IOT BASED GAS LEAKAGE MONITORING AND ALERTING SYSTEM FOR INDUSTRIES

A PROJECT REPORT

Submitted by

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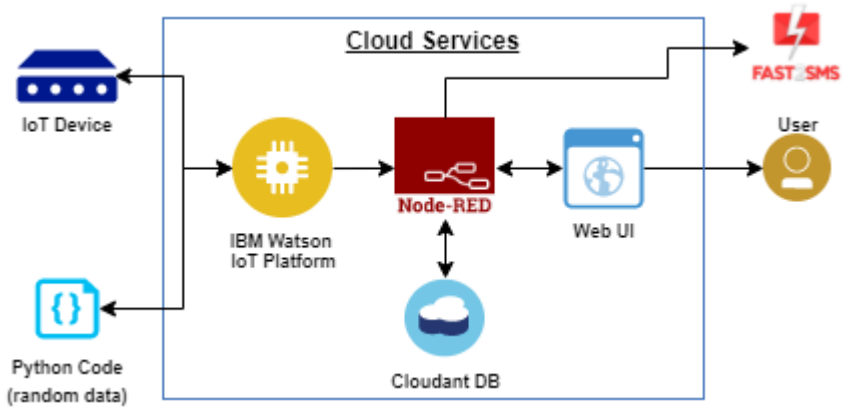
1. INTRODUCTION

Now a days the home safety detection system plays the important role for the security of people. Since all the people from the home goes to work on daily bases, it makes impossible to check on the appliances available at home specially LPG gas cylinder, wired circuits, Etc. Since last three years there is a tremendous hike in the demands of liquefied petroleum gas (LPG) and natural gas. To meet this access amount of demand for energy and replace oil or coal due to their environmental disadvantage, LPG and natural gas are preferred. These gases are mostly used on large scale in industry, heating, home appliances and motor fuel. So as to track this leakage gas, the system includes MQ6 gas sensor. This sensor senses the amount of leak gas present in the surrounding atmosphere. Through this, explosion or getting affected by the leakage of gas could be avoided.

1.1 Project overview

- This project helps the industries in monitoring the emission of harmful gases
- In several areas, the gas sensors will be integrated to monitor the gas leakage
- If in any area gas leakage is detected the admins will be notified along with the location
- In the web application, admins can view the sensor parameters.

Technical Architecture



1.2 Purpose

The Internet of Things is a developing theme of specialized, social, and monetary centrality. Customer items, tough goods, cars and trucks, modern and utility segments, sensors, and other regular articles are being joined with Internet availability and amazing information systematic capacities that guarantee to change the manner in which we work, live, and play. The Internet of Things (IoT) is an essential theme in innovation industry, strategy, and designing circles .Safety plays a critical role in

today's world and it is vital that certainsolutions are implemented in places of work and living. Whether it is electricity or oil and gas, working or living in hazardous conditions demand certain safety protocols.

• Liquified Petroleum Gas (LPG) is a type of natural gas liquified under extreme pressure and contained in a metal cylinder.
• LPG is extremely sensitive to fire and causes a great disaster if exposed to any fire source without precaution.
• LPG is more widely available than any other natural gas and is primarily used for cooking.
• Unfortunately, its broad use makes the event of gas leakage or even a blast standard. Therefore, there is a need to develop a gas leakage detection and monitoring system.

2.LITERATURE SURVEY

- In the year of 2008, Chen Peijiang and Jiang Xuehhua, "Design and implementation of Remote Monitoring System Based on GSM", this paper focuses on the wireless monitoring system, because the wireless remote monitoring system has more applications than aremote monitoring system based on SMS through GSM.

- "Internet of Things (IOT) based Gas Leakage Monitoring and Alerting System with MQ-2 Sensor" in the year of 2017, Rohan Chandra Pandey, Manish Verma, Lumesh Kumar Sahu. This paper's choice of using a real time gas leakage monitoring and Sensing the outputs levels of gas has been clearly observed by the help of this system.

- "Gas Leakage Detection and Smart Alerting System Using IoT " in the year of 2018, Shital Image, Priyanka Rajmanes, Aishwarya Gavali. In this paper we use IOT technology for enhancing the existing safety standards. While making this prototype has been to bring arevolution in the safety against the leakage of harmful and toxic gases.

2.1 Existing Problem

The design of a sensor-based automatic gas leakage detector with an alert and

control system has been proposed.This is an affordable, lesspower using, lightweight, portable, safe, user friendly, efficient, multi featured and simple system device for detecting gas. Gas leakage detection will not only provide us with significance in the health department but it will also lead to raise our economy, because when gas leaks it not only contaminates the atmosphere, but also wastage ofgases will hurt our economy. The need for ensuring safety in workplaces is expected to be the key driving force for the market over the coming years.

2.2 References

- 2013.Arun Raj, Athira Viswanathan, Athul T S, "LPG Gas Monitoring System", International Journal of Innovative Technology and Research, Volume 3, Issue 2, February 2015, Pg – 1957 to 1960.

- S Shyamaladevi, V. G. Rajaramya, P. Rajasekar, P. Sebastin Ashok, "ARM7 based automated high-performance system for LPG refill booking & leakage detection", Journal of VLSI Design and Signal Processing", Volume 3, Issue 2, 2014.

- S. Sharma, V. N. Mishra, R. Dwivedi, R. Das, "Classification of gases/odours using Dynamic Response of Thick Film Gas Sensor Array", IEEE Conference on Sensors Journal, 2013.

- Ankit Sood, Babalu Sonkar, Atul Ranjan, Mr. Ameer Faisal, "Microcontroller Based LPG Gas Leakage Detector Using GSMModule", International Journal of Electrical and Electronics Research,Volume 3, Issue2, AprilJune 2015.

- Rajeev B. Ahuja, Jayant K. Dash, Prabhat Shrivastava, "A comparative analysis of liquefied petroleum gas (LPG) and kerosene related burns", Burns, Volume 37, Issue 8, December 2011.

- Shivalingesh B. M, Ramesh C, Mahesh S. R, Pooja R, Preethi K. Mane, Kumuda S, "LPG Detection, Measurement and Booking System", IJRSI, Volume 1, Issue 4,

November 2014.

2.3 Problem Statement definition

Gas Leaks from equipment can become dangerous. Conductingroutine leak detection inspections to a facility can help prevent unexpected incidents. By Installing gas leakage detection system to prevent these unexpected incidents.

I am	I am worker who was working in an industries.
I am trying to	I want to device which will detect gas leakage in industries.
But	There is no device to detect gas leakage and alerting system in industries.
Because	There is no installation of gas leakage detecting device to identify gas leakage.
Which makes me feel	Which will makes me to feel confusion.

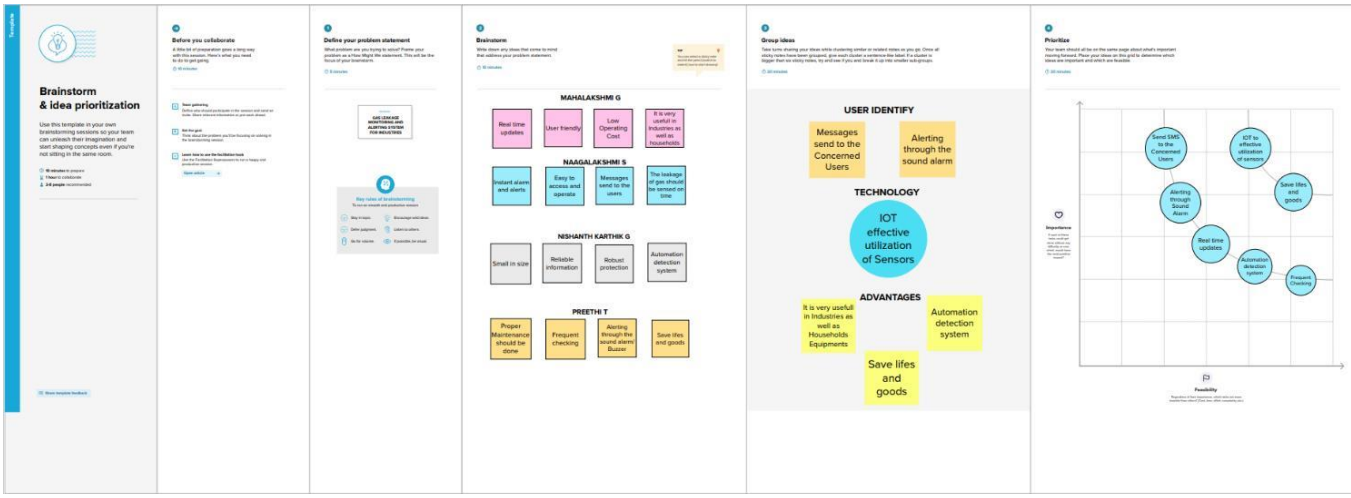
EXAMPLE

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	worker	detect leakage in gas	it is difficult to identify leakage in gas	there is no device for identifying gas leakage.	confusion
PS-2	Chemical Engineer	to detect gas leakage with detail of temperature	it is difficult to identify leakage in	there is no device for identifying gas leakage.	frustration

3.IDEATION & PROPOSED SOLUTION

3.1Empathy map canvas

3.2 Ideation and Brainstorming



3.3 Proposed Solution

S.no	Parameter	Description
1.	Problem Statement (Problem to be solved)	Gas Leaks from equipment can become dangerous. Conducting routine leak detectioninspections to a facility can help prevent unexpected incidents. By Installing gas leakage detection system to prevent these unexpected incidents.
2.	Idea / Solution description	The gas leakage detectors canbe used for the detection of combustible, flammable andpoisonous gaseous, and also to detect a gas leak or other pollutants. It makes the area where the leak occurs an warning sound and instructs operators to leave the area. TheSystem proposed is planned,built and sent an SMS warning system for detection of gas leakage. Infrared imaging sensors have recently been used for a number ofapplications in industrial plants and refineries.
3.	Novelty / Uniqueness	It will detect gas leakage withhelp of Internet of Thingstechnology and alert the customer using an alerting device.
4.	Social Impact / Customer Satisfaction	1.spending power, 2.Budget, 3.Network connection, 4.available devices, 5.Gadgets to monitor leakage.
5.	Business Model (Revenue Model)	By using this model, we can detect gas leakage and it will

		alert the user when gas leakage occurs.
6.	Scalability of the Solution	As this model depends on Internet of Things, It will works on through the Internet and send SMS to mobile if gas leakage happen in user residential area

3.4 Problem Solution fit

4.REQUIREMENT ANALYSIS

4.1 Functional requirements

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Hardware Requirement	Optical, Soil, Ultra flow meter.
FR-4	Software Requirement	Pressure point, Flow change, Statistic.
FR-5	User welfare	Calibration No Poisoning of the Sensor Reliable in all environment conditions Easy to use.

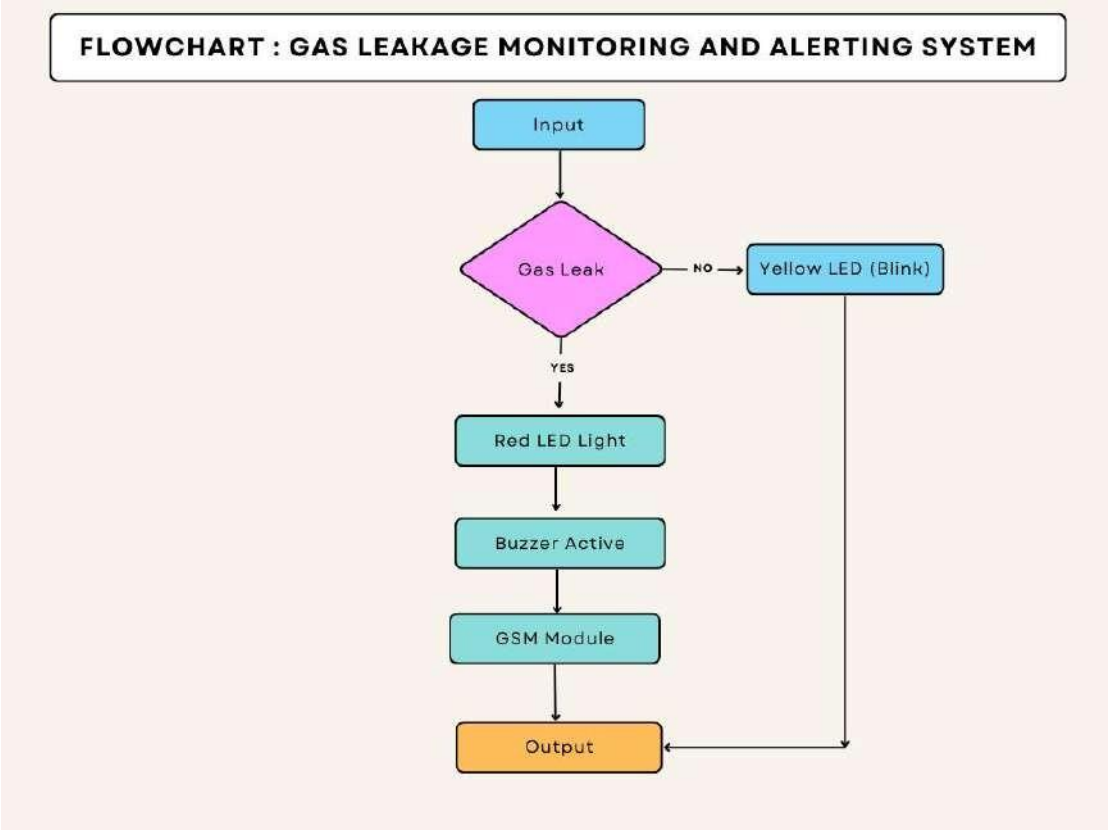
4.2 Non functional requirements

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The sensor-enabled solution helps preventthe high risk of gas explosions and affecting any casualties within and outside thepremises
NFR-2	**Security**	The device is intended for use in household safety where appliances and heaters that use natural gas and liquid petroleum gas (LPG) may be a source of risk.
NFR-3	**Reliability**	Gas Leakage Detection System (GLDS) can detect leakage at homes, commercial premises or factories. GLDS detects theleakage soon after it happened and sendsusers an immediate alarm on the incident.
NFR-4	**Performance**	The Gas Leakage Detector is a wall mounted device fitted close to the floor level with an alarm setting at 20% of lower explosive limit. Whenever there is a leak, the in-built sensor detects and alerts the user in less than 5 minutes, much before it can cause any accidents.
NFR-5	**Availability**	The circuit for an LPG leakage detector is readily available in the market, but it is

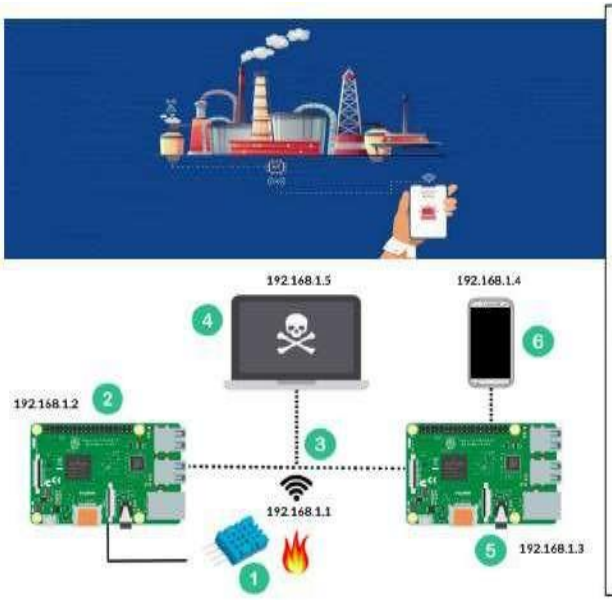
		extremely expensive). Presented here is a low -cost circuit for a Gas Leakage Detection that you can build easily.
NFR-6	**Scalability**	The system proves the need for gas detection alarm systems to be 100% reliable. A backup power supply can be included in the system design to augment for power failure condition. Also, calibration of the gas sensor can be done in other for a specific gasto be sensed instead of the LPG numerous gases it sens e

5.PROJECT DESIGN

5.1Data flow Diagram



5.2 Solution & Techincal Architecture



Guidelines:

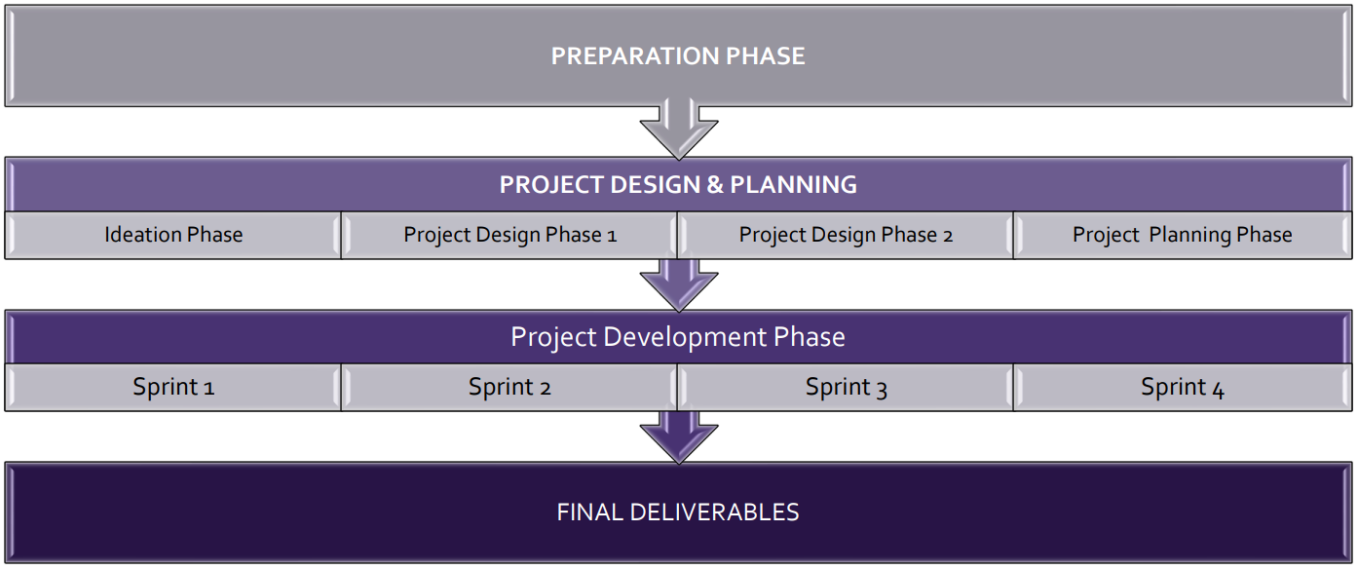
1. Include sensor to detect gas leakage.
2. Provide light and sound alerting gas leakage.
3. Using Internet of Things, alerting gas leakage in mobile phone.
4. By using Internet of Things, wifi will used for alerting worker through their mobile devices.

5.3 User Stories

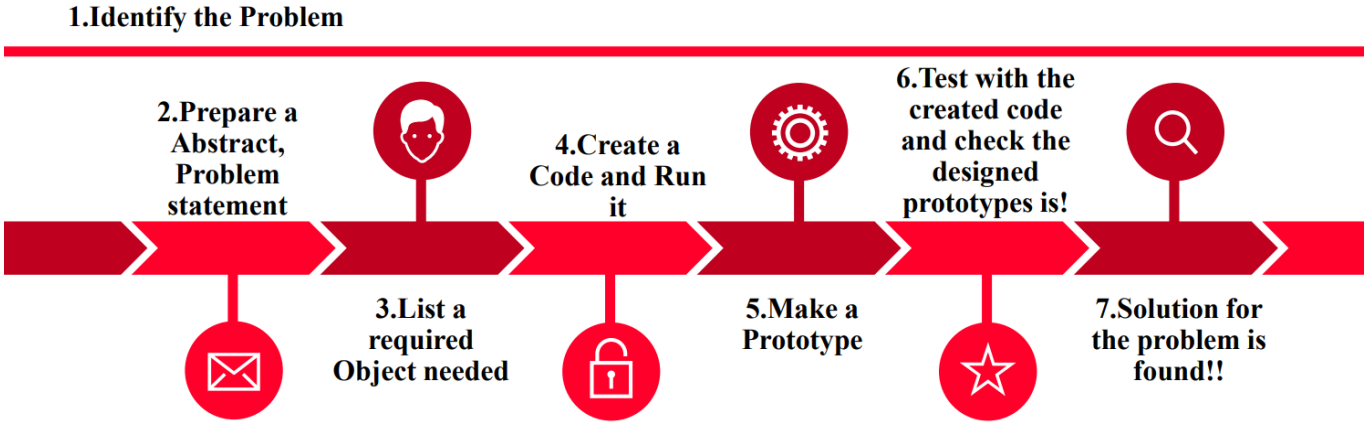
	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5
OBJECTIVES	Write a goal or activity	Gas leakage detection systems protect personnel and the environment from potentially hazardous exposure to gases.	The system comprises of sensors for detecting gas leak interfaced to microcontroller that will give an alert to user whenever there is a gas leakage, display warning information by using Liquid.	Gas Leak Detection System Gas leak detection is the process of identifying potentially hazardous gas leaks by sensors. These sensors usually employ an audible alarm to alert people when a dangerous gas has been detected.	An alarm management system represents the series of actions a system performs in an event of gas leakage.
NEEDS	Write a need you want to meet	Fire hazard prevention	Harmful gas detection	Oxygen level measurement	Prompt gas leak alerts
FEELINGS	Write an emotion you expect the customer to have	Happy about this solution	Embrassed on the solution and promoted the good wordes towords this project	Happy	Encouraging towords this project and giving good feedbacks.
BARRIERS	Write a potential challenge to your objective	Higher Officials	commercial companies	The gasses are toxic in nature, resulting in human unconsciousness and even death if consumed in larger quantities.	Moreover, gaseous blasts are another disaster that everyone - working in a factory or at home - would want to avoid at all costs!

6.PROJECT PLNNING & SCHEDULING

6.1 Sprint planning &estimation



6.2 sprint delivery schedule



7.CODING AND SOLUTIONING

7.1 Feature 1

Tinkercad is a free-of-charge, online 3D modeling program that runs in a web browser. Since it became available in 2011 it has become a popular platform for creating models for 3D printing as well as an entry-level introduction to constructive solid geometry in schools.

7.2 Feature

HARDWARE INFORMATION

ARDUINO UNO

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC toDC adapter or battery to get started .

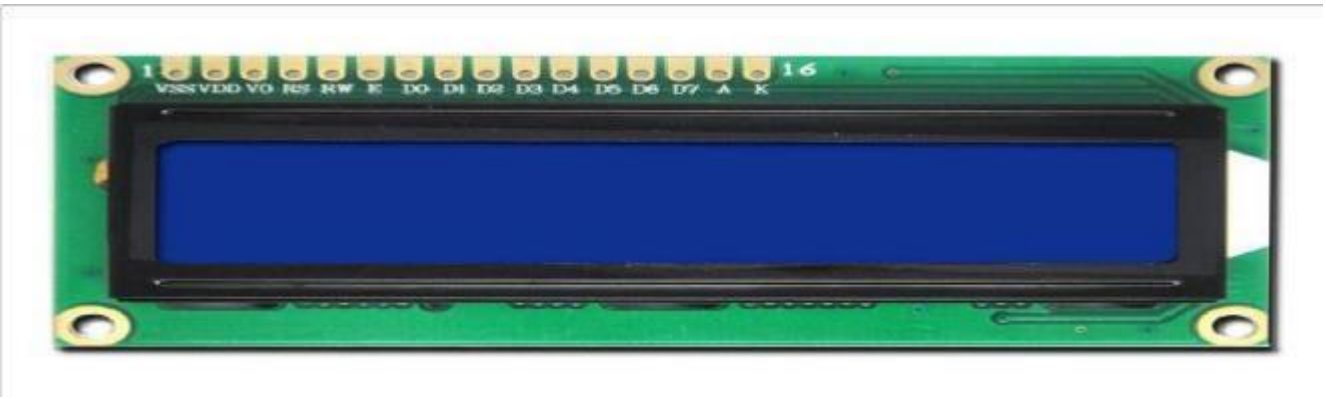
RESISTOR

A passive electrical component with two terminals that are used for either limiting or regulating the flow of electric current in electrical circuits.

PIEZO

A piezo is a device that generates a voltage when force is applied or becomes deformed when voltage is supplied

. **LCD (Liquid Crystal Display)**

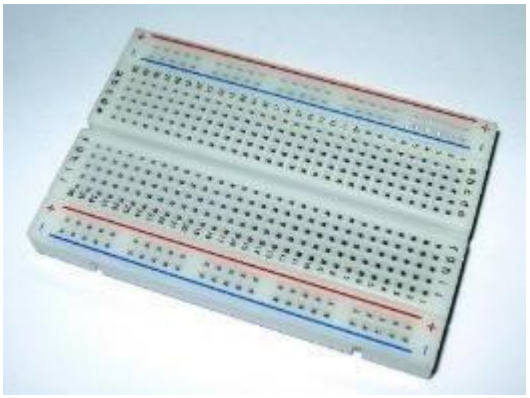


LCD stands for Liquid Crystal Display. 16×2 LCD is one kind of electronic device used to display the message and data. The display is named 16×2 LCD because it has 16 Columns and 2 Rows.

These LCD modules are low cost, and programmer-friendly, therefore, is used in various DIY circuits, devices, and embedded projects. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:

1. The declining prices of LCDs.
2. The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.
3. Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.

BREAD BOARD



A breadboard is a widely used tool to design and test circuit. You do not need to solder wires and components to make a circuit while using a bread board. It is easier to mount components & reuse them. Since, components are not soldered you can change your circuit design at any point without any hassle. It consist of an array of conductive metal clips encased in a box made of white ABS plastic, where each clip is insulated with another clips. There are a number of holes on the plastic box, arranged in a particular fashion. A typical bread board layout consists of two types of region also called strips. Bus strips and socket strips. Bus strips are usually used to provide power supply to the circuit. It consists of two columns,

one for power voltage and other for ground. Socket strips are used to hold most of the components in a circuit. Generally it consists of two sections each with 5 rows and 64 columns. Every column is electrically connected from inside.

GAS SENSOR

A gas sensor is a device which detects the presence or concentration of gases in the atmosphere. Based on the concentration of the gas the sensor produces a corresponding potential difference by changing the resistance of the material inside the sensor, which can be measured as output voltage. Based on this voltage value the type and concentration of the gas can be estimated.

LED

LED (Light Emitting Diode) is an optoelectronic device which works on the principle of electroluminance. Electro-luminance is the property of the material to convert electrical energy into light energy and later it radiates this light energy. In the same way, the semiconductor in LED emits light under the influence of electric field. The symbol of LED is formed by merging the symbol of P-N Junction diode and outward arrows. These outward arrows symbolise the light radiated by the light emitting diode.

DC MOTOR

DC motor is an electrical machine that converts electrical energy into mechanical energy. In a DC motor, the input electrical energy is the direct current which is transformed into the mechanical rotation.

ROTARY POTENTIOMETER

The rotary type potentiometers are used mainly for obtaining adjustable supply voltage to a part of electronic circuits and electrical circuits. The volume controller of a radio transistor is a popular example of a rotary potentiometer where the rotary knob of the potentiometer controls the supply to the amplifier. This type of potentiometer has two terminal contacts between which a uniform resistance is placed in a semi-circular pattern. The device also has a middle terminal which is connected to the resistance through a sliding contact attached with a rotary knob. By rotating the knob one can move the sliding contact on the semi-circular resistance.

PUSH BUTTON

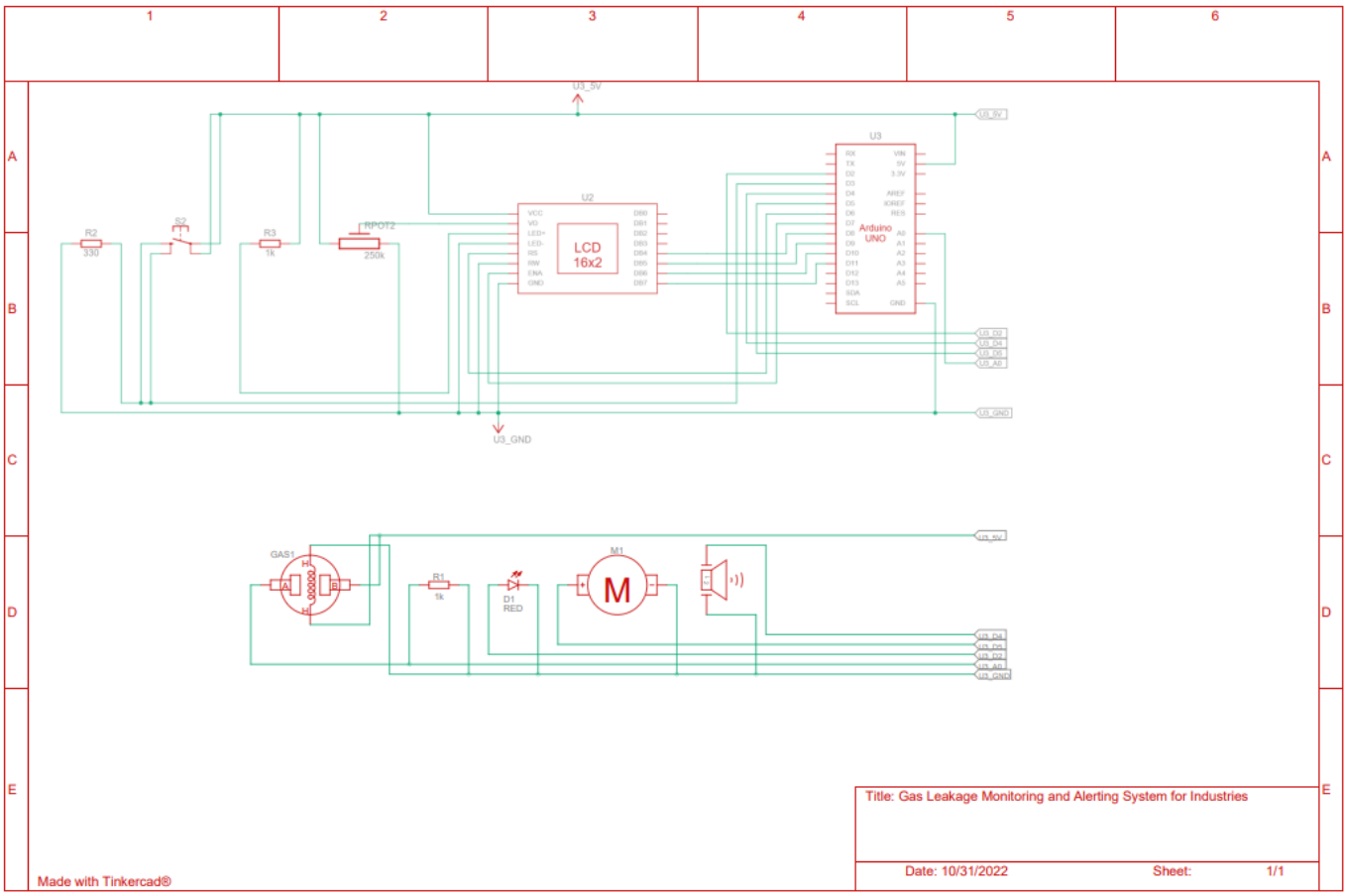
A **push-button** (also spelled **pushbutton**) or simply **button** is a simple switch mechanism to control some aspect of a machine or a process. Buttons are typically made out of hard material, usually plastic or metal.

JUMPER WIRE

Jumper wires are electrical wires with connector pins at each end. They are used to connect two points

in a circuit without soldering.

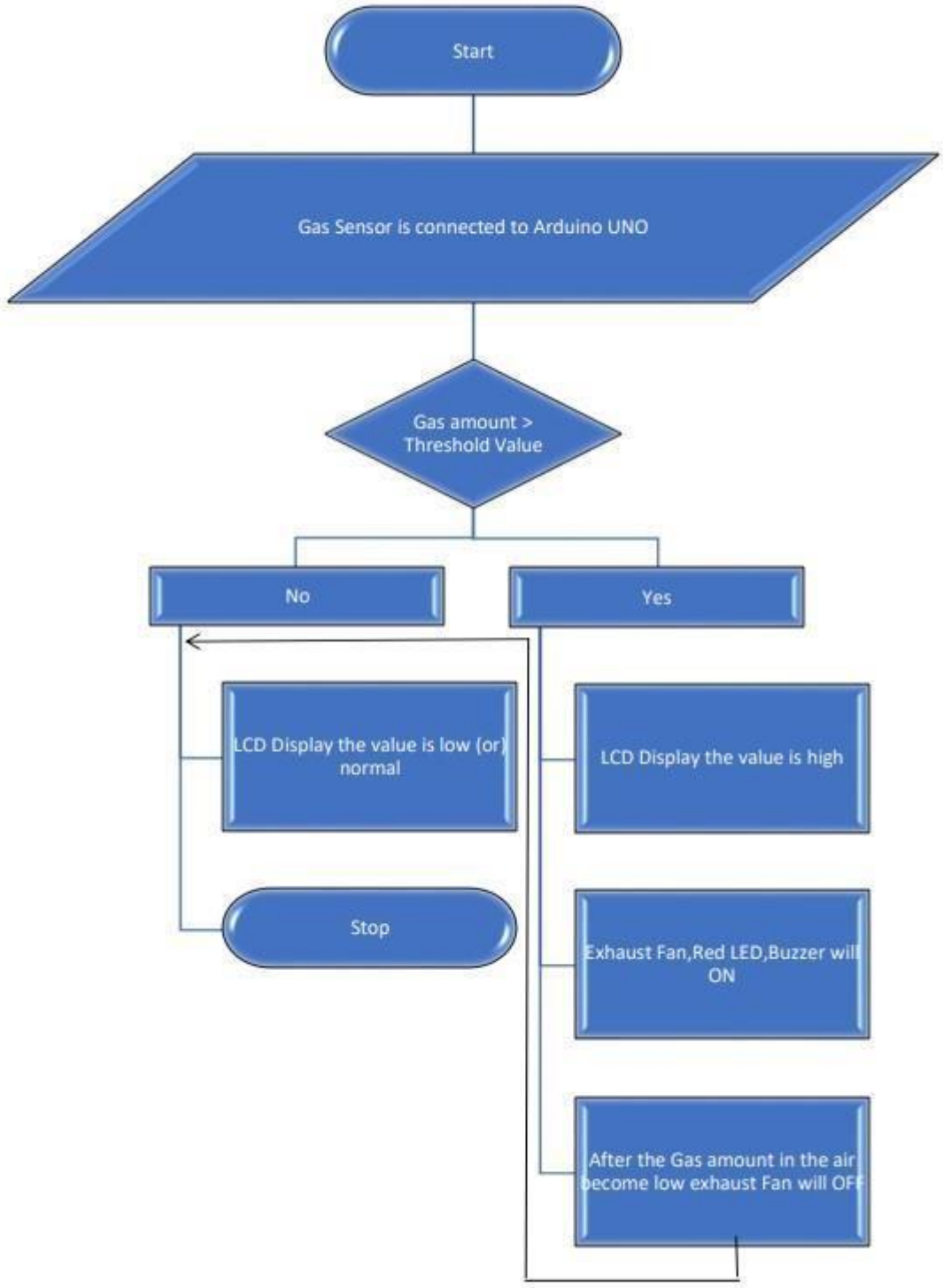
7.3 Database schema

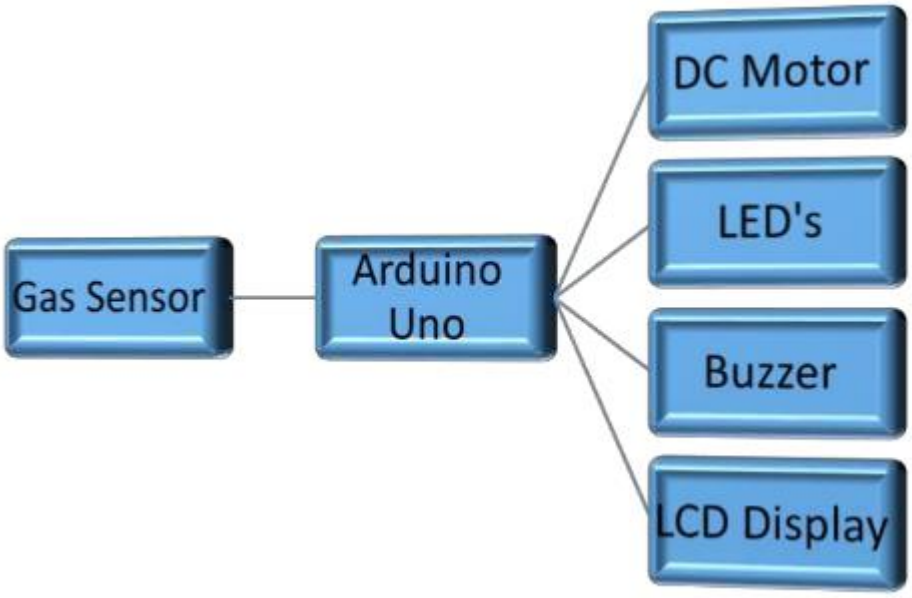


PROPOSED METHOD

In this project our central component is Arduino UNO. Arduino UNO (Atmega-328) is the main unit of the system which performs the following tasks. A signal conditioning of the Arduino UNO is done by output signal of the sensor, provided input to Arduino. Arduino will make decision when the gas amount is more than the threshold value, an automatic fan will ON and deduct the extra gas from the room or kitchen. Here, we have a gas sensor that will connect with the Arduino. The gas sensor will read the gas amount from the air. Then we must set a gas threshold value. When the gas value of the air of our home or kitchen is more than the threshold value. The exhaust fan will automatically ON. After eliminating the gas amount from the air, the exhaust fan will automatically OFF. Arduino UNO is the main unit of the system which performs the following tasks. A signal conditioning of the Arduino UNO is done by output signal of the sensor, provided input to Arduino. The detection results displayed on LCD. Indicates the people of danger in work place, factory, home. Buzzer activity with beep sound is made.

BLOCK DIAGRAM

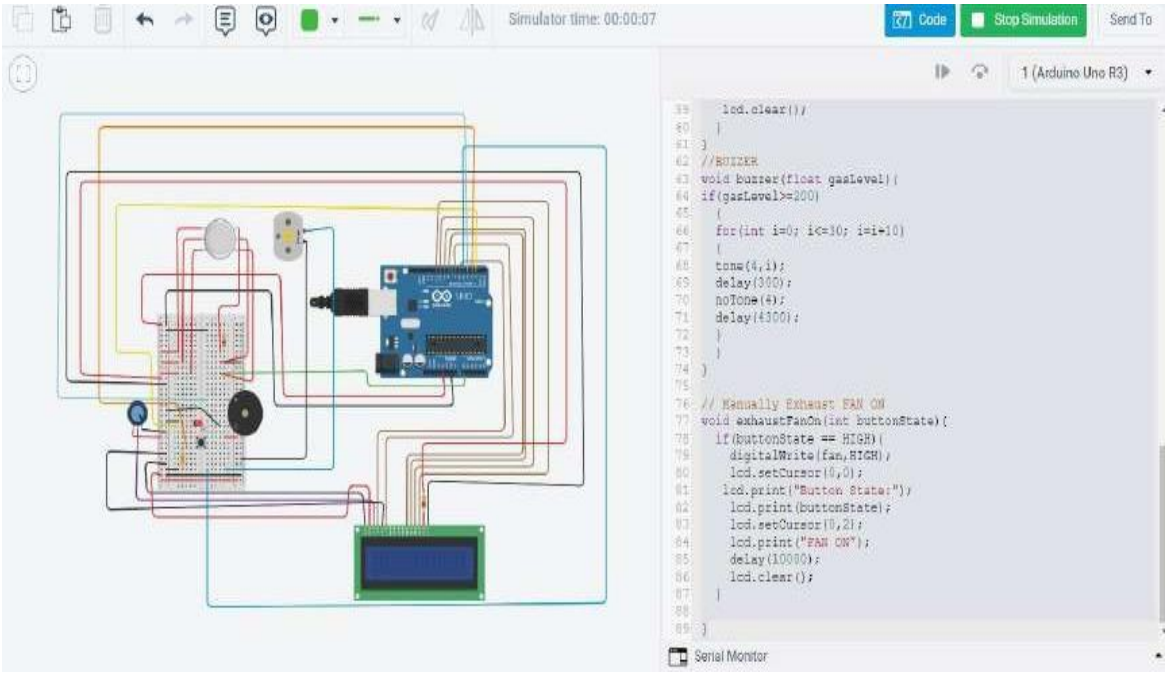




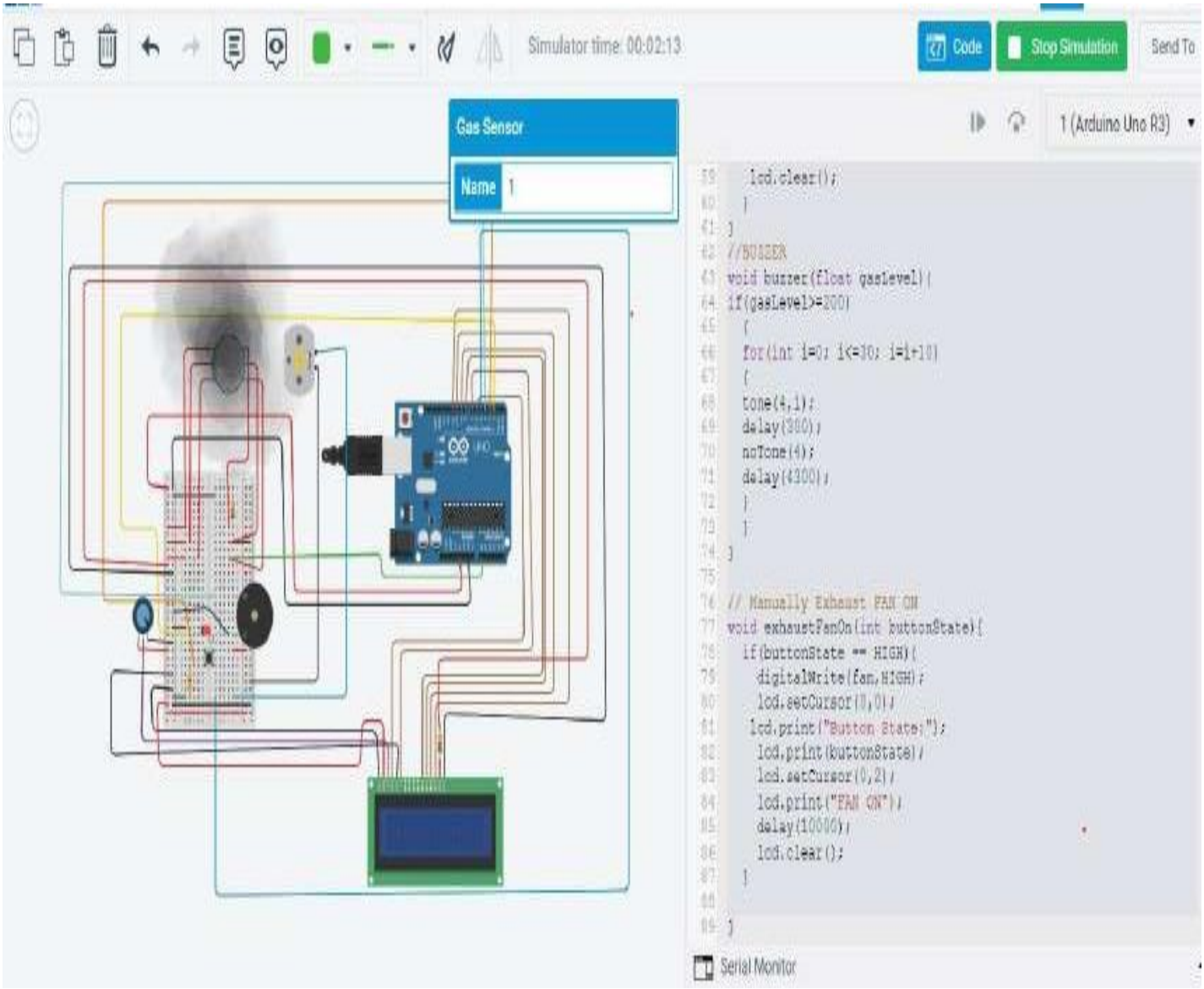
8.TESTING

8.1 Test case

Industries at normal temperature, it is not alerted.



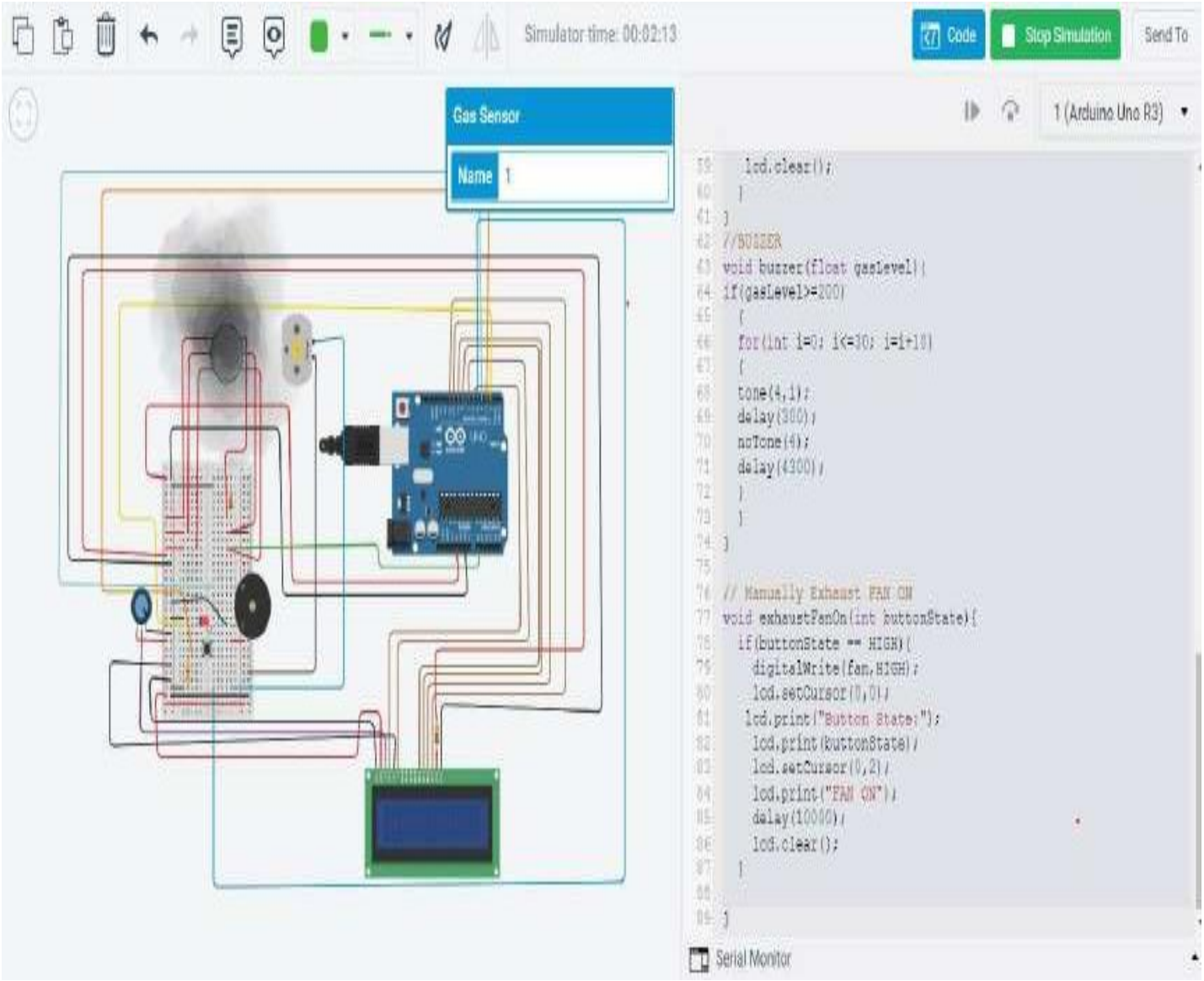
8.2 User acceptance testing



Due to gas leakage in industries, this circuit model is alerting the workerthrough their mobile phone. It will be monitor and rectify by workers in industries

9. RESULTS

9.1 Performance Metrices



10 .ADVANTAGES & DISADVANTAGES

Advantage

- This project helpful for detecting gas leakage in Industries.
- Component and Equipment are more efficient.
- Lower power consumption and reliable.
- It is also used in house for LPG gas leakage.

Disadvantage

- Location cannot be identify where gas leaking because there areseveral areas contain gas cylinder.
- It is sensitivity depends on Humidity and Temperature.
- Without Internet, This will not run and work.
- Installation is difficult.

11.CONCLUSION

After this project performance, can conclude that detection of the LPG gas leakage is incredible in the project system. Applicable usefully in the industrial and domestic purpose. In danger situations we are able to save the life by using this system. An alert is indicated by the GSMmodule. A sensor node senses gas like CO2, oxygen, propane. The estimated range of transmission and consumption of power is obtained. The simple procedures and Arduino UNO Micro controller area used to build the sensor.

12.FUTURE SCOPE

1. A Mobile Application can be created for this system which can give information about the concentration of gas present in the area, setting reminders to check gas level, also to predict the gas leak by giving values.

2. The use of Pressure sensor along with the system can provide an extra feature of Automatic Gas Booking. Like other sensors, the pressure sensor can constantly monitor the amount of gas present in cylinder and send a booking SMS if it reaches certain level.

3. Relay motors can be added into the system to provide more safety. These motors can switch off the Main Gas Supply and Main Power supply in case the gas concentration exceeds certain limit.

13 .APPENDIX

SOURCE CODE

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(6, 7, 8, 9, 10, 11);
int redled = 2;
int greenled = 3;
int buzzer = 4;
int sensor = A0;
int sensorThresh = 400;

void setup()
{
pinMode(redled, OUTPUT);
pinMode(greenled,OUTPUT);
pinMode(buzzer,OUTPUT);
pinMode(sensor,INPUT);
Serial.begin(9600);
lcd.begin(16,2);
}

void loop()
{
  int analogValue = analogRead(sensor);
  Serial.print(analogValue);
  if(analogValue>sensorThresh)
  {
    digitalWrite(redled,HIGH);
    digitalWrite(greenled,LOW);
    tone(buzzer,1000,10000);
    lcd.clear();
    lcd.setCursor(0,1);
    lcd.print("ALERT");
    delay(1000);
```

```
  lcd.clear();
  lcd.setCursor(0,1);
  lcd.print("EVACUATE");
  delay(1000);
 }
 else
 {
  digitalWrite(greenled,HIGH);
  digitalWrite(redled,LOW);
  noTone(buzzer);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("SAFE");
  delay(1000);
  lcd.clear();
  lcd.setCursor(0,1);
  lcd.print("ALL CLEAR");
  delay(1000);
 }
```

Github Link

https://github.com/IBM-EPBL/IBM-Project-46916-1660794683

Project Demo Link

https://drive.google.com/file/d/1iQ351A_5vi5RaYbCFBmZhbWGPaFNdfRO/view?usp=drivesdk