Early Detection System for Gas Leakage and Fire in Smart Home Using IOT

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Abstract : Gas leakage is a critical concern in industrial, commercial, and residential environments, posing significant risks to human health, safety, and the environment. Traditional gas detection methods often lack real-time monitoring capabilities and fail to provide timely alerts, leading to potential accidents and damages. In this context, the emergence of Internet of Things (IoT) technology offers a promising solution by enabling continuous monitoring and remote management of gas leakage detection systems. This paper presents an IoT-based gas leakage detection system designed to enhance safety and mitigate the risks associated with gas leaks. The proposed system integrates gas sensors, microcontrollers, communication modules, and cloud computing infrastructure to enable real-time monitoring, data analytics, and remote control. Gas sensors deployed in strategic locations detect the presence of hazardous gases, and the collected data is transmitted wirelessly to a central processing unit for analysis. In the event of a gas leak, the system triggers immediate alerts via mobile applications, enabling prompt response and intervention.Key features of the proposed system include scalability, flexibility, and interoperability, allowing seamless integration with existing infrastructure and compatibility with various communication protocols. Furthermore, the utilization of cloud-based platforms facilitates data storage, analysis, and visualization, enabling stakeholders to gain insights into gas leakage patterns, trends, and potential risks.

Index Terms - IOT,GSM,MQ2 gas sensor,

I. INTRODUCTION

Gas leakage is a pervasive and potentially hazardous phenomenon that poses significant risks to human health, safety, and the environment. Whether in industrial facilities, commercial buildings, or residential homes, the presence of leaking gases such as methane, propane, or carbon monoxide can lead to catastrophic consequences, including explosions, fires, and adverse health effects. Therefore, the development of reliable and efficient gas leakage detection systems is crucial for preventing accidents, minimizing risks, and ensuring the well-being of individuals and communities. Traditional gas detection methods often rely on standalone sensors or centralized monitoring systems that suffer from several limitations. These include delayed response times, limited coverage, and the inability to provide real-time alerts and data insights. Moreover, the maintenance and management of such systems can be cumbersome and inefficient, leading to gaps in monitoring and increased vulnerability to gas-related incidents. In response to these challenges, the emergence of Internet of Things (IoT) technology has opened new avenues for improving gas leakage detection and management. IoT-enabled devices, equipped with sensors, actuators, and communication capabilities, offer unprecedented opportunities for real-time monitoring, data analytics, and remote control over gas detection systems. By leveraging the power of IoT, it is possible to create intelligent, interconnected networks of sensors that can detect, identify, and respond to gas leaks with greater precision and efficiency than ever before. The IoT-based gas leakage detection system proposed in this paper represents a smart and innovative approach to enhancing safety and mitigating the risks associated with gas leaks. By integrating advanced gas sensors, microcontrollers, communication protocols, and cloud computing infrastructure, the system enables continuous monitoring of gas concentrations in various environments. Real-time data collection and analysis facilitate the early detection of gas leaks, while immediate alerts and notifications ensure prompt response and intervention.

I. RELATED WORK

1.”A Security Alert System Using GSM for Gas Leakage” by S.Rajitha, T.Swapna The aim of this project is to check LPG leakage detecting the leakage of the LPG using gas sensor and alerts the consumer about the gas leakage by sending SMS. This system uses the GSM modem to alert the person about the gas leakage by sending SMS to specified mobile phone and alert the people at home by activating Buzzer, display the message on LCD display.

2.”LPG/CNG Gas Leakage Detection System with GSM Module” by Alan M John1, Bhavesh Purbia, Ankit Sharma, Mrs. A.S Udapurkar.The aim of this project is to detects the leakage of the LPG a gas sensor and makes use of the GSM to alert the people about the gas leakage via SMS. When the sensor senses the gasoline leakage then the output of the sensor goes LOW. The detection is done by using the gas sensor, through the microcontroller the LED and buzzer are activated simultaneously. An alert is provided to the user, sending an SMS to the programmed cellular number.

3. LPG Leakage Detection and Prevention by Mohd Wasim Siddiqui1, Harish2 &Krishna Mohan Mishra3 .This paper explains that Home /Industrial fires had taken many lives and injury property in the past few decades. LPG is extremely inflammable gas and can even commenced to burn at some honest distance from the supply of leakage. Mostly fire accidents appear due to horrific pleasant rubber tube usage or when the regulator is now not grew to become off properly. The supply of fuel from regulator to burner is left on even after the regulator is switched off. By chance, if the knob become on, it would end result in the fuel leaks. This paper helps in the advancement technological knowhow that is related to gas sensing, monitoring and manage gadget of LPG leakage

In [4] authors introduced GSM based gas leakage detection system, in which the GSM module is introduced for wireless alert and gas leakage detection, efficiently implemented.

In [5] authors proposed WSN based smart system for detection of LPG and combustible gases, works in flexible ways of smart detecting of gases on recent techniques. In [3] authors presented embedded system for hazardous gas detection and alerting, comprises entire hardware into single embedded board for ease, low cost and sustainable. In [4] it describes the performance and functional characteristics of ARM based sensor. Developed to monitor changes in CO2, temperature, alert in remote location.

In [5] PIC18LF4620 based wireless sensor node, monitor the parameter humidity, light, oxygen around the pipeline

In [6] authors introduced dynamic adaptive a sensor based pedestrian crossing system at traffic junctions. This system employs ARM microcontroller, Wi-Fi, Camera module for sort of intersection framework that can give passer-by security also as drivers to see people on foot prior to stay away from any hazardous circumstance.

In [7] authors present a low-cost flexible and reliable home monitoring and control system with additional security using ESP32, with IP connectivity through local Wi-Fi for accessing and controlling devices by formal user remotely using android smart phone application.

In [8] authors proposed IoT Based Pollution Tracking and Alerting System using ESP 8266. This system records the values of pollution of various types they are air pollution, water pollution, sound pollution. If there is a raise of the values of pollution in air, water, sound the gas, turbidity, sound sensor detects these values respectively and gives it to NodeMCU.

In [9] Cloud computing is defined as storing the data in the cloud and running the applications which are connected with it. Everything is hosted in the cloud, which is connected to many computers and servers through internet.

In [10], authors presented Modernization of Indian agricultural system using micro controller" using 8051 and GSM. This system is focused on atomizing the irrigation system for social welfare of Indian agricultural system and also to provide perfect irrigation in particular area. Soil moisture sensor sense the condition of the soil whether it is dry or wet and sends the information to microcontroller. Water level sensor senses the water level in the water source and sends the information to the microcontroller. So the information from the microcontroller is sent as SMS through GSM. By taking references from the above paper we proposed a system which is used to detect leak of gas simultaneously at three different location and but it even alerts people by buzzer and by sending SMS by the GSM to the person whose number is written in the source code.

II. BACKGROUND OF THE WORK

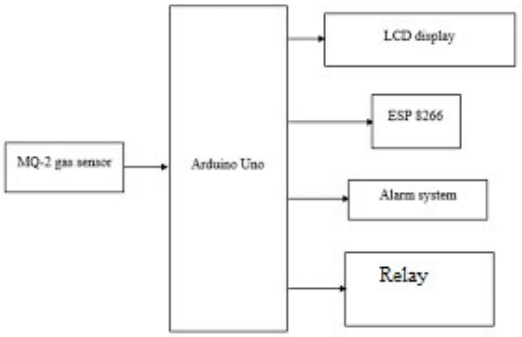
The background of IoT-based gas leakage detection systems involves the convergence of several technological advancements, primarily in the fields of IoT (Internet of Things), gas sensing technology, wireless communication, and data analytics. Here's an overview: IoT refers to the network of interconnected devices that communicate and exchange data over the internet without requiring human-to-human or human-to-computer interaction. IoT devices are equipped with sensors, actuators, and connectivity capabilities that enable them to collect and transmit data from the physical world to the digital realm. Gas sensors are devices designed to detect the presence and concentration of various gases in the environment. These sensors utilize different mechanisms such as chemical reactions, catalytic combustion, or optical detection to measure gas concentrations accurately. Advances in gas sensing technology have led to the development of more sensitive, reliable, and cost-effective sensors suitable for integration into IoT systems.

Wireless communication technologies such as Wi-Fi, Bluetooth, Zigbee, and LoRaWAN play a crucial role in IoT-based gas leakage detection systems. These technologies enable seamless connectivity between gas sensors, data processing units, and remote monitoring stations, allowing real-time data transmission and analysis. Data analytics techniques are employed to process the vast amounts of data generated by IoT-

based gas leakage detection systems efficiently. Machine learning algorithms, statistical analysis, and pattern recognition techniques are used to extract valuable insights from sensor data, including gas concentration levels, leak locations, and predictive maintenance insights. Gas leaks pose significant safety hazards, including fire, explosion, and health risks. Early detection and mitigation of gas leaks are critical for ensuring the safety of individuals, properties, and the environment. IoT-based gas leakage detection systems offer real-time monitoring and alerts, enabling prompt response to gas leak incidents and preventing potential disasters. IoT-based gas leakage detection systems can be seamlessly integrated with existing infrastructure, including industrial facilities, commercial buildings, and smart homes. Retrofitting traditional gas detection systems with IoT-enabled sensors and communication modules allows for remote monitoring, centralized management, and proactive maintenance. Overall, the background of IoT-based gas leakage detection systems reflects the growing demand for innovative solutions to address safety, environmental, and efficiency challenges associated with gas leak detection and prevention. These systems leverage the power of IoT, advanced sensing technologies, wireless communication, and data analytics to provide real-time monitoring, early detection, and proactive management of gas leak incidents.

III. PROPOSED SYSTEM

IOT and Arduino based LPG leakage detection system senses the LPG gas with the help of an LPG gas sensor. In this project, we have implemented the LPG gas sensor interfacing with Arduino. The Signal from this sensor is sent to the Arduino microcontroller. The microcontroller is connected to an LCD, Buzzer, and IOT module (ESP8266). The IOT LPG leakage detector project is implemented using an ESP8266 chip. This is a WiFi module that is used for connecting microcontrollers to the Wi-Fi network and making TCP/IP connections and sending data. Data sensed by these sensors is sent to the IOT. The IOT module then sends the data over to a website. The buzzer is turned ON once the gas leakage is detected. At this time, LCD Display shows a message as “Leakage detected”. The Prerequisite for this LPG gas leakage detection and the smart alerting project is that the Wi-Fi module should be connected to a Wi-Fi zone or a hotspot.



.Fig 1: BLOCK DIAGRAM

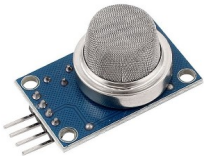
1) Components used:

i. a) Arduino Uno MCU Module
ii. c) LPG Gas sensor module
iii. d) Buzzer
iv. e) 16*2 LCD display
v. f) 1K resistor
vi. g) Cooling fan
vii. h) Connecting wires
viii. i) Relay
ix.
x. a) Arduino Uno: The Arduino uno is a microcontroller board based on the ATmega328P.It has 14 digital input/output pins, 6 inputs, and an onboard resonator. A restart button and holes are used for mounting pin headers. A 6 pin header can be connected to an FTDI cable or communication to the board. The Arduino Pro Mini is calculated for semi-permanent installation in objects. The panel comes without pre-mounted headers, allowing the use of various types of the loop or direct soldering of wires. The pin layout is agreeable with the Arduino Mini. There is two types of Pro Mini runs at 3.3V and 8 MHz, the other at 5V and 16 MHZ.

[2]

b) Wifi Module: An MCU is an intelligent semiconductor IC that consists of a processer unit memory modules, communication interfaces, and peripherals. The Microcontroller Unit is used across a wide-ranging of applications, including washing machines, robots, drones, radio, and game controllers.

c) LPG Gas sensor module: The sensing element is accomplished by detecting 6 differing kinds of combustible gases on label sensitivity. This sensing element may be labeled mistreatment in the potentiometer fitted within the jailbreak board of the MQ6 gas sensing element. The sensing element dispenses associate degree analog output. The MQ-6(LPG Gas Sensor) will observe gas concentrations in any place from 200 to 10000ppm. The sensor output is associate degree analog resistance.



Combining with the sensing element module is stopped through a 4-pin board compatible header.

d) Buzzer: A buzzer or pager is an audio signaling device, which can be mechanical, mechanical device. The buzzer has 2 pins in it. It is easy construction and low worth creating it is usable in varied applications like car/truck reversing indicators, computers, and decision bells. It is that the phenomena of generating electricity once mechanical pressure is applied to sure materials and also the other way around are additionally true.

e) Relay: Relay having 220V as well as a 5V input, when needed, is applied in the circuit to turn off the electricity. There are 5 pins in the relay. The digital pins encompass its Arduino board are linked with one pin. One is linked to the switch to attach the 220V power source. This power has deviated to the devices between the other pin. The other 2 are beach one in the main energy source and another one for the Arduino board

f) 16*2 LCD display: It is Liquid Crystal Display (LCD) It uses liquid to supply a noticeable representation and every character is manufactured from 16x2 image element dots. Handling Voltage is 4.7V to 5.3V. Current utilization is 1mA without a backlight...

In this research work, we can implement preprocessing steps and implemented the classification rule algorithms namely Multi-layer perceptron are used for classifying datasets which are uploaded by user. By analyzing the experimental results it is observed that the Multi-layer perceptron technique has yields better result than other techniques. Data mining technology provides an important means for extracting valuable medical rules hidden in medical data and acts as an important role in disease prediction and clinical diagnosis. There is an increasing interest in using classification to identify disease which is present or not. In the current study, have demonstrated, using a large sample of patients hospitalized with classification

IV RESULT

The result of this project is determined by using a lighter to collect leaked gas around the gas sensor, after sensing procedure if sensor value is greater than the threshold value then microcontroller
will perform its programmed tasks :

After detecting the gas leakage, the relay will cut off the main power supply to prevent any further accidents.

Buzzer starts beeping and a message is displayed on lcd to alert the nearby people.

The wi-fi module updates the information to the cloud.
The user can get to know the gas values and status of the system through the app and also control of the power

V BENEFITS AND APPLICATION

Enhanced safety: provides early detection of gas leakages, enabling prompt response and mitigation of potential hazards.
Remote monitoring: enables users to monitor gas leakage status from anywhere, enhancing convenience and accessibility.
Scalability: the modular design allows for easy expansion by adding additional sensor nodes to cover larger areas or multiple locations.
Cost-effectiveness: utilizes off-the-shelf components and open-source software, making it an affordable solution for both residential and industrial applications

VI FUTURE SCOPE.

Integration with Smart Home Systems: In the future, IoT-based gas leakage detection systems could be seamlessly integrated with smart home automation systems. This integration would allow for automatic shut-off of gas valves, ventilation control, and activation of emergency protocols in the event of a gas leakage, thereby enhancing safety and minimizing human intervention.
Enhanced Sensor Technologies: Advancements in sensor technologies could lead to the development of more sensitive and accurate gas sensors capable of detecting a wider range of gases at lower concentrations. This would improve the system's ability to detect gas leakages early, thereby reducing the risk of accidents.
Machine Learning and Predictive Analytics: Incorporating machine learning algorithms and predictive analytics into gas leakage detection systems could enable them to learn from historical data and identify patterns

indicative of potential gas leakages before they occur. This proactive approach would further enhance safety and prevent accidents.

CONCLUSION

We conclude that this project "IOT BASED GAS LEAKAGE DETECTOR USING ARDUINO" has been successfully designed and test. It has been developed by integrating features of all the hardware components used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced components and with the help of growing technology the project has been successfully implemented. So, we can conclude that the IOT based intelligent gas leakage detector using Arduino detects the gas leakages with an alert is indicated and also power goes off. This is applicable usefully in the industrial and domestic purpose. A sensor senses harmful gases. In danger situations we are able to save the life by using this system.

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