IOT-Based Digital LPG Gas Cylinder to prevent Hazards with Blynk Application Features

V.Elumalai
Department Of Electronics and Communication Engineering, V.S.B.Engineering College, Karur, India.

S.Tamizhanangu
Department of Electronics and Communication Engineering, V.S.B.Engineering College, Karur, India.

K.Yalini
Department Of Electronics and Communication Engineering, V.S.B.Engineering College, Karur, India.

M.Sowmya
Department of Electronics and Communication Engineering, V.S.B.Engineering College, Karur, India.

S.Suwetha
DepartmentofElectronicsand Communication Engineering, V.S.B.Engineering College, Karur, India.

Abstract- The ubiquitous presence of LPG gas cylinders in household kitchens for cooking purposes underscores their importance, yet concurrently raises concerns regarding safety hazards. In response to these concerns, this paper introduces a comprehensive solution aimed at augmenting safety measures through the development of an innovative IoT-enabled monitoring system tailored specifically for LPG gas cylinders. Central to this system are advanced features including gas leakage detection, fire detection, and real-time monitoring of crucial parameters such as gas cylinder weight and temperature. Leveraging sensor technology, the system offers continuous surveillance to preemptively identify potential risks and mitigate them effectively. Notably, the incorporation of gas leakage detection mechanisms, coupled with automated shut-off functionalities, serves as a proactive measure to prevent life- threatening situations. Furthermore, the system integrates seamlessly with the Blynk application, providing users with a user-friendly interface for remote monitoring and receiving critical alerts regarding gas levels and potential leaks. Through cloud platform integration, the system ensures centralized data management and accessibility, facilitating streamlined operations and enhanced efficiency.

Keywords: HX711, Internet of Things (IoT), Liquid Crystal Display (LCD), Load cell, Gas Monitoring, SafetyMeasures, Leakage detection, Safety Measures.

I. INTRODUCTION

The innovation of the IoT-enabled digital gas cylinder trolley prototype represents a significant step forward in addressing the safety concerns associated with LPG cylinder usage. Beyond enhancing safety, this solution also streamlines gas management processes ,offering user sun precedented convenience and peace of mind. One of the notable features of the system is its ability to provide precise gas weight estimation, eliminating the guesswork traditionally associated with determining cylinder fill levels. By continuously monitoring the weight of the gas cylinder in real time and transmitting updates to a cloud-based platform, users canEasily track gas consumption patterns and plan re fills accordingly. This not only prevents unexpected gas shortages but also ensures optimal utilization of resources. Furthermore, the integration of temperature monitoring capabilities adds another layer of safety to the system. By continuously monitoring cylinder temperatures, the system can identify irregularities that may signal potential safety hazards, such as overheating or excessive pressure accumulation. This proactive safety approach significantly diminishes the likelihood of accidents and bolsters over all user confidence in the system. Furthermore, the integration of gas leakage detection mechanisms constitutes a pivotal aspect of the system's safety features. Swift identification and response to gas leaks are imperative for averting accidents and limiting potential damages. Through the utilization of sophisticated sensors and real-time monitoring capabilities, the system can promptly detect and address gas leaks, thereby mitigating risks and ensuring user safety .Along side its safety attributes, the system's linkage with the Blynk Cloud platform amplifies user accessibility and convenience. The user-friendly Blynk application interface enables users to remotely oversee gas cylinder status, receive instant alerts, and access historical data trends from their smart phones. This seamless integration empowers users with the insights they need to make well-informed decisions and implement proactive measures to ensure safety and efficacy in their daily activities.

II. PREVIOUS WORK

To overcome this trouble, some research and tasks have been completely associated with tracking the gas leak. The LPG gas leak detector mainly has a leading unit that manages everything, like sensing the gas and alerting the user [1]. It handles a sensor, an alarm, and the internet. Sensor to detect LPG leakage, alarm for warning about leaks, and internet to connect with GSM or Wi-Fi [2][3].Here, the user connected to the internet to check the system or get alerts on their phone or computer. When LPG gas exudes

From the gas stove burner, a special sensor is connected to that coil and sends a signal. At the same time, a message is sent to the user through the Node MCU and stored in its memory. There as on for using the ESP8266 Wi-Fi module is to send alerts to the user's smart systems [4]. The Node MCU also activates the buzzer and fan to prevent explosions before the fan starts to remove the gas. If any leakage is detected, a message is sent via GSM. When the temperature rises, it's automatically switched on by the fan. It all can be easily identified through the smart phone [5].After that ,the main thing is to measure the weight of the gas cylinder. To monitor the weight of the cylinder, a load cell is utilized. This device converts the force of the LPG's cylinder weight into an electrical signal. The load cell is set under the LPG gas cylinder and measures its weight by sensing the force from the LPG load cell. It's a cheap and safe gadget that offers solutions for LPG use. Many people can afford this device to keep their homes safe [6][7][8]. The household gas monitoring system keeps an eye on several parts: A tiny computer (ESP8266) that can connect to Wi-Fi and uses little power. A weight sensor (load cell) to track how much gas is left in the cylinder. A gas leak detector(MQ5sensor)to sniff out any leaks. A small screen (an I2C display) will show you information [9][10].A buzzer will make a loud noise if there's a leak. A power source (5-volt supply) to keep every thing running. All the information about gas leaks and how much gas is left is stored in a safe place online (in the cloud). The computer sends this information using Wi-Fi. There's also an app for your phone that's how is you how much gas is left and if there's a leak happening right now [11][12]. Arduino UNO is a user-friendly electronic board. Through this, we receive the signal and control all the devices connected to it. The servo motor controls the speed and sends the signal to the Arduino UNO. The new model is a flexible and dependable wayto find LPG leaks, check the gas level in the cylinder ,and allow users to self-service refills by sending a request through SMS with automatic buttons at the desired time. If the cylinder level goes down to a critical value, BLYNK sends the signal. This system also supports users with leaks, preventing hazardous accidents [13][14][15].

III. SYSTEMARCHITECTURE

The proposed embedded system addresses to resolve the problems. It prioritizes user-friendliness through an intuitive interface. At the heart of the system lies an Arduino UNO microcontroller, tasked with interfacing and managing a variety of sensors and actuators. The intricate details of these vital components and their roles will be thoroughly explored in the following sections.

A. Arduino UNO microcontroller

The Arduino UNO stands as a broadly embraced open-supply microcontroller board, leveraging the ATmega328P chip as its foundation. Renowned for its accessibility, it furnishes a welcoming environment for the creation of microcontroller-driven endeavors. With its array of capabilities, the UNO boasts fourteen virtual input/output pins (with six offering PWM output), six analog inputs, a sixteen MHz ceramic resonator, a USB connection, a strength jack, and an ICSP header designed for in- circuit serial programming. This Arduino UNO works on a twelve Volt deliver on this circuit.

Fig.1.ArduinoUNOATmega328p

B. Load Cell

Load cells, passive transducers converting force into a weak electrical signal, are often paired with UNO to boost the signal strength for microcontrollers with limited analog sensing capabilities. The supply for this load cell is 5V and here we are used 10kg load cell. It does not directly connected to UNO. First it connects to sensor to receive the analog signal that sensor sends the signal to Arduino UNO through the pins of 4 and 5.

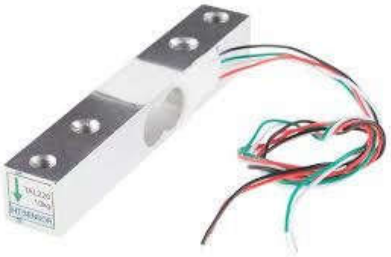


Fig.2.Load Cell

C. LCD Display

A 16x2 Liquid Crystal Display (LCD) is employed for result visualization. To minimize pin usage on the Arduino UNO microcontroller,anI2CmoduleinterfacestheLCD,enablingdata transmission with only two pins. This LCD module connected to Arduino UNO through the 11,9,8,7 UNO pin connected to Rs enable and D0 to D3 pins.

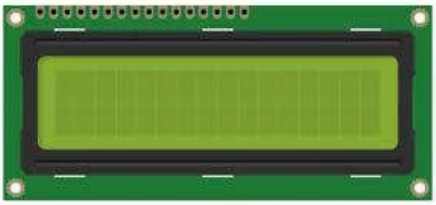


Fig.3.LCD Display

D. GPS Module

GPS device connected with DC source because in the AC source, it is not to be used. Then this is connected to the Microcontroller of Arduino UNO of ADC convertor. It also connects with the mobile application used in the BLYNK App. It tracks the location of LPG so the fire station can easily identify it LPG causes any leakage.

Fig.4.GPS Module

E. BLYNKIOT Application

Blynk, an IoT platform accessible on iOS and Android smart phones, enables remote control of Arduino and Node MCU devices over the Internet. This software is connected with a mobile app to track the location, and temperature of surroundings, through the mobile application detects the gas leakage and additionally weight of the gas cylinder.And one analog pin for reading analog sensor data like gas sensors, temperature sensors, etc.

G. Servo motor

Temperature Performance Analysis of Servomotor in LPG Gas Leakage Detection Systems. It produces torque and velocity based on the supplied current and voltage. Servomotor plays a pivotal role in LPG gas leakage detection systems, where precise control and responsiveness are imperative for timely alert sand preventive measures. However, the temperature sensitivity of servomotors raises concerns regarding their efficacy in varying environmental conditions.

Blynk

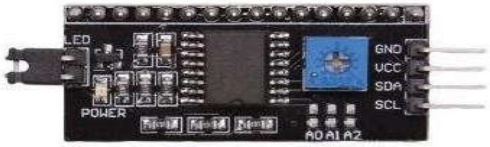
Fig.5.BLYNKIOT Application

H. Gas

Fig.7. Servomotor

F. Node MCU Microcontroller

Node MCU is an open-supply digital platform primarily based on the ESP8266 Wi-Fi Microcontroller Chip. It capabilities 16 general-cause input/output(GPIO)pins for virtual input or output



The MP3 gas sensor use din LPG gas leakage detectors works by detecting changes in the concentration of gas in the air. It contains a sensing element that reacts to the presence of LPG gas molecules, triggering an electrical signal. This signal is then processed by the detector to activate alarms or warnings, alerting users to potential leaks. It sends the analog signal to Arduino UNO. Pin out of the Gas Sensor. The GND pin serves as the ground connection and should be linked to the Arduino's GND pin. D0 functions as the digital output pin, providing a digital signal representing the detected gas.

I.Temperature Sensor

The temperature sensor senses the surrounding weather conditions. It provides crucial data for detecting anomalous thermal patterns associated with gas leaks, there by improving the reliability and efficiency of gas detection systems. It mainly focuses on the environmental conditions of servomotor.

Fig.6.Node MCU

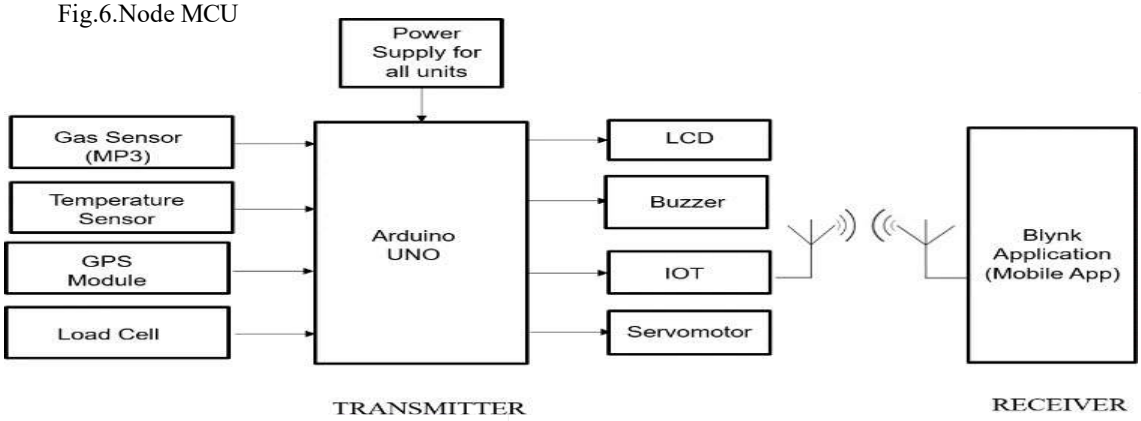


Fig.8.BlockDiagram

PROPOSEDMETHODOLOGY

Our proposed system incorporates several essential features aimed at enhancing safety and convenienceing as cylinder management:

- Continuous monitoring of gas cylinder weight ensures users are always aware of the remaining gas level, displayed both on an LCD screen and through a dedicated mobile application.
- Automatic detection of gas leakage triggers an immediate response ,with the system seamlessly shutting off the gas regulator to prevent potential hazards.
- Remote control capability enables users to manage the gas regulator from anywhere in the world, providing unparalleled flexibility and peace of mind.
- Should a gas leak occur, the system swiftly disengages the primary power supply, augmenting safety measures within the operation.
- Real-time updates on gas leakage status and cylinder weight are consistently provided through both the mobile application and the LCD display.

Upon powering up the system, all sensors become active, with the load cell serving to convert mechanical energy into electrical signals. These signals are then relayed to the Node MCU controller via the HX711 amplifier, facilitating continuous monitoring and updating of the cylinder's weight. In case of a gas leak, notifications are sent through the BLYNK app, accompanied by automatic shutdown of the gas regulator. Further more, to mitigate potential fire hazards, the system employs a relay connected to a receiver circuit, facilitating the swift disconnection of the main power supply. The BLYNK cloud server provides users with real- time monitoring of gas and weight levels, with control switches enabling them to regulate the gas flow remotely. This ensures that even if users forget to switch off the regulator, they can do so promptly from any place worldwide.

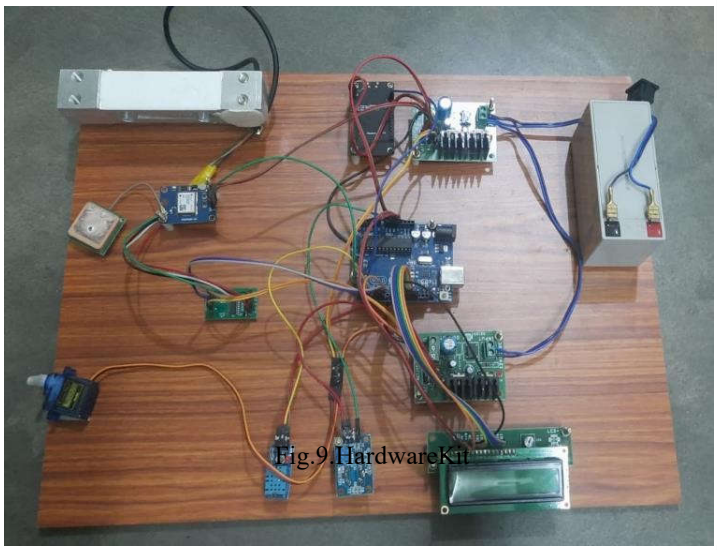


Fig.9.HardwareKit

In addition to its core functionalities, the system also incorporates features for displaying temperature, latitude ,and longitude values on both the LCD screen and the Blynk application interface. This added capability enhances the system's versatility and utility by providing users with valuable environmental information. The inclusion of temperature monitoring allows users to stay in formed about the ambient temperature surrounding the gas cylinder. This data can be crucial in ensuring the safe storage and operation of the cylinder, particularly in environments where temperature fluctuations may impact its contents or the surrounding equipment. Moreover, the system's ability to display latitude and longitude values serves to provide users with geographic coordinates corresponding to the cylinder's location. By presenting this information on both the LCD screen and the Blynk application, users gain valuable insights into the precise positioning of the cylinder. This feature is particularly beneficial in scenarios where the cylinder needs to be relocated or tracked, such as during transportation or in emergency situations. Overall, the incorporation of temperature, latitude, and longitude display functionalities adds an extra layer of situational awareness and control to the system, empowering users with comprehensive environmental and geographical data to complement its primary gas management capabilities.

IV.RESULTANDCONCLUSION

Upon completion of the model, several observation shave come to light, particularly regarding the behavior of certain components. Notably ,there are discernible changes in voltage output associated with various operational conditions.

A.LCDDisplay

The load cell utilized for weight determination, integrated with the HX711 amplifier. This is pivotal for accurately gauging the weight of the cylinder and is reflected in real-time updates on the LCD display. In addition to weight monitoring, the LCD also provides information on temperature and humidity. These supplementary features enhance the utility of the system by offering environmental data and geographic coordinates associated with the cylinder's location. This comprehensive display ensures users have access to vital information for both operational and situational awareness purposes.

B.Gas Leakage Detection and Notifications

Our study primarily centers on the detection of gas leakages and the subsequent notification mechanism integrated into the Blynk application. Through rigorous experimentation and analysis, we have successfully developed a comprehensive system able to unexpectedly figuring out gas leaks and directly alerting purchasers via the Blynk platform. The Blynk application acts as a centralized platform for overseeing and controlling various parameters associated with the gas cylinder. In addition to displaying real-time gas leakage notifications, the application provides in valuable data on temperature, cylinder weight, latitude, and longitude. This multifaceted approach ensures that users are equipped with a holistic understanding of the cylinder's operational environment and geographical position. By leveraging the capabilities of the Blynk platform, our system not only enhances safety measures by detecting gas leaks but also empowers users with action able insights and alerts. This proactive approach significantly reduces the risk of potential hazards and facilitates prompt response measures in the event of an emergency.

In conclusion, our research under scores the efficacy of integrating gas leakage detection systems with modern IoT platforms like Blynk. The seamless communication and data visualization capabilities afforded by such platforms not only enhance the safety and security of gas cylinder management but also contribute to a more informed and responsive operational framework. Moving forward, continued advancements in IoT technologies hold the promise of further improving the efficacy and accessibility of gas leakage detection systems, ultimately ensuring safer and more efficient gas management practices

REFERENCE

[1] "A Wireless Home Safety GasLeakage Detection System," in Proceedings of the First Middle East Conference on Home Safety, edited by L. Fraiwan, K. Lweesy, A. Bani- Salma,andN.Mani,11-14.BiomedicalEngineering,2011.

[2] "Security alert system using GSM for gas leakage" was published in the International Journal of VLSI and Embedded Systems (IJVES) in 2012, Rajitha and T. Swapna are the authors of this work.

[3] KennethV.Balmes,JamesMatthewT.Chua,MaryAnne O.DeJesus,andKarenCristineO.Tan,ArgelA.Bandala, "Utilization of Sensor Network for Combustible Gas Detection and Monitoring Implemented in House Hold", IEEE Conference 2015.

[4] "Smart-Gas: A smart platform for cooking gas monitoring,"IEEEFirstSummerSchoolonSmartCities, pp. 97–102, 2017, V. Gabriel, M. Da Silva Medeiros, A. Santos, and C. Edgarson.

[5] Raj, A., Kumar, A., Thakur, S., and Srivastava, A. K. (2019), Internet of Things-Based LPG Cylinder Monitoring System. The IEEE International Symposium on Smart Electronic Systems (iSES) will take place in 2019.

[6] "IoTBasedSmartGasManagementSystem,"S.Shrestha, V. P. K. Anne, and R. Chaitanya, at the 2019 3rd International Conference on Trends in Electronics and Informatics (ICOEI).

[7] ZawLin Oo, Theint Win Lai, andAung Moe, "IoT Based Low-cost Physical Protection and Alarm System for Gamma Irradiation Facility." Conference on Science and Technology Development (CSTD-2019), October 31– November 1, 2019.

[8] "IoT Based LPG Gas Level Detection Gas Leakage AccidentPrevention with AlertSystem"waspublishedby ZawLinOo,TheintWinLai,andAungMoeintheBalkan JournalofElectricalComputerEngineering,Vol.9,No.4, 2021.

[9] EarlyWarningandLPG Cylinder UsingIoT Protection of Leakage of Enabled System, IEEE Access, 2023, Kailash Sharma.

[10] Household Gas Monitoring System, IEEE Access, 2023, Basanta Mahato.

[11] Internet of Things based Liquified Petroleum Gas Leak Detection and Rapid Alert System, IEEE Access (2023), Praveen Kumar Malik.

[12] GSM-Based Gas Detection System, IEEE Access (2023), Prasanna Zade.

[13] Voice-controlled features on an Internet of Things-based digital LPG gas cylinder trolley to prevent hazards" ChawlaHunnyandSachin.SixthInternationalConference on Six Information Systems and Computer Networks (ISCON), March 3–4, 2023, GLA University.

[14] Hioto(HomeIoTAutomation)SystemforGasMonitoring and Safety System for Remote Surveillance and Control viaBlynkApp,IEEEAccess(2023),SitiSarah Maesaroh.

[15] LPG Gas Level Monitoring and Leakage Detection System, IEEE Access (2023), R Ranjith Kumar.