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LPG Cylinder Level Indication and Automatic Gas Booking System

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Abstract: ***People may now live more effectively because of the quick growth of technology. When it comes to utilizing liquefied petroleum gas (LPG), one of the most frequent problems is that the tank is empty during prime cooking times. Other issues that may arise include failing to foresee the gas cylinder's operational days and being unaware of the gasoline's present level inside the container. One of the most frequent causes of these problems while using liquefied petroleum gas is a lack of awareness of the level of gasoline within the container. We frequently forget to order a new cylinder when the one we have is empty or consumed. The electronic gadget created here is highly helpful for domestic users in these situations since it automatically sends a booking notification to the appropriate authorities' right before being emptied. The system designed here is used to measure continuously and display the gasoline content in the cylinder. And when the gasoline content is less the 10% of the original weight then the alert will be given with the buzzer alongside sending the text message to the LPG cylinder distributor to book the cylinder with the texted customer details. In this research, a framework is proposed for automating the whole LPG cylinder booking system without the need for human intervention. For the authorized LPG distributor to deliver the LPG chamber on time, this system continuously measures the weight of the cylinder, and if below 10% then delivers messages as a result to the LPG cylinder agent.***

Keywords: ***5Kg load cell with the processor, Arduino Uno board, LCD, Buzzer, GSM module, 5v and 9v regulated power supply unit, container, etc.***

I. INTRODUCTION

Liquefied Petroleum Gas (LPG) cylinders are commonly used for domestic applications for cooking purposes. But it is very difficult to find out the available LPG present in the cylinder. All of sudden if the cylinder will become empty, it is not possible to replace the cylinder with a new cylinder instantly hence it is essential to find out the level of LPG frequently and send the information to the booking office automatically when the cylinder level is reduced to less than 10% or 5%. To do so, here this instrument is designed can measure the gas level accurately by which necessary considerations can be implemented in advance. In this project work, GSM technology is used to send the gas level information to the concerned mobile phone. When the level is reduced, auto booking information like service number, user address, mobile number, etc information can be sent to the Gas Company for booking a new cylinder.

Presently this kind of technology has not existed anywhere & for demo purposes, the information will be sent to the designer of this project work, i.e., to the student's mobile phone for demo purposes. The information will be sent in the form of an SMS. The advantage of using GSM technology is that it does not have any range restriction in wireless communication system because mobile network covers all over the world.

This work, to prove the concept practically & to measure the cylinder level in grams or kilograms, the load cell is used, and it is interfaced with a proper electronic instrument designed with an Arduino board. The GSM module interfaced with Arduino will have wireless communication between the main processor and the concerned mobile phone. One important aspect of the system is that it energizes an alarm automatically when the gas level reduces to less than 10%. This indicates that the gas level is low and soon notification will be sent to the mobile phone for booking a new cylinder for demo purposes. Once the alarm is energized, it remains in energized condition until someone activates the alarm reset button.

The project has two independent working parts, one-part deals with the gas level (in the form of weight) or gas remaining in the cylinder which is designed using a sensor called a load cell and the other part is to send the information to the concerned mobile phone whose number is stored into the main processor. This is the main processing unit and is connected to a GSM device to transmit the data to the concerned mobile phone automatically.

Any smartphone can be used for this purpose. We can use a serial monitor to type in SMS messages to any phone number. Once the Arduino is activated, the message can be sent to the concerned mobile phone.

The device's ATmega328 microcontroller chip, a single-chip microcontroller developed by Atmel and a member of the mega AVR family, serves as the main processing unit of the Arduino Uno module. The Arduino is an effective tool for prototyping for numerous reasons, including the absence of a specialist programmer, the abundance of libraries available, and the ease of use of its IDE (Integrated Development Environment). Any microcontroller's operation is dictated by the program that is stored within. The software is constructed in a way that enables the Microcontroller to read and save the data obtained from the furnace. The Microcontroller uses an LCD to show the temperature and voltage levels in accordance with the data it has received. In order to control the features or operations of the product, microcontrollers are "embedded" inside another device. Micro-controllers carry out a single duty and execute a single program. Devices with minimal power consumption include microcontrollers. 50 milliwatts may be used by a Microcontroller that runs on batteries. In addition to having a specific input device, microcontrollers frequently (though not always) include a tiny LED or LCD display as an output.

The load cell, which is a crucial component in this project and plays a significant function, is now the topic of discussion. As a strain gauge, the load cell employed in this instance provides a variable resistance in response to the force applied to a load cell platform that is coupled to the load cell. Load is a transducer which converts mechanical energy to electrical energy and Strain gauges, pneumatic systems, and hydraulic systems are the three most used forms of load cells. The load cell in use here has a 5kg rating, meaning it can measure loads up to that weight. A load cell is a transducer that, like our conventional weighing scales, transforms mechanical force into readable electrical units. Their primary function is to measure or assess the amount of transmitted load.

II. LITERATURE SURVEY

In [1] has created a robotized LPG booking system in their paper with no human involvement. In order to deliver the refilled gas chamber on time, this system continuously monitors the weight of the cylinder in real-time and sends a notification to the appropriate Agent. The structure also has a gas leak detecting system. In the event of a gas spill, the system alerts the client.

In [2] have developed a cost-efficient device that is less than the price of fuel detectors in the present society. The proposed model not only tracks gas levels but also ensures safety. By detecting gas spillage and fire occurrences, the system is equipped with automatic opening of doors and windows.

A gadget that combines a microcontroller and GSM modem has been developed and built in [3], and it is used to record meter readings and calculate the amount of energy utilized from an energy supplier outlet in total by the user. A bill from the energy provider to the customer will be sent through GSM based on information about energy use. The design was executed to increase reading and billing accuracy.

They created a tool in [4] that uses a load sensor to gauge the LPG level (SEN-10245). The output of the sensor is connected to an Arduino R3 board. Through the GSM Module, the user receives the information by SMS (short message service), and when they call the registered gas booking number, an automatic reservation is created. The gas leak is then found by the gas sensor (MQ-6). As a result, we can see the LPG level as it is now shown on the LCD.

[5] described a technique in which a load cell detects the weight of the cylinder and sends that information to ubidots. The data is shown on Ubidots when the weight drops below the cutoff point, and when the indicator becomes red, a notification to book gas is sent to the agency. A MQ2 sensor continuously measures the gas concentration. An LPG leak will cause concentration to increase, warning the user.

A method that executes the complete cylinder backup operation automatically was proposed in [6]. When the weight of the cylinder hits the threshold limit, the gadget continually checks it and warns the LPG agent. The system also has a MQ-2 sensor and a fire sensor to warn customers in case of accidents in addition to the booking component.

In [7], a framework was created with the use of IOT in order to reduce the hazards brought on by the gas leak. They created a model based on the assumption that, in the event of a gas leak in an LPG container, an alarm notice will be sent through SMS to a pre-determined number with the aid of a GSM module. This model is useful for providing customers with better advice and protecting their lives from the dangerous effects of gas spills.

III. PROPOSED METHODOLOGY

The proposed system shown in figure 1 is used to address the problem. It resolves the issues with the current system and focuses on delivering features like determining the gas content and updating the user on its status. The Load sensor for weight measurement and the Arduino uno and GSM module for networking make up the system foundation.

This embedded processor is used to monitor the data parameters in real-time. The cylinder is held in a mechanically created load cell that has a weight measuring load sensor attached to it. Periodically, the load sensor attached to the underside of this plate measures the cylinder's weight and transmits the information to the signal amplifier. The microcontroller receives the digital signals that the amplifier has converted from the analogue signals, the working procedure can be well understand with flow chart shown in figure 2.

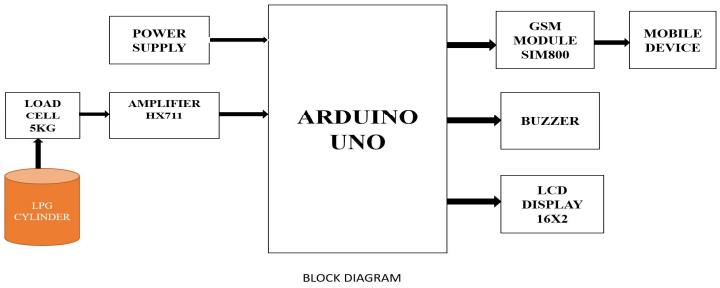

Figure 1: Block diagram of proposed system.

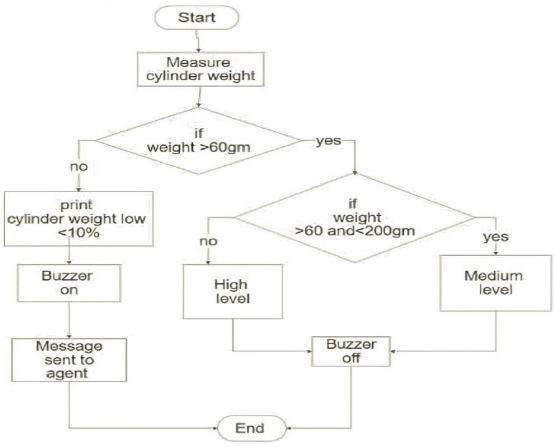

Figure 2: working flowchart

Flow chart explanation:

Step1: Start the system with empty load.

Step 2: Now put the weight into container and the weight of the container is measured periodically.

Step 3: If weight the container is greater than 60g

Step 3.1: If yes

3.1.1: If weight is greater than 60g and lesser than 200g, then

3.1.1.1: If yes, the container is in medium level and buzzer off

3.1.1.2: else the container is in high level and buzzer off

Step 3.2: else

3.2.1: then weight of the container is low that is 10%

3.2.2: buzzer is on

3.2.3: message sent to agent

Step 4: End

IV. PRINCIPLE OF OPERATION

A. Power Supply

To begin with, half-wave rectification was used to convert the AC power supply (230V) to pulsing DC (12V) by connecting a step-down transformer to a 4007 diode. A voltage regulator receives this 12V DC power source in order to maintain a steady output voltage. The voltage regulator 7812 keeps the voltage at 12 volts, while the regulator 7805 keeps the voltage at 5 volts. As a total, we now have three voltage sources: ground, a steady 12 volts, and 5 volts.

The GSM module receives 12V as the input power supply from various voltage sources. Consequently, 5V is used as input power supply for the buzzer and LCD and is regarded as digital enable 1. Internal to the Arduino board is an AMS1117 voltage regulator, which transforms a continuous 12V supply to the necessary 3.3V and provides that 3.3V internally.

B. Voltage Amplifier

Since the output from the load cell is only in millivolts, the Arduino Uno cannot handle it, therefore we use a voltage amplifier to boost the voltage.

C. Load Cell

We generate voltage signals through the voltage amplifier to feed the HX711 chip. This device features an on-chip power regulator that supplies analog power, so we do not need any external supply regulator and can directly connect with the bridge sensor. It accepts voltage signals as input and outputs digital data (load sensor).

D. LCD

A 16x2 LCD display with 32 pins is used in the system. In our method, we routinely weigh the cylinder and display the results on the LCD. We utilise a container as a cylinder since this system is being used as a demo. When the weight exceeds 200g, the word "HIGH LEVEL" appears on the screen. After then, 'MEDIUM LEVEL' is shown on this screen if the weight is higher than 60 g but less than 200 g. Next, 'LOW LEVEL' is shown on the screen if the weight is less than 60 g.

E. Buzzer

The buzzer automatically buzzes when the container's weight is less than 60 g, indicating that the container's weight is low (i.e., less than 10%).

F. GSM

The GSM module receives the processed data from the Arduino so it may connect with the network. The SIM card of the user is inserted into the GSM. Therefore, as soon as the container's level is low, the distributor receives a text message with the customer's information.

V. RESULTS

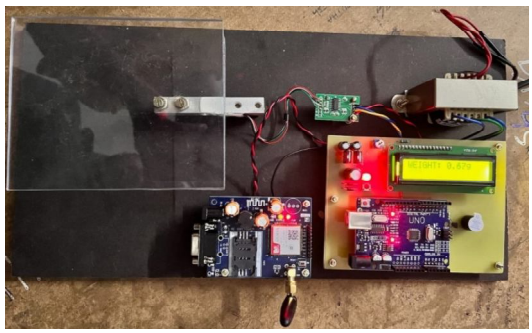

Fig3: Design of the project

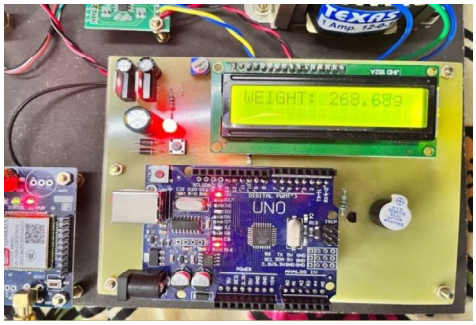

Fig4: when container is full

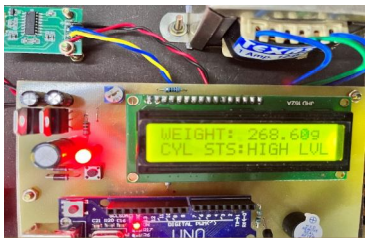

Fig5: when container is at high level i.e.,>200g

Fig6: when container is at medium level i.e.,>60g and <200g

Fig7: when container is at low level i.e.,<60g

VI. FUTURE SCOPE

In the future, an extra MQ-4 sensor might be attached in the event of a gas leak. Additionally, driver and exhaust circuits may be added. In the event of a gas leak, a GSM alarm notice can also be delivered to the customer. We can also link with smart home apps, where windows and doors open on their own when there is a gas leak, thanks to driver circuits and relays.

VII. CONCLUSION

The suggestion made in this project would be a further development of home automation. With less need for human interaction thanks to this technology, essential action may be taken in advance to monitor the gas level in the LPG cylinder. When the gas level is low, the system will automatically activate the alarm. This technology may also be scaled for use in industries with the right setup. Gas cylinder level monitoring combined with auto booking utilising GSM was successfully finished, and the results were good. We encountered several issues while trying to calibrate the load sensor output to equal weight in kilogrammes. After several treks, we were able to precisely estimate the weight. In the sphere of home automation, GSM technology is one of the rising industries for the foreseeable future. GSM facilitates communication between sensors and humans via various devices. Recent advancements in wireless sensor networks have sparked a new trend in embedded system-based autonomous message transmission.

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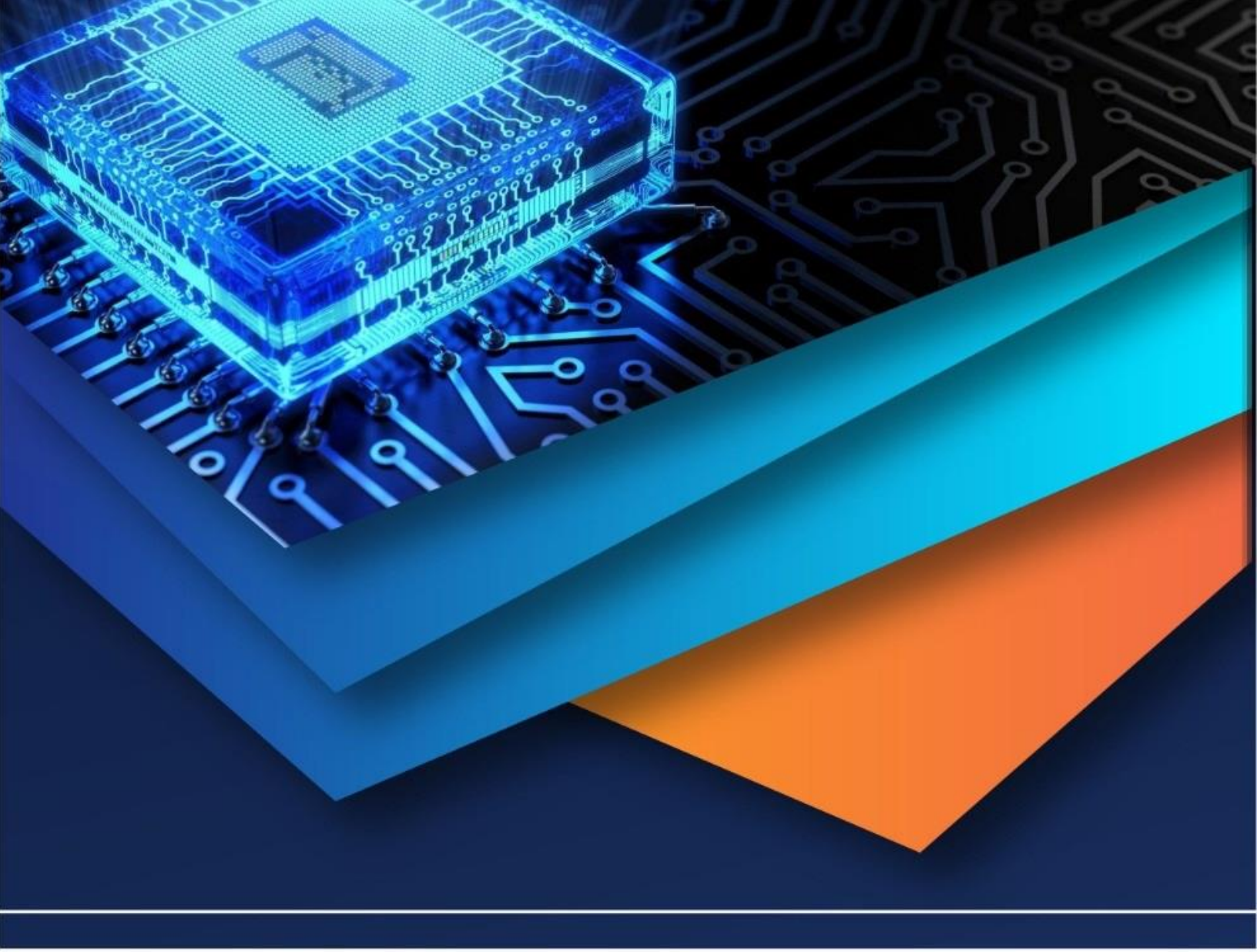

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