

Silage Moisture Level and Gas Monitoring System Using ESP32 and GSM

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ABSTRACT: Gas leakage is one of the major causes of accidents in homes, industries, and laboratories. Leakage of gases such as Liquefied Petroleum Gas (LPG), methane, or other combustible gases can lead to serious hazards including fire outbreaks, explosions, and health risks. Therefore, early detection of gas leakage is essential to ensure safety and prevent potential disasters. This project focuses on the design and implementation of a Gas Leakage Detection System using Arduino and a GSM module. The system continuously monitors the surrounding environment using an MQ-series gas sensor, which detects the presence and concentration of combustible gases in the air. When the detected gas level exceeds a predefined safety threshold, the system immediately triggers an alert mechanism. The alert system consists of a buzzer and LED indicators to provide immediate local warnings. In addition, a GSM module is used to send an SMS notification to a registered mobile number, informing the user about the gas leakage even when they are not present at the location. The proposed system is cost-effective, reliable, portable, and easy to install. It can be effectively deployed in households, industrial environments, laboratories, and commercial areas to enhance safety and minimize the risk of gas-related accidents.

KEYWORDS: Gas Leakage Detection, Arduino Nano, MQ Gas Sensor, GSM Module, Safety System, SMS Alert

I. INTRODUCTION

Gas leakage is a serious safety issue that can lead to dangerous accidents in residential, industrial, and laboratory environments. Gases such as Liquefied Petroleum Gas (LPG), methane, and propane are widely used for cooking, heating, and industrial purposes. However, leakage of these gases can cause severe hazards including fire accidents, explosions, and health problems. Many gas leakage incidents occur due to damaged pipelines, faulty cylinders, or improper handling of gas appliances. Therefore, it is important to detect gas leaks at an early stage and alert people immediately to prevent disasters.

With the advancement of embedded systems and sensor technologies, gas leakage detection systems have become more efficient and affordable. A gas detection system can continuously monitor the concentration of gases in the environment and provide immediate alerts when the gas level exceeds a safe limit. Such systems help in improving safety and reducing the risk of accidents.

This project presents a Gas Leakage Detection System using Arduino and GSM module. The system uses an MQ gas sensor to detect the presence of combustible gases in the surrounding area. The sensor continuously monitors the gas concentration and sends the data to the Arduino microcontroller. When the detected gas level exceeds the predefined threshold value, the Arduino activates a buzzer and LED indicator to provide an immediate local alert.

In addition to the local alert system, a GSM module is integrated to send an SMS notification to a registered mobile number. This ensures that the user receives a warning message even when they are not present at the location. The system is designed to be low-cost, reliable, easy to install, and highly effective in detecting gas leaks.

The proposed gas leakage detection system can be used in homes, industries, laboratories, and commercial areas to enhance safety, reduce potential risks, and protect human life and property from gas-related accidents.

Existing research demonstrates varied approaches to environmental monitoring through microcontroller based systems. In, an 8051 microcontroller integrated with GSM automates irrigation by utilizing soil moisture and water level sensors to optimize farming practices in India, ensuring precise water delivery based on real-time soil conditions. Reference introduces a GSM-based gas leak detection system that efficiently implements wireless alerts for timely notifications. Similarly, proposes a WSN-based smart system for detecting LPG and combustible gases using flexible, advanced techniques. Presents a compact embedded system for hazardous gas detection and alerting, integrating all hardware into a single board for low cost, ease of use, and sustainability. Details an ARM-based sensor that monitors CO₂ levels, temperature changes, and provides remote alerts. employs a PIC18LF4620 wireless sensor node to track humidity, light, and oxygen parameters around pipelines. describes a dynamic adaptive sensor system for pedestrian safety at traffic junctions, incorporating ARM microcontroller, Wi-Fi, and camera modules to enhance visibility and prevent accidents. outlines a low-cost, flexible home monitoring system using ESP32 with local Wi-Fi and Android app for remote device control and security. proposes an IoT-based pollution tracking system with ESP8266 that records air, water, and sound pollution via gas, turbidity, and sound sensors feeding into NodeMCU for alerts. defines cloud computing integration where microcontroller data is hosted and transmitted as SMS via GSM. Building on these references, the proposed system enables simultaneous LPG detection across three locations, alerting users through buzzer activation and GSM SMS to pre-programmed numbers.

II. LITERATURE SERVEY

Several research studies have been conducted to develop efficient gas leakage detection systems using sensors, microcontrollers, and communication technologies. These systems aim to detect hazardous gases at an early stage and provide alerts to prevent accidents.

One study proposed an IoT-based gas leakage detection system using gas sensors and a microcontroller to continuously monitor gas concentration in the environment. When the gas level exceeds a predefined threshold, the system generates alerts through buzzer indications and web-based notifications. The research highlighted that integrating sensors with IoT platforms improves monitoring accuracy and enables real-time safety alerts.

Another research work introduced a wireless sensor network (WSN) based gas leakage detection system for industrial environments. In this system, semiconductor gas sensors are connected to microcontrollers, and the detected gas signals are transmitted wirelessly using communication modules such as XBee. When gas leakage is detected, the system sends an alert message to the user through a GSM module and can also activate safety mechanisms like exhaust fans. This approach enhances reliability and enables remote monitoring of hazardous gases.

A study on gas detection using Arduino presented a low-cost monitoring system using MQ gas sensors to detect combustible gases such as LPG and methane. The sensor measures the gas concentration in the surrounding environment and sends the data to the Arduino microcontroller for processing. When the gas concentration exceeds a safe level, the system activates warning devices like buzzers and LED indicators to alert users about the leakage.

Another research proposed an automatic gas accident prevention system using Arduino and GSM technology. The system uses an MQ-series gas sensor to detect LPG leakage and automatically sends an SMS notification to the user through a GSM module. In addition, the system can take preventive actions such as shutting off the gas valve or cutting the main power supply to reduce the risk of fire accidents.

Recent studies have also focused on mobile and IoT-based gas leakage detection systems that integrate sensors with wireless communication technologies such as Wi-Fi or mobile applications. These systems allow users to receive alerts through mobile devices and improve safety monitoring in homes and industrial environments.

From the above literature, it is clear that gas leakage detection systems based on gas sensors, microcontrollers, and communication modules provide an effective solution for preventing gas-related accidents. However, there is still a need for low-cost, easy-to-install, and reliable systems that can provide quick alerts to users. Therefore, the proposed project focuses on developing a Gas Leakage Detection System using Arduino and GSM module that offers real-time monitoring and immediate alert notification.

III. IMPLEMENTATION

EXISTING SYSTEM

In many homes and industries, gas leakage detection is mostly performed through **manual observation or simple gas alarms**. Traditional gas detection systems generally use standalone gas sensors that trigger a buzzer or alarm when gas is detected. These systems are installed near gas cylinders or pipelines to detect the presence of combustible gases such as LPG or methane.

Some existing systems use **basic gas detectors** that only provide a local warning signal through a buzzer or LED indicator. When gas leakage occurs, the alarm alerts people who are present nearby so that they can take necessary action such as turning off the gas supply or ventilating the area.

In industrial environments, more advanced gas monitoring systems are sometimes used, which include multiple sensors connected to monitoring panels. However, these systems are often **expensive, complex, and require professional installation and maintenance**.

Although these existing systems help in detecting gas leaks, they have several limitations in terms of **remote alerting, automation, and real-time monitoring**.

3.1. DISADVANTAGES OF EXISTING SYSTEM

1. **No Remote Notification**

Traditional systems only provide a local alarm and cannot notify users remotely when gas leakage occurs.

2. **Limited Monitoring Capability**

Most systems cannot continuously monitor gas levels or record data for analysis.

3. **High Cost in Industrial Systems**

Advanced industrial gas detection systems are expensive and not suitable for small-scale or household applications.

4. **Lack of Automation**

Existing systems generally do not perform automatic safety actions such as sending alerts or controlling devices.

5. **Dependence on Human Presence**

If no one is present near the alarm system, the gas leak may remain unnoticed for a long time.

6. **Complex Installation**

Some traditional systems require complicated wiring and professional setup.

3.2. PROPOSED SYSTEM

The proposed system is a Gas Leakage Detection System using Arduino and GSM module designed to detect gas leaks and provide immediate alerts to users. The system uses an MQ gas sensor to continuously monitor the presence and concentration of combustible gases such as LPG and methane in the surrounding environment.

The MQ gas sensor senses the gas level and sends the analog signal to the Arduino microcontroller. The Arduino processes the sensor data and compares it with a predefined threshold value. If the gas concentration exceeds the safe limit, the system immediately activates a buzzer and LED indicator to alert people nearby.

In addition to the local alert system, the system also uses a GSM module to send an SMS notification to a registered mobile number. This feature ensures that the user receives a warning message even if they are not present at the location. The system is simple, cost-effective, and easy to install, making it suitable for homes, industries, laboratories, and commercial environments.

3.2.1. ADVANTAGES

1. **Early Gas Leak Detection**

The system detects gas leakage at an early stage, helping to prevent accidents and explosions.

2. **Remote Alert System**

The GSM module sends SMS notifications to users, allowing them to take action even when they are away.

3. **Low Cost Implementation**

The system uses affordable components such as Arduino and MQ sensors.

4. **Easy Installation**

The system is simple to set up and does not require complex infrastructure.

5. **High Reliability**

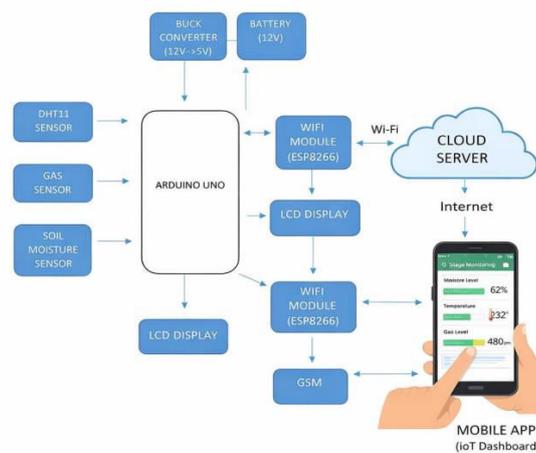
Continuous monitoring ensures accurate detection of gas leaks.

6. **Portable System**

The system can be installed in various environments such as homes, laboratories, and industries.

7. **Improved Safety**

Immediate alerts reduce the risk of fire accidents and property damage.



IV. WORKING

Arduino board is connected to GSM modem in which transmitter of Arduino is connected to the receiver of GSM modem and receiver of Arduino is connected to the transmitter of GSM modem. GSM modem is working simply like a mobile phone when we message on the number of GSM modem it replies back and can be operated according to the coding which we have done in microcontroller. The soil moisture sensor and temperature sensor are connected to analogy pins of an Arduino board. 5v power supply is generated from USB cable which is connected to Arduino board. First of all GSM/GPRS module is initialized and waits until it connects to the network. 12v power supply is scheduled to the GSM/GPRS module through adaptor. The red light indicator illustrates GSM/GPRS is ON. The data sensed by soil moisture sensor and temperature sensor is transmitted to micro-controller. Threshold values are programmed into an Arduino board initially. So, the values which are received from sensors are compared with threshold values. If the readings from the temperature sensor are more than the threshold value and the soil moisture reading is lesser than the threshold value. Then a SMS alert is sent to the user by GSM/GPRS module. Then the motor pump is switched ON by the user as soon as the message ON is received

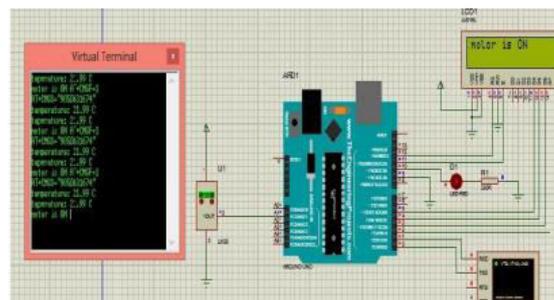


Fig-1.CIRCUIT DIAGRAM

V. CONCLUSION

This project demonstrates exceptional performance in detecting LPG gas leaks, proving highly effective for both industrial and domestic applications. In critical scenarios, the system enables life-saving interventions through timely alerts delivered via the GSM module. The sensor nodes reliably monitor gases such as CO₂, oxygen, and propane, while achieving optimal transmission range and low power consumption. Implementation remains straightforward, leveraging the Arduino UNO microcontroller for robust, cost-effective sensor integration.

In India, agriculture forms the backbone of the economy, supporting the livelihoods of millions of farmers. However, farmers face numerous challenges, including water scarcity and electricity wastage, particularly during the summer months when temperatures rise. Traditional methods of water management often result in inefficiencies and resource wastage. To address these challenges, our project proposes an innovative solution - an Agriculture Pump Monitoring and Tracking System. This system leverages modern technology, including Arduino microcontrollers, GSM, GPS, and sensors, to automate and optimize water management in agriculture. The key components of the system include sensors to measure water levels, Arduino microcontrollers for decision-making, GSM for remote monitoring and control, and GPS for location tracking. By integrating these components, the system can effectively monitor water levels in wells or rivers and control the operation of submersible pumps accordingly. One of the main benefits of this system is its ability to save electricity and water resources. By automating pump operations based on real-time water level data, the system prevents wastage of electricity caused by pumps running dry. The industries dominated by robotics and automation range from manufacturing to home entertainment.

REFERENCES

1. Selvam M. Smart phone based robotic control for surveillance applications. *International Journal of research in Engineering and Technology*. 2014 Mar;3(3):229-32.
2. T. Maria Jenifer, T. S. VasumathiPriyadarshini, Raja Lavanya& S. Raj Pandian. "Mobile Robot Temperature Monitoring System controlled by AndroidApplication via Bluetooth." *International Journal on Advanced Computer Theory and Engineering (IJACTE)* 2013; 2(3): 138-142.
3. \Pahuja, Ritika, and Narender Kumar. "Android Mobile Phone Controlled Bluetooth Robot Using 8051 Microcontroller." *International Journal of Scientific Engineering and Research (IJSER)*. July 2014; 2 (7): 14-17.
4. Mehta, Lokesh, and Pawan Sharma. "SPY Night Vision Robot with Moving Wireless Video Camera & Ultrasonic Sensor." <https://www.semanticscholar.org/paper/SPY-Night-Vision-Robot-with-Moving-Wireless-Video-%26-MehtaSharma/b41425b6b444bb46de91144902cd9fc56c4789e6>
5. Dutta PK, Mallikarjuna K, Satish A. Sensor based solar tracker system using electronic circuits for moisture detection and auto-irrigation. In2017 IEEE International Conference on Power, Control, Signals and Instrumentation Engineering (ICPCSI) 2017 Sep 21 (pp. 1475-1478). IEEE.
6. Ullah S, Hafeez G, Rukh G, Albogamy FR, Murawwat S, Ali F, Khan FA, Khan S, Rehman K. A Smart Sensors-Based Solar-Powered System to Monitor and Control Tube Well for Agriculture Applications. *Processes*. 2022 Aug 20;10(8):1654.
7. Taneja K, Bhatia S. Automatic irrigation system using Arduino UNO. In2017 International Conference on Intelligent Computing and Control Systems (ICICCS) 2017 Jun 15 (pp. 132- 135). IEEE.
8. Shahar SH, Ismail SI, Dzulkefli NN, Abdullah R, Zain MF. Arduino based irrigation monitoring system using Node microcontroller unit and Blynk application. *Indonesian Journal of Electrical Engineering and Computer Science*. 2023 Sep;31(3):1334-41.
9. Kulkarni SA, Raikar VD, Rahul BK, Rakshitha LV, Sharanya K, Jha V. Intelligent water level monitoring system using IoT. In2020 IEEE International Symposium on Sustainable Energy, Signal Processing and Cyber Security (iSSSC) 2020 Dec 16 (pp. 1-5). IEEE.
10. Spinelli GM, Gottesman ZL, Deenik J. A low-cost Arduino-based datalogger with cellular modem and FTP communication for irrigation water use monitoring to enable access to CropManage. *HardwareX*. 2019 Oct 1;6: e00066.



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