

Design and Implementation of an Intelligent LPG GAS System

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Abstract

LPG (Liquefied Petroleum Gas) is one of the most important requirements of today's lifestyle for households. It is also used in Cars, Hotels, and factories. These LPG's also has drawn backs that if there are minor leakages in the cylinder or pipes it would lead to huge disaster and it would take the life of many people. So, we have come with this paper that would detect the leakage of LPG and alerts the user and auto booking the cylinder. The paper aims to detect the leakage of LPG and alert the nearby people with the buzzer and to send SMS to the user along with APP notification. We are using the MQ135 sensor to sense the leakage as soon as the leakage is detected it will send the values to the Arduino. The Arduino will send the signal to the GSM module to send SMS along with it will buzzer the alarm and the same data is sending to the cloud to notify the user with app notification also. The same paper will help in the auto booking the cylinder for this we will use load cell when the weight reduces to the specific weight then call is done to a toll-free number to book cylinder at the same time user is notified that the cylinder is booked and the booking reference number is saved in the app for the reference of the user. This work will help the people in identifying the gas leakage and also it will help the user and agencies in booking and recording the cylinder booked details using IoT technique.

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1. Introduction

LPG (liquefied petroleum gas) gas is a mixture of propane and butane, which makes gas highly flammable [1]. Ethane oil is a powerful odorant that makes LPG gas odourless and leakage can be detected easily. LPG is the most commonly used fuel for cooking, heating appliances and can also be used as an alternate fuel for vehicles often referred to as Autogas [6].

LPG liquid causes cold burn when it gets contact with skin or eye and inhaling LPG gas at high concentration for a short period causes vomiting, dizziness and sometimes can cause death. Some people will have a low sense of smell they may or may not react to the leakage of smell in these cases gas leakage detection help essentially and prevents gas accidents [2-4].

Our paper deals with the gas leakage detection and automatic booking of the gas cylinder for refill. The sensor used in this project has a high sensitivity and gives

fast response time. This gas sensor can also detects other gases including cigarette smoke. When the gas leakage is detected the output of the sensor is sent to the user as an notification to the mobile also starts to ring a buzzer and this system detects the usage of a cylinder, when the volume of gas in the cylinder reaches minimum level then a notification is sent to the user that it's time to refill the cylinder and prompts a message for auto booking. The main objective of this proposed paper is to overcome the shortcomings or disadvantages such as delay and pre-booking of the LPG cylinder by the consumers.

2. Literature Survey

2.1 Related Work

Gas Detectors are within the marketplace for a really very long time and are vastly used. they need a large range of applications and may be found in industrial plants, refineries, pharmaceutical manufacturing, paper pulp

mills, aircraft and ship-building facilities, wastewater treatment facilities, vehicles, indoor air quality testing and homes [1]. There are plenty of how within which the Gas Detectors may well be characterized.

They're categorized supported what variety of gas they detect, what's the technology behind the making of the sensor and sometimes even the components which are used that affect their operation mechanism (semiconductors, oxidation, catalytic, photoionization, infrared, etc.)[2]. Gas Detectors also are widely characterized as fixed or portable detectors. The detailed survey of the work applied is given in Table 1.

2.2 Gaps Identified

Based on the drawbacks identified from the survey, we summarized the possible gaps needs to be addressed are,

i) **Auto booking the gas cylinder:** When the amount of gas level reduces under a particular level the notification is distributed within the android application to the user and therefore the gas agency regarding the gas booking. the automated gas booking and management of

records is finished by the android application on holder records. And thus, the user gets all the data about the delivery of a gas cylinder.

ii) **Checking the usage of gas cylinder:** The proposed system is created such it detects the amount of LPG gas within the cylinder. The difference within the gas are displayed within the app so the user may come to grasp the LPG Utilized. we are able to check the usage of the gas through the LCD system.

iii) **Automatic window opening system:** When the LPG gas leakage has been detected then the MQ135 sensor will alert about the leakage and thru GSM Module user and neighbor will get SMS notification about the leakage and with the window opening sensor all the windows are opened to cut back the danger.

iv) **LCD system to test the usage:** We are using 20x4 alphanumeric liquid Display (LCD) which implies it can display alphabets together with numbers on 2 lines each containing 16 characters. This display system is employed to test the usage of the LPG gas within the cylinder

Table 1: Survey of past work carried out

Sl.no	Author	Problem identified	Proposed solutions	Advantage	Disadvantage
1.	Ashish (2013) Srivastava Ratnesh Rajeev Rahul [1]	Auto booking and LCD Display system	We proposed both an LCD and Auto booking	It's easy to book the cylinder and check the Gas quantity	It's difficult to book the gas and know the usage of gas
2.	Sameer jagtap (2016) Prajakta Priyank Jyothi	Auto booking	In this paper, we have overcome the Auto booking problem	Its automatically book the cylinder	It's difficult to book the cylinder
3	Shital (2018) Priyanka Aishwarya Nayakwadi[3]	Auto booking	We have overcome the Auto booking problem.	There is no need user to book the Gas.	Without this, it's difficult to book the Gas
4	Ratnasabapathy B.Durga Devi N.Gopi Krishna S.Gowsalya M.Jagadeesan (2018) [4]	LCD Display system and Auto Booking	We have overcome the problems of the Display system and Auto booking	We can easily check the usage of Gas and Automatically book the LPG	It's difficult to check the usage and book the Gas
5.	S.P Rajaram Thiyai Nayagi Ribuhassini(2018 Swathika[5]	LCD Display	We have overcome the LCD Display system issue	We can easily check the usage of LPG gas	It's difficult to know the gas usage
6.	Feiroz Khan Dikshita(2018) Riya sidha Anisah Manouwar[6]	Auto booking and automatic window opening	In this paper, we have overcome the automatic gas booking and auto window opening system	It's easy to book the LPG in time and when leakage occurs windows automatically open	It's difficult to book the cylinder in time
7.	Jebamalar Asir Antony B.Abinaya(2017)	SMS alert Auto booking LCD Display	We have overcome the alert through GSM module, Auto LPG gas	We can check the usage of gas and automatic gas	In their system, there is no auto booking, LCD

	H.Deepika[7]		booking and LCD system	booking and SMS alerting system through GSM module	and also SMS alert system
8	Olubusola Kamoli Akinwal Joseph (2017) [8]	LCD Display system and Auto booking	We proposed the solution like auto booking and LCD system to check the LPG usage	With this, we can automatically book the LPG gas and check the LPG usage	It's difficult to book the cylinder on time and cannot check the LPG usage
9.	D.B Kadam Shashikant patil Akshay Ananda Rohith Ankush (2017) [9]	Automatic Window opening LCD Display Auto booking	We proposed the LCD and auto booking and automatic windows open	We can check the usage of the cylinder and book the cylinder on time	We cannot book the LPG cylinder on time and cannot check the usage
10.	Rahul Guptha Meena Salman Khan Raghunandan (2018) [10]	Auto booking and automatic window opening system	We have proposed the Automatic gas booking system and automatic window opening system	It's easy to get the LPG gas cylinder on time and when the time of leakage the windows will automatically open	We don't know when the gas will be empty and hard to book the gas cylinder on time
11.	S.M Zinnuraain Mahmudu Hasal Md Akramul Md Nazmul (2019) [11]	LCD Auto booking Automatic window open	We overcome the Display system and auto booking	It's easy to book the cylinder on time and watch the usage of the cylinder	We cannot book The cylinder on time and cannot watch usage
12.	Anusuya Kanimozhi Rathna(2019) S.Sinduja [12]	Automatic window opening system	We have overcome the issue of automatic window will be open when gas leakage detected	When gas leakage detected the window will automatically open and reduce the LPG gas inside the house	The user wants to Come home and open all the windows manually.
13	Pranay Meahram Nancy Shukla Mendhekar Renuka Gadge Shivani (2019) [13]	LCD Auto booking Automatic window opening system	We have proposed the solution for LCD and auto booking system	In this paper, we proposed an easy way to book the cylinder on time and we can also watch the usage of the cylinder	In their paper its difficult to book the cylinder on time and know the usage of Gas
14.	Maha Lakshmi P.S.G Aruna P.Gopi Krishna (2019) [14]	Auto booking and LCD Display and Load cell	We have overcome the Automatic gas booking and LCD to see the usage and to check the total use of the cylinder	It's easy to book the cylinder on time and check the usage of the LPG gas	It's difficult to check the Gas usage and book the cylinder on time
15.	Zainal H.C Syahrul(2019) Mohd A.Shafie Md Ibrahim[15]	Auto booking	We have overcome the auto booking system	Its automatically book the LPG gas on time	We don't know when to book the LPG gas cylinder

3. Proposed System

Proposed System overcomes the gaps of the prevailing system. It focuses on providing functionalities like Leakage detection and Auto booking. It also gives the user status of the gas level of the cylinder in order that

whenever it reaches a level where it's would require a refill it notifies the user about it on the mobile application in order that the user can complete the booking.

3.1 Flow of Working

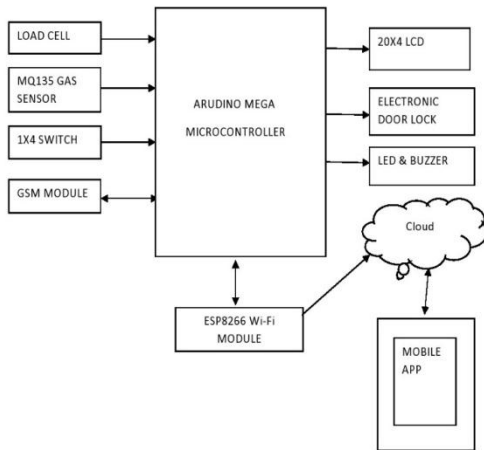


Figure 1: Block Diagram of System

This block diagram contains some important components like:

- **Arduino Mega microcontroller**

This is considered as the heart of the complete system. All the connections are done on the same board. Some of its functionalities include reading the weight sensor and gas sensor values, sending the values to the LCD and, sending the data to the GSM module

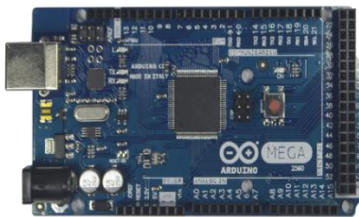


Figure 2: Arduino Board

- **MQ135 gas sensor**

MQ135 gas sensor Plays a major role in detecting of presence or absence of LPG gas, MQ135 gas sensor is an air quality sensor. Which detects gases of wide range including NH₃, alcohol and also natural gas. The sensor works on 5VDC volts. The detector will detect the gas concentrations anywhere from 10 - 300 ppm NH₃, 10 - 1000 ppm Benzene, 10 - 300 Alcohol. It detects the concentration of gas in the air. Its dimensions would be 18mm Diameter, 17mm High excluding pins, Pins - 6mm High. We set a threshold value of 270ppm. That is, if the gas leakage has occurred and it crosses a threshold value of 270 ppm or more the alarm goes on.



Figure 3: MQ135 Gas Sensor

- **Load Cell**

A load cell is a sensor or transducer then converts the electrical signal proportional to the force applied to it. We are using a 40kg load sensor in our system. This is used to measure the weight of the gas cylinder thus helps in auto booking of gas



Figure 4: Load Cell

4. Implementation

This paper provides an alarm that detects a gas leakage within the house and commercial premises. the target of the system is to continuously measure the load of the cylinder and as soon because it reaches the minimum capacity it'll automatically send an SMS alert and a notification on their mobile application so they'll act accordingly. this technique also provides leakage detection. Whenever a leakage is detected a buzzer starts ringing

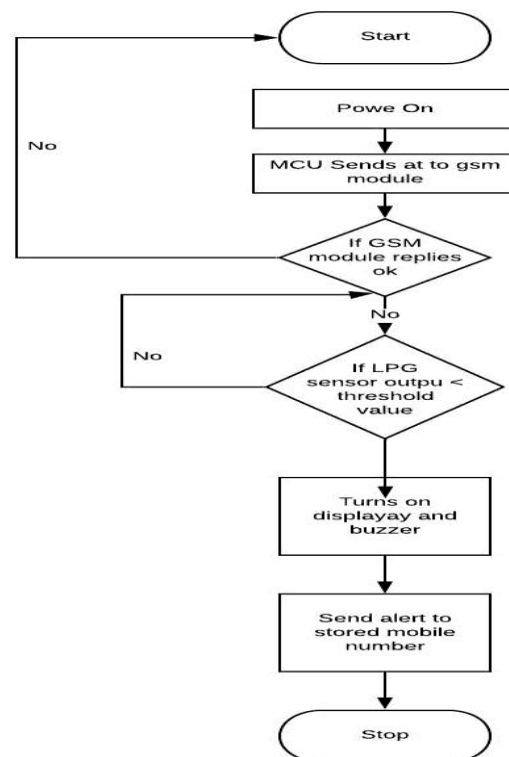


Figure 5: Flowchart of the leakage detection system

Gas leakage detection system: When the gas is leaked, the system is power on MCU(Microcontroller Unit) will send a signal to GSM module about the leakage, if GSM module will not detect then it will start again if the module will replies ok then it will move on to the sensor. If LPG will less than the threshold value then there will be no

alert message, if the LPG reaches threshold value then the buzzer and the display system will be on then the alert message will be sent to the user and the neighbour which are stored in the database. Then within some time, the alert will be turned off.

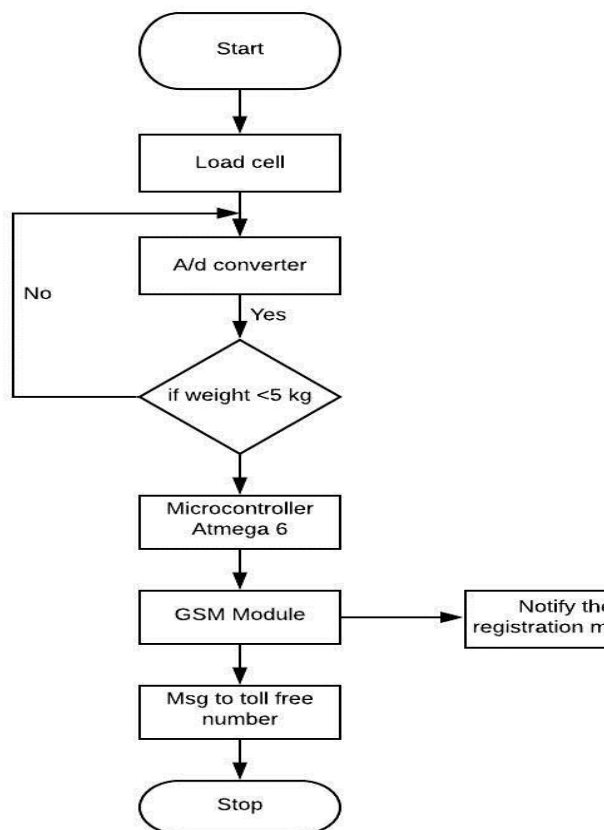


Figure 6: Flowchart of the leakage detection system

Auto booking system: LPG cylinder will be placed on the load cell, if the weight of the cylinder will be greater than the fixed value then there will be no alert message, if the cylinder weight will be less than the fixed value then Microcontroller Atmega6 will receive the signal then through GSM module the registered mobile number will receive the message about the refill booking. And it will automatically book the new cylinder and send the message to the user about the refill booking.

5. Outcomes

Hereby we have presented a few of the snapshots of the work carried out.



Figure 7: The working hardware model



Figure 8: Home page of the Mobile App



Figure 9: Registered users can search for the status of GAS through the registered ID

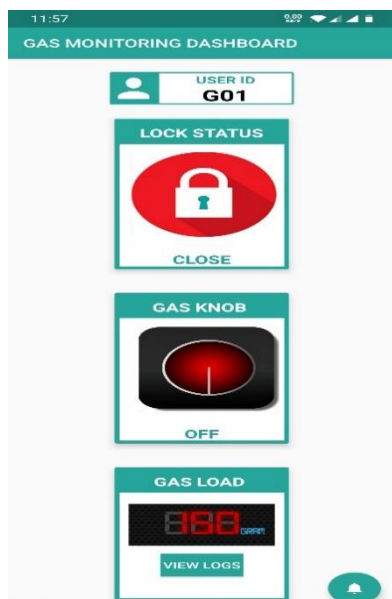


Figure 10: Different options management bar

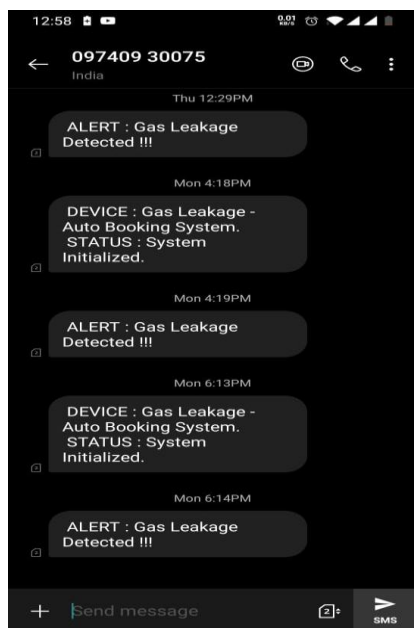


Figure 11: The SMS management to the registered mobile number

6. Conclusion

In this paper we are providing automatic cylinder booking and LPG leakage detection system without human interference. Our paper will help people for the security of life and protect the property from fire accidents. The most objective of this paper is to detect the gas leakage and measure the gas present within the cylinder when the load of the cylinder is below the brink level it'll automatically call the toll free number to auto book the cylinder and saves the small print within the application and sends a notification to the user. So, the user involves know that the cylinder booking is finished. Thus, this

paper developed by us will help the user to guide their life with safety and a snug life.

7. Future Enhancement

In Future, this monitoring system will be further enhanced robot will be developed for detecting multiple gas concentrations and fire. Rather than a load cell sensor we will even be used as a pressure sensor that detects the number of gas within the cylinder and also detects the pressure of a gas in cylinder pipe. We will also implement it further in gas pipelines.

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