AUTOMATIC LPG CYLINDER BOOKINGAND LEAKAGE DETECTION USING IOT

G.V.N.S.K. Sravya[1], T. Sucharitha[2], N. Pavithra[3], K. Nikhitha[4] and V. Sathvika[5]
[1]Assistant Professor, ECE, G. Narayanamma Institute of Technology and Sciences, Hyderabad
[2]Student, ECE, G. Narayanamma Institute of Technology and Sciences, Hyderabad
[3]Student, ECE, G. Narayanamma Institute of Technology and Sciences, Hyderabad
[4]Student, ECE, G. Narayanamma Institute of Technology and Sciences, Hyderabad
[5]Student, ECE, G. Narayanamma Institute of Technology and Sciences, Hyderabad

Abstract: LPG Gas cylinders play an important role in every household. Liquified Petroleum Gas (LPG) is a highly flammable mixture of the Hydrocarbon gases (Propylene, Butane, Butylene, Isobutane). When the LPG gasleakage goes unnoticed, it could lead to blasting of cylinder and can be life threatening. Therefore, constant monitoring of LPG is required. Generally, Gas booking is done by approximating the amount of gas left in the cylinder, which is not feasible. The main purpose of this project is to detect the gas leakage and to automate the booking of gas cylinder. When the gas detected by the MQ-6 Gas sensor exceeds certain level, buzzer and Exhaustfan will be switched ON immediately. Then the user is notified about the leakage through GSM Module to take necessary actions. To prevent further damages caused due to leakage, regulator of the gas cylinder will be switchedOFF automatically. When the weight measured by the Loadcell falls below a specified limit, it is notified to the gasstation directly to book the new gas cylinder. This system can widely be used in chemical industries, automobiles, domestic purposes. This project can further be improved by using a voice based feedback system, which will notifythe user through voice messages.

Keywords— *Gas Booking, Gas Leakage.*

1. INTRODUCTION

Home security has changed a lot from the last century and will be changing in coming decades. Security is an important aspect in the smart home applications. The new and emerging concept of smart homes offers a comfortable, convenient and safe environment for occupants. This system keeps home owners, and their property, safe from gas leakage by giving the indication in terms of short messages. Intelligent homes in simple terms can be described as homes that are fully automated in terms of carrying out a predetermined task, providing feedback to the home users and responding according to the situations. This paper is aimed at designing a GSM based automatic LPG cylinder bookingand leakage detection using loadcell and MQ-6 sensor respectively.

LPG is a highly flammable gas having a composition of Propane, Butane, Butylene, Isobutane. It is generally used for domestic purposes, automobiles and in industries. As LPG cylinders are more prone to leakages which are dangerous, therefore we need a gas leakage security system. This system requires Arduino UNO board, MQ-6 gas sensor,Loadcell, HX711 amplifier, LCD display, buzzer, GSM module, exhaust fan and servo motor. This system has two phases, leakage detection and automatic booking. The first step of this system is to detect the leakage of gas using MQ-6 sensor .When the gas leakage is greater than a specified level the buzzer and Exhaust fan will be switched ON immediately. Then the user is notified about the leakage through GSM Module to take necessary actions. To prevent further damages caused due to leakage, regulator of the gas cylinder will be switched OFF automatically. The second step is to measure the weight of gas cylinder using load cell. The HX711 amplifier is used as A/D converter . When
the weight measured by the loadcell falls below a specified limit, it is notified to the gas station directly to book the newgas cylinder.

2. BLOCK DIAGRAM

The circuit has been implemented using Arduino UNO, Gas Sensor, Load cell, HX711 Amplifier, GSM Module,Power Supply, Exhaust Fan, Buzzer, LCD Display, Servo Motor which are the main components of the circuit.
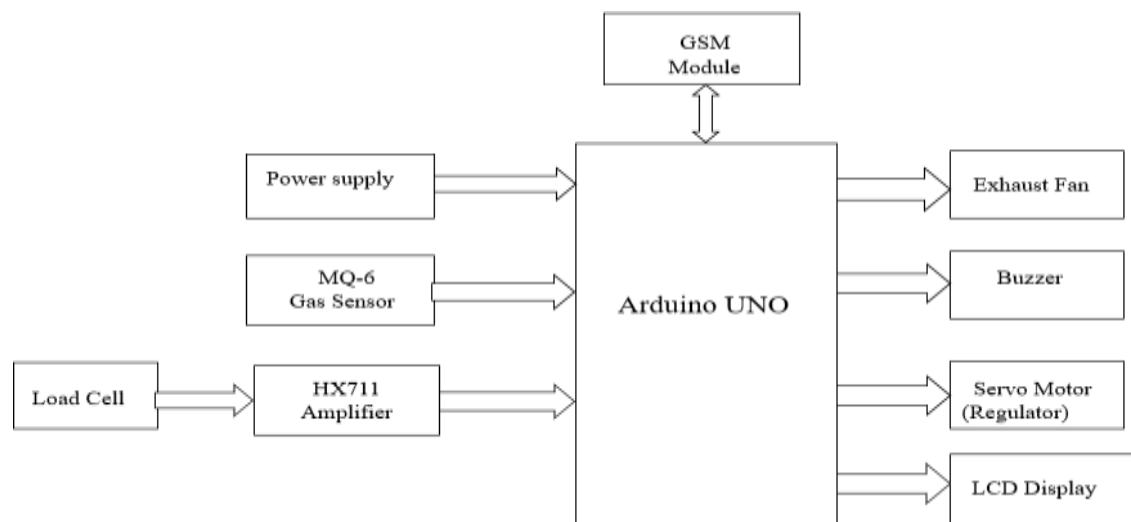

Fig. 2.1 Block diagram

3. HARDWARE DESCRIPTION

A. Arduino UNO\

It is a microcontroller board developed by Arduino.cc and based on Atmega328. Arduino Uno consists of USB Arduino Uno consists of USB interface, 14 digital I/O pins, 6 analog pins, and Atmega328 microcontroller.The operating voltage of Arduino Uno is 5V.

Fig. 3.1 Arduino UNO

B. GSM Module

GSM is a mobile communication modem; it stands for global system for mobile communication. GSM modems can also be used for sending and receiving SMS and MMS messages. A GSM modem is a specialized type of modem which accepts a SIM card and operates over a subscription to a mobile operator.AT commands are used to control GSMmodule. ATD are commands are used for calling.

Fig. 3.2 GSM Module

C. Buzzer

A buzzer is a signaling device typically used in automobiles, household appliances such as a microwave oven, orgame shows. The main function of this is to convert the signal from audio to sound.

Fig. 3.3 Buzzer

It has two pins, a positive terminal, and a negative terminal. The longer one is a positive terminal and theshorter one is a negative terminal.

D. LCD Display

LCD stands for Liquid Crystal Display. It contains a panel display which represents large number of pixels. It isgenerally used in smart phones, cameras, computers etc. to project information. It produces maximum resolution.
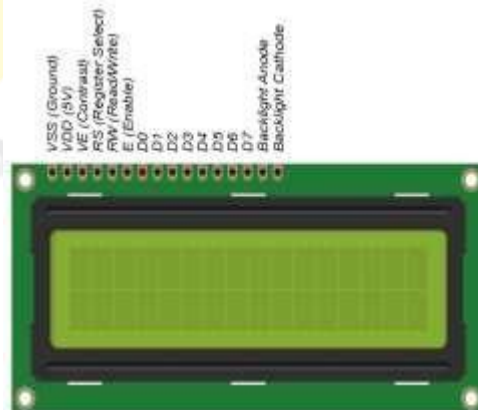

Fig.3.4 LCD Display

E. Load Cell

Load cell is a type of Force sensor which is used to measure the weight of the cylinder. When a load is appliedto the sensor, it changes its resistance. This results in change of the output voltage. They are commonly used to superviseor monitor Dams, tunnels and shafts etc.
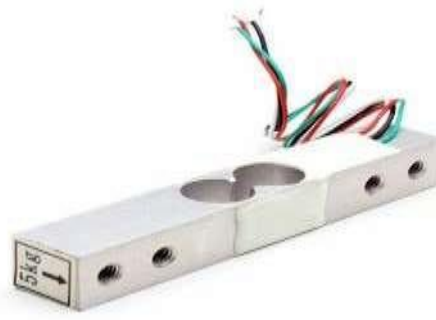
Fig.3.5 Load Cell

F. HX711 Amplifier

HX711 Amplifier is a 24bit Analog to Digital Converter which is used along with the Loadcell to measure the weight of the cylinder. The output of the loadcell is an analog signal which is fed to HX711 Amplifier. It acts as a converter and gives digital signal as the output.
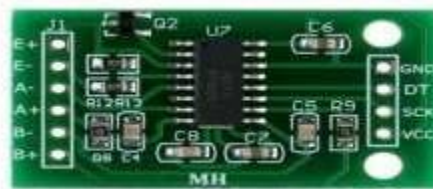

Fig.3.6 HX711 Amplifier

G. MQ-6 Gas Sensor

MQ-6 Gas sensor is a metal oxide semiconductor (Mos) type gas sensor. It is used to detect the LPG & Butane gas concentration in the air either at home or in industry. It detects combustible gases and gives output in ppm. It has pins A0, D0, Ground, VCC these pins are used in microcontroller or Arduino interference. It is a combustible gas detection and can detect by using some sensing elements, mainly aluminum-oxide based ceramic, coated with tin dioxide, enclosed in a stainless-steel mesh.

Fig.3.7 MQ-6 Gas Sensor

H. Exhaust Fan

Exhaust fan main function is to extract and remove the impure air in the room or space by bringing the fresh air and done to improve the air quality. This process is done by using its motor to turn its blader, so it pulls air out of the space.

Fig.3.8 Exhaust Fan

I. SERVO MOTOR:

Servo motor is a special machine that operates with the help of servo mechanism. It is used to complete the specific task in a precise way. Working of this motor is similar to induction motor but its construction and operation is different. Servo motor acts as a rotary actuator and it converts electrical signals into mechanical acceleration. This motor operates in closed loop system. It is designed to provide linear torque speed characteristics. In this motor position feedback system is used that controls the position and speed of the rotor.

Fig.3.9 Exhaust Fan

4. FLOWCHART

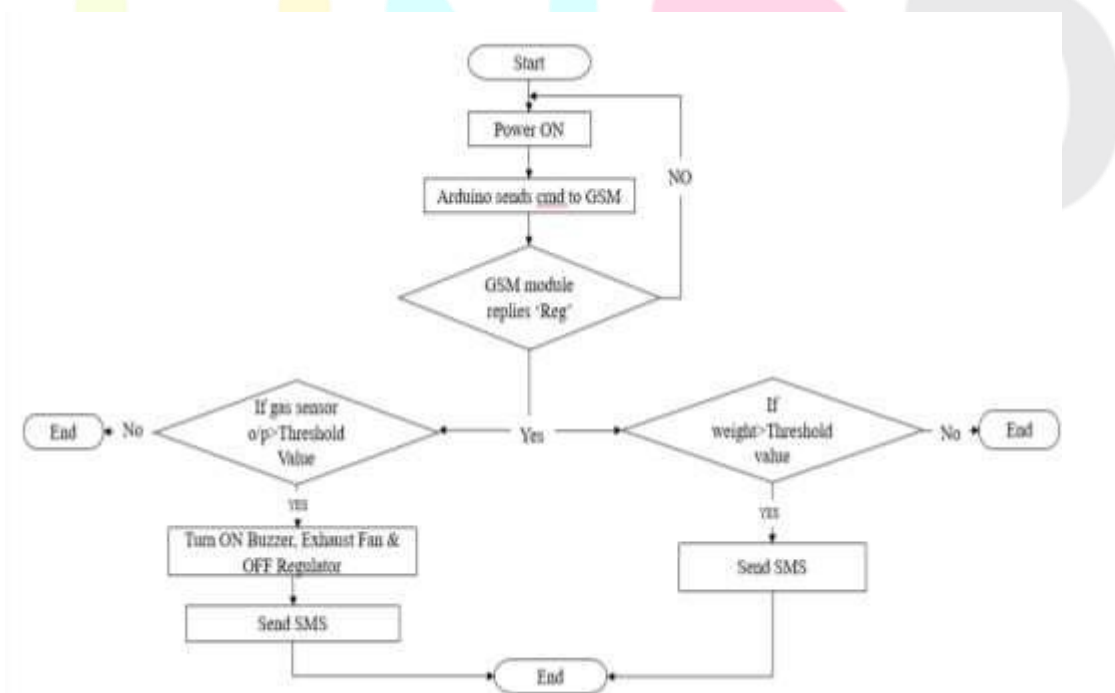Following flowchart shows implementation process of the project.

Fig. 4.1 Flowchart

5. SOFTWARE DESCRIPTION

Arduino IDE

The Arduino Integrated Development Environment (IDE) is a cross platform application that utilizes C++ programming language. This provides you access to huge Arduino Library to write the program and uploading the program to the board. Arduino boards are usually connected via USB cable. The IDE environment mainly contains twobasic parts: Editor and Compiler where former is used for writing the required code and later is used for compiling anduploading the code into the given Arduino Module. It is easily available for operating systems like MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role for debugging,editing and compiling the code in the environment.

Fig. 5.1 Arduino IDE

6. RESULTS

A gas sensor (MQ-6) is used to detect the gas leakage of the LPG cylinder. The gas sensor is interfaced with Arduino UNO. When the leakage is detected, the gas regulator-switch is turned off by the battery operated motor and instant SMS will be sent to the user to inform about the gas leakage. At the same time the buzzer starts sounding and LCD will display the message about the leakage.

Fig. 6.1 LCD display when gas is not leaked

Fig. 6.2 LCD display when gas is leaked

Load cell continuously measures the weight of the gas cylinder. When gas level goes below the threshold level, message is sent to the agency for booking purpose.

Fig. 6.3 LCD display when the gas level is below the threshold level

7. CONCLUSION

LPG Gas cylinders play an important role in every household. When the LPG gas leakage goes unnoticed, it could lead to blasting of cylinder and can be life threatening. Therefore, constant monitoring of LPG is required. Therefore, our project is aimed at detecting the gas leakage and to automate the booking of gas cylinder. When the gas detected by the MQ-6 Gas sensor exceeds certain level, buzzer and Exhaust fan will be switched ON immediately. Then the user is notified about the leakage through GSM Module to take necessary actions. To prevent further damages caused due to leakage, regulator of the gas cylinder will be switched OFF automatically.

When the weight measured by the Loadcell falls below a specified limit, it is notified to the gas station directly to book the new gas cylinder. This feature will be very helpful because the user need not check the gas level every time to book the gas. What makes this system truly unique is that it is cost-effective and is real-time. It helps the customers to upgrade the safety norms to prevent the major accidents associated with gas leakage and protect life and property from accidents.

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