Project Design Phase-II
Technology Stack (Architecture & Stack)

Date	31 January 3035
Team ID	LTVIP2026TMIDS79179
Project Name	ShopSmart – A Full-Stack Digital Grocery Store Web Application
Maximum Marks	4 Marks

Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2

Example: Order processing during pandemics for offline mode

◆ Technical Architecture

Architecture Type: Three-Tier Architecture

ShopSmart follows a **Three-Tier Architecture**:

1 Presentation Layer (Frontend – Client Side)

- Angular 17 Single Page Application (SPA)
- Responsive UI using Bootstrap
- HTTP Interceptor for JWT token injection
- Route Guards for role-based access
- Communicates with backend via REST APIs

Infrastructure: Runs on user browser (Client-side)

2️⃣ Application Layer (Backend – Server Side)

- Node.js runtime environment
- Express.js framework
- RESTful API architecture
- MVC design pattern
- Authentication middleware (JWT)
- File upload handling (Multer)
- Validation & error handling

Infrastructure: Hosted on Local Server / Cloud Deployment (Can be deployed on AWS / Render / Railway)

3️⃣ Data Layer (Database)

- MongoDB Atlas (Cloud NoSQL Database)
- Mongoose ODM
- Indexed collections for performance
- Secure connection with authentication

Infrastructure: Cloud (AWS Mumbai Region – ap-south-1)

🔌 External Interfaces

- JWT Authentication Library (jsonwebtoken)
- bcryptjs for password encryption

- CORS for cross-origin communication
- Postman (API Testing Tool)
- npm (Package Manager)

◆ Table-1: Components & Technologies

S.No	Component	Description	Technology
1	User Interface	Web-based interface for customers & admin	Angular 17, TypeScript, Bootstrap 5
2	Application Logic-1	User authentication & authorization	Node.js, Express.js
3	Application Logic-2	Product, Cart & Order Management APIs	Express.js (REST APIs)
4	Application Logic-3	Feedback & Admin Management	Express.js Controllers
5	Database	NoSQL document database	MongoDB
6	Cloud Database	Cloud-hosted database service	MongoDB Atlas
7	File Storage	Product image storage	Local File System / Multer
8	External API-1	Authentication Token Generation	jsonwebtoken (JWT)
9	External API-2	Password Hashing	bcryptjs
10	Machine Learning Model	(Future Scope – Product Recommendation System)	Not Implemented (Planned AI Model)
11	Infrastructure	Application Deployment	Local Server / Cloud Hosting

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◆ Table-2: Application Characteristics

S.No	Characteristics	Description	Technology
1	Open-Source Frameworks	Frontend & Backend frameworks	Angular, Node.js, Express.js
2	Security Implementations	Password hashing, Token authentication, Protected routes	bcryptjs, JWT, CORS
3	Scalable Architecture	Three-tier architecture with modular design	Angular + REST APIs + MongoDB Atlas
4	Availability	Cloud database with 24/7 accessibility	MongoDB Atlas
5	Performance	Optimized API response (<500ms), Indexed DB queries	Mongoose Indexing
6	Maintainability	Modular MVC structure, Reusable components	Angular Components, Express MVC
7	Reliability	Error handling & validation middleware	Express Middleware
8	Responsiveness	Works on desktop, tablet & mobile devices	Bootstrap 5

◆ Infrastructure Demarcation

🖥 Local Environment

- Development using VS Code
- Node.js v16+
- npm package manager

☁ Cloud Environment

- MongoDB Atlas (Cloud Database)
- Deployment ready for AWS / Render / Railway
- Secure database authentication

◆ Scalability & Design Justification

- Cloud-hosted database allows horizontal scaling.
- RESTful APIs enable future mobile app integration.
- Modular component-based frontend.
- Separate Admin & Customer roles.
- Clean MVC backend architecture.