PETROL BUNK AUTOMATION AND SECURITY USING RFID

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Abstract: Recently, fuel stations have been manually controlled. These fuel stations take more time to operate and require more manpower. The number of vehicles on the road is rapidly increasing. In today's advanced and automated world, fuel consumption is also increasing as vehicles become more reliant on it. When there is a rush at the fuel station, customers must wait in line. Our country's fuel stations are more time-consuming. In this paper, we developed an automated fuel station management system to address the shortcomings of the current system. This methodology's output prioritizes authenticated systems and cashless transactions. It will have a positive impact on our nation's financial situation. Additionally, it will aid in reducing fuel station corruption and could make fueling quicker and less time-consuming.

Keywords: Arduino Microcontroller, RFID Card, RFID Reader

I. INTRODUCTION

The automation of petrol bunks using RFID technology is a modern solution that aims to improve the efficiency and safety of petrol dispensing systems. RFID stands for Radio Frequency Identification, and it involves the use of wireless communication technology to transfer data between an RFID tag and an RFID reader. This technology is widely used in various industries, including supply chain management, retail, and transportation.In the context of petrol bunks, RFID technology is used to automate the process of fuel dispensing. By attaching an RFID tag to a vehicle, the petrol bunk can identify the vehicle and authorize it to access the fuel dispenser. This eliminates the need for manual intervention, reduces the risk of errors, and ensures that only authorized vehicles can access the fuel dispenser.The automation of petrol bunks using RFID technology also improves safety. By providing real-time information about fuel levels, the risk of overfilling or underfilling a vehicle's tank is significantly reduced. Additionally, the use of RFID technology can help to detect and prevent fuel theft, which is a common problem in many petrol bunks.

Overall, the automation of petrol bunks using RFID technology is a modern solution that improves efficiency and safety while reducing the risk of errors or hazards. By integrating this technology into petrol dispensing systems, petrol bunks can provide a better experience for customers and ensure the safety of their operations.

II. LITERATURE SURVEY

In this paper, they are using 2 units that are placed in the petrol stations that will take care of the end user needs and continuously monitors the fuel level, fuel temperature, or any other accidents occurring at the petrol station. Another system that takes care of the databases like customer's id, passwords, and account balance. The link between the customer and the petrol industry is taken care of by the GSM module. The software part basically takes care of the security and manages the data. There is a provision fingerprint scanner that provides security. The scanned finger impression is compared with that of the data stored in the PC if there is a match the authentication process is successful. Once the authentication phase is successful the customer has to enter the amount as per the requirement of the fuel to be injected into the vehicle [1].

Biometric thumb impression	User details
	Kori PreetiOmprakash Bank Name:Bank of India AccNo:XXXXXXXXXXX Acc Type: Saving Branch Name :Panchavati IFSC:SBIN0006333
	Kedare Monika Gautam Bank Name:Punjab National Bank AccNo:XXXXXXXXXXX Acc Type: Saving Branch Name: Sharanpur Road IFSC: PUNB03762000

Fig 2.1 Biometric system

RFID cards are used this card is scanned and it is enabled by the ID detector. When the proximity sensors confirm the presence of the vehicle the customer may proceed to enter the password and the price and other details are displayed. There is a provision for prepaid cards for moneytransactions. The required quantity of petrol is filled in the vehicle when the nozzle is inserted [2].

The automated petrol pumps make use of embedded system units such as the microcontroller that has been used to monitor the outlet of the petrol and display it regularly. Regular intervention of humans may lead to discrepancy in the amount charged and the quantity dispensed. These errors can be overcome by utilizing a special card called the RFID smart card which is capable of storing and managing databases effectively. The use of RFID cards can be further monitored by the use of fingerprint where every individual can set his or her finger print on the module after the complete identity of the person has been recognized along with a unique identity. Hence un-authorized personals that can be ceased from usage along with the amount of petrol inlet outlet with money that can be managed.[3] The government typically invests a large amount of its share in giving away petrol and petroleum products in form of subsidies of which majority of costs has been increasing rapidly as in which there is a direct expenditure in the government subsidy. The amount of data that has been collected transaction-wise. Another work illustrates the use of fuel dispenser by a computer interfacing that is responsible of automatic refueling and management. This work can accept inputs from the dispenser with the help of a parallel port interfacing and printing the receipt automatically after each transaction and can generate an yearly business report in Report.[4].

The internet of things (popularly known as the IOT) facilitates the user by making the fuel retail outlet owners that makes service easier and help it to take a look at the current status, a past sales records, stock of fuels, and sales per day. As the user's login, it provides access to the current temperature of the liquid /fuel. The service level reduces fuel theft from the consumer. The security level has been increased by the OTP verification method.[5] This research paper discusses the potential benefits of introducing an automated fuel-filling system. This system would involve using microcontrollers and RFID equipment to deduct the money from the user's card upon fuel dispensing. It would reduce the need for manpower working in fuel filling stations, making it more cost-effective. Additionally, it would require less time to operate and be more efficient than existing systems, while also preventing fuel theft.[6] The research paper is about an automated fuel station management system that will reduce the amount of time and manpower needed to operate fuel stations. This system will use cashless transactions and authentication, and it will help reduce corruption and make fuel stations faster and more efficient. This system will use two units at the fuel station, one to take care of customer needs and monitor the fuel level and temperature, and the other to keep track of customer IDs, passwords, and account balances. It will also use a GSM module to link customers to the petroleum industry, and a fingerprint scanner to authenticate customers. Finally, the software part of the project will keep track of all the data. [7] The main idea of this research paper describes the use of digital technologies to provide a secure and efficient fueling experience at a petrol station. This system would include an RFID (Radio-Frequency Identification) tag with a customer ID, which would be read by an RFID reader. The reader would then communicate with a main server using a GSM (Global System for Mobile Communications) modem to verify the customer's ID and password. The server would also store all the transaction details of the customer and the total fuel amount dispensed from the filling station. Finally, the customer would be notified about the ID details and total fuel amount dispensed through an SMS and the data would be stored in a separate database for the filling station authority's view. This feature helps to reduce manual processes and avoid corruption.[8]

This system is made up using Arduino that controls the complete system components i.e., RFID card, relay, and motor. It also provides the facility of onsite recharge. The significant component of these comes is that it takes out human connection and maintains a strategic distance from the situation of dark advertising without administration man. On the fulfillment of gathering activity cash is withdrawals from the card and the equilibrium is shown again on the LCD. When the equilibrium in the client's account is low, the cycle won't be administrated and the message will be shown as "Low equilibrium". Every one of the subtleties of date time and measure of petroleum will be put away inside the data set when the fuel is circulated[9]. In this project, the one customer having the RFID smart card enters the petrol pump; the reader at the pump unit reads the RFID information including vehicle number, user phone number, password and balance amount, which will be processed by the microcontroller. When RFID reader, reads the unique card it asks for the 3-digit password. Once the driver enters the password in keypad and if it is wrong password an alarm will be turned ON. If it is right, a welcome message will be displayed in the LCD along with the balance in the prepaid card. Then the user can enter the amount through keypad. Once the amount is entered which will be processed by the microcontroller and the microcontroller controls the petrol dispensing pump through a driver circuit, in accordance with the amount. The user can start the fueling by pressing the start switch. Then motor starts and petrol gets filled in the petrol tank from the fuel dispenser. After fuel dispensing the bill amount will be send to user mobile number through IoT Communication. The amount will be automatically reduced from the prepaid RFID card. As a security temperature sensor is used to detect Fire in the petrol pump. A camera is used to detect the Helmet of two wheelers, so that only by entering the petrol pump wearing helmet will be activating the automatic petrol unit for two wheelers[10]. This system is using RFID technology where each user will be having a rechargeable RFID card. These cards consist of RFID tags having unique verification codes. The RFID reader captures the digital data encoded in these tags. When a customer brings the card close to the reader, it captures the data and then sends the corresponding signal to the microcontroller. The microcontroller stores details of various cards and thus, compares the information captured to check if both the details match or not. If it matches then according to the amount entered by the user, the microcontroller activates the relay driver for that particular amount of time and the desired amount is dispensed into the tank. And therefore, the amount is deducted from the user's card. The proposed idea consists of certain goals like ensuring right amount of fuel dispensing, removing human errors by the use of RFID cards and ensuring customer's trust for a fair sale of the product[11].

Users must scan the RFID card to the petrol pump before refueling. If RFID is authorized/valid, then the user will be asked for a password. If the password matches, then the quantity of fuel will be asked. If the entered amount of fuel & sufficient balance is available then the pump's motor will start dispensing fuel. The motor will stop automatically once the required amount of fuel is dispensed. After that, the user will be notified by a SMS. This system includes a mobile application and an automated fuel disposal pump with RFID technology which makes the system more efficient, secure and user-friendly. But this proposed design gives real-time notification as well as it reduces human interactions in refueling process which means low labor cost in refueling business for the station owners. The system can be implemented in every country for helping people to trace the quantity of fuel they are buying and the amount of transaction they are doing, this data may help to know about the economy of a country. This system will ensure the accuracy of fuel disposal and also will be able to stop system loss, which causes a great loss for both user and owners of the pump. So, therefore this system can make a great change in the social and economic sectors of a country[12].

To implement the security system for filling petrol at the Petrol bunks by avoiding the involvement of human beings. RFID smart card avoids the risk of carrying money every time and also provides the feature of prepaid recharge. In this system every user is provided with a smart petro card, with which one can access petrol at the petrol bunks. Before using this card, we have to recharge it. Whenever we want to fill the tank then we have to place the Petro card in the card reader, which is interfaced to the microcontroller with serial interfacing. The microcontroller reads the data from the smartcard reader and asks how many liters you require, which will be displayed on the LCD screen. Then we have to enter the required number of liters of petrol through keypad which act as an input to the microcontroller. After reading this value the microcontroller will check for the available balance in the smart card, if it is sufficient then the petrol filling process will be started. The proposed work automatic fuel station eliminates the involvement of any human operator at the petrol pumps for payment transactions and avoids any manual operation at the pumping system settings. Only requirement is each of the customers has to initially get registered with the online payment system and save his identity in the form of face detection. The system can be efficiently implemented in both urban areas by reducing the time consumption as well as in rural areas by decreasing the cost of the system[13].Sudeshna Dutta, Smarajit Pal,Subhankar Majumder, Mrs.Pratyusha Biswas Deb and others Have designed a system that automates the dispensing of fuel by eliminating the Workers From the equation. They have Used Arduino Mega 2560 for designing their system, other components used in their system are RFID tag, buzzer, LCD Display and keypads for their user interface. Their system displays a welcome message at the very beginning and asks for RFID, a buzzer is turned on which indicates a successful Identification of the User. Now the user has to input the fuel amount to be put into the tank of his vehicle via the keypad. After the fuel has been dispensed successfully, the process ends which is shown by the glowing LED being turned off and the account is

logged out, now the system is ready for another transaction and goes back to the welcome Display on the LCD screen. Thus automation of the petrol bunk is done by this system which is moderately cost effective By utilizing Mega 2560 Board for their system. This system also helps the users know when the process ends by indicating it through an LED and buzzer combination. A smoke sensor could be used to increase the safety of the users present in the bunk by warning them beforehand about fires and smokes in the bunk[14]. Sakshi Zar, Shubhangi Nawale, Sukriti Chettri, Vaibhav SShind and Prof. M. K. Kumbhar have proposed a system for the automation of petrol bunk and it also uses a fingerprint scanner for checking the user's details.

The proposed system helps the traffic police check for the driving license of the user and also verify its expiry date. The user also need not carry a license since just his/ her fingerprint is enough for getting his/her details. The system architecture is built in such a way that, it checks for the nearest Petrol pump location and the location of the user , using this data the user's mobile phone is switched on/off, When the user is in the petrol bunk he/she has to input the amount of fuel to be dispensed into the tank and his/her fingerprint needs to be scanned to verify that he/she is genuine user. The amount entered then will be deducted from the user's account and corresponding fuel will be put into the tank.

The fingerprint used will also help check all the documentation details of the user and if any license or any other document like insurance is expired, they will automatically get a fine and an alert to renew the documentation. Therefore this Survey is very useful for finding out and utilizing different methods of user identification and documentation retrieval thereby making things easier for both the user and the officials to carry out their respective duties[15]. The primary goal of the research is to use RFID technology to create a smart fuel bunk system and fuel dispensing system. It worked in conjunction with secure payment and exit gate control. In this case, the Microcontroller includes a 4x4 matrix keypad, LCD, RFID reader, and GSM module for a secure payment system and transaction confirmation. The pump motor has controlled the relay after receiving a command from the microcontroller. Furthermore, this motor has been used to supply oil to a dispenser. Following that, the exit gate was controlled by a servo motor, a photodiode, and an infrared sensor. As a result, the exit gate control has made secure bill payment possible. As a result, reducing the misuse of fuel, time, and the employer is a good benefit of the system. So, this fuel station is more advanced[16]. In this article, the fuel dispensing system is discussed, along with possible RFID applications for modern fuel usage. The suggested strategy ensures that the fueling process is straightforward and secure. The process uses a fuel bank card that the customer can scan in the bunk and, if they haven't reached their monthly limit, the refilling will be successful; otherwise, an error notification will be sent to the customer's mobile phone. This card is comparable to our current debit cards. It has an ELA816B RFID reader and a passive tag.

With the aid of RFID technology in RFID Based Petrol Pump, it is to implement the work sequentially, reducing the labor of people. This project will enable us to carry out our goal of digitizing the petrol pump for providing the utmost safety to the customers while filling their tanks at gas stations. This will help to overcome multiple frauds also[17].

In this research paper, it is about designing a new type of automated petrol dispensing system that uses RFID technology. This system will replace traditional manual petrol pumps, which are time consuming and require more manpower. It will also provide customers with prepaid cards to use at the petrol bunk. The major components of the system are an ATMEGA8A-PU microcontroller, RFID tags, a power supply, a motor driver, an LED display, and an RFID reader. The main advantage of this system is that it is more efficient, cost-effective, and time-saving compared to manual petrol pumps. Additionally, RFID tags can be read automatically, which eliminates the need for manual scanning and allows for real-time tracking[18]. This is about a computerized system for managing a petrol pump. This computerized system would enable the petrol pump manager to make decisions quickly and efficiently. It would be able to track the quantity of different types of fuel (petrol, diesel, etc.) that is imported, the sales of petrol, and the wastage of impurities during the refining process. It would also be able to track the employee details, including their name, address, phone number, attendance, and salary payments. Additionally, the system would be able to generate reports about the sold petrol and employee details, as well as keep track of any credit sales and their payments. Finally, the system will be developed with the help of programming languages like ASP.net, and be able to limit access from different users[19]. This research paper is describing the need to create an automated petrol dispensing system. This system would be controlled by a programmable logic controller (PLC) and the RFID technology. The goal is to reduce the amount of time it takes for people to fill up their vehicles with petrol. The system would include a Human Machine Interface (HMI) where users can enter the amount of money they want to spend and the system will dispense the required amount of fuel. The PLC and RFID would be used to control the process, with the PLC controlling the process functions and the RFID used for authentication and data capture. The proposed system would reduce the amount of time it takes to fill up a car and would reduce the need for manual operation of the petrol dispensing process[20].

III. METHODOLOGY

3.1 Block Diagram

The automation of a petrol bunk involves the use of several technologies, including RFID, Arduino, GSM, smoke sensor, ultrasonic sensor, and an LCD screen. Each of these technologies serves a specific purpose, and when combined, they create an efficient and reliable system.

RFID technology is used to identify vehicles that are authorized to access the petrol bunk. An RFID tag is attached to the vehicle, and when the vehicle approaches the fuel dispenser, the tag is read by an RFID reader connected to the Arduino board. The Arduino board then sends a signal to allow the fuel dispenser to operate, which ensures that only authorized vehicles can access the fuel.
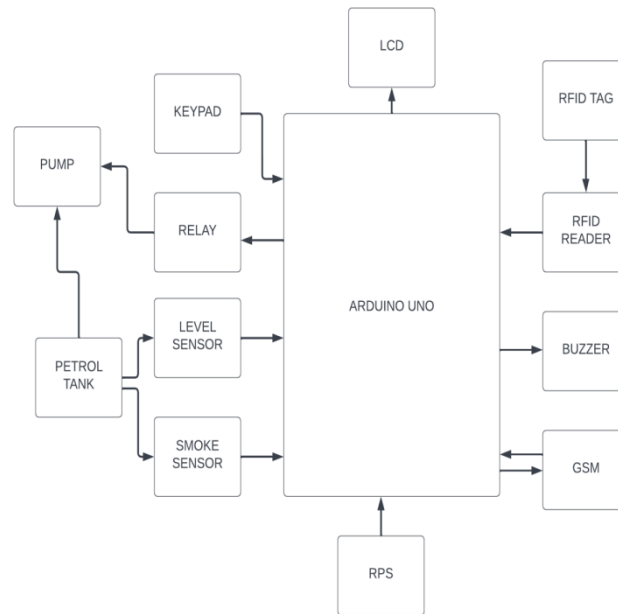

Fig 3.1.2 Block Diagram of Petrol bunk system

The ultrasonic sensor is used to detect the fuel level in the vehicle's tank. The sensor sends a signal to the Arduino board, which then displays the fuel level on the LCD screen. This provides customers with accurate information about the fuel level in their vehicle, allowing them to fill up only as much as they need.

The smoke sensor is used to detect any hazardous conditions, such as a fuel leak or fire. In the event of a hazardous condition, the smoke sensor sends an alert to the GSM module, which then sends an alert to the petrol bunk manager. This ensures that any potential hazards are identified and addressed quickly, reducing the risk of accidents and injuries. The integration of these technologies creates a seamless experience for customers. The RFID technology ensures that only authorized vehicles can access the fuel dispenser, while the ultrasonic sensor provides accurate information about the fuel level in the vehicle's tank. The smoke sensor provides an added layer of safety, ensuring that any potential hazards are quickly identified and addressed. The LCD screen provides customers with real-time information about their fuel level, making it easier for them to plan their fueling needs.

Overall, the automation of a petrol bunk using RFID, Arduino, GSM, smoke sensor, ultrasonic sensor, and an LCD screen is an efficient and reliable system that reduces the risk of errors or hazards. By integrating these technologies, petrol bunks can provide a better experience for customers while ensuring safety and accuracy.

3.2 Flow Chart

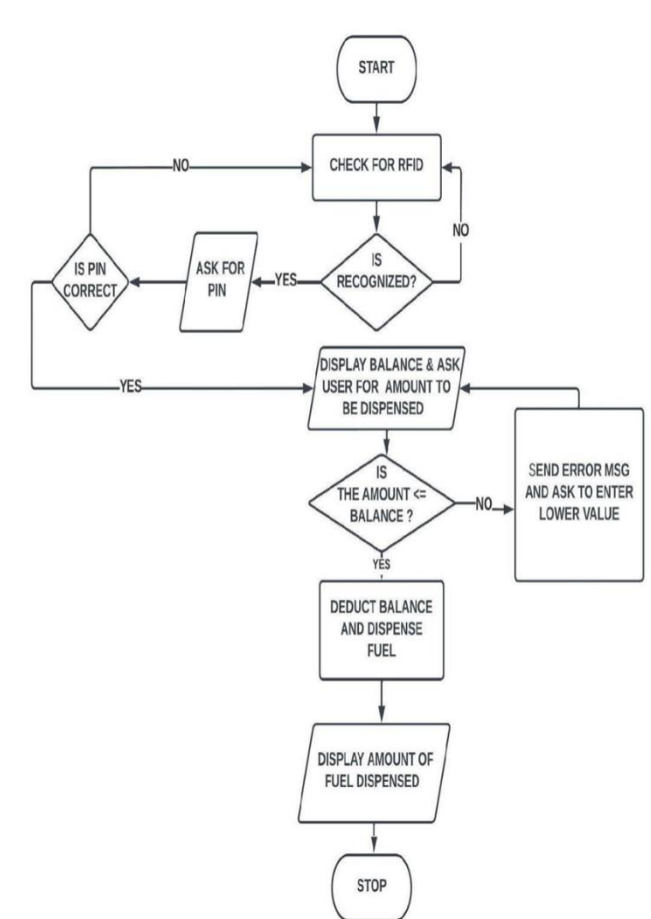The Flow of the control in this project is as shown


Fig 3.2.1 Flowchart

The system first prompts the user to swipe his RFID card on the reader in our petrol bunk, if the user is not recognized it will display error and prompt to swipe RFID card again. If the user is verified the system will then ask for his unique PIN for second degree verification, the system then checks if the provided PIN matches with the PIN given to the user, if it does not match, an error message is displayed and the system prompts for RFID card again.

If the PIN is correct, the user's balance is displayed on the LCD module and then prompts him to input the amount of fuel he wants to be dispensed .If the amount entered is greater than the balance, an error message is sent along with a message to enter a lower input. If the input entered is less than or equal to the current balance, the entered amount is deducted and the corresponding fuel is dispensed with the help of an AC pump and motor.

IV. RESULT

The user must swipe his/her RFID card onto the reader installed in the petrol pump. The user must place his/her card and his RFID tag will be checked in the system
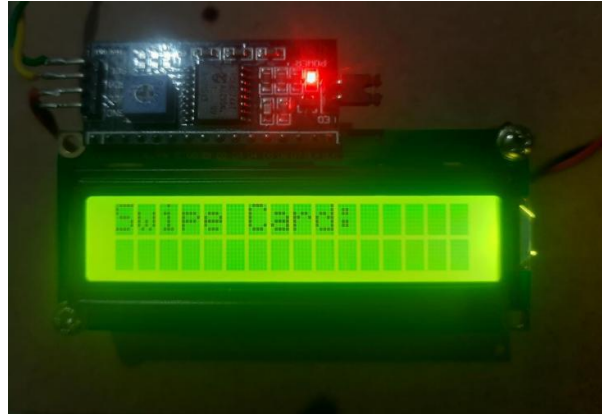

After the user swipes his RFID card onto the reader, the system checks if the user is verified   If the user is registered in the system , the system prompts the user to input the OTP/PIN provided to the user. If the password entered is correct, the system then prompts the user to enter the amount with respect to the fuel he/she needs to be dispensed.
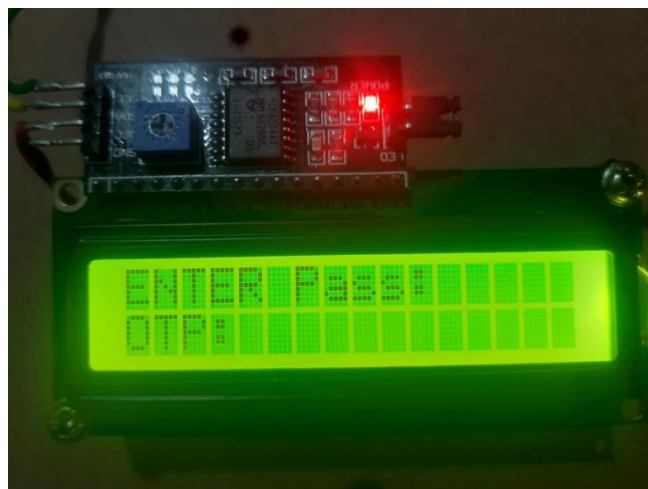

After dispensing the fuel, the system shows the current balance of the user after deducting the amount entered.
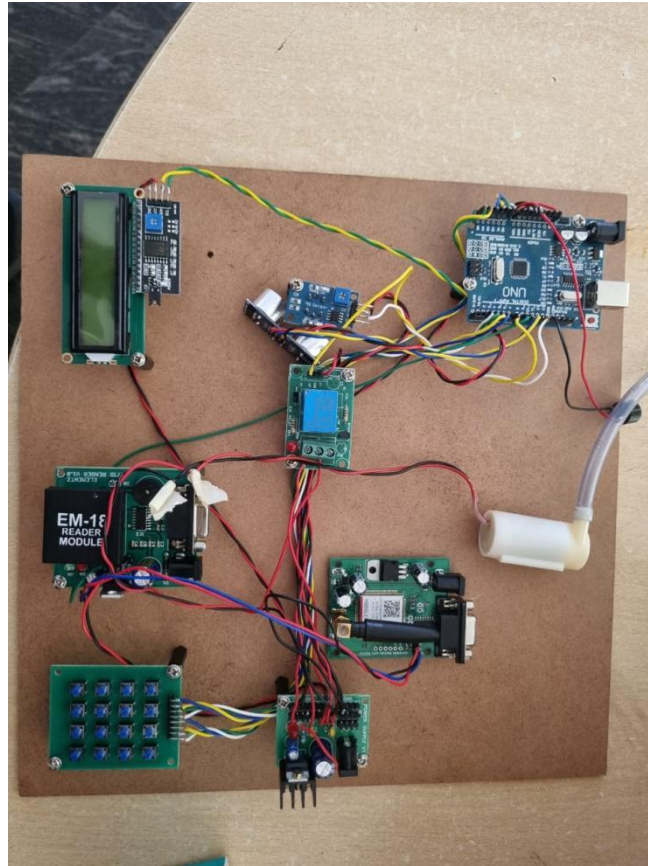
The fuel level is indicated after every dispensing cycle on the LCD.
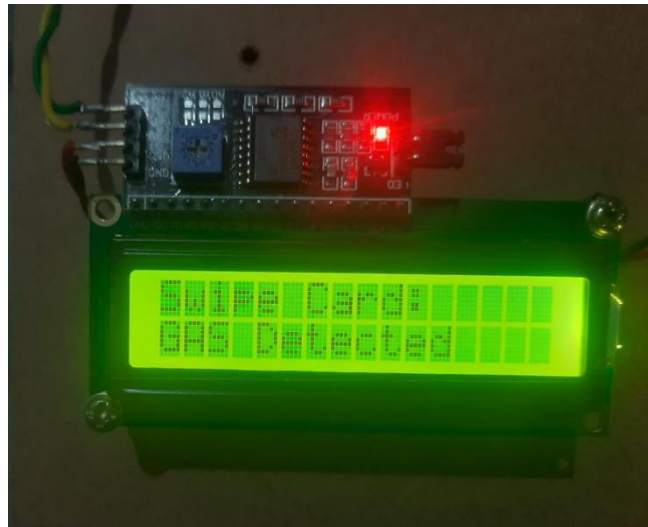
If there is fuel leakage or fire accident, an alert pops up along with a buzzer. An SMS is sent to the owner regarding the incident.

V. CONCLUSION

This is an automated fuel station management system which can reduce the amount of time and manpower needed to operate fuel stations. It suggests using microcontrollers and RFID equipment to deduct the money from the user's card upon fuel dispensing, which would reduce the need for manual operation of the petrol dispensing process, making it more cost-effective and efficient than existing systems. Additionally, it would provide customers with prepaid cards to use, and help reduce corruption and make fuel stations faster and more efficient. It would also use two units at the fuel station, one to take care of customer needs and monitor the fuel level and temperature, and the other to keep track of customer IDs, passwords, and account balances. It would also use a GSM module to link customers to the petroleum industry, and a fingerprint scanner to authenticate customers. Finally, the software part of the project would keep track of all the data. The future scope of the automation of petrol bunk with safety using RFID is vast and offers significant potential for improvement and innovation in the petrol retail industry. Some of the potential areas for future scope of work are

Integration with IoT, The integration of RFID technology with the Internet of Things (IoT) can enable real-time monitoring of the petrol station operations and facilitate predictive maintenance, reducing downtime and improving the efficiency of the petrol station.Mobile Payments can help in reducing the waiting time for customers and improve the overall customer experience. Additionally the application of artificial intelligence (AI) can help in improving the accuracy of inventory management and predictive maintenance. AI-powered systems can analyze the data collected from RFID-enabled systems to predict equipment failures and optimize inventory levels. In conclusion, the future scope of work for the automation of petrol bunk with safety using RFID is immense, and it offers significant potential for innovation and improvement in the petrol retail industry.

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