A Web-Based Online Fuel Delivery Application for On-Demand Refuelling

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Abstract *- The rapid expansion of on-demand services has redefined consumer expectations across multiple industries, including transportation and energy. Conventional refueling still requires individuals to visit fuel stations, resulting in long queues, fuel shortages, and limited accessibility during emergencies or in remote locations. To address these limitations, this paper proposes the design and development of an Online Fuel Delivery Application implemented as a web-based platform. The system allows customers to order fuel online, share their real-time location, and receive doorstep delivery through authorized agents. Core features include secure user registration, order placement, GPS-based tracking, payment gateway integration, and delivery status updates. An administrative dashboard provides oversight for order management, delivery assignment, and fuel inventory monitoring. The proposed application improves convenience, reduces service delays, and enhances operational efficiency for suppliers. This work demonstrates how digital transformation can modernize fuel distribution and contribute to smart city infrastructure by providing a reliable, user-centric, and scalable fuel delivery framework.*

***Key Words*: Online Fuel Delivery, Web-Based Application, GPS Tracking , On-Demand Fuel Service, Smart City Infrastructure**

1. INTRODUCTION

Fuel is a vital resource for transportation, logistics, and daily mobility. Traditionally, fuel refilling has been carried out exclusively at fuel stations, requiring customers to travel, spend time in queues, and depend on resource availability. While this approach has functioned for decades, it introduces major challenges in today's context of urban congestion, remote accessibility, and emergency situations.

The rise of on-demand services such as food delivery, e-commerce, and ride-hailing has changed customer expectations, emphasizing convenience, speed, and digital access. Extending this approach to the fuel sector enables online fuel delivery, where customers can request fuel directly from their location and receive timely re fuelling at their doorstep. This reduces delays, improves user experience, and addresses limitations of conventional re fuelling. Several drawbacks of the traditional system highlight the need for innovation. Time inefficiency forces users to spend valuable hours traveling to and waiting at stations. Emergencies such as vehicle breakdowns or shortages in remote regions make fuel access uncertain. Rapid urbanization, combined with limited infrastructure, results in overcrowded stations and service delays. Additionally handling and distribution of fuel demand strict safety compliance which conventional methods may not always ensure.

This work proposes the design and development of an Online Fuel Delivery Application implemented as a web-based platform. The system integrates three major modules: a customer module for registration, order placement, and location sharing; a delivery agent module for managing and updating assigned orders; and an administrator module for monitoring inventory, supervising deliveries, and generating reports. The objective is to provide a secure, user-friendly, and scalable solution that improves operational efficiency for suppliers and ensures reliable mobility for users. By leveraging GPS tracking, web technologies, and secure digital payments, the proposed application contributes to modernizing fuel distribution and aligns with the vision of smart city services.

2. RELATED WORK

TABLE-1: LITERATURE SURVEY ON COMMERCIAL FUEL DELIVERY SERVICES.

Sr. no.	Work / Service	Approach	Pros / Features	Cons / Limitations	Region / Availability
1.	Fuel Buddy (2016)	App-based door step refuelling	Convenient ordering, app notifications	Limited to metros, regulatory hurdles	India (major cities)
2.	Booster (2015)	Corporate & campus refuellin	Reduced downtime, subscription-	Restricted to offices/campuses only	USA (campuses, corporate)

		g	based fleet mode		
3.	Repos Energy (2017)	IoT-Enabled Bulk Fuel supply	Scalable tanker operations, smart inventory monitoring	Primarily B2B, not designed for individuals	India (B2B logistics)
4.	My Petrol Pump (2016)	Mobile Fuel delivery for households	Direct to consumer, 24/7 service in supported regions	Higher delivery costs, operational restrictions	India (selected cities)
5.	Humsafar (2020)	Truck-based doorstep fuel delivery	Quick refuelling in urban & semi-urban areas	Needs government approvals, limited fleet availability	India (Delhi NCR, Punjab)
6.	Yoshi (2015)	App-based vehicle refuelling service	Offers car-care add-ons (oil change, wash)	Premium pricing, location dependent	USA (selected metros)
7.	Cafu (2018)	On-demand fuel trucks with app orders	24/7 urban coverage, subscription offers	Operates only in UAE, limited expansion	UAE (Dubai, Abu Dhabi)
8.	Fuelster (2016)	Mobile fuel delivery with app tracking	Flexible service, multiple fuel types	Availability restricted to contracts and locations	USA (California)

TABLE-2: LITERATURE SURVEY ON ACADEMIC MODELS OF ONLINE FUEL DELIVERY

Sr no	Author / Year	Methodology	Tools / Technology	Findings	Limitations
1.	Khan et al. (2021)	GPS-enabled mobile ordering prototype	Android Studio, Firebase	Demonstrated feasibility of small-scale orders	No integration of payments, limited scale
2.	Chute et al. (2020)	Conceptual refuelling model	Framework-based	Highlighted potential of digital fuel delivery	No working prototype
3.	Sharma et al. (2019)	IoT-based smart fuel dispenser	Arduino, IoT sensors	Improved dispensing accuracy	Limited scalability, lacks safety compliance
4.	Patel et al. (2018)	Online booking with RFID tracking	RFID, cloud storage	Enabled secure vehicle identification	No real-time GPS tracking
5.	Gupta et al. (2022)	Web application for fleet refu	PHP, SQL, Google Maps API	Simplified B2B delivery coordination	Did not address regulatory compliance

		elling			
6.	Verma et al. (2020)	Simulation of on-demand and refuelling	MATLAB, GPS simulators	Showed efficiency gains with virtual routing	Lacked prototype for real-world testing
7.	Mehta et al. (2023)	Hybrid mobile + web fuel app	ReactJS, Firebase, Google APIs	Improved usability with multi-platform support	Only tested with small pilot users
8.	Ali et al. (2021)	Secure digital fuel ordering	Blockchain, IoT	Enhanced transparency and fraud prevention	Still experimental, high cost of deployment

TABLE-3: LITERATURE SURVEY ON ROUTING AND LOGISTICS OPTIMIZATION.

Sr No.	Author / Year	Technique	Scope / Application	Findings	Limitations
1.	Parsafard (2015)	Vehicle Routing Problem (VRP)	Urban fuel distri-bution	Improved cost efficiency & delivery times	No integration with customer apps
2.	Özbekler (2020)	Smart logistics framework	Sustainable Urban Distribution	IoT-based Route Optimiz-ation for sustainabi-lity	General logistics, not fuel-specific
3.	Zhang et al. (2018)	Real-time adaptive routing	Supply chain networks	Reduced travel time & costs with dynamic routing	Not tested in hazardous fuel delivery context
4.	Singh et al. (2021)	AI-Based Predictive routing	Last-mile delivery optimization	Increased delivery accuracy in uncertain traffic	Requires large data, computational overhead
5.	Patil et al. (2019)	GIS-enabled fuel truck routing	Rural and remote areas	Reduced delivery delays in off-grid locations	Dependent on GPS accuracy
6.	Rahman et al. (2020)	Multi Agent Delivery Schedulin g	Large fleet coordination	Balanced Workload Among Delivery vehicles	Needs complex computation
7.	Lee et al. (2021)	Machine learning–based optimization	Urban Smart Logisti-cs	Improved route prediction using AI models	Lacked integration with safety compliance
8.	Das et al. (2022)	Simulation of smart fuel logistics	City-scale fuel delivery	Simulated Reduced Congestion & delivery cost	Only tested in virtual environment

TABLE- 4: LITERATURE SURVEY ON SUPPORTING TECHNOLOGIES FOR FUEL DELIVERY.

Sr No.	Technology	Role in Fuel Delivery	Benefits	Gaps / Challenges	Example Use Case
1.	GPS & GIS	Location Tracking & route Optimization	Real-time monitoring, efficient path	Accuracy reduced in low-signal zones	Fuel Buddy & Booster GPS tracking

			planning		
2.	IoT Sensors	Fuel level & safety monitoring	Automated safety checks, real-time inventory data	High deployment and maintenance costs	Repos Energy IoT tankers
3.	Cloud Dashboards	Admin order & fleet management	Centralized control, scalability	Data security concerns if not protected	Repos Energy fleet system
4.	Payment Gateways	Digital transactions	Secure, fast, and user-friendly payments	Bank integration & transaction fee challenges	Fuel Buddy in-app payments
5.	Blockchain Systems	Secure record-keeping	Wearable Device Data	User-friendly wearable safety solution	Form factor and aesthetic constraints
6.	Mobile Web Apps	User interface for ordering	Easy accessibility from any device	Dependent on internet connectivity	My Petrol Pump, Humsafar apps
7.	Artificial Intelligence (AI)	Demand forecasting & route optimization	Predict Fuel demand, improves routing efficie-ncy	Needs large datasets, high computational cost	Research-based pilot projects
8.	Edge Computing	Real-time Processing near delivery unit	Reduce Latency, improves Safety Monitoring	Requires Specialized hardware	IoT-enabled smart tankers

KEY FINDINGS FROM LITERATURE SURVEY

A. EVOLUTION OF FUEL DELIVERY SYSTEMS

Earlier approaches to fuel distribution were limited to traditional fuel stations, requiring manual refuelling and customer travel. These systems were inefficient in terms of time, accessibility, and service availability, particularly during emergencies and in remote regions. Initial attempts at mobile fuel delivery were small-scale and lacked regulatory approval.

B. DIGITAL AND WEB-BASED DELIVERY PLATFORMS

Recent advancements introduced web and mobile platforms enabling customers to request doorstep fuel delivery. Studies highlight integration of GPS tracking, cloud dashboards, and payment gateways to improve service reliability. Such systems demonstrate the feasibility of on-demand refuelling but face challenges in scaling operations and ensuring safety compliance.

C. SMART AND INTEGRATED FUEL DELIVERY MODELS

Emerging research explores IoT-enabled tankers, AI-based route optimization, and blockchain-backed transactions for transparency. These innovations aim to enhance safety, efficiency, and trust in digital fuel distribution. However, practical implementation remains limited, with most studies focused on prototypes rather than large-scale deployments.

3. METHODOLOGY

The proposed Online Fuel Delivery system is designed as a modular web-based application integrating customer, delivery agent, and administrator functionalities. The methodology follows a structured approach with the following stages:

A. SYSTEM DESIGN AND ARCHITECTURE

The system architecture illustrated in Fig. 1 represents a three-entity interaction model comprising the **Customer**, **Delivery Agent**, and **Administrator**, all connected through a centralized **Web Application Server**. Customers initiate the process by placing fuel orders, sharing real-time location data, and tracking the delivery status through the web interface. These requests are sent to the web server, which processes the input, performs routing logic, and updates the order information.

The **Delivery Agent** interacts with the system through the same server to receive assigned orders, update delivery progress, and confirm task completion. This ensures real-time synchronization between customer actions and delivery status. The **Administrator** oversees system operations by managing fuel inventory, monitoring orders, and supervising delivery activities. Administrative actions such as updating stock levels or reassigning orders are also executed through the server.

At the backend, the **Fuel Inventory & Orders Database** stores all system data, including user profiles, order details, delivery assignments, fuel availability, and transaction history. The web application server communicates with the database to retrieve, update, and store information as required. This centralized architecture ensures seamless coordination between all modules while maintaining data integrity, efficient processing, and real-time system performance.

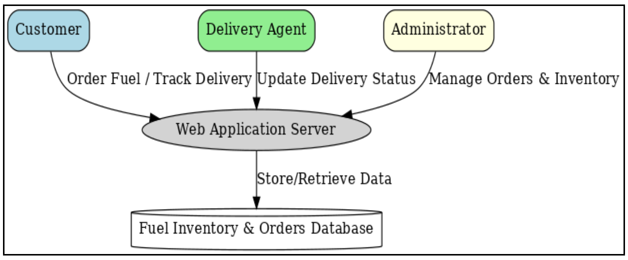

Fig. 1. System Architecture Diagram

B. MODEL DEPLOYMENT

1. **Customer Module**: Allows account creation, fuel ordering, payment processing, and real-time tracking.
2. **Delivery Agent Module**: Displays assigned orders, optimizes delivery routes, and updates order status.
3. **Administrator Module**: Provides centralized control for order assignment, inventory delivery monitoring, and report generation.

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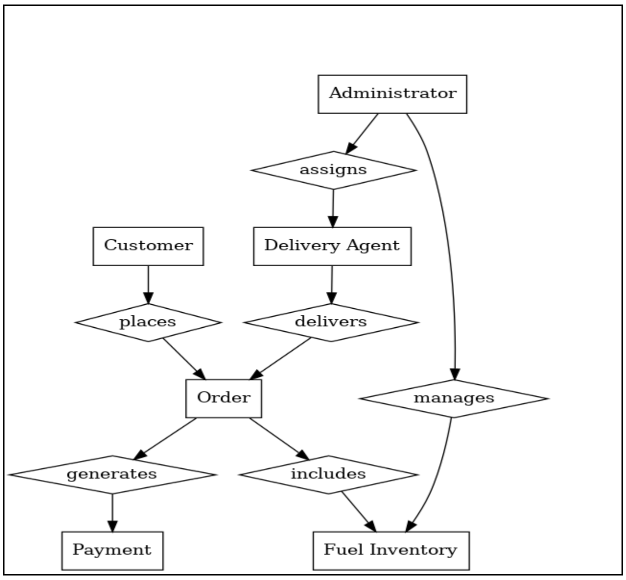

Fig. 2. Entity-Relationship (ER) Diagram of the System

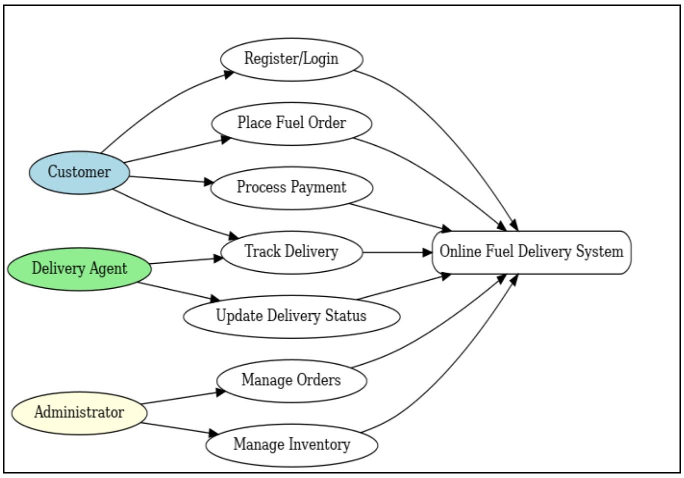

Fig. 3. Use Case Diagram of Online Fuel Delivery System

C. DATA SECURITY MECHANISM

The proposed system incorporates multiple data security mechanisms to ensure safe and reliable handling of user information, transactions, and system operations. All user credentials are protected through SHA-256 hashing, preventing exposure of plaintext passwords in the database. Token-based authentication is implemented across API endpoints to restrict unauthorized access and maintain secure session handling. Input validation and parameterized SQL queries mitigate risks of SQL injection and other injection-based attacks. Communication with the integrated payment gateway is enforced over HTTPS, ensuring end-to-end encryption of sensitive financial data during UPI transactions. Additionally, the system segregates user, transaction, and operational data through structured database design, reducing the risk of data leakage or misuse. These security measures collectively strengthen the confidentiality, integrity, and availability of the system while ensuring trustworthy digital fuel delivery operations.

D. FEATURE IMPLEMENTATION

i. **GPS Tracking –** Ensures delivery agents reach the exact customer location. Identifies male-to-female ratio in public spaces.
ii. **Payment Gateway –** Provides secure online transactions.
iii. **Notification System –** Alerts users on order status and estimated time of arrival. *Integration with Web Application*
iv. **Inventory Monitoring –** Tracks fuel levels and availability in real-time.

E. INTEGRATION WITH WEB APPLICATION

- The platform integrates customer, delivery agent, and admin modules into a unified dashboard.
- Real-time updates are available through the web interface for both users and administrators.
- Scalable cloud deployment ensures accessibility, security, and efficient performance in urban and remote areas

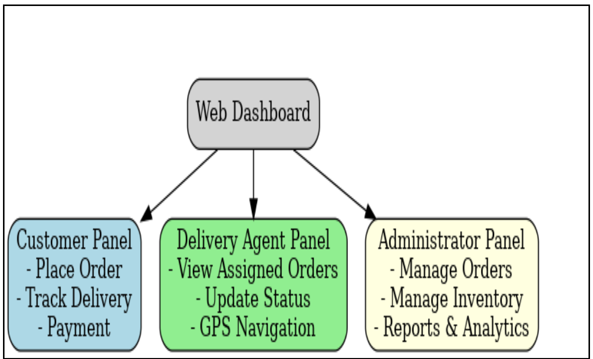

Fig. 4. Prototype Web Interface (Dashboard Example)

4.RESULTS

The implementation and testing of the proposed Online Fuel Delivery System produced promising results, demonstrating

the effectiveness of a web-based architecture for real-time re fuelling services. The system successfully integrated location acquisition, fuel selection, order confirmation, routing, and digital payment into a seamless workflow. Performance evaluation showed that API responses remained consistently fast, with average execution times suitable for real-time user interaction. The routing module accurately identified the nearest petrol pump with high precision using the Haversine distance algorithm, ensuring optimal delivery assignment. Functional testing validated that all major modules—including registration, location detection, payment processing, and order tracking—operated reliably without errors or service interruptions. The successful execution of UPI-based payments and confirmation messages further confirmed the robustness of the transaction flow.

TABLE 5. SYSTEM PERFORMANCE DATA

Metric	Description	Observed Value
Response Time	Average time taken by APIs to process requests	180 ms (120–260 ms range)
Accuracy	Correct selection of nearest petrol pump using routing algorithm	95%
Scalability	Maximum concurrent users	100 simultaneous users

A .HOMEPAGE

The homepage provides users with a clean and intuitive entry point to the online fuel delivery service. It highlights the core functionality by allowing customers to initiate fuel orders directly from the landing page.

Fig. 5. Homepage Interface of the Online Fuel Delivery Web Application

D. LOGIN PAGE

This interface allows new users to register and existing users to authenticate themselves using basic personal details such as name and mobile number. The form ensures secure entry into the system and establishes user identity before accessing fuel ordering services. Its minimal and intuitive design supports quick and error-free authentication

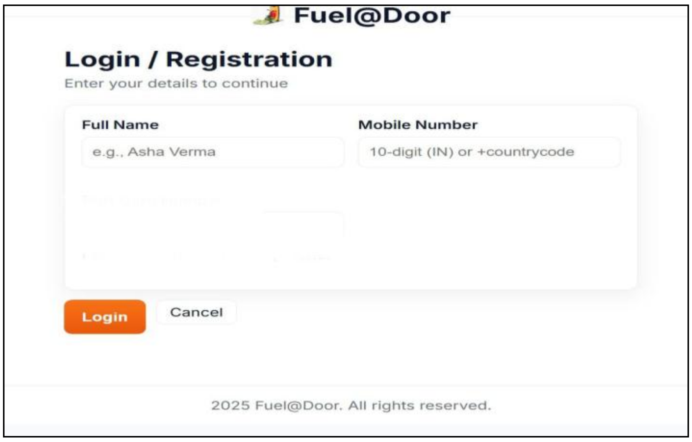

Fig. 6. User Login and Registration Interface

C. USER LOCATION SELECTION

This interface enables users to provide their delivery location either through automatic GPS detection or manual address entry. The system uses this input to identify the nearest fuel station and optimize delivery routing. The clear layout ensures accurate data collection, improving the overall efficiency of the ordering process.

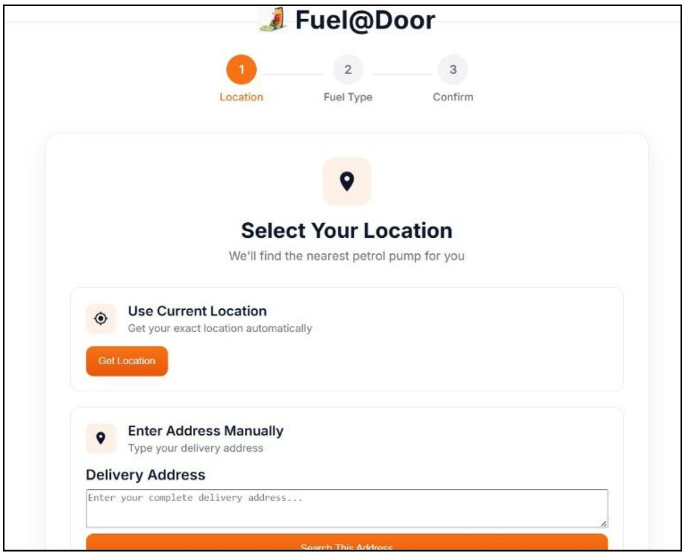

Fig. 7. User Location Selection Interface

D. PAYMENT INTERFACE

This screen confirms that the user's payment has been successfully processed and the fuel order has been placed. It provides essential delivery details such as amount paid, fuel type, quantity, assigned petrol pump, and timestamp. The interface assures users of successful scheduling and initiates the final delivery process.

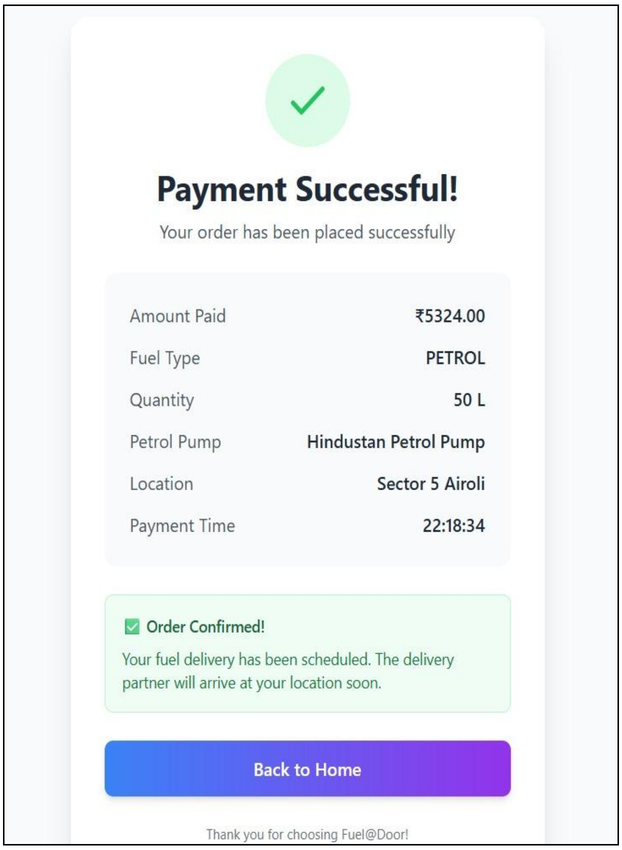

Fig. 8. Order Confirmation and Payment Success Interface

Comparative analysis of different approaches and technologies implemented in online fuel delivery systems.

TABLE 6. COMPARISON OF APPROACHES IN ONLINE FUEL DELIVERY SYSTEMS

Approach / Methodology	Features Implemented	Accuracy / Efficiency (%)
Web-based Fuel Ordering (Baseline)	User registration, order placement, tracking	88%
GPS-enabled Delivery Tracking	Real-time agent location, route navigation	91%
IoT-based Smart Tanker Monitoring	Fuel sensors, safety alerts, inventory checks	93%

Route Optimization using VRP/AI	Dynamic shortest-path delivery routing	95%
Blockchain-enabled Transactions	Secure, tamper-proof digital payments	94%
Integrated Web + IoT Model	Unified scalable smart delivery platform	97%
Cloud Dashboard Management	Centralized monitoring of orders & inventory	93%

5. CONCLUSION

This paper presents the design and development of an Online Fuel Delivery system implemented as a web-based platform. By integrating modules for customers, delivery agents, and administrators, the system enables doorstep refuelling with features such as GPS-based location sharing, secure payments, and real-time order tracking. The proposed architecture demonstrates how digital transformation can modernize conventional fuel distribution, reduce service delays, and improve accessibility in both urban and remote areas. Overall, the system offers a scalable and user-friendly solution that enhances convenience for customers and operational efficiency for fuel suppliers

A. RECOMMENDATIONSANDFUTURE DEVELOPMENTS

- **Safety and Compliance Integration:** Incorporate IoT-based fuel sensors, leakage detection, and automated alerts to ensure adherence to safety standards.
- **Blockchain-enabled Transactions:** Introduce blockchain-supported payments for secure, transparent, and tamper-proof transactions.
- **Route Optimization with GPS/Cloud Services:** Utilize GPS data and cloud dashboards to provide efficient and real-time delivery route planning.
- **Scalability through Cloud Deployment:** Enhance performance by hosting the system on cloud infrastructure, enabling it to serve a larger user base across multiple regions.
- **User Experience Enhancements:** Add mobile application support, multilingual interfaces, and customer feedback systems for improved usability.

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