IOT Based Low-Cost Gas Leakage, Fire and Temperature Detection

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Abstract **- Gas pipes play very important roles for cities, industries and thus in growing economies. So, gas leakages lead to losses as well as are a threat because they can also lead to fire accidents. Placing sensors at each section of pipe is very costly. So here we propose an innovative robot that clings on to the outer surface of the gas pipe and moves with the pipe to check for leakages.The robot consists of gas sensor that is used to detect gas leakages. As the robot keeps moving along the metal pipe it keeps monitoring for any gas leakage, on detection it uses an interface gps sensor to transmit location of the leakage detected over to the IOT login system, here we use UBIDOTS to receive and display the gas leakage alert and location over IOT.Thus, we have a fully automated insect like robot that moves with the gas pipe and detects gas leakages instantly at a low budget.**

Keyword: IoT (Internet of Things), Gas Leakage Detection, Fire Detection, Temperature Monitoring, MQ-2 Gas Sensor, Flame Sensor, DHT11 Temperature Sensor

I. INTRODUCTION

IoT (Internet of Things) is a widely used technology in the industrial revolution. Its growth has been exponential in this decade and is commonly used for measuring and reporting data.

The various applications include healthcare and framework systems with integration of artificial intelligence, industrial developments smart surveillance, smart home systems.

Due to the rise in advancement of technology in industries, there is an enlargement of IoT technology. Understanding the system in gas leakage from, the key idea is to propose and develop a simple gas leakage system using IoT and notifying the user using thing tweet which is an app to link a user's twitter account to the thing speak database. The notifications of the gas leakage are sent as an alert in the user's twitter handle.

II. LITERATURE SURVEY

In this paper [1] there is a rapid development in technology which influencing the human life in several aspects due to rapid development in different fields but we still need to adopt that technology such that we can make human life easier to live. In our Country it is not possible to supply LPG through Pipes to each and every home as production of LPG is too short. At present we are having an system Advance LPG cylinder booking through IVRS or online which is most difficult for the illiterate and busy schedule people to book the LPG cylinder in advance. Another Major problem LPG cylinder users facing is "They don't know exactly the status of LPG gas completion" makes even more delay in booking the cylinder which is uncomfortable most of the times.

In this paper [2] Boyanka Nikolova, Marin B. Marinov, Georgi Todorov Nikolov Detection of low concentration of air pollution, like cigarette smoke, cooking fumes, etc. is possible with the combination of an air quality sensor and data acquisition system. In present paper is presented approach for design and implementation of air quality monitoring system based on tin dioxide gas sensor, integrated temperature and humidity sensors, portable modular data acquisition system and graphical programming language. An interpolation method reducing influence from temperature and humidity is suggested.

In this paper [3] the design of LPG leakage monitoring system is proposed for home safety. The accidents due to the explosion of LPG is increasing now days which became a threaten to human life. 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. In additional to this, the system continuously monitors the level of the LPG in the cylinder using load sensor and if the level is below the threshold limit the system inform them by SMS and also by the LCD display. So that the user have an idea about the max time the LPG lasts. An automatically booking of the cylinder using a GSM module is also used in this proposed system. The device ensures safetyand prevents suffocation and explosion due to gas leakage. Advantages: to ensure the safety of people and surroundings.

In this paper [4] main issue facing users of LPG cylinder is "They are unaware of the status of completing LPG gas" which makes booking the cylinder much more time-consuming, which is mostly inconvenient. For this reason, most of the analphabets are unable to complete the booking, and usually , these phone line telephones are moreover not reachable because of the overcrowded calls or else telephones that are not functioning because of about procedural problems. The advises a program that is automate full LPG cylinder reservation technique without hominoid interference. The device endlessly monitors the heaviness of the cylinder and will automatically send notification to the approved LPG Manager once it exceeds the minimum threshold so that they perhaps distribute the LPG cylinder in step. In conjunction through the Automatic Cylinder Reservation, we have developed a safety measures for the user in which it continually tracks LPG gas leak [1i]and warns consumer about it

In this paper [5] Gas leaks can be hazardous to all sentient beings and the environment. Due to the lack of real time warning systems, people staying nearby the industries can lose their lives. In this proposed system the detector(s) senses the presence of hazardous gases where they should not be present and informs the nearby people using mobile app. Next main issue facing users of LPG cylinder is "They are unaware of the status of completing LPG gas" which makes booking the cylinder much more time-consuming, which is mostly inconvenient. For this reason, most of the analphabets are unable to complete the booking, and usually , these phone line telephones are moreover not reachable because of the overcrowded calls or else telephones that are not functioning because of about procedural problems. The advises a program that is automate full LPG cylinder reservation technique without hominoid interference. The device endlessly monitors the heaviness of the cylinder and will automatically send notification to the approved LPG Manager once it exceeds the minimum threshold so that they perhaps distribute the LPG cylinder in step.

III. SYSTEM BLOCK DIAGRAM

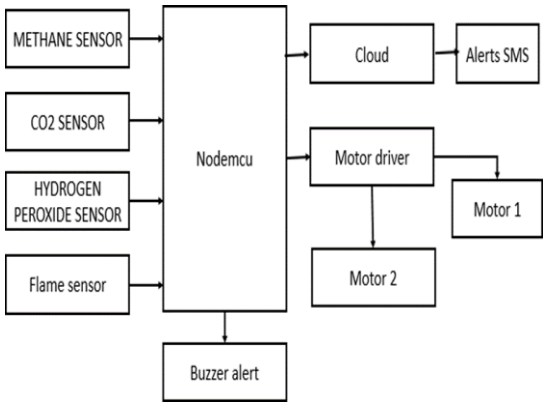


Fig: 1 Block Diagram IOT GAS

A. EXISTING SYSTEM

The existing system is done by using the smoke sensor to detect the gas if it detect the gas means it automatically give message through the GSM module to the authenticated person In gas sensor it only detect the one poison gas and in normal gas pipe is release the co2 , methane , hydrogen peroxide to identify these gas is not possible And then main disadvantage is to place each and every node of pipe it is not possible for long distance.

B. PROPOSED SYSTEM

The given proposed system is done by using Nodemcu microcontroller with three sensor like CO2 gas sensor, LPG gas sensor, hydrogen peroxide sensor and flame sensor.The CO2, LPG gas, and hydrogen gas sensor is used to identify the CO2, LPG gas, hydrogen peroxide gas from the industry.If any gas is detected, it automatically send the alert message to the authorised persons and automatically turn on ventilation fan.Here any fire can identified by the flame sensor, it will shrinks water on the flame. And continuously update the sensor value to the cloud it is highly useful for future reference

C .HARDWARE DESCRIPTION

POWER SUPPLY

All electronic circuits works only in low DC voltage, so we need a power supply unit to provide the appropriate voltage supply for their proper functioning .This unit consists of transformer,

rectifier, filter & regulator. AC voltage of typically 230volts rms is connected to a transformer voltage down to the level to the desired ac voltage. A diode rectifier that provides the full wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage.

RECTIFIER:

A dc level obtained from a sinusoidal input can be improved 100% using a process called full wave rectification. Here in our project for full wave rectification we use bridge rectifier. From the basic bridge configuration we see that two diodes(say D2 & D3) are conducting while the other two diodes (D1 & D4) are in off state during the period t = 0 to T/2.Accordingly for the negative cycle of the input the conducting diodes are D1 & D4 .Thus the polarity across the load is the same.Memory

FILTERS:

In order to obtain a dc voltage of 0 Hz, we have to use a low pass filter. So that a capacitive filter circuit is used where a capacitor is connected at the rectifier output& a dc is obtained across it. The filtered waveform is essentially a dc voltage with negligible ripples & it is ultimately fed to the load. Communication

REGISTERS:

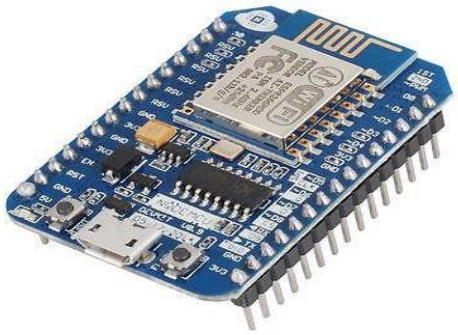
The controller IC has two 8 bit registers, an instruction register (IR) and a data register (DR). The IR stores the instruction codes and address information for display data RAM (DD RAM) and character generator RAM (CG RAM).

REGULATORS:

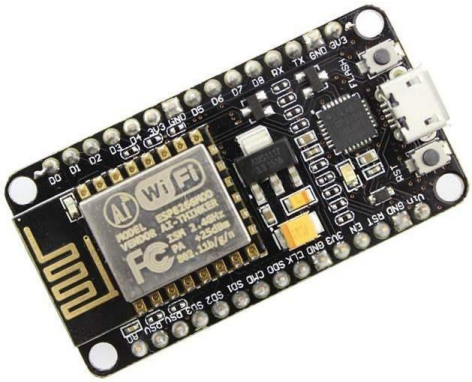
The output voltage from the capacitor is more filtered & finally regulated. The voltage regulator is a device, which maintains the output voltage constant irrespective of the change in supply variations, load variations & temperature changes. Here we use fixed voltage regulator namely LM7805.The IC LM7805 is a +5v regulator which is used for microcontroller.

NODE MCU

NodeMCU is an open source IoT platform.[4][5] It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.[6][7] The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson[8] and SPIFFS



NodeMCU Development Board/kit v0.9 (Version1)



NodeMCU Development Board/kit v1.0 (Version2)

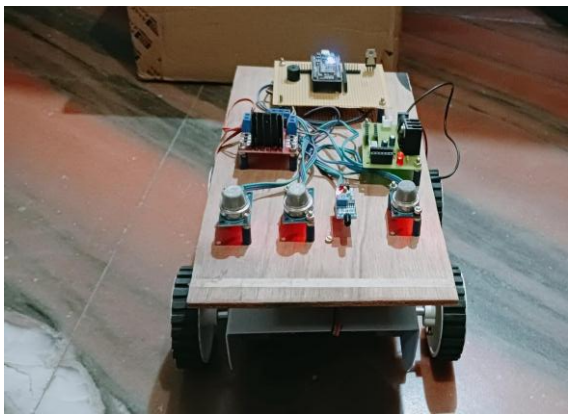
GAS SENSORS

The gas sensor module consists of a steel exoskeleton under which a sensing element is housed. This sensing element is subjected to current through connecting leads. This current is known as heating current through it, the gases coming close to the sensing element get ionized and are absorbed by the sensing element. This changes the resistance of the sensing element which alters the value of the current going out of it.

IV. RESULTS

The IoT-based low-cost gas leakage, fire, and temperature detection system demonstrated reliable and efficient performance during testing. The MQ-2

gas sensor successfully detected the presence of LPG and smoke, triggering alerts when concentrations exceeded the set threshold. Similarly, the flame sensor was capable of identifying open flames within a short range, enabling immediate activation of safety measures such as buzzers and mobile alerts. The DHT11 temperature sensor accurately monitored ambient temperatures and responded to unsafe levels by issuing timely warnings. The integration with an IoT platform allowed real-time data transmission and remote monitoring via a mobile application, ensuring user awareness and prompt action.



G.PERFORMANCE ANALYSIS

The performance analysis of the IoT-based low-cost gas leakage, fire, and temperature detection system revealed that the prototype operated with high accuracy and reliability under various test conditions. The gas sensor (MQ-2) responded swiftly to increasing gas concentrations, with an average response time of less than 5 seconds. The flame sensor demonstrated a strong detection capability within a 1.5-meter range, maintaining consistent performance in both low and moderate light environments. The temperature sensor (DHT11) delivered stable readings with minor variations, remaining within an acceptable error margin of ±2°C. The system's integration with an IoT platform ensured real-time monitoring and prompt alert delivery through mobile notifications, with minimal latency in data transmission.

V. CONCLUSION

This research's main objective is to build a low-cost and straightforward system that can be operated at three modes: gas and fire leakage detection mode and temperature detection mode. In many research papers, it almost uses the message alert system. When the gas, smoke, or fire leaks, it will send a message alert to the user phone. But we use a call alert system, which gives some advantages to users. Moreover, we deployed a system with different sensors. Overall it is user friendly and low cost. Besides, it doesn't give not only the call alert but also a graphical alert on the webserver. In previous works, the raspberry pi uses for getting the accurate output. We tried to do it by NodeMCU and applied machine learning to get sensors' accuracy or prediction ability in critical situations. Future work of this research will include data analytics that will apply to the cloud side to improve the system's services and accuracy. Also, use multiple gases and fire sensor for detecting gas and fire leakage in industries and prepare a database for gathering sensors output. Besides, somebody will develop it for calling or messaging multiple users by creating a database in the future. GSM data will be stored in the database and transmit to multiple users. Furthermore, a gas and fire sensing robot can be constructed to sense Gas Leakage through pipelines.

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