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LPG Weight And Leakage Monitoring System Using IoT

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ABSTRACT
In this study, we suggest a system to track the weight of LPG gas as well as any leaks. Today, LPG (liquid Petroleum Gas) is indispensable in almost every home. No level indicator, such as a metre or sensor, is built into LPG gas cylinders. The method for identifying a cylinder's low LPG gas level is the primary subject of this study. When a household's gas cylinder runs out, it often places an order for a replacement cylinder. Using an Arduino and a weight detection sensor, we can monitor the LPG level in the cylinder and order a replacement pressurised cylinder well in advance of it running out.
Keywords: - Arduino UNO, GSM Modem, Gas Sensor, Load Cell.

I. INTRODUCTION

Liquefied petroleum gas, sometimes known as LPG, is the type of fuel that is most frequently used for cooking in India. The number of people who use LPG in the country is roughly 28 crore. The system for detecting gas leaks now adheres to several different standards that have been adopted. LPG gas cylinders do not have any kind of detecting metre or detection system put on them, so there is no way to tell how much gas is still in the cylinder from looking at it. LPG is an excellent fuel for cooking that, in addition to being inexpensive and simple to acquire, is also very readily available. Because of the increased demand for LPG, consumers are required to pre-book their LPG cylinders at least one month in advance of when they want their new cylinders delivered. The majority of the time, customers have a tough time determining how much LPG is still contained within the cylinder, which results in a great deal of frustration on their part. In such a scenario, it is necessary to have an effective technique for monitoring the level of LPG contained within the cylinder, so that users are aware of the amount of LPG contained within the cylinder at all times. They are able to carry out the essential procedures in order to book a new cylinder [6, 7]. As the number of people who use this fuel continues to rise, it has become urgently necessary to establish specific safety requirements that must be adhered to in order to live a life free from accidents [3, 4].

The escape of the poisonous gas is the primary cause of the catastrophic accidents that are associated with the use of LPG. It is possible for there to be gas leaks coming from the gas cylinders that are used in virtually every household in India. The gas pipeline is another potential source of gas leakage. Old gas pipelines frequently become corroded, and as a result, they are more likely to burst, which allows gas to escape into the environment. Since LPG is a flammable gas, the risk of fire is significantly increased in the event that it escapes from its container. In and of itself, liquefied petroleum gas (LPG) is odourless; nevertheless, a potent odorant called ethanethiol is added to the mixture so that any leaks can be immediately detected.

In the beginning, the systems were primarily developed and put into place for the purpose of leakage detection in consideration of the numerous dangers posed by the explosion of LPG. However, because of the continuously growing demand for LPG, its availability has become increasingly difficult to come by in recent years. As a result, it provided a platform for study concerning the development of devices that provide real-time monitoring of the amount of LPG contained in a cylinder [8]. Microcontroller with ARM7 architecture and MQ6 gas sensing module used for measuring the gas concentration. In the event that there is a gas leak, it notifies the user by sounding an alarm and sending a message, and it also cuts off the main power supply. The weight of the cylinder can be measured with the help of a load cell. When the weight of the cylinder drops below a predetermined limit of 2 kilogrammes, the GSM module will send an SMS message to the gas agency in order to book a new cylinder [1].

The GSM Modem, LCD Display, LED, and Buzzer, as well as the 89C51RD2 Microcontroller. The microcontroller is connected to each and every one of the devices. LCD display shows the current level of gas contained within the cylinder at all times. When the level drops below a predetermined threshold, a message alerting the user and the gas agency to book cylinders is transmitted through GSM to both parties [2]. The MQ6 gas sensor is used to determine whether or not there is a gas leak. In the event that there is a gas leak, it will sound like a buzzer and send a message to the user. The load cell is responsible for measuring the weight of the cylinder, and it communicates this information to NodeMcu, which subsequently transmits the data to the ubidot cloud using the Wi-Fi ESP8266. When the weight is less than the threshold, the indicator goes red, and an email is sent to the agency to request that the gas cylinder to be booked. The data is displayed on ubidots. MQ2 sensor performs continuous measurements of the gas concentration. Ubidot readings will reflect an increase in concentration whenever there is a loss in LPG gas pressure. If the concentration rises to greater than 400 parts per million, the indicator will turn red, and the user will receive a warning message [5].

The primary objective of this study is to facilitate safety precautions in areas where security has been an essential concern while simultaneously monitoring for leakage of liquid petroleum gas (LPG). This will help prevent severe fire incidents. The technology uses a gas sensor to identify when there has been a leak of LPG and then notifies the customer through text message that there has been a gas leak. A weight sensor is used by the system in order to determine the weight of the cylinder. The GSM Modem is utilised by the suggested system in order to send an SMS message to the individual, warning them about the gas leak. When the system determines that the amount of LPG concentration in the air has reached the level that has been predetermined, it sends an alert to the customer by sending an SMS to the mobile phone that has been registered, and it also warns the people who are at home. This system also provides the current level of LPG, and based on that level, the user can schedule the delivery of a new LPG cylinder.

II. SYSTEM OVERVIEW

The Arduino UNO, Gas sensor, Load cell, GSM module, and HX711 Module are the components that make up the system block diagram.

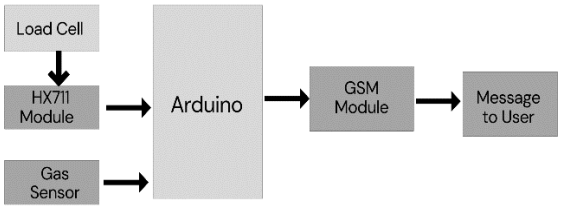

Fig.1 System Block Diagram

Arduino UNO Microcontroller*:* The ATmega328p microprocessor serves as the foundation for the Arduino UNO, an open-source board for microcontrollers. There are several different expansion boards and other circuits that can be connected to different sets of digital and analogue input/output pins. The board is programmable using the Arduino Integrated Development Environment (IDE), and it is equipped with 14 digital I/O pins in addition to 6 analogue I/O pins. You are able to build programmes and then upload them to your board with the help of Arduino Software.

- Operating Voltage: 5V
- The suggested input voltage range is 7-12V, while the maximum input voltage range is 6-20V.

Fig.2 Arduino UNO Microcontroller

Gas sensor: Isobutene, propane, and methane are some of the components that make up LPG gas. It is necessary to have a sensitive and effective gas sensor that detects just the presence of LPG gas contents and is less sensitive to other gases, such as odours from cooking, cigarettes, and so on. The Gas Sensor (MQ2) module is helpful for detecting gas leakage in both residential and commercial settings. It is able to detect H2, LPG, CH4, CO, alcohol, smoke, and propane, among other things

. Fig.3 Gas Sensor (MQ 2)

Because of its great sensitivity and quick response time, it enables measurements to be conducted as quickly as is practically practicable. The potentiometer allows for the adjustment of the sensor's level of sensitivity.

***Load cell*:** A load cell is what's needed to get accurate weight readings. A force transducer is the specific kind of transducer that is referred to as a load cell. A force like tension, compression, pressure, or torque is converted into an electrical signal that may be measured and standardised by the device. The load cell receives an increasing amount of force, which results in a corresponding increase in the electrical signal.

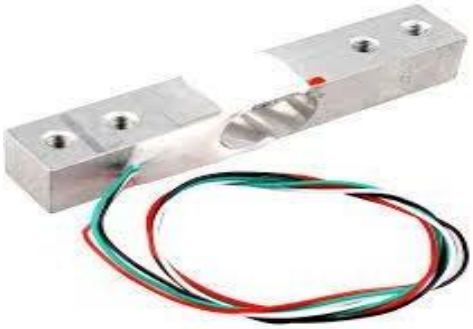

Fig 4 Load Cell

HX711 Module: The HX711 is a precise analog-to-digital converter (ADC) with 24 bits of resolution that was developed specifically for use in weighing scales. Four wires are used to make the connection between the load cell and the HX711 Load cell Amplifier. The colours red, black, white, and green/blue are assigned to these four wires. From module to module, there is a possibility of a very tiny colour difference in the wires.

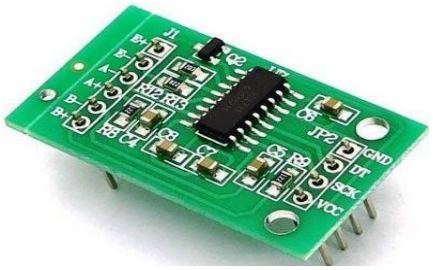

Fig. 5HX711 Module

GSM Module: The microcontroller will make any necessary or appropriate adjustments when the gas sensor identifies the presence of gas and the load cell reports the amount of gas remaining in the cylinder. It is necessary for the owner of the system or any housemates to be informed of the status of all of these connected components. The technology that makes it extremely easy to send and receive messages using a GSM module relies on basic AT commands, which can be implemented by connecting it to the microcontroller's Rx and Tx pins. This makes sending and receiving messages using the GSM module very convenient. The SIM800A GSM module is what's being used, and it's the one that makes use of the SIM memory to save the number of the system owner, housemates, distributor, or anybody else the messages need to be passed to. In order to transmit and receive text messages, it just needs a very small amount of memory and can run on a standard 12-volt adaptor.

Figure 6: GSM Module (SIM 800A)

III. SYSTEM OPERATION

The functioning of the system is dependent on the components that have been stated. The GSM module and the Arduino are both provided by the power source. The Arduino board is then updated with the program. The load cell is what is used to measure the weight, and it is coupled to the HX711 module, which is responsible for converting analog signals to digital. The weight that has been measured is transmitted from this load cell to the Arduino. The Arduino then carries out its operations and uses a GSM module to send an alert message to the owner in the event that the weight has decreased. The rx and tx pins of the GSM module are wired up to the digital inputs on the Arduino. The following is how the load cell is connected to the HX711 module:

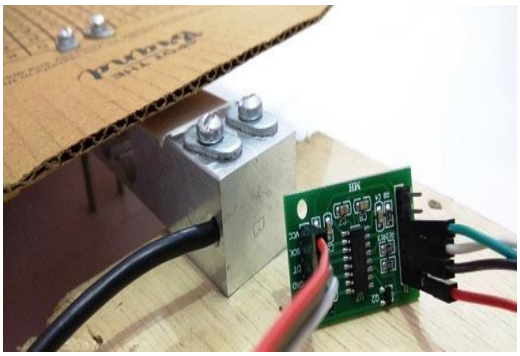

Fig.7 Load Cell Connection

The gas sensor, known as MQ 2, is used to measure the amount of leakage. The analog signal from the gas sensor is connected to the analog signal from the Arduino. The Arduino then carries out its operation and uses the GSM module to transmit an alert message about a leak to the owner.

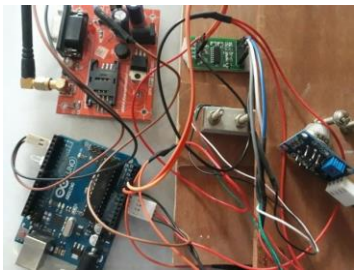

Fig. 8 Connections

IV. RESULTS

The prototype of the system is being constructed, and when an LPG is brought close to the system, the sensor identifies the leakage and sends an alarm message to the owners of the system. Additionally, the system prototype performs continuous monitoring of the LPG level within the cylinder, and if the weight of the cylinder drops below a predetermined threshold value, an alert message is sent to the owner.

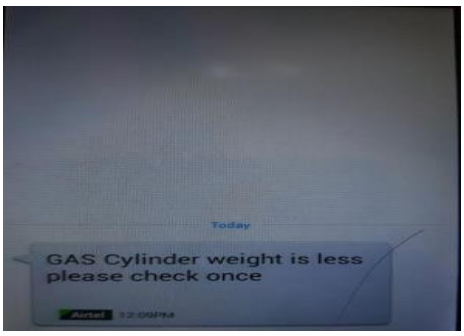

Fig. 9 Leakage Message

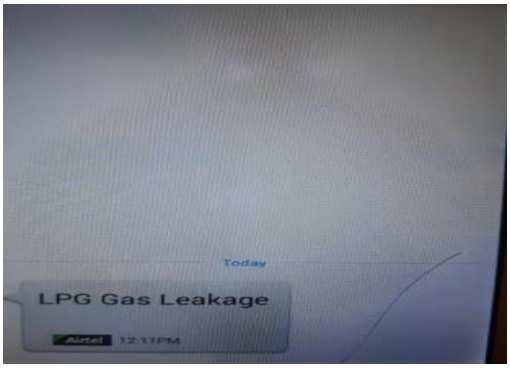

Fig. 10 Less Weight Message

V. CONCLUSION

Within this system, a gas leakage and weight monitoring system that is both cost-effective and well-planned was developed, designed, and effectively implemented. Because this system is completely automated, there is no need for any human involvement. We are able to avoid the difficult scenario that is produced due to the unavailability of petrol cylinders by applying this approach, and we advise the owner of the residence to book the cylinder. By notifying the owner immediately, the system prevents the accident that would have otherwise been caused by the LPG gas escaping from its container. This device is suitable for usage in industrial settings in addition to residential ones. The cost of developing the system is substantially lower than the cost

of gas detectors that are commercially available on the market, and it is significantly less than the cost of developing the system.

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