AUTOMATIC LPG CYLINDER LEAKAGE DETECTION AND BOOKING SYSTEM USING ARDUINO

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Abstract: LPG cylinder leakage is one of the major problems which is mainly happened in industrial sectors and homes. Nowadays, we have LPG cylinder booking online is so difficult, especially for illiterate people. The main purpose of this project is to figure out problems due to leakage and booking. Based on safety and security we have to design a system that will alert the user whenever any dangerous actions will occur in the kitchen gas sensor (MQ6) detects the gas then it will alert the user through buzzer and mobile. And another advantage is nothing but it can continuously measure the weight of the cylinder by using a weight sensor (load cell) whenever it reaches the threshold value then it will send a message to gas agency and user and also displays the weight of the cylinder on the LCD display. This system regularly gives updated information about gas to the user that is how much gas present inside the cylinder. It is useful for illiterate people, and older people protect them from hazardous actions.

Keywords: MQ6, LCD, Arduino uno, Load cell, Buzzer, GSM Module, HX711 ADC.

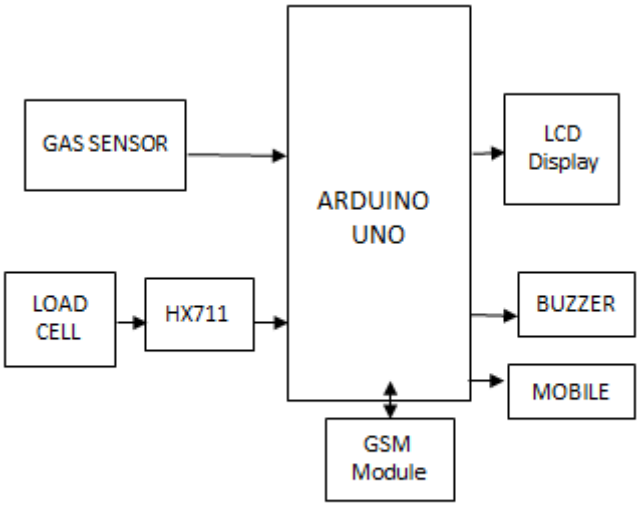
1. INTRODUCTION

There are 40 Crore LPG connections in India at the moment. Nearly, one-sixth of deaths due to accidental fires are caused due to gas leakage. There are many ways to detect the gas leak and alert the users. The existing devices will provide an alarm when a gas leak is detected. The objective of the proposed system is to send SMS to the user and to measure the weight of the cylinder continuously and sends a message to the distributor for rebooking of the cylinder. So that the agent and user can contact before the cylinder becomes empty. This proposed system can detect LPG gases such as propane and butane. For booking a cylinder we fix a threshold value. The main aim of the project is to reduce the deaths and major fire accidents because of leakage of liquid petroleum gas (LPG) and to monitor the threshold level of the weight of cylinder without the help of humans. By using a gas sensor the leakage is detected and alerts the user about the leakage by sending SMS, the weight of the cylinder is measured continuously with the help of load cell and Hx711 and weight are displayed on LCD. The proposed design also uses a GSM modem to alert the user either for gas leakage or for rebooking the cylinder via sending a message.

The message which we want to send will be programmed and the SMS is sent to the registered mobile number. To alert the people we will buzzer also as an indication of a gas leak is detected.

2. Design and Implementation

The hardware of the proposed system is as shown in figure 1. The proposed system consists of LPG gas leakage module, Arduino Uno, MQ6 sensor GSM module, LCD display, Buzzer, Load cell, HX711.



| Figure 1: Block diagram

Arduino uno:

Arduino uno is a central processing unit of the system. All the components are connected to it and then programmed. The functionalities are performed as per the instructions.

GSM Module:

GSM is nothing but a Global system for mobile communication. GSM is interfaced with Arduino and this can be mainly used to send and receive messages and make calls with GSM AT commands.

LCD:

Here it shows the weight of the cylinder.

3. proposed approach

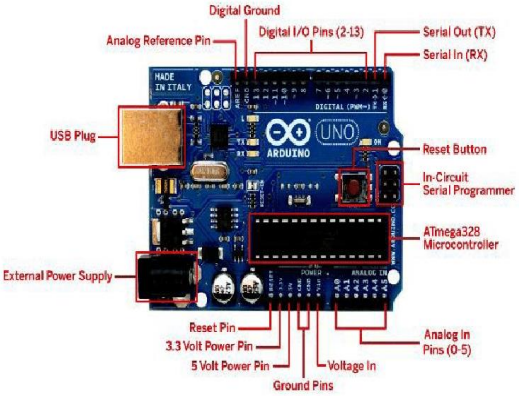
In this proposed system, the Arduino Uno is interfaced with different modules. In the case of the leakage detection process, if (any mall functions) any gases like methane or propane are released surrounding the cylinder are happened near the cylinder and is checked by the gas sensor. If the gas level is above the threshold level it immediately sends a message to the user and generates a sound using a buzzer. In the case of the booking process, it continuously measures or checks the weight of the cylinder by using a load cell and HX711. Whenever the weight is less than the threshold value then it sends a message to the gas agency and user. And the weight is displayed on the LCD display.

Arduino uno:

The central processing unit of the proposed system is Arduino Uno. The Arduino uno is an AT MEGA328 based microcontroller and which having 14 digital input-output pins and 6 analog input pins. Out of 14 pins 6 pins are used for PWM outputs. It consists of 16 MHZ crystal oscillator which is used Arduino for dealing with timing issues. It can also consist of power jack, reset pin, ICSP header, power pins. Arduino can be powered up by using USB cable and power jack. It can be reset by using reset pin once we reset Arduino our program will run from the beginning. It is having IDE which allows them to write instructions and upload them onto the board.

Features:

- It needs an input voltage of 6V to 20V.
- It provides DC current for I/O pin is 20mA.
- DC current for 3.3V pin is 50Ma.
- Flash memory - 32 kb, SRAM - 2KB, EEPROM-1KB.
- Speed of the clock is 16 MHZ.



Load cell:

A load cell is mainly used to measure weight and it is interfaced with Arduino through HX711. The load cell is a weight measurement sensor and which converts an applied load into an electrical signal. The electrical signal can be either voltage or frequency change. It works on the piezoelectricity principle. Usually, a strain gauge load cell is used. Whenever a load is applied on the loadcell then it creates a strain at that location and the force is sensed by the elastic deformation of strain gauges.

Features:

- It has a capacity of up to 3-200kg.
- It is made with aluminum-alloy, alloy steel.

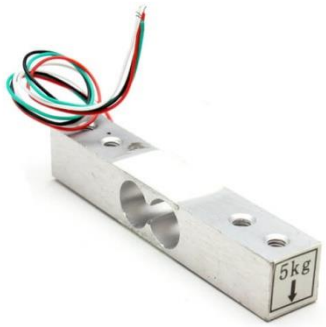


Figure 3: Load cell

Hx711 Amplifier:

Hx711 is a load cell amplifier and it is connected between the load cell and Arduino. It is mainly used to read an electrical signal that is either voltage or resistance change from the load cell. The data from the load cell is amplified by using HX711 amplifier after that the data can read by an Arduino from the HX711. The HX711 amplifier is connected to the load cell by using four wires those are named as RED(VCC), black(GND), white, green. In order to connect with an Arduino then we have to use clock and data pins.

Features:

- Operating voltage- 2.6V- 5V.
- Temperature range: -40°C to +85°C.
- Operating DC current – 1.5mA.

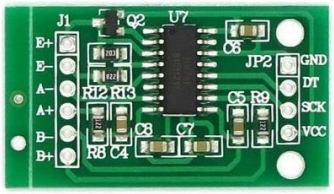


Figure 4: HX711

GSM Module:

GSM is a mobile communication device that is used to make communication between Arduino and GSM TTL. It is one of the widely used mobile communication systems and it can able to transmit voice data and signals over the channels. It operates at the frequencies are 850MHZ, 900MHZ, 800MHZ, 1800MHZ. A GSM modem requires a SIM card which establishes a communication with the help of the network. It is interfaced with Arduino and its operations with a 5V power supply.

Features:

- Control via AT commands.
- Temperature range: -40 C to +85 C.
- Supply voltage range: 3.2V to 5V.
- Operating DC current: 1.0mA.

Figure 5: GSM Module.

MQ6 Sensor:

The MQ6 sensor is widely used in the LPG gas leakage detection process. It is highly sensitive to LPG, propane, and Sno2 gases and less sensitive to alcohol, smoke, and can also detect natural gas. MQ6 sensor can able to read or sense the values in the form of analog values so it is interfaced with Arduino through analog pins. It internally consists of a comparator which detects the gas and compares it with the threshold value whenever it crosses the preset value then gives out high output using digital pins. It is operated with 5V and gives out a fast response.

Features:

- It can detect the gas range: 200-10000ppm.
- Response time: less than10sec.
- Operating DC current: 150mA.
- Operating voltage: 5V.

Figure 6: Gas Sensor

LCD Display:

LCD abbreviation is Liquid Crystal Display(LCD). LCD is an electronically modulated optical device that is made up of pixels that are arranged in a rectangular grid. This LCD crystal has a backlight that provides light to the pixels. LCD contains a matrix of pixels that helps to display information on the display screen. Here we are using 16*2 display means which has 16 rows and 2 columns used to display the status of the weight of the cylinder continuously.

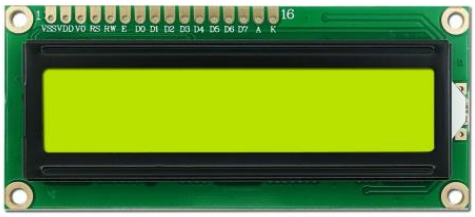


Figure 7: LCD display

Buzzer:

The buzzer is electronic components that consist of two pins are power and ground. It is mainly used to produce sound on the basis of the piezoelectric effect in order to alert the surrounding people. Here the buzzer is used to produces the sound whenever gas leakage has occurred.

Figure 8: Buzzer

4. Flow chart:

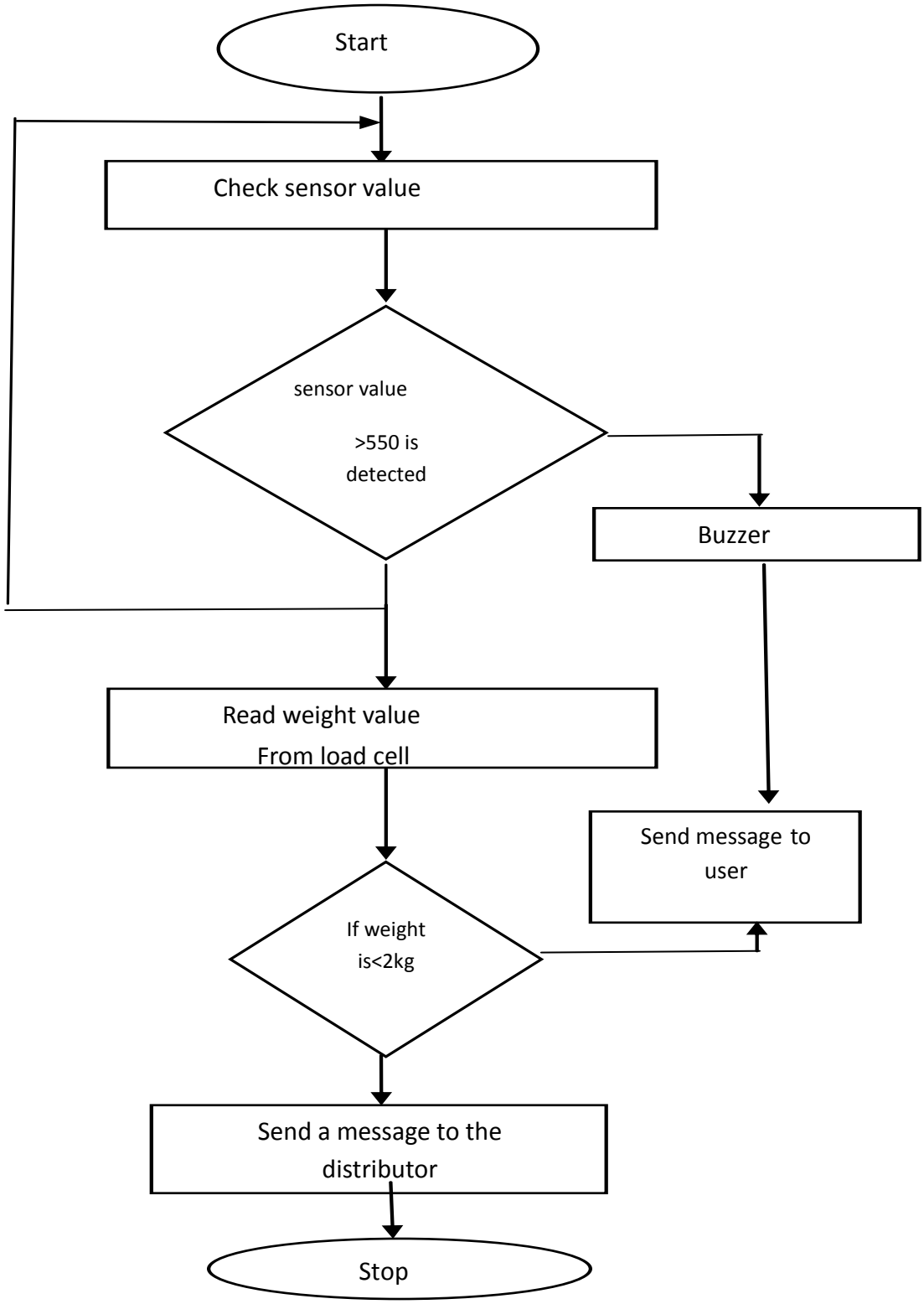


Figure 9: Flow chart

5. OUTPUT:

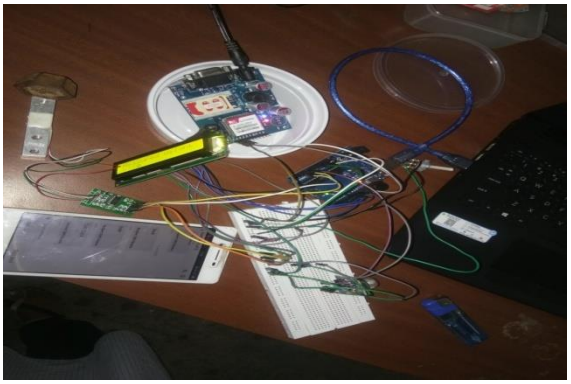


Figure 10: complete hardware

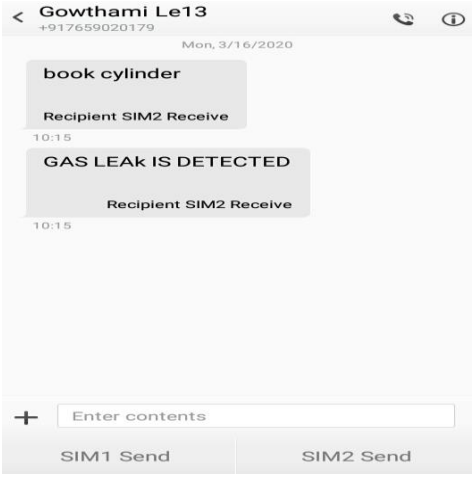


Figure 11: SMS send to the user

6. Advantages:

- Gas leakage can be detected and prevent the accidents due to sort of gas leakage.
- Simple and less complex design.
- It provides fast response rate and accurate results.
- Cost effective and reliable.

7.Conclusion:

After a few studies of some researches, we found the problems faced by LPG gas consumers so we decided to reduce the accidents by designing a completely automate the processed system. The primary objective of our project is to reduce the accidents caused by any malfunction in the gas cylinder in order to present damage or burst of LPG using sensors. The secondary objective is to measure the gas present in the cylinder by fixing a threshold value. This system developed to help the LPG gas consumers to lead a happy life with less danger.

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