Design and Implementation of Smart LPG Leakage Detection and Booking with Alert System over IoT

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ABSTRACT

This project includes the detection of gas leakage considering safety and intimates the user through the GSM system. If the LPG leakage sensed by the MQ-2 sensor, then immediately block the gas regulator using Solenoid Electric Valve and the exhaust fan is turned ON. Whenever there is a change in the surrounding environment it will detect by the sensors (load cell, MQ-2) a siren is triggered. Booking a new LPG cylinder every month when the old cylinder gets emptied, has been a very long time consuming and manual process. This can be simplified by automating this process with the help of a load cell which is interfaced with a Microcontroller and IoT technology. The gas cylinder on top of a load cell, the load gets decreased as the gas cylinder is being used and when a particular threshold is met it will be detected and the message will be sent to the gas agency through GSM technology.

Keywords : Internet of things (IoT), Load cell, GSM(Global System for mobile communication), LPG(Liquefied Petroleum Gas), LCD, Gas sensor.

I. INTRODUCTION

LPG gas is essential in our daily life. Nowadays the use of LPG is extending to so many applications. Though it is useful when it leaks tends to an explosion. So the leakage of this gas has to avoid unnecessary explosions. Here we design and implement a system that detects the leakage of LPG gas and quick alerts the user to audio-visual indication. This circuit can detect leakage in our home or in a service station, storage tank environment. This unit can be easily operated to an industrial level by upgrading its ranges, can be extended to receive "SMS ALERTS" by using a GSM modem. This system is an effective way to monitoring the weight of gas quantity in the cylinder, and to intimate as well as to place a refill order in the respective gas agency, via message by means of GSM module. The continuous measure is done using the load cell which intern works on the principle of piezoelectric sensor, i. e; when a gas container is placed on the load cell it measures the weight and sends an electric pulse to the microcontroller which will compare the pulse with an ideal value in the form of digital. If the compared output is high then it sends a high pulse to the IoT which will update it to the internet but doesn't place an order, but if the compared output is low then it sends a low pulse to the IoT which will update it to the internet an even place a gas refill order, so the need of providing it

with these is that when a gas order is being placed it notifies the consumer with a Text SMS.

II. DESIGN AND IMPLEMENTATION

This method consists of a gas leakage detection system and weight measurement module with the help of Arduino UNO, microcontroller, GSM 900A, and alert system. The Arduino UNO microcontroller requires the power supply ranging from 7 to 12 V which are radially available as adaptors these days. The power supply may be either from an AC through DC adaptor or battery. The main purpose we are using Arduino UNO is to provide the flexibility to write the code in a convenient way.

The load cell is the other main component we are using in our project. A load cell is a transducer that is used to convert a force into an electrical signal that is used to measure a weight of LPG cylinder so that alert the user within how many days the cylinder is to be empty. For the leakage gas detection, we have used the gas sensor (methane and propane), we make use of the MQ-2 gas sensor which is suitable for detecting CH4, natural gases and excessive smoke. For showing the output of the result at various sensor values we can use the 16×2 LCD screen. Also, we are including the Exhaust fan (BLDC Fan) for the removal of leakage LPG gas in a particular area which has to be operated automatically and it will help to the cleared surrounding atmosphere.
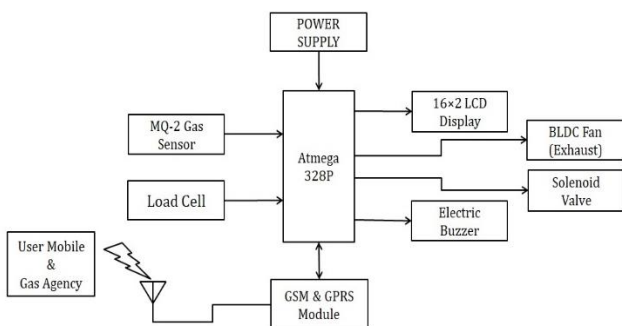

Fig 1. Block Diagram

A. MQ-2 (Gas Sensor)

MQ 2 sensor is basically an LPG (liquefied petroleum gas) which is composed of propane & butane, so when gas leakage is sensed by the sensor it will send a high pulse to the micro-controller which will update it in the IoT, and even a buzzer is start alerting. And the problem can be analyzed, sorted & solved. Thus the overall components & sensors play a role in the system.

Fig. 2 MQ-2 Gas Sensor

B. LCD Display

LCD stands for Liquid Crystal Display. They have become very common with the industry by clearly replacing the use of Cathode Ray Tubes (CRT). CRT consumes more power than LCD display it is heavier and bigger also. We all know about LCDs, but no one knows the exact working of LCD. It is finding widespread use replacing LEDs (seven segments or other multi-segment LEDs) due to the following reasons:

- The declining prices of LCDs.
- The ability to display numbers, characters and graphics related data in the simplest form.
- It is compact and very light-weights compared to CRT.

- With the Incorporation of a controller into the LCD, thereby making the CPU to keep displaying the data.

C. Microcontroller

ATMEGA 328P is an 8-bit microcontroller based on AVR RISC architecture which provides high performance and low power controller from Microchip. It is a 28 pin microcontroller. It has 14 digital pins as an I/O, in which 6 can be used as PWM outputs and 6 can be analog input pins. It is used in ARDUINO boards, and also the most popular of all AVR controllers. It will operate ranging from 3.3V to 5.5V but normally we use 5V as a standard voltage. It has been excellent features include such as cost-efficiency, low power dissipation, programming lock for security purposes, and real timer counter also many operations with the separate oscillator.
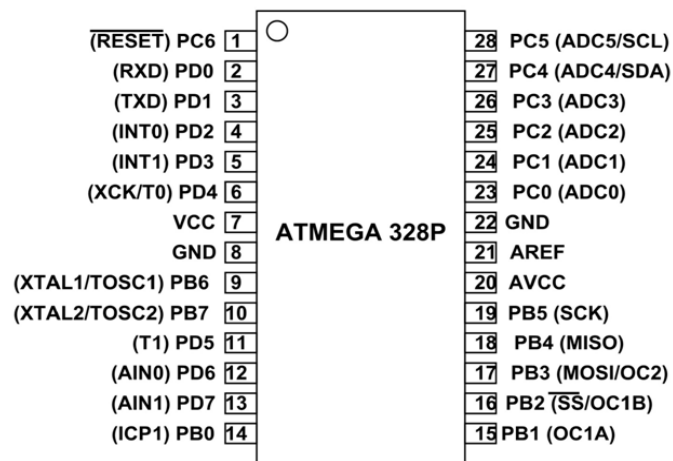

Fig. 3 ATMEGA 328P Microcontroller

D. Load cell

As per the dictionary, a load cell is namely suggested as a "weight measurement device necessary for electronic scales that display weights in digits." However, a load cell is not restricted to weight measurement in electronic scales. The load cell is one of the passive transducer or sensor which converts applied force into electrical signals, They are also referred to as "Load transducer". However, the only load cells which are prevalent are the load cells based on strain gauges. Hence, the term load cell means strain gauge-based load cells. The reason behind the wide adoption of strain gauge based load cells.

E. GSM technique

This project designed is as an automatic LPG booking, leakage detection, and also economical, real-time gas monitoring system. In this system, whenever the LPG leakage is detected through the sensor and information is sent to the user by SMS & simultaneously alerts the customer using a GSM module. The additional advantage of the system is that it continuously monitors the level of the LPG and updated over the internet present in the cylinder using the weight sensor and automatically books the cylinder using a GSM model. This model is it contained GSM which is an old technique used & has a bit of lack of awareness for the uneducated people.

F. Solenoid Valve

A solenoid valve is an electromechanically operated valve. The solenoid valve varies in the characteristics of electric current. The solenoid valve is the most frequently used control element fluidics. Solenoid offers safe switching as well as high reliability with fast response, long service life good medium compatibility of the materials used, low control power and compact design, they used the strength of the magnetic field they generate, the mechanism they used to regulate the fluid, and the type and characteristic of fluid they control.
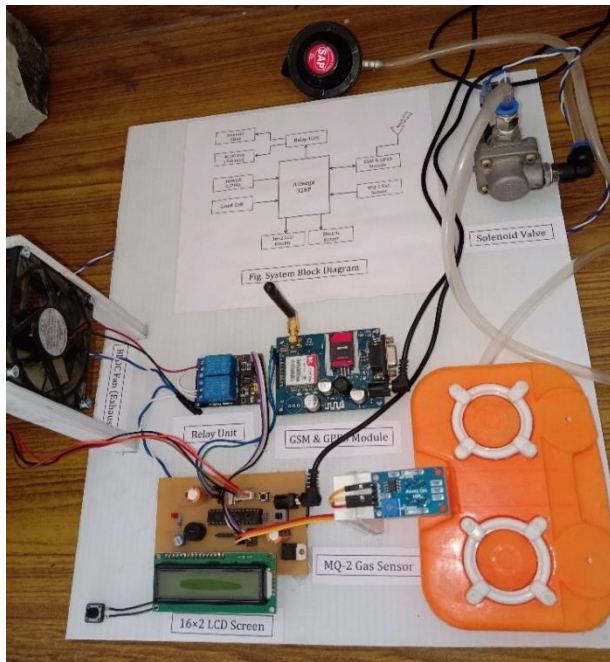
Fig. 4 Design of Project

III. RESULT AND DISCUSSION

The below figure shows the status of the gas sensor which senses any chance of gas leakage near to the gas container. The sensor continuously keeps on sensing if any change is observed then it is updated.

Fig. 5.1 Gas Leakage Alert

Fig. 5.2 Leakage Gas in Air (PPM)

The below figure shows the status of Load Cell for any change in the LPG gas level, That data should be uploaded on the internet through IoT. There are only

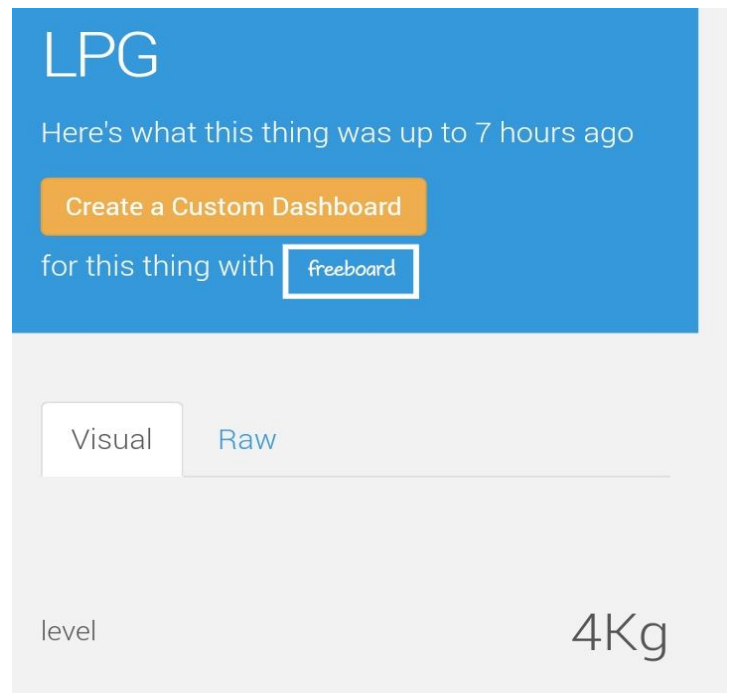two levels that are either half of the Threshold level or low level (< 1kg).

Fig. 6 Gas level Monitoring (Using IoT)

IV. APPLICATION

a. Protection from any gas leakage in cylinder areas and cars.
b. For safety purposes from gas leakage in heating gas-fired appliances like boilers, domestic water heaters.
c. Large industries which use gas as their production.
d. For safety from gas leakage in cooking gas appliances like oven, stoves, etc.

V. ADVANTAGES

1. It is used in the house as LPG leakage detection.
2. The sensor has excellent sensitivity combined with the quick fast response time.
3. The system is highly reliable, tamper-proof and secure.
4. In the long run, the maintenance cost is very less when compared to the present systems.

5. It is possible to get an instantaneous result and with high accuracy.

V. FUTURE SCOPE

a) In the future, a temperature sensor can be fitted.

b) Along with that an exhaust and a driver circuit may be fitted in case there is a fire and the user is not able to get to the location in time.

c) This monitoring system can be additionally upgraded by utilizing the Bluetooth setup of GSM to send the alarm messages to the user.

d) Audio output can be introduced to make it user-friendly.

VI. CONCLUSION

Hence, from the above discussion, we can conclude that this system for the application of the users who use gas in their daily life. It not only helps in making the daily work easier but also plays a major role in the security purpose or avoidance of accidents to the user and it helps in leading an easy life. It has a more advantageous function than the existing system thus the real-time automatic approach in case of rebooking of the cylinder. This monitoring and detection system is proposed mainly to meet the safety standard and to avoid fire accidents because of leakage.

VII. REFERENCES

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