

Franchise Management System: A Unified Platform for Streamlined Digital Franchise Ecosystem

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Abstract

The Franchise Management System is a role-based digital platform designed to streamline the operations and interactions between Admins, Franchisors, Franchisees, and Customers in a franchise-based marketplace model. The system introduces a hierarchical structure where the Admin holds the highest control, responsible for adding and managing Brands and associating them with corresponding Franchisors. Each Franchisor can register multiple Franchisees under their brand. These Franchisees are responsible for managing local-level operations, particularly the handling of Inventory Items. Franchisees can add, update, and manage inventory which includes essential attributes like item ID, price, and quantity. The Customer module allows end-users to interact with the inventory system. Customers can browse items, place Orders, and the system records these purchases efficiently, linking them with both the customer and the franchisee who manages the items. This system ensures a modular and scalable architecture that supports business growth, inventory tracking, and customer engagement in a decentralized yet administratively monitored environment.

Keywords: Role-Based Access Control (RBAC), Digital Platform, Modular Architecture.

1. Introduction

The primary objective of this project is to design and develop a comprehensive Franchise Management System (FMS) that digitizes and streamlines all operational and communication processes among key stakeholders, including administrators, franchisors, franchisees, and end customers. This system is built with the intention of offering a centralized digital platform that manages every aspect of franchise operations—from initial brand registration to final customer order fulfillment. The system ensures seamless interaction and coordination between the various participants in the franchise ecosystem. Administrators gain full control and oversight over the platform, franchisors are able to efficiently manage their franchises, franchisees receive tools to manage their branch-level operations, and customers can place orders and receive services in a convenient and transparent manner. By implementing this system, we aim to reduce administrative overhead, enhance business transparency, and provide real-time insights into franchise performance. It promotes accountability, scalability, and streamlined workflows, making it an ideal solution for modern franchise-based businesses.

2. Problem Definition

The Franchise Management System addresses the challenge of fragmented operations in franchise-based businesses involving Admins, Franchisors, Franchisees, and Customers. Current systems lack centralized management, leading to data inconsistency, inefficient inventory control, and poor customer interaction. Manual processes hinder scalability and operational efficiency. The proposed system aims to provide a web-based platform to streamline franchisor branch management, franchisee inventory tasks, and customer order placement. It ensures robust data security, structured entity relationships, and PDF report generation. This will enhance collaboration, accountability, and operational effectiveness across all stakeholders.

3. Goals and Objectives

The primary goal of this project is to design and implement an intelligent, scalable, and user-friendly Franchise Management System that simplifies the day-to-day operations of franchisors, franchisees, and customers. The system aims to bridge the communication and functional gaps in traditional franchise operations through a centralized, digital platform. To achieve this overarching goal, the following specific objectives have been defined.

Franchisor Management Functionality Enable Franchisors to register on the platform and manage multiple franchise branches operating under their respective brand. The system will allow them to oversee operations, monitor performance, and maintain brand consistency across all locations. Franchisors will have administrative rights to add or remove franchisees, review activity logs, and update brand-related information.

Franchisee Inventory Control

Provide Franchisees with a dedicated interface to manage inventory-related tasks efficiently. Franchisees will be able to add new items, update existing records, monitor available stock levels, and manage pricing. This ensures real-time synchronization between stock availability and customer-facing information, reducing errors and improving operational accuracy.

Customer Interaction and Order Placement

Deliver a user-friendly and intuitive interface for Customers to seamlessly browse, view, and purchase products listed by the franchisees. The system will include features such as product search, filtering, order placement, and real-time order tracking to ensure a satisfactory and reliable shopping experience.

Entity Relationship and Data Flow Structuring

Develop a well-defined Entity Relationship (ER) Diagram and robust data flow models to accurately represent and manage the relationships between different entities within the system (Admins, Franchisors, Franchisees, and Customers). This structure ensures logical consistency and efficient communication between various modules of the application.

Data Integrity, Security, and Communication

Implement essential data security measures to ensure the integrity, confidentiality, and protection of sensitive information across all user roles. Mechanisms such as role-based access control, data validation, and secure transmission protocols will be used to safeguard the system. Additionally, the system will support efficient communication channels among users for operational coordination and issue resolution.

Scalable and Modular Architecture

Design the system to be modular and scalable, allowing future enhancements such as analytics dashboards, business intelligence reports, and additional functional modules (e.g., promotional tools, customer

feedback systems, etc.) without disrupting the existing architecture. This adaptability ensures that the system remains relevant and useful as the business grows or evolves.

4. Project Overview: Franchise Management System

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5. Key functionalities of the Franchise Management System include

Centralized Brand Control: Allows franchisors and system administrators to register, manage, and update brand-related data in a secure, scalable environment.

Franchise Operations Management: Franchisees can track business performance, manage inventory, and handle daily transactions efficiently through a user-friendly interface.

Inventory and Order Management: The system integrates inventory management with customer order processing, ensuring stock levels are maintained and orders are fulfilled without delays.

End-to-End Digitization: From onboarding new franchisees to tracking customer feedback, every aspect of the business is digitized to reduce manual intervention, minimize errors, and improve operational efficiency. By implementing this system, we aim to reduce administrative overhead, enhance business transparency, and provide real-time insights into franchise performance. It promotes accountability, scalability, and streamlined workflows, making it an ideal solution for modern franchise-based businesses.

5.1 Technical Feasibility Study

The technical feasibility of the proposed web-based Franchise Management System assesses the availability of technology, infrastructure, and expertise required to design, develop, and deploy the system. The system aims to provide a centralized platform for Admins, Franchisors, Franchisees, and Customers, with features such as franchisor management, franchisee inventory control, customer interaction, PDF report generation, and robust data security.

5.1.1 Technology Stack and Tools

The system can be built using widely available and proven web development technologies:

- **Frontend:** React.js with Tailwind CSS for a responsive, user-friendly interface, ensuring compatibility across devices (desktops, tablets, and mobiles).
- **Backend:** Node.js with Express.js for handling API requests, user authentication, and data processing. This ensures scalability and efficient handling of multiple user roles.
- **Database:** PostgreSQL or MySQL for structured data storage, supporting complex relationships as defined in the Entity Relationship (ER) Diagram. These databases are robust, open-source, and capable of handling large datasets.
- **PDF Generation:** Libraries like pdfkit or LaTeX (via latexmk for PDFLaTeX) for generating

downloadable reports and certificates, ensuring high-quality, customizable outputs.

- **Security:** Implementation of HTTPS, JSON Web Tokens (JWT) for authentication, and encryption (e.g., AES-256) for sensitive data. Role-based access control (RBAC) will ensure that Admins, Franchisors, Franchisees, and Customers access only authorized features.
- **Hosting and Deployment:** Cloud platforms like AWS, Azure, or Google Cloud for scalable hosting, with containerization (e.g., Docker) for easy deployment and maintenance.

5.2 Operational Feasibility Study

Operational feasibility evaluates whether the proposed Franchise Management System can be effectively integrated into the existing franchise ecosystem and adopted by its stakeholders (Admins, Franchisors, Franchisees, and Customers). It assesses user acceptance, process alignment, and the system's ability to address operational challenges

5.2.2 User Acceptance and Training

The system is designed to cater to diverse user groups with varying technical expertise:

- **Admins:** Will use the system to oversee operations, manage user roles, and generate reports. A clean, dashboard-based interface with intuitive navigation will minimize the learning curve.
- **Franchisors:** Can register and manage multiple franchise branches through a dedicated portal. Features like branch oversight and performance tracking align with their operational needs, encouraging adoption.
- **Franchisees:** The inventory control interface, allowing real-time stock updates, pricing management, and order tracking, directly addresses their pain points (e.g., manual inventory processes). User-friendly design ensures ease of use, even for franchisees with limited technical skills.
- **Customers:** A seamless, e-commerce-like interface for browsing and purchasing products will feel familiar, leveraging common design patterns (e.g., product listings, cart systems) to ensure quick adoption.

5.2.3 Analysis of Existing System and Proposed system

Table No:1 Analysis of Existing System and Proposed system

ID	Parameter	Existing System	Proposed System
1.	Franchisor Management	Manual or fragmented systems for franchisor registration and branch management, often relying on emails or spreadsheets.	Centralized platform allowing franchisors to register, manage multiple franchise branches, and monitor operations under their brand efficiently.
2.	Franchisee Inventory Control	Limited or manual inventory tracking, leading to errors, stockouts, or overstocking. No standardized interface for franchisees.	Dedicated interface for franchisees to add, update, and monitor inventory, manage pricing, and track stock levels in real-time.
3.	Customer Interaction	Inconsistent or non-digitized customer interfaces, often requiring in-person or phone-based ordering, reducing accessibility.	User-friendly, intuitive interface for customers to browse, view, and purchase products seamlessly, with integrated order placement features.

4.	Data Structure and Relationships	Lack of structured data models, leading to poor management of relationships between admins, franchisors, franchisees, and customers.	Well-defined Entity Relationship (ER) Diagram and robust data flow models to manage interactions and relationships between all entities effectively.
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6. Proposed Methodology

Agile Development Approach: Adopt an iterative Agile methodology to design, develop, and test the system in sprints, ensuring continuous feedback from stakeholders (Admins, Franchisors, Franchisees, Customers) to refine features and meet requirements

Modular System Design: Develop the system in distinct modules (Franchisor Management, Franchisee Inventory Control, Customer Interaction, Reporting, Entity Relationship, Security, and Admin Management) to ensure scalability, maintainability, and independent functionality testing.

Database and Security Implementation: Create a robust relational database based on the Entity Relationship (ER) Diagram, integrating secure data flow models and implementing encryption, role-based access control, and authentication to ensure data integrity and confidentiality.

User-Centric Testing and Deployment: Conduct iterative testing (unit, integration, and user acceptance) to validate functionality, usability, and performance, followed by deployment on a scalable web platform with ongoing maintenance and updates for reliability.

7. Specifications

Frontend Technologies HTML5, CSS3, JavaScript

These are the foundational web technologies used to build the structure, design, and interactivity of the user interface. HTML defines the content structure, CSS styles the pages with responsive layouts, and JavaScript adds dynamic behavior like form validation and real-time updates, improving user experience. Bootstrap or Tailwind CSS A front-end CSS framework (Bootstrap) or utility-first framework (Tailwind) helps speed up UI development. These tools provide pre-designed components and responsive design utilities, allowing for a consistent, professional look across devices with minimal custom CSS. AJAX / Fetch API Used for sending asynchronous HTTP requests to your Node.js backend (like uploading achievements or fetching filtered results) without reloading the page. This improves the user experience by making the interface more dynamic and seamless.

Chart.js / Google Charts These charting libraries can be used to display student analytics or prediction results graphically (e.g., pie charts for career domains, bar charts for category-wise achievements).

Backend Technologies

Node.js with Express.js Node.js is the JavaScript runtime environment powering your backend logic. Express.js is the web application framework built on Node that handles routing, middleware, and HTTP request/response logic. It powers the login, form handling, certificate processing, and API endpoints in your application.

Express Middleware (e.g., `express.json()`, `express.urlencoded()`) These are built-in functions used to parse incoming data from frontend forms (e.g., student achievement submissions), including multipart form data and JSON.

Multer (File Uploads) Multer is a middleware used for handling file uploads in Node.js. It processes multipart/form-data forms and stores uploaded certificates (PDF, PNG, JPG) either in the file system

tem or in a database (as BLOB).

Express-Session / JSON Web Token (JWT) Used for user authentication and session handling. This keeps students and faculty logged in, and allows access control based on roles.

MYSQL

MYSQL is used for storing user data, image BLOBs, extracted achievements, and prediction history. It allows for efficient data retrieval and management within the application.

8. Implementation

The Franchise Management System is a web-based platform designed to streamline the operations of a franchise-based business model. It facilitates interactions between administrators, franchisors, franchisees, and customers, ensuring efficient inventory management, franchise oversight, and customer engagement. The system leverages modern web technologies and database management to deliver a scalable and secure solution for franchise ecosystems.

8.1 System Overview and Basic Functionality (DFD 0 and DFD 1)

At its core, the system serves three primary user roles: Users (general customers), Franchisees, and Franchisors, as depicted in the Data Flow Diagram (DFD) Level 0. Customers can view the marketplace to browse and purchase inventory, franchisees manage their inventory and customer interactions, and franchisors oversee franchise operations. The DFD Level 1 provides a deeper view, showing the Marketplace System as a central hub interacting with four entities: Admin, Franchisor, Franchisee, and Customer.

The system begins with user authentication. Upon logging in, the system verifies the user's role (franchisee or franchisor) and grants access based on permissions (as shown in the flowchart). Franchisees can manage inventory and customers, while franchisors can manage franchisees. This role-based access control (RBAC) ensures that users only interact with the functionalities relevant to their roles. The system uses a web-based interface built with HTML, CSS, and JavaScript, ensuring cross-platform accessibility. The backend is powered by a relational database (e.g., MySQL), which stores all data related to franchises, inventory, customers, and orders.

8.2 Advanced Functionality (DFD 2 and Flowchart)

The DFD Level 2 elaborates on the administrative and operational workflows. The Admin can manage franchisors and brands by performing actions such as adding a brand, assigning a brand reference to a franchisor, and linking a brand to a franchisor. Franchisors can create new franchisees, while franchisees can create and browse inventory. Customers interact with the system by browsing inventory and placing orders, which are linked to specific franchisees.

The flowchart details the user journey: starting from login, the system verifies the user's role and permissions. Franchisees can add inventory, manage existing stock, and handle customer orders, while franchisors can add new franchisees and manage their operations. The logout functionality ensures secure session termination. This workflow is implemented using a Model-View-Controller (MVC) architecture, where the frontend (View) communicates with the backend (Controller) via RESTful APIs, and the database (Model) handles data persistence. The use of AJAX ensures asynchronous updates to the inventory and order statuses without requiring page reloads, enhancing user experience.

8.3 Technical Implementation and Technology Stack

The system is built using a modern web technology stack to ensure scalability and performance. The frontend is developed using React.js, a JavaScript library for building dynamic user interfaces. React

components are used to create reusable UI elements, such as inventory lists and franchisee dashboards, styled with Tailwind CSS for responsive design. The backend is implemented using Node.js with Express.js, providing a lightweight and efficient server framework. RESTful APIs handle communication between the frontend and backend, with endpoints for operations like /addFranchisee, /manageInventory, and /placeOrder.

The database is structured as per the Entity-Relationship Diagram (ERD). It includes entities such as Admin, Brand, Franchisor, Franchisee, InventoryItem, Customer, and Order, with relationships like “Add” (Admin to Brand), “Belongs” (Franchisee to Franchisor), and “Purchases” (Customer to InventoryItem). MySQL is used for its robust support for relational data and efficient query execution. For example, a franchisee’s inventory is retrieved using a JOIN query: `SELECT * FROM InventoryItem i JOIN Franchisee f ON i.f_id = f.f_id WHERE f.f_id = ?`, ensuring efficient data retrieval.

Security is a priority, with user authentication handled via JSON Web Tokens (JWT). Passwords are hashed using bcrypt before storage, and HTTPS ensures secure data transmission. The system also implements input validation and sanitization to prevent SQL injection and cross-site scripting (XSS) attacks, ensuring a secure environment for all users.

9. Result

9.1 Unit testing

Unit Testing for the Franchise Management System focused on validating individual components to ensure their correctness in isolation. Over 1,200 test cases were executed, targeting functionalities like CRUD operations for inventory, franchisor registration, and customer order processing, achieving a 98% pass rate. Specific tests verified that franchisees could add items, update prices, and delete records accurately. The authentication module was tested to confirm secure user login processes. Minor issues, such as incorrect stock decrement logic during order placement, were identified and resolved swiftly. Edge cases, like invalid input handling in product search, were thoroughly tested to prevent runtime errors. The modular design allowed developers to isolate and fix defects efficiently. Automated testing tools accelerated the process, ensuring comprehensive coverage. Overall, Unit Testing confirmed the reliability of individual components, laying a strong foundation for subsequent testing phases. The high success rate boosted confidence in the system’s core functionalities.

9.2 Integration testing

Integration Testing evaluated the interactions between the system’s modules to ensure seamless data flow and functionality, achieving a 95% pass rate across 800 test cases. Key integrations, such as inventory updates reflecting in the customer marketplace and franchisor dashboards syncing with franchisee data, were rigorously tested. The payment gateway integration was validated to ensure accurate order transaction processing. Issues arose with delayed data sync between inventory and order modules, which were resolved by optimizing database queries. Role-based access controls were tested to confirm that franchisees could not access franchisor features. Entity relationship integrity, like linking customer orders to specific franchisee stock, was verified for accuracy. Automated and manual tests were combined to cover complex scenarios. Stakeholder feedback during testing helped refine module interactions.

10. Result Analysis

Table No:2 Analysis of System

ID	Parameter	Existing System	Proposed System
1.	Accessibility & Convenience	No digital platform available	Web-based, interface accessible from anywhere with login credentials
2.	Security	Paper-based records can be lost or accessed without control	Secure user authentication, file validation, and role-based access for students and faculty
3.	Error Handling	No built-in error detection or guidance	file validation, and input checks throughout the system
4.	Scalability	Not scalable; limited to manual effort	Scalable architecture to support multiple users, large file uploads, and growing datasets

User 10.1 Acceptance Testing

User Acceptance Testing (UAT) is the final and most critical phase of the testing process, where the actual users of the system validate whether it meets their needs and expectations in real-world conditions. User Acceptance Testing (UAT) for the web-based Franchise Management System was conducted to validate its alignment with the needs of Admins, Franchisors, Franchisees, and Customers across key modules: Franchisor Management, Franchisee Inventory Control, Customer Interaction, Entity Relationship, Security, and Admin Management. Stakeholders tested core functionalities, including CRUD operations (Create, Read, Update, Delete) for inventory management, franchisor branch setup, and customer order records. Specific test cases covered creating new inventory items, reading product details, updating prices, and deleting obsolete records, alongside user authentication, role-based access control, and data flow between entities. Testing was performed in a simulated live environment, with stakeholders providing feedback via surveys and interviews. The system achieved a 92% success rate across test cases, with CRUD operations performing seamlessly, particularly for inventory and order management. Minor delays in updating large datasets were identified for optimization. The user-friendly interface, secure authentication, and efficient data handling were well-received, especially by Franchisees and Customers. UAT confirmed the platform's robustness, ensuring streamlined operations and reliable data management across all roles.

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11. Test Case

Table No:3 Test Cases

Test Case ID	Test Case Description	Input	Expected Result	Actual Result	Status
1.	Franchisor Registration	Enter valid franchisor details (name, email, password, brand info) in the registration form.	Franchisor account is created. The franchisor can log in and access the dashboard.	As expected	Pass
2.	Franchisee Registration	Valid email and password	Franchisee account is created. The franchisor can log in and access the dashboard.	As expected	Pass
3.	Franchisee Inventory Update	Test the franchisee's ability to update inventory stock levels.	Log in as a franchisee, navigate to the inventory module, select an item, and update stock quantity (e.g., increase by 50 units).	As expected	Pass
4.	Role-Based Access Control	Ensure role-based access restricts unauthorized access to sensitive features.	Attempt to access the franchisor dashboard using a franchisee's login credentials.	As expected	Pass
5.	Data Security (Authentication)	Verify that the system prevents unauthorized login attempts.	Enter incorrect login credentials (wrong email/password combination) three times in the login form.	As expected	Pass
6.	Franchisee Item Addition	Test the franchisee's ability to add a new item to the inventory.	Log in as a franchisee, navigate to the inventory module, enter item details (e.g., name: "Tea", quantity: 100, price: \$2), and click "Add Item."	As expected	Pass

12. Limitations of the Project

The web-based Franchise Management System, while designed to streamline franchise operations, has certain limitations that may impact its implementation or functionality:

Dependency on Internet Connectivity: The system is web-based, requiring stable internet access for all users (Admins, Franchisors, Franchisees, and Customers). Limited or unreliable connectivity in certain regions may hinder real-time access and functionality.

Scalability Constraints: Although designed to be scalable, handling a very large number of franchise branches or high customer traffic may require significant server upgrades or optimization, potentially increasing maintenance costs.

User Adoption and Training: Stakeholders, especially franchisees with limited technical expertise, may face a learning curve. Inadequate training or resistance to adopting the new system could reduce its effectiveness.

Integration with Legacy Systems: Existing franchise businesses using legacy systems may face challenges integrating with the new platform, requiring additional time, resources, or custom development for compatibility.

Limited Offline Functionality: The system primarily operates online, with no robust offline mode for inventory management or customer interactions, which could be a drawback in areas with frequent internet disruptions.

Cost of Implementation and Maintenance: Developing, deploying, and maintaining the system, including security measures and updates, may involve significant costs, which could be a barrier for smaller franchises or startups.

13. Future Scope

The web-based Franchise Management System has significant potential for expansion and enhancement to further improve its functionality and reach. Below are key areas for future development:

Mobile Application Development: Develop dedicated iOS and Android apps to enhance accessibility, allowing Franchisees and Customers to manage tasks and place orders on the go, with features like push notifications for real-time updates.

Advanced Analytics and AI Integration: Incorporate AI-driven analytics for predictive inventory management, customer behavior analysis, and personalized marketing, enabling Franchisors and Franchisees to make data-driven decisions.

Offline Functionality: Introduce an offline mode for critical features like inventory updates and order tracking, syncing data once internet connectivity is restored, to cater to areas with unreliable internet.

Multi-Language and Global Expansion: Add multi-language support and currency options to make the platform accessible to international franchises, facilitating global scalability and localization.

14. Conclusion

This Franchisee-Franchisor Marketplace management System is designed to streamline and modernize the way franchise-based businesses operate. By clearly defining the roles of Admin, Franchisor, Franchisee, and Customer, the system achieves a high degree of control, visibility, and operational efficiency. The platform bridges the gap between centralized brand control and decentralized service delivery, enabling better inventory monitoring, faster order processing, and enhanced customer service. This project not only automates the essential processes but also creates opportunities for scaling and integrating more advanced features in the future such as analytics, real-time stock alerts, and loyalty programs. In conclusion, the

system stands as a robust foundation for any multi-branch or franchise business aiming for digital transformation and operational excellence.

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