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# Gas Leakage Monitoring and Alerting System for Industries

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**DOMAIN:** (INTERNET OF THINGS) IOT

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## **FINAL REPORT**

### **ABSTRACT:**

Leakage of gas is a major issue in the industrial sector, residential buildings, and gas-powered vehicles, one of the preventive methods to stop accidents associated with gas leakage is to install gas leakage detection devices. The focus of this work is to propose a device that can detect gas leakage and alert the owners to avert problems due to gas leakages. The system is based on a microcontroller that employs a gas sensor as well as a GSM module, an LCD display, and a buzzer. The system was designed for gas leakage monitoring and alerts with SMS via an Arduino microcontroller with a buzzer and an MQ2 gas sensor. The circuit contains a Microcontroller MQ2 gas sensor, buzzer, LCD display, and GSM module, when the sensor detects gas leakage it transmit the information to the Microcontroller while the microcontroller makes a decision and then forwarded a warning message to the user as SMS to a mobile phone for decision to be taken accordingly. The output of this project will be significant in averting problems associated with gas leakages now and in future.

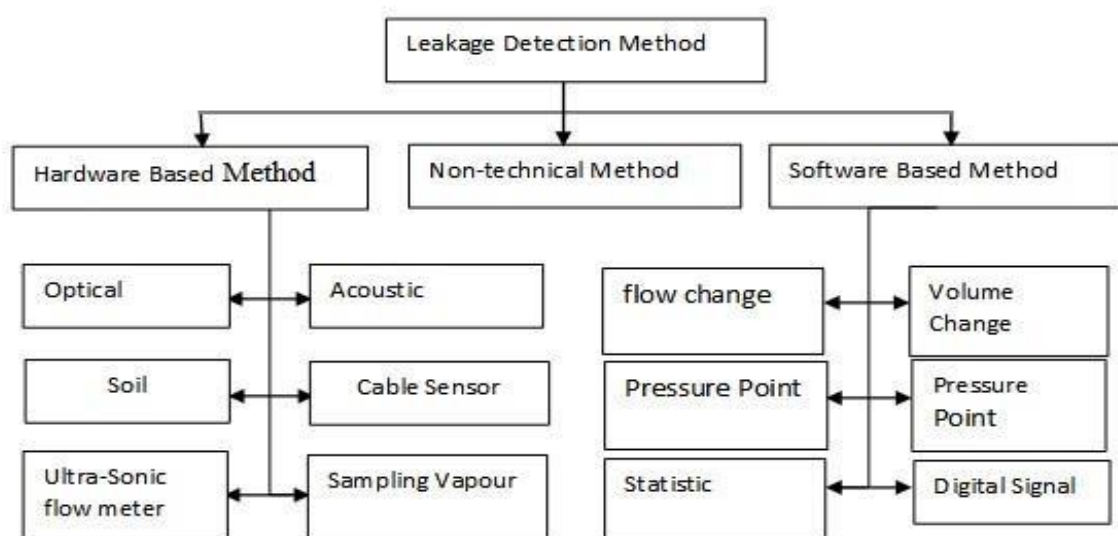
**Index Terms:** Gas Leakages, GSM module, Gas Leakage Detector, Gas Sensor, GSM module.

## INTRODUCTION

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 . The focus of this work is to design a system that monitors gas leakage in an enclosed system using an Arduino Uno microcontroller and an alarm system are used to alert people within leakages neighborhood while SMS will be sent to the premises owner or safety organization to towards making decision to avert damages and loss of lives/properties. The objectives among others if the design is implemented are:

- i. To prevent loss of lives and properties when gas leakages occur
- ii. To enable prompt action by the premises owner and safety organization towards avert problems that may be associated with gas leakages.
- iii. To enable people around the gas leakages premises take action to prevent damages escalation.

### Gas Leakage Detection Method Based on Technical Nature



## OBJECTIVES:

The design of a sensor-based automatic gas leakage detector with an alert and control system has been proposed. This is an affordable, less power 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 of gases 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.

### Problem Formulation:-

Gas leakage is nothing but the leak of any gaseous molecule from a stove, or a pipeline, or cylinder etc. This can occur either purposefully or even unintendedly. As we are aware that these kinds of leaks are dangerous to our health, and when it becomes explosive it could cause great danger to the people, home, workplace, industry and the environment.

Few of the major incidents that took place due to gas leakage include the Bhopal Disaster and the Vizag Gas leak.

## METHODS AND MATERIAL:

**System:** Input, Output, Function, Success, Failure

**Input:** Sensor data signal which is not regular or Change in Signal **Output:**

End User get informed with alert buzzer and Display to LCD Functions:

1. **Access () :-** In this module we are going to access the feature provided by the module which Will include Sensor data access.
2. **Control () :-** In this module we are controlling the Alert System by using System which is connected to hardware or sensor data.
3. **Broadcast () :-** In this module we are going to broadcast the alert Display to LCD.
4. **Success Conditions:**
  1. If such data which is received through sensors are not stable or are more than threshold it will predict that there is leakage situation
5. **Failure Conditions:** Desired output is not generated due to following failures.
  1. Software & Hardware Failure
  2. Network Connection Failure

## LIST OF COMPONENTS:

S.No.	Name of the Component	Quantity
1.	Arduino UNO R3	1
2.	Breadboard	1
3.	LED	2
4.	Resistor	5
5.	Piezo	1
6.	Gas Sensor	1
7.	LCD 16*2	1

## HARDWARE INFORMATION

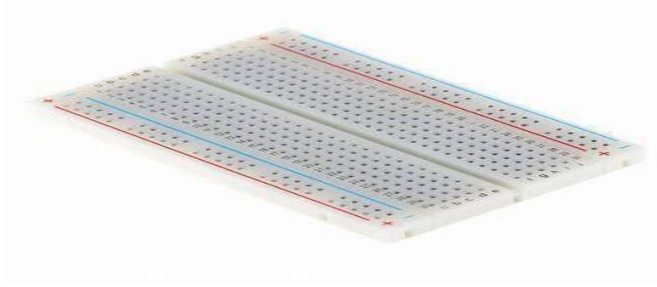
### ARDUINO UNO:



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-to-DC adapter or battery to get started

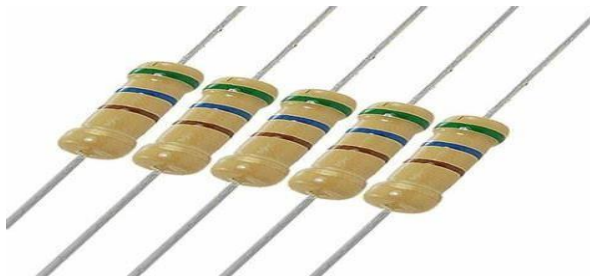
The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

## **BREADBOARD:**



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.

## **RESISTOR:**



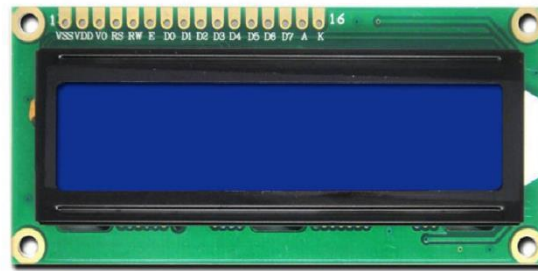
A passive electrical component with two terminals that are used for either limiting or regulating the flow of electric current in electrical circuits.

## **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.

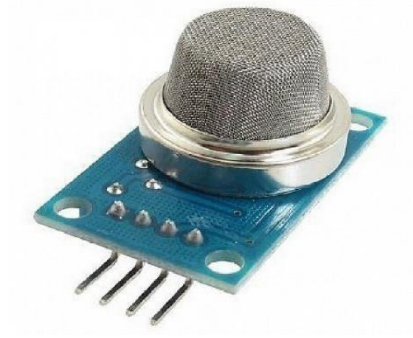
These LCD modules are low cost, and programmer-friendly, therefore, is used in various DIY circuits, devices, and embedded projects. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:

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

## BUZZER

A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke. The first electric buzzer was invented in 1831 by Joseph Henry. They were mainly used in early doorbells until they were phased out in the early 1930s in favor of musical chimes, which had a softer tone. Piezoelectric buzzers, or piezo buzzers, as they are sometimes called, were invented by Japanese manufacturers and fitted into a wide array of products during the 1970s to 1980s. This advancement mainly came about because of cooperative efforts by Japanese manufacturing companies. In 1951, they established the Barium Titanate Application Research Committee, which allowed the companies to be "competitively cooperative" and bring about several piezoelectric innovations and inventions.

## **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.

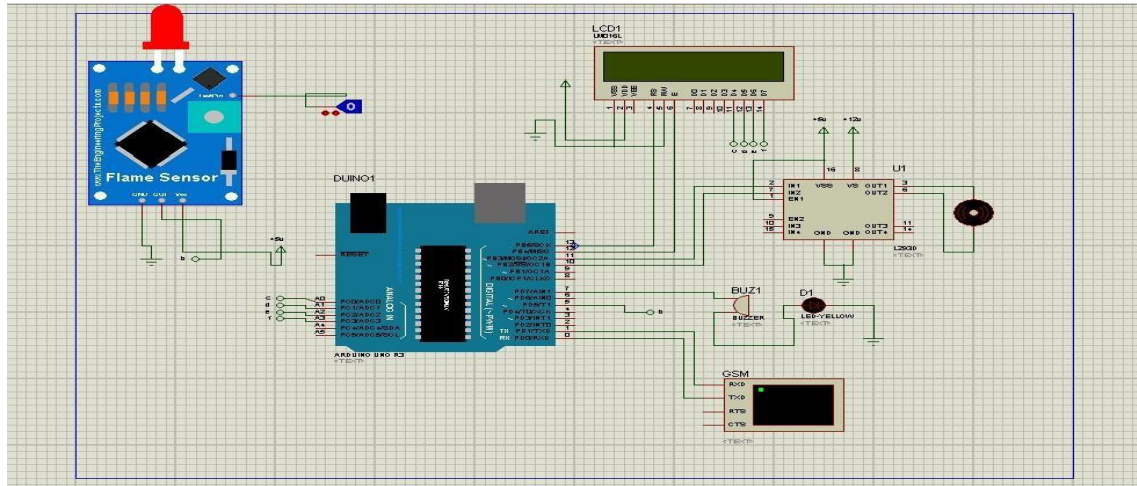
## **LED:**



LED (Light Emitting Diode) is an optoelectronic device which works on the principle of electro-luminance. 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.

## Bluetooth Module

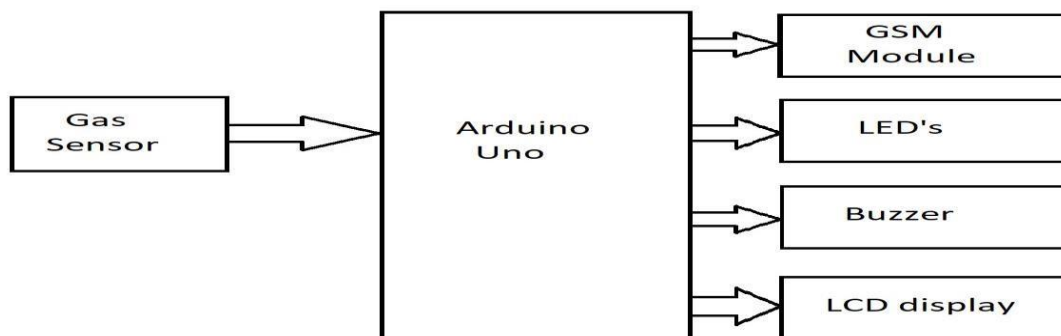
**SIM900 GSM Module** – This means the module supports communication in 900MHz band. We are from India and most of the mobile network providers in this country operate in the 900MHz band. If you are from another country, you have to check the mobile network band in your area. A majority of United States mobile networks operate in 850MHz band (the band is either 850MHz or 1900MHz).



## PROPOSED METHOD :

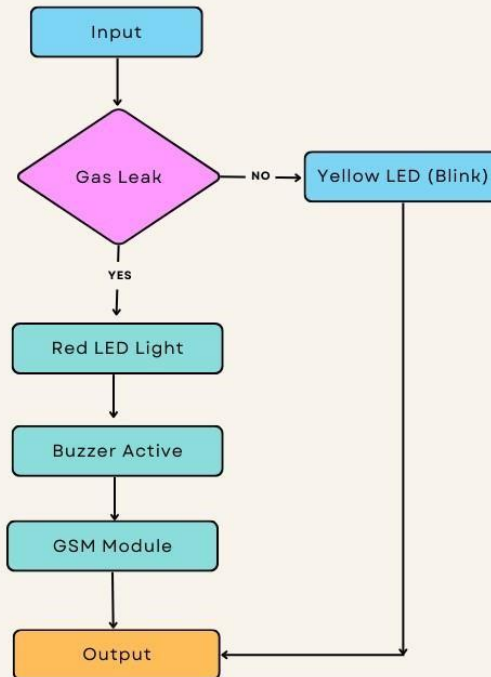
Arduino UNO (Atmega-328) is the main unit of the system which performs the following tasks. A signal conditioning of the Arduino UNO is done by output signal of the sensor, provided input to Arduino. The detection results displayed on LCD. Indicates the people of danger in work place, factory, home. Buzzer activity with beep(siren) sound is made.

Also send alert SMS to the in charge of the plant whose number is saved in SIM card by using GSM modem. The SMS received depends upon the leak of gas in the detection area of the sensor.



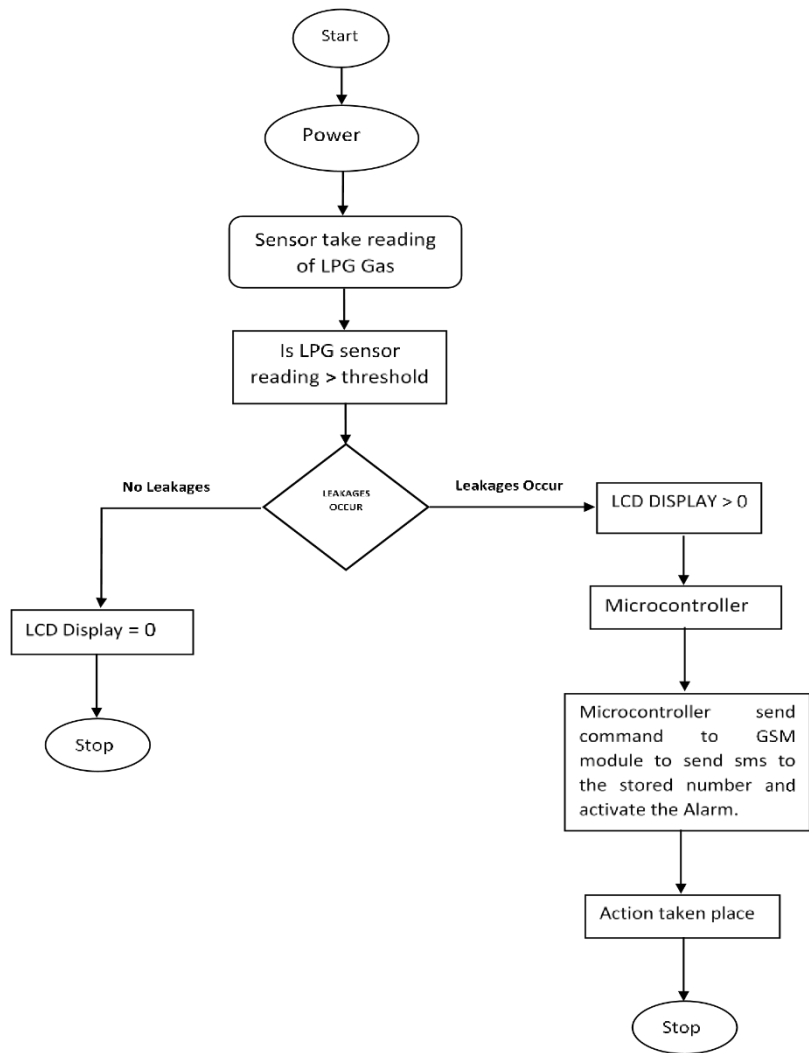


## FLOWCHART : GAS LEAKAGE MONITORING AND ALERTING SYSTEM

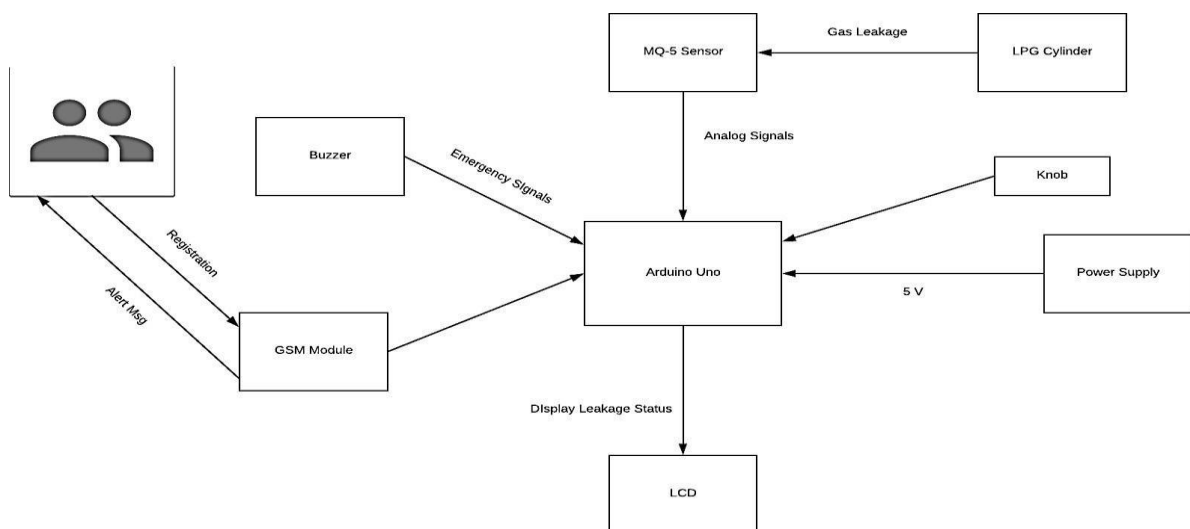


### PROPOSED SYSTEM:

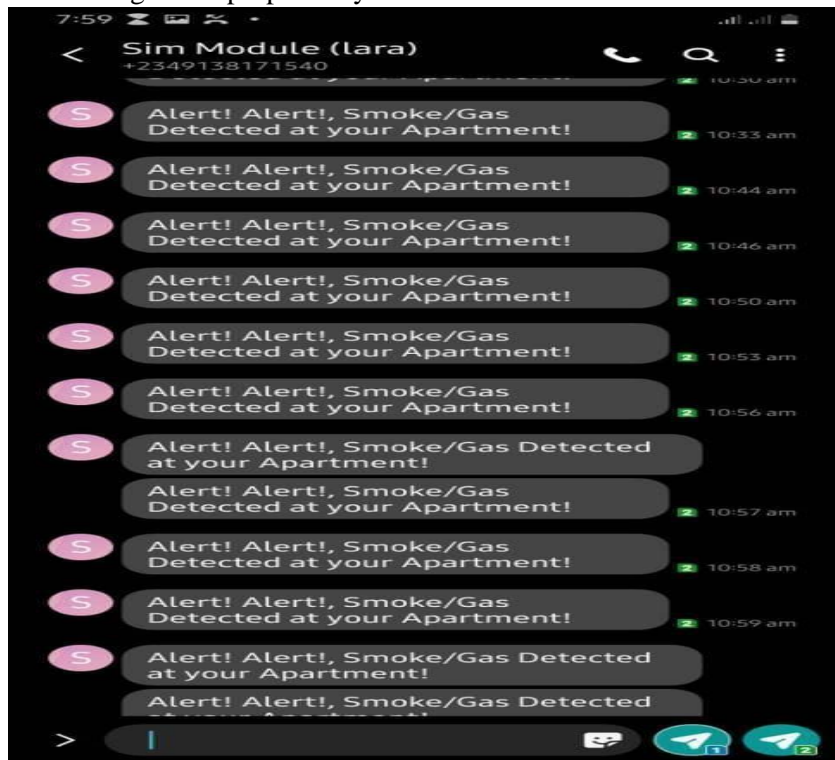
We design and develop an propose system which include some safety factors. A safety has been a major issue today's day to day life. LPG is a petroleum gas are the most commonly used in residential and commercial places. For industrial plants it has been used fuels like petrol, diesel. These gases are filled in cylinders which are easily un-damageable. But leakage can take place through pipes or regulators or knobs which may cause accidents like suffocation, uneasiness or sometimes may catch fire and short circuit as well. The main aim of this project is developing a system that can detect gas leakage. On detection it will send an alert SMS and the gas supply knob of cylinder will be switched off automatically.



**Fig. 3. Operational mode of the proposed System**

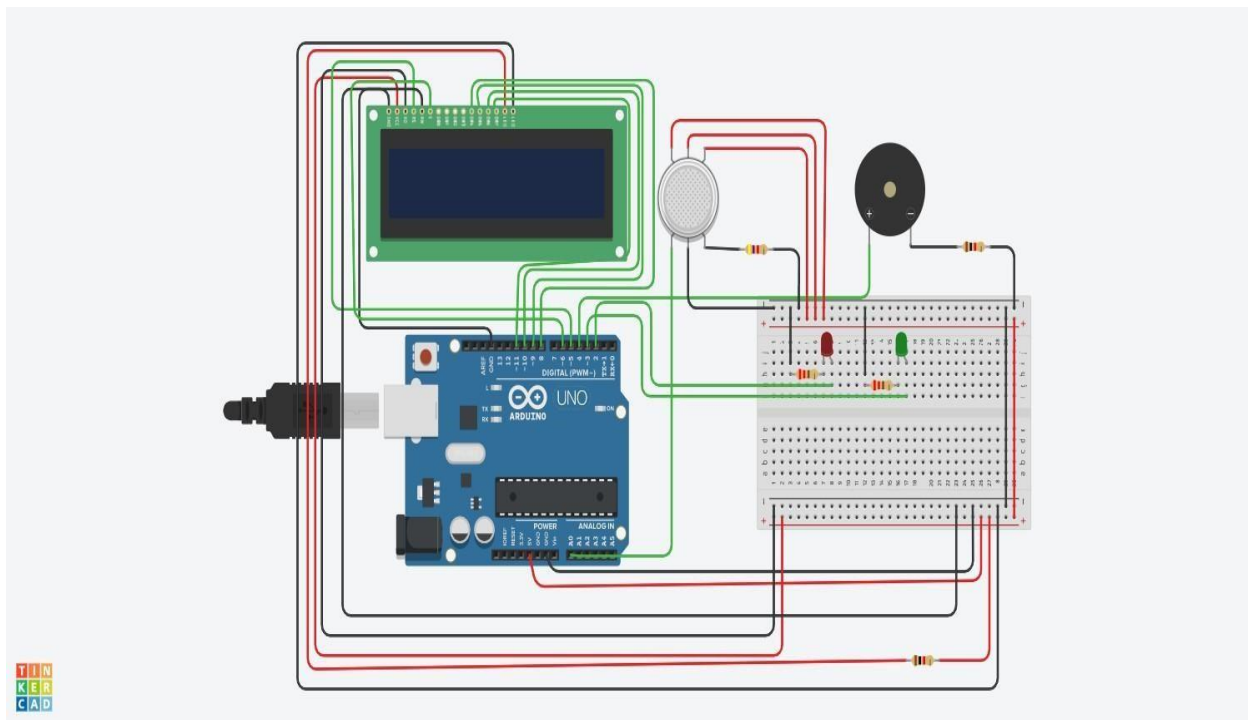


Screen short for testing of the proposed system



Finally, the device was tested by using a gas to simulate flame to ensure everything was working fine and it did.

### CIRCUIT DIAGRAM:



## **SOLUTION STATEMENT :**

The system can be taken as a small attempt in connecting the existing primary gas detection methods to a mobile platform integrated with IoT platforms. The gases are sensed in an area of 1m radius of the rover and the sensor output datas are continuously transferred to the local server. The accuracy of sensors are not upto the mark thus stray gases are also detected which creates an amount of error in the outputs of the sensors, especially in case of methane. Further the availability and storage of toxic gases like hydrogen sulphide also creates problems for testing the assembled hardware. As the system operates outside the pipeline, the complication of system maintenance and material selection of the system in case of corrosive gases is reduced. Thus the system at this stage can only be used as a primary indicator of leakage inside a plant.

## **CONCLUSION:**

This work presents the design and implementation of gas leakage detection system. Various works on gas leakages detection system was reviewed and presented. The purpose of implementation of gas leakages detection at individual/domestic uses, and not easy to be further modified. An advantage of this simple gas leak detector is its simplicity and its ability to warn about the leakage of the LPG gas . This system uses GSM technique to send alert message to respective person if no one is there in the house and then gas leaks occurs, GSM module is there to send immediate messages to the respective person regarding the gas leak. The main advantage of this system is that it off the regulator knob of the cylinder automatically when gas leakage detected.