PROJECT

GAS LEAKAGE MONITORING AND ALERTING SYSTEM FOR INDUSTRIES

(Gas detecting alarm system with arduino):

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GAS LEAKAGE MONITORING AND ALERTING SYSTEM FOR INDUSTRIES

1.INTRODUCTION

Gas leakage is a major problem with industrial sector, residential premises and gas powered vehicles like CNG (compressed natural gas) buses and cars. Homes and Industrial fires have taken a growing toll in lives and property in recent years. "Most gasses used for industrial activities are highly inflammable and can burn even at some distance from the source of leakage. "Most fire accidents are caused because of a poor- quality rubber tube or when the regulator is not turned off. The supply of gas from the regulator to the burner is on even after the Regulator is switched off. By accident, if the knob is turned on, it results in the gas leaks. Safety plays a major role in today's world and it is necessary that good safety systems are implemented in places of education and work. This project modifies the existing safety model installed in industries and this system also can be used in homes and offices. The main objective of this project is designing microcontroller based gas leakage detective system. some hazardous gases like liquefied petroleum gas(LPG) and propane can be sensed using this device. One of the preventive methods to stop accident associated with the gas leakage is to install gas leakage detection kit at vulnerable places. The aim of this project is to present such a design that can automatically detect gas leakage in vulnerable premises. In particular gas sensor has been used which has high sensitivity. This project was based on liquefied petroleum gas. If these gases exceed the normal level then an alarm is generated immediately. The advantage of this detection and alerting system over the manual method is that it offers quick response time and accurate detection of an emergency and in turn leading faster diffusion of the critical.

1.1 PROJECT OVERVIEW

 The usage of the gas brings great problems in the domestic as well as working places. The inflammable gas such as Liquidized petroleum gas (LPG), which is excessively used in the house and at work places. The leakage of the gas causes destructible impact to the lives and as well as to the heritage of the people. So, by keeping it in the concept of the project we have determined to develop an examining system which finds the leak of LPG gas and protects the work places by taken correct precaution at correct time. This system provides the information such as when a gas leakage is noticed, sensors of in the project are used to notice the gas leakage and immediately turns ON the buzzer for the danger indication. Buzzer is a clear indication of gas leakage. By the detection of the hazardous gas the alerting message reached to the person who has control over it from the GSM. Detection of the gas leakage is important and halting leakage is important equally. The main objective of this project is that it is extremely accurate with a least cost, this project system is best to detect gas leakage and also warn people around by buzzer beep sound and an SMS is been send to the responsible person for preparatory safe calculations. some people have low sense of smell, may or may not respond on low concentration of gas leakage. In such a case, gas leakage security systems become an essential and help to protect from gas leakage accidents. a number of project have worked on gas leakage security system. the alarm is activated immediately, if the gas concentration exceeds normal level. Bhopal gas tragedy was an example of gas leakage accident in india. This was world worst gas leakage industrial accident. Gas leakage detection is not only important but also alerting the people involved is equally essential .This project provides a cost effective and highly accurate system, which not only detect gas leakage but also the necessary people.

1.2 PURPOSE

Personal Gas Monitor - a device worn by a person that measures airborne gases and provides a warning when alarm levels of hazardous gases are reached.
Portable Gas Monitor - is equipment used to test the condition of air prior to entering an area that could have a hazardous atmosphere

2. LITERATURE SURVEY

 The leakage detection and real time gas monitoring system. In this system, the gas leakage is detected and controlled by means of exhaust fan. The level of Gas leakage is also continuously monitored proposed the design of wireless gas leakage monitoring system. In this project, the user is alerted about the gas leakage through alarm and the power supply is turned off. proposed the system in which the leakage is detected by the gas sensor and produce the results in the audio and visual forms. It provides a design approach on software as well as hardware. proposed the smart sensor technology. In this flexible reliable smart gas detection system is developed. In this, the leakage is detected and controlled by using exhaust fan proposed the system in which two sensors are used for detecting the gas leakage and for monitoring the level of gas in the cylinder respectively proposed the system in which two types of gases namely processor and simulates using MQ2 gas sensor to alert the user by sending alarm proposed the system that uses two different sensors for detecting the leakage and requires resetting manually after every situation. proposed the system to meet occupational health and safety standards and also it alerts the user by alarm. proposed the system that uses trace sensing technology and also detects the leakage.

COMPONENTS USED IN THE DESIGN OF GAS LEAKGE DETECTION
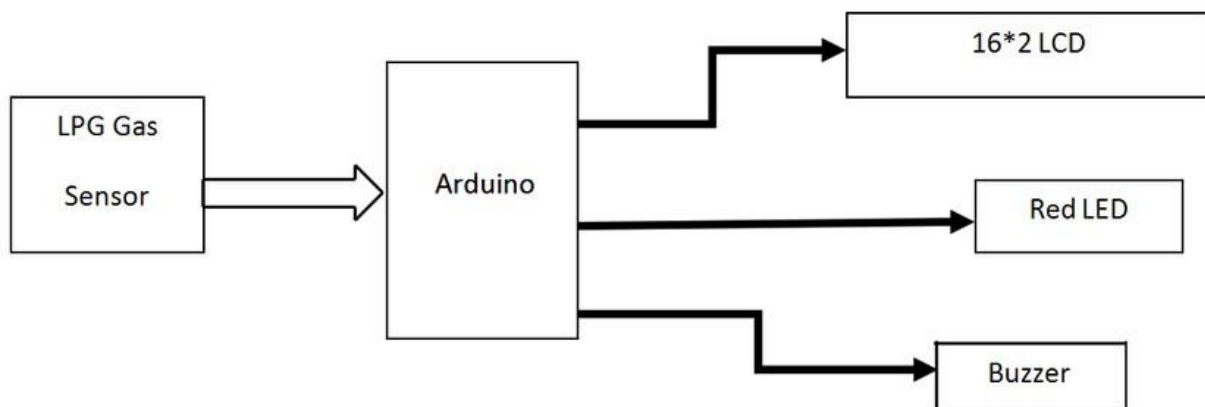
2.1   EXISTING SYSTEM

In the existing method, different gas sensing technology is used. The gas leakage is detected by the semiconductor sensor. Now a days gas leakage accidents are very common in chemical industries and oil industries. the main reason of these accidents is due to the leakage of gas. This is the basis of these kinds of accidents. Already there are some sorts of remedial measures such as when the leakage is detected, alert message is sent to the fire station and the owner.

LIST OF COMPONENTS

S.NO	NAME OF THE COMPONENTS	QUANTITY
1	Arduino uno	1
2	MQ2 Gas sensor	1
3	Ohms Resistor	4
4	Piezo buzzer	1
5	Bread board	1
6	two different colour LED	2
7	LCD (16x2)	1

2.2 REFERENCES

[1] Kumar Keshamoni and Sabbani Hemanth. "Smart Gas Level Monitoring, Booking & Gas Leakage Detector over IoT " International Advance Computing Conference IEEE, 2017.

[2] Petros Spachos , Liang Song and Dimitrios Hatzinakos. "Gas Leak Detection and Localization System Through Wireless Sensor Networks" The 11th Annual IEEE Consumer Communications and Networking Conference - Demos. IEEE, 2014.

[3] Babuprasanth.V. "Cloud Connected Smart Gas Leakage Detection And Safety Precaution System" International Journal of MC Square Scientific Research Vol.6, No.1 Nov 2014.

[4] Asmita Varma, Prabhakar S, Kayalvizhi Jayavel. "Gas Leakage Detection and Smart Alerting and Prediction Using IoT." Internet of Things and Applications (IOTA), International Conference on. IEEE, 2017

[5] Mohammad Reza Akhondi, Alex Talevski, Simon Carlsen, Stig Petersen. "Applications of Wireless Sensor Networks In the Oil, Gas And Resources Industries." International Conference On Advanced Information Networking And Applications, IEEE 2010

[6] Ashish Shrivastava, Ratnesh Prabhaker, Rajeev Kumar and Rahul Verma "Gsm Based Gas Leakage Detection System." International Journal Of Technical Research And Applications EISSN: 2320-8163

[7] Tyler Kersnovski, Felipe Gonzalez, Kye Morton. "A UAV System For Autonomous Target Detection And Gas Sensing." Yellowstone Conference Center, Big Sky, Montana, IEEE 2017

[8] Vana Jelicic, Michele Magno, Davide Brunelli, Giacomo Paci, Luca Benini, Fellow. " ContextAdaptive Multimodal Wireless Sensor Network For Energy-Efficient Gas Monitoring" IEEE Sensors Journal · January 2013 DOI: 10.1109/JSEN.2012.2215733,

2.3 PROBLEM STATEMENT DEFINITION

Gas leakage leads to various accidents resulting into both financial loss as well as human injuries. In human daily life, environment gives the most significant impact to their health issues. The risk of fires, explosion, suffocation, all are based on their physical properties such flammability, toxicity. The number of deaths due to the explosion of gas cylinder has been increasing in recent years. the reason for such explosion is due to substandard cylinders, old values, worn out regulators and lack of awareness using cylinder add to risk. inspections by oil companies found that many LPG consumer are unaware of safety checks of gas cylinders.in other to minimize or eliminate the hazard of gas leakage there is a need for a system to detect and alert on such incidence leading to the development of this project.

3. IDEATION OR PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS
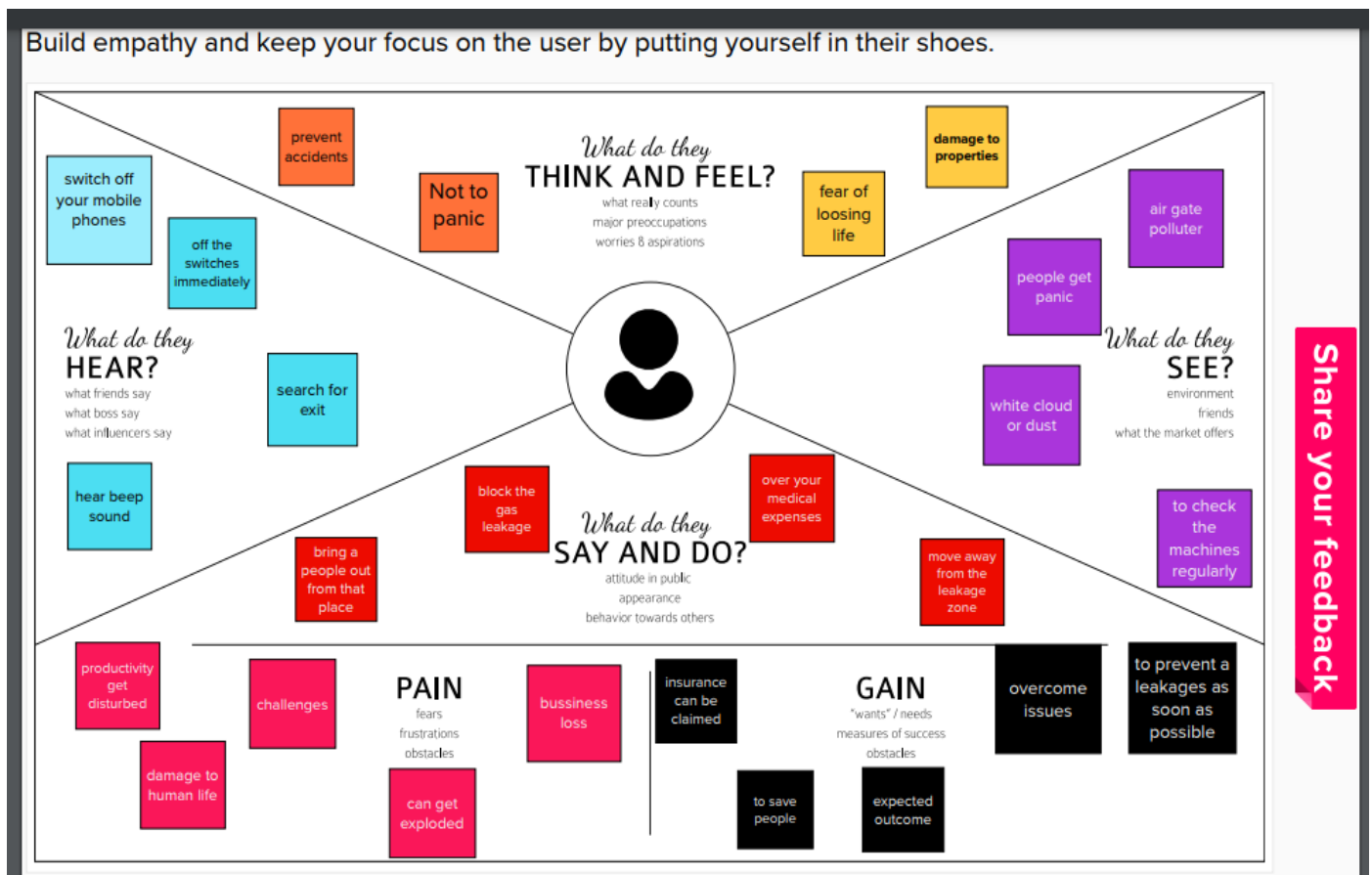
3.2 IDEATION OR BRAIN STORMING

3.3 PROPOSED SOLUTION

3.4 PROPOSED SOLUTION FIT

4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	The system gas leakage detects gas in the atmosphere and will be continuously update and display the gas value. the value can be seen by the user through the mobile app easily.
FR-2	User Confirmation	The user after connecting the system to the internet send a message to the user saying that the system is activated and ready to perform
FR-3	User Authentication	Normal webpage is shown to the user. It shows the sensor values stored in the database. It also displays the prediction to the user for the values external by him.
FR-4	User processing	The user start the system by connecting to a hotspot or a wi-fi connection.
FR-5	User Business goal	The internet of things is the system of gadgets, vehicles and home machine that contain hardware, programming, actuators, and network which enables these things to interface, collaborate and trade information
FR-6	User Reporting	It decided whether the environment is safe or not and accordingly a message will be sent.

4.2 NON FUNCTIONAL REQUIREMENT

Following are the non-functional requirements of the proposed solution.

| FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The system interface should be easy and effective.
NFR-2	Security	the communication between the Arduino and the GLDS should be secure by encryption. The system should not display the homeowner personal information to anyone.
NFR-3	Reliability	The system should be operated in android reliable system.
NFR-4	Performance	The system should response immediately to any leakage situation The system should update the local database in real time.
NFR-5	Availability	The system should work 24 hours 7 days a week.
NFR-6	Scalability	The gas detector should be from anywhere at any time. The homeowner information should be modified easily.

5.PROJECT DESIGN
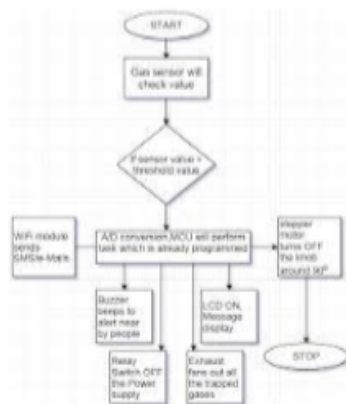
5.1 DATA FLOW DIAGRAM

Data Flow Diagrams:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

Example: (Simplified)
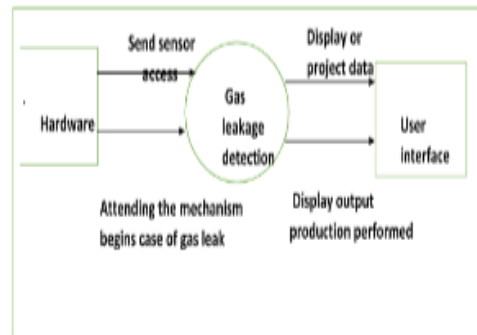
Level 0 : DFD

5.2 USER STORY

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail	I can register access the dashboard with the g-mail	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password	I can register user and logged out, if I go to the login page and enter my user name and password and click on login then the data associate to my user should be accessible	High	Sprint-1
	Dashboard	USN-1	As a user, I can register dashboard email or password	I can register password and click the login then log in fail with the error message that specifies that the username or password was wrong	High	Sprint-1
Customer (Web user)	Login	USN-2	As a user, I can register for the application through the g-mail	I can receive the application from the g-mail	High	Sprint-2
Customer Care Executive	Registration	USN-3	We have all needed help from a customer service executive at one time or another, sometimes its cell phone with garbled	I can register from the customer service executive the form of application	Medium	Sprint-1

			display or a lost or an urgent gas leakage.			
Administrator	Help desk	USN-4	Agent to provide emergency step to customer	I can provide a emergency step to customer	Medium	Sprint-2
	Manage	USN-5	Control centre failure response team turn off all ovens, open flames, and other potential, ignition sources.	I can provide a control centre failure response team turn off all ovens, open flames, and other potential, ignition sources	High	Sprint-1

6. PROJECT PLANNING & SCHEDULING

6.1 SPRINT PLANNING
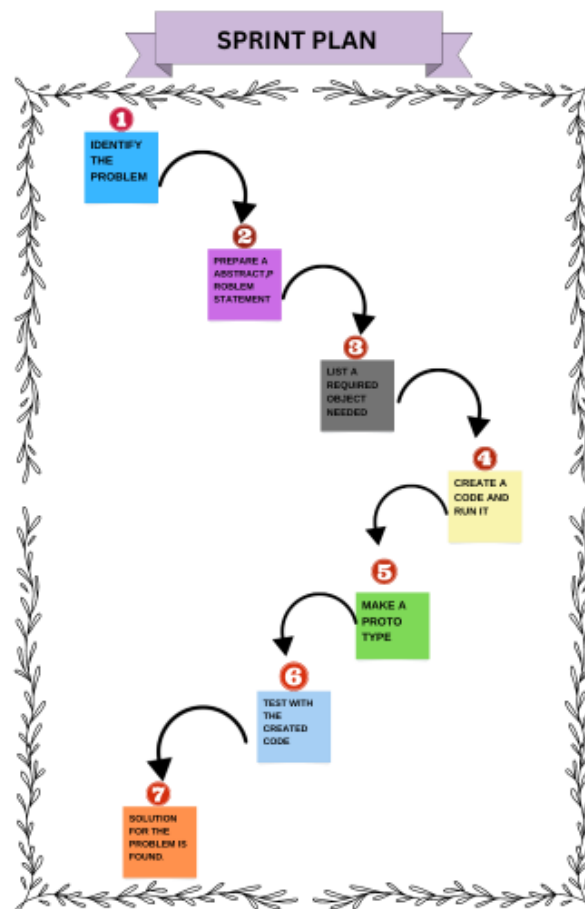
6.2 SPRINT DELIVERY SCHEDULE

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Use the below template to create product backlog and sprint schedule

| Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint 1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password	3	High	5
Sprint 1		USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	5
Sprint 2		USN-3	As a user, I can register for the application through Facebook	2	Low	5
Sprint 1		USN-4	As a user, I can register for the application through Gmail	2	Medium	5
Sprint 1	Login	USN-5	As a user, I can log into the application by entering email & password	1	High	5
Sprint 3	Buy/Reject	USN-6	As a user, offices will be able to monitor all the areas placed within cameras on a single dashboard	1	High	5
Sprint 1	Help desk	USN-7	As a user, optimize and control and operations with crop yield insights gain alerts through our detection sensors about pest occurrence and intra	2	Medium	5
Sprint 2	Manage	USN-8	As a user, reduce equipment breakdown and reduce worry about costs	1	High	5

Project Tracker, Velocity & Burndown Chart (4 Marks)

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint 1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint 2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint 3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint 4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)
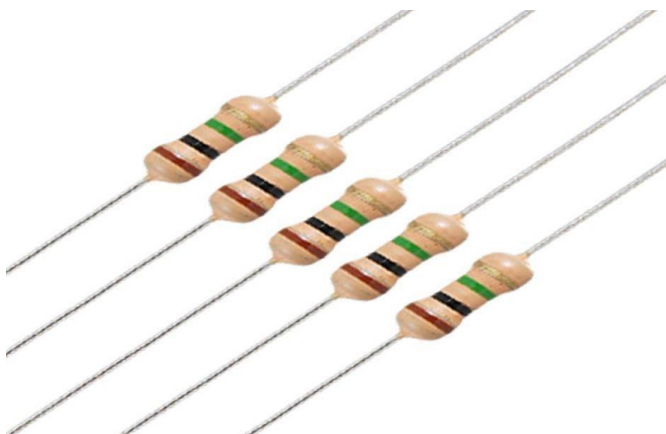
7. METHODS AND MATERIALS

ARDUINO UNO:
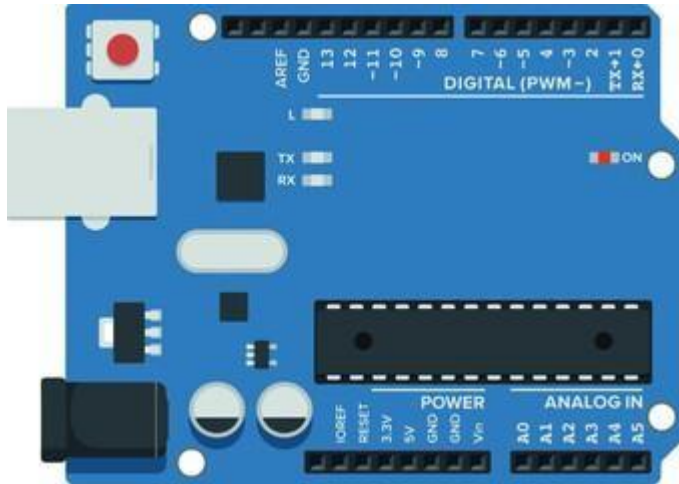
When Arduino receives a HIGH pulse from the LPG Gas sensor module its green led turns off and the red led turns on with led a 5v buzzer also starts beeping until it senses LPG gas. When Arduino gets a LOW pulse from the LPG Gas detector module, then the red led and buzzer turns off and the green led turns.
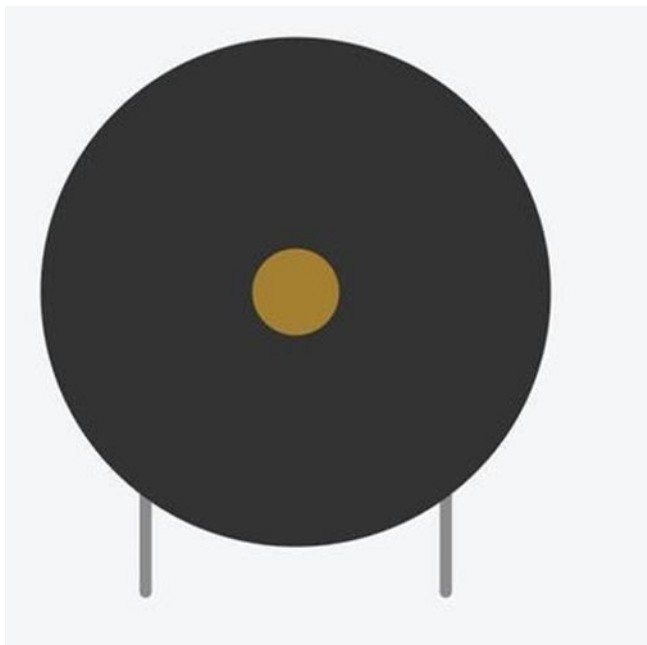
RESISTOR:

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.

PIEZO BUZZER:

Buzzers can be found in alarm devices, computers, timers and confirmation of user input such as a mouse click or keystroke. You will also learn how to use tone() and noTone() function. Using this function you can make a piano sounds.

RED AND GREEN LED:

The Bi-color LED is a handy little component that allows two colors (red and green) in a single LED while only having two pins (cathode and anode). The color of the LED depends on the polarity of the connection only allowing one color at a time.

16x2 LCD:

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. This LCD has two registers, namely, Command and Data.
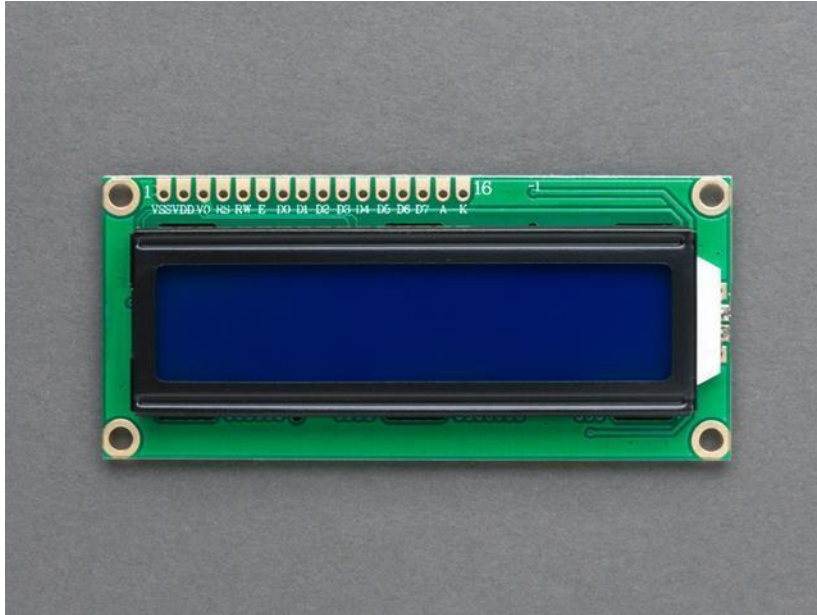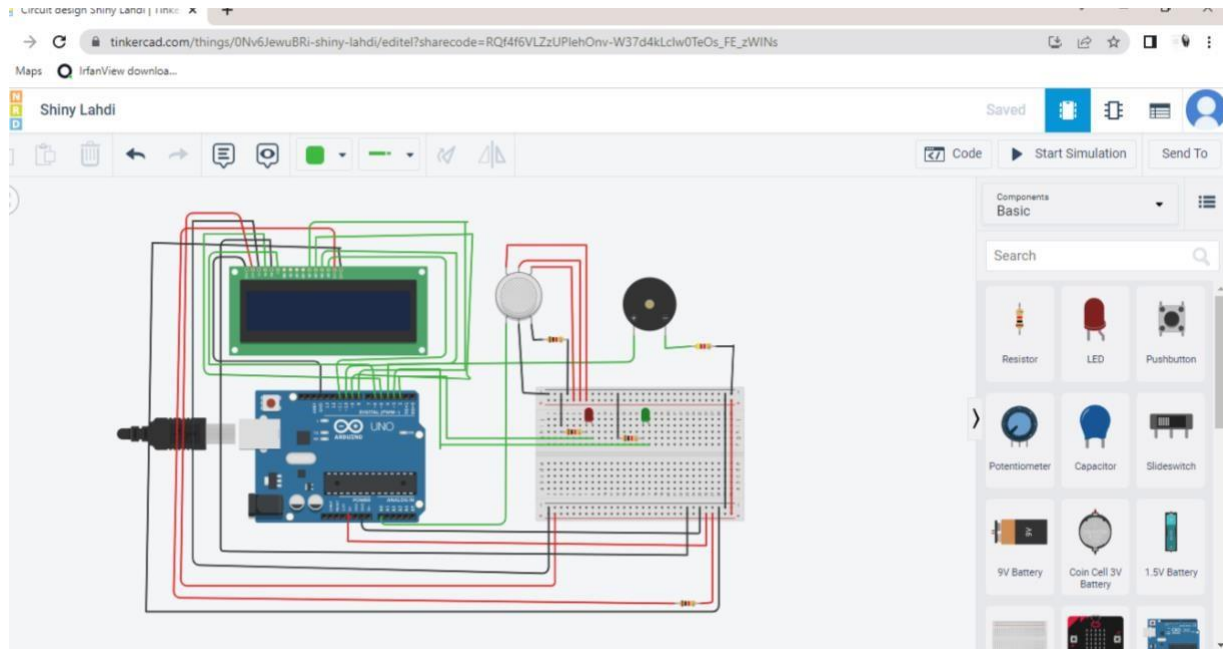
BREADBOARD:

A breadboard is a rectangular plastic board with a bunch of tiny holes in it. These holes let you easily insert electronic components to prototype (meaning to build and test an early version of) an electronic circuit, like this one with a battery, switch, resistor, and an LED (light-emitting diode.
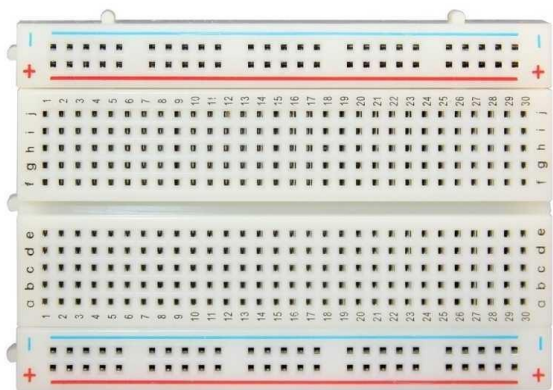
8. PROJECT

## Gas detecting alarm system with arduino

how to build an Arduino gas detecting alarm system in tinkercad. This circuit uses the gas sensor to detect if there is fire, smoke, or gas leakage nearby.
Using the LCD and the alarm, this circuit also can display its "Gas Leakage Alert" message, while alerting people nearby.

We have used a gas sensor module to detect gases. If a gas leakage occurs, the sensor gives a HIGH pulse and when the Arduino gets a HIGH pulse from the sensor, it sends a signal to the LCD and the piezo buzzer. Then the

LCD would show the "Evacuate" message and activates the piezo buzzer which beeps again and again until the gas detector doesn't sense the gas in the environment. Else, the gas sensor gives LOW pulse to the Arduino, then LCD would then show the "All Clear" message.

Step 1
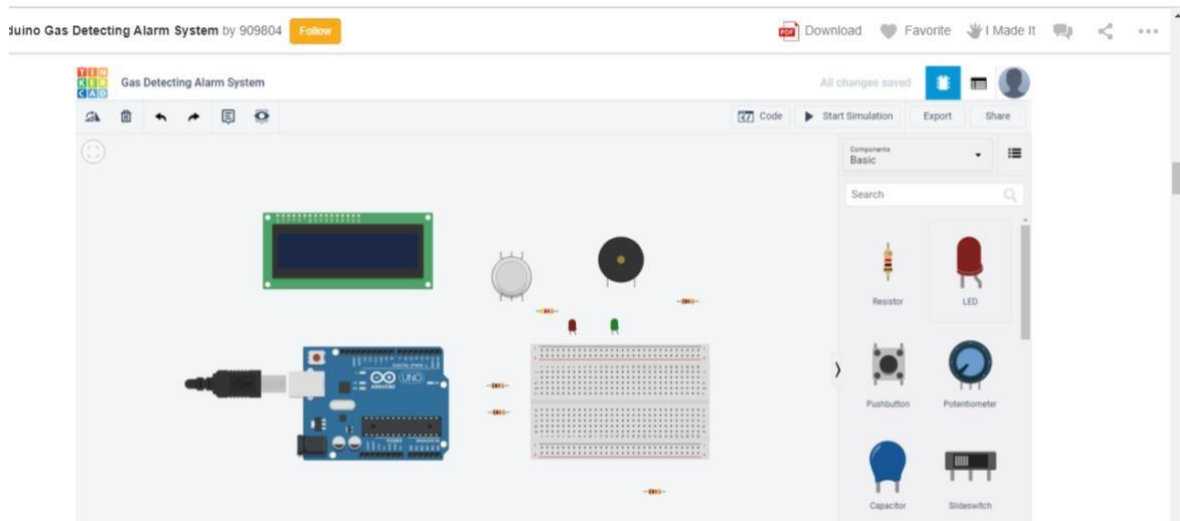
# Step 2
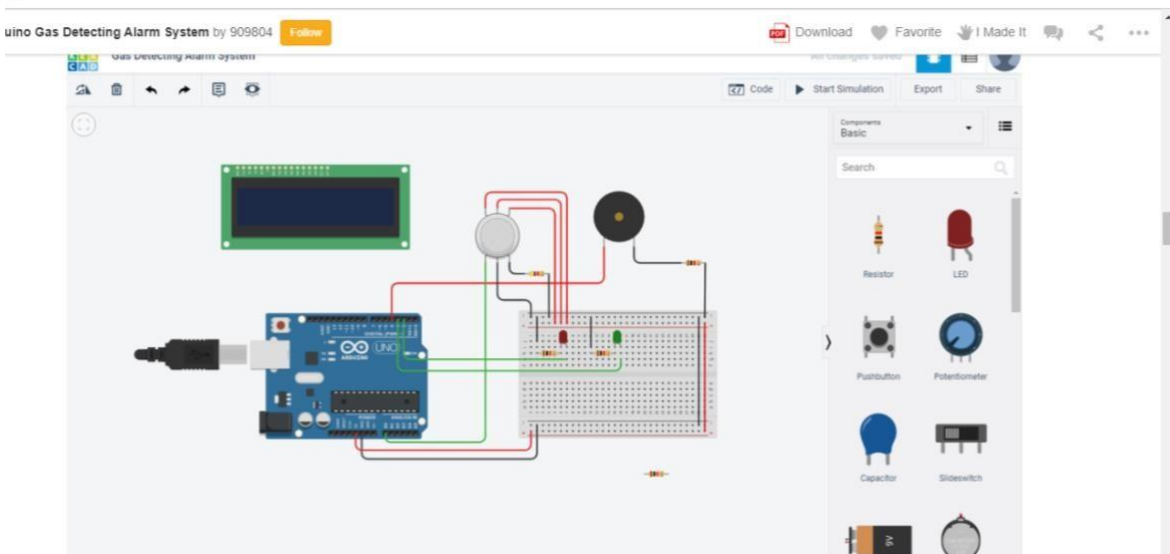
Steps :

1. Connect Arduino 5V to positive power rail

2. Connect Arduino GND to negative power rail

3. Connect Arduino A0 to gas sensor B1

4. Connect gas sensor A1, H2, A2 to positive power rail

5. Connect gas sensor H2 to ground

6. Connect gas sensor B2 to 4.7k ohms resistor, then to ground

7. Connect piezo positive terminal to Arduino pin 4

8. Connect piezo negative terminal to 1k ohms resistor, then to ground

9. Connect the cathodes of the two LEDs to 1k ohms resistor, then to ground

10. Connect the anode of the red LED to Arduino pin 2

Step 3
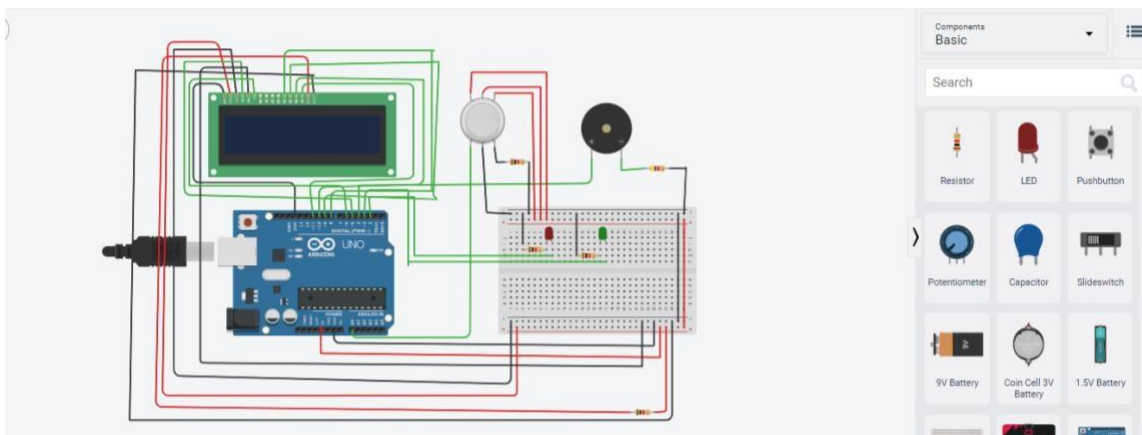
1. Connect LCD ground, contrast, and LED cathode to ground

2. Connect LCD anode to 1k ohms resistor, then to the positive power rail

3. Connect LCD power to the positive power rail

4. Connect LCD register select to Arduino pin 5

5. Connect LCD read/write to ground

6. Connect LCD enable to Arduino pin 6

7. Connect LCD terminal 4,5,6,7 to Arduino pin 8,9,10,11

Step 4

Code

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(5,6,8,9,10,11);
   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);
   }
```
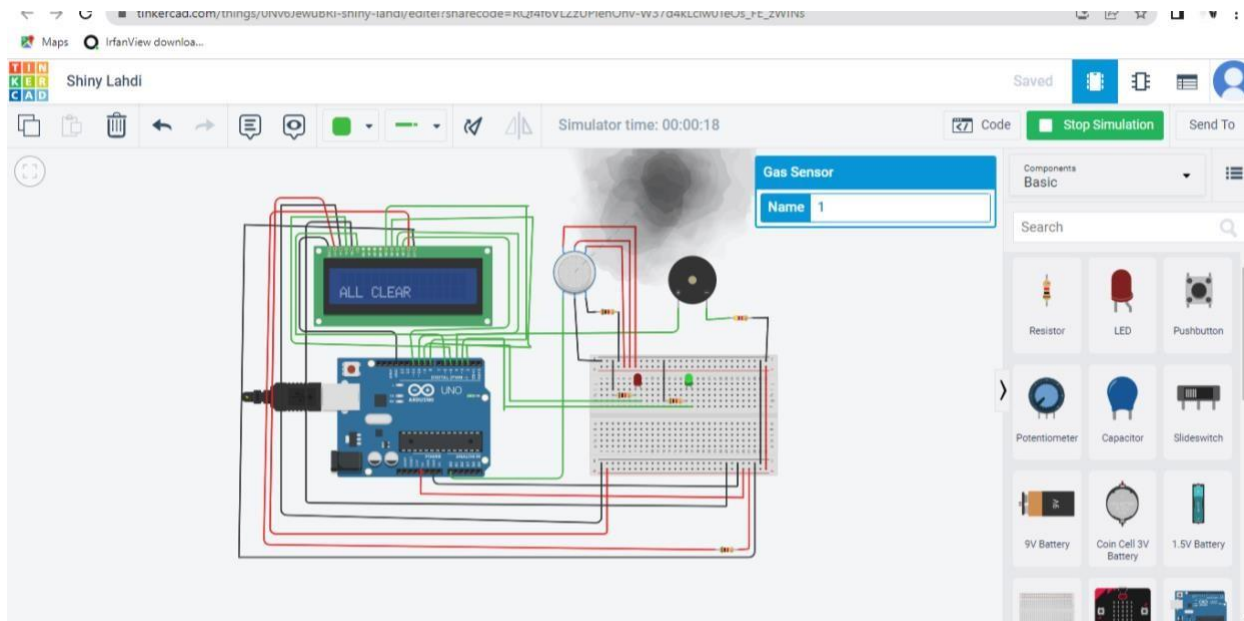
Here is the Arduino Code for Gas Detecting Alarm System.

Step 5

Run the simulation

When you run the simulation, the LCD should be able to display both safe and evaluate messages, while the piezo buzzer should be able to beep if the gas sensor detect any gas leaks.

9.ADVANTAGE & DISADVANTAGE

- Get real-time alerts about the gaseous presence in the atmosphere
- Prevent fire hazards and explosions
- Supervise gas concentration levels
- Ensure worker's health
- Real-time updates about leakages
- Cost-effective installation
- Data analytics for improved decisions
- Measure oxygen level accuracy
- Get immediate gas leak alerts

DISADVANTAGE

Poor stability and greater environmental impact; in particular, the selectivity of each sensor is not * and the output parameters cannot be determined. Therefore, it should not be used in places where accurate measurement is required.

10.FUTURE SCOPE

For industrial purpose mobile robot using artificial intelligence can be

developed for detecting multiple gas concentration.

11. APPENDIX

PROJECT LINK

https://www.tinkercad.com/things/0Nv6JewuBRi-shiny-lahdi/editel?sharecode=RQf4f6VLZzUPlehOnv-W37d4kLcIw0TeOs_FE_zWINs

12. CONCLUSION

Gas leakage leads to severe accidents resulting in material losses and human injuries. Gas leakage occurs mainly due to poor maintenance of equipments and inadequate awareness of the people. Hence, LPG leakage detection is essential to prevent accidents and to save human lives. This paper presented LPG leakage detection and alert system. This system triggers LED and buzzer to alert people when LPG leakage is detected. This system is very simple yet reliable.