IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Enhancing Safety, Efficiency, and Convenience in Gas Usage: The Advantages and Challenges of Gas Management Systems

Arivarasan S[1], Kaviya Dharshini S[2] , Ponnarasi V[3] and Kiruthika U[4]

[1]Assistant Professor, Computer Science and Engineering, V.S.B Engineering College, Karur, Tamilnadu, India

[2] Student, Computer Science and Engineering, V.S.B Engineering College, Karur, Tamilnadu, India

[3] Student, Computer Science and Engineering, V.S.B Engineering College, Karur, Tamilnadu, India

[4] Student, Computer Science and Engineering, V.S.B Engineering College, Karur, Tamilnadu, India

Abstract—

Gas booking is a major requirement in every individual's life. The need of this project is to save time while booking of gas. When we call the gas agent our request may not be recorded or call cannot be connected. These are all waste of the person's time. If we have not noted the completion of gas we need to book it in black for money. By this project the level of the gas will be monitored at all the time and we get message when gas is about to complete or critically low that is below 20%.

In this project we would like to introduce an arduino based system in which the load cell used to discover the weight of the gas present inside the cylinder .The gas sensor is used to measure or detect the gas leakage in the system. The sensor has the proper sensitivity and the brief reaction time at fewer prices. If gas completion is identified message to the lawful candidate or family member through the usage of the cloud, it alerts the lawful candidate or family member by sending the notification to refill the cylinder. Furthermore, the sensor is utilised to detect gas leaks at home. If a gas leak is detected automatically, a message will be sent to the user. IOT is one of the most widely utilized networks on the planet. As a result, a load cell has been utilised to periodically check the weight of the gas. Following that, the values are supplied into the microcontroller. If the gas in the cylinder reveals a value where the remaining percentage level is less than the threshold level specified for gas to be reported as being empty, an automated message will be sent to gas enterprise to book the replacement cylinder. Following that, the customer will receive a response message on the booking status. Meanwhile, in the gas sector, application software is being created to inform and record the booking. This work assists the society in particularly indicating gas leakage and also assists both clients and the agency in automatically booking gas utilizing the IOT approach. Gas leakage is a serious issue in the industrial sector, as well as in residential areas. Installing a gas leak detection kit in sensitive places is one of the preventive techniques for avoiding an incident caused by a gas leak. The purpose of this work is to present a system for detecting, alerting, and automatically controlling gas leaks. A gas sensor with a high sensitivity to gases such as propane and butane, as well as LPG, was employed in particular. After the LPG has been identified, an alert is activated. The gas leak detection system comprises of a IOT module that sends an message to the user.

Keywords: ARDUINO UNO, NODEMCU, GAS SENSOR, LOAD CELL

INTRODUCTION

This framework makes use of a limited radiation sensor and a gas sensor, which collect data and send it to the IoT component. The major purpose of the entire scenario is to identify radioactive leaking and poisonous gas. If any radiation or toxic gases are present in industrial areas, the gases or radiation mostly affect adjacent live individuals. Relies on untrustworthy gas and radiation detection. LPG is used for a variety of functions in households and business settings, including cooking, heating, lighting, cooling, and so on. This energy source is mostly composed of extremely combustible chemical compounds such as propane and butane. LPG loss can occur in a house, company, or gas

factories, but infrequently. The loss of this gas can be hazardous since it raises the possibility of an explosion. An odor, such as ethanol, is added to the LPG so that most people can detect the losses. Yet, some persons who have a poor sense of smell may not depend on this inherent safety mechanism. In these situations, a gas leak detector is essential for protecting people from the hazards of gas leakage. A lot of research articles on gas leak detecting techniques have been published. We have read a study piece concerning our topic "

Enhancing Safety, Efficiency, and Convenience in Gas Usage: The Advantages and Challenges of Gas Management Systems". This paper describes the detection and alarm system for LPG gases, which is used to prevent fires and protect the safety of the house. In the country, around 30 core people utilize LPG, accounting for 40% of the population. For the gas leak detecting system, many standards have been established. The present system includes an alarm system designed primarily to detect gas leaks in residential and commercial properties. The primary goal of this system is to monitor liquefied petroleum gas (LPG) leaks in order to avert catastrophic fire incidents and assist safety actions. The technology detects LPG leaks from the gas sensor and notifies the user through text message of the leak.

LITERATURE SURVEY

[1] Gas leakage source detection and boundary tracking of continuous objects have received a significant research attention in the academic as well as the industries due to the loss and damage caused by toxic gas leakage in large-scale petrochemical plants. With the advance and rapid adoption of wireless sensor networks (WSNs) in the last decades, source localization and boundary estimation have become the priority of research works.

[2] With the increase of large outdoor advertising boards, the issues of public safety raised by the collapse of outdoor advertising boards have attracted great public concern. In this paper, a wireless sensor network (WSN) monitoring system is designed for the structural health monitoring (SHM) of large outdoor advertising boards.

[3] Toxic and Combustible gases are one of the most notorious killers of Oil and Gas Industry (OGI) workers. Hardly can one find an accident in which they are not involved, as such governments around the world enforce the use of gas sensors in all works that are related to these gases. Until recently, wired gas sensing systems are used.

[4] This paper focus on a leak diagnosis and localization method based on infrared image sequences. Some problems on high probability of false warning and negative affect for marginal information are solved by leak detection. An experimental model is established for leak diagnosis and localization on infrared image sequences. The differential background prediction is presented to eliminate the negative affect of marginal information on test vessel based on a kernel regression method..

[5] Detection of gases in industrial contexts is of great importance for ensuring safety in storage and transport in order to limit atmospheric pollution and precisely control industrial and agricultural processes. Although chemical sensors are in widespread use, solid-state infrared detectors for gas sensing promise numerous advantages over conventional catalytic detectors in terms of sensitivity, calibration requirements, and lifetime.

[6] Methane is the primary constituent of natural gas and is used in many industrial processes. Detection of the presence of methane is important, especially before it reaches explosive concentrations. Earlier sensor types are based on catalytic adsorption (which may limit the sensor lifetime) at elevated temperatures (requiring additional power and possibly compromising safety). Recently, optical sensors based on infrared (IR) absorption by hydrocarbon molecules have become an important research focus.

[7] Leak detection is critical for the integrity management of oil and gas pipelines. The pipeline leak can cause a major accident, especially when transporting dangerous substances. The impact to the environment and human life is paramount and thus it is essential to detect the pipeline leak in time..

[8] In this study, a small leak detection method based on variational mode decomposition (VMD) and ambiguity correlation classification (ACC) is proposed. The signals acquired from sensors were decomposed using the VMD, and numerous components were obtained. According to the probability density function (PDF), an adaptive de-noising algorithm based on VMD is proposed for noise component processing and de-noised components reconstruction.

[9] In many water distribution systems, a significant amount of water is lost because of leakage during transit from the water treatment plant to consumers. As a result, water leakage detection and localization have been a consistent focus of research. Typically, diagnosis or detection systems based on sensor signals incur significant computational and time costs, whereas the system performance depends on the features selected as input to the classifier. In this paper, to solve this problem, we propose a novel, fast, and accurate water leakage detection system with an adaptive design that fuses a one-dimensional convolutional neural network and a support vector machine.

[10] The analysis of pipeline leakage signals, using 1 mm and 2 mm leaks, has shown that proposed detection method can detect a small leak accurately and effectively. Moreover, the experimental results have shown that the proposed method achieved better performances than support vector machine (SVM) and back propagation neural network (BP) methods.

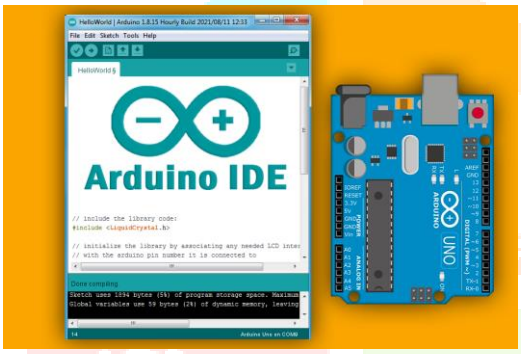
PROPOSED METHOD

The IOT-based gas leak detecting system is proposed. This system is made up of gas sensors such as co2 sensors. This framework makes use of limited gas sensors that collect data and communicate it to a web server via the internet of things module. When a gas leak is detected, this system sends an alarm message to the registered contact through IOT, and the buzzer turns on automatically. The weight of the cylinder as determined by the load cell and the gas leakage in the system are shown on the LCD display. When we receive a warning that the gas is going to run out or is dangerously low (less than 20%), the automated booking is initiated. Finally, using the IOT module, it sends an alarm to the registered cellphone number via a web server. Changes in parameters exceed the presets, the system will act automatically and assist in taking actions to control the environmental parameters.

SOFTWARE DESCRIPTION

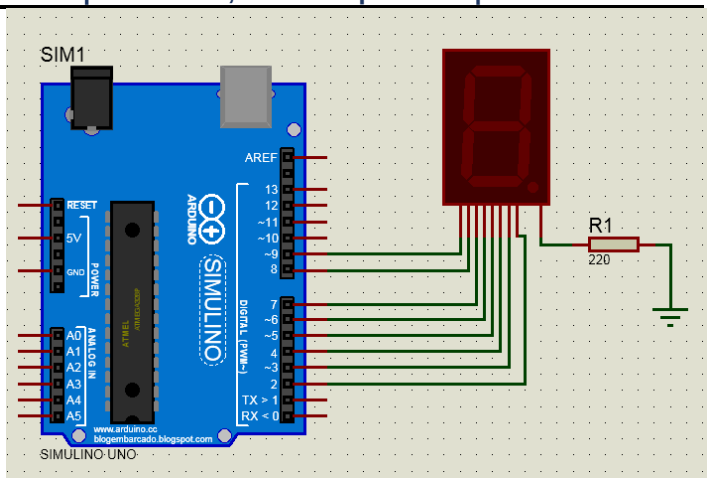
ARDUINO IDE

The Arduino IDE is an open-source software package that allows users to develop and upload code in real-time. Because this code is then saved on the cloud, it is frequently used by individuals looking for an added degree of redundancy. The system may be used with any Arduino software board. The Arduino IDE is compatible with Windows (11, 10, 8.1, 8, 7), Mac, and Linux operating systems. The majority of its components are written in JavaScript, making them easy to change and compile. While its primary purpose is to write scripts, there are various additional characteristics worth mentioning. It includes a mechanism for simply sharing any details with other project stakeholders. When necessary, users can adjust internal layouts and schematics. There are many assistance manuals available that will be valuable throughout the first installation procedure. There are also tutorials available for folks who do not have much familiarity with the Arduino framework.

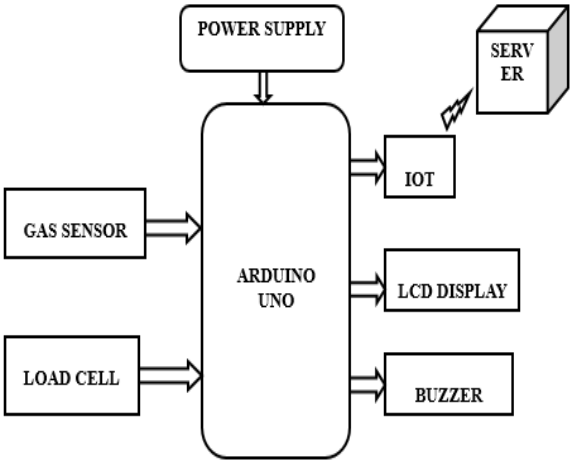


PROTEUS

Proteus Virtual System Modelling combines mixed-mode SPICE simulation with the fastest microcontroller simulation available. It enables quick software prototyping of both hardware and firmware ideas! Before ordering a real prototype, design, test, and debug your embedded projects with the Proteus electrical circuit simulator. Agile development for the workflow of embedded systems. Proteus VSM provides an environment for design entry and development by utilizing our established Schematic Capture software. Proteus Schematic is a well-known program that blends simplicity with sophisticated editing features. It supports schematic capture for both simulation and PCB design. Designs submitted for testing in Proteus VSM can be netlisted for PCB layout using either our own PCB Design products or third-party PCB layout tools. Designs submitted for testing in Proteus VSM can be netlisted for PCB layout using either our own PCB Design products or third-party PCB layout tools. ISIS also gives you a lot of flexibility over the aesthetics of your drawings, such as line widths, fill styles, typefaces, and so on. These capabilities are fully utilized in delivering the visuals required for circuit animation.



HARDWARE BLOCK DIAGRAM



HARDWARE BLOCK DIAGRAM

HARDWARE EXPLANATION

In my project,detect the gas leakage and alert to the person.The gas sensor sense the co2 level.If co2 level are high.my project indimate person through LCD and beep sound.And one more addition settings to add the IOT.The IOT monitor the safety accruement of factory/home in anywhere,

METHODS

MODULE LIST

- Arduino uno
- Power supply
- GAS sensor
- LOAD cell
- Node MCU
- Buzzer
- LCD

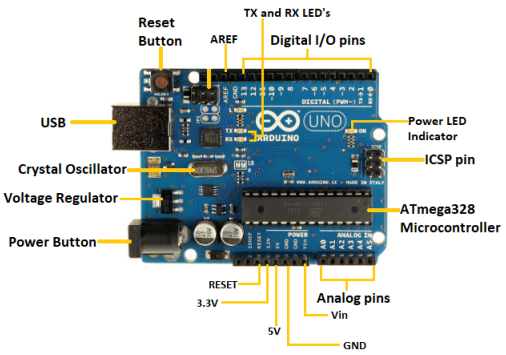
MODULE DESCRIPTION

POWER SUPPLY

A power supply is an electrical device that provides electricity to a load. A power supply's primary function is to convert electric current from a source to the proper voltage, current, and frequency to power the load. As a result, power supplies are sometimes known as electric power converters. Some power supplies are stand-alone units, while others are integrated into the load appliances they power. Power supplies seen in desktop computers and consumer electronics devices are examples of the latter. Power supply may also regulate the current consumed by the load to safe limits, shut off the current in the case of an electrical failure, and conduct power conditioning to prevent electronic noise.

Ardino uno

The Arduino Uno is an open-source microcontroller board created by Arduino.cc that is based on the Microchip ATmega328P microprocessor. It was first launched in 2010. The board has a number of digital and analogue input/output (I/O) pins that may be used to connect to various expansion boards (shields) and other circuits. The board features 14 digital I/O pins (six of which are capable of PWM output), 6 analogue I/O pins, and is programmable through a type B USB cable using the Arduino IDE (Integrated Development Environment). It may be powered by a USB connection or an external 9-volt battery, and it handles voltages ranging from 7 to 20 volts. It's comparable to the Arduino Mini and Leonardo. .



Gas sensor

Gas sensors are commonly understood to provide a measurement of the concentration of an analyte of interest, such as CO, CO2, NOx, or SO2, without delving into the plethora of underlying approaches such as optical absorption, electrical conductivity, electrochemical (EC), and catalytic bead technology . Many other gas sensors, however, as discussed in , measure a physical property of the environment around them, such as simple temperature, pressure, flow, thermal conductivity, and specific heat, or more complex properties such as heating value, supercompressibility, and octane number for gaseous fuels. The latter may necessitate capital-intensive (engines) or destructive testing, such as combustion, or may include the measurement of a variety of factors to serve as inputs to a correlation

Buzzer

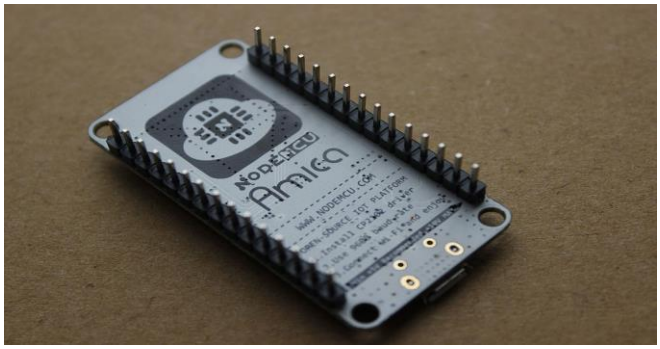
Piezoelectric buzzers, often known as piezo buzzers, were created by Japanese manufacturers and used in a variety of items from the 1970s through the 1980s. This improvement was mostly the result of collaborative efforts by Japanese industrial companies. They formed the Barium Titanate Application Research Group in 1951, which allowed the industries to be "competitively cooperative" and create various piezoelectric advancements and inventions. Earlier devices used an electromechanical mechanism similar to an electric bell but without the metal gong. Similarly, a relay may be wired to disrupt its own actuation current, causing the contacts to buzz (the contacts buzz at line frequency if powered by alternating current) These devices were frequently mounted to a wall or ceiling to serve as a sounding board. Piezoelectric buzzers, often known as piezo buzzers, were created by Japanese manufacturers and used in a variety of items from the 1970s through the 1980s. This improvement was mostly the result of collaborative efforts by Japanese industrial companies. They formed the Barium Titanate Application Research Committee in 1951, which allowed the firms to be "competitively cooperative" and bring about various changes.

LCD DISPLAY:

A liquid-crystal display (LCD) is a flat-panel display or other electronically controlled optical device that employs liquid crystals' light-modulating characteristics in conjunction with polarizers. Liquid crystals do not emit light directly, but rather utilise a backlight or reflector to generate colour or monochromatic pictures. LCDs can show random pictures (as in a general-purpose computer display) or fixed images with minimal information content that can be seen or concealed. Presentt words, numerals, and seven-segment displays, such as those seen in digital clocks, are all examples of devices having these displays.

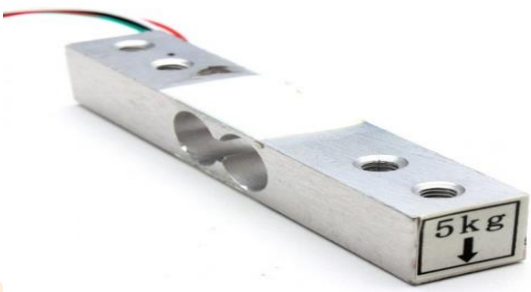
NODE MCU

NodeMCU is an open source firmware with open source prototyping board designs. The term "NodeMCU" is a combination of the words "node" and "MCU" (micro-controller unit). The word "NodeMCU" strictly refers to the firmware rather than the related development kits. A circuit board configured as a dual in-line package (DIP) that merges a USB controller with a smaller surface-mounted board housing the MCU and antenna is commonly used for prototyping. The DIP format enables for simple prototyping on breadboards. The design was initially based on the ESP8266's ESP-12 module, which is a Wi-Fi SoC combined with a Tensilica Xtensa LX106 core, which is frequently used in IoT applications.



Load cell

A load cell turns a force, such as tension, compression, pressure, or torque, into a measurable and standardised electrical output. It functions as a force transducer. The electrical signal varies proportionately to the force applied to the load cell. Pneumatic, hydraulic, and strain gauge load cells are the most popular. The strain gauges change shape when the spring element deforms. Voltage can be detected as a result of the change in resistance in the strain gauges. Because the change in voltage is proportional to the amount of force applied to the cell, the amount of force may be determined from the output of the load cell.



CONCLUSION

This project is based on the intelligent gas booking system using wireless sensor networks, and it is working well. The main parameters of the intelligent gas booking system are based on the safety purpose of today's life, as everyone uses LPG gas for cooking and other purposes, and there is no safety in the place. This project will function well in any complicated stage. During the design and construction stages in order to avoid snags at the final stage. The arrangement was created with great care to avoid mistakes in the circuit, and it was designed to be as straightforward as possible for us to grasp. The components have also considered performance and cost effectiveness.

To tackle the drawback seen in additional traditional methods, an intelligent system for toxic gas and radiation detection screening for caution has been developed utilizing IoT. The successful design, development, and implementation of a low-cost gas level detection system provides a fully automated approach to the booking of the gas and notifies the user when a gas leak is discovered as well as when the gas level is low. When a system leak is discovered or the gas level is dangerously low, the IOT notifies the user via message. When compared to other gas monitoring systems on the market, the cost of building the system is inexpensive.

ADVANTAGES

- Convenience
- Efficiency
- Safety
- Cost savings
- Environmental benefits

DISADVANTAGES

- Initial cost
- Maintenance costs
- Technical issues
- Dependence on technology
- Privacy concerns
- False alarms

APPLICATION

- Residential homes
- Apartments and gated communities
- Commercial establishments
- Gas agencies
- Industrial settings

FUTURE WORKS

Some potential future work for gas booking and leakage detection systems could include:

- Integration with smart home technologies: Gas booking and leakage detection systems could be integrated with other smart home technologies, such as smart thermostats or security systems, to provide more comprehensive monitoring and control capabilities. Predictive maintenance: Advanced analytics and machine learning algorithms could be applied to gas booking and leakage detection systems to predict maintenance requirements and prevent failures before they occur.
- Remote monitoring: Gas booking and leakage detection systems could be remotely monitored through cloud-based platforms, enabling real-time monitoring and control from anywhere.
- Enhanced leak detection: Technologies such as artificial intelligence and computer vision could be applied to gas leakage detection systems to improve accuracy and reduce false alarms.
- Use of renewable gases: With the increasing focus on environmental sustainability, gas booking and leakage detection systems could be adapted to manage the distribution and usage of renewable gases such as biogas or hydrogen.

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