Smart LPG Gas Leakage Detection, Monitoring & Automatic Online Booking

Mohan A. Gholap¹, Manojkumar A. Chitale², Pragati P. Dixit³, Mahalaxmi V. Amate⁴, Gayatri S. Bhosale⁵ Assistant Professor⁽¹⁾⁽²⁾, UG student⁽³⁾⁽⁴⁾⁽⁵⁾ Hirasugar Institute of Technology (HIT), Nidasoshi, Belgaum, Karnataka mohangholap.cse@hsit.ac.in, manojchitale.cse@hsit.ac.in

ABSTRACT

Liquified Petroleum Gas (LPG) is widely used as industrial fuel and for domestic purpose as fuel because of its desirable properties which include high calorific value; it creates very less smoke and does not cause much harm to the environment. But, LPG is highly inflammable and can burn even at some distance from the source of leakage. Most fire accidents are caused due to poor–quality rubber tube or the regulator is not turned off when not in use. To avoid this problem there is need for a system to detect and monitor the gas leakage. The main objective of this paper is to represent such system that monitors LPG leakage to avoid fire accidents providing house safety. The system detects the fire by using Thermistor and alerts the consumer about gas leakage by activating the alarm.

1. INTRODUCTON

In this paper we have presented an automated system of detecting and monitoring the gas leakage and also to check the level of gas filled in the container. This system is to monitor the gas leakage, load of the cylinder and status of the gas Knob. It Detects the Gas leakage using gas sensor (MQ2). This sensor detects the combustible gases and smoke and alerts the user by triggering the buzzer. Weight of the gas cylinder is measured using Load cell. It is a transducer that is used to create an electrical signal whose magnitude is directly proportional to the force being measured. Status of the gas Knob is detected using IR sensor. It is an electronic sensor that measures infrared light radiating from objects in its field of view. If the status of the Gas Knob is in Switch on state, then it will alert consumer by sending SMS.

Following are some of the important components used in the proposed system.

1.1 ARDUINO UNO:

Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer.

The basic features of Arduino board:

- The micro-controller used is ATmega328, built with Harvard architecture advanced RISC (Reduced Instruction Set Computing) technology.
- Operating voltage is 5v The recommended input voltage is 7-12v.
- The analog input pins are 6 (A0-A5) and digital pins are 14.
- The Flash Memory is 32 KB of which 0.5 KB used by boot loader. The SRAM size is 2 KB. The EEPROM size is 1 KB.
- Arduino also contains 1 USB Interface,1 ICSP Header.

1.2 ESP8266:



The ESP8266 Wi-Fi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. The ESP8266 has 17 GPIO pins (0-16), however, We can only use 11 of them, because 6 pins (GPIO 6 - 11) are used to connect the flash memory chip. This is the small 8-legged chip right next to the ESP8266. Fig 1.2.1 shows the ESP 8266.

ESP8266 can be used as an external Wi-Fi module, using the standard AT Command set Firmware by connecting it to any microcontroller using the serial UART, or directly serve as a Wi-Fi enabled micro controller, by programming a new firmware using the provided SDK. The GPIO pins allow Analog and Digital IO, plus PWM, SPI, I2C, etc

1.3 LCD (LIQUID CRYSTAL DISPLAY):

LCD is used to show the output of different sensor values and various results to show of size about 32 ASCII characters in 2 lines commonly used one is 16*2 LCD modules. It has 16 pins and the first one from left to right is the Ground pin. The second pin is the VCC which we connect the 5 volts pin on the Arduino Board. Next is the Vo pin on which we can attach a potentiometer for controlling the contrast of the display. Next, The RS pin or register select pin is used for selecting whether we will send commands or data to the LCD.

LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and sevensegment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements. LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement.

1.4 Temperature Sensor (DHT11):



SENSOR (DHT11)

This DHT11 Temperature and humidity sensor features a calibrated digital signal output with the temperature and humidity complex. Its technology ensures the high realiability and excellent long-term stability. A high-performance 8-bit microcontroller is connected. This includes a resistive element and sense of a wet NTC temperature measuring devices. It has excellent quality, fast response, anti-interference ability and high cost performance advantages. The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor.DHT11 is a 4-pin sensor, these pins are VCC, DATA, GND and one pin is not connected in use shown in figure 1.4.1.

1.5 THERMISTOR

A thermistor is a type of resistor whose resistance is dependent on temperature, more so than in standard resistors. With NTC thermistors, resistance decreases as temperature rises. An NTC is commonly used as a temperature sensor, or in series with a circuit as an inrush current limiter. Thermistors differ from resistance temperature detectors (RTDs) in that the material used in a thermistor is generally a ceramic or polymer, while RTDs use pure metals. The temperature response is also different; RTDs are useful over larger temperature ranges, while thermistors typically achieve a greater precision within a limited temperature range.

1.6 IR SENSOR (INFRARED SENSOR)

An infrared sensor can measure the heat of an object as well as detects the motion.IR Sensors are basically electronic devices which are used to sense the changes that occur in their surroundings. The change may be in color, temperature, moisture, sound, heat etc. They sense the change and work accordingly. In IR sensor the there is emitter and detector. Emitter emits the IR rays and detector detects it.

An infrared sensor circuit is one of the basic and popular sensor module in an electronic device. This sensor is analogous to human's visionary senses, which can be used to detect obstacles and it is one of the common applications in real time. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, The resistances and these output voltages, change in proportion to the magnitude of the IR light received.

1.7 BUZZER

Buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

A buzzer is a small yet efficient component to add sound features to our project/system. It is very small and compact 2-pin structure hence can be easily used on <u>breadboard</u>, Perf Board and even on PCBs which makes this a widely used component in most electronic applications. There are two types are buzzers that are commonly available. The one shown here is a simple buzzer which when powered will make a Continuous Beep sound.

1.8 LOAD CELL

Weight of the gas cylinder is measured using Load cell. It is a transducer that is used to create an electrical signal whose magnitude is directly proportional to the force being measured.fig 1.3.8 shows the Load cell.

1.3.9 MQ2 GAS SENSOR

MQ2 is a basically an LPG which is a composed of propane and butane, so when an gas leakage sensed by the sensor. The sensor consist of 4 pins namely VCC, GND, DOUT, AOUT.

2. LITERATURE SURVEY

Following work is already carried out in this field:

1. Kumar Keshamoni "Smart Gas Monitoring, Booking & Gas leakage detector over IoT" Aurora's scientific technological & research Academy Bandlaguda, Hyderabad, India.- This paper explains only about the load of GAS container.

2. Mahesh S.R. et al, "LPG detection, measurement and booking system"- This paper explains about implementing a system to check the status of LPG stove whether On or OFF using IOT.

3. Shailendrakumar Daivagna, et al, "GSM based automatic LPG ordering system with leakage alert", IJRET: International Journal of Research in Engineering and Technology, 3(12), June-2014.- This paper explains automatic booking of LPG Cylinder by using GSM module.

3. EXISTING SYSTEM

Existing design is based on microcontroller, it can track LPG emptiness all the time if LPG is very close to finish or at empty level then it will alert user by sending SMS &user in turn can order the LPG cylinder. And if it found any leakage in the gas cylinder it will alert the user by triggering the siren.

The basic block diagram of the "Smart gas booking, leakage detection and controlling" using ARM controller is shown in below figure 3.1.



Fig 3.1: Existing system

The gas container is placed on the Load Cell and it constantly keeps on sending the electric pulses to the microcontroller to compare it with the ideal value. The use of Temp. sensor & gas sensors and their respective roles which is to maintain the Boards & gas container security, they are also connected with the MC and an trigger pulse is sent if any gas/ fire is occurred..

The other block is the sub board which consists of the RF decoder & RF Rx which are helpful in the triggering of the Siren alarm by sensing the signal sent from the RF Tx. the reset switch(pulse) is used to reset the microcontroller & the devices connected to it. The LCD display is used to display the status of the gas container and as well as to report if any accident is to occur.

4. PROPOSED SYSTEM

Proposed system is designed by consideringsafety issues to detect gas leakage,load of cylinder,status of the gas knob and also to provide easy way for LPG booking. Following Figure 4.1 shows the architecture of the proposed system.





The gas container is placed on the Load Cell and it constantly keeps on sending the electric pulses to the Arduino to compare it with the ideal value. the use of Temp. sensor& gas sensors and their respective roles which is to maintain the Boards & gas container security, they are also connected with the Arduino and an trigger pulse is sent if any gas/ fire is occurred. The other block is the sub board which consistsbuzzer which is the notification module. The LCD display is used to display the status of the gas container and as well as to report if any accident is to occur.

5. RESULTS AND OUTPUTS

The proposed system is already implemented using AURDUINO and required sensors. Following figures shows some scenarios when the experiment is conducted. First figure (Fig 5.1) shows our experimental setup of the proposed system. Second figure (Fig 5.2) shows LED display when No Gas leakage is detected and when No fire is detected. Third figure (Fig 5.3) shows the sample alert SMS's received on the registered mobile number.



CONCLUSION

The proposed system is useful in home safety and industrial applications. This system is going to detect the leakage of the gas and alerts the owner about the leakage of gas by activating the buzzer. The system continuously monitor the weight of the gas cylinder, detects the status of the gas knob, if the knob is ON in absence of fire it displays on LCD and also sends SMS to users. During the experiment, the system met all the functional and non functional requirements.

Future work may involve, allowing automatic action for the leakage detection, when Gas knob is in ON state and also when the container becomes empty.

REFERENCES

- 1. Keshamoni, K., Hemanth, S. (2017, January). *Smart Gas Level Monitoring, Booking & Gas Leakage Detector over IoT.* In Advance Computing Conference (IACC), 2017 IEEE 7th International (pp. 330-332). IEEE.
- 2. Mahesh S.R Pooja R Preethi K. Mane Kumuda S. Shivalingesh B.M, Ramesh C. LPG detection, measurement and booking system. IJRSI, 1(6), November 2014
- 3. Shailendra Kumar Dewangan3 Praveen Singh Rathore4 Abid Khan1, Neju K. Prince2. *Gsm based automatic lpg ordering system with leakage alert*. IJRET: International Journal of Research in Engineering and Technology, 3(12), Jun-2014.
- 4. P Rajasekar S Shyamaladevi, V G Rajaramya and P Sebastin Ashok. Arm7 based automated high performance system for lpg refill booking & leakage detection. International journal of engineering research, science and technology (IJERST), 3(2), May, 2014.
- 5. Dr. M. Dhanabhakyam & T. Sumathi. A study on customer's attitude and satisfaction towards helping in house hold. The SIJ Transactions on Industrial, Financial and Business Management (IFBM), 2(2), March-April 2014.