Microcontroller Based Monitoring and Controlling of LPG Leaks Using Internet of Things

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Abstract. This paper aims to monitor LPG gas leakage continuously at home or in industry. In the event of gas leakage, this information will be updated via IoT communication to the web browser. The user can continuously monitor the data using IoT. The gas sensor that can detect LPG gas is called the MQ06 sensor. IoT, the LPG leak detection system in Arduino senses LPG gas using a LPG gas sensor. This project implements LPG gas sensor interfacing with Arduino. The signal is sent to the Arduino microcontroller from this sensor. A LED, buzzer and IOT module (ESP8266) are connecting the microcontroller. The design for the IoT LPG leak detector implemented using the ESP8266 chip. This Wi-Fi module is designed to connect microcontrollers to a Wi-Fi network and to connect to TCP/IP and send data. Emotion data is then sent to the IoT. The IoT module sends data to the web. The detector is switched on when a gas leak is detected and a "leak" message is displayed on the site. LPG leak detection system based on IoT and Arduino can be installed in homes, hotels and storage areas of LPG cylinder. The main benefits of this project are that it is possible to determine the leakage and to send the data to a website to monitor it and to take corrective measures. When adequate action is taken quickly after reporting on the IoT, it can help save lives and property losses.

Keywords: LPG, IoT, Arduino, Gas detection, RFID.

1. Introduction

This paper is an effective method and specifies the control of the volume of gas in the container as well as the ordering near the appropriate branch (gas agent) and filling the online message through the IoT module [1]. Subsequent measurements are made by means of a load cell operating on the basis of a piezoelectric sensor, e.g. When a gas is placed in a container, it measures the weight and sends an electric pulse to a microcontroller that compares the pulse to the best value in digital form (an electric pulse becomes an equivalent numerical value).

If the comparator output is high, it sends a (high) pulse to the web server, updates the internet but does not have a sequence, and if the comparator is low, sends the (low) pulse to the web server updates the internet and even orders fuel. For the convenience of the user, there is even a radio frequency module (100mm) [2], [3] with an encoder set from the main board and a decoder from the internal panel, so the need to provide that happens when ordering the gas. It informs the client of the siren alert.

We use IoT to warn users to prevent further gas leaks. Toxic gas is harmful to health but is widely used in industry. These gases must be controlled. An increase in their normal levels can be felt and appropriate precautions can be taken. The Arduino [4] sends a notification message to users via an ethernet switch through the Android app and servo motor to shut off the gas valve by connecting the alarm and LCD sensor to display the desired task. The system detects a gas leak with the help of a gas
sensor and notifies the Arduino board that performs such actions as, for example, audible signals, close the gas valve and turn on the suction fan.

2. Related Works
In 2008, Chen Pejian and Jiang Xuhua [5], focused on wireless monitoring in an article entitled “Design and implementation of remote monitoring system based on GSM” because wireless remote control with remote control based on SMS via GSM.

In 2002, K. Galaxy, V. Vlodarski, K. Kalantar-Zade, and A. Trinchi [6], “Study of gas sensors for cabin air quality control” in this work analyzed the use of iron oxide electrodes to increase air quality in the vehicle. The gas sensor controls sold in this article are compared to the MQ-3 based sensors with gas-like properties. The response of the sensor is higher than that of the commercial device tested.

In 2008, Liu Xianya, Wang Zheng dong and Chheng Rong [7], focused on "smart home security alarms and remote control systems based on a single computer." In this automatic control of audio alarm and remote control leakage based on 89C51 computer chip. The system can call the police number and issue an emergency alert. It can also be an alarm and show the address where the alarm came from. This smart security system can be controlled remotely by phone.

Implementations which are shown above with Internet of Things: Challenges and state-of-the-art solutions. This paper gave us the details about IOT based monitoring LPG gas leakage continuously at home or in industry.

3. Methodology
Embedded systems include microcontrollers (ATMega-328), the main technology unit of the whole system, and all modules and devices can be attached to microcontrollers. Figure 1 below shows the block analysis.

![Figure 1. The proposed system block diagram](image)

The system has an MQ-6 gas sensor connect it to the thermostat. Both devices know the level of gas and the temperature of the environment in which the system is installed, that is, display the readings on the LCD. The Ethernet shield is connected to the Arduino Uno board embedded in the software code for termination user warning. When the gas level exceeds the predetermined level (250 PPM for the proposed system), the transmitter warns the user [8].

The user can control the device connected to the system by a fan, a fan, a smoke alarm, an alarm / a motor, and a gas shutoff valve. Users can enable / disable these devices using the Android app that supports the Arduino configuration (Blynk app) in conjunction with the thermostat. Both devices know the level of gas and the temperature of the environment in which the system is installed, that is, display the readings on the LCD.
Embed in software code to send warning to users. When the gas level exceeds the predetermined level (250 PPM for the proposed system), the transmitter warns the user. The user can control the device connected to the system by a fan, a fan, a smoke alarm, an alarm / a motor, and a gas shutoff valve. Users can enable / disable these devices using Android application software, which supports Arduino configuration (Blynk application).

3.1. Hardware Tools
3.1.1. Arduino Uno
The Arduino is an interactive space designed to make applications compatible with nearby micro-monitors. Features of the 8-bit Atmel AVR microcontroller or open source hardware built around 32-bit ARM. Modern models have a USB 6 interface, 6 analog inputs, and a 14-pin digital I / O interface that allows users to connect different expansion boards.

Arduino Uno is an ATmega328 based microcontroller and is shown in figure 2. It has 14 digital input / output contacts, six of which can be used as output PWM, 16-megapixel ceramic, ISO, USB connector, 6 analog inputs, power outlet and reset button. This provides all the support for a microwave. To get started, connect them to computer with either a USB cable or a USB adapter or battery. The Arduino Uno board differs from the other boards, and they do not use a chip for drivers from the FATIU USB. It is programmed as Atmega16U2 USB converter (up to Atmega8U2 R2).

3.1.2. LCD Interfacing to Microcontroller
The LCD (Liquid Crystal Display) is a flat screen device and its schematic is shown in figure 3 used to display electronic data in form text or integers. The lightweight structure and portability are its main characteristics. When the sensor value is stored in the EEPROM, the date and time are continuously displayed on the LCD. LCD uses four data lines to transmit data. When RS = 0 and EN nodes reach the top, the LCD will be released. When RS = 1 and SL reach the peak, the LCD will be released. VEE is used to adjust contrast.

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Figure 2. Arduino Uno board

Figure 3. LCD connection to ATMega-328
3.1.3. Gas sensors
The following figure 4 shows MQ-2 gas sensor unit. This is a great sensor [9] for detecting hazardous liquid leaks in our homes or service stations in warehouse environments and even in vehicles that use liquid gas such as fuel. The device can be easily connected to an alarm / block circuit to provide an alarm or display the focus of a liquid coil. The sensor has good sensitivity with fast response time.

![Figure 4.MQ-2 Gas Sensor](image)

3.1.4. ESP8266EX Wi-Fi
ESP8266EX (ESP- Expressive Systems Smart platform; Exercised version) offers a complete and original wifi network solution that can be acquired by the application or downloaded by wireless applications from another application to the processor. ESP8266EX receives the program directly from external light. Such software has an integrated cache to improve the system performance. As a Wi-Fi adapter, you can connect the wireless internet to any microcontroller design with a simple connection (SSI interface). It includes antenna connectors, electronic modules, power amplifiers, low noise receivers, filters, power control modules and solutions designed to achieve minimum PCB areas including modules. The ESP8266EX is often integrated with external sensors and other special devices through its GPIO device, so it can work as a completely separate system if needed. So the IoT [10] module has a base phrase on the paper.

3.2. Flow chart
The task of displaying the output from the microcontroller in both the LPG leakage detection as well as LPG monitoring is explained in flowchart.

![Figure 5.Flow chart of LPG monitoring](image)

The proposed LPG monitoring system and the leak detection system consists of two sensors a microcontroller, LCD display, relay and a buzzer. The proposed system operates on 230 volts AC, which is converted to 12 V DC. Using the IC7805 voltage regulator, the 12 V power supply is reduced to 5 V and is used in the proposed system. MQ-2 is a gas and gas detection sensor with components. The proposed system uses propane and butane. As a very sensitive sensor, it detects the presence of liquefied gas at a concentration of 200-10,000 ppm. It contains an outer membrane
containing zinc dioxide (SnO2). When in contact with protons, compounds and butane in a liquid, the coating interacts with them, resulting in an output voltage. This voltage is processed by the microcontroller to obtain a numerical value. As a result, digital values inform consumers.

LCD is used to display the results after the operation in the microcontroller. The LCD screen used in the proposed system is JHD 162A, which is a 16×2 LCD. It is used in 4-bit mode and it is given the task of displaying the output from the microcontroller in both the LPG leakage detection as well as LPG monitoring.

LCD screens are used to display the results after the measurement on a microcontroller. The LCD screen used in the proposed system is a JHD 162A with 16 × 2 LCD. It is used in 4-bit mode and serves to demonstrate the results of micro-monitoring devices in the detection of LPG leaks as well as in the detection of LPG.

4. Implementation and Results

The hardware implementation of the system when power supply is OFF and on is shown in figure 6 and 7. When the gas sensor detects HIGH LPG readings from the surroundings area the Buzzer rings to alert neighbours of danger so they can react to diffuse the situation.

Case1: When there is no gas leakage, the alert system remains silent and user would not receive any alert notification.

Case2: If the alert is triggered from the gas sensor it means that there is LPG gas leaking in the surrounding. In this case the alarm alert is turned ON and the user will get a notification “LPG DETECTED” and is shown in figure 8. The following figure 6 shows an update for any change in the liquid gas level online through IoT with only low (0) or higher (1). Gas is considered low when level 0 occurs and high if level 1 occurs.

![Figure 6. Hardware implementation when power supply is OFF](image)

![Figure 7. System when power supply is ON](image)
Figure 8. System when LPG Gas is not detected

The following figure 9 shows an update for any change in the liquid gas level online through IoT with only low (0) or higher (1). Gas is considered low when level 0 occurs and high if level 1 occurs.

Figure 9. Gas Level Monitoring

The figure 10 shows the condition of the gas container, knowing the possibility of any gas leak near and around the gas tank, the sensor will continue to feel constantly and if any changes are detected will be Update online with IoT. If the level is 1 then there is gas leakage from the tank.

Figure 10. Gas Leakage Level

The figure 11 measures the temperature of the sensor, which measures the temperature near the gas condenser to prevent a small fire situation. If the first level has a fire near the gas tank, otherwise it is normal.
5. Conclusion
The proposed system detects gas and its prevention is easy for any type of user, whether technical or not. The system sends out alerts to users wirelessly and users can easily connect to a device through a smartphone. The easy operation of equipment such as the exhaust fan makes the environment more vulnerable. The use of the Arduino container controller also makes the system cheaper. Easy access and easy management make the system highly efficient. It is an integral part of all the hardware components used. The presence of each module is carefully thought out and placed, thus contributing to the optimal operation of the unit. Second, with the help of emerging technologies, the use of advanced IC’s has been successfully implemented.

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