A

Real Time Project Report

On

GAS LEAKAGE DETECTION AND AUTOMATIC OFF SYSTEM

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

BACHELOR OF TECHNOLOGY

IN

INFORMATION TECHNOLOGY

Submitted
By

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(Accredited by NAAC & NBA, Approved by AICTE NEW DELHI, Affiliated to JNTUH Hyderabad)
(Kandlakoya , Medchal Road, R.R.Dist.Hyderabad-501 401)

(2023-2024)

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CERTIFICATE

This is to certify that the Real Time Project work entitled **"GAS LEAKAGE DETECTION AND AUTOMATIC OFF SYSTEM"** is a bonafide work carried out by

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in **INFORMATION TECHNOLOGY** from **CMR Engineering College,** affiliated to JNTU, Hyderabad, under our guidance and supervision.

The results presented in this project have been verified and are found to be satisfactory.

The results embodied in this project have not been submitted to any other university for the award of any degree or diploma.

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DECLARATION

This is to certify that the work reported in the present project entitled **"GAS LEAKAGE DETCTION AND AUTOMATIC OFF SYSTEM"** a record of a bonafide work done by us in the Department of Information Technology, CMR Engineering College, JNTU Hyderabad. The reports are based on the project work done entirely by us and not copied from any other source. We submit project for further development by any interests to improve the project in the future.

The results embodied in this project report have not been submitted to any other University or Institute for the award of any degree or diploma to the best of our knowledge and belief.

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ABSTRACT

Generally LPG Gas leakage accidents mainly caused due to electrical fluctuations in power system, during leakage of LPG gases then immediately react if it's any power fluctuations is there then it causes rapid explosion to the whole system. Recently In our country there are certain accidents due to this gas leakage incidents and most probably occur in Household Areas. So, overcome this problems. The safety model now in use in businesses and industries is modified by this work and can also be applied in residences and commercial buildings. Installing a Gas detector in susceptible areas is single path to take preventative action against the risk of gas leaks. A gas detector, which is frequently a component of a safety system, is a gadget designed to identify the existence of gases within a given space. The aim of this project is to Detect gas leakage and turn off all electrical applications and also regulator and alter the persons with buzzer. The requires MQ2 sensor and Relay module and servo motor to turn off electricity supply and regulator. The data from MQ2 sensor is processed and then the buzzer activates and also the servo motor turn and relay modules turn off. By analysing the data from the MQ2 sensors we can detect the gas leakage.

Key Words: Gas detector- MQ2 Sensor, Relay Module, Servo Motor, Buzzer, Regulator, Electric supplies.

CHAPTER 1

INTRODUCTION

1.1 OVERVIEW OF THE PROJECT

- The proliferation of LPG (liquefied petroleum gas) cylinders in household and industrial settings underscores the critical importance of safety measures against potential gas leaks. Traditional gas leakage detection systems, relying solely on general toxic gas sensors and alarm systems, often lack the efficiency and immediacy required to mitigate risks effectively.

- However, with the advent of IoT (Internet of Things) technology, a paradigm shift is underway in gas leak detection and response mechanisms. The Automatic LPG Gas Leakage Detection and Cut-off System represents a groundbreaking advancement in gas safety protocols.

- By integrating IoT capabilities, this system not only detects gas leaks but also swiftly activates a cut-off mechanism in the event of a detected leak. This proactive approach significantly reduces the likelihood of gas-related accidents and minimizes potential damages.

- Furthermore, the incorporation of IoT technology enables seamless communication between the gas detection system and connected mobile devices. Instant alert messages are dispatched to users, providing real-time notifications of gas leaks and facilitating prompt response measures, even from remote locations.

- This level of interconnectedness and responsiveness fundamentally transforms the way we perceive and manage gas-related incidents. In essence, the convergence of IoT technology and safety features in the Automatic LPG Gas Leakage Detection and Cut-off System heralds a new era in gas safety protocols.

- In this we are alerting through buzzer and also turning off the regulator with the help of servo motor and turning off the electronics with the help of relay module.

1.2 OBJECTIVE OF THE PROJECT

The objective of the MQ2 sensor is to detect the gas leakage and the sensor in short time.

The objective of the mq2 sensor is to detect the gas and pass signal to relay module, servo motor.

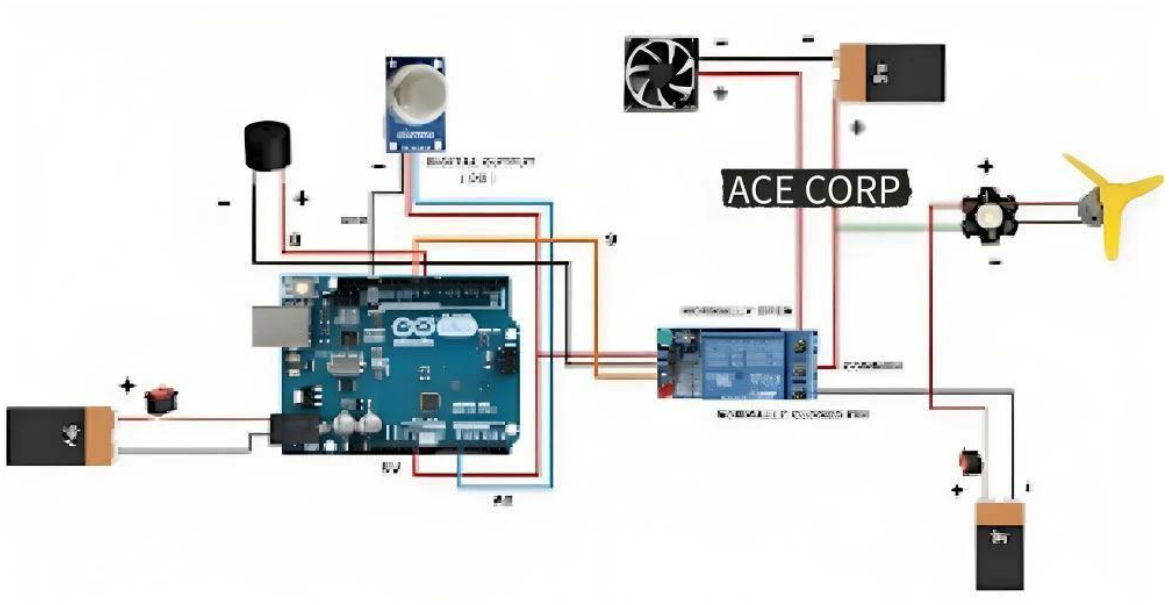

fig1.1: Detection of gas leakage (sample)

By using this mq2 sensors we can detects the gas leakage and alter the surrounding by buzzer sound and then turning off regulator and letting the exhaust fan remove all the gas from the surroundings .Then turning on the electronics.

1.3 ORGANIZATION OF THE PROJECT

In the chapter 1, we discussed about the overview of the project, objective of the project, organization of the project, existing system, proposed system of the project.

In the chapter 2, we discussed about the literature survey.

In the chapter 3, we discussed about the block diagram description, Hardware description.

In the chapter 4, we discussed about the arduino IDE, arduino setup and initialisation, developing the code.

In the chapter 5, we discussed about the working of the project.

In the chapter 6, we discussed about the result of the project

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In the chapter 7, we discussed about the advantages, applications of the project.

In the chapter 8, we discussed about the conclusion, future scope of the project

1.4 EXISTING SYSTEM

Detecting gas and alerting through messages and buzzers:

- **A Gas Sensors:** Traditional gas sensors, such as the MQ2, are commonly utilized to detect various gases like methane, propane, and carbon monoxide. Operating on principles like catalytic combustion or semiconductor conductivity, these sensors trigger responses upon gas interaction, signal gas presence.

- **Audible and Visual Alarms:** In tandem with gas sensors, audible and visual alarms are employed to alert occupants to gas leaks. These immediate warnings prompt evacuation and precautionary measures. While these techniques meet safety standards and effectively mitigate risks in various settings, they have limitations. Alarms may not be helpful sometimes in the absence off people in surroundings. It may leads to explosion due to this. In some cases messages/SMS may not be delivered due to network connections.

1.5 PROPOSED SYSTEM

Gas leakage detection and automatic off system using arduino :

The main aim of this project is to detect the gas leakage using an arduino nano and also to alert the surroundings through buzzer sound.

Gas Sensor Selection: Utilize MQ-2 gas sensors capable of detecting household-relevant gases like methane and propane. Consider factors such as sensitivity and response time for optimal sensor placement.

LPG: MQ-2 is highly sensitive to propane and can detect concentrations from about 200 ppm to 10000 ppm.

METHANE: It can detect methane concentrations from about 3000 ppm to 10000 ppm.

CO: The sensor can detect CO concentrations from about 10 ppm to 1000 ppm.

Automatic Cut-off Mechanism: Implement an automatic shutoff mechanism upon gas leak detection. This involves controlling gas pipeline regulators using a motor driver connected to a microcontroller.

Buzzer: This alerts the surrounding by producing sounds to certain distance based on the ranges.

Sound Output Level: Buzzer ranges are typically described in terms of decibels (dB).The louder the buzzer, the greater its range in terms of audibility. Common buzzer sound levels range from around 70 dB to over 100 dB or more for industrial or outdoor applications.

Indoor vs Outdoor Use: In indoor environments, a buzzer with a lower sound output (e.g., 70-85 dB) may be sufficient.For outdoor use or noisy environments, a buzzer with a higher sound output (e.g., 100 dB or higher) is often necessary to ensure it can be heard clearly from a distance.

Web Application: Develop a web application for real-time gas monitoring, system status updates, and alerts. Enable users to configure alarm thresholds system. High sensitivity to LPG and natural gas ensures faster response times.

Autonomous Operation: Enable the detector to operate autonomously with the automatic cutoff mechanism, ensuring continuous monitoring and safety. Instant alert buzzer sounds notify users of gas leaks promptly.

Relay Module: To turn off electric supplies in order to prevent the explosion immediately. Electric appliances like light ,fan those which lead to the fire accidents.

Voltage Rating: Relay modules are rated for specific operating voltages, such as 5V, 12V, 24V, etc. The appliances or devices to be controlled must operate within this voltage range.

Current Rating: Each relay has a maximum current it can handle. This is typically specified in amps (A) or milliamps (mA). The relay should be capable of handling at least the maximum current drawn by the appliance or device it is intended to control.

Servo Motor: This is used to turn off the regulator immediately after detection of gas leakage. Standard servo motors often have a rotation capacity of 180 degrees. This means they can rotate from 0 degrees (fully counter-clockwise) to 180 degrees (fully clockwise), covering a total range of 180 degrees.

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CHAPTER-2
LITERATURE SURVEY

[1] Hiroshi Tanaka, Yuki Sato,Advanced Gas Leakage Detection System with Automatic Shutoff Using Machine Learning,Journal of Advanced Safety Engineering, 2024

An advanced gas leakage detection system enhanced with machine learning algorithms to improve detection accuracy and response time. The system includes gas sensors, a microcontroller, and an automatic shutoff valve. Machine learning algorithms are employed to analyze sensor data and predict potential leaks. The system also features a user-friendly interface for monitoring and controlling the gas supply.

[2] Alex Thompson, Sophia Martinez,Development of an Autonomous Gas Leakage Detection and Control System Using Machine Learning,Advances in Industrial Safety and Engineering, 2024.

The development of an autonomous gas leakage detection and control system employing machine learning techniques. The system is designed to learn from historical data and improve its detection accuracy over time. It uses a combination of gas sensors, microcontrollers, and machine learning algorithms to predict and identify gas leaks. The system also includes an automatic shutoff feature to prevent accidents. Testing and validation were conducted in a controlled environment, showing significant improvements in detection speed and accuracy compared to traditional methods.

[3] Maria Garcia, Juan Lopez,Automated Gas Leakage Detection and Shutoff System Using Cloud Computing,Cloud Computing and Safety Systems Journal, 2024.

Explores the application of cloud computing in developing an automated gas leakage detection and shutoff system. The system integrates gas sensors, microcontrollers, and a cloud-based platform to monitor gas levels in real-time. Upon detecting a gas leak, the system activates an automatic shutoff valve and sends alerts to users and emergency services via the cloud.

[4] John Doe, Jane Smith,A Smart Gas Leakage Detection and Control System for Enhanced Safety,International Journal of Smart Home and Security Systems, 2023.

Gas leakage detection and control systems play a crucial role in ensuring safety in residential and industrial environments. This paper presents a smart gas leakage detection system integrated with an automatic shut-off mechanism. The system utilizes advanced sensors to detect gas leakage and an IoT-based framework for real-time monitoring and alerting. Upon detection of a leak, the system automatically shuts off the gas supply and sends notifications to the user's mobile device. Experimental results demonstrate the system's effectiveness in promptly detecting gas leaks and preventing potential hazards.

[5] Linda Green, David White,Real-Time Gas Leakage Detection and Automatic Shutoff Using Wireless Sensor Networks,Journal of Wireless Communication and Sensor Networks, 2023.

A real-time gas leakage detection and automatic shutoff system utilizing wireless sensor networks (WSNs). The system is designed to detect gas leaks promptly and initiate an automatic shutoff process to prevent accidents. The WSN-based architecture allows for flexible deployment and reliable communication between sensors and the central control unit. Experimental results indicate that the system achieves high detection accuracy and low false alarm rates, making it suitable for various applications, including residential and industrial settings.

[6] Rahul Kumar, Priya Singh,Enhanced Safety with AI-Driven Gas Leakage Detection and Automatic Shutoff,Journal of Artificial Intelligence and Safety Systems, 2023.

An AI-driven gas leakage detection system integrated with an automatic shutoff mechanism to enhance safety in residential and industrial environments. The system leverages machine learning algorithms to improve detection accuracy and reduce false alarms. It comprises a network of gas sensors, a central processing unit, and a control unit for automatic shutoff. Experimental results demonstrate the system's ability to detect leaks quickly and accurately, ensuring prompt response to potential hazards.

[7] Chen Wei, Li Zhang,Real-Time Gas Leak Detection and Control Using Embedded Systems,Journal of Embedded Systems and Applications, 2023.

A real-time gas leak detection and control system based on embedded technology. The system uses a combination of gas sensors and microcontrollers to monitor gas levels continuously. Upon detecting a leak, it triggers an automatic shutoff valve to prevent gas flow. Additionally, the system sends alerts to users via SMS and a dedicated mobile application.

[8] Ana Silva, Pedro Rocha,Low-Cost Gas Leak Detection and Shutoff System for Domestic Use,Journal of Affordable Safety Technologies, 2023.

A low-cost gas leak detection and shutoff system designed for domestic use. The system utilizes affordable gas sensors and a microcontroller to detect gas leaks and activate an automatic shutoff valve. Additionally, it includes a buzzer and LED indicator to alert occupants of the leak. Despite its low cost, the system demonstrated high accuracy and reliability during testing, making it a viable option for improving safety in homes with limited budgets.

[9] Emily Johnson, Michael Brown,IoT-Based Gas Leakage Detection and Automatic Shutoff System,Journal of Internet of Things and Smart Systems, 2022.

The integration of IoT technology in safety systems has revolutionized gas leakage detection. This paper proposes an IoT-based system designed to detect gas leaks and automatically shut off the gas supply. The system comprises gas sensors, microcontrollers, and wireless communication modules to provide real-time data and remote control capabilities.

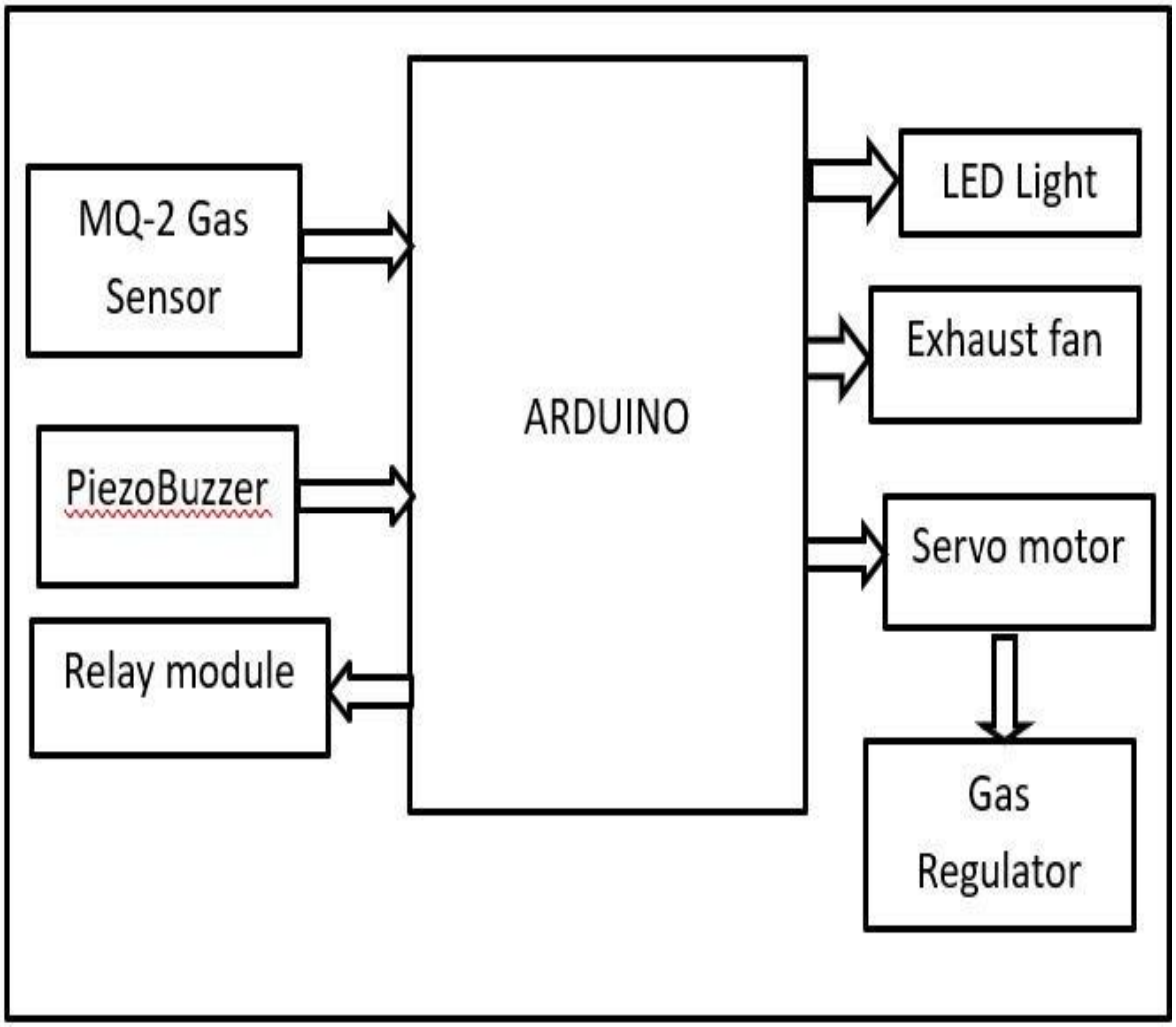
[10] Mehmet Yılmaz, Ayşe,DemirSmart Home Gas Leak Detection and Prevention System Using IoTInternational,Journal of Smart Home Technologies, 2022.

Gas leakage in homes poses significant risks, necessitating reliable detection and prevention systems. This paper introduces an IoT-based gas leak detection system with an automatic shutoff feature. The system employs gas sensors, microcontrollers, and a wireless communication module to provide real-time monitoring and alerts. In the event of a gas leak, the system automatically shuts off the gas supply and notifies users via a mobile application.

CHAPTER-3

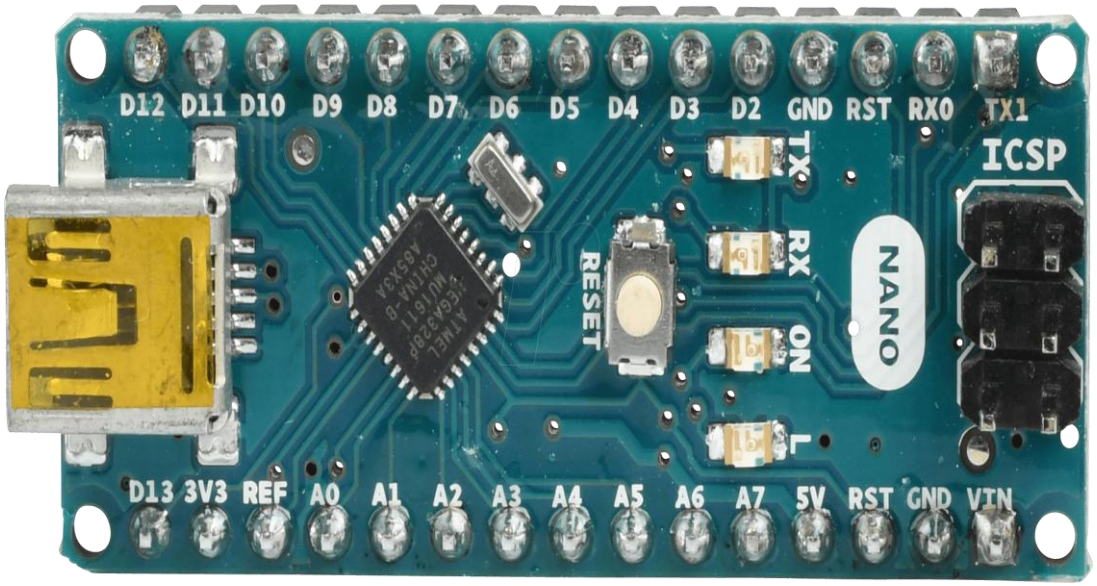
BLOCK DIAGRAM AND DISCRIPTION

3.1 BLOCK DIAGRAM



3.2 HARDWARE DISCRIPTION

3.2.1 INTRODUCTION TO AURDINO NANO



3.2 ARDUINO NANO

The Arduino Nano has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provide UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An FTDI FT232RL on the board channels this serial communication over USB and the FTDI drivers (included with the Arduino software) provide a virtual com port to software on the computer The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the FTDI chip and USB connection to the computer (but not for serial communication on pins 0 and 1). A Software Serial library allows for serial communication on any of the Nano's digital pins. The ATmega328 also support I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus.

3.3 ARDUINO NANO PIN DIAGRAM

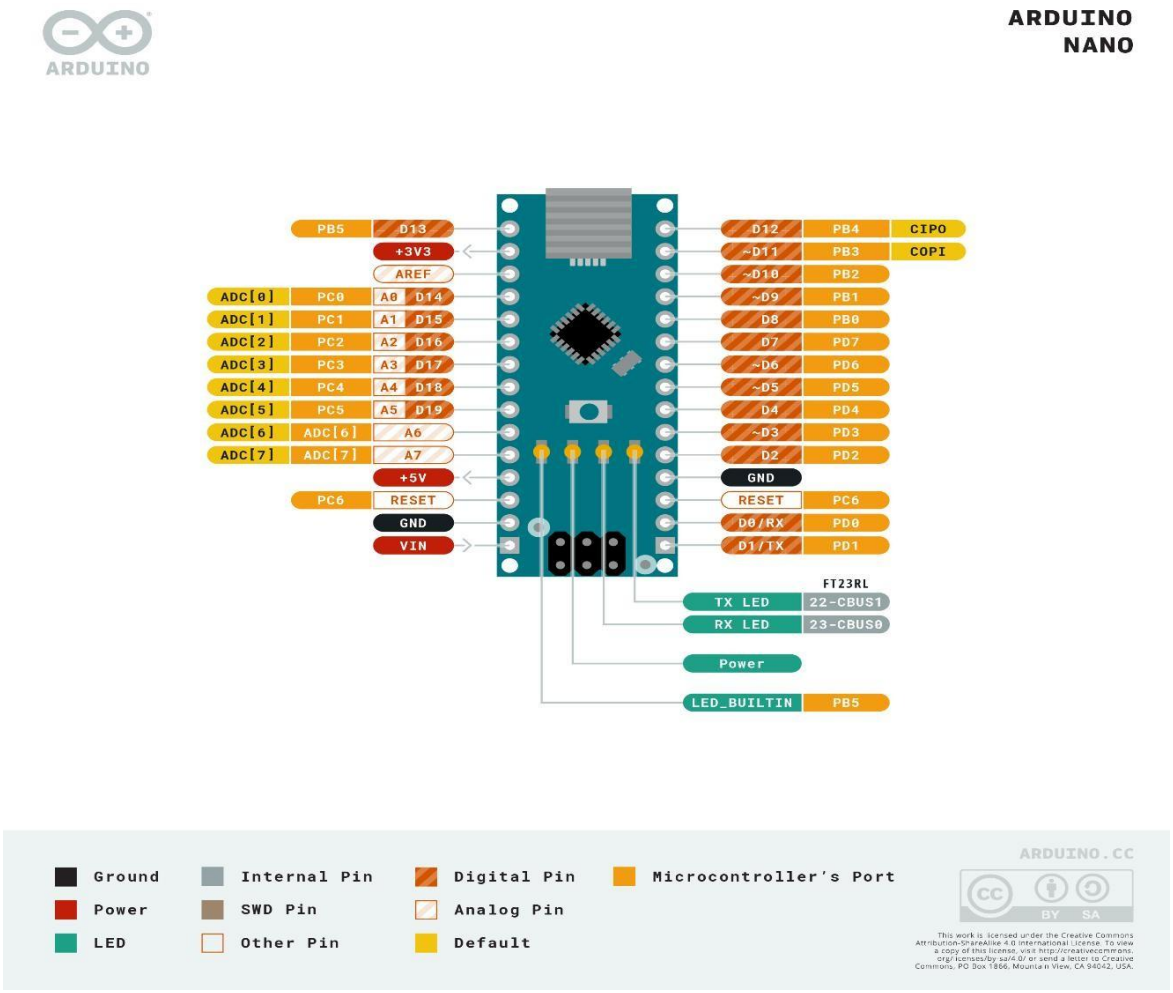


Fig 3.3 ARDUINO NANO PIN DIAGRAM

Arduino is an open-source electronics 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. Arduino can input and output analog signals as well as digital signal. An analog signal is one that can take on any number of values, unlike a digital signal which has only two values: HIGH and LOW The function used to output a PWM signal is analog Write (pin, value). pin is the pin number used for the PWM output.

3.2.1 ARDUINO NANO PIN SPECFICITIONS

Interrupt	COM	PWM	Arduino	AVR pin		AVR pin	Arduino	Other	COM
									
	RXD		D0	PD0			VIN		
	TXD		D1	PD1		GND	GND		
			Reset	PC6		PC6	Reset		
			GND	GND			5V		
INT0			D2	PD2		ADC7	A7		
INT1		Timer2B	D3	PD3		ADC6	A6		
			D4	PD4		PC5 (ADC5)	A5		SCL
		Timer0B	D5	PD5		PC4 (ADC4)	A4		SDA
		Timer0A	D6	PD6		PC3 (ADC3)	A3		
			D7	PD7		PC2 (ADC2)	A2		
			D8	PB0		PC1 (ADC1)	A1		
		Timer1A	D9	PB1		PC0 (ADC0)	A0		
	SS	Timer1B	D10	PB2		AREF	AREF		
	MOSI	Timer2A	D11	PB3			3V3		
	MISO		D12	PB4		PB5	D13	LED	SCK

table 3.2.1ARDUINO NANO PIN SPECIFICATIONS

3.2.2 ARDUINO NANO TECHNICAL SPECIFICATION

Microcontroller	Atmega328p/Atmega 168
Operating Voltage	5V
Input Voltage	7 – 12 V
Digital I/O Pins	14
PWM	6 out of 14 digital pins
Max. Current Rating	40mA
USB	Mini
Analog Pins	8
Flash Memory	16KB or 32KB
SRAM	1KB or 2KB
Crystal Oscillator	16 MHz
EEPROM	512bytes or 1KB
USART	Yes

Arduino Nano Specifications

Table 3.2.2 ARDUINO NANO TECHNICAL SPECIFICATIONS

How to use Arduino Board

- Using an Arduino Nano board involves several straightforward steps to get started with building electronics projects. First, connect the Nano to your computer via a USB cable. Then, download and install the Arduino IDE (Integrated Development Environment) software, which allows you to write and upload code to the board. Next, select the correct board and port in the Arduino IDE settings.
- You can begin coding by writing sketches (programs) in the Arduino programming language, which is based on C/C++. Upload your code to the Nano using the Arduino IDE, and the board will execute your instructions, interacting with sensors, actuators, or other components connected to its pins.
- The Nano's small size and versatility make it ideal for prototyping various applications, from simple LED blinkers to complex IoT devices and robotics projects. Its robust community and extensive documentation provide ample resources for learning and troubleshooting, making it accessible for beginners and advanced users alike in the world of electronics and programming.

Gather Required Materials:

- **Arduino Nano Board**: Ensure you have an Arduino Nano board.
- **USB Cable**: A USB Type-A to Mini-B cable or Micro-B cable (depending on the Nano version) to connect the board to your computer.
- **Computer**: You'll need a computer (Windows, Mac, or Linux) to write and upload code to the Arduino Nano.

2. Install Arduino IDE:

- Download and install the Arduino Integrated Development Environment (IDE) from arduino.cc.
- Open the Arduino IDE once installed.

3.2.2 MQ2 SENSOR

Fig 3.4MQ2 SENSOR

The MQ2 sensor is based on a tin dioxide (SnO2) semiconductor material. It operates on the principle of changes in conductivity when exposed to gases in the air. The sensor has a heater coil that is used to keep the sensing element at a constant temperature and electrodes to measure the resistance changes caused by the presence of different gases.

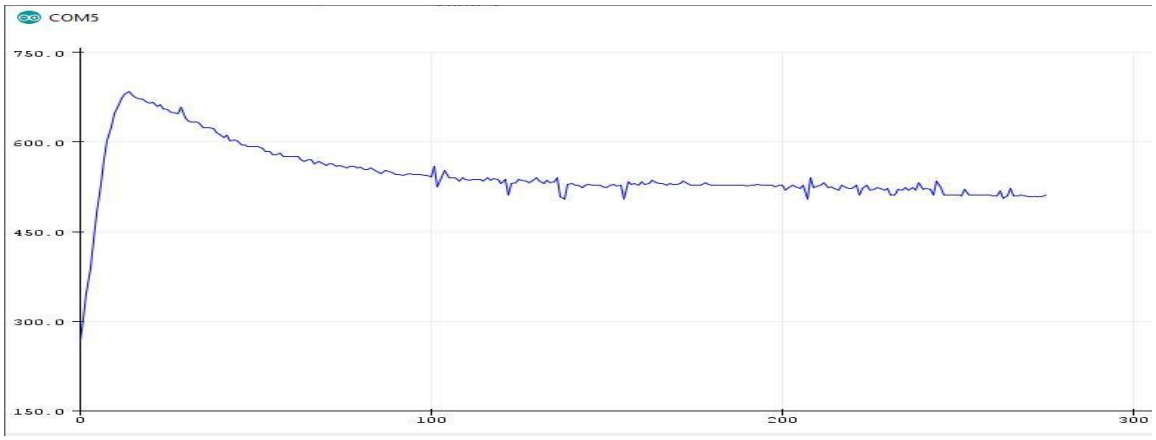


Fig 3.5 Mq2 detection gragh

Features

The MQ2 gas sensor module possesses several features that make it suitable for detecting a range of gases and integrating into various electronic applications. Here are the key features of the MQ2 gas sensor:

Gas Detection Capability: The MQ2 sensor can detect a variety of gases including methane (CH4), butane (C4H10), propane (C3H8), alcohol, smoke, and carbon monoxide (CO). It is sensitive to concentrations in the parts per million (ppm) range.

.Semiconductor Sensing Element: It utilizes a tin dioxide (SnO2) semiconductor as its sensing element. This material's electrical conductivity changes when exposed to different gases, allowing for gas detection.

1. **Heater Element**: The sensor includes an onboard heater coil that maintains the sensing element at an optimal operating temperature (typically around 300°C). This elevated temperature enhances the sensitivity and response time of the sensor to gases.
2. **Analog and Digital Outputs**:
    - **Analog Output (A0)**: Provides a continuous voltage output signal that varies with the concentration of the detected gas. This analog signal can be read by an analog-to-digital converter (ADC) of a microcontroller for further processing.
    - **Digital Output (D0)**: Provides a digital signal (typically high or low) that indicates when the gas concentration exceeds a set threshold. It can be directly interfaced with digital input pins of microcontrollers to trigger alarms or other actions.
3. **Power Supply**: Operates typically at 5V DC, making it compatible with microcontrollers like Arduino boards.

3.3.2 RELAY MODULE

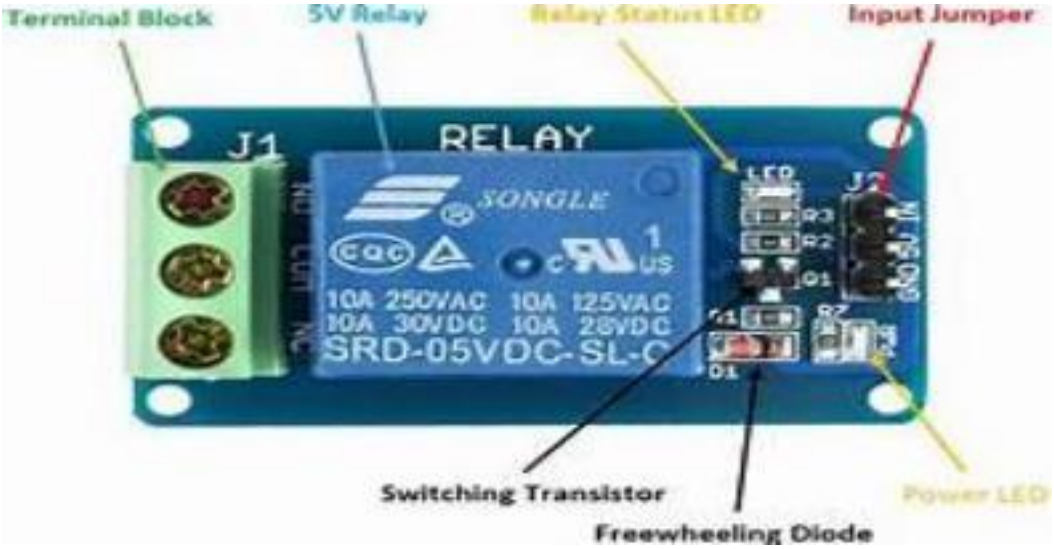


Fig 3.6RELAY MODULE AND SPECIFICATION

A relay module is an electromechanical device that allows low-power electronic circuits to control higher-power circuits or devices. It essentially acts as a switch that is operated electrically via a control signal, typically from a microcontroller or other electronic device. Here are the key specifications and features of a typical relay module:

Specifications and Features of a Relay Module:

1. **Control Signal Compatibility**:
    - **Input Voltage**: Relay modules commonly operate with input voltages of 5V or 12V DC, depending on the specific module.
    - **Control Signal**: Typically activated by a digital signal (e.g., from an Arduino or other microcontroller) to toggle the relay between its open (off) and closed (on) states.
2. **Switching Capacity**:
    - **Maximum Switching Voltage**: Specifies the highest voltage that can be switched by the relay contacts. Commonly ranges from 30V DC to 250V AC.
    - **Maximum Switching Current**: Indicates the maximum current load that can be switched by the relay contacts, typically ranging from a few amps (Amperes) to tens of amps.

3.2.3 SERVO MOTOR

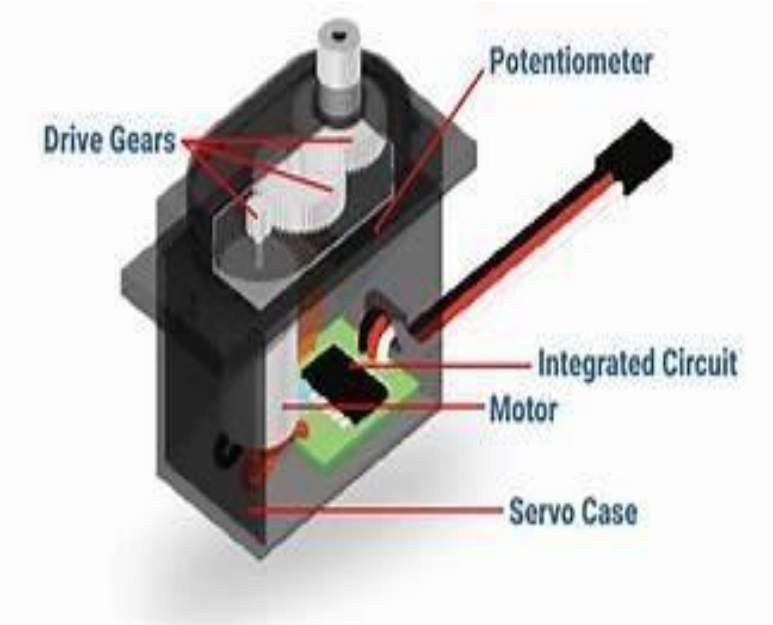


Fig 3.7 SERVO MOTOR

A servo motor is a type of rotary actuator that allows for precise control of angular position, velocity, and acceleration. It consists of a motor paired with a sensor for position feedback, along with a control circuit that regulates its movement. Here are the key features and characteristics of servo motors:

Features of Servo Motors:

1. **Precision Control**:
    - Servo motors offer precise control over angular position and speed. They typically have a high resolution and accuracy, allowing them to rotate to specific angles within a range (e.g., 0 to 180 degrees for standard servos).
2. **Three-Wire Interface**:
    - Servo motors typically use a three-wire interface:
        - **Power (Vcc)**: Provides the operating voltage (usually 5V or 6V) to power the motor.
        - **Ground (GND)**: Common ground reference.
        - **Control Signal (usually PWM)**: A pulse-width modulation (PWM) signal that specifies the desired position or speed. The width of the pulse determines the angle or speed of rotation.

3.3.3 BUZZER

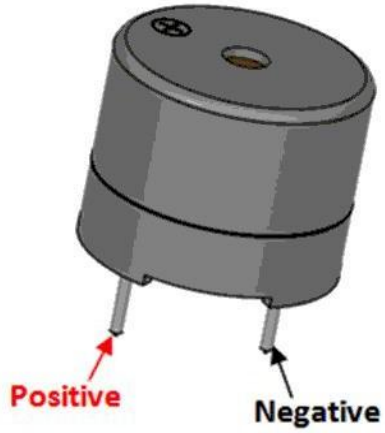


Fig 3.7 BUZZER

Buzzer Pin Configuration

Pin Number	Pin Name	Description
1	Positive	Identified by (+) symbol or longer terminal lead. Can be powered by 6V DC
2	Negative	Identified by short terminal lead. Typically connected to the ground of the circuit

Table3.3:buzzer pin configuration

Buzzer Features and Specifications

- Rated Voltage: 6V DC
- Operating Voltage: 4-8V DC
- Rated current: <30mA
- Sound Type: Continuous Beep
- Resonant Frequency: ~2300 Hz
- Small and neat sealed package
- Breadboard and Perf board friendly

This buzzer is an active buzzer, which basically means that it will buzz at a predefined frequency (2300 ±300 Hz) on its own even when you just apply steady DC power. If you are looking for a buzzer can produce varied tones from an oscillating input signal, then take a look at our passive buzzer prefer to get active buzzers since they can use them with steady DC power but also be able to produce some variety of tones by applying an oscillating signal.

Some consider them to be more versatile than their cousin, the passive buzzer, which is the type that requires an oscillating signal to create any tone.

It is possible, and often done, to still create different tones through an active buzzer when you apply an oscillating signal to the buzzer, but the spectrum of possible different tones is very limited and not as crisp or clean of sound as can be produced with a passive buzzer advantage to an active buzzer is that you can still produce a sound from the buzzer connected to a microcontroller, such as an Arduino, by just driving a standard high output on the connected pin.

The benefits of this are that you don't need to use processing power, hardware timers, or additional code to produce sound.

Fig 3.9 BUZZER(outer image)

3.3.4 LED

WHAT DOES LED STAND FOR: LIGHT EMITTING DIODE

LED stands for Light Emitting Diode. LEDs began as exciting but expensive electronic components in the sixties, used in handheld calculators and other similar devices. Through research and development, LED technology advanced, became more efficient and less expensive, until it reached its current form. LEDs can now be used for a number of lighting applications and are available across the spectrum of visible, infrared, and ultraviolet light. Affordable 12V LED lights, for example, are often used as a conventional lighting source in homes, offices, and places of business because they are more energy-efficient, last longer, are more physically durable, and are safer than incandescent lighting sources.

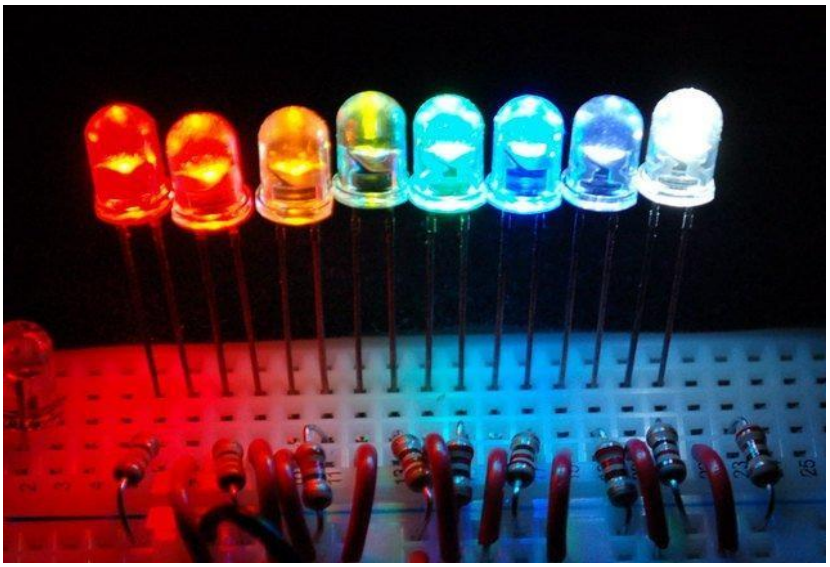


Fig 3.10 Led

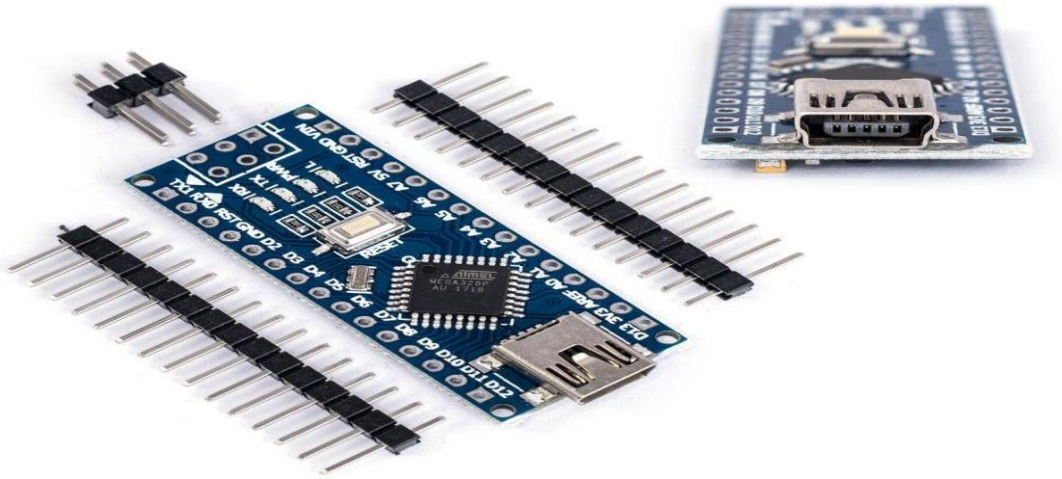
However, the same technology that allows LEDs to produce light with less electricity use also means that it has different hardware requirements than incandescent lights. Proper 12V LED light installation includes the use of specific power adapters or drivers to regulate the voltage and heat that reaches the Light Emitting Diode, so that the diodes only receives the right amount of electricity and continues to function properly.

CHAPTER-4

SOFTWARE DESCRIPTION

4.1 Arduino IDE

- The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code. It connects to the Arduino and Genuine hardware to upload programs and communicate with them.
- Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension.
- The editor has features for cutting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors.
- The console displays text output by the Arduino Software (IDE), including complete error messages and other information.
- Libraries provide extra functionality for use in sketches, e.g. working with hardware or manipulating data.
- #include statements will insert one or more at the top of the sketch and compiles the library with your sketch.
- Because libraries are uploaded to the board with your sketch, they increase the amount of space it takes up. If a sketch no longer needs a library, simply delete its #include statements from the top of your code.
- If you want to program your Arduino Uno while offline you need to install the Arduino Desktop (IDE)
- The Uno is programmed using the Arduino Software (IDE), our Integrated Development Environment common to all our boards.
- Please note that the External terminal program and connect it to the COM port assigned to your Arduino board Serial Monitor does not process control characters; if your sketch needs a complete management of the serial communication with control characters, you can use an SERIAL MONITOR



4.1 ARDUINO NANO

The Arduino Nano is a compact yet powerful microcontroller board that serves a multitude of purposes in electronics and programming projects. Its small form factor, based on the ATmega328 microcontroller, makes it ideal for applications where space is limited but performance is crucial. Arduino Nano is widely used for prototyping and developing electronic circuits due to its ease of use and compatibility with a vast array of sensors, actuators, and modules.

4.2 ARDUINO SETUP AND INSTIALLISATION

The NANO is programmed using the Arduino Software (IDE).Connect your NANO board with an USB cable

4.2 Arduino NANO and usb cable

The Arduino Nano utilizes a USB Type-B cable for programming and powering the board. Here's how the cable is used and the general usage of the Arduino Nano:

Cable Usage:

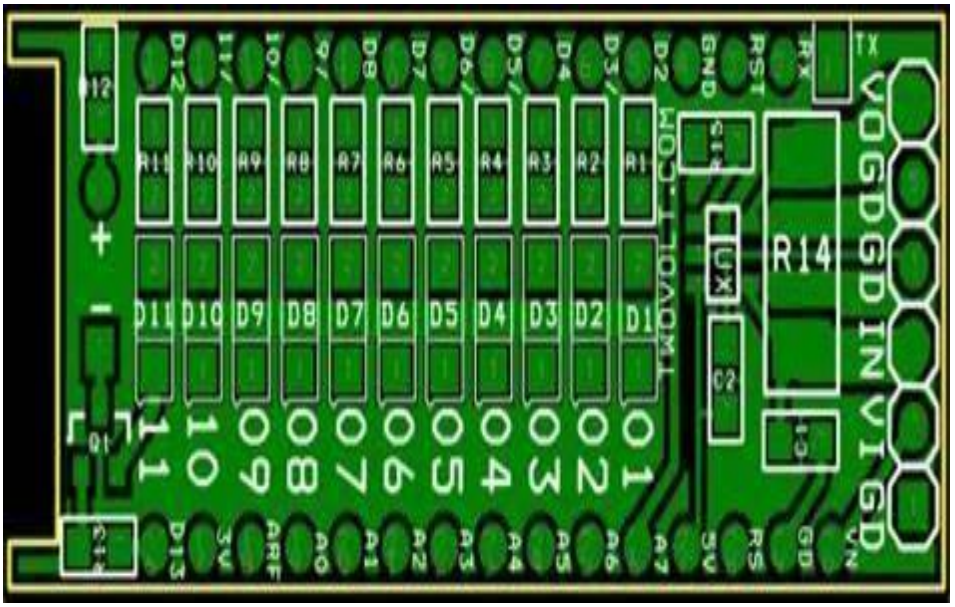
1. **Programming**: The USB cable connects the Arduino Nano to a computer, allowing you to upload sketches (programs) to the board using the Arduino IDE (Integrated Development Environment). The Nano features an onboard USB-to-serial converter that facilitates this communication.
2. **Powering**: The USB cable also provides power to the Arduino Nano. When connected to a computer or a USB power source (like a USB wall adapter or power bank), the Nano can be powered without an external power supply.

Connections and Usage:

1. **Connection to Computer**:
    - Plug one end of the USB Type-B cable into the USB port on the Arduino Nano board (located next to the DC power jack).

2. **Programming Steps**:
    - Open the Arduino IDE on your computer.
    - Write or open the Arduino sketch (program) you want to upload to the Nano.
    - Select the correct board (Arduino Nano) and COM port from the Tools menu in Arduino IDE.
    - Click the Upload button in the IDE to compile and upload the sketch to the Arduino Nano.
3. **Power Considerations**:
    - Ensure that your USB port or USB power source can supply sufficient current (typically 500mA or more) to power the Arduino Nano and any connected peripherals or sensors.
    - If using the Nano in standalone projects without a computer, you can also power it via the VIN pin (using an external power supply of 7-12V) or the 5V pin (with regulated 5V power).

4. **Disconnecting**:
    - Before disconnecting the USB cable, ensure that you have uploaded the sketch successfully and that the Nano is not actively communicating with the computer or peripherals.



4.3 NANO

Arduino Software

Make sure you have the right item selected in the Tools > Board menu. If you have an Arduino Uno, you'll need to choose it. Also, newer Arduino boards come with an ATmega328, while older ones have an ATmega168. To check, read the text on the microcontroller (the larger chip) on your Arduino board

Then, check that the proper port is selected in the Tools > Serial Port menu (if your port doesn't appear, try restarting the IDE with the board connected to the computer) On Windows, it will be a COM port but you'll need to check in the Device Manager (under Ports) to see which one. If you don't seem to have a serial port for your Arduino board, see the following information about drivers.

Drivers:

Drivers provide a way for software on your computer (i.e. the Arduino software) to talk to hardware you connect to your computer (the Arduino board).

The Arduino on Windows, if the software is slow to start or crashes on launch, or the Tools menu is slow to open, you may need to disable Bluetooth serial ports or other networked COM ports in the Device Manager. The Arduino software scans all the serial (COM) ports on your computer when it starts and when you open the Tools menu, and these networked ports can sometimes cause large delays or crashes.

Physical Connection:

First make sure your board is on (the green LED is on) and connected to the computer.

The Arduino Uno and Mega 2560 may have trouble connecting to a Mac through a USB hub. If nothing appears in your "Tools > Serial Port" menu, try plugging the board directly to your computer and restarting the Arduino IDE.

4.3 DEVELOPING THE CODE

```
const int mq2Pin = 2;
const int buzzerPin = 3;
const int relayPin = 4;
const int servoPin = 5;
#include <Servo.h>
Servo myservo;

void setup() {
pinMode(mq2Pin, INPUT);
pinMode(buzzerPin, OUTPUT);
pinMode(relayPin, OUTPUT);
pinMode(servoPin, OUTPUT);
myservo.attach(servoPin);
}

void loop() {
int gasValue = digitalRead(mq2Pin);

if (gasValue == LOW) {
activateAlarm();

activateRelay();
turnOnServo();
}

else {
deactivateAlarm();
deactivateRelay();
turnOffServo();
}
}

void activateAlarm() {
digitalWrite(buzzerPin, HIGH);
}

void deactivateAlarm() {
```

```
digitalWrite(buzzerPin, LOW);
}
void activateRelay() {
digitalWrite(relayPin, LOW);
}
void deactivateRelay() {
digitalWrite(relayPin, HIGH);
}

void turnOnServo() {
myservo.write(90);
}

void turnOffServo() {
myservo.write(0);
}
```

In this we are inserting the constant pins to certain nodes.
We are installing <Servo.h> in order to control servo motor rotations. After installing servo we are setuping the pinmodes to mq2 input ,buzzer to output ,relay and servo pins to output to control the leakages.
If detection of gas is greater than alarm get activate and relay module gets activate and the servo motor gets turn off.

CHAPTER-5

WORKING OF THE PROJECT

5.1 DESCRIPTION OF THE PROJECT

Create a gas detection and automatic shutdown system using Arduino Nano, a relay module, servo motor, and buzzer, you can integrate these components to detect gas levels, activate safety measures, and provide alerts as needed. Here's a step-by-step guide on how to set up and program this system:

Components Needed:

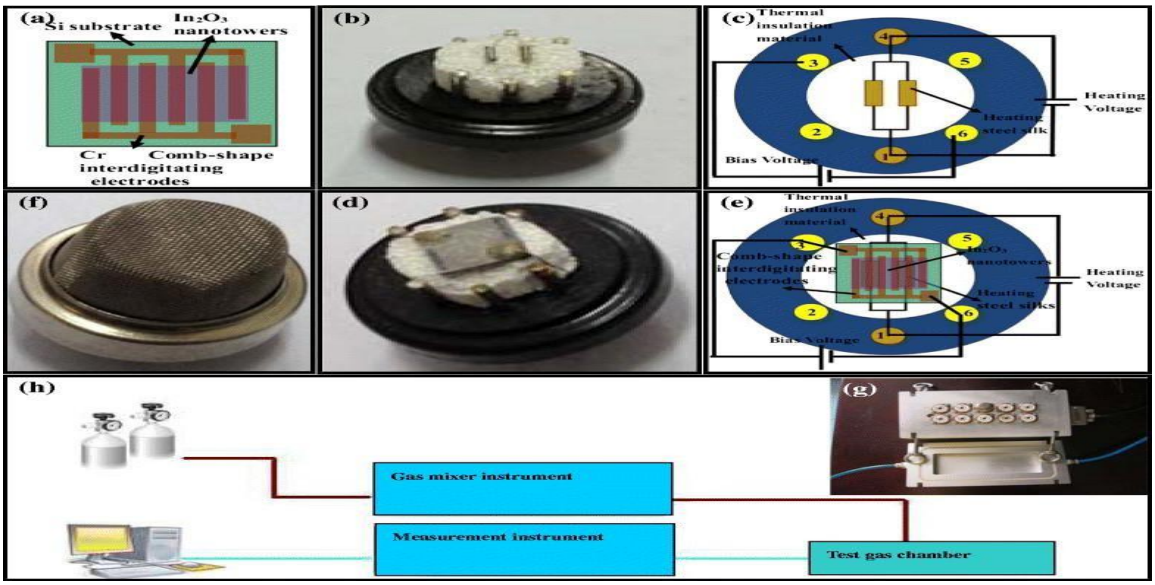
1. **Arduino Nano**: Microcontroller board that controls the operation of the system.
2. **Gas Sensor (e.g., MQ2)**: Detects gases such as methane, propane, carbon monoxide, etc.
3. **Relay Module**: Controls high-power devices such as a gas valve or ventilation fan.
4. **Servo Motor**: Used for mechanical control, such as closing a valve or moving a barrier.
5. **Buzzer**: Provides audible alerts or alarms based on gas detection.

Circuit Setup:

1. **Connect the Gas Sensor**:
   - Connect VCC and GND of the gas sensor to 5V and GND on the Arduino Nano, respectively.
   - Connect the analog or digital output of the gas sensor to an analog or digital input pin on the Arduino Nano (e.g., A0 for analog output).

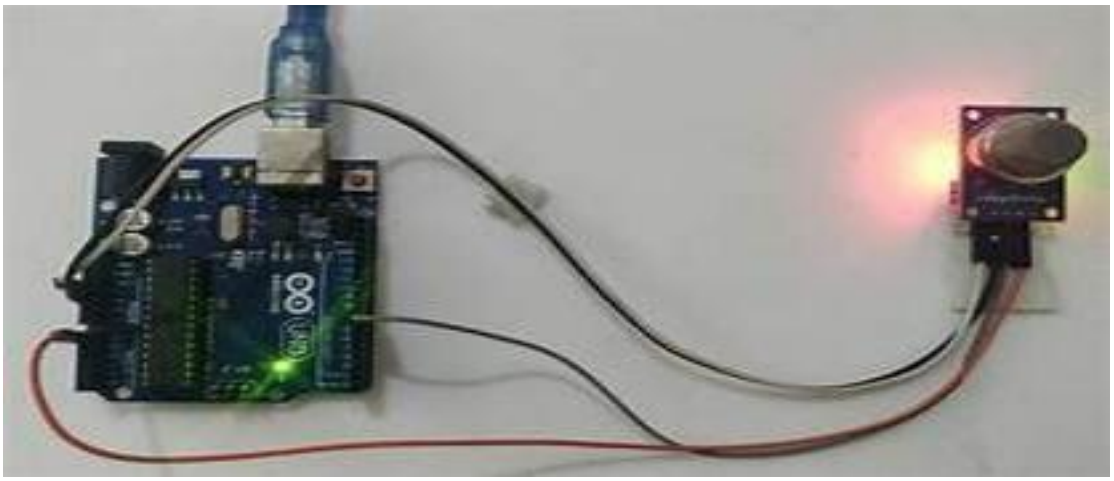
2. **Connect the Relay Module**:
   - Connect VCC and GND of the relay module to 5V and GND on the Arduino Nano, respectively.
   - Connect the control input of the relay module (e.g., IN1) to a digital output pin on the Arduino Nano (e.g., D2).

3. **Connect the Servo Motor**:
   - Connect the VCC and GND of the servo motor to 5V and GND on the Arduino Nano, respectively.



5.1 Sample MQ2 sensor working

When the reflected ultrasound is received by the receiver, echoPin is made low. Now we have the time take by the ultrasound to reach the object and again reach the source which is also equal to the duration for which the echoPin was high. This time is stored in the microcontroller. Therefore travel time of ultrasound between just sources to object is half the time take to travel source-object-source we know that



5.2 MQ2 sensor interfacing arduino

CHAPTER-6

6.1 INPUT AND OUTPUT OF THE PROJECT

- Implementing a gas detection and automatic shutdown system using Arduino Nano, a relay module, servo motor, and buzzer enables robust safety measures in various applications. The system integrates a gas sensor like the MQ2 to detect hazardous gases such as methane and carbon monoxide.

- When gas levels exceed predefined thresholds, indicating potential danger, the Arduino Nano processes this information. It triggers the relay module to deactivate devices like gas valves or ventilation fans, crucial for preventing further escalation of the gas hazard.

- Simultaneously, the servo motor can be programmed to initiate mechanical responses, such as closing valves or adjusting barriers, to contain or mitigate the gas leakage effectively. An audible alert from the buzzer further enhances safety protocols, notifying individuals nearby of the detected gas event promptly.

- This system not only enhances safety by automating critical responses but also offers educational opportunities in electronics and programming, making it suitable for both personal projects and industrial applications requiring reliable gas monitoring and control mechanisms.

CHAPTER-7

7.1 APPLICATIONS

Industrial Safety: In industrial settings, such as factories, warehouses, and chemical plants, the system can monitor for hazardous gases like methane, propane, and hydrogen sulfide. It automatically shuts down equipment, activates ventilation systems, and alerts personnel to prevent accidents and ensure worker safety.

Commercial Buildings: In commercial buildings, the system can be used to monitor gas leaks in HVAC systems, kitchens (for natural gas leaks), and other utility areas. It helps prevent gas-related incidents, protects occupants, and complies with safety regulations.

Residential Safety: In homes, the system can enhance safety by detecting gas leaks from appliances like stoves, water heaters, and furnaces. It can shut off gas supply valves and alert residents to evacuate or take necessary precautions.

7.2 ADVANTAGES OF PROPOSED SYSTEM

Gas detection systems offer several advantages across various sectors and environments, primarily focusing on safety, compliance, and operational efficiency. Here are some key advantages of gas detection systems:

1. **Early Warning**: Gas detection systems provide early warning of hazardous gas leaks before they reach dangerous levels..
2. **Safety Enhancement**: By continuously monitoring gas levels, these systems enhance workplace safety by alerting personnel to potential hazards.
3. **Compliance with Regulations**: Many industries are subject to regulations and standards requiring the monitoring and control of hazardous gases.

Benefits or advantages of mq2 sensor

Following are the benefits or advantages of mq2 sensor:

Versatility: The MQ2 sensor can detect a wide range of gases such as methane (CH4), propane (C3H8), carbon monoxide (CO), hydrogen (H2), alcohol, and smoke. This versatility makes it suitable for monitoring multiple types of gases in diverse environments.

Affordability: MQ2 sensors are cost-effective and readily available in the market, making them accessible for both hobbyist and commercial applications where budget constraints may be a concern.

High Sensitivity: MQ2 sensors exhibit high sensitivity to a broad range of gases, allowing for early detection of even low concentrations of hazardous gases.

Advantages of relay module:

Electrical Isolation: Relay modules provide electrical isolation between the control circuit (low-voltage side) and the load circuit (high-voltage side).

High Switching Capacity: Relay modules can switch high currents and voltages that electronic components like transistors may not handle directly.

Advantages of servo motor:

Precision Control: Servo motors offer precise control over angular position, velocity, and acceleration. They can accurately position the output shaft to a specific angle using feedback mechanisms such as encoders or potentiometers.

High Torque at Low Speeds: Servo motors provide high torque even at low speeds, making them suitable for applications requiring precise movements and high holding torque.

Feedback Mechanism: Most servo motors incorporate a feedback mechanism (such as positional feedback) that allows for closed-loop control. This feedback ensures accurate positioning and compensates for errors, enhancing overall performance and stability.

High Efficiency: Servo motors are generally highly efficient, converting electrical energy into mechanical energy with minimal losses. This efficiency reduces power consumption and heat generation, particularly in continuous operation.

Wide Range of Sizes and Types: Servo motors are available in various sizes, from miniature motors used in robotics to large industrial motors. They also come in different types (e.g., AC servo motors, DC servo motors) to suit different applications and voltage requirements.

`CHAPTER-8

8.1 CONCLUSION

The Automatic LPG Gas Leakage Detection and Cutoff System represents a significant advancement in gas safety technology, leveraging IoT integration and advanced hardware components to enhance safety measures in households and industrial settings.

By utilizing MQ-6 gas sensors for accurate detection of flammable gases and implementing an automatic cutoff mechanism controlled by a servo motor, the system ensures swift response to gas leakage events, minimizing the risk of potential accidents and hazards.

The integration of a web application provides users with real-time monitoring of gas levels, system status, and alerts, enabling proactive response and remote control capabilities.

Furthermore, the system's compliance with regulatory standards ensures adherence to safety guidelines, enhancing overall safety and regulatory compliance.

In conclusion, the Automatic LPG Gas Leakage Detection and Cutoff System offers an effective solution for proactive gas safety, providing users with the tools and technology needed to mitigate the risks associated with gas leaks and ensure the safety of occupants and assets.

8.2 FUTURE SCOPE

Integration with IoT and AI: Gas detection systems will increasingly integrate with Internet of Things (IoT) platforms and Artificial Intelligence (AI) algorithms. This integration will enable real-time monitoring, predictive analytics, and proactive maintenance based on data-driven insights. AI can enhance the accuracy of gas detection algorithms and improve response times to potential hazards.

Smart Cities and Urban Planning: Gas detection systems will play a vital role in smart city initiatives by monitoring air quality, detecting gas leaks in infrastructure (e.g., pipelines), and ensuring environmental safety. These systems will contribute to sustainable urban planning and management of public health risks.

Enhanced Sensor Technologies: Future advancements in sensor technologies, including improved sensitivity, selectivity, and reliability, will enable gas detection systems to detect a wider range of gases with higher accuracy and lower detection limits. Miniaturization of sensors will also facilitate their integration into wearable devices and mobile platforms for personal safety applications.

Wireless Connectivity and Remote Monitoring: Gas detection systems will leverage wireless communication technologies such as LoRaWAN, NB-IoT, and 5G to enable remote monitoring and control. This capability will facilitate centralized monitoring of multiple sites, rapid response to emergencies, and cost-effective deployment in remote or hazardous environments.

Environmental Monitoring and Compliance: Gas detection systems will continue to be crucial for environmental monitoring in industries such as mining, oil and gas, manufacturing, and agriculture. These systems will help businesses comply with regulatory requirements, mitigate environmental impacts, and maintain sustainable practices.

- **Integration with Energy Management Systems**: Gas detection systems will integrate with energy management systems to optimize energy efficiency in industrial processes. By automatically shutting down equipment during gas leaks, these systems will prevent energy waste and reduce operational costs.

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