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AUTOMATED FUEL SYSTEM

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Abstract : In today's society, long wait times at petrol stations have become a significant issue, particularly aggravated by delays in money handling processes. This issue is further compounded by the protracted processes involved in handling payments for fuel. In response to this problem and in alignment with the global shift towards smarter and more efficient systems, our project introduces a trans formative solution that redefines the conventional fueling experience. Through the seamless integration of modern mobile technology, users can now make secure and convenient payments for fuel directly via a dedicated mobile application, effectively eliminating the need for physical credit cards or cash transactions. The app also maintains a comprehensive record of fuel-related expenses, affording users valuable insights into their fuel consumption habits and facilitating efficient budget management. The key innovation of our project lies in its ability to streamline the fueling process by marrying mobile technology with the traditional petrol station experience. By offering a hassle-free and efficient payment method through the mobile app, we address the persistent issue of long wait times at petrol stations. This integration not only enhances user convenience but also promotes cost-efficiency by reducing the time spent at the station.

Keywords - Petrol Station, Transaction, Mobile Payment, Mobile App, Fuel Dispensing

I. INTRODUCTION

An Automated Fuel System with a smart app optimizes fuel management through real-time monitoring, a user-friendly interface. The primary goal of an automated fuel system is to minimize losses, ensure efficient fuel management, improve safety, streamline operations, data analytics, secure payment integration, and fuel management needs. An automated fuel system is a sophisticated and computer-controlled infrastructure designed to manage and optimize the distribution, and consumption of fuel in various industrial and commercial settings. This software orchestrates fuel procurement, distribution, monitoring, and optimization, ensuring efficient and reliable operation of the fuel system. Additionally, the software utilizes advanced algorithms to analyze the collected data in real-time, enabling proactive maintenance and optimization of fuel usage for enhanced operational efficiency. Automated fuel systems offer numerous benefits, including improved efficiency, enhanced accuracy, tighter security, and better control over fueling operations. By leveraging advanced technology and automation, these systems play a crucial role in optimizing fuel management across a wide range of industries.

II. OBJECTIVE

1) Secure payment integration is a crucial objective of an automated fuel system, enabling seamless transactions while ensuring data security and integrity.
2) An automated fuel system aims to ensure compliance with regulatory standards and enhance safety protocols.
3) Another objective is to enhance operational efficiency by streamlining fuel management processes.
4) One of the key objectives of the automated fuel system is to reduce the reliance on manual labour in fuel management processes.
5) Utilizing data analytics capabilities, the automated fuel system aims to provide valuable insights into fuel usage.

III. LITERATURE SURVEY

This paper proposes a system aimed at securing a fueling system accessible through UPI ID transactions. This system ensures user security by leveraging UPI ID technology, which provides a unique proof of identity for each user. The operational process involves a customer entering the petrol station, where a PIR sensor detects their motion and subsequently activates the fueling machine. Notably, the system relies extensively on technology, encompassing network connectivity and payment processing infrastructure [1]

The paper proposes a system where customers are provided with a smart card containing an RFID tag, while petrol pumps are equipped with RFID readers. Through RFID technology, payments can be processed without the necessity for physical cash or human interaction. This facilitates swift and seamless transactions at petrol pumps, ultimately reducing waiting times and improving the overall customer experience. However, it is important to note that RFID systems may be susceptible to unauthorized access and cloning of RFID tags [2]

In this paper they introduce the Fuel Delivery on Demand system, which is engineered to automate users' orders and requests. Through the associated app, users can seamlessly register, share their location, and place fuel requests. Upon submission, a fuel truck promptly arrives at the user's designated location. This innovative system significantly boosts customer convenience, minimizes manual errors, and elevates overall customer satisfaction levels. However, it is important to note that customers might encounter delays in fuel delivery, particularly during peak demand periods or adverse weather conditions [3]

The paper describes a method for measuring the quantity of fuel dispensed into a vehicle's tank, with the remaining balance transmitted to the user's mobile device via GSM technology. Additionally, daily updates to fuel rates are provided to prevent deceptive practices. This system serves to mitigate corruption and facilitates fast, secure transactions. However, it is noted that customers need to possess a certain level of knowledge to effectively navigate automated fueling systems [4]

The paper presents a smart fuel station control system that leverages RFID and GSM technology. RFID technology is utilized to ensure the accurate dispensing of fuel, thereby effectively reducing instances of fuel misuse [5]

The paper introduces a smart petrol pump system that operates on IoT and RFID technology, automating the fueling process. As a vehicle approaches the pump, RFID technology identifies it and communicates with a central system for billing and authentication. This system streamlines inventory management and bolsters security by mitigating fraud at fuel stations. However, it is acknowledged that the system may encounter technical glitches, connectivity issues, or occasional system failures [6]

The paper introduces an automated fuel filling system that utilizes Petro cards and smartphones for customer payments and fueling control. Customers swipe their cards, input a password, and specify the desired fuel amount, initiating the pump to commence filling. The process ceases upon reaching the specified amount, with payment deducted in real-time. Additionally, customers can remotely recharge their Petro cards via SMS, enhancing system flexibility and convenience [7]

The paper proposes the automation of petrol bunks through the integration of Biotelemetry and Petro Card technology, enabling unmanned petrol pumps. Customers utilize RFID technology for authentication, while electronic clearing systems facilitate payments. Notably, the system incorporates alcohol concentration detection to prevent refueling if the driver's alcohol levels exceed safety limits, thereby promoting road safety and efficiency. However, it is acknowledged that older vehicles may not support Petro cards or biotelemetry technology [8]

The paper introduces a system designed for fuel station operations, aimed at electronically recording and managing transactions. It automatically logs fuel sales, generates receipts for customers, and enables remote monitoring of transactions via the Internet. This automation is envisioned to mitigate opportunities for fraud and corruption in fuel transactions, thereby enhancing transparency in the process [9]

The paper describes a process where users initially register and link their vehicles with a mobile application, which also issues an RFID card functioning as a prepaid fuel card. Subsequently, email notifications are dispatched to users, and all transaction details are meticulously recorded in a centralized system via the mobile app. This system augments transparency in fuel transactions by autonomously documenting and notifying users regarding refill amounts, costs, and timings [10]

IV. SYSTEM HARDWARE

Here's how each of the mentioned devices can be utilized in an automated fuel system:

1. **Arduino Uno R3-**

Central control unit for managing and coordinating various components of the automated fuel system. Processes sensor data, controls fuel pumps and valves, and interfaces with the LCD for user feedback and interaction.

2. **GSM-800L-**

Enables remote monitoring and control of the fuel system via SMS or calls. Provides alerts and notifications for fuel level, system status, or any detected issues.

3. Li-ion Battery-

Provides backup power to the Arduino and GSM module in case of a power outage. Ensures continuous operation and data logging even when the main power source is unavailabl

4. Buck Converter-

Converts the higher voltage from the battery or power supply to the required voltage for the Arduino and other components. Regulates the voltage to ensure stable and reliable operation of the electronics.

5. Switch-

Manual or automatic switch for turning the fuel system on/off. Can be used for safety or maintenance purposes to isolate the system from power sources.

6. HW-Battery 9V-

Backup power source for critical components such as the Arduino during power outages. Provides temporary power to maintain system functionality until the main power source is restored.

7. Relay Fuel-Pump-

Controls the operation of the fuel pump based on signals from the Arduino. Enables the Arduino to remotely activate or deactivate the fuel pump as needed.

8. Flow-Sensor-

Measures the flow rate of fuel during dispensing. Provides accurate data to the Arduino for monitoring fuel consumption, detecting leaks, or controlling the fueling process.

9. LCD 20*4-

Displays real-time information such as fuel level, system status, and user prompts. Enables user interaction and feedback for initiating fueling, viewing data, or acknowledging alerts.

10. Power Supply 24V-

Main power source for the fuel system components, including the Arduino, GSM module, and fuel pump. Provides stable voltage to ensure reliable operation of the system under normal conditions.

11. DC Jack-

Connector for connecting the main power supply to the fuel system. Facilitates easy installation and maintenance of the power source.

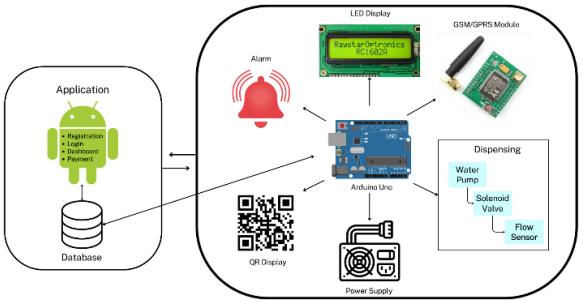


Fig : System Architecture

V. METHODOLOGY

- We choose Flutter Frameworks, for database firebase and IoT devices, taking into account factors like scalability, performance, and compatibility.
- The entire application is built on a specific framework that handles the backend logic and communication with the database. The database stores user information, fuel transaction history, and other relevant data. The IoT devices are integrated into this framework, allowing seamless communication between the application and the physical fuel dispensing system.
- With the chosen technologies, we crafted the platform architecture, user interface, and overall user experience to deliver an engaging and user-friendly environment.

- First user registers on the application providing necessary details like name, email, password, Vehicle number etc. After registration, the user logs in using their credentials to access the dashboard.
- Upon logging in, the user is directed to the dashboard where they can access various modules. One of the modules is the profile module where the user can view and update their personal information.
- Within the dashboard, the user navigates to the fuel selection module. Here, the user selects the type of fuel they want to dispense (e.g., petrol, diesel, etc.).
- After selecting the fuel type, the user specifies the amount of fuel they want to dispense. This could be done through a user interface on the application.
- The application communicates with the IoT devices installed in the fuel dispensing system. Upon receiving the user's request for fuel dispensing, the IoT devices control the dispensing mechanism to dispense the specified amount of fuel.
- The application features a fuel history module allowing users to review their past fuel transactions, and a help module offering assistance and guidance for any issues or queries related to the application or fuel dispensing process.
- The automated fuel system integrates GSM technology with hardware components like Arduino R3, switches, flow sensor, LCD display, water pump, and more. Users initiate fueling by sending an SMS, which triggers payment validation and dispenses fuel accordingly. The system communicates transaction updates via SMS and alerts users of any issues using buzzer and LED indicators. Overall, it provides a convenient and secure fueling experience through SMS interaction.

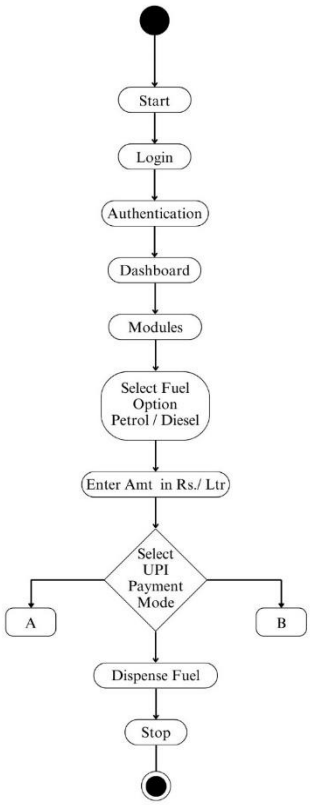


Fig. Flowchart

VI. ANALYSIS

In this paper, we examine the influence of an automated fuel system on fuel efficiency and safety. Our findings indicate that the automated fuel system notably boosts fuel efficiency, diminishes waste, and enhances safety through real-time monitoring. This underscores its pivotal role in advancing productivity, performance, and safety standards. These outcomes make a substantial contribution to the progression of automation technology and fuel management practices.

VII. RESULT AND DISCUSSION

The integrated system demonstrates robust performance in facilitating fuel dispensing transactions. Upon registration and login, users encounter a dashboard presenting a profile module for managing personal information. They proceed by selecting the desired fuel type and specifying the dispensing amount, ensuring smooth transactions. Moreover, users can access fuel history details and help modules within the application, fostering a user-friendly experience. Overall, the system places a premium on user convenience, efficiency, and accessibility in managing fuel transactions.

The performance evaluation of our application was conducted based on some parameters:

- URRT – User Registration Response Time
- SLT – System Load Time
- FTPT – Fuel Transaction Processing Time
- SRT – Sensor Response Time

Result Table -

Parameters	Result (in sec)
User Registration Response Time	3 Sec
Dashboard Loading Time (SLT)	2 Sec
Fuel Type Selection Response Time (SLT)	1 Sec
Dispensing Confirmation Time (FTPT, SRT)	3 Sec

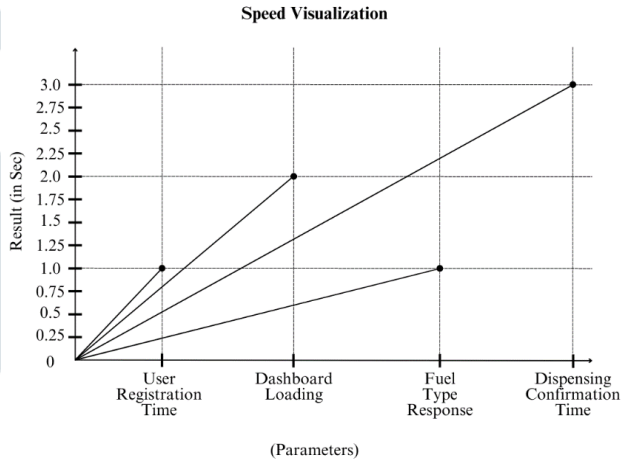
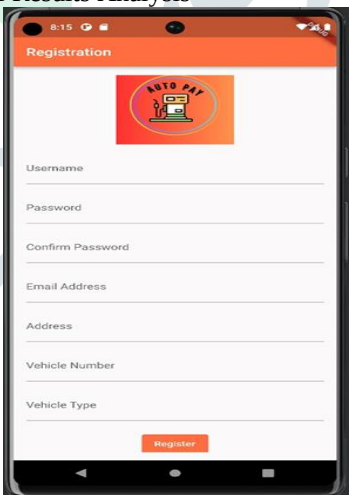


Fig. Graphical Results Analysis



VIII. CONCLUSION

Our proposed system offers a comprehensive solution to address fuel dispensing requirements efficiently. Prioritizing user-friendliness, features such as registration, profile management, and transaction tracking streamline user interactions, enhancing the overall experience. The system's diverse fuel type selection and precise dispensing functionality ensure reliability and accuracy in every transaction. Furthermore, the inclusion of informative modules such as fuel history and help sections underscores our dedication to user satisfaction and support. Ultimately, our system embodies technological innovation and user-centric design, effectively catering to diverse user needs while optimizing efficiency and accessibility

in fuel management processes.

IX. ACKNOWLEDGMENT

I would like to extend our sincere appreciation to the team behind the automated fuel system. Your innovative approach and dedication have revolutionized our operations, ensuring efficiency and reliability in fuel management. Your tireless efforts in developing and implementing this system have significantly contributed to streamlining our processes and reducing operational costs. Your expertise and commitment to excellence have set new standards in fuel system automation, making our operations safer and more environmentally friendly. Thank you for your outstanding contribution to our organization.

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