

IoT Based Leakage Detection

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Abstract - This system is not only cost-effective but also provides real-time monitoring and immediate alerts, reducing the risk of accidents and ensuring the safety of workers and surrounding communities. Leakage of gases can lead to loss of valuable resources, increased production costs, and environmental damage. Leakage can occur in various forms including air, water, gas, or chemical leaks from pipelines, valve fittings, or tanks. In addition to the economic and environmental impact, leakage can also pose a safety risk to employees working in the affected area. The release of hazardous materials, such as toxic chemicals, can result in serious health consequences if not addressed promptly. To prevent leakage, industries need to implement proactive measures such as regular maintenance checks, upgrading equipment, and implementing leak detection systems. By addressing leakage issues, industries can reduce costs, improve efficiency, and demonstrate a commitment to environmental responsibility and workplace safety. Here in our project Node MCU is utilized to build a leakage detection system when this happens the registered user get the email notifying about the gas concentration in that place through Arduino IoT cloud and IFTTT platforms so that user can take immediate actions. Here our system when it detects leakage the control pump attached to relay pumps the solution from the container there by reducing the concentration of gas leaked and protecting the environment from harmful damages and reduces the rate of accidents which takes many lives.

Index terms - If This Then That, Wi-fi system-on-a-chip, Liquid Crystal Display, Arduino IoT cloud, Node MCU.

I INTRODUCTION

Every year, numerous people lose their lives to gas-related incidents. It is important to take necessary precautions to avoid such accidents. Alcohol can be dangerous and should be handled with care and proper precautions. It is a flammable liquid that can easily catch fire if it comes into contact with an ignition source. Thus, it is important to store alcohol in a cool, dry and well-ventilated area, away from heat sources and open flames. In addition to its use as a source of energy, methane also has an important role in the natural gas industry. It is the primary component of natural gas, which is used for heating and cooking in homes and businesses, as well as in transportation and industrial operations. Methane is also used as feedstock in the production of chemicals such as methanol, ammonia, and hydrogen.

However, the release of methane into the atmosphere is a major contributor to climate change. Methane is a potent greenhouse gas, and its warming effect is estimated to be up to 84 times stronger than carbon dioxide over a 20-year time frame. Methane emissions come from a variety of sources, including the oil and gas industry, agriculture, and waste management.

To address this issue, efforts are being made to develop technologies and practices that can reduce methane emissions in various industries. In our project when this alcohol or methane gases are released and detected by the sensor automatically solutions are pumped by the pump from the container and reduces the concentration of those gases.

II BACKGROUND

Big Data: It refers to the massive amount of structured and unstructured data that can be accessed and analysed to extract insights and make informed decisions. Big data technologies enable the processing, storage, and analysis of this data in real time or near-real time, using advanced algorithms and statistical models.

Embedded Systems: An embedded system is a computer system designed to perform specific tasks with a dedicated function within a larger mechanical or electrical system. It is a combination of hardware and software that is designed to perform a specific function, often with real-time computing constraints.

Security Protocols and Architectures: Security protocols and architectures are designed to secure IoT systems from different vulnerabilities, such as unauthorized access, theft, tampering, and hacking. These include encryption, authentication, and access control mechanisms to ensure data privacy, integrity, and confidentiality.

Protocols Enabling Communication: Communication protocols are necessary for IoT devices to be able to communicate with each other to perform specific tasks. These include wireless protocols such as Bluetooth, Zigbee, and Wi-Fi, as well as wired protocols such as Ethernet and RS-485.

Web services are software systems designed to support interoperable machine-to-machine interaction over a network. They enable different IoT devices and systems to access and share data with each other using web-based technologies. Internet and Search Engines: The Internet and search engines facilitate the connectivity and communication between different IoT systems, devices, and users. They allow the devices to access the vast amounts of data available on the web

and provide users with the ability to find and access specific information relevant to their needs.

III LITERATURE SURVEY

Additionally, the system includes a relay and a pump controller. When gas is detected, the relay will be triggered to activate the pump and start pumping the gas out of the atmosphere. The pump controller adjusts the speed of the pump based on input from various sensors such as flow meters and level sensors. This helps ensure the gas is quickly and efficiently removed from the atmosphere. Once the gas is removed, the system will turn off the pump and stop the alarm.

The Node MCU is used for connecting the system to the internet and enabling remote monitoring and control. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Expressive Systems, allowing the system to connect to the internet and send notifications or alerts. The user can monitor the system status and control the pump or alarm remotely through the IoT cloud platform's open editor. This provides greater flexibility and convenience, allowing the user to manage the system from anywhere with an internet connection.

Overall, this system provides a reliable and efficient solution for gas detection and removal, with the added convenience and flexibility of remote monitoring and control. It can be used in a variety of settings, including homes, offices, and industrial facilities.

2. The gas sensor (MQ2 Sensor) is used to detect the presence of flammable gases such as LPG, propane, and methane. Once the gas is detected, the sensor sends a signal to the microcontroller to activate the alarm and display the gas level on the LCD screen. The fire sensor is used to detect the presence of fire or high temperatures. When the sensor detects heat or fire, it sends a signal to the microcontroller to activate the alarm and display the fire level on the LCD screen.

The proposed system also includes an auto air ventilation system that detects the quality of air

inside a room and automatically switches on the ventilation system to provide fresh air. Similarly, the water flow system detects the water level in a tank and automatically controls the water pump to maintain a certain level.

All of these systems are controlled by an Arduino microcontroller, which is programmed to monitor and control the different sensors and systems. The GSM module is used to send a message to the owner's phone if there is any emergency detected by the sensors. This allows the owner to take action immediately and prevent any accidents.

In conclusion, the proposed system is an advanced and innovative way to ensure the safety of a home or building. It uses the latest technology to monitor and control different systems and provides real-time notifications to the owner in case of any emergency.

3. This project aims to create a safety system that can detect LPG gas or smoke leakage and alert the user through SMS notifications. The heart of the system is the MQ-4 sensor, which is sensitive to LPG gas and smoke particles. When gas leakage or smoke is detected, the sensor sends a signal to the Node MCU, which processes the data and activates the GSM SIM800L module.

The GSM SIM800L module is responsible for sending SMS notifications to the user's mobile phone. The node MCU is programmed to send the message with the relevant information such as gas leakage or smoke detected and the location of the sensor.

To further ensure safety, the system has a buzzer that sounds an alarm if gas leakage or smoke is detected. Additionally, a solenoid valve and exhaust fan can be powered by a buck converter to evacuate the gas or smoke and prevent any accidents from happening.

This system can be permanently installed in kitchens or other rooms where LPG gas is used. The system is designed to be easy-to-use, low-cost and efficient while providing a reliable safety solution for homes.

In conclusion, this system is a brilliant solution for the detection of LPG gas or smoke. This project can

be used as a prototype for a commercial product with the possibility of adding more features like Wi-Fi connectivity for remote control and monitoring.

3.1 Limitations of existing system

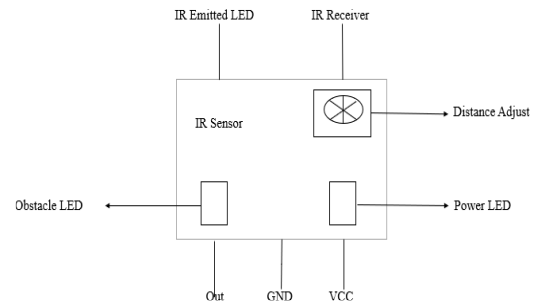
The existing IoT device is related to kitchen, room vehicles but not related to industry. Mainly for hazardous gases or it's components. Sending message through Twilio API or using the GSM module only.

3.2 Problem Statement

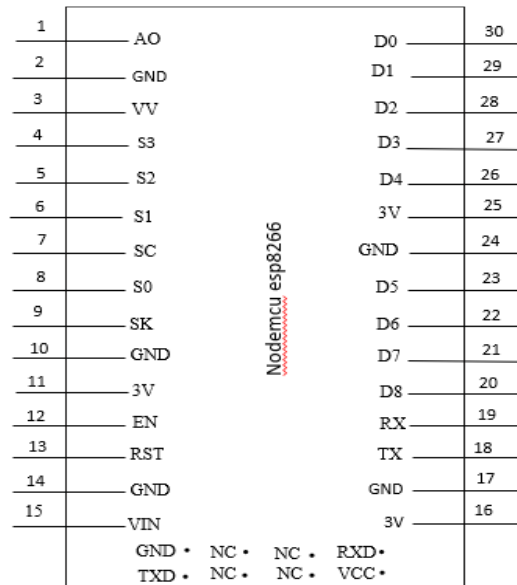
Our proposed system detects the smoke, alcohol, and automatically pumps the solution resided in the container and reduce the content of gases in the atmosphere.

IV PROPOSED SYSTEM

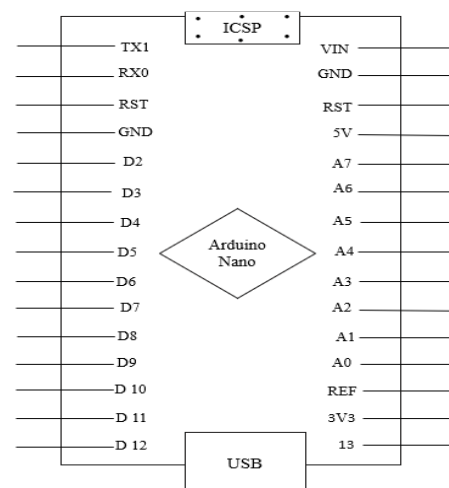
These applets consist of a trigger (the “if this” part) and an action (the “then that” part). For example, if the temperature sensor detects a certain temperature (trigger), then the air conditioning turns on (action). IFTTT can be used with the Arduino IoT Cloud to integrate IoT projects with other services and devices, such as Twitter, Instagram, and Philips Hue lights. This allows for greater automation and customization of IoT projects. Our proposed system detects the smoke, alcohol, and automatically pumps the solution resided in the container and reduce the content of gases in the atmosphere.



b) Node MCU



c) Arduino Nano



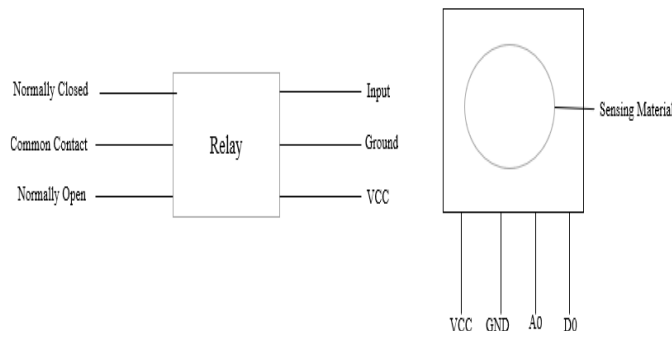
d) Relay and MQ2 Sensor

V METHODOLOGY

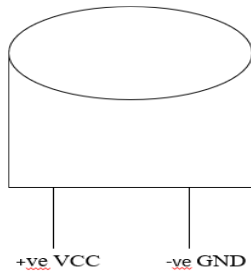
A) The Arduino Nano is a small, compact board based on the ATmega328P microcontroller, and is suitable for small, low-power projects. It includes features such as a USB interface for programming and power, and can be programmed using the Arduino IDE. The Nano also includes digital and analog pins for interfacing with sensors and actuators, and can be powered by a 5V supply. It is commonly used in IoT projects for its small size, low power consumption, and ease of use.

System's Hardware:

a) IR Sensor



e) Buzzer

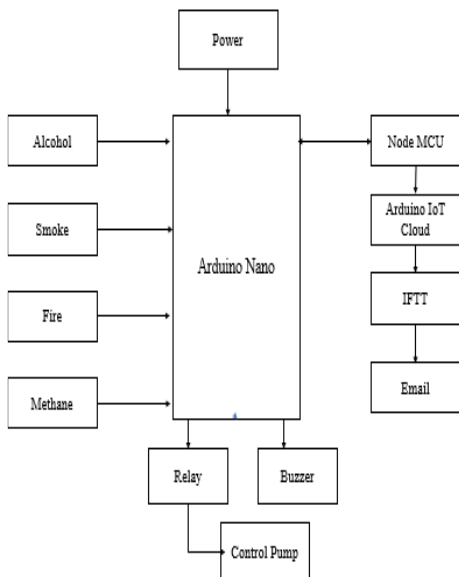


B) Arduino IoT Cloud adding ESP8266 device, creating variable to get and store the scenario values, widgets to show the graphical representation of the sensors value like increasing, decreasing or constant value Initially create a agent in Arduino IoT platform.

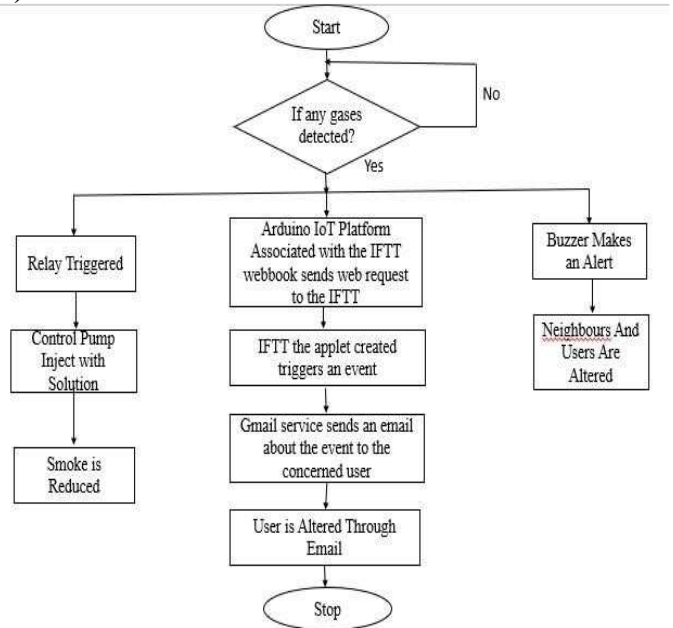
C)IFTTTplatform

This is where we create our own applet switchable for our project. As user need to get alerted about the gas concentration. In IFTTT Platform, webbook and Gmail services are available which help to send email for the user webbook sends the data in response to the event with any push or pull by another. If one creating the event which we want to be triggered that in the value for the users reference and in the role of the webbook. This one sends an email to the concerned one about the scenario data values , this is the role of Gmail

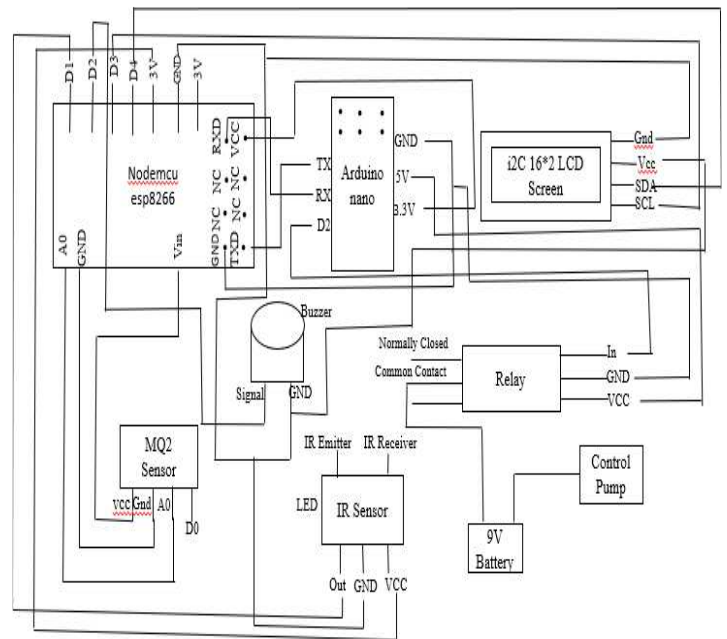
D) Conceptual Design



E) Flow Chart



F) Circuit Diagram



CONCLUSIONS

This is a great proposal for a NodeMCU based detection and management system to improve safety and reduce the risk of fire deaths and infrastructure damages caused by gas leakages. The proposal highlights the need for an automatic detection and management system to ensure the safety of people who may be unconscious during an emergency. The proposed system is low-cost and incorporates an automatic detection system to detect gas leakages. Additionally, the system includes a solution container that is automatically pumped to reduce the released gases and prevent accidents from occurring. The system offers an innovative solution to gas leakages, which can be a significant safety issue. In addition, the project can be incorporated into various systems to make them safe and efficient.

Overall, the proposal is well-thought-out, and the proposed system can be beneficial to many people. The low-cost and efficient nature of the system makes it accessible to a wide range of people thereby helping to reduce the risk of gas leakage and prevent accidents from occurring. Arduino IoT cloud no need of importing any of the libraries like Arduino IDE or any need of the Blynk app installation.

ACKNOWLEDGMENT

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