Project Design Phase

Solution Architecture

Date	19 June 2025
Team ID	LTVIP2025TMID53033
Project Name	ShopSmart: Your Digital Grocery Store Experience

Solution Architecture:

The **solution architecture** of ShopSmart is structured to address the business need for a seamless, scalable, and efficient online grocery shopping experience. The architecture effectively connects user-facing interfaces with backend services and data storage systems to ensure responsive and secure operations for customers, sellers, and administrators.

Key Goals of the Architecture:

- Identify the best-fit technology stack (MERN) to address the core challenges of traditional grocery shopping.
- Design a robust system capable of handling dynamic user roles and real-time operations.
- Define component interaction, data flow, and modular responsibilities across the system.
- Ensure maintainability, scalability, and performance optimization in a live e-commerce environment.

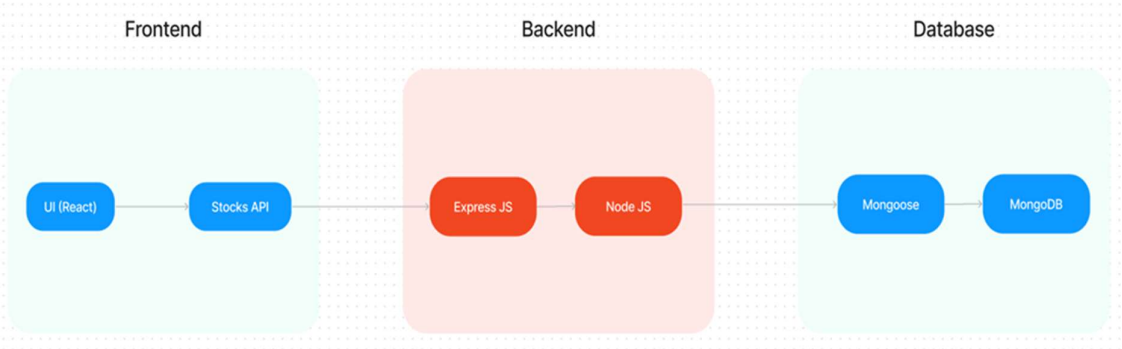
Architecture Layers and Components:

1. **Frontend Layer (React.js):**
    - Provides dynamic and interactive UI for different user roles (Customer, Seller, Admin).
    - Implements responsive design using modern libraries to support both mobile and desktop.
    - Integrates features like product listings, search filters, shopping cart, login/register, and order history.

2. **Backend Layer (Node.js + Express.js):**
    - Acts as the central API layer handling all HTTP requests from the frontend.
    - Uses Express routes and controllers to manage business logic like authentication, cart updates, product CRUD operations, and order processing.
    - Implements JWT-based authentication and middleware for secure and role-specific access control.
3. **Database Layer (MongoDB):**
    - Stores structured collections for Users, Products, Orders, Admins, and Carts.
    - Supports flexible document-based storage, enabling quick updates and retrievals for dynamic shopping behavior.
    - Integrated using Mongoose ODM to simplify queries and enforce data validation rules.
4. **Authentication & Authorization:**
    - JWT tokens are issued on login and stored in frontend localStorage.
    - Tokens are validated on every API call to ensure secure access.
    - Access is controlled through roles: Customers access user features, Sellers manage inventory, and Admins oversee the entire system.
5. **Real-Time Operations:**
    - Cart state, product availability, and admin dashboards reflect live updates.
    - Orders are tracked post-placement, with confirmation sent via email/SMS.
6. **Deployment and Scalability:**
    - Designed for local development (localhost:3000/frontend, 5000/backend) and scalable cloud deployment.
    - Modular folder structure and reusable components allow for easy feature expansion and scaling to additional regions or product categories.
7. **Error Handling and Security:**
    - API endpoints are protected with authentication middleware.
    - Server errors are caught and handled gracefully, with appropriate status codes and user feedback.

- Passwords are hashed using bcrypt for secure storage.

Technical Architecture:



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