ISSN: 2278-4632
Vol-14 Issue-01 2024

Internet of Things (IoT) based Gas leak detection and Alarm system powered by Blynk

Mr. MOLUGUMATI PREMCHAND[1], Mrs. G. LAKSHMI PRASANNA[2] , Mrs. VELPURI PADMA[3]
ASST PROFESSOR[1] , ASSISTANT PROFESSOR[2,3] DEPARTMENT OF ECE,
SWARNANDHRA COLLEGE OF ENGINEERING AND TECHNOLOGY, NARASAPUR

Abstract

Liquefied petroleum gas (LPG) is a chemical by-product of petroleum, thus anybody working with gas or in industrial settings should exercise caution around it. Gas leaks are harmful to both people and the environment. Therefore, it is important to regularly inspect and maintain the workplace atmosphere to prevent such disasters and to keep the air pure. The Internet of Things is at the heart of the proposed gas leakage monitoring system. The NodeMCU ESP8266 Wi-Fi module serves as the microcontroller for the system. A combustible gas sensor (MQ2) (CO) can detect gases like methane (CH4) and carbon monoxide. We can see the gas concentration using the ThingSpeakIoT Platform after sending the voltage output from the MQ2 sensor to the BlynkIoT platform via an iOS phone. Instantly upon detection of a leak, an alarm will go out and a fan will begin to run.

KEYWORDS:

Things that talk to one other, a gas leak, the Internet of Things, a Blynk platform, LPG, and an alarm system

INTRODUCTION

Living in a safe environment is of utmost importance. Being safe is being aware of, and acting accordingly, towards any dangers that may cause harm or death in the environments that people frequent. A great number of houses and individuals are vulnerable to various threats. The gas leak is worrisome since it might seriously injure the person's surroundings. [1] A mixture of commercial gases such as butane and propane with saturated and unsaturated hydrocarbons, liquefied petroleum gas (LPG) was created by Dr. Walter Snelling in 1910. In addition to being utilized as a fuel source, LPG has several other practical uses, such as in automobiles, for warmth and lighting, and in numerous other non-domestic situations. The practice of LPG leakage is becoming popularity. Nevertheless, devastating flames might ensue from LPG leakage. Deaths caused by these incidents have also been on the rise in recent years. Because of this, an LPG leak detection and prevention system is essential. In the past, people would use chemically-dipped paper that changed color when exposed to certain gases in order to detect them. This method was used until the 1980s, when home electronic gas detectors were invented. Meanwhile, a number of tools were developed to detect, track, and notify of the release of harmful gasses [2]. The chemical compound LPG, which combines propane and butane, is very flammable. Because it is an odorless gas, it is possible to detect leaks rapidly by adding ethanethiol, a strong odorant. LPG From 0.72% in the past, gas leaks are currently the cause of 10% or more of all kitchen accidents. It is believed that the 5 kilogram small LPG cylinder, which does not need a rubber tube but instead has the burner placed immediately above it, is safer than the one that uses a rubber pipe, as the latter runs the danger of leaking if it were to break [3].

ANALYSIS OF READINGS

The authors of [1] developed a gas leakage detection system that uses an Arduino UNO and a SIM900 GSM/GPRS gateway to notify people when harmful gasses are present. If a gas leak is detected by the gas sensor, the authors of [2] propose an automatic SMS alerting system over GSM. Their technology can determine the weight of the LPG cylinder and display it on the screen. If the quantity is 10 kg or less, the dealer will get an SMS to reserve an LPG cylinder. In addition, when the weight of the LPG cylinder falls below 0.5 kg, it reminds the inhabitants to change it out by sending a text message. The author explains a method for measuring gas concentrations in percentages and parts per million in [5],

ISSN: 2278-4632
Vol-14 Issue-01 2024

which might shield humans from the airborne toxins. In his proposed configuration, a MQ2 gas sensor would be used in conjunction with an Arduino Uno R3, a nRF24L01Plus Wireless Transceiver Module, and the ability to monitor the gas sensor's output using serial monitoring inside the Arduino programming environment. To build a prototype for gas detection based on the internet of things, the author of [6] recommends the Proteus design suite. For data analysis and comprehension, he uses the Blink Internet of Things platform. To summarize, he said that the proposed method lets the user connect the devices using a smartphone, no matter where they are, and get alert alerts wirelessly.

PROPOSED SYSTEM COMPONENTS

In this research, the hardware components (Gas Sensor MQ-2, Wi-Fi Node MCU ESP8266, Fan, Power Supply 9V, Buzzer, Relay, Buttery 3.3v to 5v, red LED and green LED, Transistor B514, Breadboard, 200 ohms resistors) were used along with Blynk Application. The following subsections describe the details of the proposed system. Table (1) below review the components, their quantity, and price in IQD.

TABLE 1

List of required hardware opponents, quantity and price in IQD

Component	Quantity	Price
ESP8266 nodemcu	1	13000
MQ2 gas sensor	1	5000
T09D060-2D1 power supply	1	8000
92*92*25mm fan	1	3000
Buzzer	1	1000
Normally-open relay	1	2000
9 volts battery	1	3000
Bread board	1	3000
LEDs	2	1000
Transistor	1	2000
Resistor	1	250
Wires	16	3000

METHODOLOGY

The gas sensor MQ-2 will communicate with the controller (ESP8266) over the controller's analogue port (A0) (4), as illustrated in Figure 1, in the event that a gas leak is detected. The ESP8266 controller will then use Wi-Fi in conjunction with the Blynk app, which is available for both Android and iOS; the recommended system operated on iOS), to detect and respond to gas leaks. Simultaneously, the gas leak will be expelled by turning on the fan, and a warning will be sounded via the microcontroller's digital interface (D5) by turning on the buzzer. When the red LED is on, the circuit is closed, and the relay turns on and off high loads, like the fan, in this example. The transistor acts as a switch, turning on and off low loads. Figure 5 shows the flow diagram of the proposed system.

FUNCTIONAL PRINCIPLES

The sections that follow will explain how each component of the proposed system would function in practise. a)

Blynk is a Platform.

Everyday items may be remotely accessed and handled using digital technologies like smartphones and computers thanks to the Internet of Things (IoT), a network that links these products. Smart homes employ IoT to manage lights and other home appliances, in addition to its use in industrial control systems and home security systems. Managing the building's internet and phone connections, operating fully automated industrial equipment, etc. The Internet of Things opens up new avenues for imagination. Large structures, such as factories or government buildings, often have a lot of lights. On sometimes, employees would forget to turn them off when they left for the day. Security might

ISSN: 2278-4632
Vol-14 Issue-01 2024

potentially save energy usage by controlling the building's lighting using Internet of Things (IoT) clouds or applications.

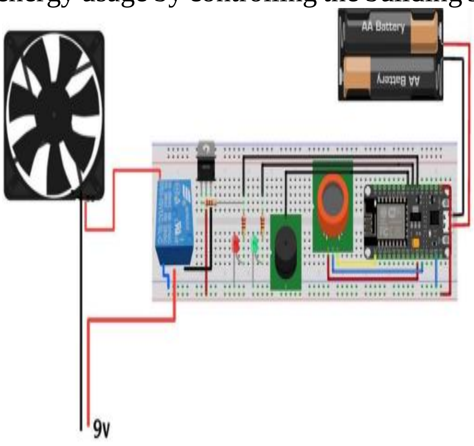

Fig. 1: Circuit Diagram of the Proposed System.

Blynk is an IoT platform that supports both IOS and Android while being compatible with a plethora of microcontrollers such as Node MCU (ESP), STM32, Arduino and Raspberry Pi over the Internet. The architecture of Blynk consists of three major components: [9] 1) The Blynk application, which controls an embedded system and displays sensing data on widgets.

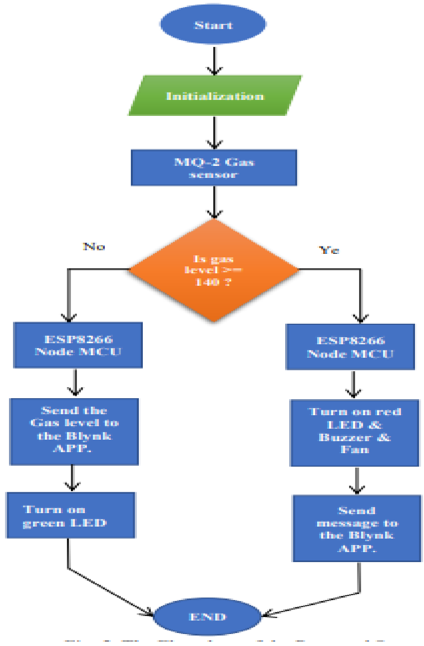

Fig. 2: The Flowchart of the Proposed System.

2) The Blynk server, which allows all cloud-based communications between smartphones and embedded system.

3) The Blynk libraries, which consist of various widgets to perform different control, display, and time management operations.

Proposed System Operations

This system contains two power sources. The first source is a power Supply T09D060-2D1, which is a transformer that converts high voltage 220v to low voltage 9v and feeds the fan. The second source is a battery rechargeable (3.3v-5v) that feeds the controller (Wi-Fi Node MCU ESP8266) as well as the rest of the circuit elements. The controller ports must be connected to the sensor as follows: (Vc→ 3.3v

ISSN: 2278-4632
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, GND → GND , A0 → A0) also (D5 → +buzzer , D6 → + green LED , D7 → +red LED) The relay is also connected to the transistor and the fan, as shown in Fig. (6) below:

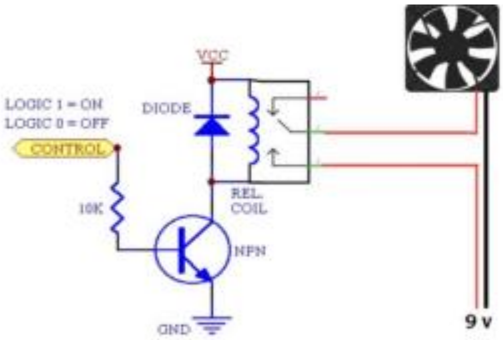

Fig. 3: Relay Connections.

REAL TIME PROTOTYPE

Using the controller (ESP8266) and the gas sensor (MQ 2) as described in the preceding sections, the system represented in Fig (7). When a gas leak is detected, the sensor will send a signal to the controller over Wi-Fi; the controller will then notify nearby mobile devices through the Blynk app, should a leak be there. An Internet of Things cell phone is employed in this setup. The red light and fan are operational, too.

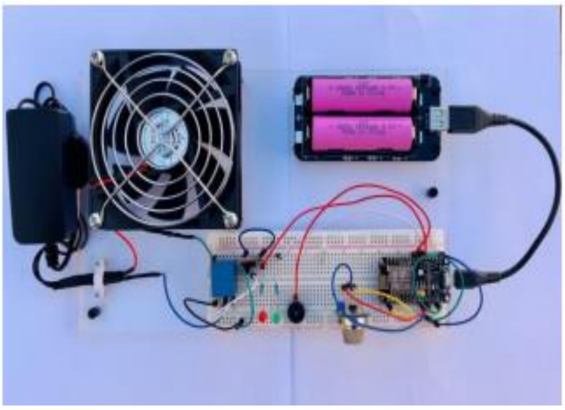

Fig. 4: Real-Time Prototype of the Proposed System

BLYNK'S IOT PLATFORM RESULTS

When a gas leak occurs, a message warning of the presence of leaked gas will be sent to the mobile phone interface as shown in Fig. (8) below which clarifies the Blynk app. notification.

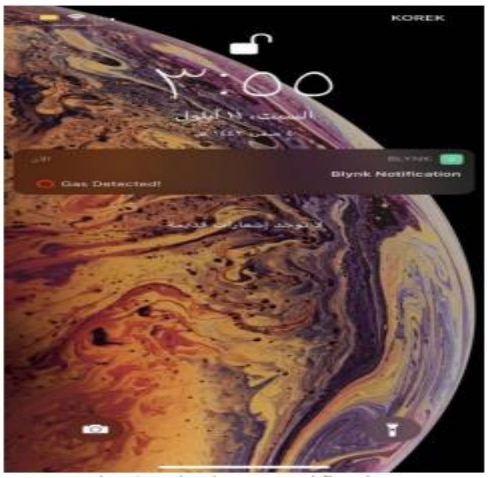

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Fig. 5: Blynk app notification.

Figure 9 shows a gas leaking example with a Blynk warning message; the quantity of gas, as measured by the gas sensor, is shown. The gas level, for instance, was 192, which is more than the allowable limit of 140. The typical state of the system, with no gas leakage, is shown in Fig. (10) by the data sensor reading value of 75, which does not above the threshold limit of 140. The following table provides the basis for the system status, which should be stated.

TABLE 2

Threshold of Gas Detection

MQ2 Sensor Reading	Status
< 140	No gas leakage
≥ 140	Gas leakage detected

IoT Thing speak platform is used to record the readings of the MQ2 gas sensor. Fig. (11) views the readings that performs the LPG intensity in the gas leakage location. Fig. (12) shows the details of 'Field1' from 8 fields available in the Things peak's channel. The starting of the leakage is also illustrated in the figure. From Fig. (12), starting of the gas leakage is clear in the details of the Things peak's field1 where the gas sensor reading was 141 which presents the gas intensity in the atmosphere with 14.1%.

Fig. 6: Blynk app notification for gas leakage case.

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Fig. 7: Blynk app notification for no gas leakage case

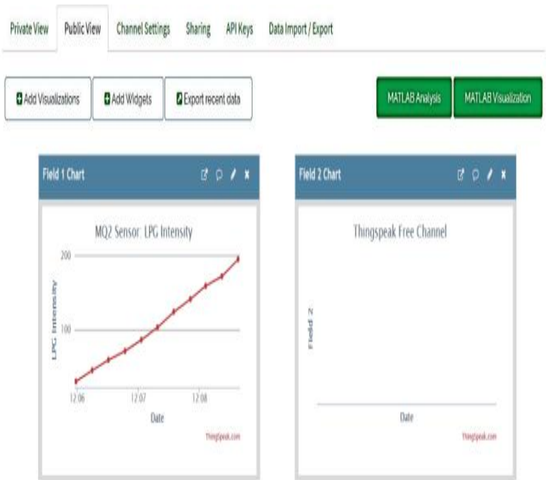

Fig. 8: Thing speak IoT platform visualization for gas sensor readings

Fig. 9: Things peak's channel1/field1 visualization for gas sensor readings.

CONCLUSIONS

In this research, we lay forth a plan to use the Internet of Things to detect gas leaks at lower levels. The gas leak is detected by the MQ-2 gas sensor. A signal is sent from the sensor to the microcontroller, which in turn connects with the ESP2866 NodeMCU. The microcontroller then triggers the signal that is sent to the external device that acts as a mobile phone simulator. To prove its worth, the NodeMCU floods the Blynk app with messages at once, maybe even once per second. This is a lot more often than the message frequency needed by other IoT systems. For example, the gas sensor data are recorded once every 15 seconds using the Thing Talk IoT platform. By modifying the code of the Nidec, one may change the maximum number of alerts that can be sent. The simplicity of operating equipment, such as the exhaust fan, directly correlates to the decreased possibility for harm. To keep costs down, we used NodeMCU, a low-cost microcontroller. The system is user-friendly since it is simple to access and manipulate. In addition, the research presents a gas leakage detection system that utilizes two IoT platforms: the Blynk app to notify the concerned person and the Thing Talk cloud to store and display the data.

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