Marwadi University Marwadi Chandarana Group NAAC A+	**Marwadi University** **Faculty of Engineering & Technology** **Department of Information and Communication Technology**	
Subject: CP		
Exp-3	**Date:23-09-25**	**Enrollment No:92200133007**

System Design and Architecture

1. Introduction

The proposed system is a **web application platform** for managing and selling 3-phase electrical items. It will integrate modern web technologies to ensure efficiency, scalability, and security. The architecture follows a **modular design approach**, enabling separation of concerns, maintainability, and extensibility for future features such as AI-powered recommendations or IoT integrations.

2. Modular Design

The system is divided into four primary modules:

Frontend Module (User Interface)

- Developed in **React.js**, providing responsive, intuitive, and mobile-optimized interfaces.
- Functions: product browsing, advanced filtering (voltage, current, load), cart, and checkout.

Backend Module (Application Logic & APIs)

- Built with **Node.js + Express** for REST API development.
- Functions: authentication (JWT), role-based access control, order management, and product catalog services.

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Database Module

- Uses **MySQL** for structured data storage (products, users, orders, inventory).
- Includes an **Entity-Relationship Diagram (ERD)** with tables for Users, Products, Orders, and Inventory.

Cloud & Infrastructure Module

- Deployment on **AWS (EC2 + RDS)** or **Heroku** for hosting.
- Optional CDN for faster content delivery.

Justification for modularity:

- Enhances **maintainability** by isolating business logic from UI.
- Promotes **reusability** (APIs can serve web and mobile clients).
- Enables **scalability** (individual modules can be scaled independently).

3. Technology Stack

Layer	Technology Chosen	Justification
Frontend	React.js + Tailwind CSS	Highly popular, component-based, fast rendering, responsive design.
Backend	Node.js + Express	Lightweight, asynchronous, scalable; ideal for API-driven apps.
Database	MySQL	Reliable RDBMS, supports complex queries, industry standard.
Authentication	JWT + OAuth2	Secure, scalable, widely adopted for modern web apps.
Version Control	GitHub	Enables team collaboration and version tracking.

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References:

- IEEE study on scalability of Node.js microservices (IEEE Xplore, 2022).
- Gartner Report on React.js adoption trends (Gartner, 2023).
- ACM Digital Library on database optimization for e-commerce (ACM, 2021).

4.Scalability Plan

The system is designed to scale **horizontally and vertically**.

- **Application Scaling:**
  - Load balancing with **NGINX** or AWS Elastic Load Balancer.
  - Microservices approach for future extensions (e.g., analytics, ML).
- **Database Scaling:**
  - **Replication and sharding** to handle large datasets.
  - Caching with **Redis** to minimize query response time.
- **Performance Optimization:**
  - CDN for static assets.
  - Lazy loading for UI components.
  - Connection pooling for database queries.
- **Reliability and Cost:**
  - Cloud auto-scaling reduces downtime during peak loads.
  - Free/low-cost tiers for initial development, with growth-based scaling.