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Smart Toxic Gas Detection System Using LoRa Technology

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Abstract: This paper presents a smart gas deduction system that utilizes LoRa (Long Range) technology for efficient and automated gas consumption monitoring. The traditional method of manual meter reading and billing is prone to errors, delays, and high costs. To address these challenges, the proposed system leverages the low-power, wide-area network capabilities of LoRa to enable real-time and remote monitoring of gas usage. The smart gas deduction system consists of three main components: gas meters, LoRa-enabled communication modules, and a central server. The gas meters are equipped with sensors to measure gas consumption accurately. The LoRa communication modules are integrated into the gas meters, enabling wireless transmission of consumption data to the central server.

Keywords: LoRa, NodeMCU, 16*2 LCD Display, MQ-135 Gas Sensor, Buzzer, Led light.

I. INTRODUCTION

The toxic gases like carbon monoxide, methane which is emitted from the drainage wastes. The emitted gases are inhaled by the workers in drainage cleaning and it causes a major health effects. With the increasing demand for efficient energy management and the need for sustainable solutions, the integration of smart technologies in various sectors has become crucial. In the domain of gas supply and consumption, the implementation of a smart gas deduction system using Long-Range (LoRa) technology offers significant benefits. This introduction provides an overview of the smart gas deduction system and highlights the advantages of employing LoRa technology for efficient gas monitoring and control.

II. THEORETICAL ANALYSIS

LPG is a major fundamental necessity of everyfamily, its leakage may cause a disaster.

In order to detect theleakage of LPG and to intimate the surrounding people, we came up with an idea LPG leakage detection and prevention kit. So, we build a NODEMCU based LPG detector.

On the off chance that gas spillage happens, this framework identifies itand makes an alarm by humming the bell connected with thecircuit [2].

This work is so helpful but it was so hard to build and any person who is having some knowledge on LORA can build this. In this, we have used an LPG detector sensor module to detect the leakage of gas.

If any LPG gas leakage happened, it will give a analog input to the A0 stick and the NODEMCU will read the analog input.

Whenever the NODEMCU gets trigger input from the gas sensor, then we will have D3 as output from the NODEMCU and it will act as a trigger pin for the Arduino to show "LPG gas leakage detected" on the 16*2 LCD display.

In order to help the peopleand to provide the security, we may implement this. So, in this we are using the NODEMCU and LoRa boards whichcan be controlled using the Arduino IDE software and integrated drivers [5].

When the sensor value is crosses theutmost value, then it will pass the analog readings to the NODEMCU.

Then the NODEMCU will trigger the output pins of D0, D1, D2 and D3 for various indications. The system will blow the horn from D1 stick and it will glow the LED at D0 stick and gives trigger to the DC motor fan to remove the gasfrom the room or surroundings and it will show a message onLCD display using LoRa.

The LoRa will take the trigger value from NODEMCU from pin D3 and then it will show the LPG leakage Detected on 16*2display.

If the gas leakage was not crossing the utmost value, then the Arduino will not show anything on the display, and it will beturned off. The major apparatus required for this project are -

1. LoRa
2. Sensor(MQ135
3. Buzzer
4. NODEMCU (Micro controller)
5. 16x2 LCD
6. Bread board

III. BLOCK DIAGRAM

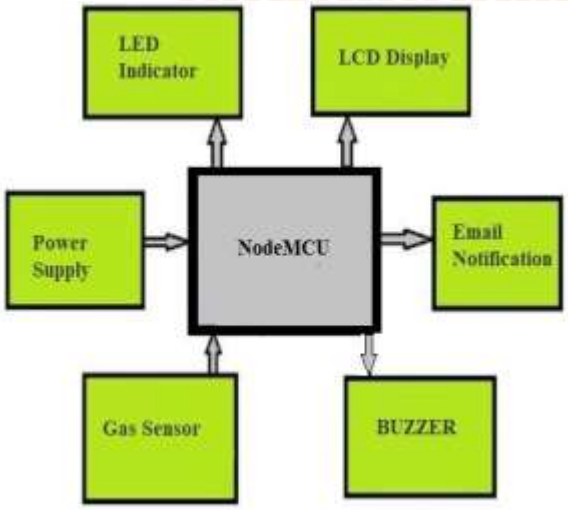

Fig-1: Block Diagram

IV. FUNCTIONS OF COMPONENTS

A. LoRa:

Lora, short for Long Range, is a wireless communication technology specifically designed for low-power, long-range communication between devices. It is commonly used in applications such as Internet of Things (IoT) devices, smart cities, industrial automation, and agriculture. The most commonly used frequency bands for Lora are 868 MHz in Europe and 915 MHz in North America. It utilizes a spread spectrum modulation technique called Chirp Spread Spectrum (CSS) to achieve long-range communication with low power consumption

B. NODEMCU:

NODEMCU is also an open - source LoRa board. It is integrated with firmware which will run using the ESP8266 Wi-Fi SoC, and the apparatus which is depended on the ESP-12 module. The expression of "NODEMCU" as a matter of course that refers to the firmware that has opposed to the improvement of units. This firmware will be using the Lua scripting language.

C. MQ135 Ga Sensor:

The MQ135 gas sensor is an electrochemical gas sensor commonly used for detecting a wide range of gases in the atmosphere. It is particularly sensitive to harmful gases such as ammonia (NH3), nitrogen oxides (NOx), carbon monoxide (CO), and various organic compounds. The MQ135 sensor operates based on the principle of chemical reaction. It contains a sensing element that changes its electrical conductivity when it comes into contact with the target gas. The resistance of the sensor changes in the presence of the gas, and this change is measured to determine the gas concentration.

Alarm & Indicator (Buzzer):

A ringer is set to deliver sound alert about the spillage before turning ON the fumes fan. It likewise rings to help about the topping off to remember the chamber when the gas level tumbles down beneath the edge esteem.

LCD Display:

A 16X2 LCD (Liquid Crystal Display) show is utilized as the visual marker. The purpose for utilizing this LCD show is its cost adequacy and simple programmability. It shows different messages, for example, spillage of gas, ready message for booking of chamber and so forth. It additionally shows the activities did by the micro controller.

PROCEDURE

In this, our project will contain NODEMCU, MQ-135 gas leakage detecting sensor, Buzzer, LED, 16*2 LCD display, LORA, and 1k resistor. Hardware Selection: Choose the appropriate hardware components for your system. This typically includes LoRa-enabled gas meters, LoRa gateways, and a central server or cloud platform for data processing and storage. Ensure that the hardware components are compatible with LoRa technology. Design the LoRa network infrastructure for optimal coverage and connectivity. Consider factors like the distance between gas meters and gateways, signal strength, and interference. Conduct site surveys if necessary. The LPG gas sensor is connected to the NODEMCU through the A0 pin in NODEMCU. Then the NODEMCU will start triggering all the output pins. When the NODEMCU triggers, it will pass high output through D0, D1, D2, and D3. The output will be given through the D0 to D4 pins in NODEMCU. D0 relates to LED. D1 relates to Buzzer. D3 is used as a trigger for LORA to show the text in a 16*2 LCD Display.

EXPERIMENTAL RESULTS

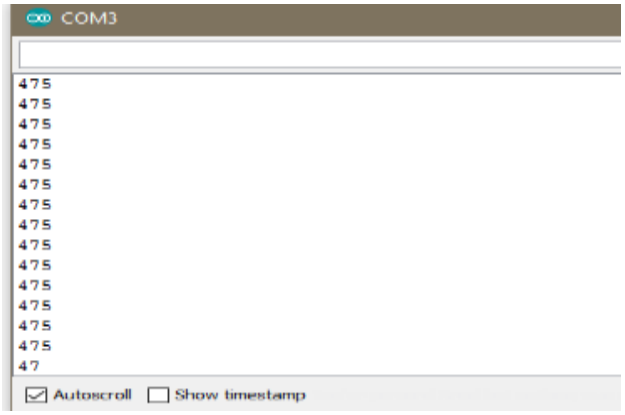

Fig-2: MQ-135 Sensor readings when no Gas leakage

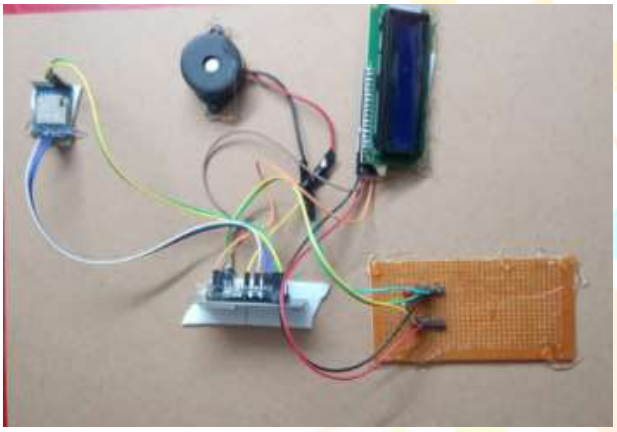

Fig-3: Output when no Gas leakage

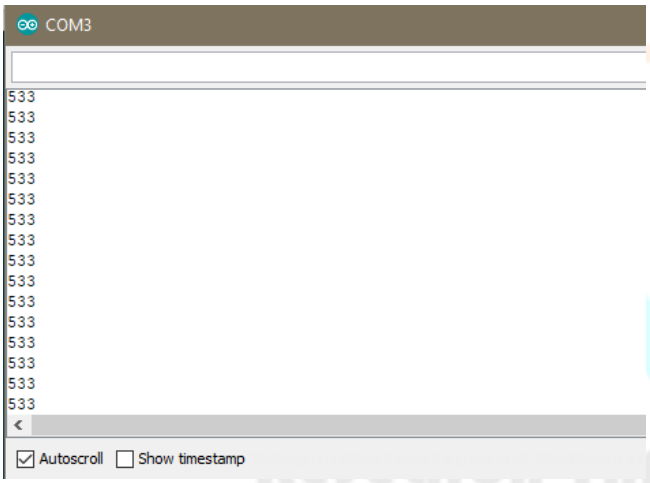

Fig-4: MQ-135 Sensor readings when GAS leakage wasdetected

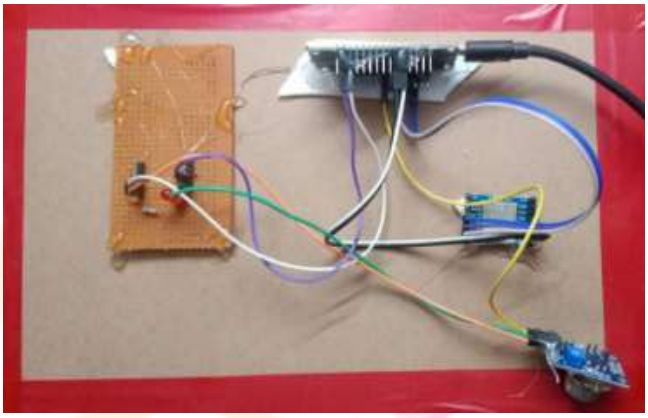

Fig-5: Output when GAS leakage was detected

V. CONCLUSION

1. Efficient Communication: LoRa (Long Range) technology provides long-range and low-power communication capabilities, making it ideal for smart gas deduction systems. It enables seamless and reliable communication between gas meters and central monitoring systems.
2. Real-time Monitoring: The system allows for real-time monitoring of gas consumption. By leveraging LoRa technology, gas meters can transmit consumption data at regular intervals, providing accurate and up-to-date information to the central monitoring system.
3. Inside 2-4sec the transfer will remove the fundamentalpower supply.
4. Ringer starts signaling and a message is shown on LCD to caution the clients and close by individuals.
5. Wi-Fi module will send SMS/email utilizing the cloudto the clients.

VI. FUTURE SCOPE

Given the given highlights this framework can be made increasingly useful by including not many progressively essential little data sources like

1. Temperature: To screen the temperature of the chamber just as nature and program the framework to act as needs be. (Note: Piccolo include on-chip temperature sensors and LEDs)
2. Although this framework is profited by LORA for messagingand informing this can be made colossal by enhancing it with Android and LORA for messaging and informing [5].
3. Sensors: Continuous and profitable inclusion and the

expansion of applicable and up and coming new innovation-based sensors would influence to a great extentto the believability of the framework [8].

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