IOT BASED HOME AUTOMATION SYSTEM WITH FIRE AND GAS DETECTION

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Date of Submission: September 2023

DECLARATION OF AUTHENTICATION

We certify that the research/project based thesis titled, "**IOT Based Home Automation System with Fire and Gas Detection**" is completely our group work. All sources and knowledge for this paper which were found by other researchers are acknowledged by reference. Materials of work such as images, figures, tables and citations in this paper are accepted by our Supervisor. We hereby declare that this thesis has not been previously submitted either in whole or in part, for any other degree or publication.

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CERTIFICATION

This is to certify that this project entitled "**IOT Based Home Automation System with Fire and Gas Detection**" 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.

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LIST OF ABBREVIATIONS

IoT	Internet of Thigh
SGS	Smart Grid System
LED	Light Emitting Diodes
ISP	In System Programming
EEPROM	Electrically Erasable Programmable Read-Only Memory
PWM	Pulse Width Modulation
USB	Universal Serial Bus
ICSP	In-Circuit Serial Programming
AC	Alternating Current
DC	Direct Current
IDE	Integrated Development Environment
SRAM	Static Random Access Memory
UART	Universal Asynchronous Receiver/Transmitter
SPP	Serial Port Protocol
AFH	Adaptive Frequency Hopping Feature

ACKNOWLEDGEMENT

The report titled as on **IOT Based Home Automation System with Fire and Gas Detection**" 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 **Nurul Ambia Alaul,** 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

In infrastructure and industrial plants the rapid growth is creating environmental issues like pollution, climate change and malfunctioning. It has a great consequence for the requirement of an operationally adaptable, efficient, cheap and smart monitoring systems. For this purpose we come up with idea to use these kind of technology the Internet of Things (IoT) in form of a solution. In this paper, we suggest wireless data gathering frameworks that enable each detector node to track the changes in the behavioral pattern of gases and to identify their role in gas leakage problem, whilst at the same time trying to minimize power consumption. In the proposed device, the fire detector (Flame Sensor) the gas detector (MQ2) are used to determine the environment and the undesirable gas within the manufacturing plant, gauged details can be connected to the web. In addition, our research findings demonstrated substantial energy efficiency and high-precision data analysis relative to conventional protection device strategies. For monitoring the fluctuation of parameters like air pollution levels from their normal levels in this case the sensing devices are connected to the embedded computing system.

CHAPTER 1

INTRODUCTION

1.1 Introduction

The Internet-of-Things (IoT) is a vision for an internetwork of intelligent, communicating objects such as home appliances, vehicles, factory machines, wearable devices and various types of sensors. The convergence of technologies like ubiquitous wireless communications, machine learning, real-time analytics and embedded systems has made novel IoT applications possible in a multitude of domains. A combination of commercial interests and government initiatives have made smart homes, smart healthcare, smart cities, and smart transport primary areas of focus for IoT application development. Internet-of-things-enabled personal healthcare applications will require sensors to collect data in smart spaces, such as smart homes or healthcare environments, and from wearable or implanted RFID tags. Data from RFID devices will provide insights into people's diurnal activities, help detect abnormal events, and possibly alert caregivers to problems. The idea of using an IoT to create smart cities may have originated with a 1990's era nationwide coalition, Smart Growth America (SGA). SGA sought to address issues related to urban environments, including resource management, transportation, and public administration. Recent government support for information and communication technology systems may finally allow the SGA's vision to be realized. Potential applications of IoT include the monitoring of building health, energy consumption, noise, and air quality; improved waste and traffic management; and smart lighting. The Internet-of-Vehicles (IoV) is a subfield of IoT that uses wireless technology to enable vehicles to communicate with their environment. IoV creates opportunities for developing novel applications in intelligent traffic control and management, road safety and vehicular safety such as online diagnosis, anti-theft systems and tracking. IoV enables vehicles to communicate utilizing multiple modes of communications including vehicle-to-vehicle, vehicle-to-network-to-vehicle, and vehicle-to-infrastructure communications. Smart home is a section of the IoT paradigm that aims to integrate home automation and security. Enabling objects in a typical household to be connected to the Internet allows home-owners to remotely monitor and control them. From lamps that are set on timers to turn off at a specific time of the day, to

smart thermostats that will regulate the temperatures in a house and generate detailed reports about energy usage, smart homes have found its niche in the consumer market. The availability of affordable smartphones, micro-controllers and other open-source hardware along with the increasing use of cloud services, has made it possible to develop low-cost smart home security systems. With families having busier lives than ever, smart home automation and security systems can also cater to household members with limited mobility such as the handicapped and the old. The purpose of this paper is to present a low-cost architecture using RF based communication in a household to create an IoT-enabled smart home security system. Smart home devices that typically consume low power such as smart bulbs and door or window sensors use RF transceivers to communicate with each other. In this.

1.2 Defining Fire Accident Protection System Concept

Today, humanity can be classified as living in a “machine society” where technological tools are predominantly at different levels, interfacing in the day–to-day activity of man. These livelihood activities constitute and deliver economic, social and political benefits and potential risks to the survivability of nations –especially developing nations like ours.

Due to the fast development in telecommunication technologies, it is believed that wireless communication is a good practice for remote sensing and automation in industrial and residential locations. Nigeria, like any developing country, is witnessing an era of rapid economic and social development. This development brings with it, new technologies, new materials, power sources and telecommunication equipment. Modern industries are springing up housing volatile materials and highly sophisticated equipment that increase the menace of fire. Concern for safety of lives and properties calls for an efficient and dependable fire protection system. This has enhanced the application of new technologies in the fire field. Sensors are able to consider certain dynamic and static variables such as humidity, the type of fuel, slope of the land, the direction and the speed of the wind, smoke , to mention a few.

The reports of most of the panel of enquiries on fire accidents in Nigeria, oral interview of some fire experts and personal experience confirmed the fact that electrical fault is a major source of fire accident. Hence, realization that a fire

protection system capable of automatically switching off electrical power supply to the affected area in addition to the traditional role of raising an alarm and triggering a sprinkler or other automatic fire lighting system is going to be more efficient than the existing systems which leaves that important role unaddressed. Now a day's automatic fire detection and control is becoming very essential to reduce the fire in the building and industry. Automatic fire alarm system provides real-time surveillance, monitoring and automatic alarm. A key aspect of fire protection is to identify a developing fire emergency in a timely manner, and to alert the building's occupants and fire emergency organizations. This is the role of fire detection and alarm systems. Generally fire detectors are designed to respond at an early stage to one more of the four major characteristics of combustion, heat, smoke, flame or gas. No single type of detector is suitable for all types of premises or fires. Heat detectors respond to the temperature rise associated with a fire and smoke detector respond to the smoke or gas generated due to fire.

Thus, proposed in this paper is the design and implementation of a fire alarm system with SMS notification, this idea is economically efficient as well because the system proposed is intelligent and reduces human intervention and labor extensively and execution can be gotten at a very low cost providing extensive environmental, property and life safety.

1.3 Objective

The basic objective of this system is to utilize the available and cheap method of the remote and automation process of the GSM network and sensing system to collect real-time status of the environment and make measurements to prompt a remote response in case of a fire incident.

- To design and implement Advance Fire Alarm System.
- To design and implement GSM Notification System.
- To design and implement Fire accident Protection System.

1.4. Scope of Project

The scope of this project is to design and construct fire alarm system interfaced with a microcontroller unit and GSM module with the wireless communication features over SMS. Within the scope of this project, the prototype model is equipped with a dedicated SIM (Subscriber Identification Module). Minimal power consumption can be achieved for the operations. The limitation of this project is that the system would not be able to perform communication get the real status of the location when there is no network coverage.

Due to the increase in fuel costs, we use LPG gas in most petrol/diesel vehicles. The use of LPG gas in car and home is very risky. The LPG gas cylinders used at home and elsewhere are the same condition, which is mainly due to LPG gas leakage accidents. For the protection and security of LPG gas explosion problem, we design the IoT based system to prevent home and vehicle accidents.

1.5 Examples of Embedded Systems

Embedded systems are found in a wide range of application areas. Originally they were used only for expensive industrial control applications, but as technology brought down the cost of dedicated processors, they began to appear in moderately expensive applications such as automobiles, communication, and office equipment and television

1.6 Methodology

The method used in the execution of this project comprises the combination of serial communication protocols, signal processing, programming logics with embedded system. In other to establish the aim of the project these methods were combined from the design stage to the construction and performance results of the system. Using carefully selected materials and software implementation to drive the complete system as seen in the final construction. This chapter entails the design procedure of the system detailing the theoretical analysis, choice of components and values and construction and packaging materials. Indicating calculations, schematics and drawings

1.7 Project Outline

Chapter 2 shows a study of the literature review of related work which was used to develop the project.

Chapter 3 describes the block diagram, working procedure, connection diagram and explanation.

Chapter 4 describes all the hardware devices and power supply to the project.

Chapter 5 reviews the results found through the project and provides a discussion on the findings.

Chapter 6 specified the limitations of the project, provides the future works that may be approached and conclusion.

1.8 Summary

Firstly, we discuss about smart grid, home automation. We also discuss about Benefits of Smart Cards and Advantages, Disadvantages of the security system. Then we discuss about problem statement, methodology and objective of this project. Lastly, we discuss about project outline in this chapter.

CHAPTER 2

LITERATURE REVIEWS

2.1 Introduction

As an essential part of researching the three main questions posed by this thesis, it was necessary to examine and review available literature material for suitability for inclusion into this thesis. There are three sections to the literature review
Corresponding to each of the questions posed.

2.2 Liquefied Petroleum Gas

LPG or LP Gas is Liquefied Petroleum Gas. This is a general description of Propane (Chemical formula C3H8) and Butane (chemical formula C4H10), either stored separately or together as a mix. LPG is a mixture of hydrocarbon gases which are propane and butane used as a fuel in heating appliances and vehicles. Propane and butane are gaseous at normal temperature and can be liquefied under low pressure to provide easier packing. The name LPG comes from the fact that these gases can be liquefied at normal temperature by application of a moderate pressure increase, or at normal pressure by application of cooling using refrigeration. LPG comes from two sources. It occurs naturally in oil and gas fields and is separated from the other components during the extraction process from the oil or gas field. LPG is also one of the by-products of the oil refining process. LPG is used as a fuel for domestic, industrial, horticultural, agricultural, cooking, heating and drying processes. LPG can be used as an automotive fuel or as a propellant for aerosols, in addition to other specialist applications. LPG can also be used to provide lighting through the use of pressure lanterns.

2.3 Theory

Gas Leakage Detector with Notifier System is the innovation from existing Gas Detector. This project is mainly for an individual who wants to keep their home safe from the risk of burning. The benefit of this project is to detect any leakage of cooking gas and it will alert the user about leakage. Microcontroller Arduino UNO at the processor where it processes the input from the sensor and to GSM module to

communicate with the user by sending an alert through SMS. This kind of gas detector is more efficient as the user will get the information faster and the detection of gas is continuous.

2.4 Types of Fire Alarming System

Fire is a self-sustaining, chemical chain reaction with varying degrees of light and heat. Temperature and smoke sensing alert system is motivated to sense the temperature and smoke and send the alert in an intelligent fashion in case of emergency situation due to fire blow. In every country in the world the fire alarming system is considered to be essential for lots of physical structures including industries, shopping malls and private houses.

Fire is made up of four components:

- Fuel
- Oxygen
- Heat
- Chemical Chain Reaction.

2.5 Classes of Fire

There is a universal system to describe different types of fires. This system incorporates the use of letters, colors and symbols to help users select an extinguisher suitable for the type of material involved in the fire.

Class A: Ordinary combustibles, such as wood, cloth, paper, rubber, many plastics, and other common materials that burn easily.

Class B: Flammable liquids. Includes gasoline, oil, grease, tar, oil-based paint, lacquer, and flammable gas.

Class C: Electrical equipment, such as wiring, fuse boxes, circuit breakers, machinery and appliances.

Class D: Combustible metals. Includes magnesium, aluminum, lithium, and other combustible metals or metal dust.

2.6 Types of Fire Extinguishers

Labelling on the fire extinguisher identifies which class of fire it is appropriate for; Class A, B, C, D or K and instructions on how to use it.

- Dry Chemical: Dry Chemical is the most widely used type of fire extinguisher and is also recognized as a multi-purpose ABC fire extinguisher. The agent works by interrupting the chemical chain reaction. Also, on a class A fire it creates a barrier between the fuel and the oxygen.
- Carbon Dioxide: Works by separating oxygen and heat. Usually ineffective against class A fires.
- Water/Foam: Works by cooling the fire and coating the fuel. Foam extinguishers create a foam barrier preventing the fuel from coming in contact with oxygen, can cause shock hazard on class C fires, can cause liquids in class B fires to spread and effective on class A fires.
- Dry Powder: Works by separating fuel from oxygen and/or removing heat. Effectiveness is based on the type of class D fire it is designed to extinguish. Ineffective on class A, B, C fires (metal fires) only.
- Wet Chemical: Works by forming a soapy foam blanket over the burning material and cooling it below its ignition temperature. Designed for restaurant type kitchens.
- Clean Agent: Works by interrupting the chemical chain reaction.

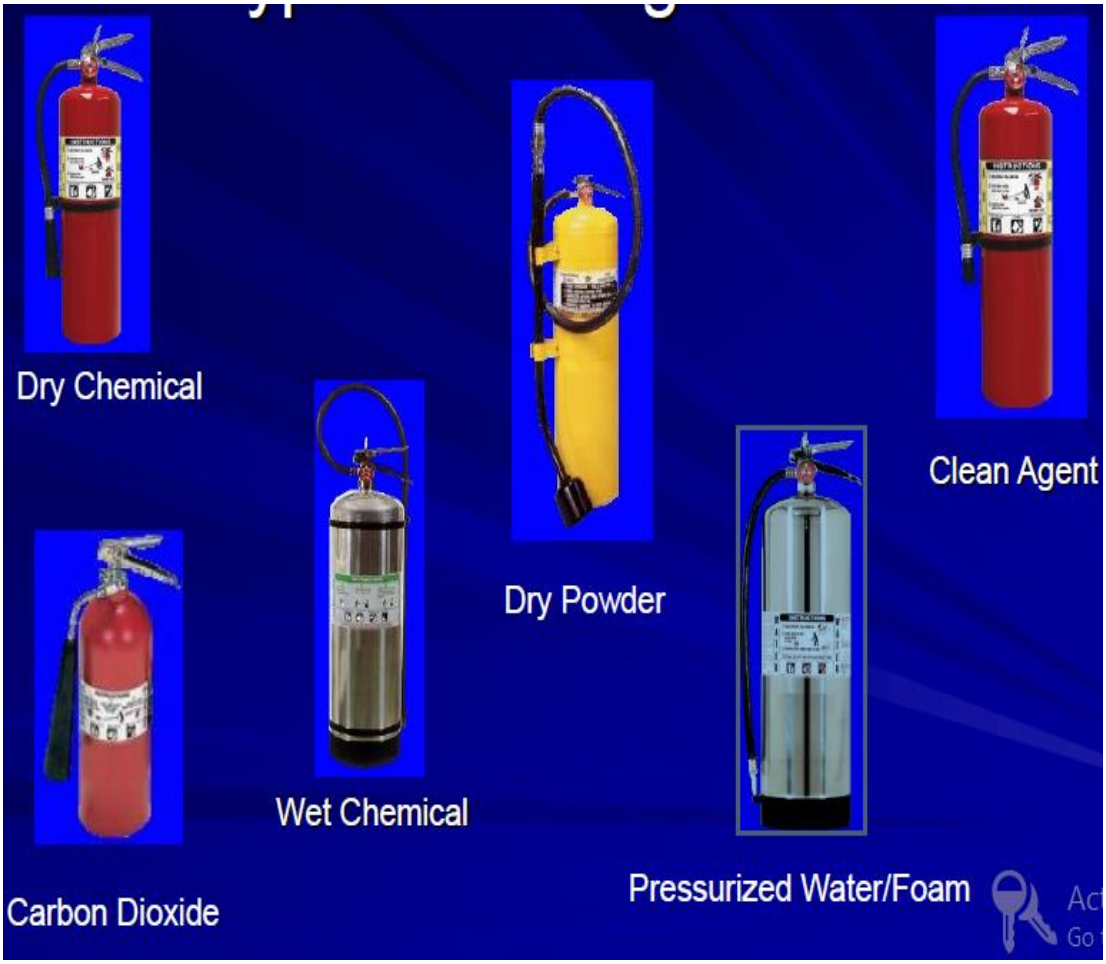

Figure 2.1: Types of Fire Extinguishers.

2.7 Review of Related Works

The paper presented in discusses that fire, being an important process that affects ecological systems across the globe has both positive and negative effects. However soil erosion, atmospheric pollution and hazard to life and property are majorly the negative effects. Fire accident creates serious health and safety hazard in developing countries, which also resulted into catastrophic situation. This huge loss is inestimably enormous; hence this paper proposes the development of a GSM -based fire detector system. A cost effective system that detects fire or smoke and sends alert information to a mobile phone for quick and immediate action thereby, avoiding unnecessary and costly industrial and domestic breakdown. The fire alert design was built around techniques for digitalizing analogue signals obtained from transducers used to monitor temperature of the room and the light intensity of the room. The room temperature to be monitored, being analogue, is measured through the use of a thermistor, while the light intensity of the room is detected using Light Dependent Resistor (LDR). The

LDR's resistance increases with reduced light intensity causing the voltage input into the inverting input of the comparator used to be higher than the reference voltage set at the non-inverting input of the comparator which makes the comparator to output a LOW. The thermistor resistance decrease with increase in temperature and this would cause a decrease in the voltage input to the non-inverting input of the comparator thereby causing the voltage reference set at the inverting input to be greater. In this state the comparator outputs a LOW, to indicate high temperature (i.e. fire). The two LOW outputs were ORed and coupled to the astable stage of the circuitry.

The system developed in has come to light through the way of inspiration to develop a compact system, based on the fundamental ideas of safety, security and control. Once this system is installed to operation specifying temperature and smoke threshold, in case of any emergency situation due to increasing temperature and/or smoke at place surpassing the threshold, the system immediately sends automatic alert-notifications to the users, concerned with the situations. The user gets total control over the system through mobile SMS, even from the distant location, that to change the threshold, turn on/off the feature of sending 'alert notification' and also to reset the system after the emergency situation is overcome. Before executing any command (through SMS) from the user, the system asks for the preset password to verify an authorized user. The security issues have been considered with utter attention in this system to ensure its applicability in industries and business organizations, where security is an important concern. Hence, the fundamental ideas of safety, security and control have been entirely ensured through the system, which have definitely worked as the gear moving factor to look for a new dimension of an 'Intelligent Fire Alert System'. Multiple temperature and smoke sensors are incorporated in the system to cover a wide range of area, which are connected to Atmega32 microcontroller interfaced with a GSM module. The alert notification can be sent to multiple users and the corresponding mobile numbers can be set/reset by the user in the server mobile through the user interface of the program, running on the computer.

The design has been developed since the social and economic cost of natural disasters which has increased in recent years due to population growth, change in land use patterns, migration and unplanned urbanization, environmental degradation and global climate change. Catastrophic disasters include fires, earthquakes, volcanic eruptions, tropical cyclones, floods, and droughts. Fire considered being natural or manmade, thus the management shall provide safety of the building occupant. The design

consists of five major circuits to compensate the system operation. It includes Detection and Initiating Devices (DEADS), Notification Devices (NODES), Central Station Monitor (CSM), Annunciation Devices (ANODES) and the Suppression Circuitry. The DEADS is composed of a smoke detector and smoke ionization sensors which transmit initiated signal to CSM. The NODES are active devices like smoke alarms, and speakers attached to every room designed to give alarms to the room occupants. The Central Station Monitor designed with Arduino Uno as the Microcontroller served as the brain of the system interfaced with PHP & MySQL. The ANODES works once fire cannot be suppressed by the system itself, thereby when the fire department and other incident team needs to be contacted. The suppressor composed of robotic-arm connected to the water supply, fire hydrants, and sprinkler heads. The methodologies described in this paper heavily rely on integration of web science to an embedded system. Compared with traditional or conventional fire alarm system, this design reduces energy consumption, reduction of maintenance and service operation costs, improved security services, and increase the satisfaction of building occupants.

Security in travel is primary concern for everyone. Today fire accident are most often occurring in trains. A remedy to reduce the death loss occurring due to fire accidents in trains is presented. Fire on a running train is more catastrophic than on a stationary one, since fanning by winds helps spread the fire to other coaches. When these accidents are occurring in remote areas or during night times the loss or damage being caused is at higher rates. The damage is heavier due to improper reach of service at right time due to improper communication.

2.8 The History of Home Security

Recently, many local governments have been aiming to implement an IoT-based smart city through the construction of a test bed for IoT verification and an integrated infrastructure. This movement also corresponds to the creative economy that is emphasized by the Korean government. In this chapter, smart city implementation models based on IoT that can be implemented by local governments are described through examples.

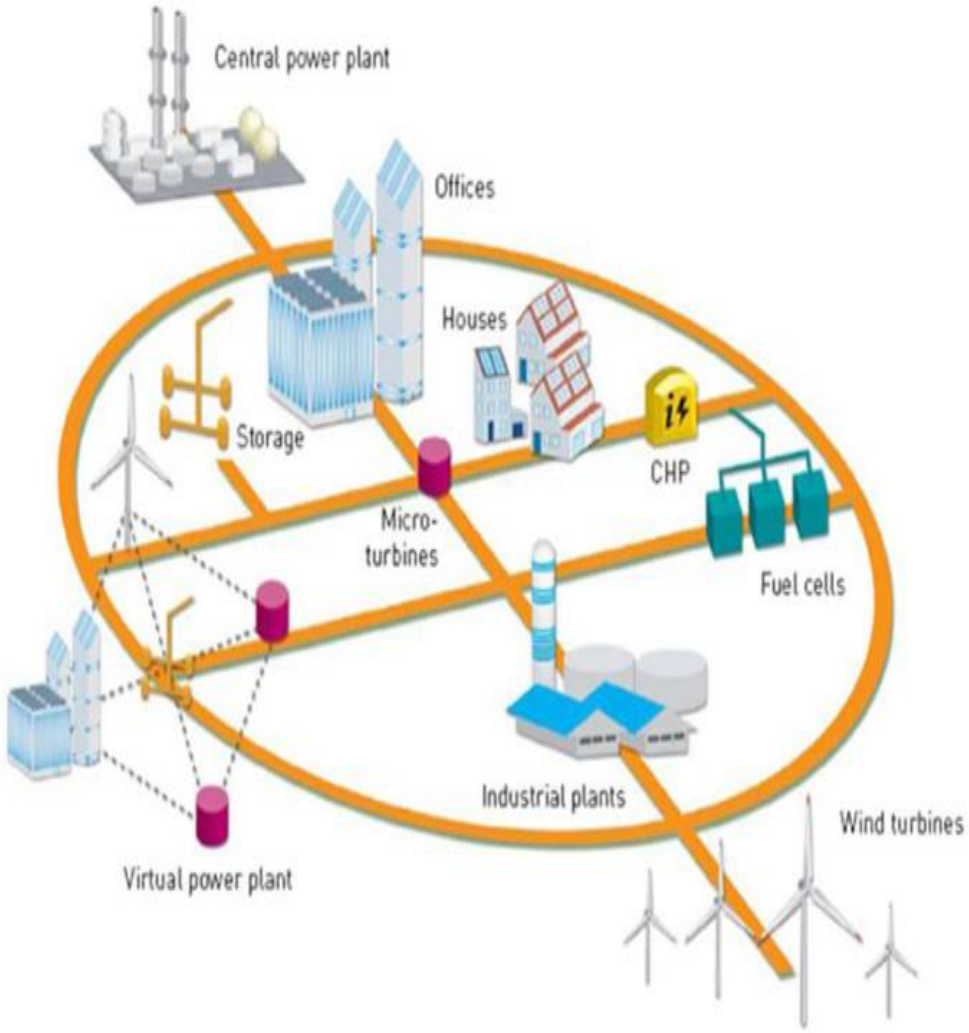

Figure 2.2: Smart City Concept

2.9 Introduction to GSM Network

GSM (Global System for Mobile Communication) has been the backbone of the phenomenal success of mobile communication in the previous decade. Now at the dawn of true broadband services, GSM continues to evolve to meet new demands. GSM is an open, non-proprietary system with international roaming capability. GSM was originally known as Group Special Mobile but nowadays it is commonly referred as Global System for Mobile Communication. It is a set of standards developed by the European Telecommunications Standards Institute (ETSI) to describe technologies used for second generation digital communications, commonly referred as 2G technologies. It was developed as a replacement to the first generation analog

communications. It originally described a digital circuit switched network optimized for full duplex voice communications.

GSM is the world's most popular standard for mobile telephony systems. GSM is used by over 4 billion people all over the world. GSM also pioneered the low cost implementation of the Short Message Service (SMS) which allows parties to exchange delay tolerant short text messages. The popularity and coverage of cellular networks allows the use of SMS service.

According to the analysis of real data taken from a real GSM network in India, SMS delivery success rate is found to be 94.3%. Of these successfully delivered messages, 73.3 arrived to their destination within 10 seconds. About 5% of them required more than 1 hour to reach the destination.

Using SMS for AMR will certainly increase the flow of messages tremendously. GSM uses several cryptographic algorithms for security. The development of UMTS introduces an optional Universal Subscriber Identity Module (USIM), which uses a longer authentication key to give greater security, as well as mutually authenticating the network and the user.

2.10 Summary

Firstly we discuss about smart grid system, Mechanism of security access system. We also discuss about Types of security access system, phone apps access systems, history of smart grid. Lastly we discuss about the history of home appliance.

CHAPTER 3

THEORETICAL MODEL

3.1 Introduction

NodeMCU Libraries is the most important for NodeMCU based project. So that we briefly discuss about NodeMCU libraries, algorithm and working procedure of Smart grid system. We present our whole procedure in this project by the algorithm.

3.2 NodeMCU Libraries Used

3.2.1 Software Serial

The NodeMCU hardware has built-in support for serial communication on pins 0 and 1 (which also goes to the computer via the USB connection). The native serial support happens via a piece of hardware (built into the chip) called a UART. This hardware allows the NodeMCU chip to receive serial communication even while working on other tasks, as long as there room in the 32 byte serial buffer.

3.2.2 Functions Used

Software Serial (rx Pin, txPin)

Software Serial is used to create an instance of a Software Serial object, whose name you need to provide as in the example below. The inverse logic argument is optional and defaults to false. See below for more details about what it does. Multiple Software Serial objects may be created, however only one can be active at a given moment.

Rx Pin: The pin on which to receive serial data Tx Pin: the pin on which to transmit serial data.

Begin (speed)

Sets the speed (baud rate) for the serial communication.

Read ()

Return a character that was received on the RX pin of the software serial port. Note that only one Software Serial instance can receive incoming data at a time.

3.3 Connection Diagram of Smart Automation System

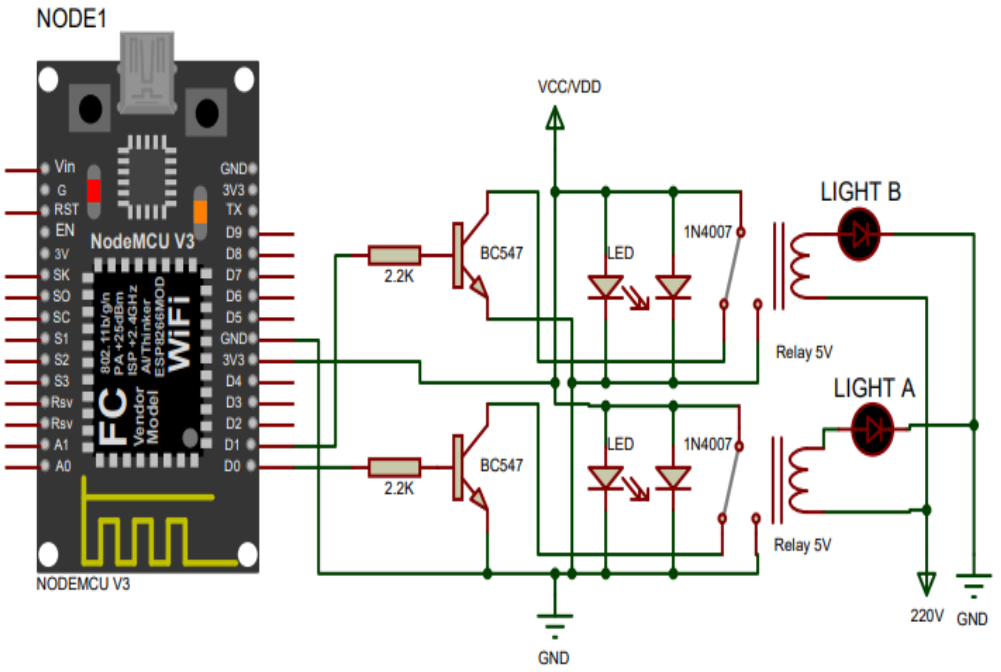

Figure 3.1: Smart Automation System

3.4 Connection Diagram of Fire and Gas Detection System

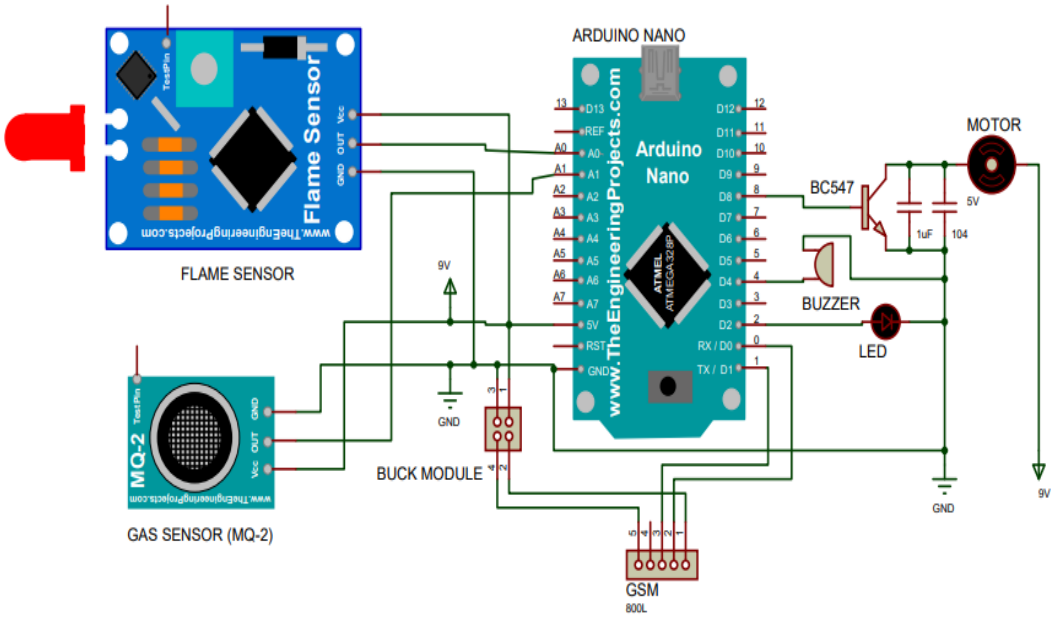

Figure 3.2: Fire and Gas Detection System

3.5 Block Diagram of Smart Automation System

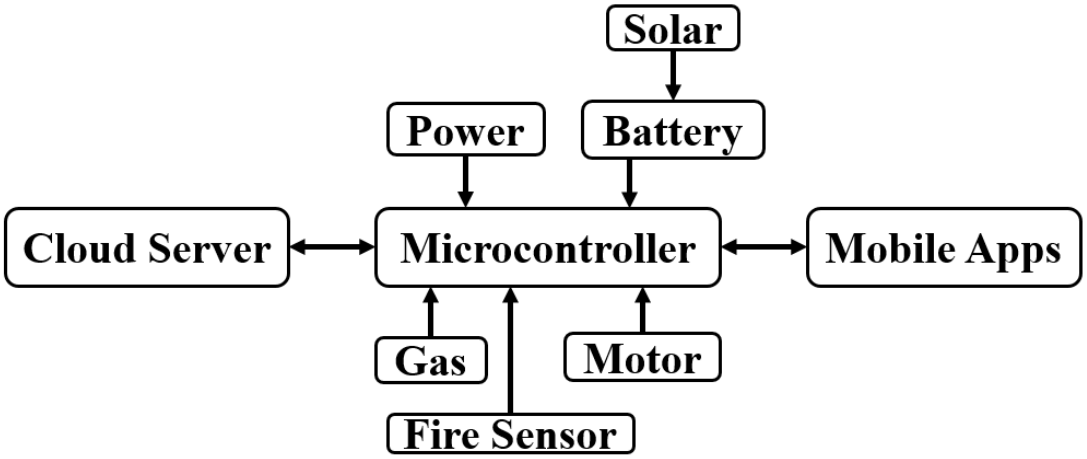

Figure 3.3: Block Diagram

Table No 3.1: The function of this project

System Block	Function
NodeMCU Microcontroller	As data processing center
Adaptor (9V)	As the power supply
LED	As indicator
LED Light	Mechanical working

The system required a program that must be implemented to the microcontroller. Programming language for the Arduino microcontroller is C language. To run the program and incorporate the program to the microcontroller needed software i.e. NodeMCU. Microcontroller NodeMCU has been equipped with an internal EEPROM, Flash memory, etc. This section will examine the input, and give orders to the LED, to fill out his program with the principle of ISP (In System Programming) so that the program can be done without removing control.

Power supply circuit is used to supply power throughout the series; the power needed for the whole series is equal to 5 Volts DC.

3.6 Summary

Firstly, we showed the connection diagram. Then we discuss about the block diagram and explanation. And lastly we briefly discuss about working procedure in this project.

CHAPTER 4

Hardware Development

4.1 Introduction

Now-a-days the telecommunication technologies become wider and more new features exist to make human life better. This project will use a Bluetooth feature in mobile phone to automatically open the door so that Bluetooth technology syncs my phone directly with the lock.

4.2 NodeMCU

The NodeMCU (Node MicroController Unit) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (WiFi), and even a modern operating system and SDK. That makes it an excellent choice for the Internet of Things (IoT) projects of all kinds.

However, as a chip, the ESP8266 is also hard to access and use. You must solder wires, with the appropriate analog voltage, to its pins for the simplest tasks such as powering it on or sending a keystroke to the "computer" on the chip. You also have to program it in low-level machine instructions that can be interpreted by the chip hardware. This level of integration is not a problem using the ESP8266 as an embedded controller chip in mass-produced electronics. It is a huge burden for hobbyists, hackers, or students who want to experiment with it in their own IoT projects. But, what about Arduino? The Arduino project created an open-source hardware design and software SDK for their versatile IoT controller. Similar to NodeMCU, the Arduino hardware is a microcontroller board with a USB connector, LED lights, and standard data pins. It also defines standard interfaces to interact with sensors or other boards. But unlike NodeMCU, the Arduino board can have different types of CPU chips (typically an ARM or Intel x86 chip) with memory chips, and a variety of programming environments. There is an Arduino reference design for the ESP8266 chip as well. However, the flexibility of Arduino also means significant

variations across different vendors. For example, most Arduino boards do not have WiFi capabilities, and some even have a serial data port instead of a USB port.

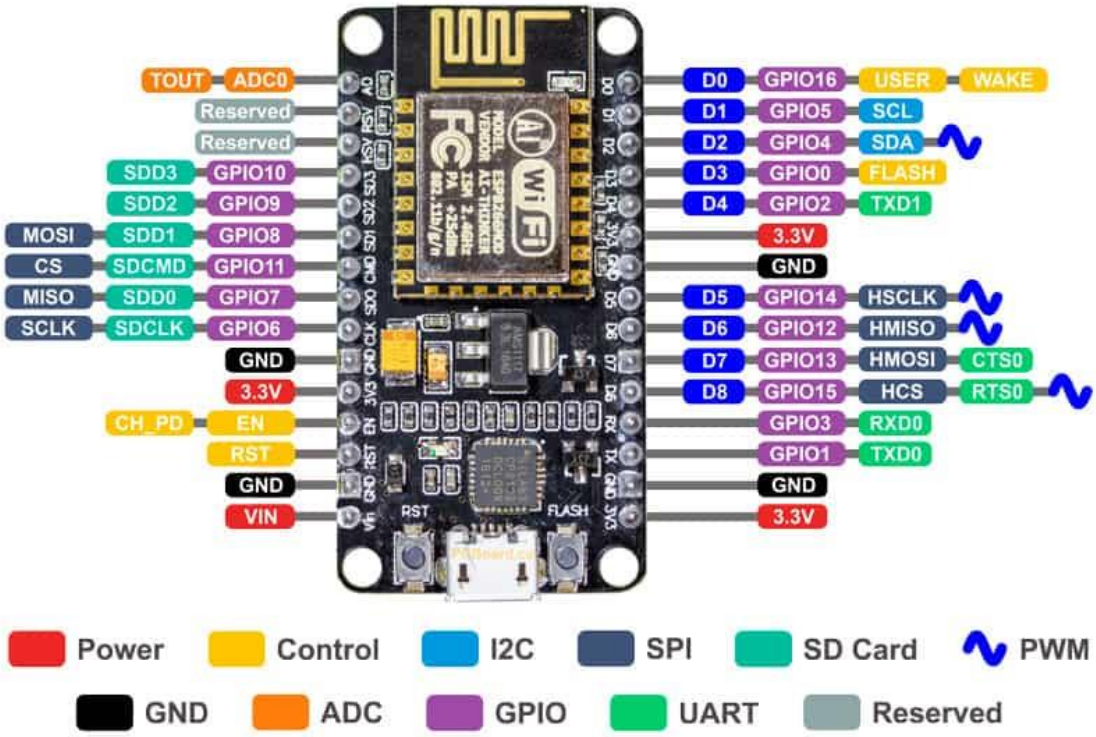

Figure 4.1: Identification NodeMCU

4.3.1 Different Models of the NodeMCU

The NodeMCU is available in various package styles. Common to all the designs is the base ESP8266 core. Designs based on the architecture have maintained the standard 30-pin layout. Some designs use the more common narrow (0.9″) footprint, while others use a wide (1.1″) footprint – an important consideration to be aware of.

The most common models of the NodeMCU are the Amica (based on the standard narrow pin-spacing) and the LoLin which has the wider pin spacing and larger board. The open-source design of the base ESP8266 enables the market to design new varients of the NodeMCU continually.

Figure 4.2: NodeMCU

4.3.2 Power

The power pins are as follows:

• VIN: The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source).

• 5V: The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.

• GND: Ground pins.

4.3.3 Memory

The ESP-8266 32-bit has 4 MB / 64 KB of flash memory for storing code. It has also 2 KB of SRAM and 64 KB of EEPROM.

4.3.4 Inputs and Outputs

Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ESP-8266 USB-to-TTL Serial chip.

PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analog Write() function.

SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.

LED: 13, there is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the on the board.

4.4 LED Light

Stands for "Light-Emitting Diode." An LED is an electronic device that emits light when an electrical current is passed through it. Early LEDs produced only red light, but modern LEDs can produce several different colors, including red, green, and blue (RGB) light. Recent advances in LED technology have made it possible for LEDs to produce white light as well.

LEDs are commonly used for indicator lights (such as power on/off lights) on electronic devices. They also have several other applications, including electronic signs, clock displays, and flashlights. Since LEDs are energy efficient and have a long lifespan (often more than 100,000 hours), they have begun to replace traditional light bulbs in several areas. Some examples include street lights, the red lights on cars, and various types of decorative lighting. You can typically identify LEDs by a series of small lights that make up a larger display. For example, if you look closely at a street light, you can tell it is an LED light if each circle is comprised of a series of dots.

The energy efficient nature of LEDs allows them to produce brighter light than other types of bulbs while using less energy. For this reason, traditional flat screen LCD displays have started to be replaced by LED displays, which use LEDs for the backlight. LED TVs and computer monitors are typically brighter and thinner than their LCD counterparts.

Figure 4.3: LED Light

4.5 Lamp Holder

Figure 4.4: Lamp Holders

Lamps are usually inserted in lamp holder sockets which provide electrical connections to the lamp and support it in the lighting fixture. The use of sockets

allows lamps to be safely and conveniently replaced at the end of life, or to change power, color, lighting technology or etc. There are many different standards for these lamp holders, created by de facto and by various standards bodies. A general coding system is a letter or abbreviation followed by a number. Some miniature lamps have wire leads suitable for direct connection to wires; some reflector lamps have screw terminals for wire connections.

4.6 LED

Light Emitting Diode is abbreviated as LED. They are used at different places such as street lighting; home LED lighting, commercial LED etc. LED lights are small light bulb which fits into the electrical circuit. Working mechanism of LED lights is depending upon the electrons in the semiconductor. LED lights have more lifespan then other ordinary lights.

Figure 4.5: LED

4.7 Resistor

A resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit. Resistors can also be used to provide a specific voltage for an active device such as a transistor

Figure No 4.6: Resistor

4.8 5 Volts Adapter

An adapter or adaptor is a device that converts attributes of one electrical device or system to those of an otherwise incompatible device or system. Some modify power or signal attributes, while others merely adapt the physical form of one electrical connector to another.

Figure 4.7: 5 Volt Adapter

4.9 Microcontroller

A microcontroller is an integrated circuit (IC) device used for controlling other portions of an electronic system, usually via a microprocessor unit (MPU), memory, and some peripherals. These devices are optimized for embedded applications that require both processing functionality and agile, responsive interaction with digital, analog, or electromechanical components.

The most common way to refer to this category of integrated circuits is “microcontroller" but the abbreviation “MCU” is used interchangeably as it stands for “microcontroller unit”. You may also occasionally see “µC” (where the Greek letter mu replaces “micro”).

“Microcontroller” is a well-chosen name because it emphasizes defining characteristics of this product category. The prefix “micro” implies smallness and the term "controller" here implies an enhanced ability to perform control functions. As stated above, this functionality is the result of combining a digital processor and digital memory with additional hardware that is specifically designed to help the microcontroller interact with other components.

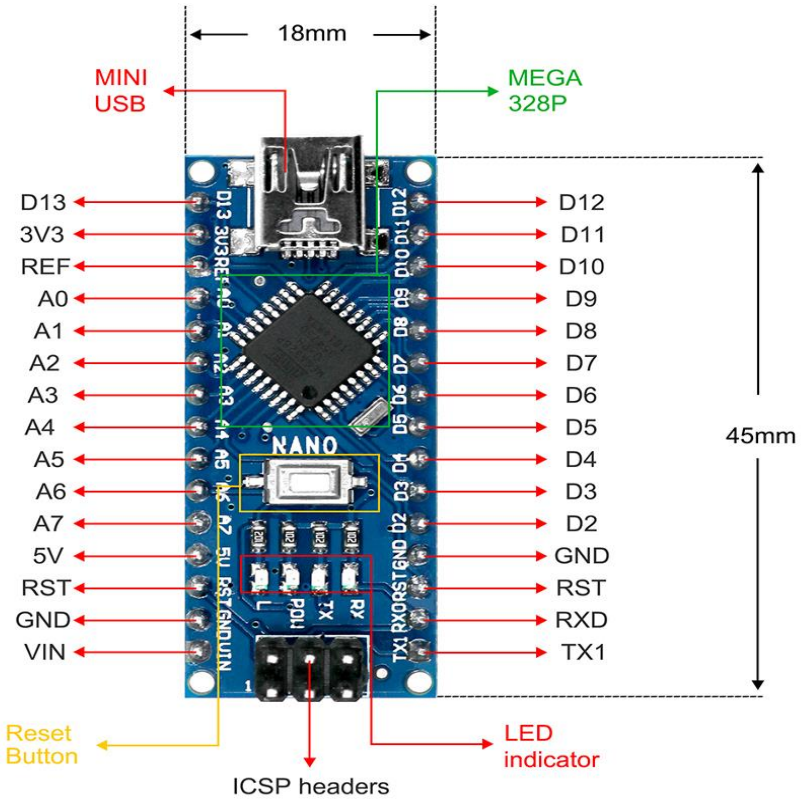

Figure 4.8: Arduino Nano

4.10 SIM800L

At the heart of the module is a SIM800L GSM cellular chip from SimCom. The operating voltage of the chip is from 3.4V to 4.4V, which makes it an ideal candidate for direct LiPo battery supply. This makes it a good choice for embedding into projects without a lot of space.

All the necessary data pins of SIM800L GSM chip are broken out to a 0.1″ pitch headers. This includes pins required for communication with a microcontroller over UART. The module supports baud rate from 1200bps to 115200bps with Auto-Baud detection. The module needs an external antenna to connect to a network. The module usually comes with a Helical Antenna and solders directly to NET pin on PCB. The board also has a U.FL connector facility in case you want to keep the antenna away from the board. There's a SIM socket on the back! Any activated, 2G micro SIM card would work perfectly. Correct direction for inserting SIM card is normally engraved on the surface of the SIM socket.

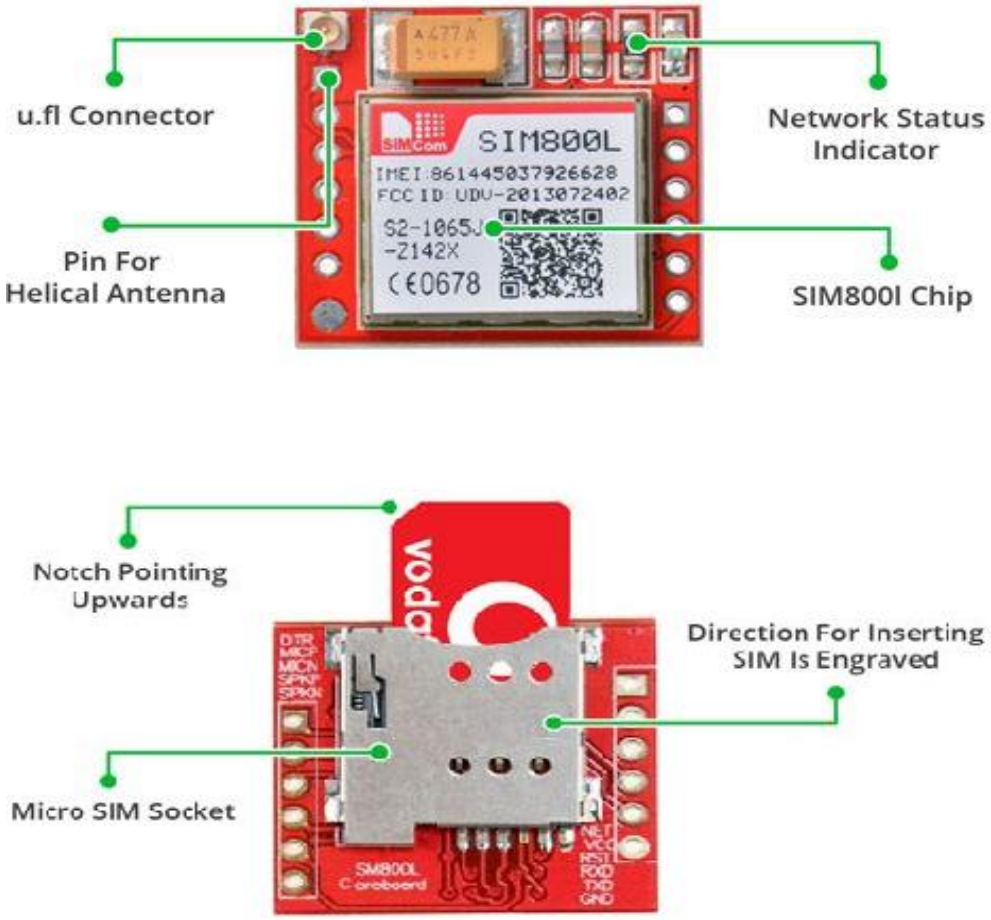

Fig. 4.9: SIM800L

4.11 Flame Sensor

The major component of a flame detector system is a flame detector and it consists of photoelectric detective circuits, signal conditioning circuits, microprocessor systems, I/O circuits, and wind cooling systems.

The sensors in the flame detector will sense the radiation that is sent by the flame, the sensor of the flame detector would be a photoelectric sensor and this sensor would convert the radiant intensity signal of the flame to a relevant voltage signal and this signal would be converted after that it would be processed in a single chip microcomputer and is converted as output.

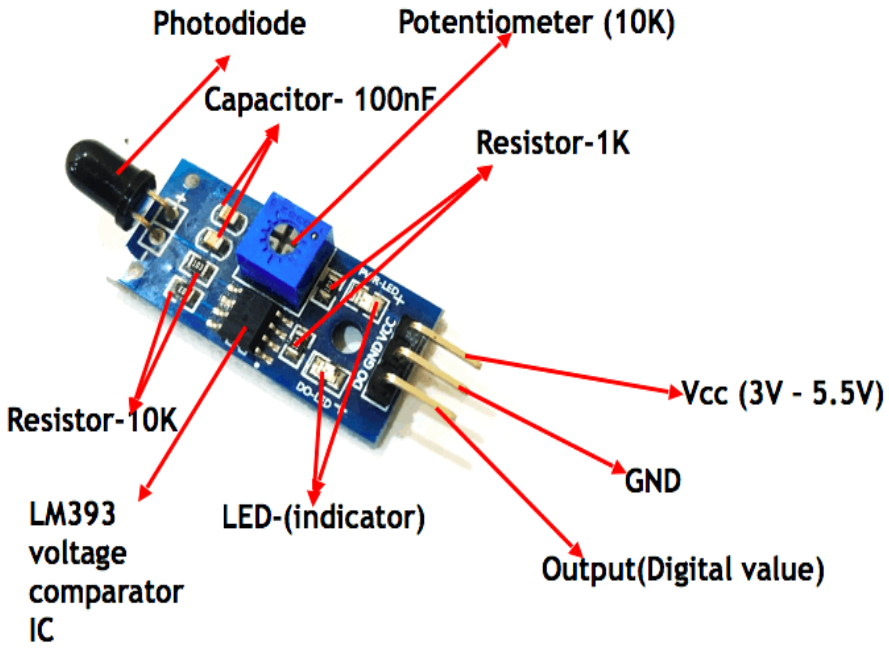

Figure: 4.10: Flame Sensor.

4.12 Buzzers

Buzzers are sound components prepared by incorporating a piezoelectric vibration plate in a plastic case (resonator). Piezoelectric Sounders are sound components which generate sound suitable for use as input signals (including multi-tone, melody and so forth) without built-in oscillation circuits. This characteristic allows them to be used in a wide range of applications. They come as the SMD type, which is optimal for small, high-density mounting and the pin type, which can be used for general purposes. Piezoelectric buzzers are sound components which generate a monotone using a built-in oscillation circuit. [3]

Figure: 4.11: Buzzers

4.13 Vero Board

Vero board is a brand of stripboard, a pre-formed circuit board material of copper strips on an insulating board. which is the generic name for a widely used type of electronics prototyping board characterized by a 0.1 inch (2.54 mm) regular (rectangular) grid of holes, with wide parallel strips of copper cladding running in one direction all the way across one side of the board? It is commonly also known by the name of the original product Vero board, which is a trademark, in the UK, of British company Vero Technologies Ltd and Canadian company Pixel Print Ltd. In using the board, breaks are made in the tracks, usually around holes, to divide the strips into multiple electrical nodes. With care, it is possible to break between holes to allow for components that have two pin rows only one position apart such as twin row headers for IDCs.

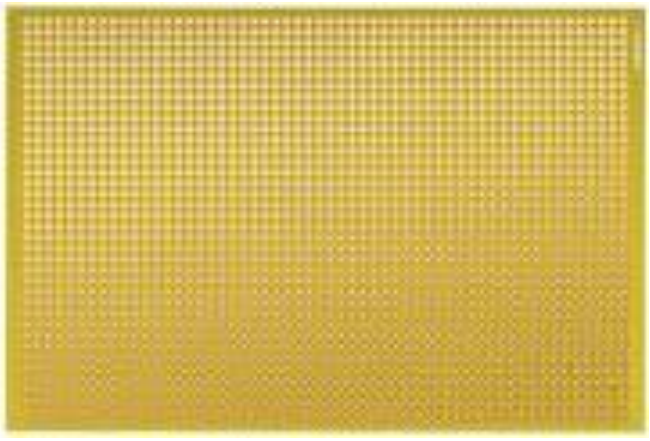

Figure: 4.12: Vero Board

4.14 DC Connector

A DC connector (or DC plug, for one common type of connector) is an electrical connector for supplying direct current (DC) power. Compared to domestic AC power plugs and sockets, DC connectors have many more standard types that are not interchangeable. The dimensions and arrangement of DC connectors can be chosen to prevent accidental interconnection of incompatible sources and loads. Types vary from small coaxial connectors used to power portable electronic devices from AC adapters to connectors used for automotive accessories and for battery packs in portable equipment.

Figure: 4.13: DC Connector

4.15 Gas Sensor

Gas sensor module is a sensor detector used to detect the flammable gas and smoke concentration of the combustible gas in the air, and output is read in the analog voltage and digital value output.

Supply input voltage is 5v. It is very sensitive to H2, LPG, CH4, CO, SMOKE, and PROPANE. It has three pins for transmitter, receiver, ground and sensitivity can be adjust by the potentiometer. Detects LPG from 200ppm to 10000ppm.

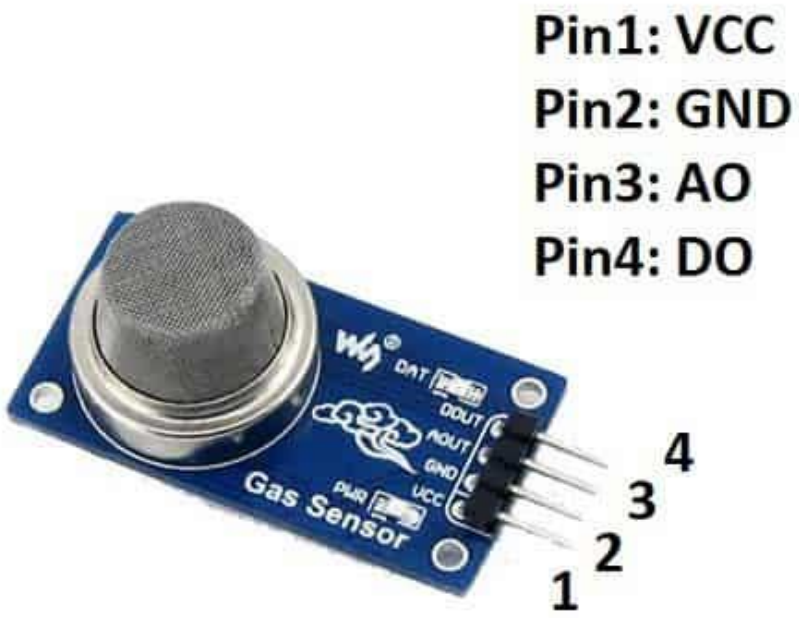

Figure: 4.14: Gas Sensor.

4.16 DC Motor

A DC motor is equipped with magnets, either permanent magnets or electromagnetic windings that produce a magnetic field. When current passes through the armature, also known as the coil or wire, placed between the north and south poles of the magnet, the field generated by the armature interacts with the field from the magnet and applies torque. In a DC motor, the magnet forms the stator, the armature is placed on the rotor and a commutator switches the current flow from one coil to the other. The commutator connects the stationary power source to the armature through the use of brushes or conductive rods. Furthermore, DC motors operate at a fixed speed for a fixed voltage and there is no slip.

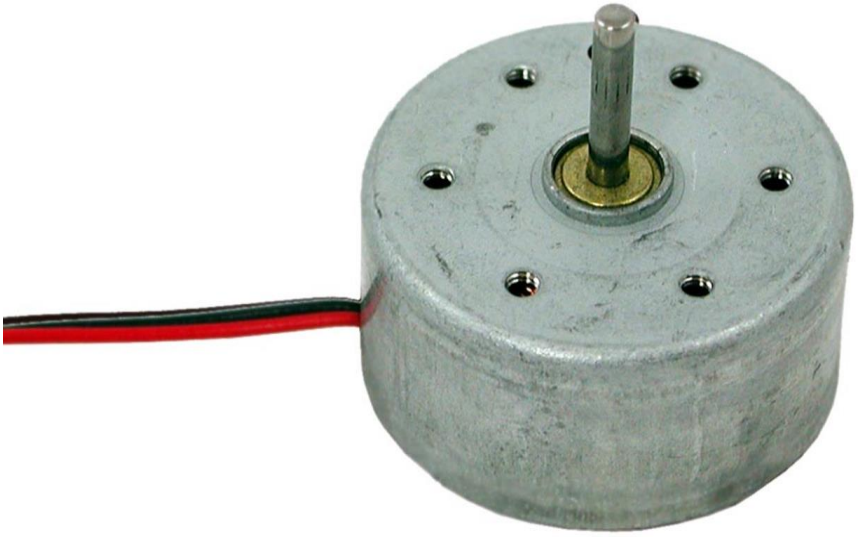

Figure: 4.15: DC Motor

4.17 Relays

Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit. As relay diagrams show, when a relay contact is normally open (NO), there is an open contact when the relay is not energized. When a relay contact is Normally Closed (NC), there is a closed contact when the relay is not energized. In either case, applying electrical current to the contacts will change their state.

Relays are generally used to switch smaller currents in a control circuit and do not usually control power consuming devices except for small motors and Solenoids that draw low amps. Nonetheless, relays can "control" larger voltages and amperes by having an amplifying effect because a small voltage applied to a relays coil can result in a large voltage being switched by the contacts.

Protective relays can prevent equipment damage by detecting electrical abnormalities, including overcurrent, undercurrent, overloads and reverse currents. In addition, relays are also widely used to switch starting coils, heating elements, pilot lights and audible alarms.

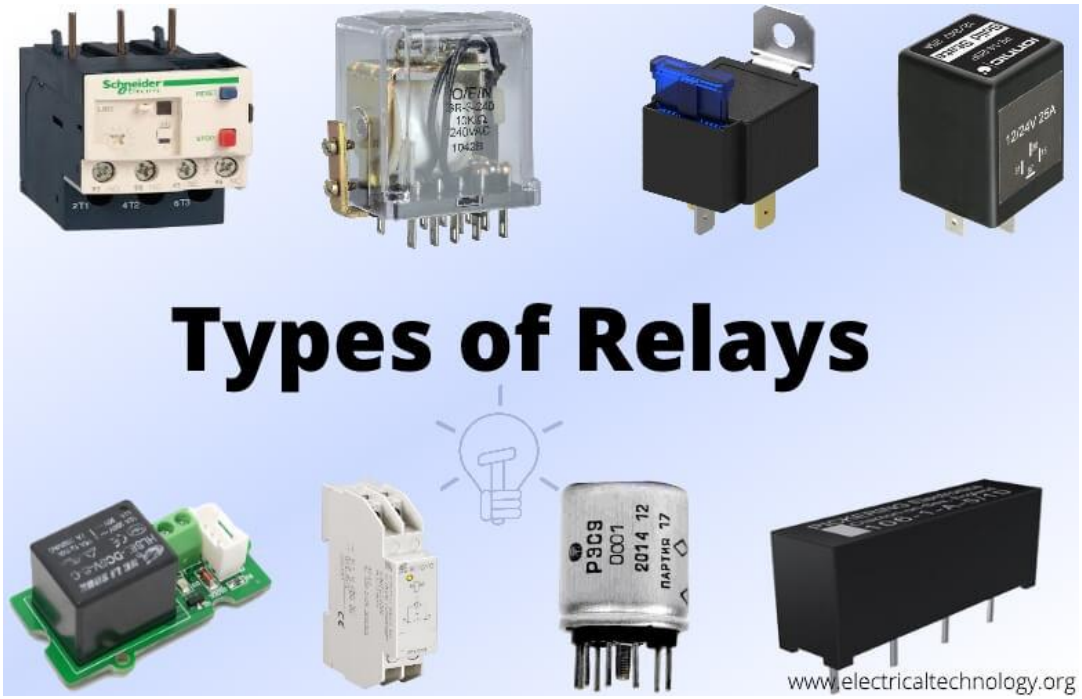

Figure 4.16: Relays

4.18 Battery

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smartphones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that when connected to an external circuit will flow and deliver energy to an external device. When a battery is connected to an external circuit, electrolytes are able to move as ions within, allowing the chemical reactions to be completed at the separate terminals and so deliver energy to the external circuit. It is the movement of those ions within the battery which allows current to flow out of the battery to perform work. Historically the term "battery" specifically referred to a device composed of multiple cells, however the usage has evolved additionally to include devices composed of a single cell.

Electricity, as you probably already know, is the flow of electrons through a conductive path like a wire. This path is called a circuit.

Batteries have three parts, an anode (-), a cathode (+), and the electrolyte. The cathode and anode (the positive and negative sides at either end of a traditional battery) are hooked up to an electrical circuit.

The chemical reactions in the battery cause a buildup of electrons at the anode. This results in an electrical difference between the anode and the cathode. You can think of this difference as an unstable build-up of the electrons. The electrons want to rearrange themselves to get rid of this difference. But they do this in a certain way. Electrons repel each other and try to go to a place with fewer electrons.

In a battery, the only place to go is to the cathode. But, the electrolyte keeps the electrons from going straight from the anode to the cathode within the battery. When the circuit is closed (a wire connects the cathode and the anode) the electrons will be able to get to the cathode. In the picture above, the electrons go through the wire, lighting the light bulb along the way. This is one way of describing how electrical potential causes electrons to flow through the circuit.

However, these electrochemical processes change the chemicals in anode and cathode to make them stop supplying electrons. So there is a limited amount of power available in a battery.

When someone recharge battery, and then change the direction of the flow of electrons using another power source, such as solar panels. The electrochemical processes happen in reverse, and the anode and cathode are restored to their original state and can again provide full power.

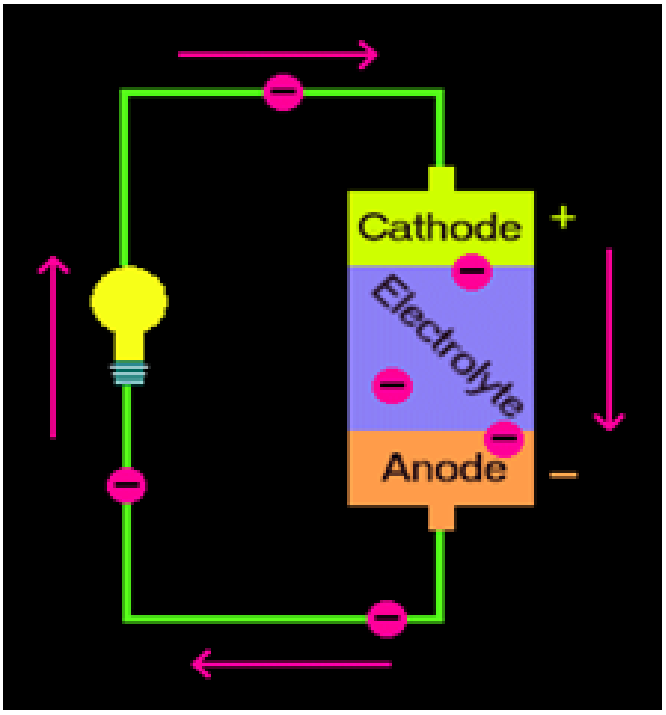

Figure 4.17: Working principle of battery

4.19 Solar Panel

It is a radiant light and heat from the Sun that is harnessed using a range of ever-evolving technologies such as solar heating, photovoltaic, solar thermal energy, solar architecture, molten salt power plants and artificial photosynthesis. It is an important source of renewable energy and its technologies are broadly characterized as either passive solar or active solar depending on how they capture and distribute solar energy or convert it into solar power.

Figure 4.18: Solar Panel

4.20 Transistor

A transistor is a semiconductor device used to amplify or switch electronic signals and electrical power. It is composed of semiconductor material with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals changes the current through another pair of terminals. Because the controlled (output) power can be higher than the controlling (input) power, a transistor can amplify a signal. Today, some transistors are packaged individually, but many more are found embedded in integrated circuits. The transistor is the fundamental building block of modern electronic devices, and is ubiquitous in modern electronic systems.

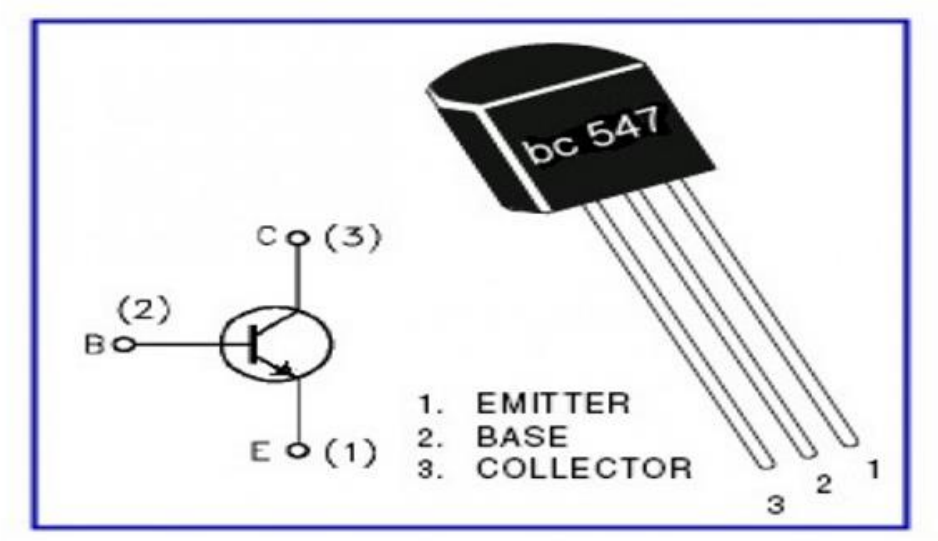

Figure 4.19: Transistor

4.21 Summary

Firstly we discuss about components name which are used in this project. Then we discuss about NodeMCU where we briefly discuss about why NodeMCU, technical specification, power, inputs outputs, memory, communication etc. Then we briefly discuss about LED Light, Relay, Light Holder, resistor and 5 volts adapter in this chapter.

CHAPTER 5

RESULT AND DISCUSSIONS

5.1 Introduction

Result presents the success of a project. We find out the successful result of this project by different experiment.

5.2 Apps Control Using Home Appliance

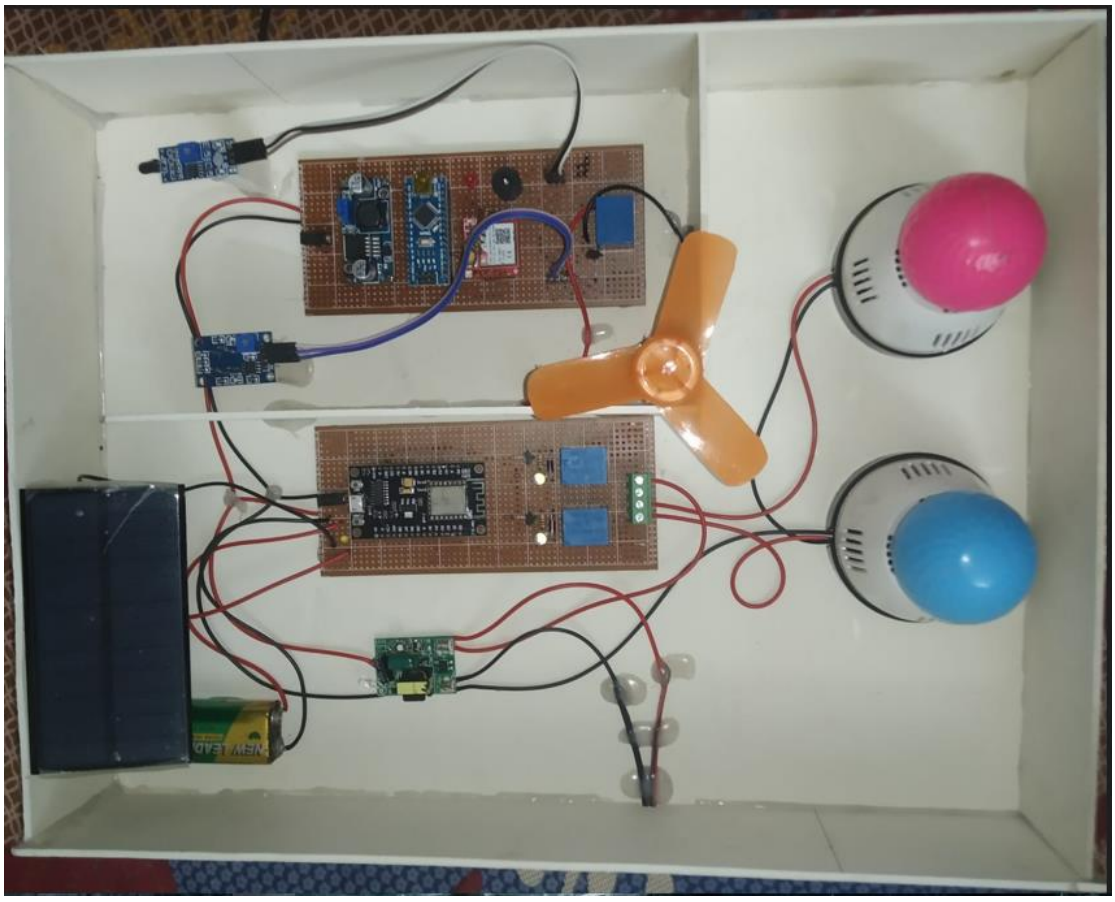

Figure 5.1: Project Image

Figure 5.2: Smart Automation System

5.3 Total Equipment Quantity

Table No 5.1: Equipment Quantity

SL	Equipment Name	Quantity
1	Node MCU	1
2	Arduino Nano	1
3	GSM (800L)	1
4	Light Holder	2
5	Solar Panel	1
6	Buck module	1
7	Flame Sensor	1
8	Gas Sensor	1
9	Battery 9V	1
10	Transistor (BC547)	3
11	Resistor	5
12	9V Adapter	1
13	Light 220V	2
14	Relay	3
15	Diode	2
16	LED	4
17	Connector	5
18	Vero Board	2
19	White Wood Board	As necessity
20	Glue Gun Stick	As necessity
21	Wire	As necessity

5.4 Summary

Firstly we discuss about Control door security using Smart Grid, use Cloud and phone Apps use home appliance. Finally I discuss Total Project Quantity.

CHAPTER 6

CONCLUSIONS

6.1 Conclusions

This study is significant in outlining general information about IoT, such as definition, market size, and status of IoT, which has become a hot IT topic nowadays, and in presenting applicable IoT business models to help business entities and research institutes participating in related projects build a smart city as part of the future vision of local governments by reflecting the new information paradigm of IoT. A limitation of this study, however, is the lack of available data in Korea that hinders the required empirical analysis on the benefits of IoT technology. We hope that more research in this field will be conducted in the future.

6.2 Overview of Smart Automation System

Smoke and gas sensing are essential for early detection of fire, and as a result, many fire scenarios result in the loss of life and significant expense. Meanwhile, researchers throughout the world work on smoke and gas detection systems based on sensor networks, digital image processing, or computer vision. A self-sustaining IoT-based real-time forest fire forecasting and detection system is proposed in this proposal for assisting firefighting teams in suppressing fires where they begin slowly using information about their position. In addition, it utilized sprinklers that spray water at a controlled pressure. Firefighters are responsible for identifying and extinguishing flames. With technology advancing quickly, automation is becoming more and more prevalent. On the other side, firefighters with MQ2 (Gas Sensor), Flame Sensor, and DC fan will turn ON are frequently in risk of losing their life. Toxic chemicals identified in the firefighting environment were responsible for the bulk of the deaths. The paper presents a prototype based on sensors and Internet of Things (IoT) for outdoor fire detection, with an emphasis on temperature and gas measurement precision when a fire starts, in order to address these challenges. A database schema for alarm settings based on sensor data allowed us to manage

changes using a combination of wireless components, development boards, and electrical devices.

6.3 Future Scopes

There are a lot of scopes to develop in this project like we can use GSM module instead of Bluetooth module. It can increase our control rage as well as it can notify us in case of insecure situation by sending us message or dialing call.

We can control our home security through internet. By this, we can always check last update of home security.

Not only it, we can also use biometric security system instead of smart card security system. It can protect our home from unexpected person entrance.

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APPENDIX

The Code Used in NodeMCU

```
#include "arduino_secrets.h"
#include "thingProperties.h"

#define LED1 16  //D0
#define LED2 5   //D1

void setup() {
  Serial.begin(9600);
  pinMode(LED1, OUTPUT);
  pinMode(LED2, OUTPUT);
  }

void loop() {
  ArduinoCloud.update();
}

  if (light1 == 1)
  {
    digitalWrite(LED1, HIGH);
  }
  else
  {
    digitalWrite(LED1, LOW);
  }

  if (light2 == 1)
  {
    digitalWrite(LED2, HIGH);
  }
  else
  {
    digitalWrite(LED2, LOW);
  }
```

The Code Used in Arduino Nano

```
int Flame1 = A0;
int Gas1 = A1;

int Buzzer1 = 4;
int LED1 = 2;

void setup()
{
 pinMode(Flame1, INPUT); // Flame Sensor
 pinMode(Motor1, OUTPUT); // Buzzer
 pinMode(Buzzer1, OUTPUT); // Buzzer
 pinMode(LED1, OUTPUT); // LED
}
void loop()
{
 val = digitalRead(Flame1); // pir sensor output pin connected
 if (val == 0 )
 {
  digitalWrite(LED1, HIGH); // LED
  digitalWrite(Buzzer1, HIGH); // Buzzer
  digitalWrite(Motor1, HIGH); // Motor
  delay(2000);
  Serial.print("AT+CMGS=\"+8801700000000\"\r");
  Serial.print("Fire Alert Detected!");
 }
 else
 {
  digitalWrite(LED1, LOW); // LED
  digitalWrite(Buzzer1, LOW); // Buzzer
  digitalWrite(Motor1, LOW); // Motor
 }
}
```