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Blynk-powered gas leak detection and alarm system based on the Internet of Things

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Abstract

Industrial settings or people who work with gas or liquefied petroleum gas (LPG) should be cautious since it is a chemical by-product of petroleum. Damage to the environment and human health are both results of gas leaks. So, to avoid such calamities and in order to maintain a clean air environment, the workstation atmosphere should be routinely checked and maintained. The suggested gas leakage monitoring system utilises IoT technologies. The system's microcontroller is the NodeMCU ESP8266 Wi-Fi module. Methane (CH4) and carbon monoxide gas may be detected with the use of the combustible gas sensor (MQ2) (CO). The gas concentration will be determined by the voltage output of the MQ2 sensor, which will then be sent to the Blynk IoT platform through an iOS phone, and visualised using the Thing speak IoT Platform. An alarm will sound and a fan will start up the moment a leak is detected.

KEYWORDS:

The Internet of Things, a gas leak, a Blynk platform, Thing speak, liquefied petroleum gas, and an alarm system

INTRODUCTION

Having a secure environment to live in is crucial. To be safe is to be aware of, and take precautions against, the kinds of hazards that may hurt or kill people in the places they frequent. Many homes and people are at danger from a wide variety of hazards and possible dangers. The gas leak poses a concern since it might cause significant harm to the area where the individual is. [1] In 1910, Dr. Walter Snelling developed liquefied petroleum gas (LPG), a combination of commercial gases like propane and butane with saturated and unsaturated hydrocarbons. Because of its versatility, LPG is used for a broad range of applications, including as a fuel source, in vehicles, as a heating and lighting source, and in many other settings outside the home. LPG leaking is becoming more popular. However, LPG leaks might result in catastrophic fires. The frequency of fatalities from such events has also increased in recent years.

This highlights the need for a leak detection and prevention system for LPG. Before electronic gas detectors were developed for homes in the 1980s, these gases were detected using chemically-dipped paper that turned a different colour when exposed to the gases in question. But then, various devices were created to identify, monitor, and alarm the discharge of toxic gases [2]. A highly combustible chemical compound, LPG is a combination of propane and butane. It is an odourless gas owing to which Ethanethiol is added as a potent odorant, so that leakage may be quickly identified. LPG Ten percent or more of all kitchen mishaps are now caused by gas leaks, up from 0.72% in the past. It is thought that the tiny LPG cylinder weighing 5 kg, in which the burner is positioned directly above the cylinder without utilising a rubber tube, is safer than the one which utilises a rubber pipe, since this tunnel has the risks of becoming broken, which may lead to leakage [3].

ANALYSIS OF READINGS

Using Arduino UNO and SIM900 GSM/GPRS gateway, the authors of [1] created a gas leakage detecting system to alert humans to the presence of dangerous gases. In [2], the authors suggest an automated SMS notification system through GSM should a gas leak be detected using the gas sensor. The weight of the LPG cylinder may be calculated by their technology and shown on the screen. An SMS is sent to the dealer to reserve an LPG cylinder if the amount is less than or equal to 10 kg. Also, it sends out a text message to the residents of the residence when the LPG cylinder's weight drops below 0.5 kg, reminding them to swap it out. In [5], the author describes a technique for gauging the concentration of gases in parts per million and percentage, which may protect people from the many harmful substances present in the air. He offered a setup that included an Arduino Uno R3, a nRF24L01Plus Wireless Transceiver Module, and a MQ2 gas sensor, with the latter's output being monitored through serial monitoring in the Arduino IDE. The author of [6] suggests using the Proteus design suite to create a prototype for IoT-based gas detection. The Blink Internet of Things platform is his go-to for analysing and understanding collected data. He summed up the system by saying that the suggested approach allows the user to get alert notifications through wireless means and link the devices via a smartphone regardless of their physical location.

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

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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

As shown in Fig. 1, if a gas leak is detected by a gas sensor MQ-2, the sensor will communicate with the controller (ESP8266) using the controller's analogue port (A0) (4). Then, in the event of a gas leak, the controller (ESP8266) will employ (Wi-Fi) technology in tandem with the Blynk Application (available for both Android and IOS; the suggested system ran on IOS). At the same time, the fan will be running to circulate the air and get rid of any leaking gas, and the buzzer will be on to sound an alert through the microcontroller's digital interface (D5). The transistor functions as a switch, activating and deactivating low loads; while the circuit is closed — when the red LED is lit — the relay activates and deactivates high loads, in this case the fan. FIGURE Displays the proposed system's flowchart (5).

FUNCTIONAL PRINCIPLES

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

Blynk is a Platform.

The Internet of Things (IoT) is a network that interconnects everyday objects so that they may be remotely accessed and managed using digital methods such as smartphones and computers. In addition to its uses as a home security system and an industrial control system, IoT is also used in smart homes to run lighting and other household-use equipment. To run an entirely automated industrial equipment, for instance, or to manage access to the building's internet and phone lines, for example. Utilizing IoT allows for more creative possibilities. There are usually numerous lights in large buildings like factories or government buildings. Sometimes workers would leave them on after they leave for the day. By having security use Internet of Things (IoT) clouds or apps to manage the building's lights, energy consumption might be reduced.

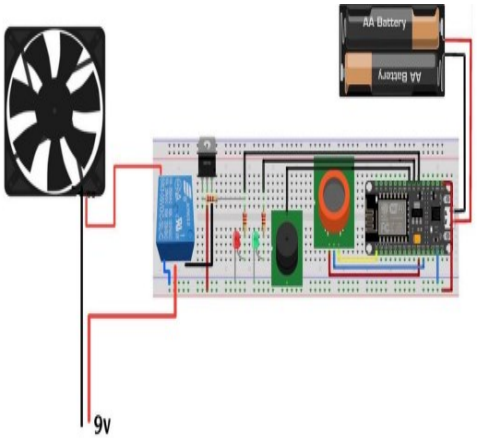

Fig. 1: Circuit Diagram of the Proposed System.

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.

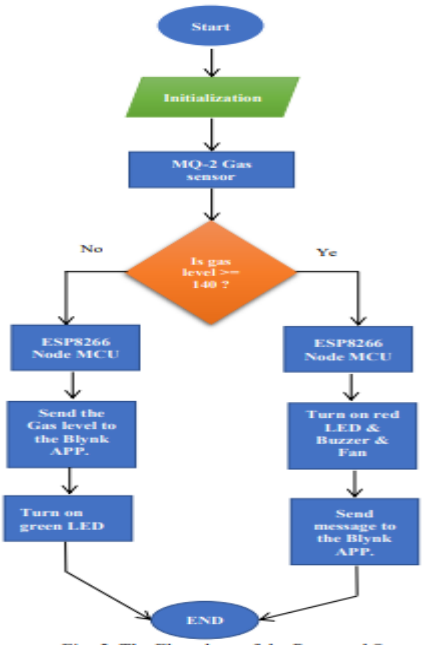

Fig. 2: The Flowchart of the Proposed System.

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

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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 , 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:

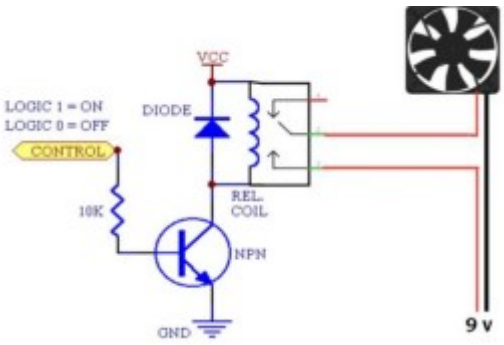

Fig. 3: Relay Connections.

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.

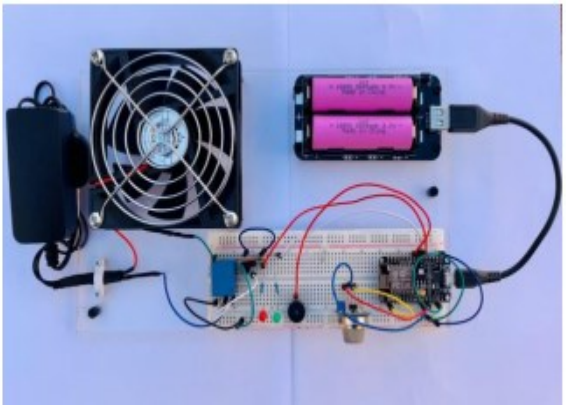

Fig. 4: Real-Time Prototype of the Proposed System

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.

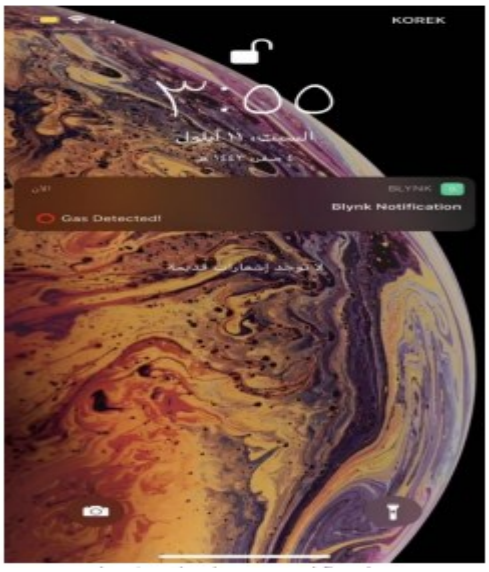

Fig. 5: Blynk app notification.

Fig. (9) illustrates a Blynk warning message of gas leakage case, the amount of gas which is the gas sensor reading can be seen. For example, the gas level was (192), which exceeded the threshold limit (140). While Fig. (10) illustrates the value of the data sensor reading (75) which does not exceed the threshold limit (140), so it represents the normal condition of the system in terms of no gas leakage. It should be mentioned that the system status is based on the following table.

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%.

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

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

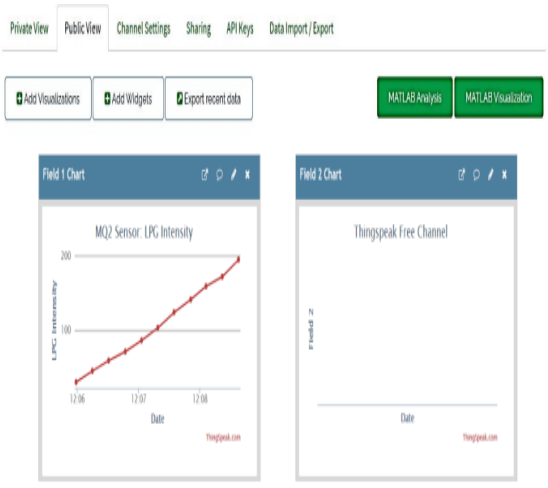

Fig. 8: Thing speak IoT platform visualization for gas sensor readings

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

CONCLUSIONS

This study details an Internet of Things strategy for detecting low-level gas leaks. The MQ-2 gas sensor detects the leaking gas. The sensor communicates with the ESP2866 NodeMCU through a signal sent to the microcontroller. The microcontroller then activates the signal sent to the external device that simulates a cell phone. By sending multiple messages to the Blynk application at once—possibly as often as once per second—the NodeMCU demonstrates its efficacy. This is significantly more frequent than the message interval required by other IoT platforms, such as the Thing speak IoT platform, which is used to record the gas sensor readings once every 15 seconds. Modifying the Nidec's code would allow the user to alter the maximum number of alerts to be issued. The reduced potential for injury is a direct result of the ease with which equipment like the exhaust fan may be operated. NodeMCU is a low-cost microcontroller that helps keep the overall price down. The system's convenience lies on its easy accessibility and manipulation. This study also introduces a gas leakage detection system built on two Internet of Things (IoT) platforms: the Blynk IoT application for alerting the concerned individual and the Thing speak IoT cloud for storing and visualising collected data.

REFERENCES

[1] Machel Thimoty Tombeng, "Prototype of Gas Leak Detector System Using Microcontroller and SMS Gateway", Cogito Smart Journal, Vol. 3, No. 1, 2017.

[2] T. Alex Stanley Raja, R. Senthil Kumar, A. Nandhakumar, and K. V. Santhosh Kumar, "LPG Leakage Detection and Autorefilling Using Arduino", International Journal of Engineering and Advanced Technology, Vol. 8, Issue 2S, 2018.

[3] Vasudev Yadav, Akhilesh Shukla, Sofiya Bandra, Vipin Kumar, Ubais Ansari, and Suraj Khanna, "A Review on Microcontroller based LPG Gas Leakage Detector", Journal of VLSI Design and Signal Processing, Vol. 2, Issue 3, 2016.

ISSN 2321-2152
www.ijmece.com
Vol 10, Issue 3, 2022
https://doi.org/10.5281/zenodo.14504947

[4] Noor Kareem Jumaa, "Survey: Internet of Thing Using FPGA", Iraqi Journal for Electrical and Electronic Engineering, Vol. 13, Issue 1, 2017.

[5] Mobasshir Mahbub, "Toxic and hazardous gas detection, measurement and monitoring system for safety assurance in home and industrial application of wirelesssensor node", Engineering and Technology Research, Vol. 1, No. 3, 2019.

[6] Guru rama gayathri and Yoga ananth, "IoT BASED GAS MONITORING SYSTEM USING ARDUINO", International Research Journal of Engineering and Technology, Vol. 7, Issue 4, 2020.

[7] Prof. Parag Naik, Pranay Dhopte, Rajat Wanode, Roheet Kantode, and Saurabh Nagre, "Gas Sensor Using Arduino UNO & MQ2 Sensor", International Journal of Advanced Research in Computer and Communication Engineering, Vol. 7, Issue 3, 2018.

[8] Syeda Bushra Shahewaz and Ch. Rajendra Prasad, "Gas leakage detection and alerting system using Arduino Uno", Global Journal of Engineering and Technology Advances, Vol. 05, No. 03, 2020. [9] http://www.blynk.cc