

## A REVIEW ON 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 proposed system introduces a transformative 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 proposed system lies in its ability to streamline the fueling process by marrying mobile technology with the traditional gasoline 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 and a user-friendly interface. The primary goal of an automated fuel system is to ensure efficient fuel management, minimize losses, enhance safety, streamline operations, use data analytics, secure payment integration, and meet fuel management needs. An automated fuel system is a sophisticated and computer-controlled infrastructure designed to manage and optimize the storage, distribution, and consumption of fuel in various industrial and commercial settings. The core of an automated fuel system is the software that manages all aspects of fuel handling. This software collects and processes data from various sensors and devices, ensuring that fuel is supplied where and when it is needed. In this proposed system, we are using technologies like Flutter, MySQL databases, Stripe Payment gateways, various sensors, and IOT devices.

### II. RELATED WORK

**M.Saravanan, D. Yuvaraj, K. Lokesh, R. Mahesh Ashwin, S. V. Kavin karthik, March 2020," Automated Fuel Pump System Using UPI Payment"**

In this paper, a system is proposed to secure a fueling system that can be accessed through UPI ID transactions. It ensures security for users, as UPI ID technology provides a unique proof of identity for each user. The system operates when a customer enters the petrol station; a PIR sensor detects the customer's motion and activates the fueling machine. The system relies heavily on technology, including network connectivity and payment processing infrastructure.[1]

**Rohith. S, Akilan. K, Murali Krishna. M, Dr.Kandasamy, May 2022,"Auto-mated Petrol Pump Using RFID Technology"**.

In this paper, a smart card containing an RFID tag is provided to customers, and the petrol pump is equipped with an RFID reader. Payments can be processed through RFID technology without the need for physical cash or human interaction. RFID technology facilitates rapid and seamless transactions at petrol pumps, reducing waiting times and enhancing the overall customer experience. RFID systems can be vulnerable to unauthorized access and cloning of RFID tags.[2]

**Miss. R. Gowri, Mr. R. Sathish Kumar, June 2023," Fuel Delivery on Demand Application".**

In this paper, the Fuel Delivery on Demand system is designed to automate users' orders and requests. Users can easily register on the app, share their location, and request fuel. Once the request is made, a fuel truck will arrive at the user's location within minutes. This system enhances customer convenience, reduces manual errors, and improves customer satisfaction. Customers may experience delays in fuel delivery, especially during peak demand times or adverse weather conditions.[3]

**Rashida M. H., Raseena K.R., Risvana M. P., Sreemol C. V.,Nitha C. Velayudhun,2019,"Automatic Fuel Filling System".**

In this paper, the have developed an automated fuel station management system. A system is integrated into the vehicles to measure the quantity of fuel being filled into the vehicle's tank. The specified amount is transmitted to the pump system through a data modem, and the corresponding amount is debited. The remaining balance is then sent to the user's mobile device via GSM. Daily updates to the fuel rates ensure that customers cannot be deceived. This system effectively reduces corruption and enables fast and secure transactions. Customers requires knowledge to deal with automated fueling system.[4]

**Md.Fahim Shahrier Khan, Mohammed Shahed Hossen, Naeemul Islam, Md Kosar, December 2020,"Smart Fuel Station Controlling System".**

In this paper, the proposed smart fuel station control system utilizes RFID and GSM technology. RFID ensures the precise dispensing of fuel, which effectively reduces fuel misuse.[5]

**Zahra'a M. Baqir, Hassan J. Motlak,2 April 2021," Smart Automatic Petrol Pump System Based On Internet Of Things".**

In this paper, the smart petrol pump system, based on IoT and RFID technology, automates the fueling process. When a vehicle approaches the pump, RFID technology identifies it and communicates with a central system for billing and authentication. The system facilitates efficient inventory management and enhances security by preventing fraud at fuel stations. The system may have some technical glitches, connectivity problems, or system failures.[6]

**Sahana. S. Rao, V. Siddeshwara Prasad ,2017," Centralized Automation of Petrol Bunk Management and Safety using RFID and GSM Technology".**

In this paper, the automated fuel filling system utilizes petro cards and smartphones for customers to make payments and control the fueling process. Customers swipe their cards, enter a password, and specify the desired fuel amount, at which point the pump starts filling. The process stops when the desired amount is reached, and payment is deducted in real-time. Furthermore, customers have the ability to recharge their petro cards remotely via SMS, adding flexibility and convenience to the system.[7]

**Gowri Shankar. E, Menaka. R, Mythili Hema. D Gokul Krishnan, Baskaran. D,2016," Automation of Petrol Bunk using Biotelemetry System and Petro Card".**

In this paper, the automation of petrol bunks using Biotelemetry and Petro Card technology involves unmanned petrol pumps, where customers utilize RFID technology for authentication and electronic clearing systems for payment. The system includes alcohol concentration detection to prevent refueling if the driver's alcohol levels exceed safety limits, thereby enhancing road safety and efficiency. The alcohol concentration detection promotes road safety by discouraging drunk driving. Older vehicles may not support petro cards or biotelemetry technology.[8]

**Ali Newaz Bahar, Nazrul Islam, Shougat Hossain, Ruhul Amin Sujon, 2015,"A New Automation Approach for Fuel Station Management System".**

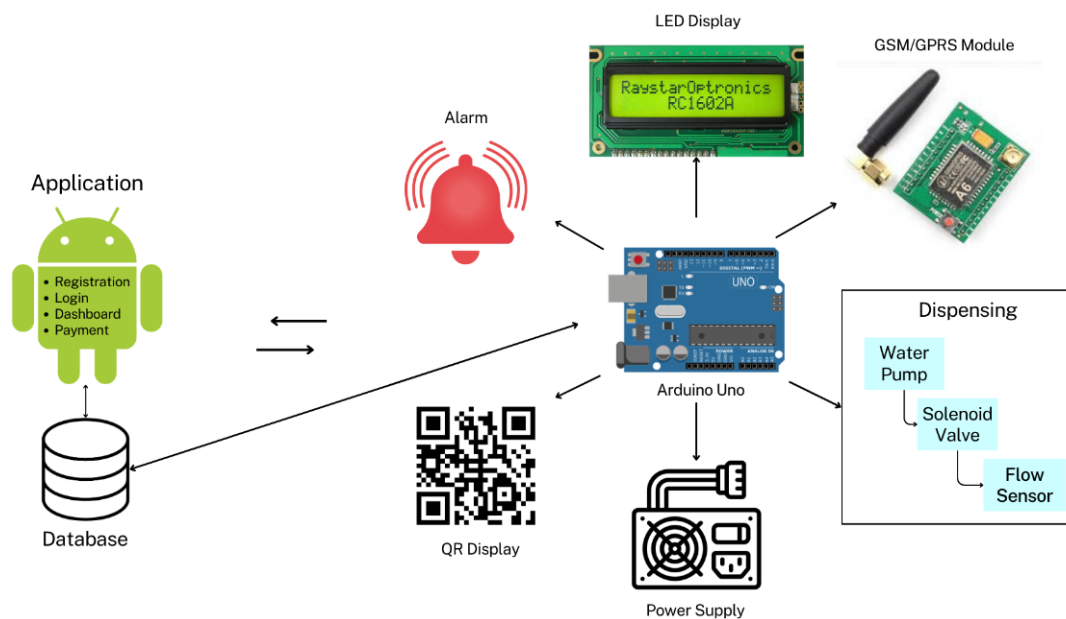
In this paper, a system for fuel station operations is designed to record and manage trans-actions electronically. It automatically records fuel sales, generates receipts for customers, and allows for remote monitoring of transactions through the Internet. Automation can help reduce opportunities for fraud and corruption in fuel transactions, enhancing transparency.[9]

**Md. Badiuzzaman Pranto, Md. Mahidur Rahman, Zunayeed-Bin-Zahir ,2019," Vehicle Fuel Monitoring and Management using RFID authentication and Telematics Notification".**

In this paper, users first register and link their vehicles with the mobile application, which also provides an RFID card acting as a prepaid fuel card. Following this, email notifications are sent to the users, and all transaction de-tails are recorded in a centralized system through the mobile app. The system enhances transparency in fuel transactions by automatically recording and notifying users about refill amounts, costs, and times.[10]

### III. METHODOLOGY

The system consists of two parts: software and hardware. We use a mobile application for user interactions. Transaction management, payment processing, and backend services manage the core functionality, while components at the fuel station, such as fuel dispensers, payment terminals, LED displays, GSM modules, and sensors, handle physical fuel transactions. A user places a fuel order using the Android app, specifying the amount and type of fuel required. The Android app sends the order to the server, which verifies user credentials and initiates the payment process. Once the order is confirmed and payment is received, the server instructs the Arduino Uno to prepare for fuel delivery. The Arduino Uno controls the fuel dispensing system to pump the required amount of fuel into the user’s vehicle.



#### Arduino Uno

Arduino Uno serves as a central control unit. Programmed to manage the fuel pump, flow sensors, LED display, and GSM GPRS module, Alarm Arduino Uno orchestrates seamless communication and coordination, ensuring accurate dispensing, transaction recording, and remote monitoring capabilities. It acts as the intelligent brain of the system, enhancing overall automation and control in the fuel dispensing process.

#### GSM-GPRS Module

A GSM-GPRS module is utilized to enable remote monitoring and control. It facilitates communication with a central server, allowing for real-time transaction data transmission, system status updates, and potential alerts, enhancing the efficiency and security of the dispensing process.

#### LED Display

An LED display is employed to show real-time information such as dispensed quantity and total cost. It enhances user interaction by providing immediate visual feedback during the fueling process, contributing to a more informed and efficient customer experience at the pump.

#### Alarm

An alarm is integrated to alert users or operators in case of irregularities or issues such as low fuel levels, system malfunctions, or potential security breaches.

### **Water Pump**

A fuel pump is integral, drawing fuel from a storage tank and delivering it through a dispensing nozzle to vehicles. The fuel pump ensures a controlled and precise flow of fuel during the dispensing process.

### **Solenoid Valve**

The solenoid valve opens and closes based on signals from the Arduino Uno, allowing precise regulation of fuel flow during dispensing. This ensures accurate and secure transactions, prevents unwanted fuel leakage, and enhances the overall safety and efficiency of the dispensing process.

### **Flow Sensor**

A flow sensor measures the rate of fuel flow, providing real-time data to the Arduino Uno. This allows for precise control of fuel dispensing, ensuring accurate transactions, and enhancing the efficiency and reliability of the overall dispensing process. The flow sensor plays a critical role in preventing overflows and optimizing fuel management.

## **IV. ANALYSIS**

In this paper, we examine the impact of an automated fuel system on fuel efficiency and safety. Our study reveals that the automated fuel system significantly enhances fuel efficiency, reduces waste, and improves safety through real-time monitoring. This highlights its crucial role in advancing productivity, performance, and safety. These results contribute significantly to the advancement of automation technology and fuel management.

### **Advantages:**

1. **Efficiency:** Automated fuel systems significantly reduce the time and labor required for manual fuel tracking, monitoring, and dispensing. Realtime monitoring and reporting enable more accurate inventory management and timely refilling
2. **Enhanced Safety:** Environmental monitoring and compliance features ensure that fuel storage and dispensing meet safety and environmental regulations. Access control and security measures protect against unauthorized access and fuel theft.
3. **Scale and Flexibility:** Automated fuel systems can be scaled to meet the needs of businesses with growing fuel demands or multiple fueling sites.

### **Applications:**

1. **Fleet Management:** Automated Fuel Management System is used to monitor and manage fuel consumption for a fleet of vehicles, optimizing routes and fuel efficiency to reduce operating costs.
2. **Reporting and Analytics:** The system generates reports on fuel consumption, costs, and trends, facilitating data-driven decisions for budgeting and operational improvements.
3. **Maintenance Scheduling:** Automated Fuel Management System can integrate with maintenance software to schedule vehicle servicing based on fuel consumption data, preventing breakdowns and reducing downtime.
4. **Security and Theft Prevention:** The system enhances security by monitoring for unauthorized fuel access and deterring theft or misuse.

## **V. OUTCOMES**

The outcome of implementing an Automated Fuel Management System with problem solving and efficiency methodologies is improved fuel efficiency, accurate data, streamlined processes, cost reduction, enhanced security, and empowered employees. It enables Data-driven decision-making, ensures compliance, and enhances an organization's competitiveness.

## **VI. CONCLUSION**

The main goal of our proposed system is to upgrade the traditional petrol pump by reducing manpower and enabling smart transactions with UPI ID and the key feature of digital wallet transactions. It ensures security for users, as UPI ID technology gives unique proof of identity to each user. The users will use the mobile application anytime and anywhere across the world. This system also provides all the transaction information, like refill amount, refill type, refill cost, transaction time, etc. So, therefore, this system can make a great change in the social-economic sector of a country.

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