

Smart Gas Booking and LPG Leakage Detection System

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Abstract: *Now a day's safety and time are major issue. And home fires have taken a growing toll in lives and property in recent year. LPG is highly inflammable and can burn even at some distance from the source of leakage. Most fire accidents are caused because leakage of gas. In this project we are dealing with detection, monitoring and control system of LPG gas leakage. Using relay DC motor the stove knob is automatically controlled. Along with this safety measures the system has additional advantage of automatic rebooking of cylinder when the level of gas goes below the normal weight of cylinder.*

Key Words: *Gas sensor, GSM, DC motor, microcontroller, load cell.*

I. Introduction

LPG is used in many needs such as domestic fuel, industrial fuel, automobile fuel. So the main aim of proposed system is to provide safety from gas leak. The system detects the leakage of LPG using gas sensor and alerts the consumer about the gas leak by sending SMS. The system also turns on the alarm and exhaust fans so that the leaked gas can be sent out. Another advantage of the system is automatic rebooking of cylinder. The proposed system continuously measure the weight of the cylinder and as soon as it reaches the minimum threshold it will automatically send an SMS alert to the user as well as authorized LPG agent so that they can act accordingly. And all this information about gas leak, rebooking, weight of cylinder can be displayed on the LCD.

Our system provides safety from the gas leakage, it detects leakage and takes control action over it. It is helpful for us to avoid explosion it also have provision for automatic gas booking.

II. Literature Survey

In the year 2011, A. MAHALINGAM, R. T. NAAYAGI, 1, N. E. MASTORAKIS, "Design and Implementation of an Economic Gas Leakage Detector", This project developed system to detect the gas leakage and providing immediate alarm or intimation to the user. Later in 2013, few people developed the design proposed for home safety. This system detects the leakage of the LPG and alerts the consumer about the leak by buzzer. This project was developed using microcontroller ARM version 7 processor and simulated using Keil software.

III. Proposed System

Proposed system consists of gas leakage detection sensor which is interfaced with microcontroller. If leakage is detected microcontroller immediately start the stepper motor to turn off the gas regulator. Totally external coupling is made to turn off gas regulator. Message will be also displayed on LCD display. Microcontroller will run an audio file when leakage is detected. Load cell is used to monitor the weight of cylinder. GSM module is interfaced with controller which will automatically book the cylinder when weight of cylinder goes below the threshold. It is also used to SMS gas leakage to specified mobile number.

IV. Design & Implementation

This proposed method consists of gas leakage detection system, weight measurement module, microcontroller, GSM module and alert system.

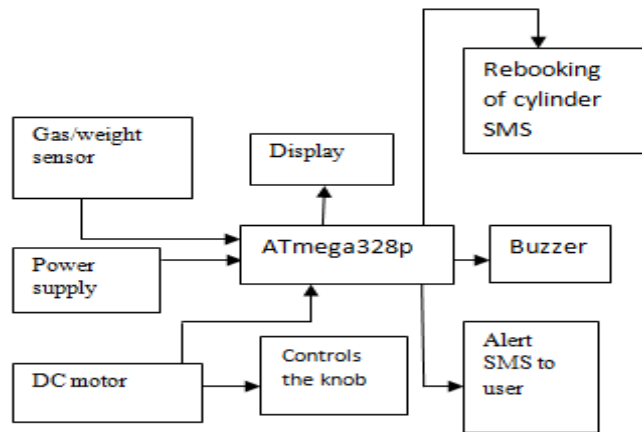


Fig 4.1: System block diagram

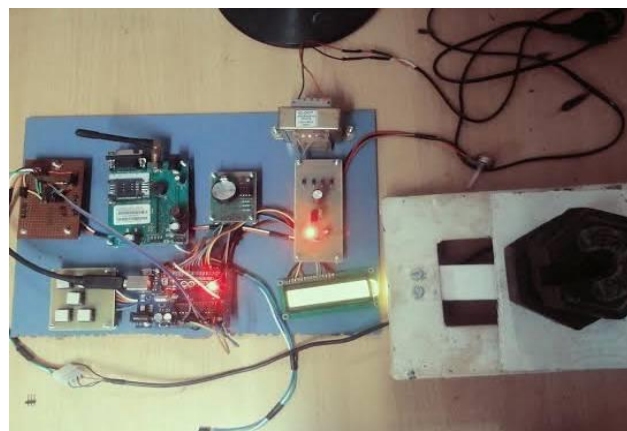


Fig 4.2: Experimental setup of the system

V. Hardware Description

5.1 Microcontroller:

An efficient and smooth working controller is needed to continuously sense both leakage and level of the gas. And also fast response is require when leakage found .Along with this the monitoring system must provide additional leakage information which can be used in further processing. The detection system includes Arduino Duemilanove[3] microcontroller board which is Arduino compatible with microcontroller chip ATmega328p. The Duemilanove is a microcontroller breakout board featuring ATmega328 based on the popular Arduino Footprint. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button.

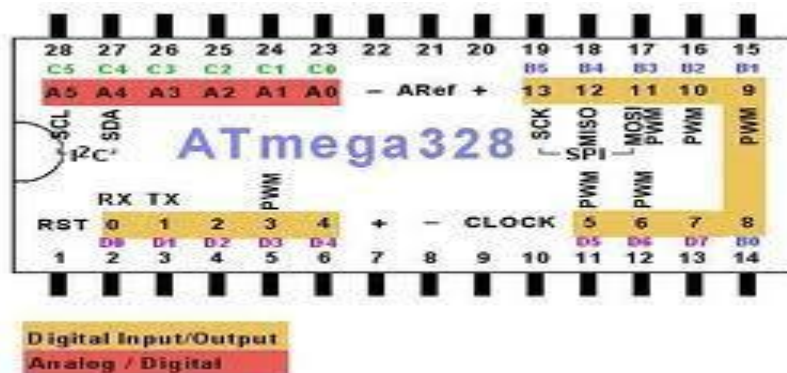


Fig 5.1.1: Microcontroller

The Arduino Duemilanove has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provide UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An FTDI FT232RL on the board channels this serial communication over USB and the FTDI drivers (included with Windows version of the Arduino software) provide a virtual com port to software on the computer. The device operates between 1.8-5.5 volts. By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed. The key parameters of Atmega328p are Flash(32 kilobytes),pin count-32, maximum operating frequency(20MHz),maximum input/output pins(23) and no interface.

5.2 Gas sensor:

Gas sensor MQ-6 is highly sensitive to LPG, isobutene and propane. This sensor is used in gas leakage detecting equipments in domestic and industrial applications. It is suitable for LPG detection and important thing is, it avoids the noise signal of alcohol, cooking fumes and smoke. In clean air it has lower conductivity. If combustible gas is detected, the sensor conductivity increases with increase in gas concentration. Higher sensitivity to LPG, low cost and long life are the main features to select this gas sensor. Voltage variation obtained is from 0.5 volts in clean air to 0.9 volts when leakage detected. Hence 0.7 volts is considered as threshold level indication of gas leakage. If output voltage of 0.7 volts is detected, gas leakage system will be operated.



Fig 5.2.1: Gas sensor

5.3 Weight sensor:

There must be aware in advance of amount of gas in the cylinder, before rebooking the cylinder to the distributor. For this purpose the weight sensor is used, thus it monitors the level of gas present in the cylinder .for calibration purpose the weight sensor is used along with load cell.



Fig 5.3.1: Load cell

5.4 Display:

It is necessary requirement to put a display about system monitoring and controlling performance, which displays the various messages such as leakage of gas detection, booking of cylinder in case of refilling of cylinder. Additionally the system also, displays the actions carried out in the microcontroller. For the work of displaying the alert messages Liquid crystal display (LCD) of 16*2 characters operating on +5 volt supply and operated 4-bit mode is implemented.

5.5 GSM:

The GSM modem is highly flexible plug and play modem based on tri-band sim300. Sim300 can fit almost all the space requirements in much real-time application. This global system for mobile communication technology making it very easy to send and receive the messages support the AT commands. These commands can be implemented by interfacing to the receiver and transmitter pins of microcontroller. MQ6 gas sensor detects the leakage of gas, weight sensor provides the level in cylinder, and microcontroller will take the protective and necessary action. All these notable information /status happening has to be conveyed to the user. The simcom300 [6] stores the mobile number of users and distributors Operation of Monitoring and Detection system.

VI. Operation Of System

6.1 Leakage Detection system:

In the detection system the MQ6 gas sensor is used which is sensible to LPG, isobutene and propane gases. This sensor sends a signal (digital pulse) to the microcontroller when gas is being leaked. An alert message is sent through the GSM[8][9] to the user and a buzzer alarm is activated in the room. This alarm produces huge sound which drops down the attention of user and neighbours in current leak/fire accidents. These alert message will be displayed on LCD Simultaneously, LPG regulator fitted to the cylinder is automatically turned off using a relayed DC motor to avoid more leakage from cylinder.

6.2 Refilling of cylinder:

The LPG cylinder refilling unit comprises mainly the weight sensor, which is coupled with to the ATmega328p microcontroller. When the weight of the cylinder reaches the below the predetermined value the GSM modem interfaced to the microcontroller sends booking request to the distributor. The distributor will verify the validity of customer in the database and accordingly an acknowledgement message is sent through GSM modem to the user automatically.

VII. Result

Monitoring and detection system is proposed and when a small leak occurs, the system sensor detects the leakage (the range is between 400-600 ppm) and sends the alert SMS to the user and activates the alarm and provides the protection circuitry (Exhaust fan).controls the knob of cylinder using relay DC motor. Alternatively the system monitors the LPG level of cylinder, automatically books the cylinder when it reaches the lower weight 0.5kg.

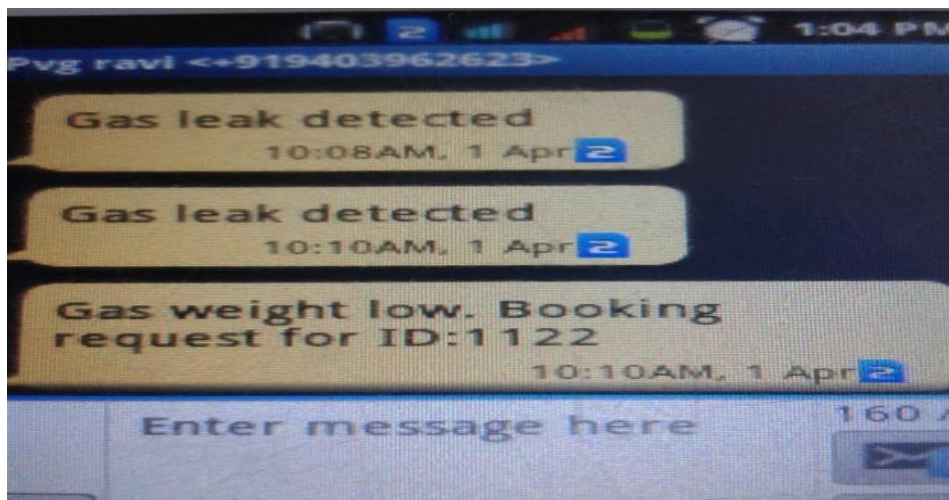


Fig 7.1 Result display on LCD

VIII. Conclusion

The system provides control action by closing the regulator knob, after that the system sends a alert message to the user and fire station within short time of leakage. It has more advantageous function than the existing system thus the real-time automatic approach is proposed in case of rebooking of cylinder. This monitoring and detection system is proposed mainly to meet the safety standards and to avoid fire accidents because of leakage.

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