

A Secure Cross-Platform E-Commerce System for Jewellery Retail with Advanced Authentication and Payment Integration

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ABSTRACT

This paper presents the design and implementation of a secure cross-platform e-commerce system developed specifically for jewellery retail businesses. The system consists of a web application built using Next.js and a mobile application developed using React Native, both connected to a centralized backend API and MySQL database. Jewellery e-commerce presents unique challenges compared to traditional online retail due to high-value transactions, detailed product specifications, and the need to build strong customer trust. The proposed system addresses these challenges by implementing advanced authentication using JSON Web Tokens (JWT) with refresh token rotation, secure password hashing, and role-based access control to ensure data protection. The platform integrates Razorpay payment gateway to enable secure and reliable online transactions, including payment verification and automated receipt generation. The system also includes advanced product management features supporting multiple variants such as size, weight, and colour, along with real-time inventory tracking to prevent overselling. Cloudinary integration enables efficient image storage and management, improving product visualization. Performance evaluation shows efficient system performance, fast response times, and support for concurrent users while maintaining security and data integrity. The cross-platform architecture ensures consistent functionality across web and mobile devices, improving accessibility and user experience. The proposed system provides a scalable, secure, and efficient solution for jewellery retailers transitioning to digital platforms and establishes a strong foundation for future enhancements such as AI-based recommendations and augmented reality features.

Keyword : - E-commerce, JWT Authentication, Cross-Platform, Payment Gateway, Next.js, React Native, Security

1. INTRODUCTION

The jewelry retail industry faces unique challenges in digital transformation due to high-value transactions, detailed product specifications, and the need for customer trust. Traditional e-commerce platforms often lack the specialized features required for jewelry retail, such as variant management (color, weight, size), secure high-value payment processing, and detailed product visualization.

This paper presents M.K. Jewellers, a comprehensive e-commerce platform designed specifically for jewelry retail. The system addresses these challenges through:

- (1) Cross-platform accessibility via web and mobile applications,
- (2) Enhanced security through JWT-based authentication with refresh token rotation,
- (3) Secure payment processing integrated with Razorpay,
- (4) Advanced product management supporting multiple variants and media, and Automated documentation with PDF receipt generation.

1.1 Motivation

The motivation for this work stems from: growing demand for online jewellery shopping, need for secure high-value transaction processing, requirement for detailed product information presentation, importance of cross-platform user experience, and necessity of robust inventory management.

1.2 Contributions

The main contributions of this work are:

- A secure, scalable architecture for jewelry e-commerce
- Implementation of industry-standard authentication with token rotation

- Integration of multiple payment methods with fallback mechanisms
- Cross-platform consistency across web and mobile
- Automated business process workflows

2. SYSTEM ARCHITECTURE

The system follows a three-tier architecture:

- (1) Presentation Layer with Next.js web app and React Native mobile app,
- (2) Application Layer with RESTful API using Next.js API routes, and
- (3) Data Layer with MySQL database and Prisma ORM.

2.1 Technology Stack

Frontend: Next.js 15.4.6 (React 19.1.0) for web, React Native with Expo for mobile, Redux Toolkit for state management, React Query for server state synchronization. UI/UX design inspired by industry-leading jewelry e-commerce platforms (BlueStone) [11].

Backend: Next.js API Routes for RESTful endpoints, Prisma ORM for database operations, MySQL for data persistence, Node.js runtime environment.

Security: JWT with JOSE library, refresh token rotation, bcryptjs for password hashing, HTTP-only cookies for web sessions.

Integration: Razorpay payment gateway, Cloudinary for media management, Nodemailer for email notifications, PDFKit for receipt generation.

2.2 Authentication & Security

The system integrates Razorpay payment gateway to enable secure online transactions. The payment process includes order creation, payment verification, and receipt generation. Error handling and transaction logging improve reliability.

2.3 JWT-Based Authentication

The system implements a dual-token authentication mechanism with access tokens (15 minutes lifetime) and refresh tokens (30 days lifetime). This approach balances security and user experience.

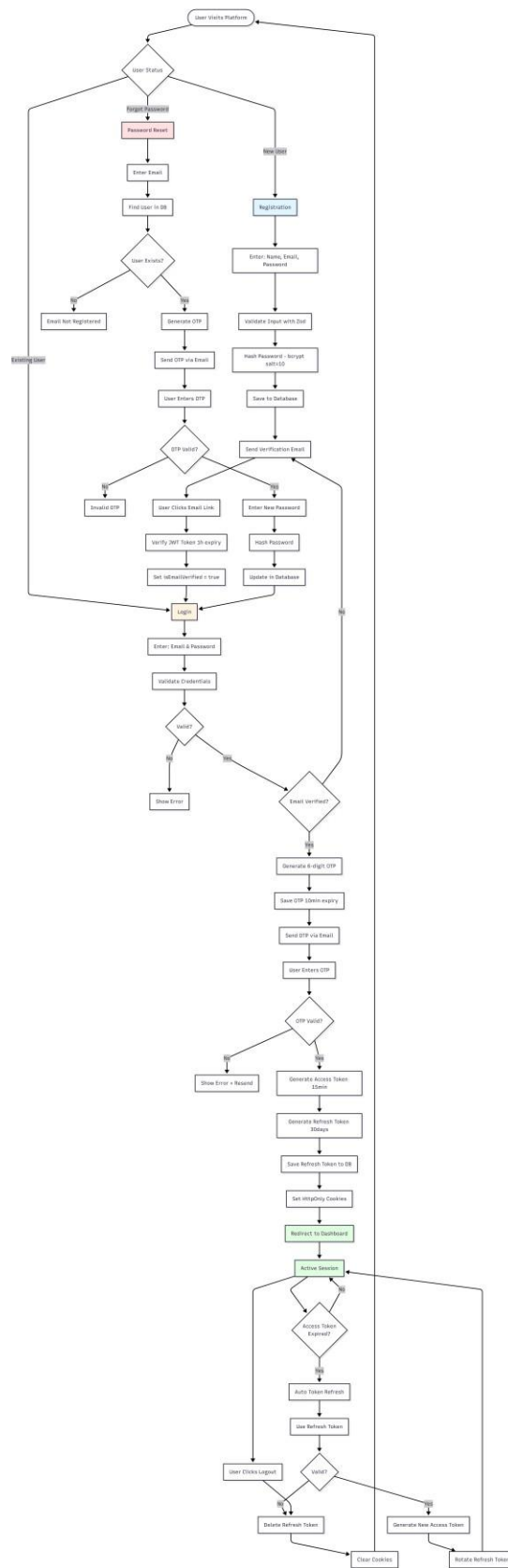


Fig. 1. Three-tier system architecture showing presentation, application, and data layers.

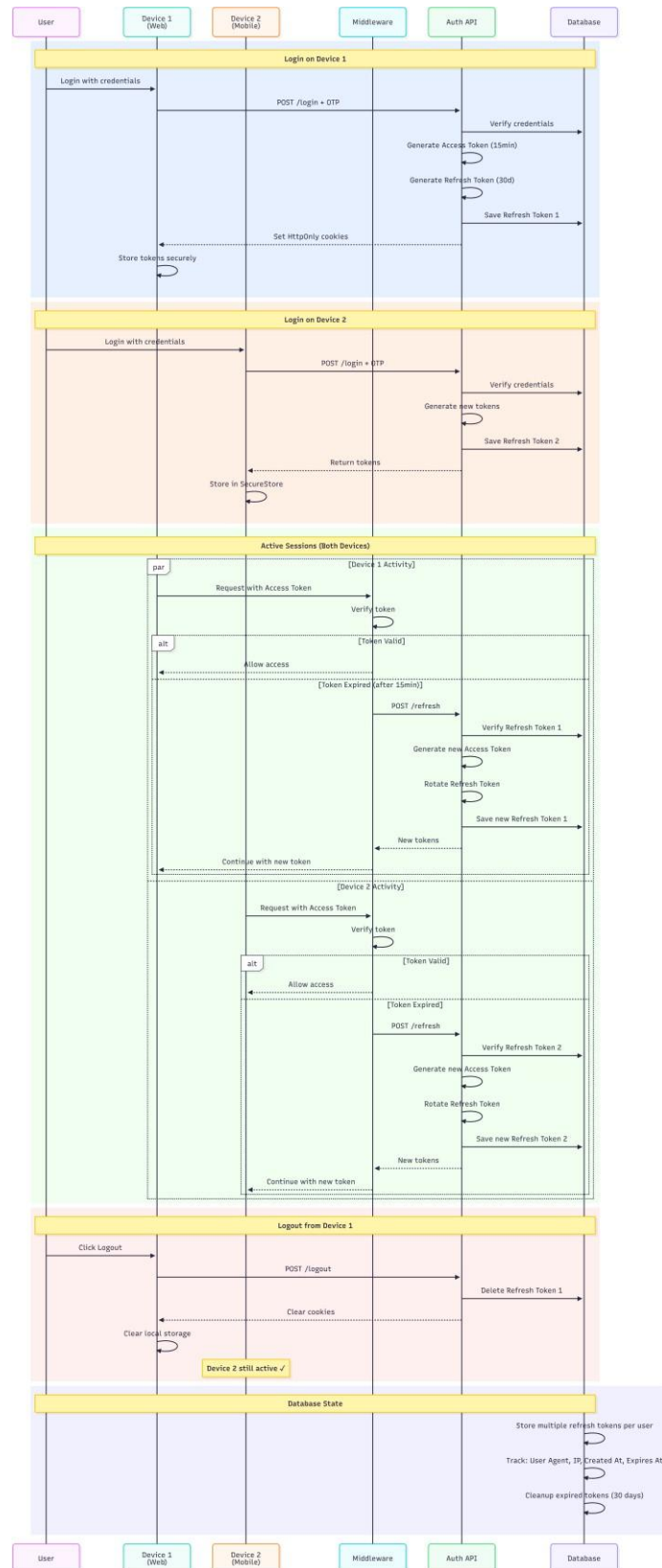


Fig. 2. JWT authentication flow with token generation and storage.

2.4. Token Rotation

To enhance security, the system implements token rotation. When an access token expires, the client uses the refresh token to obtain a new access token and optionally a new refresh token, preventing token theft and replay attacks.

2.5 Security Measures

Security measures include:

- (1) bcryptjs password hashing with salt rounds,
- (2) refresh tokens stored in database with user association,
- (3) token invalidation on logout,
- (4) automatic cleanup of expired tokens via cron jobs,
- (5) middleware- based authentication,
- (6) role-based access control,
- (7) CORS configuration, and
- (8) input validation with Zod schemas.

3. PAYMENT PROCESSING

3.1 Razorpay Integration

The system integrates Razorpay for secure payment processing. The payment flow includes: checkout initiation, total calculation with GST, Razorpay order creation, payment interface display, payment completion, webhook notification, signature verification, order status update, receipt generation, and confirmation email.

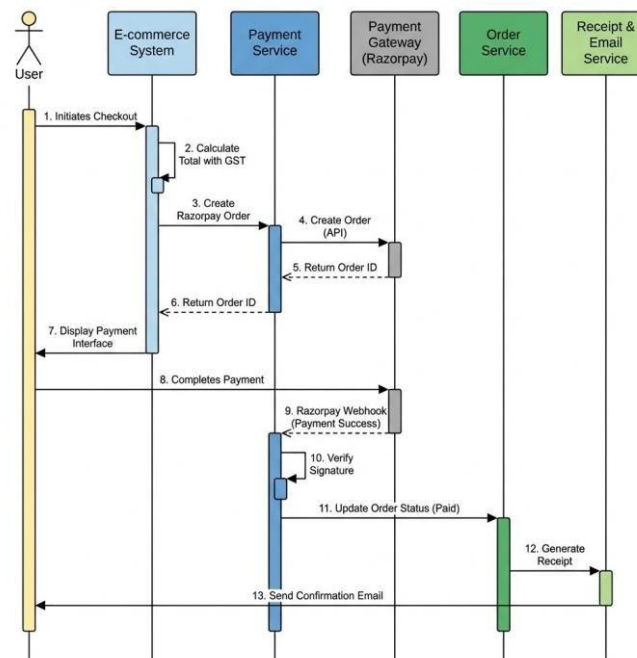


Fig. 3. Payment processing workflow with Razorpay integration.

Payment Security Server-side validation includes order amount verification, payment signature verification, and duplicate payment prevention. Error handling covers payment failure recovery, timeout handling, and user notifications. Complete transaction logging provides an audit trail.

4. CROSS PLATFORM IMPLEMENTATION

The system supports both web and mobile platforms using a unified backend API.

3.1 Web Application

The web application is developed using Next.js and provides fast performance, SEO optimization, and responsive design.

3.2 Mobile Application

The mobile application is developed using React Native. It provides native performance, offline support, and secure authentication.

5. CONCLUSION

This paper presented a comprehensive cross-platform e-commerce system designed specifically for jewelry

retail. The system successfully addresses unique challenges through secure authentication, integrated payment processing, and detailed product management. The dual-token JWT authentication ensures security while maintaining user experience. Performance evaluation demonstrates efficient concurrent user handling while maintaining data integrity. The modular architecture allows for future enhancements and scalability.

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