

## PROJECT DESIGN PHASE

### Solution Architecture

Date	18 February 2026
Team ID	LTVIP2026TMIDS47401
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 and 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 behaviour.
- 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 local Storage.
- 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.

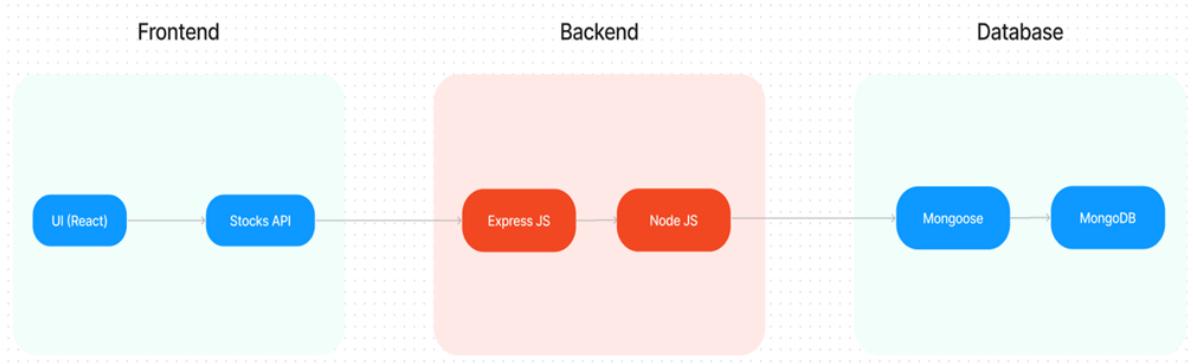
### 6. Deployment and Scalability:

- 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:



## Solution Architecture:

