

E-Refuel Hub

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ABSTRACT

E-Refuel Hub is an innovative system for mobile fuel delivery management systems for modernizing and digitizing fuel distribution processes. This system allows individuals, industries and organizations to conveniently order fuel through Android applications, reducing their reliance on physical visits to fuel stations. The platform consists of two core modules: the user app and the administrator app. This streamlines order placement, fuel stock tracking, and delivery delivery. The application integrates GPS-based route management using the Google Maps API for efficient fueling and real-time location tracking. It also uses Firebase Cloud Messaging to use immediate confirmation and delivery notifications. Data is securely managed through a local SQLite database and a light server setup, ensuring that the system works effectively in areas where connections are limited. E-Refuel Hub aims to optimize fuel logistics, improve service accessibility, and contribute to automating fuel supply chains in urban and remote environments.

Keywords : *The E-Refuel Hub is a mobile-based fuel delivery system that uses technologies like Android, Firebase, Google Maps API, and SQLite to automate fuel ordering, tracking, and delivery. It features user and admin modules, real-time GPS tracking, online payment integration, and inventory management to modernize traditional fuel distribution.*

I.INTRODUCTION

Fuel demand in both urban and rural areas is rapidly increasing due to the growing number of vehicles. Traditionally, fuel procurement involves manual processes in which individuals and organizations physically participate in fuel stations, leading to time consumption, company delays and logistical challenges. To address these inefficiencies, the E-Refuel Hub system is proposed as a digital solution for fuel ordering and delivery management. E-Refuel Hub is a mobile application developed primarily for the Android platform, allowing users to store fuel orders directly from their smartphones. This system has two main interfaces: The first is

end-user and fuel station administrators. Users can select folders, specify amounts, specify delivery addresses, and follow the status of the order.

Meanwhile, fuel station owners can monitor fuel levels, manage user orders, assign delivery and update inventory in real time. By integrating technologies such as SQLite for local data storage, Firebase cloud messaging for notifications, Google Maps-API for GPS tracking, the system ensures efficient communication between users, administrators and delivery personnel. Additionally, it works with minimal cloud dependencies suitable for semi-network or offline regions. The purpose of this project is to provide a

reliable, scalable and user-friendly platform that converts traditional fuel delivery methods into modern technology operation services that improve comfort, transparency and operational efficiency.

II.RELATED WORK

Developers of Android (2023)

Provides thorough instructions for creating Android apps, covering topics including UI design, architecture patterns, and integrating with device functions. The ERefuel Hub uses Android as the primary platform for its admin and user apps, taking advantage of native libraries and Android Studio tools to improve compatibility and speed[1].

Hipp, D. R. – SQLite Consortium (2023)

Developed and maintains SQLite, a self-contained, lightweight SQL database engine that is frequently utilized in mobile and embedded devices. ERefuel Hub uses SQLite to safely store admin records, fuel orders, delivery logs, and user data in offline or partially connected situation[2].

Team Google Firebase (2023)

Firebase Cloud Messaging (FCM) offers realtime syncing and messaging features along with cross-platform push notification services.

Order confirmations, delivery status updates, and other important communications are sent immediately thanks to FCM's integration with E-Refuel Hub[3].

Platform Team for Google Maps (2023)

Provides realtime navigation, route optimization, and geolocation APIs. The Maps API enables consumers to track their deliveries in real time and assist

gasoline delivery workers in adhering to GPS-based routes that are optimized[4].

M. Fowler (2015)

Reusable architectural patterns for scalable software design are introduced in Patterns of Enterprise Application Architecture. Fowler's architecture ideas are reflected in ERefuel Hub's modular design, which includes user, admin, and delivery systems[5].

A. Bose (2020)

Scalability, modularity, and user-focused development were covered in the discussion of system design concepts for mobile applications. Contributed to the app's system architecture, guaranteeing responsive user experience and functional separation[6].

R. Sharma (2021)

Posted guides on how to integrate Firebase with Android apps, covering realtime database connectivity, messaging, and authentication. Contributed to the app's implementation of Firebase-based functionalities for user communication and realtime data synchronization[7].

Developers at Google (2023)

Best practices for developing offline apps were discussed, including caching, local storage, and synchronization techniques. These procedures were used to guarantee that the application runs without hiccups in places with spotty network connectivity[8].

S. Banerjee (2021)

Investigated the integration of secure payment gateways, such as UPI, card processing, fraud detection, and encryption, in Android apps.

Oversaw the ERefuel Hub's safe integration of multi-mode payment capabilities [9].

Singh, A., and Kumar, N. (2022)

Researched how logistics systems employ GPS and Maps APIs for realtime vehicle tracking and route optimization. Provided support for the ERefuel system's delivery management component, which manages fuel tracking and route planning.

[10]

J. Thomas (2021)

Concentrated on the architecture of mobile apps with a focus on caching, offline functionality, and modular system development. Had an impact on the E Refuel Hub's modular interface, local servers, and SQLite selection[11].

FuelBuddy Technologies Pvt. Ltd(2023)

Runs an Indian gasoline delivery app that provides mobile fuel refills for machinery and automobiles. acted as a rival and commercial benchmark, pointing out shortcomings and characteristics that ERefuel Hub wants to strengthen, like offline support, real time updates, and rural deliveries[12].

III. METHODOLOGY

The **E-Refuel Hub** project follows a modular and layered development methodology that emphasizes functionality, scalability, and offline support. The system is designed to handle mobile fuel ordering, delivery tracking, and real-time notifications using Android technologies. The methodology is divided into multiple stages.

3.1 Requirement Analysis

Requirements were collected from real-world use cases such as challenges in accessing fuel in remote areas, limited station availability, and poor manual

processes. Stakeholder analysis identified the primary users as customers, fuel station owners (admins), and delivery personnel.

3.2 System Design

A layered architecture was chosen, dividing the application into the presentation layer (UI), logic layer (order processing, routing), and data layer (SQLite). The system was divided into distinct modules. Allows users to place fuel orders, track delivery, and receive notifications. Enables station owners to manage fuel stock, assign deliveries, and track operations. Integrates Maps API for optimal route navigation. Uses SQLite for offline and local storage. Uses Firebase Cloud Messaging for real-time alerts.

3.3 Development Tools and Technologies

Android Studio (Java and XML) SQLite (Local Database), RESTful APIs (for admin-user communication) Google Maps API (Navigation & Location Tracking), Firebase Cloud Messaging (Real-Time Notifications) User authentication, encrypted storage, and secure payment integration.

3.4 Implementation

The system was implemented in Android using Java for logic and XML for UI design. Backend functionality such as fuel stock updates, order validation, and delivery routing was implemented using RESTful APIs. Offline-first design was implemented using SQLite for persistent local data handling, ensuring functionality in limited network areas. Firebase integration was used to deliver push notifications for order confirmations and status

updates. Google Maps API integration enabled real-time tracking for deliveries.

3.5 Testing

The application was tested on various Android versions and devices. Unit testing was conducted on individual modules. Integration testing ensured smooth data flow between user, admin, and delivery modules. Field testing simulated offline scenarios to evaluate app performance in low-network areas.

3.6 Deployment

The app was deployed as an Android APK for end-user testing. A lightweight local server was used for backend operations to support semi-network environments.

Admin interface was also deployed for fuel station managers.

ARCHITECTURE DIAGRAM

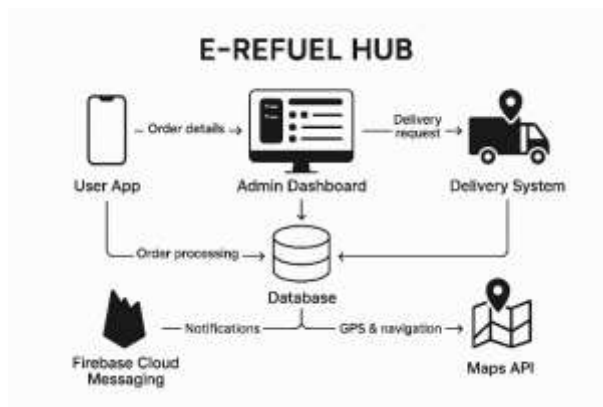


Fig 3.6. E-Refuel Hub

IV. TECHNOLOGY USED

The **E-Refuel Hub** project integrates a variety of technologies to ensure real-time communication, location tracking, offline support, and secure transactions. These technologies are chosen to

create a robust and scalable Android application for fuel delivery management.

4.1. Android Studio

Purpose: Integrated Development Environment (IDE) used for building the Android application.

Use in Project: Designed the user and admin interfaces, coded functionalities using Java, and tested the application.

4.2. Java

Purpose: Primary programming language for Android development.

Use in Project: Used to develop the business logic of the app including order processing, user actions, and admin operations.

4.3. XML (Extensible Markup Language)

Purpose: Used for designing user interfaces in Android.

Use in Project: Structured the layout of screens (login, order placement, tracking dashboard, etc.).

4.4. SQLite

Purpose: Lightweight, embedded relational database.

Use in Project: Stores user profiles, fuel order history, fuel stock data, and delivery logs locally on the device to support offline usage.

4.5. Firebase Cloud Messaging (FCM)

Purpose: Real-time notification and messaging service provided by Google Firebase.

Use in Project: Sends push notifications for order confirmations, fuel dispatch, and delivery updates.

4.6. Google Maps API

Purpose: Provides geolocation, routing, and mapping services.

Use in Project: Enables GPS-based navigation for delivery personnel and real-time location tracking for users.

4.7. RESTful APIs

Purpose: Allows communication between the client (app) and backend server.

Use in Project: Handles data exchange such as order details, stock updates, and user requests between modules.

4.8. Local Server (Lightweight Backend)

Purpose: Processes internal requests and manages data operations in low-connectivity regions.

Use in Project: Provides a reliable backend infrastructure that works without requiring a full cloud server.

4.9. Payment Gateway Integration

Purpose: Allows secure digital transactions via UPI, cards, and wallets.

Use in Project: Enables users to pay for fuel orders in-app, with receipts generated and stored securely.

4.10. Authentication and Encryption

Purpose: Protects user data and ensures secure access.

Use in Project: Ensures login and transactions are authenticated and encrypted to protect sensitive information.

V. RESULTS

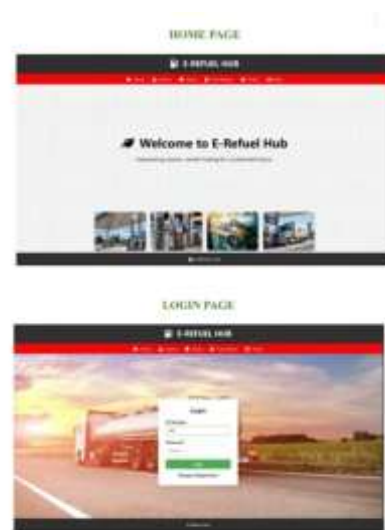


Fig 5.1 Home Page and Login Page

Homepage

The E-Refuel Hub's Home Page, with its sleek and contemporary interface, acts as the main entry point for users. The sign that greets guests reads, "Empowering cleaner, smarter fueling for a sustainable future." Key sections including Admin, About, Fuel Station, Public, and Rider are easily accessible from the top navigation bar.

Page of Login

A user-friendly interface for safe access to the E-Refuel Hub platform is provided by the Login Page. The page has places for entering your ID number and password, and it features a petrol truck on the road at sunset as the background. A button for Shopper Registration is offered for new users, and a straightforward layout guarantees ease of use.



Fig 5.2 About Page and Register Page

THE ABOUT PAGE

E-Refuel Hub's About page outlines the platform's goal of transforming fuel distribution. It emphasizes important aspects that guarantee ease and dependability for both consumers and enterprises, like doorstep delivery, real-time tracking, regulatory compliance, and simple scheduling.

PAGE FOR REGISTRATION

An easy-to-use registration form for fuel station operators may be found on the Register page. In order to provide smooth onboarding to the platform, it gathers necessary data such as ID number, name, station name, contact information, address, image upload, and fuel type selection (Petrol, Diesel, or Both).



Fig 5.3 Reject Status

REJECT STATUS SUMMARY:

The following entries have been marked with a "Reject" status in the E-Refuel Hub system:

ID 226 – Jaya Fuels, SHARWAD, rejected for both fuel types.

ID 232 – Jaya Fuels, SHARWAD, rejected for both fuel types.

ID 289 – Jheemraj, Jbijav, rejected for petrol fuel type.

Each record includes options to update, delete, or view the details and images associated with the entry.

To return to the dashboard, click "Back to home".

VI. CONCLUSION

The E-Refuel Hub initiative effectively tackles the difficulties linked to conventional fuel procurement techniques by providing a contemporary, efficient, and easily accessible mobile fuel delivery service. By incorporating cutting-edge technologies such as GPS navigation, real-time inventory monitoring, secure payment systems, and Firebase Cloud Messaging for immediate alerts, the application significantly improves user experience and operational productivity. Its modular design, which includes user, admin, and delivery management components, guarantees smooth collaboration among stakeholders while enhancing fuel logistics, even in regions with limited network access. By utilizing the Android platform and employing secure, scalable, and dependable technologies, E-Refuel Hub not only revolutionizes fuel distribution but also aids in minimizing time, operational

expenses, and logistical challenges. This system possesses considerable potential for growth and future integration with electric vehicle charging solutions, positioning it as a holistic answer to the changing fuel and energy requirements.

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