

Gas Leakage Monitoring and Alerting System for Industries using IOT

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ELECTRONICS AND COMMUNICATION ENGINEERING

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ABSTRACT:

Internet of Things aim towards making life simpler by automating every small task around us. As much is IoT helping in automating tasks, the benefits of IoT can also be extended for enhancing the existing safety standards. Safety, the elementary concern of any project, has not been left untouched by IoT. Gas Leakages in open or closed areas can prove to be dangerous and lethal. The traditional Gas Leakage Detector Systems though have great precision, fail to acknowledge a few factors in the field of alerting the people about the leakage. Therefore we have used the IoT technology to make a Gas Leakage Detector for Society. 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 Arduino UNO R3, LCD display 16*2. The system was designed for gas leakage monitoring and alerts with SMS via and display through LCD. The circuit contains a Microcontroller gas sensor, LCD display, and LED, Piezo, DC Motor when the sensor detects gas leakage it transmit the information to the Microcontroller while the microcontroller makes a decision and then it will display on LCD. The output of this project will be significant in averting problems associated with gas leakages now and in future.

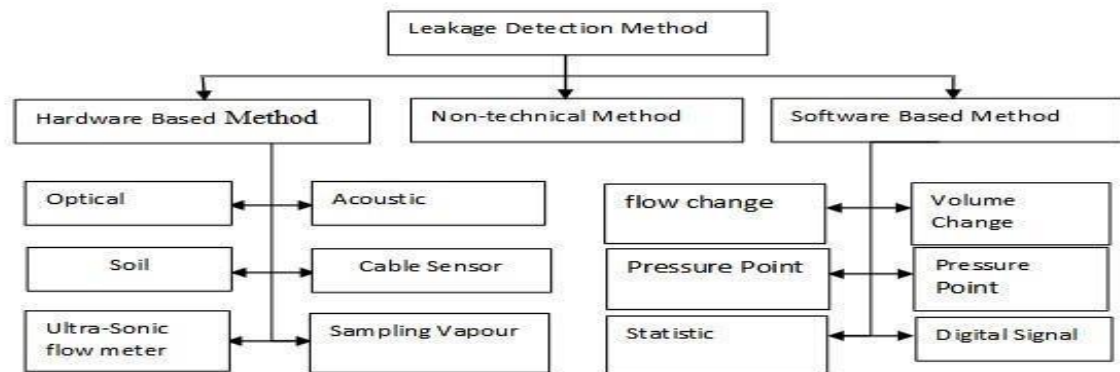
Index Terms: Gas Leakages, Gas Leakage Detector, Gas Sensor, Internet of Things

INTRODUCTION:

The 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 unintentionally. 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.

METHODS AND MATERIAL:

System: Input, Output, Function, Success/Failure Conditions(Gas ON/OFF).

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:

- **Access () :-** In this module we are going to access the feature provided by the module which Will include Sensor data access.
- **Control () :-** In this module we are controlling the Alert System by using System which is connected to hardware or sensor data.
- **Broadcast () :-** In this module we are going to broadcast the alert Display to LCD.

Success Conditions: If such data which is received through sensors are not stable or are more than threshold it will predict that there is leakage situation.

Failure Conditions: Desired output is not generated due to following failures: Network Connection Failure

LIST OF COMPONENTS:

S.No.	Name of the Component	Quantity
1.	Arduino UNO R3	1
2.	DC Motor	1
3.	LED(Red)	1
4.	330 Ω Resistor	1
5.	Piezo	1
6.	Gas Sensor	1
7.	LCD 16 x 2	1
8.	1 k Ω Resistor	2
9.	250k Ω Potentiometer	1
10.	Pushbutton	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 .

RESISTOR:



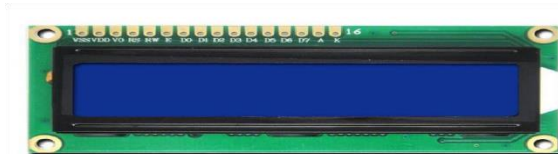
A passive electrical component with two terminals that are used for either limiting or regulating the flow of electric current in electrical circuits.

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):

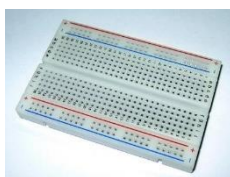


LCD stands for Liquid Crystal Display. 16×2 LCD is one kind of electronic device used to display the message and data. The display is named 16×2 LCD because it has 16 Columns and 2 Rows.

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 electro-luminescence. Electro-luminescence 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:



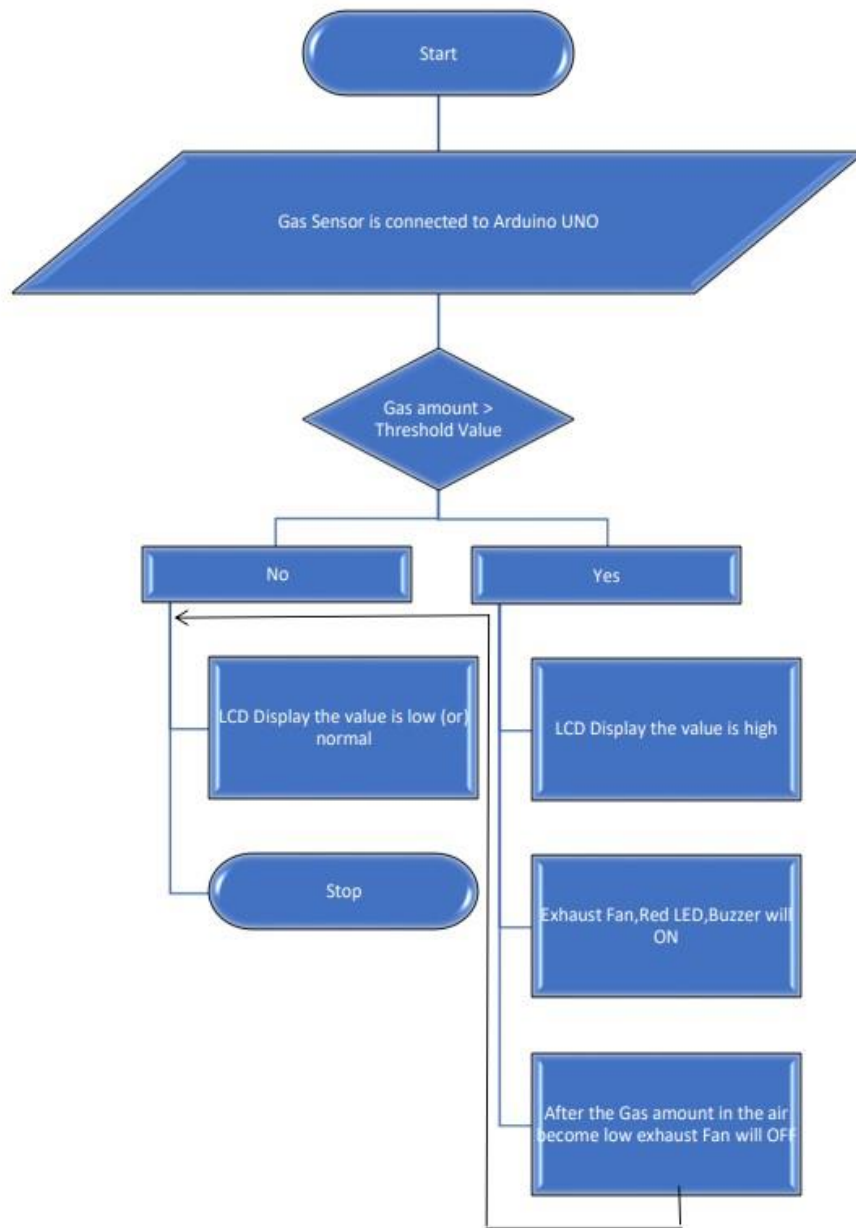
Jumper wires are electrical wires with connector pins at each end. They are used to connect two points in a circuit without soldering.

PROPOSED METHOD :

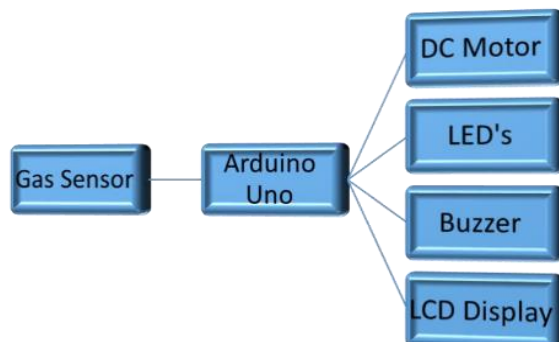
In this project our central component is Arduino UNO. Arduino UNO (Atmega-328) is the main unit of the system which performs the following tasks. A signal conditioning of the Arduino UNO is done by output signal of the sensor, provided input to Arduino. Arduino will make decision when the gas amount 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.



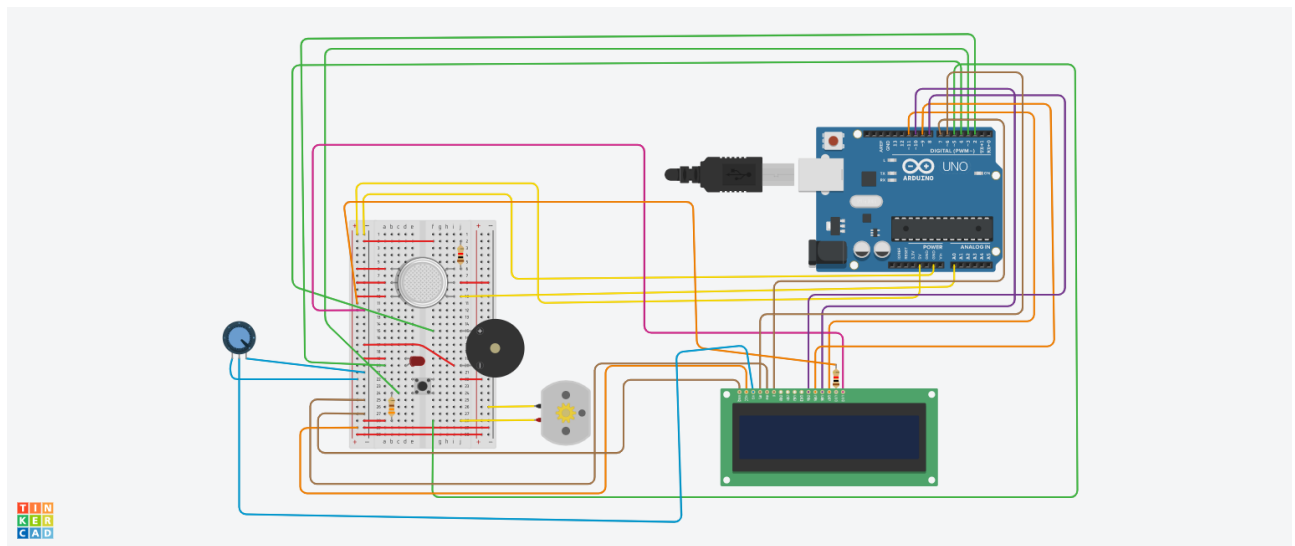
BLOCK DIAGRAM:



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.

CIRCUIT DIAGRAM:



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

CODE:

```
#include <LiquidCrystal.h>
```

```
LiquidCrystal lcd(6, 7, 8, 9, 10, 11);  
float gasPin = A0;  
float gasLevel;  
int ledPin = 2;  
int buttonPin = 3;  
int buzzPin = 4;  
int buttonState;  
int fan = 5;
```

```
void setup(){  
  pinMode(ledPin, OUTPUT);  
  pinMode(buttonPin, INPUT);  
  pinMode(gasPin, INPUT);  
  pinMode(fan, OUTPUT);  
  Serial.begin(9600);  
  lcd.begin(16, 2);  
  lcd.setCursor(0,0);
```



```

    lcd.print(" Welcome");
    lcd.setCursor(0,2);
    lcd.print("GAS LEAKAGE SYSTEM");
    delay(500);
    lcd.clear();
}

void loop(){
    // Read the value from gas sensor and button
    gasLevel = analogRead(gasPin);
    buttonState = digitalRead(buttonPin);

    // call the function for gas detection and button work
    gasDetected(gasLevel);
    buzzer(gasLevel);
    exhaustFanOn(buttonState);
}

// Gas Leakage Detection & Automatic Alarm and Fan ON
void gasDetected(float gasLevel){
    if(gasLevel >= 300){
        digitalWrite(buzzPin,HIGH);
        digitalWrite(ledPin,HIGH);
        digitalWrite(fan,HIGH);
        lcd.setCursor(0,0);
        lcd.print("GAS:");
        lcd.print(gasLevel);
        lcd.setCursor(0,2);
        lcd.print("FAN ON");
        delay(1000);
        lcd.clear();
    }else{
        digitalWrite(ledPin,LOW);
        digitalWrite(buzzPin,LOW);
        digitalWrite(fan,LOW);
        lcd.setCursor(0,0);
        lcd.print("GAS:");
        lcd.print(gasLevel);
        lcd.setCursor(0,2);
        lcd.print("FAN OFF");
        delay(1000);
        lcd.clear();
    }
}

//BUZZER
void buzzer(float gasLevel){
    if(gasLevel>=300)
    {
        for(int i=0; i<=30; i=i+10)
        {
            tone(4,i);
            delay(400);
            noTone(4);
            delay(400);
        }
    }
}

```

```

    }
  }
}
// Manually Exhaust FAN ON
void exhaustFanOn(int buttonState){
  if(buttonState == HIGH){
    digitalWrite(fan,HIGH);
    lcd.setCursor(0,0);
    lcd.print("Button State:");
    lcd.print(buttonState);
    lcd.setCursor(0,2);
    lcd.print("FAN ON");
    delay(10000);
    lcd.clear();
  }
}

```

TINKERCAD LINK:

<https://www.tinkercad.com/things/cRl5hzjYGgl-gas-leakage-monitoring-and-alerting-system-for-industries-final>

Circuit Design_ GAS LEAKAGE MONITORING AND ALERTING SYSTEM FOR INDUSTRIES:

https://drive.google.com/drive/folders/1_38-L2hEIAaEFQOK9yLnSr_IKjo3czqS

SOLUTION STATEMENT :

This project mainly focuses on the detection of gas leakage and providing security when the user is around or away from home. The use wireless technology for providing security against gas leakage to users hence cost effective and more adaptable. 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 Crystal Display (LCD). This will enable the user to take precaution of explosion disaster which may result on Liquefied Petroleum Gas (LPG) cookers like loss of properties, injury or even death. GLDS provides ideal solution to gas leakage problems faced by home owners in daily life.

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. In danger situations we can save the life by using this system. 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