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IOT Based Smart Stand for LPG Cylinder Monitoring and Safety Enhancement

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ABSTRACT -- *It is an IoT-based Smart Stand for LPG Cylinder Monitoring and Safety Enhancement. LPG cylinders are currently used in every Indian home to cook. In order to make human life easier and safe an automated system is necessary. This system has a variety of monitoring tools that are both safe and automatic. It uses load cells to measure the quantity of gasoline left in the cylinder and it will be informed to the user through an LCD and a mobile/blynk interface. It also warns the user if the gasoline has depleted beyond the predefined limit. It detects gasoline leaks and performs a variety of accident-prevention tasks such as warning the user about gas leaks through a mobile interface called Blynk app and turns ON the exhaust fan and buzzer as well as turns off the gas regulator without the need for human intervention. Remote control of the regulator is also available, allowing you to extinguish the flame by turning off your regulator from anywhere using a mobile interface.*

KEYWORDS: *IoT, LPG cylinders, Load cell, Blynk, ESP 8266 NodeMCU, MQ-9 gas sensor*

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I. INTRODUCTION

Almost everything nowadays is safe and automated, excluding the LPG cylinder systems. In this paper, an automated safety system is presented that simplifies the human lifestyle in handling LPG cylinders while also reducing the risk of cylinder explosion incidents to some amount. Almost everyone estimates the quantity of gasoline in the cylinders by lifting it or igniting the fuel with a burner. Both are unreliable and imprecise methods of determining the amount of gasoline in cylinders. By utilizing a load sensor as a key component, this system communicates the quantity of gasoline existing in the cylinder to the outside world via an LCD.

The primary purpose of identifying the amount of gasoline is to book a cylinder when the gasoline in the cylinder runs out. This technique has the benefit of not requiring the user to constantly monitor the amount of fuel. Every user will be able to set their limit. When the gasoline reaches the limit, it sends a warning to the user, informing them that their fuel is about to run out and that they should book a new cylinder.

The majority of LPG mishaps are caused by gas leaks, which can cause explosions if not detected. This system employs an MQ9 sensor, which detects gas leakage and instructs the controller to activate the exhaust fan, allowing gasoline to escape from the premises and into the air, reducing the risk of an accident. It also notifies the mobile unit and sounds a buzzer to alert the user about the leakage.

When you are far away from the kitchen and remembered that you left food on the burner with the gas turned on, in this kind of scenario, you can't turn off the gas immediately. This system provides a mobile/blynk interface, using which you can stop the flame by switching off your regulator from any place you are at.

II. LITERATURE SURVEY

V. Tamizharasan, T. Ravichandran, M. Sowndariya, R. Sandeep, and K. Saravanavel paper [1] on *"Gas Level Detection and Automatic Booking Using IoT*" demonstrated monitoring the gas level in the cylinder and sending a notification to the user via a mobile network if the gas level falls below a specific threshold.

K. M. Sudar et al. paper [2] on *"Gas Level Detection and Automatic Booking Notification Using IoT"* demonstrated that notifying the user when there is a gas leak will not be enough to eliminate the risk of gas leak accidents, so they introduced a way to let the gas out from the premises by using an exhaust fan, with the result that if the user fails to identify the leak, the impact will be minimal.

M. H. B. M. Yaya, R. K. Patchmuthu, and A. T. Wan paper [3] on *"LPG Gas Usage and Leakage Detection Using IoT in Brunei"* Introduced an automatic regulator switching, which automatically turns off the

regulator when gas leakage exceeds a predetermined limit. This will help to prevent accidents and gasoline depletion due to gas leaking.

A. Chakraborty, S.C. Shah and Y. Sravan Kumar paper [4] on "*Smart Parking System Based on the IR Sensor and Node MCU with the Blynk Application*" provided us an idea how to control NodeMCU by using Blynk application.

III. IMPLEMENTATION

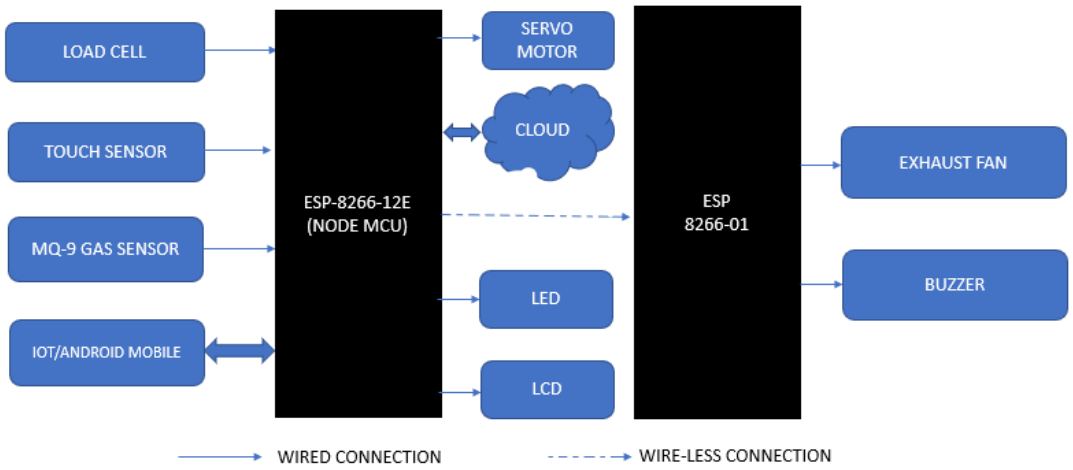

Fig 1: Block Diagram

The overall system circuitry is a combination of two wirelessly coupled circuits. The primary circuit is installed beneath the stand, which houses the ESP8266-12E NodeMCU and the components seen in the block diagram. It performs utmost operations namely Gas level indication, Regulator control, and Gas leak detection and sending accident prevention commands to the secondary circuit when a gas leak occurs. The secondary circuit, which is wirelessly connected to the primary circuit, consists of an exhaust fan and a buzzer connected to the ESP 8266-01 and conducts functions such as exhaust fan switching and alarming buzzer under the primary circuit's commands.

Load cell, Touch Sensor, and MQ-9 gas sensor are the three components that are responsible to provide inputs to NodeMCU. MQ9 Gas sensor provides information such as the presence of combustible gases in the air. load cell continuously monitors the weight of the cylinder and provides this information to NodeMCU. The touch sensor acts as a switch when the finger comes in contact with the sensor it closes/opens the regulator valve.

LCD, buzzer, Servo motor, LED and exhaust fan are the hardware output devices through which NodeMCU performs multiple operations. LCD displays the gasoline content available in the cylinder with that the user can acknowledge the amount of gas available in the cylinder. The buzzer and exhaust fan are the 2 devices that function when there is a gas leak occurs. The buzzer creates a buzzing sound to alert the user about the gas leak and an exhaust fan is used to spill out the gas on the premises. The servo motor is assembled with the gas valve to control its position. The gas regulator can be opened/closed whenever the servo motor does an angular rotation. The position of the gas regulator is indicated through the LED.

Cloud and OS/Android mobile with blynk installed are Blynk software-dependent blocks that are responsible for all the communications between the smartphone and hardware. It allows the user to control, command, and monitor the system functions.

IV. BLYNK INTERFACE OF THE SYSTEM

Fig 2: Blynk interface of the system

The interface comprises two virtual switches, one switch is used to turn on/off the regulator and the other one is to turn on/off the exhaust fan. The switches are indicated whether they are on/off as in the form text on the switches. It is necessary to be updated when the regulator or exhaust fan is switched using physical switches.

Similar to the switches the interface provides two sliders that play a vital role in the limit setting. The notification percentage slider avails the user to set the required limit by sliding it. The principle behind obtaining the gasoline content is subtracting the weight of the cylinder from the gross weight to get the amount of gasoline available. A cylinder weight slider is a key to subtract the cylinder weight to obtain the gas content in the cylinder. The user needs to set the slider to a weight equal to the type of cylinder he/she using. This information can be found on the top of the cylinders.

There are two gauges that look like meters. One gauge is to indicate gasoline content available in the cylinder through which one can observe it either by digital number or by the amount of ring filled in the meter. The other gauge provides the gross weight of the cylinder

V. RESULTS

Fig 3: Front view of the proposed system

VI. CONCLUSION AND FUTURE SCOPE

6.1 Conclusion

With this system, most of the limitations associated with LPG cylinders are alleviated to a large extent. We automated and provided remote control of the majority of the operations linked with it, making the use of LPG cylinders simple and safe. This mechanism informs the user about the gasoline content in the cylinder and notifies the user when the fuel is drained beyond the predetermined limit. Prevents gas leaks by automatically turning off the regulator still if the gas leak continues, the user will be notified via the Blynk app and buzzer; additionally, it spills out the gasoline by immediately turning on the exhaust fan. The feature of remote regulator control allows you to extinguish the flame by turning the gas regulator OFF from anywhere. This feature will be helpful if you leave food on the stove with the gas switched on and you are not present in the kitchen to turn off the flame.

6.2 Future Scope

The proposed system can be further developed with the features such as if there is any fire accident occurs the system should send GPS location of fire accident to the fire station as an emergency. The system should provide a report of the daily gas usage with that the user can acknowledge the usage of gas. It should automatically book a new cylinder when the gas gets depleted beyond the limit by eliminating intermediate involvement of human calling to the gas agency.

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