user in most cases to avoid hassle and dangers when the gas level falls below a threshold level [4].

These are few of the works that have been done in the past years but none have considered the closed room scenario that becomes a very serious issue Through this approach, we have tried to address this issue and tried to combat such an occurrence.

1.3. Objectives

- Specific fire location monitoring from central control room;
- To save unwanted accident due to careless movement for fire;
- To reduce fire damages;
- The presence of natural Gas as well as fire;
- Send an SMS alert to the user and nearest fire station

1.4. Project Organization

In this report, Chapter one covers introduction, background, objectives.
Chapter two represents theory, description of the microcontroller, Servo motor, MQ 2, Flame Sensor, Transformer, GSM and others components.
Chapter three describes and working principle of the project.
In chapter four we have discussed result and discussion, cost estimation, future modification, conclusion.

CHAPTER II

THEORY OF THE PROJECT

2.1. Introduction

This chapter includes the total over view of the device. In this chapter we have followed-up the theory of Arduino Uno, briefly describe of Microcontroller (ATMEGA 328P), Flame Sensor,GSM, MQ2,relay module, Water Pump, Servo Motor and other components. Here we can know that the total system overview of the projects. And we will also know that how the equipment are working with each other.

2.2. Theory

We've developed the system that can handle this critical switching situation perfectly. Our system has fire detection, gas leakage detection and send sms to authorised person.

2.2.1. Arduino Uno

Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language and the Arduino Software (IDE), based on Processing.

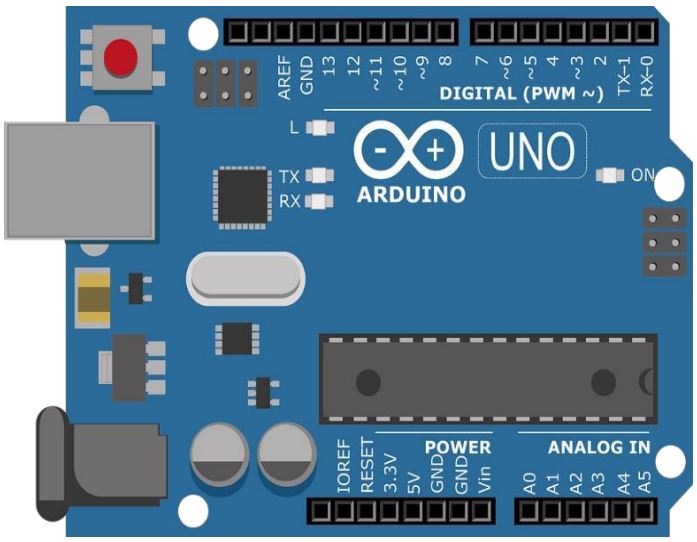


Fig: 2.1 Arduino UNO

Technical specifications:

Table 2.1: Technical specifications of Arduino UNO

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz

2.2.2. Microcontroller ATMEGA328P

The Atmel® picoPower® ATmega328/P is a low-power CMOS 8-bit microcontroller based on the AVR® enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega328/P achieves throughputs close to 1MIPS per MHz. This empowers system designer to optimize the device for power consumption versus processing speed.
The Atmel AVR® core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in a single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers. The ATmega328/P provides the following features: 32Kbytes of In-System Programmable Flash with Read-While-Write capabilities, 1Kbytes EEPROM, 2Kbytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, Real Time Counter (RTC), three flexible Timer/Counters with compare modes and PWM, 1 serial programmable USARTs , 1 byte-oriented 2-wire Serial Interface (I2C), a 6- channel 10-bit ADC (8 channels in TQFP and QFN/MLF packages) , a programmable Watchdog Timer with internal Oscillator, an SPI serial port, and six software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM, Timer/Counters, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next interrupt or hardware reset. In Power-save mode, the asynchronous timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except asynchronous timer and ADC to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low power consumption. In Extended Standby mode, both the main oscillator

and the asynchronous timer continue to run. Atmel offers the QTouch® library for embedding capacitive touch buttons, sliders and wheels functionality into AVR microcontrollers. The patented charge-transfer signal acquisition offers robust sensing and includes fully debounced reporting of touch keys and includes Adjacent Key Suppression® (AKS™) technology for unambiguous detection of key events. The easy-to-use QTouch Suite toolchain allows you to explore, develop and debug your own touch applications. The device is manufactured using Atmel's high density non-volatile memory technology. The On-chip ISP Flash allows the program memory to be reprogrammed In-System through an SPI serial interface, by a conventional nonvolatile memory programmer, or by an On-chip Boot program running on the AVR core. The Boot program can use any interface to download the application program in the Application Flash memory. Software in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read-While-Write operation. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATmega328/P is a powerful microcontroller that provides a highly flexible and cost effective solution to many embedded control applications. The ATmega328/P is supported with a full suite of program and system development tools including: C Compilers, Macro Assemblers, Program Debugger/Simulators, In-Circuit Emulators, and Evaluation kits.

2.2.3. MQ 2 Gas Sensor

A Metal Oxide Semiconductor (MOS) type gas sensor called the MQ2 is used primarily to identify gases like methane, butane, lpg, smoke, etc. Because gas detection relies on a change in the sensing material's resistance as a result of contact with the gas, it is also known as chemiresistors.



Fig: 2.2: MQ 2

The MQ2 sensor is one of the most widely used in the MQ sensor series. It is a MOS (Metal Oxide Semiconductor) sensor. Metal oxide sensors are also known as Chemiresistors because sensing is based on the change in resistance of the sensing material when exposed to gasses. The MQ2 gas sensor operates on 5V DC and consumes approximately 800mW. It can detect LPG, Smoke, Alcohol, Propane, Hydrogen, Methane and Carbon
Monoxide concentrations ranging from 200 to 10000 ppm. The MQ2 is a heater-driven sensor. It is therefore covered with two layers of fine stainless steel mesh known as an "anti-explosion network". It ensures that the heater element inside the sensor does not cause an explosion because we are sensing flammable gasses. It also protects the sensor and filters out suspended particles, allowing only gaseous elements to pass through the chamber. A copper-plated

clamping ring secures the mesh to the rest of the body. When the outer mesh is removed, the sensor looks like this. The sensing element and six connecting legs that extend beyond the Bakelite base form the star-shaped structure. Two (H) of the six leads are in charge of heating the sensing element and are linked together by a Nickel-Chromium coil (a well-known conductive alloy).

The remaining four signal-carrying leads (A and B) are connected with platinum wires. These wires are connected to the body of the sensing element and convey slight variations in the current flowing through the sensing element.

The tubular sensing element is made of Aluminum Oxide (AL2O3) based ceramic with a Tin Dioxide coating (SnO2). Tin Dioxide is the most important material because it is sensitive to combustible gasses. The ceramic substrate, on the other hand, improves heating efficiency and ensures that the sensor area is continuously heated to the working temperature. To summarize, the Heating System is composed of a Nickel-Chromium coil and an Aluminum Oxide-based ceramic, while the Sensing System is composed of Platinum wires and a Tin Dioxide coating. When a SnO2 semiconductor layer is heated to a high temperature, oxygen is adsorbed on the surface. When the air is clean, electrons from the conduction band of tin dioxide are attracted to oxygen molecules. This creates an electron depletion layer just beneath the surface of the SnO2 particles, forming a potential barrier. As a result, the SnO2 film becomes highly resistive and prevents electric current flow. In the presence of reducing gasses, however, the surface density of adsorbed oxygen decreases as it reacts with the reducing gasses, lowering the potential barrier. As a result, electrons are released into the tin dioxide, allowing current to freely flow through the sensor.

2.2.4. Flame Sensor

A sensor which is most sensitive to a normal light is known as a flame sensor. That's why this sensor module is used in flame alarms. This sensor detects flame otherwise wavelength within the range of 760 nm – 1100 nm from the light source. This sensor can be easily damaged to high temperature. So this sensor can be placed at a certain distance from the flame. The flame detection can be done from a 100cm distance and the detection angle will be 600. The output of this sensor is an analog signal or digital signal. These sensors are used in fire fighting robots like as a flame alarm.



Fig: 2.3: Flame Sensor

A flame-sensor is one kind of detector which 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. This sensor is used in industrial boilers. The main function of this is to give authentication

whether the boiler is properly working or not. The response of these sensors is faster as well as more accurate compare with a heat/smoke detector because of its mechanism while detecting the flame.
This sensor/detector can be built with an electronic circuit using a receiver like electromagnetic radiation. This sensor uses the infrared flame flash method, which allows the sensor to work through a coating of oil, dust, water vapor, otherwise ice.

Features & Specifications

The features of this sensor include the following.

- Photosensitivity is high
- Response time is fast
- Simple to use
- Sensitivity is adjustable
- Detection angle is 600,
- It is responsive to the flame range.
- Accuracy can be adjustable
- Operating voltage of this sensor is 3.3V to 5V
- Analog voltage o/ps and digital switch o/ps
- The PCB size is 3cm X 1.6cm
- Power indicator & digital switch o/p indicator
- If the flame intensity is lighter within 0.8m then the flame test can be activated, if the
- flame intensity is high, then the detection of distance will be improved.

Applications

- Hydrogen stations
- Industrial heating
- Fire detection
- Fire alarm
- Fire fighting robot
- Drying systems
- Industrial gas turbines
- Domestic heating systems
- Gas-powered cooking devices

Thus, this is all about a flame sensor. From the above information finally, we can conclude that the main purpose of this sensor is to reduce the risks which are associated with the ignition. These sensors respond frequently than a smoke or heat detector.

2.2.5. Servo Motor

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. Servomotors are not a specific class of motor,

although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system. Servomotors are used in applications such as robotics, CNC machinery or automated manufacturing.

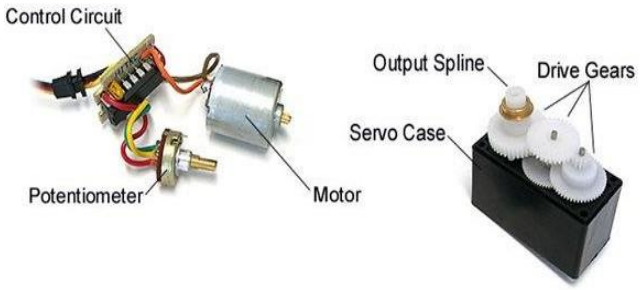


Fig: 2.4: Servo Motor

Servos are controlled by sending an electrical pulse of variable width, or pulse width modulation (PWM), through the control wire. There is a minimum pulse, a maximum pulse, and a repetition rate. A servo motor can usually only turn 90° in either direction for a total of 180° movement. The motor's neutral position is defined as the position where the servo has the same amount of potential rotation in the both the clockwise or counter-clockwise direction. The PWM sent to the motor determines position of the shaft, and based on the duration of the pulse sent via the control wire; the rotor will turn to the desired 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. Shorter than 1.5ms moves it in the counter clockwise direction toward the 0° position, and any longer than 1.5ms will turn the servo in a clockwise direction toward the 180° position. When these servos are commanded to move, they will move to the position and hold that position. If an external force pushes against the servo while the servo is holding a position, the servo will resist from moving out of that position. The maximum amount of force the servo can exert is called the torque rating of the servo. Servos will not hold their position forever though; the position pulse must be repeated to instruct the servo to stay in position.

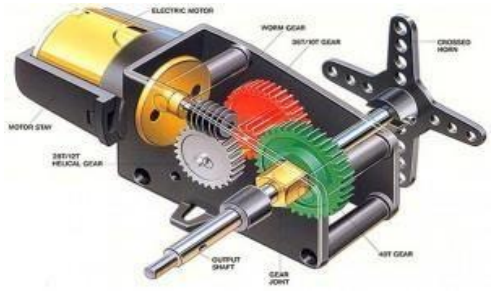


Fig: 2.5: Servo motor internal Mechanism

Servo motors are classified into different types based on their application, such as AC servo motor, DC servo motor, brushless DC servo motor, positional rotation, continuous rotation and linear servo motor etc. Typical servo motors comprise of three wires namely, power control and ground. The shape and size of these motors depend on their applications.

2.2.6. Water Pump

Water pumps are fundamental to homes, structures and modern plants for providing water from underground sources. The particular ways they work rely upon the idea of utilization that they are required for. Since there are numerous reasons that these pumps serve, there is the same number of sorts accessible today.



Fig: 2.6: Mini Water pump

2.2.7. Mini Piezo Buzzer

Apply 3V to 5V to this piezo buzzer module and you'll be rewarded with a loud 2KHz BEEP. Unlike a plain piezo, this buzzer does not need an AC signal. Inside is a piezo element plus the driver circuitry that makes it oscillate at 2KHz. The piezo buzzer is 5V TTL logic compatible and Breadboard friendly pin spacing. This buzzer is ideal when you need to fit a buzzer in a small place. It has its own built-in drive circuit. It offers low current consumption. Used in manufacturing applications such as laptops, alarms, pagers, etc.



Fig: 2.7: Mini Piezo Buzzer

2.2.8. Relay

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof. Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal.

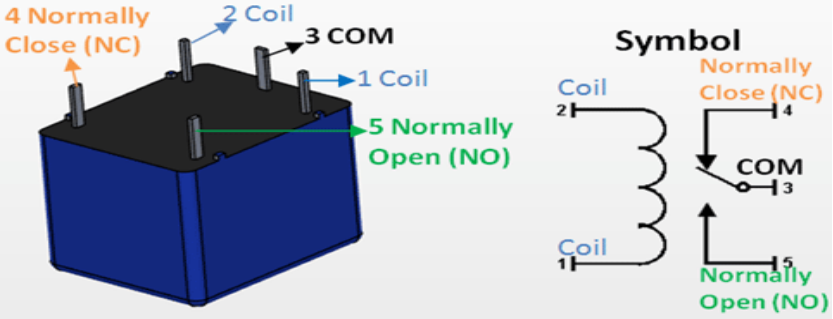


Fig: 2.8: Relay

Table 2.2: Relay Pin Configurations

Pin No	Pin Name	Description
1	Coil End 1	Used to trigger (On/Off) the Relay. Normally one end is connected to 5V and the other end to ground
2	Coil End 2	Used to trigger (On/Off) the Relay. Normally one end is connected to 5V and the other end to ground
3	Common(COM)	Common is connected to one End of the Load that is to be controlled
4	Normally Close(NC)	The other end of the load is either connected to NO or NC. If connected to NC the load remains connected before trigger
5	Normally Open(NO)	The other end of the load is either connected to NO or NC. If connected to NO the load remains disconnected before trigger

Once is the Trigger Voltage; this is the voltage required to turn on the relay that is to change the contact from Common.NC to Common->NO. Our relay here has 5V trigger voltage, but you can also find relays of values 3V, 6V and even 12V so select one based on the available

voltage in your project. The other parameter is your Load Voltage & Current, this is the amount of voltage or current that the NC, NO or Common terminal of the relay could withstand, in our case for DC it is maximum of 30V and 10A.

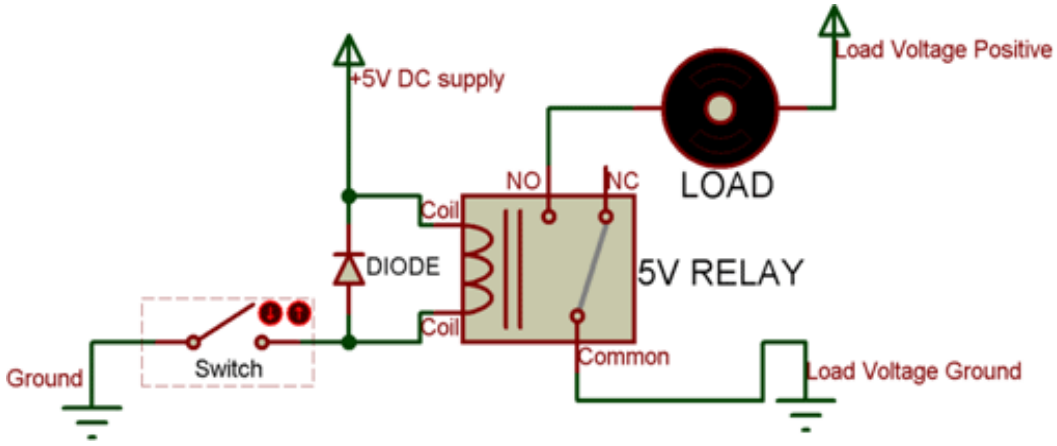


Fig: 2.9: Relay Circuit diagram

The above circuit shows a bare-minimum concept for a relay to operate. Since the relay has 5V trigger voltage we have used a +5V DC supply to one end of the coil and the other end to ground through a switch. This switch can be anything from a small transistor to a microcontroller or a microprocessor which can perform switching operating. You can also notice a diode connected across the coil of the relay, this diode is called the Fly back Diode. The purpose of the diode is to protect the switch from high voltage spike that can produced by the relay coil. As shown one end of the load can be connected to the Common pin and the other end is either connected to NO or NC. If connected to NO the load remains disconnected before trigger and if connected to NC the load remains connected before trigger [10].

Applications of Relay:

- Commonly used in switching circuits.
- For Home Automation projects to switch AC loads
- To Control (On/Off) Heavy loads at a pre-determined time/condition
- Used in safety circuits to disconnect the load from supply in event of failure
- Used in Automobiles electronics for controlling indicators glass motors etc.

2.2.9. 12V DC Power supply (Rectifier)

A bridge rectifier circuit is a common part of the electronic power supplies. Many electronic circuits require rectified DC power supply for powering the various electronic basic components from available AC mains supply. We can find this rectifier in a wide variety of electronic AC power devices like home appliances, motor controllers, modulation process, welding applications, etc.

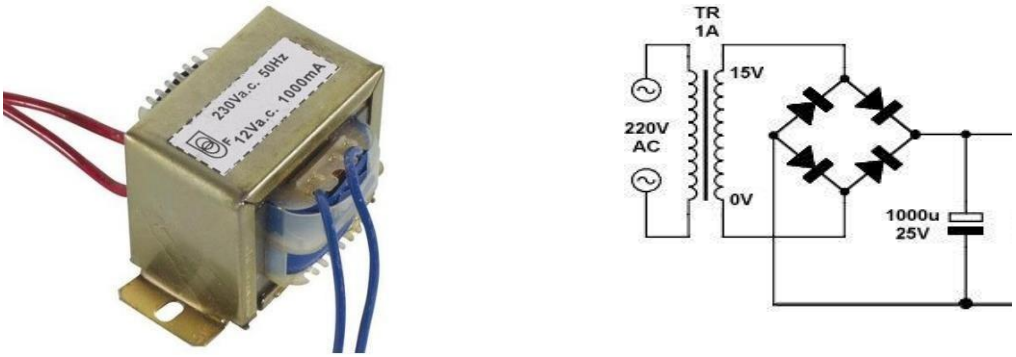


Fig: 2.10: 220/12V rectifier

The bridge rectifier circuit diagram consists of various stages of devices like transformer, Diode Bridge, filtering and regulators. The first stage of the circuit is a transformer which is a step-down type that changes the amplitude of the input voltage. Most of the electronic projects uses 230/12V transformer to step-down the AC mains 230V to 12V AC supply. Next stage is a diode-bridge rectifier which uses four or more diodes depending on the type of bridge rectifier. Choosing a particular diode or any other switching device for a corresponding rectifier needs some considerations of the device like Peak Inverse Voltage (PIV), forward current If, voltage ratings, etc. It is responsible for producing unidirectional or DC current at the load by conducting a set of diodes for every half cycle of the input signal.

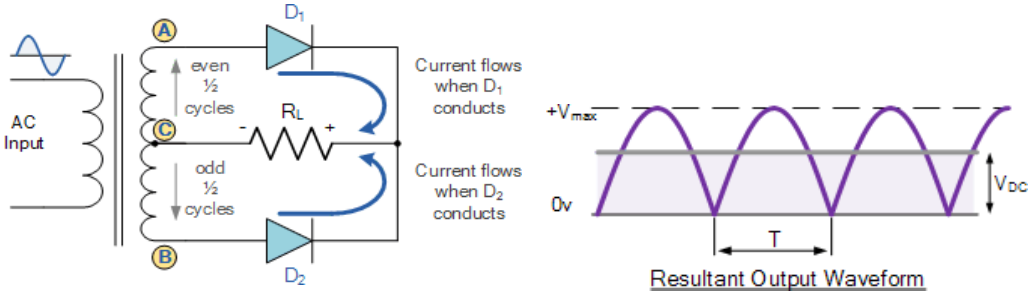


Fig: 2.11: Output Waveforms of 220V/12V rectifier

2.2.10. GSM



Fig: 2.12: GSM

The SIM800L GSM/GPRS module is a miniature GSM modem that tin be cast-off in a large number of IoT plans. A cell phone accomplishes nearly anything this segment can; SMS script messages, building and delivering phone calls, between to the internet over GPRS, TCP/IP, also more. Finally, the module provisions GSM/GPRS as a quad-band link, so its mechanism is pretty much any place. Next to the center of the element possibly will be a SIM800L GSM cellular chip commencing Sim Com.

The chip's operative voltage ranges commencing 3.4V to 4.4V making it a viable contender for a straight LiPo battery offer. This marks it as an applicable substitute for implanting into projects without taking up numerous spaces. All the mandatory information pins of the SIM800L GSM chip are cracked resolute 0.1″ pitch captions. This comprises pins anticipated for communiqué with a microcontroller above UART. The segment maintenances a baud frequency of 1200bps near 115200bps through Auto-Baud recognition. The element wishes an exterior projection to attach to a net. The building block sometimes hails from a helical antenna besides welds onto the internet pin on PCB. Additionally, the board has a U.FL instrumentation port for when wishing to place the antenna away from the board.

2.2.11. LCD Display

DESCRIPTION

This is another great blue/yellow backlight LCD display. As the pin resources of Arduino controller is limited, your project may be not able to use normal LCD shield after connected with a certain quantity of sensors or SD card. However, with this 12C interface LCD module, you will be able to realize data display via only 2 wires. If you already has 12C devices in your project, this LCD module actually cost no more resources at all. It is fantastic for Arduino based project.

This is a RoHS compliant 12C Serial LCD Daughter board that can be connected to a standard 16x2 or 20x4 Character DisplayModule that supports 4-bit mode. All Character Modules sold on our site support 4-bit mode, and nearly all commercially available16×2 and 20x4 line character modules support it too.

This board has a PCF8574 12C chip that converts 12C serial data to parallele data for the LCD display.here are many examples onthe internet for using this board with Arduino. Do a search for "Arduino LCD PCF8574". The 12C address is 0x3F by default, but thiscan be changed via 3 solder jumpers providedthe board. This allowsto 3 LCD displays to be controlled via a single 12C bus

Product Images are shown for illustrative purposes only and may differ from the actual product.

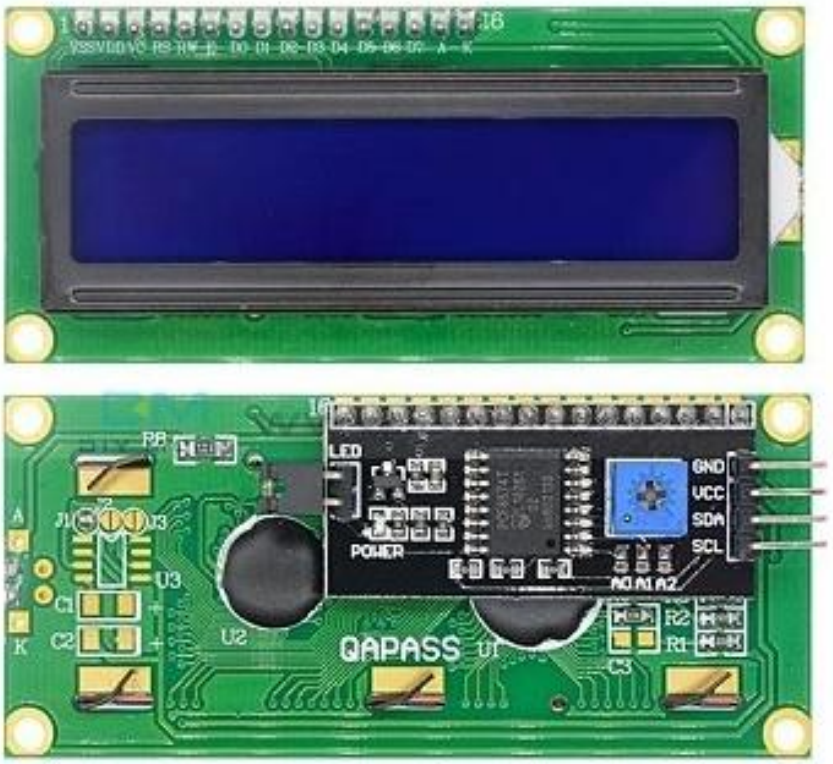


Fig: 2.13: LCD Display

Features:

1. Interface: 12C
2. 12C Address: 0x27
3. Pin Definition: VCC, GND, SDA, SCL
4. Back lit (Green with white char color)
5. Supply voltage: 5V
6. Size: 27.7mmx42.6mm
7. Contrast Adjust: Through Potentiometer8. Only employ two I/O interface.

Specifications:

1. 5V power supply.
2. Serial 12C control of LCD display using PCF8574.
3. Backlight can be enabled or disabled via a jumper on the board.
4. Contrast control via a potentiometer.
5. Can have 8 modules on a single I2C bus (change address via solder jumpers) address, allowing.
6. Size: 41.6 x 19.2 mm.

CHAPTER III

DESING & FEBRICATION

3.1. Introduction

In this chapter fully cover with discuss design and fabrication of this project. Here we will discuss about developed block diagram and briefly describe about the circuit description and also learn about working principle. Total project flow chart is also available in this chapter.

3.2. Block Diagram

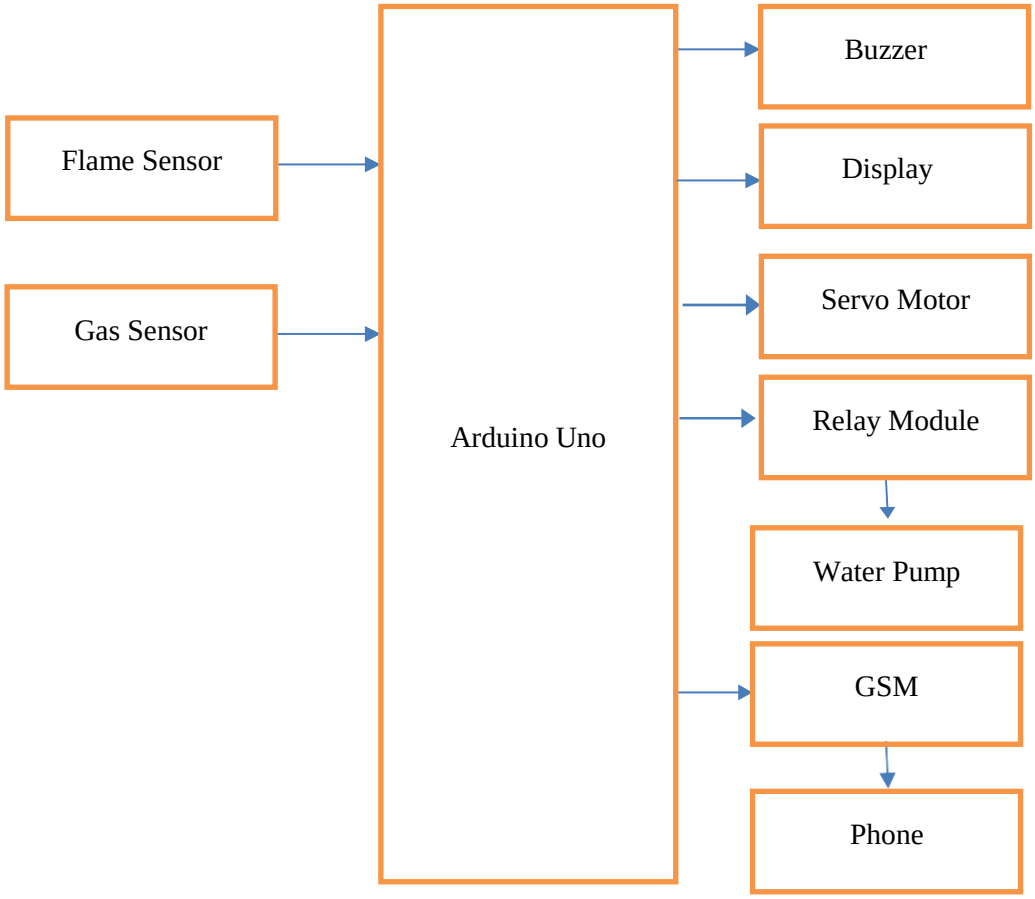


Fig: 3.1: Block diagram of project

Here's the block diagram of our GSM Based CNG Station. we are using arduino Uno for controlling our device. Here Flame Sensor and Gas sensor sends data to arduino Uno and Arduino UNo send data to Buzzer, Relay Module, GSM, and Servo Motor.

3.3. Circuit Description & Description

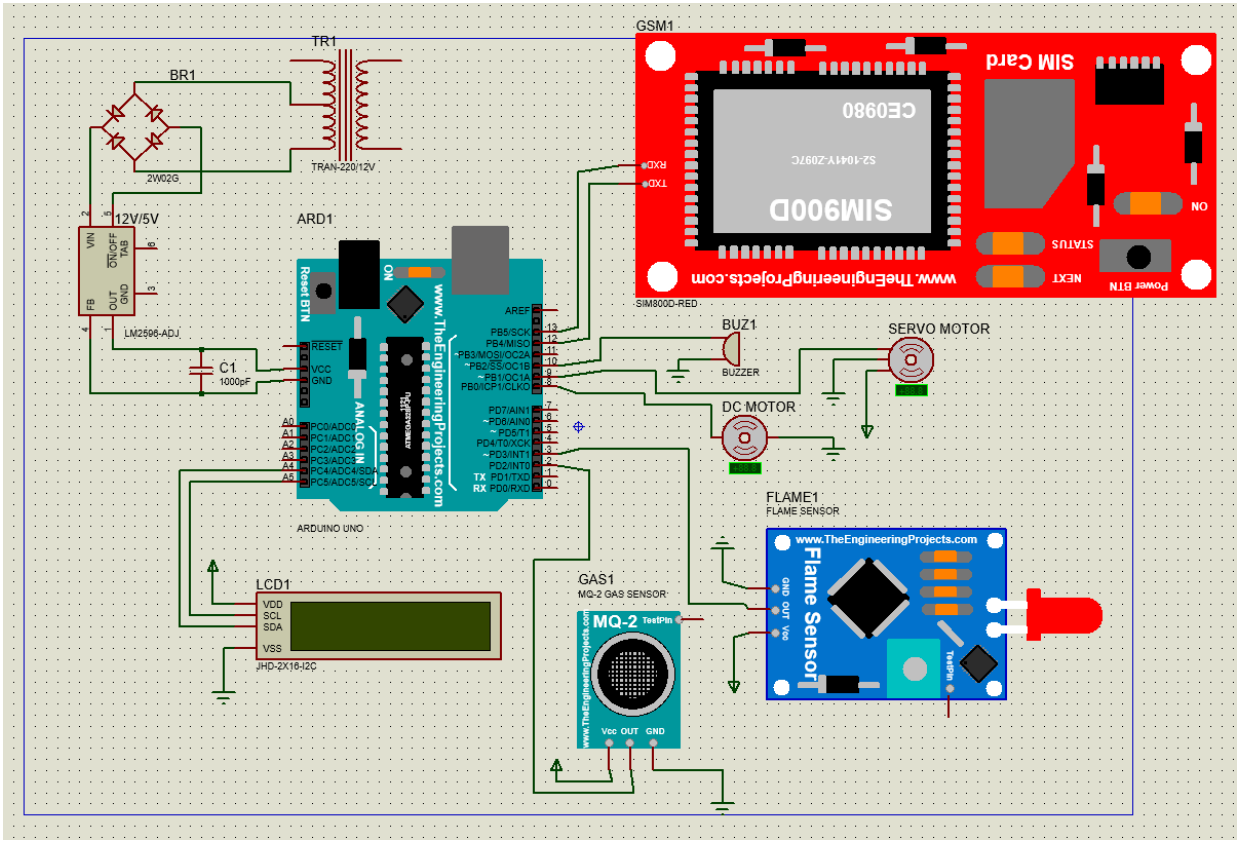


Fig: 3.2: Circuit diagram of the Project

In our circuit, we've used an Arduino as the controller. Also we are using flame sensor, gas sensor, gsm, servo motor, buzzer, relay Module and water pump.

GSM connected with arduino pin tx and rx, relay module connected with d1 pin of arduino. buzzer connected with d11 pin of arduino. Servo motor connected with d12 pin of arduino. fire sensor and gas sensor connected with A0 and A1 pin of Arduino Uno.

After power up everything, the Flame sensor and gas sensor continuously read the data and sends the data to the controller. Controller control the output device.

.

3.4. Overview of GSM Based CNG Station

As we all know that the wire distribution of remote data monitoring network is very difficult and costly, it is very effective for us to design intelligent monitoring system using GSM wireless communication network. In our design, the CNG station monitoring system can monitor the environment of CNG automobile gas station in real time, and can detect more data by using different environment sensors, for example, the system can be remote Auto security alarm

system by equipped with infrared detecting sensors. If the monitoring system have multiple environment data collecting spots, which can build up background network, every spot can be numbered, the sending data displays the number of environment collecting spot, in this way, the CNG automobile gas station can be monitored in networking and managed unmanly. The monitoring system can be popularize and play a great role in the daily life.

3.5. Working Principle

GSM Based CNG Station . We are using arduino Uno for controlling our device. Here Flame Sensor detected fire and sends data to arduino then arduino sends data to buzzer and servo motor to open emergency gate also send data to relay module for run the water pump. Also Gas sensor detected gas and sends data to arduino Uno and Arduino UNo send data to Buzzer, GSM, and Servo Motor to open emergency gate. If Fire detected or gas detected or both of are detected then sends sms to authorized person.

3.6. Image of the Project

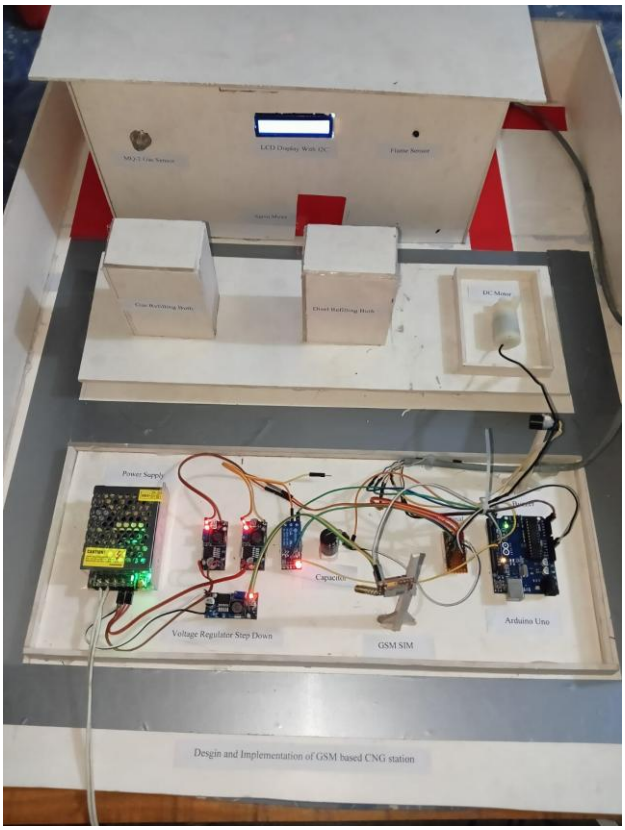


Fig: 3.3: Real image of the project

3.7. Flow Chart

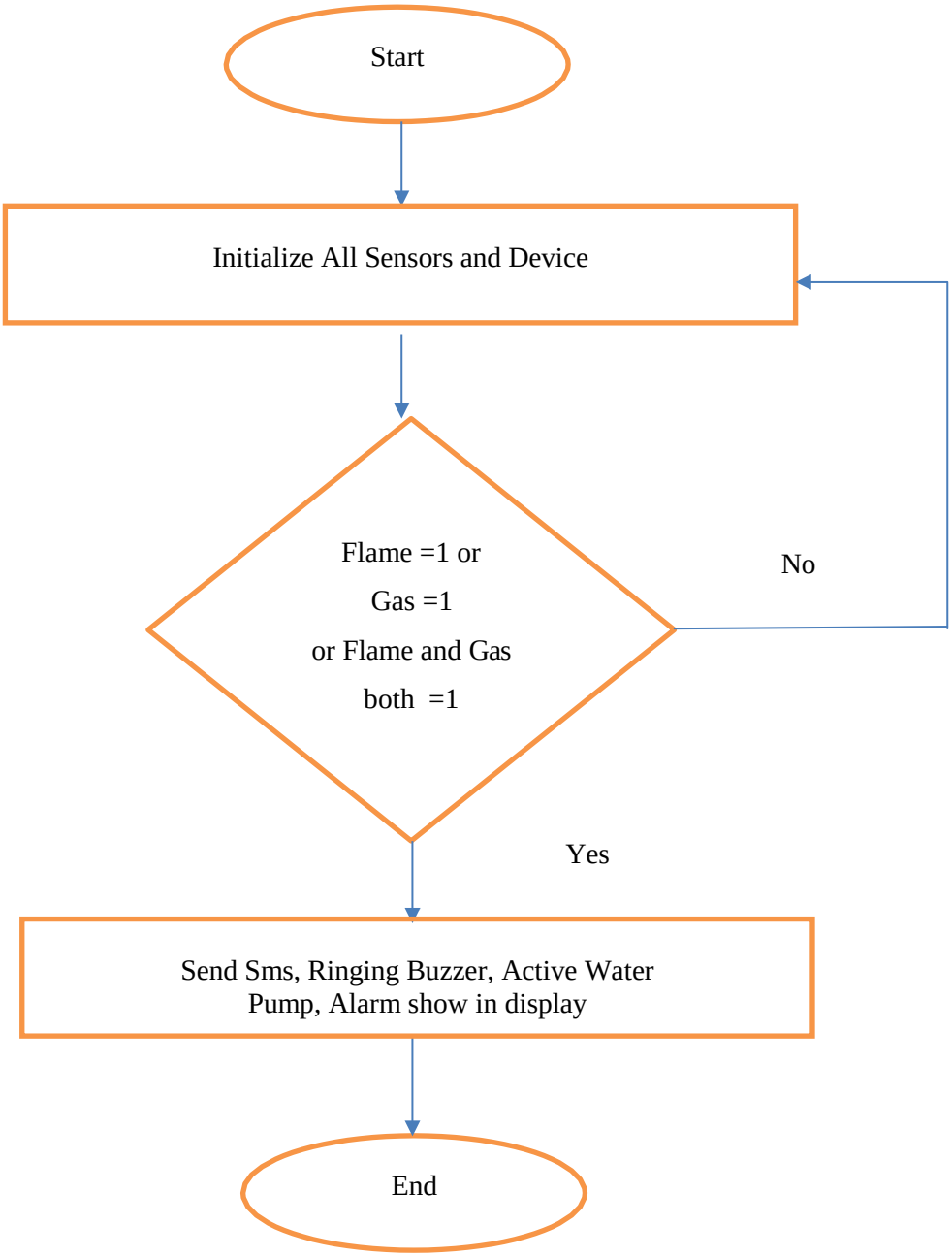


Fig: 3.4: Flow chart of the project

3.8. Conclusion

In this chapter we have discussed the block diagram,circuit discription, working principle, flow chart also show the real image of the project and others. In the later part of this paper we discussed the result & discussion of the project to make the concept clear to anyone.

Chapter IV

RESULT & DISCUSSION

4.1. Introduction

This chapter contains the results obtained and discussion about the project. We have also covered discussions about advantages, disadvantages and limitation of current version of the protection system.

4.2. Result



Fig: 4.1: When Fire Detected



Fig: 4.2: When Gas Detected

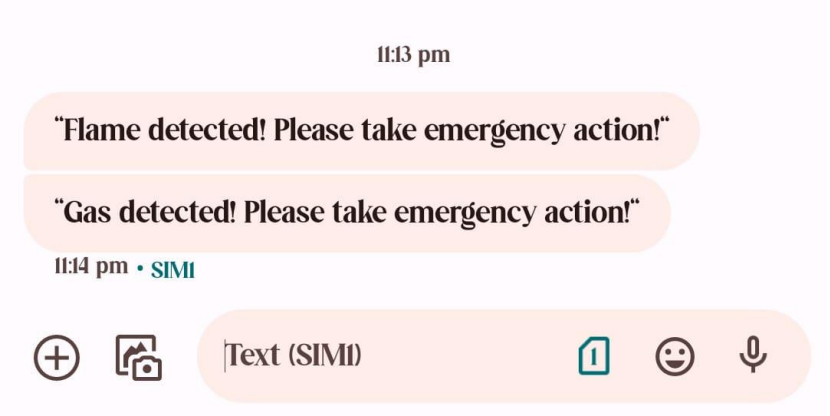


Fig: 4.3: SMS from CNG Station when detected gas or fire

4.3. Advantags

- Remote Monitoring and Control
- Gas Inventory Management
- Safety and Security
- Data Analytics and Reporting

4.4. Disadvantages

- Initially High cost for implementation
- Sensor Error
- False Alarm

4.5. Discussion

A GSM-based (Global System for Mobile Communications) CNG (Compressed Natural Gas) station is a modern and technologically advanced approach to managing and operating CNG refueling facilities. This concept involves integrating GSM technology into various aspects of a CNG station's operations to achieve improved efficiency, safety, and customer experience. Let's discuss the key points and benefits of a GSM-based CNG station:

Real-time Alerts and Notifications: The GSM-based system can be configured to send immediate alerts and notifications to designated personnel in case of emergencies, safety breaches, or equipment malfunctions. This real-time communication ensures that corrective measures are taken swiftly, reducing the risk of accidents or operational disruptions.

Safety Improvements: Safety is paramount in CNG stations. GSM-based systems can monitor for gas leaks, irregular pressure, or temperature fluctuations. Rapid detection and notification of such issues enable swift responses to prevent safety hazards.

4.6. Cost Estimation

Table:4.1: Cost Estimation

SI	Particulars	Specification	Qty.	Price
1	Arduino Uno		1	1050
2	Flame Sensor	Fire Detection	1	120
3	MQ-2 Gas Sensor	Gas Detection	1	120
4	Power supply	230V/12V, 3Amp	1	500
5	wire	As per need	40ft	120
6	Capacitor	1000uf, 50V	2	30
7	GSM SIM800L	SIM Module	1	450
8	Servo Motor		1	150
9	Relay Module		1	120
10	water Pump		1	120
11	Display	16×2 I2C	1	180
12	Voltage regulator step down		3	360
	Others			1200
			Total=	4520

4.7. Applications

- CNG Station
- Hospitals
- Houses
- Markets
- Restraurents

Chapter V

CONCLUSION

5.1. Conclusion

In conclusion, integrating GSM technology into CNG stations can lead to improved operational efficiency, safety, and customer satisfaction. This convergence of communication and energy technologies paves the way for a more connected and intelligent energy infrastructure. However, it's important to stay updated with the latest advancements in both GSM and CNG technologies to fully leverage their potential benefits.

5.2. Future Work

For further change, the exploration can include a few components like security framework or Making the framework remote that empower the export controller to control detecting component. This is ensured there is solid move down framework for this framework if any crisis happens. Also, this framework could screen and controls aerate and cool for different executions with some framework could screen and controls aerate and cool for different executions with some framework adjustments. The harmful gas discharge alert framework security components can likewise be enhanced by adding another capacity to check the sensor's condition on the chance that the sensor is not working appropriately or if the sensor alignment has been dislodged. A force sparing components and force supply go down would likewise be a key expansion to the framework in the principle power supply is down. The caution framework can likewise be snared to a clock and a telephone that dials specifically to the proprietor furthermore the powers if the perilous gas, temperature, fire, vibration and smoke focus levels are identified constantly for more than may be a couple hours. In future work will also be add the other microcontroller for show the value of different sensors in led.

References

[1] Ashish Shrivastava, Ratnesh Prabhaker, Rajeev Kumar and Rahul Verma, “GSM BASED GAS LEAKAGE DETECTION SYSTEM”, published in 2013.

[2] Prof.M.Amsaveni, A.Anurupa, R.S.Anu Preetha, C.Malarvizhi, M.Gunasekaran, “Gsm based LPG leakage detection and controlling system”, published in 2015.

[3] J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.

[4] Halavva Patil, Shreedhar Niradi, Jyoti D.T, Seema J.S, Shweta D.G, “Smart Gas Booking and LPG Leakage Detection System”, published in 2017

Appendix

Code:

```
#include <SoftwareSerial.h>

SoftwareSerial GSM(7, 8); // Define the pins for GSM (RX, TX)
int flamePin = A0;       // Analog pin for flame sensor
int gasPin = A1;         // Analog pin for gas sensor

void setup() {
  Serial.begin(9600); // Initialize the serial communication for debugging
  GSM.begin(9600);    // Initialize the GSM module
  pinMode(flamePin, INPUT);
  pinMode(gasPin, INPUT);
}

void loop() {
  int flameValue = analogRead(flamePin); // Read flame sensor value
  int gasValue = analogRead(gasPin);     // Read gas sensor value

  // Check for flame
  if (flameValue > 800) { // Adjust the threshold as needed
    sendSMS("Flame Detected!");
    delay(10000); // Wait for 10 seconds before sending another SMS
  }

  // Check for high gas levels
  if (gasValue > 800) { // Adjust the threshold as needed
    sendSMS("High Gas Levels Detected!");
    delay(10000); // Wait for 10 seconds before sending another SMS
```

```
  }
}

void sendSMS(String message) {
  GSM.println("AT+CMGF=1"); // Set SMS mode to text
  delay(1000);
  GSM.println("AT+CMGS=\"+880. ....\""); // Replace with the recipient's phone number
  delay(1000);
  GSM.println(message); // The message to send
  delay(1000);
  GSM.println((char)26); // Ctrl+Z to end the message
  delay(1000);
  GSM.println();
}
```