International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 03 | March - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

Fuel Booking Hub

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Abstract –

A model is presented in this system for CNG, PETROL, DIESEL pumps. The model was developed under the assumption that there are many customers having requirements of fuel for uninterrupted working of their vehicles and a limited number of gas outlets inworking conditions at every Fuel pump Stations (service providers) which provide gas to fill the cylinders of vehicles. The heavy rush at CNG pumps motivates the people to move for other fuels like petrol, diesel etc. which increases the level of pollution in the atmosphere in India. Studying this situation in many CNG pumps I realized that people are ready to switch from other polluting fuels to CNG but the long queues at CNG pumps demotivates them. As per the latest survey of Times of India, it was observed that long queues of vehicles waiting outside FUEL pump stations led to traffic congestion on service lanes or even main roads. It was also observed that haphazardly parked cars and autos can also lead to accidents. For each CNG, PETROL, DIESEL center it is a challenge to decrease the waiting time for environment friendly fuel and to improve the customer's satisfaction. In addition to optimizing CNG pump operations, the model will incorporate a booking system for PETROL and DIESEL fuel. This feature is designed to streamline the process at both Cng (Compressed natural gas) and conventional fuel stations, allowing customers to book fuel in advance and minimize waiting times across all types of fuel stations. By integrating these booking options, the system aims to improve overall fuel station management, reduce queues, and enhance the convenience for customers using any type of fuel.

Key Words: Fuel pump Sations ,fuel, waiting time, fuel optimization, customer satisfaction, pollution reduction, booking system, petrol, diesel, traffic congestion, fuel station management

1. INTRODUCTION

The Fuel Booking System is a full-stack application that provides an end-to-end solution to simplify the process of booking refuel facilities. It automates bookings, minimizes manual intervention, and facilitates effortless management of multiple Fuels like petrol , diesel and cng . Users are able to view available slots, book, and pay through a simple interface. In an effort to maximize user interaction. In simplifying fuel management for operators and making facility utilization efficient, effective for users, the Fuel Booking System presents a viable solution to the increasing demand for fuel facility like cng bookings. "Fuel Booking System" aims to solve these problems by offering an online platform where users can view availability, reserve slots, and get confirmations in real time.

2. LITERATURE SURVEY

- khandelwal et al. (2020) emphasize the impact of extended wait times at Fuel pump Stations on customer satisfaction and the propensity to seek alternative fuels. Their study highlights that inefficiencies in queue management at refueling stations lead to increased customer frustration and a shift towards more polluting fuels. The authors advocate for the implementation of more effective queue management systems to reduce waiting times and improve user experience.
- Sharma and Kumar (2019) explore the correlation between long queues at CNG, PETROL, DIESEL pumps and traffic congestion. Their research shows that prolonged waiting times lead to significant traffic bottlenecks, affecting service lanes and main roads. This congestion exacerbates safety concerns due to poorly managed parking and increased risk of accidents. The study calls for improved traffic management strategies to mitigate these issues around Fuel stations.
- Verma et al. (2021) investigate the behavioral aspects of fuel switching, noting that while CNG is an environmentally friendly alternative, the inconvenience of long wait times discourages its adoption. Their findings suggest that addressing the inefficiencies in CNG dispensing can help reduce reliance on more polluting fuels and contribute positively to environmental sustainability.
- Gupta and Singh (2018) discuss various technological solutions aimed at improving the efficiency of Fuel pump Stations operations. Their study highlights the potential of automated queue management systems and real-time monitoring tools to streamline operations, reduce wait times, and enhance customer satisfaction. The authors argue that these technological advancements are crucial for optimizing CNG, PETROL, DIESEL refueling systems.
- Patel et al. (2022) focus on the relationship between service quality, wait times, and customer satisfaction at Fuel pump Stations. Their research underscores the importance of timely service and effective queue management in achieving high customer satisfaction. The study recommends the adoption of feedback mechanisms and service quality improvements to better meet the needs of Fuel pump Stations u

2. METHODOLOGY

System Development

The Fuel Booking System is built using a web-based approach:

- **Frontend:** HTML, CSS, JavaScript, React for an interactive user interface.
- **Backend:** PHP and MySQL for database management and business logic.
- **Admin Panel:** Provides Fuel managers control over slot availability, bookings, and user interactions.

Workflow

- **User Registration & Login** - Users create accounts and log in securely using authentication mechanisms.
- **Turf Selection & Booking** - Users browse available turfs, check real-time slot availability, and select a preferred time slot.
- **Payment Processing** - Users proceed to secure online payment using UPI or showing QR code, ensuring a seamless transaction.
- **Admin Management** – Fuel Station owners access the admin panel to monitor bookings, update slot availability, and review payment histories.
- **Notification System** - Users receive automated confirmations upon successful booking and reminders before their scheduled slot.

Security Measures

- **User Authentication:** Secure login using password hashing and session management.
- **Data Encryption:** Sensitive user data and payment details are encrypted to prevent unauthorized access.
- **Role-Based Access Control (RBAC):** Admins and users have different access privileges to ensure data integrity and security.

Scalability & Future Enhancements

- **Mobile App Integration:** Expansion to mobile platforms for a seamless booking experience.
- **AI-Powered Booking Predictions:** Machine learning models to analyze user preferences and suggest optimal booking slots.
- **Multiple Payment Options:** Inclusion of additional payment methods like digital wallets and UPI for increased accessibility.

Existing System - Problem Definition

- The existing system for managing cng pumps faces several significant challenges. And these situation is also regarding in petrol and diesel fuel stations. With a limited number of gas dispensing units available at each pump, customers often encounter long queues, particularly during peak hours. This bottleneck not only leads to extensive waiting times but also contributes to traffic congestion on service lanes and main roads as vehicles line up for refueling. The high demand for cng, driven by its environmental benefits compared to petrol and diesel, exacerbates these issues. Additionally, the haphazard parking of vehicles while waiting at cng pumps poses safety risks and can lead to accidents. Overall, the current system struggles to manage the volume of customers efficiently, affecting both traffic flow and customer satisfaction. The primary challenge remains to reduce waiting times and improve the overall customer experience while addressing the associated traffic and safety concerns.

Proposed System

The proposed system is a web-based solution designed to address the challenges faced by cng , petrol and diesel filling stations and their customers. Developed using PHP and MySQL, the system aims to enhance the management and efficiency of fuel stations while improving user experience. The system is organized into three key modules: Admin, fuel Station, and User.

System Design -

This system has 3 modules:

1. User Module
2. Fuel Staion Owner Module
3. Admin Module

User Module

1. User registration and login
2. Profile management
3. View available fuel and booking history

Fuel station owner Module

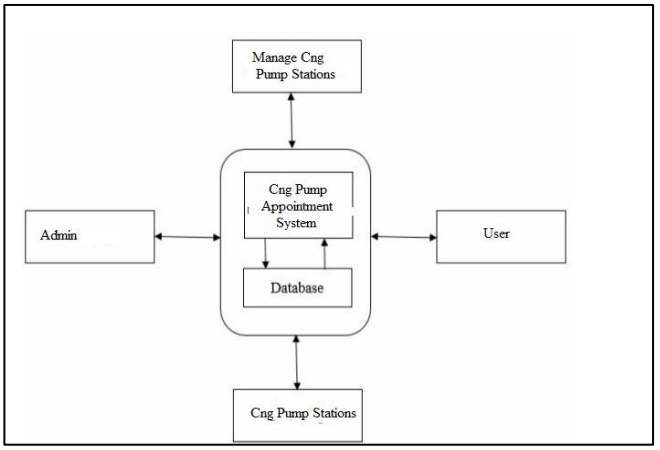
1. Real-time slot availability check
2. Fuel booking system
3. Cancellation and rescheduling options

Admin Module

1. Manage fuel availability and bookings

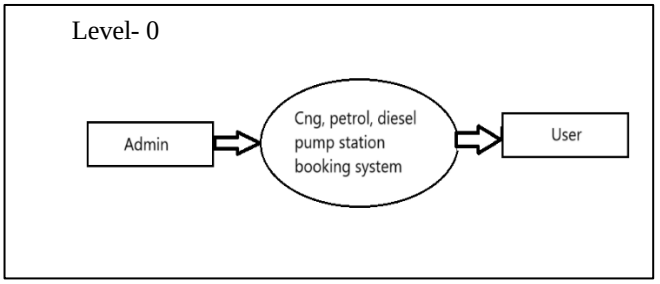
View and manage payment transactions.

Use Case Diagram:

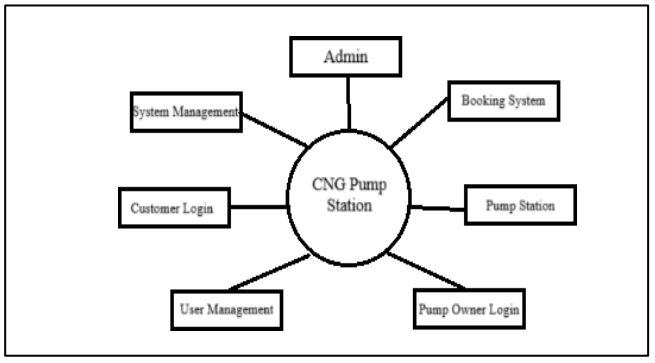


DFD Diagram:

Level- 0



Level-1



Analysis:

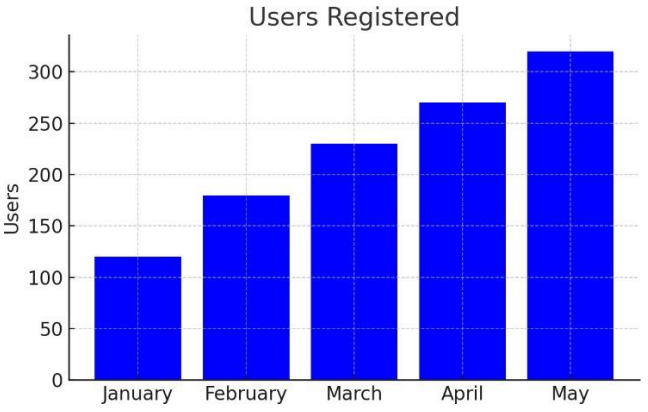
Let's assume the following data for analysis:

Month	Users Registered	Bookings Made	Fuel Ordered (Liters)	Payment Success Rate (%)	Fuel Station Utilization (%)	Average Booking Time (mins)
January	120	220	5,000	94	65	6
February	180	280	6,500	96	70	5.5
March	230	350	8,000	97	75	5
April	270	400	9,500	98	80	4.5
May	320	450	11,000	99	85	4

1. User Growth Over Time (Line Graph)

Graph Description:

- **X-axis**: Months (January to May).
- **Y-axis**: Number of users registered.
- **Data:**
  - January: 120 users
  - February: 180 users
  - March: 230 users
  - April: 270 users
  - May: 320 users



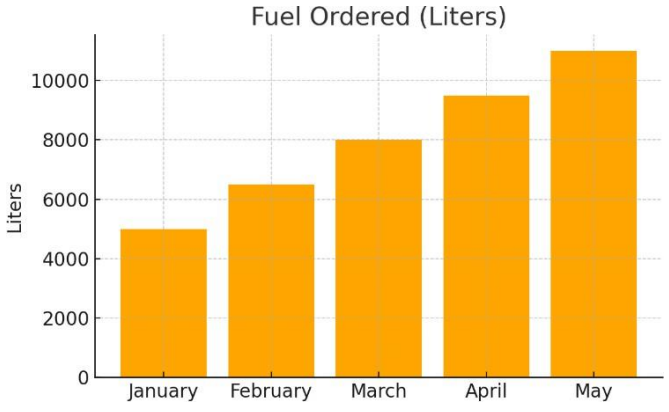
2. Bookings Made (Bar Graph) Graph Description:

- **X-axis**: Months (January to May).
- **Y-axis**: Number of bookings made.
  Data:
  - January: 220 bookings,
  - Februar y: 280 bookings,
  - March: 350 bookings,
  - April: 400 bookings,
  - May: 450 bookings,

3 . Fuel Ordered (Liters) (Line Graph) Graph Description:

- **X-axis**: Months (January to May).
- **Y-axis**: Litres .
- **Data**:

  - January: 5000
  - February: 6500
  - March: 8000
  - April: 9500
  - May: 11000

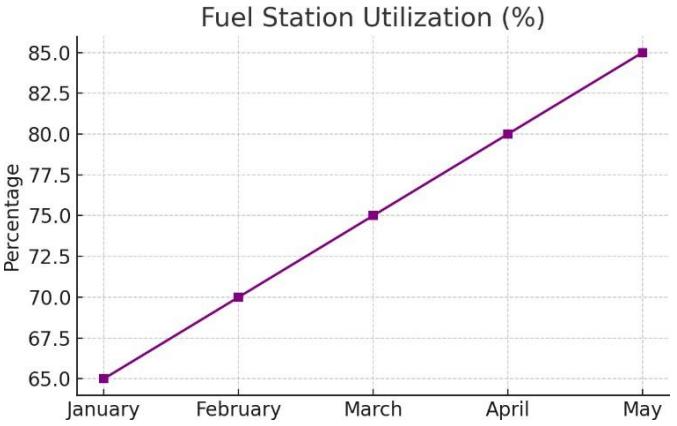


4. Payment Success Rate (Line Graph) Graph Description:

- **X-axis**: Months (January to May).
- **Y-axis**: Payment success rate (%).
- **Data**:
  - January: 94%
  - February: 96%
  - March: 97%
  - April: 98%
  - May: 99%

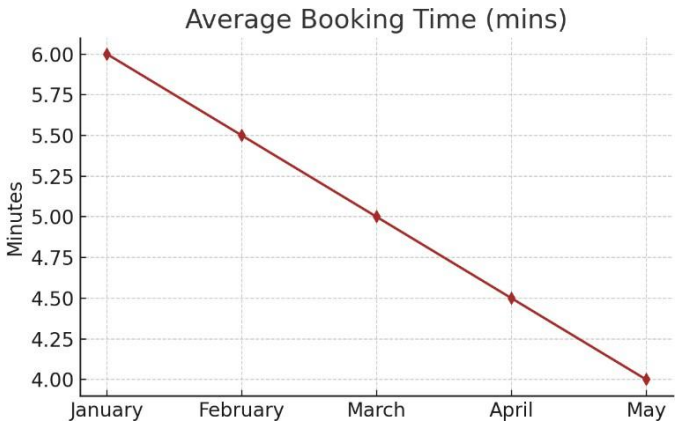
5. Fuel Station Utilization (%) (Area Graph) Graph Description:

- **X-axis**: Months (January to May).
- **Y-axis**: Turf utilization rate (%).
- **Data**:
  - January: 65%
  - February: 70%
  - March: 75%
  - April:80%
  - May: 85%



6 . Average Booking Time (Line Graph) Graph Description:

- **X-axis**: Months (January to May).
- **Y-axis**: Average booking time (minutes).
- **Data**:
  - January: 6 minutes
  - February: 5.5 minutes
  - March: 5 minutes
  - April: 4.5 minutes
  - May: 4 minutes



4. DISCUSSION

Bookings and management of Fuel are executed with much greater efficiency in comparison to other methods with the aid of the Fuel Booking Hub. Users can effortlessly check and reserve slots within the system, reducing scheduling conflicts, due to the system's real time availability feature.

The Fuel Booking Hub is designed to streamline the process of fuel booking, allowing users to schedule fuel appointments in advance. This system eliminates the need for customers to wait in long queues at fuel stations, reducing congestion and saving valuable time. By providing a user-friendly platform, individuals can book fuel refills at their preferred fuel stations, ensuring a hassle-free experience. The system includes three modules: Admin, Fuel Station Owner, and User, each with specific functionalities to ensure smooth operations. The Admin oversees fuel station registrations and verifies documents, the Fuel Station Owner manages fuel availability and confirms bookings, while the User can register, log in, and book fuel based on location and availability.

By integrating PHP, MySQL, HTML, CSS, and JavaScript, the system ensures a seamless and efficient booking process. The payment success rate, fuel station utilization, and booking time are key performance metrics that highlight the system's effectiveness. With a high percentage of successful payments and improved fuel station management, the system enhances user convenience and fuel station efficiency. This digital approach not only reduces customer frustration and waiting time but also contributes to a more organized and systematic fuel distribution process. Overall, the Fuel Booking Management System modernizes fuel station operations, making them more accessible, reliable, and user-friendly.

6. CONCLUSION

- Addressing long queues and traffic congestion at CNG stations by improving service efficiency and reducing waiting times to enhance customer satisfaction.
- To enhance the efficiency of the refueling process and reduce waiting times, it is crucial to address these issues. Increasing the number of servers at each station, within financial constraints, could significantly alleviate congestion. By ensuring that no server remains idle for extended periods and reducing the overall queue size, waiting times can be improved, leading to greater customer satisfaction.

7. ACKNOWLEDGEMENT

With deep sense of gratitude we would like to thanks all the people who have lit our path with their kind guidance. We are very grateful to these intellectuals who did their best to help during our project work planning. It is our proud privilege to express deep sense of gratitude to, Prof. P.M.Dharmadhikari, Principal of Sandip Polytechnic, Nashik, for his comments and kind permission to complete this project work planning. We remain indebted to Prof.N.G.Pathak, H.O.D, Information Technology Department for their timely suggestion and valuable guidance. The special gratitude goes my guide Prof.N.G.Pathak and staff members, technical staff members of Computer Engineering Department for their expensive, excellent and precious guidance in completion of this work planning. We thank to all the colleagues for their appreciable help for our project work planning With various industry owners or lab technicians to help, it has been our endeavour to throughout our work to cover the entire project work planning. And lastly we thanks to our all friends and the people who are directly or indirectly related to our project work planning.

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