TITTLE	AUTHOR	YEAR	METHODOLOGY	FINDINGS	PROS / CONS
Gas leakage detection based on IOT.	Suma, V., Ramya R. Shekar, and Kumar A. Akshay	2019	ARM Cortex-M, MQ-2 gas sensor, LPG sensor	The main objective of the work is designing microcontroller based toxic gas detecting and alerting system. The hazardous gases like LPG and propane were sensed and displayed and notify each and every second in the LCD display. If these gases exceed the normal level then an alarm is generated immediately and also an alert message (Email) is sent to the authorized person through the INTERNET and used ARM development board.	Pros: This results in a more efficient in operation because it is connected to a common web page specially built to notify or email the responsible authority automatically so reduces the stress of constant monitoring. Cons: cost is high,complex to design
IOT based industrial plant safety gas leakage detection system	Kodali, Ravi Kishore, R. N. V. Greeshma, Kusuma Priya Nimmanapalli, and Yatish Krishna Yogi Borra	2018	MQ-6 sensor is used for sensing LPG concentrations in air.MQ-4 sensor for Methane and MQ-135 sensor for Benzene.	This project proposes a leakage detector which sends the warning to the concerned people through SMS. This detector senses the presence of harmful gases particularly, LPG, Methane and Benzene.	Pros: In this system architecture, multiple sensors are placed around the region of interest in the plant. An IFTTT based gas leakage detection system with an alerting message feature to the response team is presented. The Sensing System detects the leakage and Alerting system sends a warning message through IFTTT Cons: Network coverage

GSM based gas leakage detection system	Shrivastava, Ashish, Ratnesh Prabhaker, Rajeev Kumar, and Rahul Verma	2013	GSM , RF link ,Gas sensor MQ-6, stepper motor Driver IC (ULN2003A), Microcontroller (AT89C51).	The aim of this paper is to present such a design that can automatically detect and stop gas leakage in vulnerable premises. In particular gas sensor has been used which has high sensitivity for propane (C3H8) and butane (C4H10). Gas leakage system consists of GSM module, which warns by sending SMS	Pros: The gas leakage system can react in time. Cons: The efficiency and memory of the microcontroller can be increased if Philips microcontroller is used in place of AT89C51.
Electronic design of liquefied petroleum gas leakage monitoring, alarm, and protection system based on discrete components	Attia, Hussain A., and Halah Y. Ali	2016	Liquefied Petroleum Gas, gas leakage, LPG detector, Operational amplifier, drive circuit, Buzzer, Valve.	This paper presents an alternative engineering solution of a simple system through a full electronic analog design based on discrete components. The proposed electronic system works on continuous detecting LPG gas leakage level though suitable gas detector, then based on the electronic design, a suitable actions of gas valve control signal and sound alarm signal will be produced.	pros: Analog design with simulation results for a complete system alarm and protection system based on electronic discrete components as an alternative solution instead on micro controller based solutions that to avoid the complexity and high cost. Cons: Less Accuracy
LPG gas monitoring system.	Raj, Arun, Athira Viswanathan, and T. Athul	1957-1960	Microcontroller(PIC 16F877A),Gas sensor,weight sensor (Load cell-L6D), GSM module and display(s)	The design of LPG leakage monitoring system is proposed for home safety. In this system, the gas sensor detects the leakage of the LPG and alert the owner about the leak by sending SMS to his personal mobile and activate the alarm.	Pros: Cost-effective gas leakage detection system. Cons: Less effectiveness and Accuracy

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A survey on wireless sensor network-based IoT designs for gas leakage detection and fire-fighting applications	Salameh, Haythem Bany, Mohammad Dhainat, and Elhadj Benkhelifa	2019	Temperature sensor, Oxygen sensor, Gas sensor	One of the envisioned IoT applications is the use of wireless sensor nodes in gas-leakage monitoring and detection applications. Such IoT applications can provide better protection to fire fighters and provide safety and early-warning gas detection alarms within a timely manner for individuals, factories and institutions.	Pros: precision, system architecture, simplicity, robustness energy consumption issues. Cons: energy consumption issues
Development of an automated gas-leakage monitoring system with feedback and feedforward control by utilizing IoT.	Shahadat, Mhia Md, Avijit Mallik and Md Islam	2019	MQ-6 gas sensor, temperature sensor, and humidity sensor along with internet of things (IoT)	A System to monitor the leakage and make alert to users of it and to monitor the consequences of environmental changes an IoT platform has been introduced.	Pros: Smart System, Gas Leakage Control Cons: Accuracy
Development of movable gas tanker leakage detection using wireless sensor network based on embedded system.	Shinde, Sagar, S. B. Patil and A. J. Patil.	2012	Gas detection sensors along with IoT	To identify the state-of-the-art in leak detection and localization methods and to evaluate the capabilities of these techniques	Pros: Reliability Cons: Effectiveness and accuracy
A comparative study on gas alarm detection system.	Baballe, Muhammad Ahmad and Mukhtar Ibrahim Bello	2022	MQ 5 gas sensor, Arduino, Alarm unit, LCD display	The fueloline detector sensor used withinside the layout will recognize the information and submit it into an records cloud.	Pros: instant results with very high accuracy. Cons: little sensitivity to smoke

A Critical Review on LPG Gas Leakage Detection and Monitoring System.	Subri, Siti Sunaidah Sukma, Norkiah Mat Zaki and Rosniza Ramli.	2021	A combination of GSM and IoT-based systems	Several approaches and methods have been developed to reduce the incident related to the subject, which uses (1) monitoring-based measures; (2) detection-based measures; (3) tool or mechanical system-based measures.	Pros: reliable and efficient gas leakage detection Cons: Less Accuracy

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"Early detection system for gas leakage and fire in smart home using machine learning."	Salhi, Lamine, Thomas Silverston, Taku Yamazaki, and Takumi Miyoshi	2019	Arduino UNO; MQ2 Gas Sensor; GSM Modem; LCD; Buzzer.	The presence of hazardous LPG gas leakage in a domestic, work place, also, stored gases container gas which exhibits ideal characteristic is use. For that sake, an alarm unit is used to vibrate an alarm which is buzzer. Buzzer gives an audible sign of the presence of LPG volume. The sensors are widely used to detect essence of propane, iso-butane, LPG and even smoke.	Pros: In danger situations we are able to save the life by using this system. An alert is indicated by the GSM moduletime. Cons: The deployment cost in an underground scenario is very expensive.
"Gsm-based gas leakage detection and alert system."	Nuga, Olubusola Olufunke, Kamoli Akinwale Amusa, and Ayorinde Joseph Olanipekun.	2017	GSM modem, Detection, Cooking Gas, DC Stepper Motor, PIC Microcontroller.	The GSM-based gas leakage alert system utilizes a gas sensor to detect leakages in the event that it occurs and then send short message to a predefined telephone number. MQ2 gas sensor, PIC 16F877A microcontroller, GSM modem and a DC stepper motor are the main hardware components employed in the development the gas leakage detection and alert system.	Pros: A short SMS is sent to a pre-defined phone number using GSM infrastructures to alert the concern people of the incident of gas leakage Cons: The quantity of LPG was measured in concentration because volume of the gas that leaked could not be easily measured
"IoT based Gas Leakage Monitoring and Alerting System."	Meshram, Pranay, Stuti Mendhekar, Renuka Gadge, Nancy Shukla, and Shivani Kanaskar.	2019	Android App, Gas Leakage, IoT, LPG, Sensors	Home wellbeing identifies the spillage of the LPG and cautions the purchaser about the hole by a warning through by utilizing android application through Internet of Things (IoT) and the shopper can kill the gas	Pros: This system can detect gas leakage productively using a gas sensor and alert other people by using Wi-Fi module to send a message to their mobile phones and

				valve, from anyplace on the planet.	by activating LED and buzzer. Cons: High Cost
"Home and industrial safety IoT on LPG gas leakage detection and alert system."	Soh, Zainal HC, Syahrul AC Abdullah, Mohd A. Shafie, and Mohammad N. Ibrahim.	2019	Gas Leakage Detection System, Gas sensor, IoT Cloud, Liquefied Petroleum Gas, Ubidots.	The estimated source location of gas leakage can be determined by analysing the gas leakage level reading detected on different gas sensor position.By combining IoT system, the gas leakage can easily be analyzed everywhere & the user can easily monitor the safety of the house or industrial places in case of gas leak even from afar.	Pros: The gas leakage level reading detected on different gas sensor position Cons: Gases helps human and gases also can harm human if not handle properly.
"Review on gas leak detection techniques."	Gour, Puran, B. H. A. U. S. A. H. E. B. Sonawane, and S. A. G. A. R. Shinde.	2014	Gas Leak Detection, Localization, Sensors.	Gas leakages detection and accidents in high risky industries like gas, chemical, petroleum industries is hard and difficult to control the loss. The wire-based techniques connect the sensors along the pipelines with wires. Monitoring information measured by each sensor is transmitted to the monitoring control center through these wires.	Pros: At low flow rates a mass balance based detection system would be more suitable. Cons: Visual observation or portable detectors are able to detect very small leaks and the leak location, but the detection time is very long

Internet of things based gas leakage monitoring and alerting system with MQ-2 Sensor.	Pandey, Rohan Chandra, manish verma, lumesh kumar sahu, and Saurabh deshmukh	2017	Gas Sensor,LPG Sensor,LCD Display.	The hazardous gases like LPG and propane were sensed and displayed and notify each and every second in the LCD display. If these gases exceed the normal level then an alarm is generated immediately and also an alert message (Email)	Pros: The alert message is sent to Worker. Cons: network coverage
Gas leakage detection and smart alerting system using IOT	Imade, Shital, Priyanka Rajmanes, Aishwarya Gavali, and P. V. N. Nayakwadi.	2018	Gas detector sensors, Arduino board, ESP8266 and Cloud server	Gas Leakage Detector having Smart Alerting techniques involving calling, sending text message and an e-mail to the concerned authority and an ability to predict hazardous situation so that people could be made aware in advance by performing data analytics on sensor readings	Pros: Live-Monitoring and Control On-Demand Automatic Reordering Facility Cons: The limited number of choices, price
Design and development of gas leakage monitoring system using arduino and zigbee.	Yan, Huan Hui, and Yusnita Rahayu		LabVIEW, Arduino, ZigBee, Gas sensor.	This sensor will detect the concentration of the gas according to the voltage output of sensor and operated in the alarm system autonomous control system and monitoring system by using Arduino uno as the microcontroller for the whole system. Whereas the Zigbee will send the data reading from the gas sensor to monitoring system that display on LabVIEW Graphical User Interface (GUI).	Pros: Increase the alertness and responsibility regarding the environment towards public and workers Cons: network coverage

				Besides, user can take immediate action upon the leakage occurs, else the gas supply and the system will shut down automatically within 10 minutes to prevent the condition becoming worst.	
A wireless home safety gas leakage detection system.	Fraiwan, Luay, Khaldon Lweesy, Aya Bani-Salma, and Nour Mani.	2011	Detection and transmission module, and the receiving module	This module checks if a change in concentration of gas(es) has exceeded a certain pre-determined threshold. If the sensor detects a change in gas concentration, it activates and audiovisual alarm and sends a signal to the receiver module.	Pros: The system was tested using LPG and the alarm was activated as a result of change in concentration. Cons: Cost and maintaining is high
Sensor-based gas leakage detector system.	Khan, Mohammad Monirujjaman.	2020	LPG, Gas Sensors MQ-6, Buzzer, Alarm.	It is a design of a gas leakage detection system that can automatically detect, alert and control gas leakage. This proposed system also includes an alerting system for the users. The system is based on a sensor that easily detects a gas leakage.	Pros: It easily detects gas leakage. Cons: Delay of receiving the signals