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Exploring the Potential of IOT for Car Safety Using Arduino UNO and MQ2 and 3-IR sensor

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Abstract. This research presents a novel solution for the detection of inflammable gases using an Internet of Things (IoT) approach. The system integrates a NodeMCU microcontroller and an MQ2 gas sensor for precise gas detection in various environments. The NodeMCU collects and transmits gas concentration data to an onlineplatform, ThingSpeak, allowing for continuous monitoring and visualization. In the event of a gas leak, a custom applet on IFTTT (If This Then That)is triggered, instantly notifying users via mobile devices. The proposed system offers a cost-effective, scalable, and efficient solution for enhancing safety and security in environments where inflammablegases pose potential risks. Preliminary results demonstrate the system's ability to provide timely notifications, contributing to proactive safetymeasures and enabling rapid responses to gas- related emergencies.The proposed system also gives a approach to the safe driving in a mountain ranges or in a fog or the dark road.

Keywords: NodeMCU, MQ2 sensor, IFTTT, IOT, 3-array IR sensor, Motor Driver L298N, Arduino UNO.

1. INTRODUCTION

In environments where the presence of inflammable gases poses potential safety risks, rapid and reliable gasdetection is crucial. This research presents an Internet of Things (IoT) solution that integrates a NodeMCU microcontroller and an MQ2 gas sensor to provide real-time gas concentration data. The system leverages cloud-based monitoring through ThingSpeak and mobile notification through IFTTT, offering a cost-effective and efficient approach to enhancing safetyand security by ensuring timely alerts in case of gas leaks. This innovation not only improves safety measures but also enables quick responses to gas- related emergencies, potentially mitigating hazardous situations.

To drive in the dark path or for a critical path like if driving in a mountain range it possible an accident that the car may fall down the 3-IR array sensor will help the car to be on the track if it goes wrong and will prevent the accident.

2. LITERATURE REVIEW

In the face of escalating concerns regarding air quality, especially in densely populated regions, the application of Internet of Things (IoT) technology has emerged as a transformative force in air quality monitoring. The multifaceted nature of air quality challenges, influenced by diverse pollutants and factors, necessitates a shift from traditional preventivemaintenance approaches to predictive maintenance solutions driven by IoT. In particular, regions like India grappling with pollution from sources such as coal and petroleum require comprehensive data to address the complexity of air quality management. IoT-enabled systems empower real-time indoor air quality assessment, offering the means to not only identify pollutants but also continuously monitor their concentrations. This paper titled Real-Time Monitoring Air Purification System Using MQ2 Sensor by M Vinod, D Shreya and G Supriya contributes to this evolving field by proposing a user- friendly IoT solution that combines real-time indoor air quality monitoring with air purification capabilities. By addressing the pressing need for comprehensive systems, this research endeavors to empower individuals to proactively monitor and enhance the air quality within their indoor environments, thereby making significant strides in the realm of air quality management and public health.

IoT's essence lies in the acquisition, storage, and processing of real-time data from various sources to optimize processes and derive actionable insights. Integral to this process is the device cloud, a repository for IoT data that enhances accessibility and analysis. However, the financial burden associated with established cloud platforms, such as Azure, can present a significant challenge, especially for small-scale IoT projects. Although several free IoT platforms are available, they often come with limitations that restrict their suitability for specificuse cases. This literature review of the research paper Senor Data

Recording and Alerts Notification using IFTTT with ESP32 by Gayatri Mohanta underscores the exploration of a cost-effective, and sometimes free, cloud storage alternative to mitigate the financial constraints associated with IoT data storage. Google Sheets, a cloud-based spreadsheet tool, emerges as an intriguing candidate for IoT data storage and management. Distinguished by its capacity to create flexible and interconnected spreadsheets, GoogleSheets seamlessly integrates with various Google services, such as Google Maps. This cross-functionality empowers the development of innovative IoT solutions. Of particular note, Google has facilitated developers' capacity to programmatically populate Google Sheets with data through Application Programming Interfaces (APIs) and Google Apps Script (GScript). This approach offers an accessible and economical solution for addressing the fiscal constraints associated with data storage, opening up the possibilities for cost-effective IoT data management. A practical demonstration further illustrates the feasibility of employing Google Sheets as a device cloud, providing insights into its accessibility and affordability as a data storage solution for IoT enthusiasts and projects with budgetary constraints.

Urban kitchens, often constrained by limited spaceand ventilation, face critical safety challenges due to the persistent risk of gas spillage and fires. The emergence of smart management systems aimed at addressing these issues has gained prominence. The paper Gas Leakage with Auto Ventilation and Smart Management System using IOT talks about systems that can leverage advanced sensor technologies,including the MQ2 gas sensor and IR fire sensors, to detect potential hazards promptly. Microcontrollerssuch as the Arduino UNO serve as the backbone of these safety solutions, facilitating sensor-actuator interactions. Real-time notifications through SMS andapplications like Blynk empower users to respond proactively to gas leaks and fire incidents. Beyond detection and notification, some systems feature automatic ventilation to reduce gas concentrations and fire suppression mechanisms, thereby enhancing overall kitchen safety and reducing potential damages to life and property, thus offering a robust solution for urban environments.

A wide array of gases, encompassing toxic and flammable varieties, poses substantial risks to both human health and the environment. Exposure to these gases can result in a spectrum of ailments, from respiratory issues to severe health complications, and,in extreme cases, lead to fatalities or catastrophic explosions. While various gas detection systems have been developed in the past, a notable limitation is their singular focus on specific gases, particularly LPG gas. Recognizing the need for a more comprehensive and versatile approach, this research paper A comprehensive system for detection of flammable and toxic gases using IOT presents a pioneering gas detection system. It not only covers the detection of a diverse set of hazardous gases, including smoke, Ethanol, CNG Gas, Methane, toluene, propane, Carbon Monoxide, acetone, Hydrogen Gas, and Formaldehyde, but it also ensures efficient real-time gas detection. Additionally, the system has the capacity to activate evacuation alarms for swift responses to gas-related emergencies, while SMS notifications are generated to alert relevant personnel. The system's readiness for deployment and adaptability to various work environments positions it as a promising advancement in gas safety technology, promising enhanced safety and reduced potential harm across industrial, residential, and commercialsettings.

Gas leakage and fire hazards, notably associated with the use of highly flammable Liquified Petroleum Gas (LPG), continue to pose significant threats to both lifeand property. Researchers have consistentlyunderscored the importance of early detection as a means to mitigate these risks effectively. In response to this imperative, the paper IOT based smart gasmanagement system by Sony Shrestha, V.P. Krishna Anne and R. Chaitanya introduces an Internet of Things (IoT) based Smart Gas Management System, which amalgamates an array of cutting-edge technologies. The system incorporates gas and fire sensors, load cells, GSM modules, and voice modules, orchestrated by the Arduino UNO microcontroller. It offers a multifaceted approach to gas safety, capable of real- time detection of gas leakage and fires, with users promptly alerted through SMS and phone calls. However, the system transcends mere detection by intelligently automating gas cylinder management. When the load cell detects that the gas cylinder's weight has fallen below a predefined threshold, it triggers an automatic booking process with the gas agency and simultaneously informs the user of the impending gas depletion. This user-centric and technologically advanced system has the potential to address critical concerns in both residential and commercial settings, ushering in an era of enhanced gas safety and convenience.

3. METHODOLOGY

3.1 CNG leakage detection.

System Configuration:

Hardware Setup: The hardware system consists of a NodeMCU (ESP8266) board and an MQ2 gas sensor. The NodeMCU is connected to the MQ2 sensor through the appropriate pins to enable gas dataacquisition.

Software Setup: The NodeMCU is programmed using the Arduino IDE. The code includes logic for gas concentration measurement and Wi-Fi communication.

Data Acquisition:

Gas Sensing: The MQ2 sensor is used to measure the concentration of inflammable gases in the surrounding environment. The sensor provides analog data output, which is then digitized for processing.

Data Sampling: The NodeMCU collects gas concentration data at defined intervals to ensurecontinuous monitoring. Firstly, gas concentration at normal conditions is monitored and using that data, the threshold limit for buzzer alert is set.

Data Transmission:

Wi-Fi Connectivity: The NodeMCU connects to the local

Wi-Fi network to enable internet access.

ThingSpeak Integration: Gas concentration data is sent to ThingSpeak, an IoT platform, via HTTP POST requests. This platform hosts a dedicated channel for data visualization.

Mobile Notification:

IFTTT Setup: An applet is created on IFTTT, linking the ThingSpeak channel and mobile notifications. The applet is configured to

trigger mobile alerts when gas concentration data exceeds predefined thresholds.

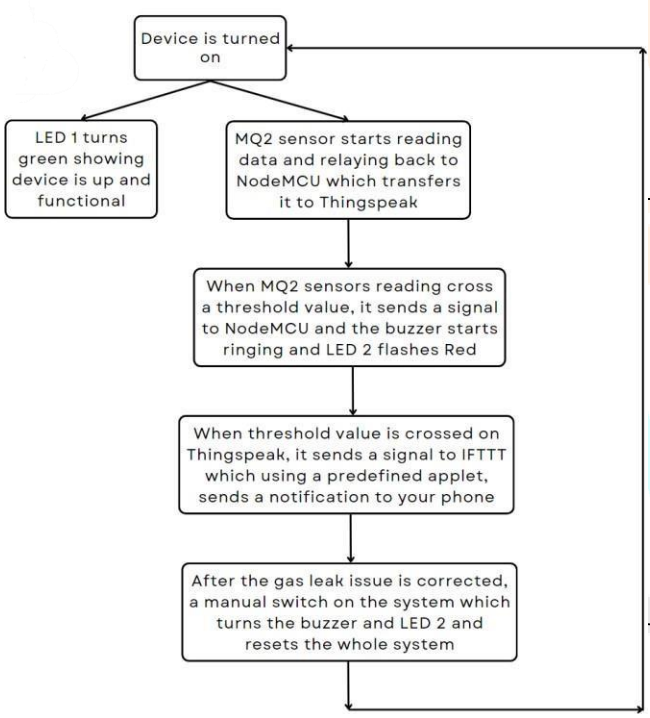
Data Visualization:

ThingSpeak Interface: The gas concentration data is displayed on ThingSpeak in real-time (with a small 15 second delay), enabling remote monitoring through web browsers and mobile devices. This server is further linked to an external GUI website, which showcases this data in real time, along with few extra features.

Testing:

Validation: The system's functionality is validated through gas release experiments to confirm the accuracy of gas detection and notification.

Flowchart



3.2 2Accident prevention System using 3-array IR Sensor.

System Configuration

Hardware Setup: The hardware system consists of the Arduino-UNO microcontroller. L298N motor driver that to control the 2 motors. A prototype car. 3-IR array sensor.

Software setup: the Arduino UNO is programmed in Arduino IDE. The code includes the logic to control the 2 motors on the feed of the 3-IR array sensor.

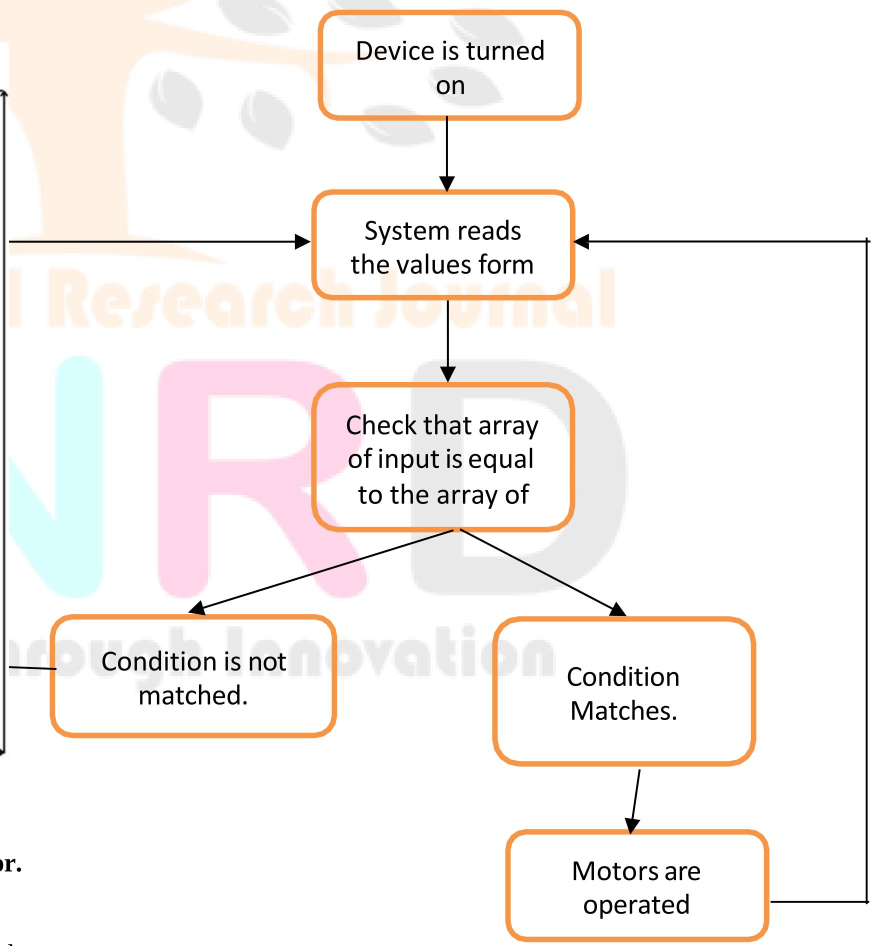
Code To Control the Motors Using 3-IR Array Sensor

The code consists a function that is 'CheckArray'. The function works as the it gets the input array using the 3-IR array sensor and if the input array matches the conditions given in the code the motors are operated according.

Circuit Connections

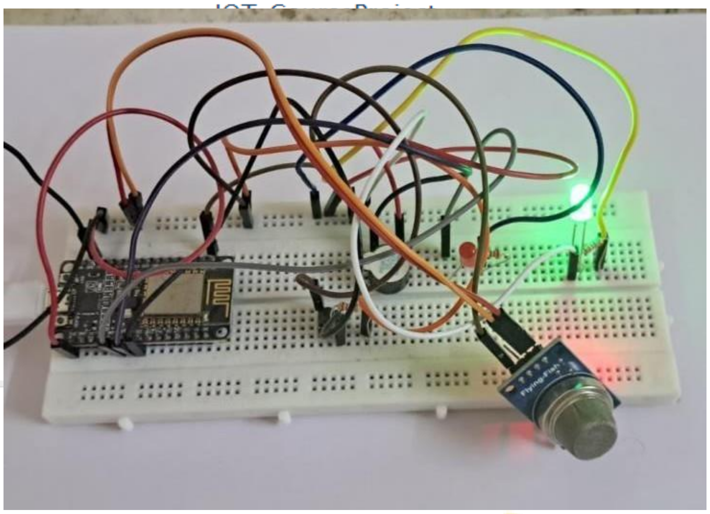
First the inputs of the 3-IR array sensor is connected to the Arduino-UNO that the IR1is connected to the digital pin 3 of the Arduino- UNO.IR 2 is connected to the digital pin 4.IR3 is connected to the digital pin 5. The input pins for the motor driver L298N are connected to the analog pin A0, A1, A2, A3 respectively. The Enable pins of the motor 1 and 2 of the motor driver is connected to the digital pin 6,7 respectively. The power is given by the 12v DC battery terminals of the battery is connected to the L298N motor driver as to the 12V input and the ground to the ground of L298N. The 5V output of the L298N is connected to the Vin of the Arduino-UNO and the ground of the L298N is connected to the ground pin of the Arduino-UNO. As to make the ground common for the whole circuit we connect the ground of the IR sensor to the ground of the Arduino-UNO.

Flowchart



1. RESULTS

4.1 Results for CNG Leakage Detection System



Response Time

The system exhibited rapid response times, with gas leaks detected and reported within a minute of exceeding predefined concentration thresholds.[1]

Accuracy

Calibration procedures ensured that the system accurately reflected gas concentrations levels.

Reliability

Throughout the testing phase, the systemdisplayed high reliability in gas leak detection, with minimal instances of false positives or false negatives.

User Notifications

The integration with IFTTT for mobile notifications proved to be effective. Users received instant alerts on their mobile devices whenever gas concentrations exceeded predefined safety thresholds.[2] Thesenotifications provided timely warnings, allowing for prompt corrective actions.

Test User Feedback:

During the project's demonstration and testing phase, users provided valuable feedback. They found the system easy to use and the mobile notifications highly beneficial in enhancing safety and security.

Overall, the results confirm the effectiveness of the Inflammable Gas Detection System with Mobile Notification Interfacing. It offers a robust solution for real-time gas monitoring, ensuring rapid response to potential gas-related hazards and enhancing safety measures.

IMAGES

Image 1: Thingspeak data visualization

Image 2: Hardware System with all connections

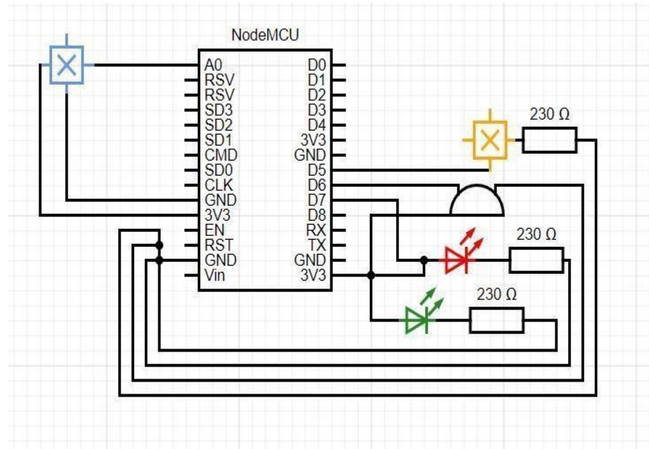


Image 3: Hardware System Architecture Diagram

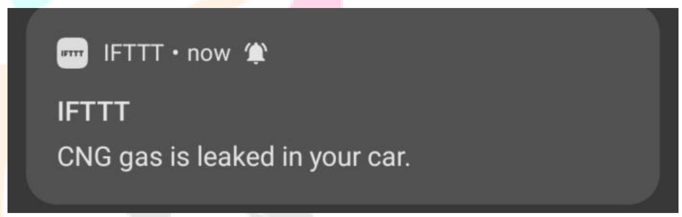


Image 4: Mobile Notification

4.1 Results for Accident prevention System using 3-array IR Sensor

Response time: the response time for the operation of the 3-IR array Sensor that the and values reading and operating the motors is so rapid.

Accuracy: As per the recent accuracy it is accurate that to detect the proper line and to operate accordingly.

Reliability: Throughout the testing phase, the system displayed high reliability in gas leak detection, with minimal instances of false positives or false negatives.

1. DISCUSSION

The Inflammable Gas Detection System with Mobile Notification Interfacing presented in this study offers a promising solution for enhancing safety and security in environments where the presence of inflammable gasesposes potential risks. The discussion section provides an analysis of the project's implications, limitations,and future considerations.

System Performance and Reliability:

The system demonstrated robust performance in gas detection and notification. The low response time, high accuracy, and reliability are notable achievements, making it a valuable tool for early gas leak detection. This is particularly crucial in industrial settings,laboratories, and households, where gas safety is a paramount concern.

Data Analysis Insights:

The analysis of gas concentration data highlighted the system's sensitivity to changes in environmental gas levels. Understanding these patterns and variations is essential for proactive gas safety measures. Future research can delve deeper into the identification of specific gas types and their sources based on concentration trends.

Integration with Mobile Notifications:

The seamless integration with IFTTT for mobile notifications empowers users with real-time information, enabling them to take immediate action in the event of gas leaks. The accessibility of this feature on mobile devices enhances the practicality and utility of the system, making it a valuable addition to smart home and industrial automation.

User Feedback and User-Friendly Design:

Positive user feedback underscores the user- friendliness of the system. A simple and intuitive interface, coupled with effective notifications, ensures that even non-technical users can benefit from this technology. User feedback also indicated satisfaction with the reliability and promptness of the notifications.

Limitations and Future Considerations:

Despite the successes of the system, there are areas for improvement and further exploration. Some limitationsinclude:

Gas Specificity: The system currently detects a rangeof inflammable gases but does not provide gas-specific information. Future iterations could address this limitation for more precise hazard assessment.

Scalability: While the system's hardware and software are adaptable, scaling it for large, multi-sensor deployments may require optimizations.

Environmental Factors: The impact of environmental conditions on sensor performance, such as temperature and humidity, should be further investigated to enhancesystem robustness. IR sensor is always supposed to be clear

Energy Supply: For deployments, the system needs to have uninterrupted and constant energy supply, which might be an issue in places with connectivity issuesand use of batteries might make the system more proneto energy loss.

Future Scope: The code can improvise that it can be more prices by integrating PID. Hardware can be improvised that it can be cased properly and we can use proper cables instead of open jumper wires.

2. CONCLUSION

The leakage of the gas in a car can cause the major accident. This CNG leakage detection system prevents this accident just by the detecting the level of the gas leakage. Along with this there is the accident prevention system that helps to the driver when it is in the mountain ranges where it is difficult to drive in such case that the IR sensor will help the car to be on the track for all the time

3. REFERENCNS

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