UNIVERSITY OF ENERGY AND NATURAL RESOURCES, SUNYANI.

SCHOOL OF SCIENCE

DEPARTMENT OF INFORMATION TECHNOLOGY AND DECISION SCIENCES

DETAILED TEXTUAL DOCUMENTATION OF THE ERP SYSTEM'S ARCHITECTURE, MODULES, FUNCTIONALITIES AND IMPLEMENTATION.

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INTRODUCTION

1.1 Project Overview

This document details the design of an Enterprise Resource Planning (ERP) system for a mini manufacturing company. The ERP system will integrate various business processes, including inventory management, production planning, sales processing, purchasing, finance, human resources, and reporting. The objective is to streamline workflows, improve operational efficiency, and support informed decision-making within the company.

2. System Overview

2.1 System Architecture

The ERP system is designed using a three-tier architecture comprising the Presentation Layer (UI), Business Logic Layer (Backend), and Data Layer (Database) incorporated with API. The system will be built using the MERN stack (MongoDB, Express.js, React, Node.js).

Presentation Layer: React will be used for creating a user-friendly interface, ensuring responsiveness and ease of use.

Business Logic Layer: Node.js and Express.js will handle the core logic, API requests, and interactions between the frontend and backend.

Data Layer: MongoDB will serve as the database to store all business-related data, ensuring flexibility and scalability.

2.2 Key Modules

1. Inventory Management: Manages stock levels, tracks inventory changes, and supports reorder management.

2. Production Planning and Control: Handles production schedules, resource allocation, and monitoring of production processes.

3. Sales and Order Processing: Manages customer orders, sales tracking, and invoicing.

4. Purchasing and Supplier Management: Tracks suppliers, manages purchase orders, and evaluates supplier performance.

5. Finance and Accounting: Manages financial transactions, including accounts payable/receivable, budgeting, and financial reporting.

6. Human Resources Management: Handles employee records, payroll, and performance tracking.

7. Reporting and Analytics: Provides dashboards and reports to support decision-making and monitor KPIs.

2.3 User Roles and Permissions

The system will have different user roles with specific permissions:

Admin: Full access to all modules and system settings.

Inventory Manager: Access to Inventory and Purchasing modules.

Production Manager: Access to Production Planning and Control, and Reporting.

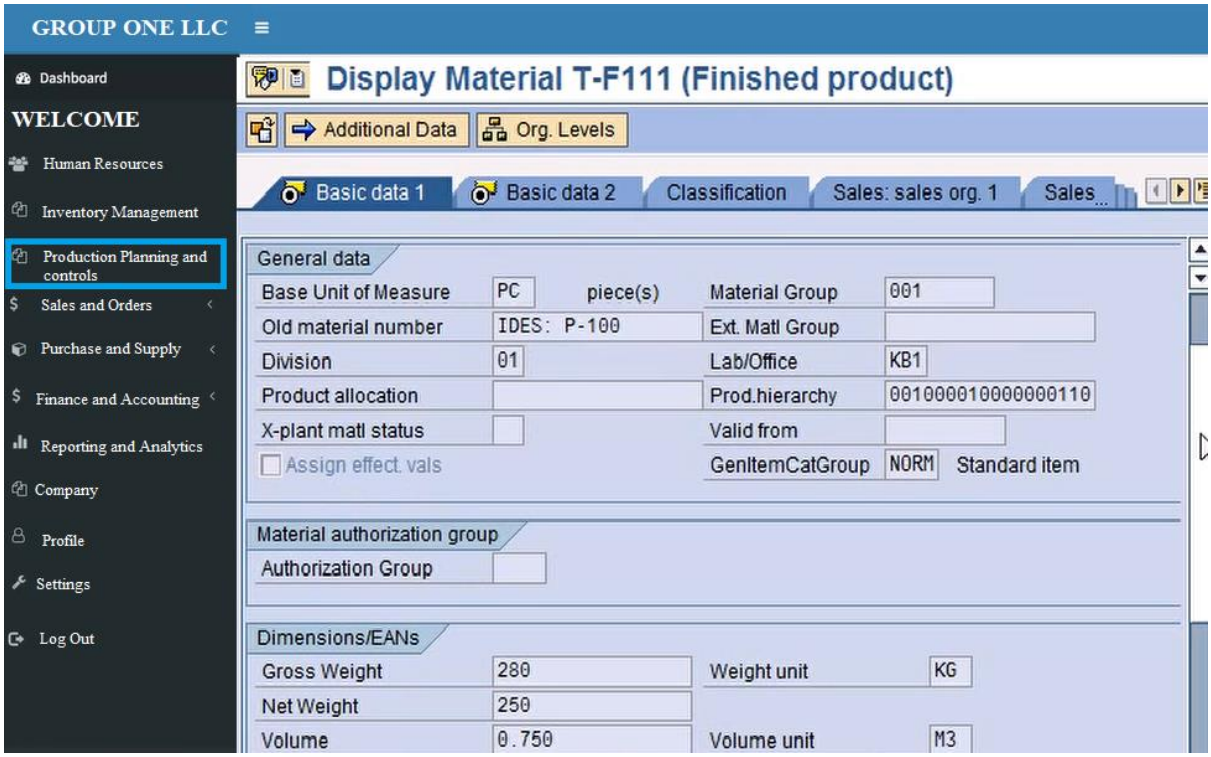
Sales Manager: Access to Sales, Order Processing, and Customer Management.

Finance Manager: Access to Finance, Accounting, and Reporting modules.

HR Manager: Access to Human Resources and Payroll.

3. Detailed Design

3.1 PRODUCTION PLANNING AND CONTROL MODULE



Key Functionalities:

Production Scheduling

Objective: Efficiently plan and manage production activities to meet delivery deadlines and optimize workflow.

Key Features:

Scheduling Tools: Utilize Gantt charts and visual scheduling tools for detailed and Realtime visualization of production timelines.

Automated Adjustments: Automatically adjust production schedules based on changes in order priorities, resource availability, or unexpected disruptions.

Integration: Seamlessly integrate with other modules, such as Inventory and Procurement, to ensure that the required resources are available when needed.

2. Resource Allocation

Objective: Optimize the allocation of materials, labour, and equipment to meet production demands efficiently.

Key Features:

Resource Planning: Allocate resources based on current availability, demand forecasts, and production schedules.

Resource Levelling: Balance workloads by preventing overallocation and ensuring that all resources are utilized efficiently.

Inventory Integration: Track and manage the usage of raw materials, ensuring that inventory levels are maintained and resources are replenished as necessary.

3. Progress Monitoring

Objective: Track and monitor the progress of production activities to ensure adherence to schedules and identify potential issues early.

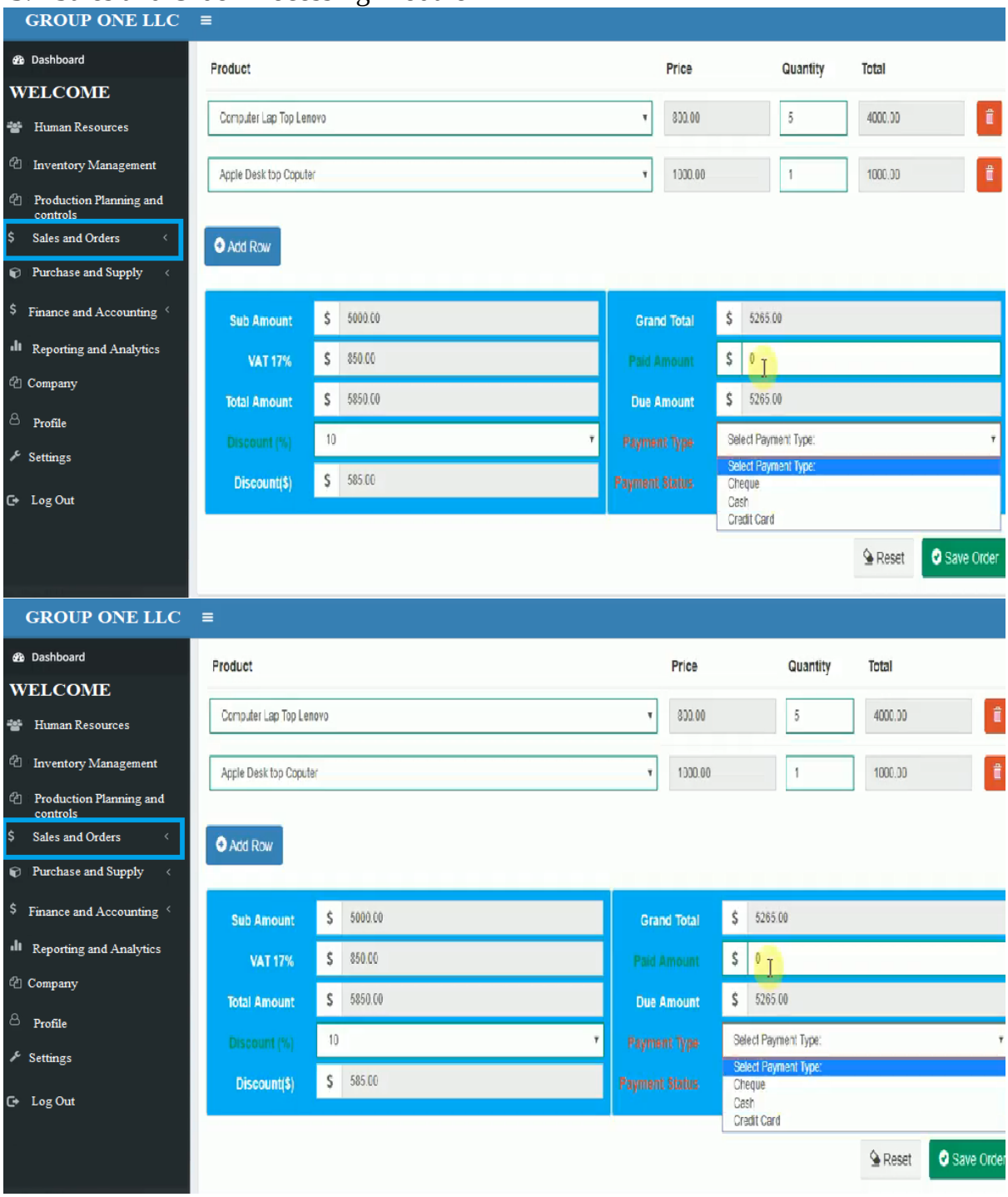
Key Features:

Realtime Tracking: Monitor the status of production tasks and overall order completion in Realtime.

KPI Dashboards: Utilize dashboards to display key performance indicators (KPIs) such as production efficiency, output rates, and downtime.

Alerts and Notifications: Set up automated alerts for deviations from the production schedule or resource related issues, enabling prompt corrective actions.

3.2 Sales and Order Processing Module



Sales and Order Processing Module

1. Order Management

Objective: To efficiently handle and track customer orders from placement to fulfilment.

Key Features:

Order Entry: Allow for the seamless entry of customer orders, whether online, through sales representatives, or via other channels.

Order Tracking: Provide real-time tracking of order status, including processing, shipping, and delivery updates.

Order Modifications: Enable modifications to orders postplacement, such as changes in quantities, delivery dates, or customer details.

Integration: Link with inventory management to ensure stock availability and with production scheduling for order fulfilments.

2. Invoicing

Objective: To automate the generation and management of invoices, ensuring accurate and timely billing.

Key Features:

Invoice Generation: Automatically generate invoices based on completed orders, including necessary details like itemized costs, taxes, and discounts.

Payment Tracking: Monitor payment status, track outstanding invoices, and send reminders for overdue payments.

Invoice History: Maintain a comprehensive history of all generated invoices for auditing and financial reporting purposes.

Integration: Sync with accounting systems to ensure that all financial data is accurately recorded.

3. Customer Management

Objective: To maintain detailed records of customers and track their purchase history for better sales and service.

Key Features:

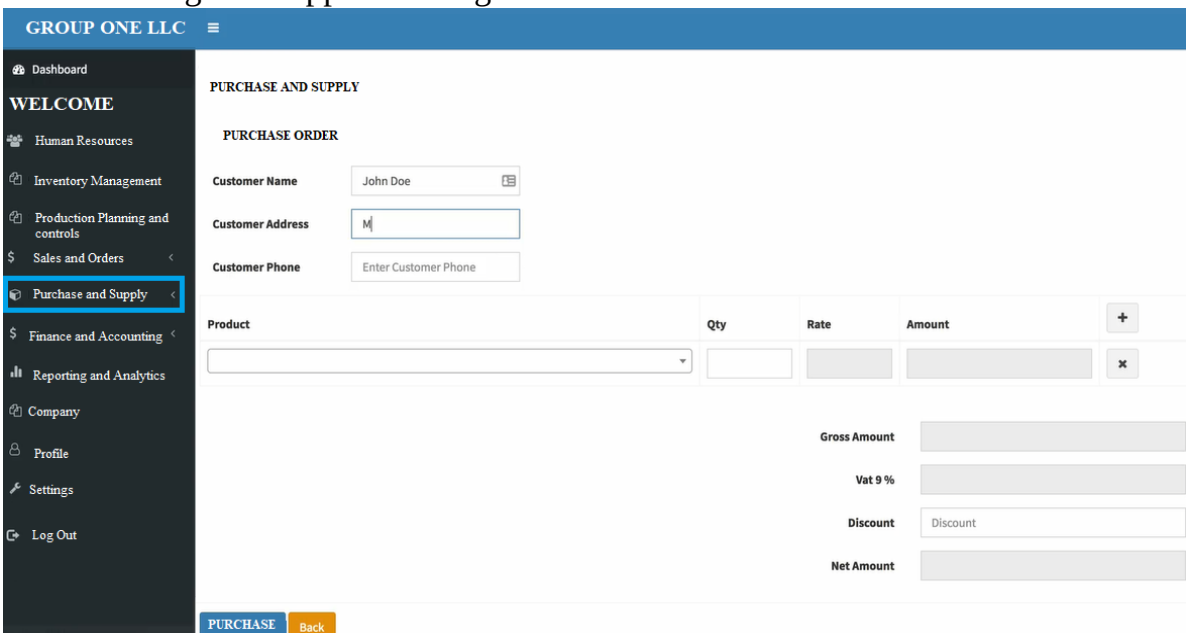
Customer Database: Store comprehensive customer information, including contact details, preferences, and purchase history.

Sales History Tracking: Track past purchases to understand customer behaviours and predict future needs.

Customer Segmentation: Segment customers based on criteria such as purchase frequency, total spend, and product preferences for targeted marketing.

Integration: Integrate with CRM tools for enhanced customer relationship management and personalized sales strategies.

3.3Purchasing and Supplier Management Module



Key Functionalities:

. Purchase Order Management

Objective: To efficiently track and manage the entire lifecycle of purchase orders, from creation to fulfilment.

Key Features:

Purchase Order Creation: Facilitate the generation of purchase orders based on requisitions, supplier quotations, or inventory needs.

Order Tracking: Monitor the status of purchase orders in Realtime, including approval, shipment, and receipt of goods.

Order Modifications: Allow for adjustments to purchase orders, such as changes in quantity, delivery dates, or supplier details.

Approval Workflow: Implement a multilevel approval process to ensure that purchase orders are authorized by the appropriate personnel.

2. Supplier Evaluation

Objective: To assess and rate supplier performance, ensuring the selection of reliable and cost-effective suppliers.

Key Features:

Performance Metrics: Track key performance indicators (KPIs) such as delivery timeliness, quality of goods, and adherence to contractual terms.

Rating System: Implement a rating system to evaluate suppliers based on their performance, helping to identify preferred suppliers.

Supplier Audits: Schedule and conduct regular audits to review supplier practices and compliance with company standards.

Feedback Mechanism: Provide a platform for collecting feedback from various departments regarding supplier performance.

3. Inventory Integration

Objective: To ensure that purchasing decisions are aligned with inventory needs, reducing the risk of overstocking or stockouts.

Key Features:

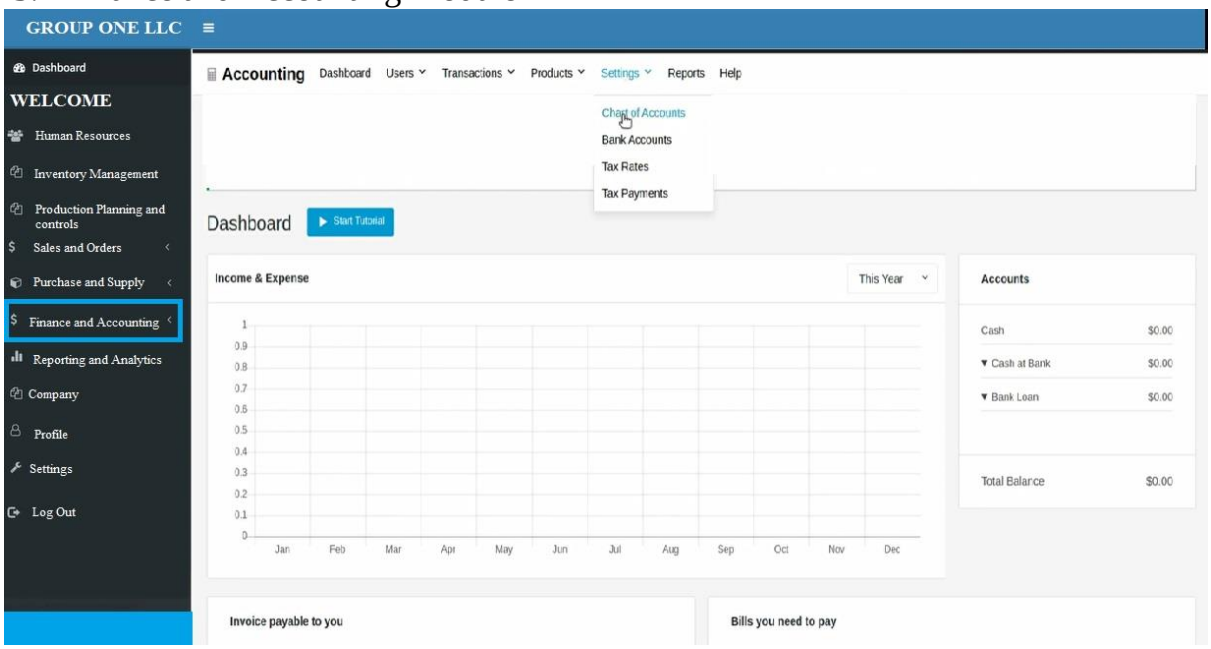
Automated Reordering: Automatically generate purchase orders when inventory levels fall below predefined thresholds, ensuring continuous supply.

Realtime Syncing: Continuously sync with inventory levels to provide UpToDate data on stock availability, lead times, and order quantities.

Demand Forecasting: Utilize historical data and trends to forecast demand, helping to plan and adjust purchasing activities proactively.

Integration with Other Modules: Link with production scheduling and sales order management to ensure that all relevant data is considered in purchasing decisions.

3.4 Finance and Accounting Module



Key Functionalities:

Financial Management Module

1. Financial Tracking

Objective: To monitor and manage the flow of finances within the organization, focusing on accounts payable and receivable.

Key Features:

Accounts Payable: Track outstanding debts and manage payments to suppliers, ensuring timely and accurate payment processing.

Accounts Receivable: Monitor incoming payments from customers, track overdue invoices, and manage collections.

Cash Flow Management: Provide Realtime visibility into cash flow, helping to manage liquidity and optimize working capital.

Integration with Other Modules: Sync with sales, purchasing, and inventory modules to ensure accurate financial tracking across all business processes.

2. Budgeting

Objective: To plan, allocate, and monitor budgets across various departments and projects within the organization.

Key Features:

Budget Planning: Allow departments to create detailed budget plans, including projections for income and expenditures.

Budget Allocation: Distribute allocated budgets to various departments, projects, or cost centres, ensuring that spending aligns with organizational goals.

Variance Analysis: Compare actual spending against budgeted amounts, identifying and analysing variances to manage financial performance.

Forecasting: Use historical data and trends to forecast future budget needs, helping in strategic planning and decision-making.

3. Reporting

Objective: To generate comprehensive financial reports that provide insights into the organization's financial health and performance.

Key Features:

Profit and Loss Statements: Generate detailed profit and loss (P&L) statements, providing a clear view of revenues, costs, and profitability over a specific period.

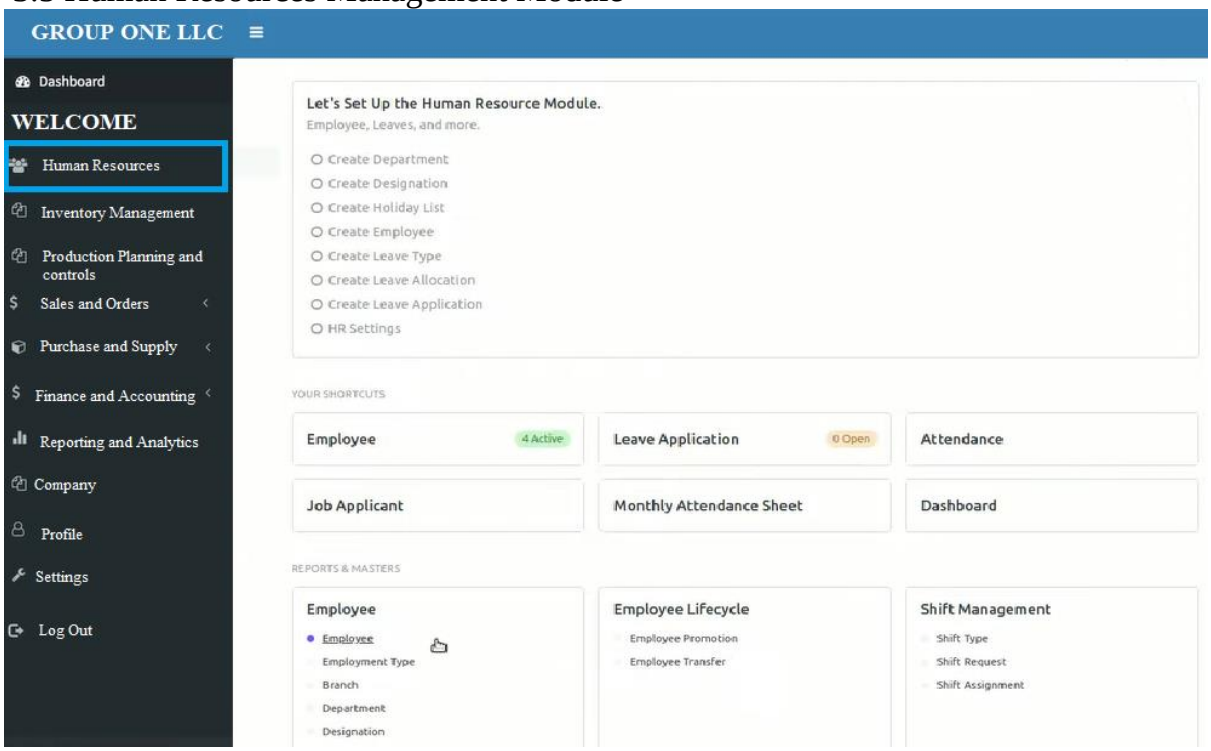
Balance Sheets: Create balance sheets that summarize the company's assets, liabilities, and equity, offering a snapshot of financial position.

Cash Flow Statements: Produce cash flow statements that track the inflow and outflow of cash, highlighting operational, investing, and financing activities.

Custom Reporting: Allow for the customization of financial reports to meet specific business requirements, including filters, formats, and presentation styles.

Regulatory Compliance: Ensure that all financial reports adhere to relevant accounting standards and regulatory requirements.

3.5 Human Resources Management Module



Key Functionalities:

1. Employee Records

Objective: To maintain and manage comprehensive employee information, ensuring that personnel data is accurate, secure, and easily accessible.

Key Features:

Employee Database: Store and manage detailed records for each employee, including personal information, employment history, qualifications, and job roles.

Document Management: Upload and manage important employee documents such as contracts, certifications, and identification.

Role Based Access Control: Ensure that sensitive employee data is protected through role-based access, granting permissions only to authorized personnel.

Compliance Management: Track and manage compliance with labour laws and company policies, including mandatory training, certifications, and legal documentation.

2. Payroll Processing

Objective: To automate the calculation and disbursement of employee salaries, ensuring timely and accurate payroll processing.

Key Features:

Salary Calculations: Automatically calculate salaries based on factors such as hours worked, overtime, bonuses, deductions, and tax withholdings.

Payment Disbursement: Facilitate direct deposit of salaries into employee bank accounts, or generate checks where required.

Tax Compliance: Ensure compliance with tax regulations by automatically calculating and withholding the appropriate taxes for each employee.

Payroll Reports: Generate detailed payroll reports, including summaries of salaries, deductions, and tax withholdings for auditing and recordkeeping purposes.

3. Performance Tracking

Objective: To monitor and assess employee performance, providing data driven insights for performance reviews and development planning.

Key Features:

Performance Metrics: Track key performance indicators (KPIs) for each employee, including productivity, quality of work, and goal achievement.

Performance Reviews: Facilitate structured performance review processes, allowing managers to evaluate and provide feedback on employee performance.

360Degree Feedback: Enable comprehensive performance assessments by gathering feedback from peers, subordinates, and supervisors.

Development Plans: Create and monitor individual development plans, linking performance assessments to training programs and career progression.

Reporting: Generate performance reports to identify trends, recognize high performers, and address areas requiring improvement.

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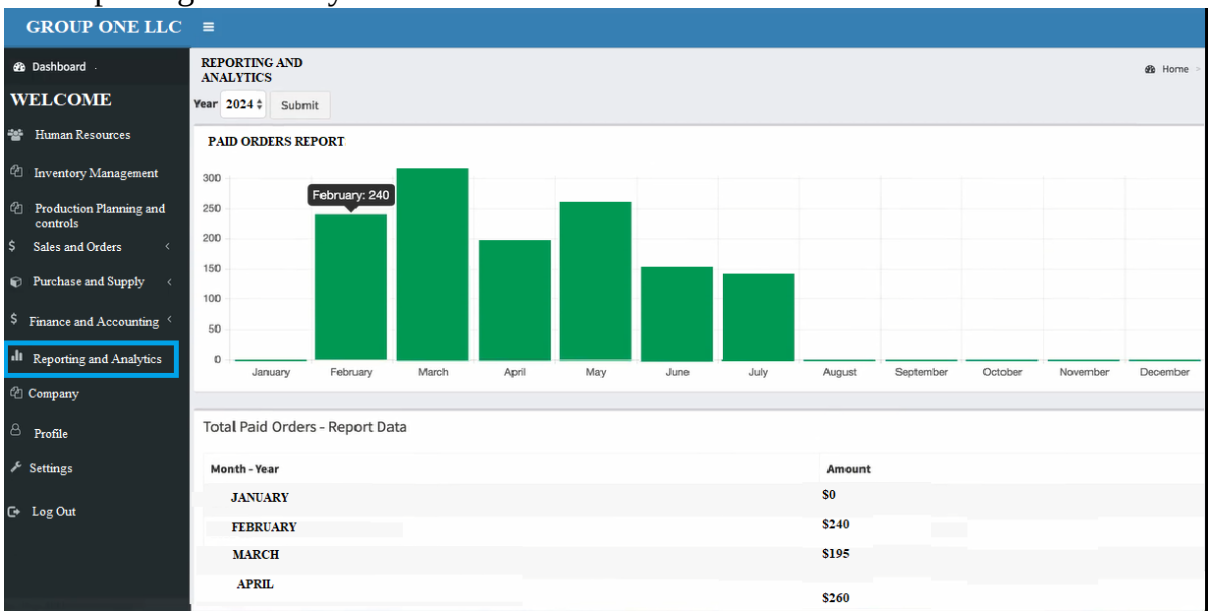
3.6 Reporting and Analytics Module



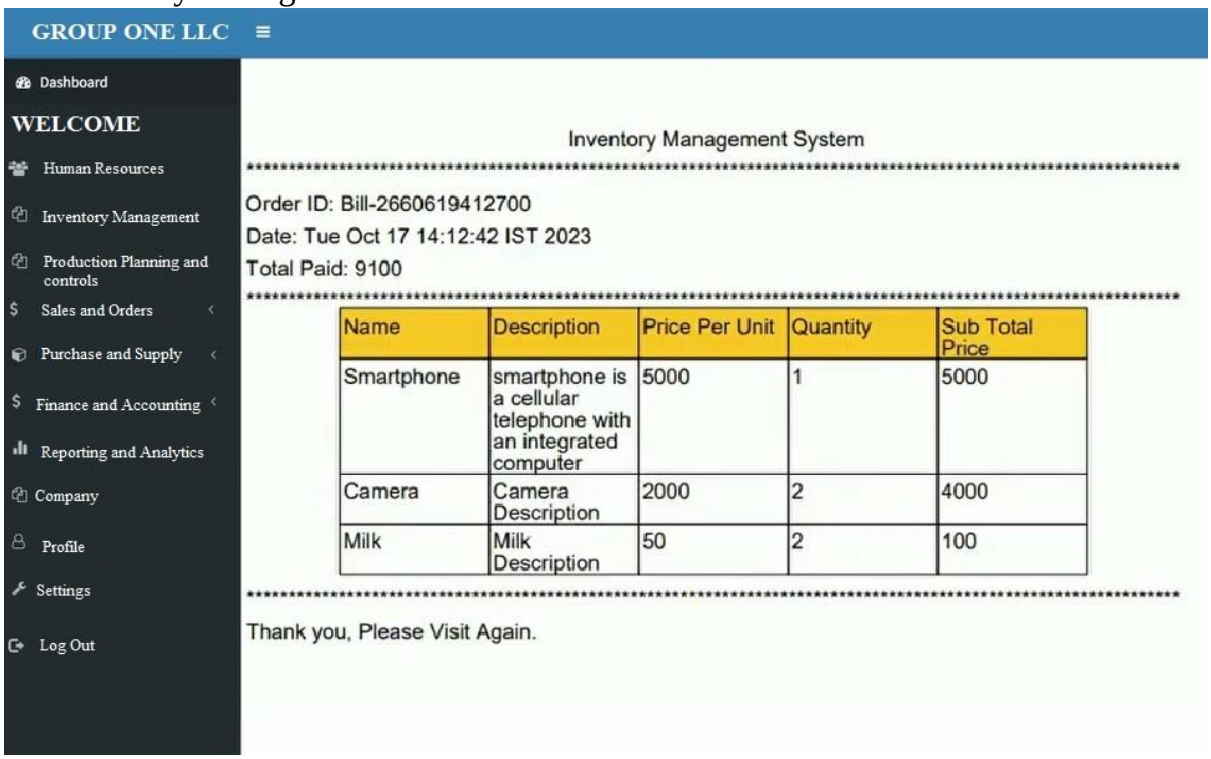
Key Functionalities:

Data Aggregation: Collect data from all modules to generate comprehensive reports.

KPI Monitoring: Provide Realtime dashboards to track key performance indicators.

Custom Reports: Allow users to generate custom reports based on selected criteria.

3.7 Inventory Management Module



Key Functionalities:

Stock Tracking

- **Objective**: Real-time monitoring and accurate tracking of inventory levels.
- **Key Features**:
    - Real-time updates of stock levels.
    - Location tracking within the warehouse.
    - Regular stock audits to match recorded and physical inventory.
    - Integration with production, sales, and purchasing modules for consistent data.

Reorder Management

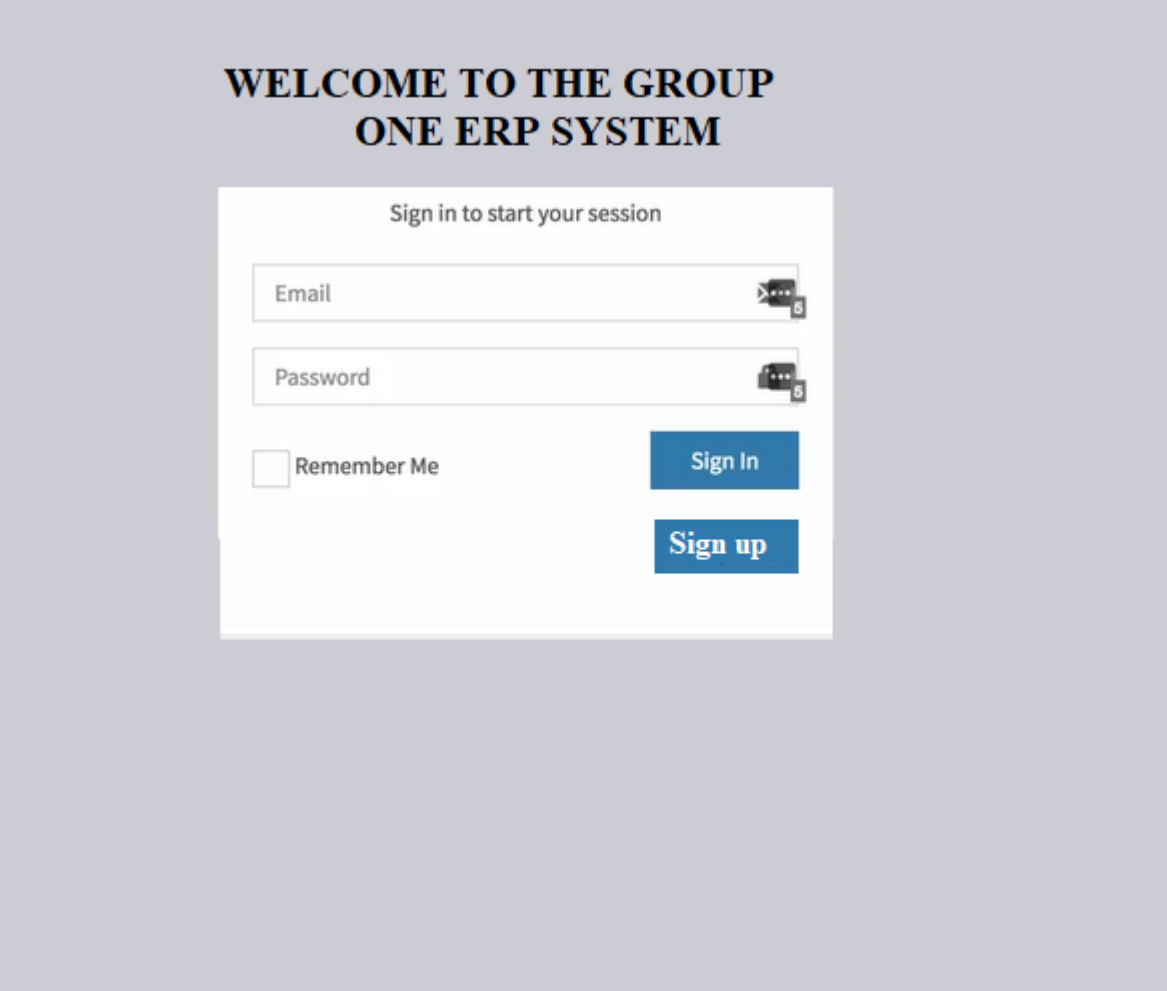
- **Objective**: Automate stock replenishment to maintain optimal inventory levels.
- **Key Features**:
    - Automatic alerts for stock below reorder levels.
    - Define minimum and maximum stock levels.
    - Automated purchase order generation.
    - Safety stock calculation to buffer against demand fluctuations.

Supplier Management

- **Objective**: Manage supplier relationships and link inventory items to suppliers for a reliable supply chain.
- **Key Features**:
    - Link inventory items to preferred suppliers with details on pricing and lead times.
    - Track and evaluate supplier performance.
    - Maintain a history of supplier interactions.
    - Integrate with the Purchasing and Supplier Management Module for streamlined procurement.

4. Security Considerations

4.1 Authentication and Authorization



User Authentication: Implement Jetbead authentication to secure API endpoints.

Role Based Access Control (RBAC): Define permissions based on user roles to restrict access to sensitive data and functionalities.

4.2 Data Encryption

Encryption in Transit: Use HTTPS for secure communication between the client and server.

Encryption at Rest: Encrypt sensitive data in the database, such as financial information and employee records.

4.3 Backup and Recovery

Regular Backups: Schedule regular backups of the database.

Disaster Recovery: Implement a disaster recovery plan to restore data in case of system failure.

5. System Integration

API Driven Architecture: The ERP system has been designed with a RESTful API driven architecture, ensuring that all modules within the system communicate seamlessly. This architecture facilitates Realtime data exchange and allows for easy scalability and adaptability as the company grows.

Third-party Integrations: The system is built with futureproofing in mind, allowing for smooth integration with third-party systems such as payment gateways, CRM software, and accounting tools. This ensures that the ERP system can evolve alongside the company's needs and technological advancements.

5.2 Data Consistency

Transactional Integrity: The ERP system guarantees that all transactions are atomic, ensuring consistency across the entire platform. This means that each transaction is completed fully or not at all, preventing data corruption or incomplete processes.

Data Synchronization: Robust synchronization mechanisms have been implemented to maintain consistent data across all modules. This ensures that all departments and processes are working with UpToDate and accurate information, minimizing errors and discrepancies.

6. Testing and Validation

6.1 Unit Testing

Scope: Each individual component and module of the ERP system has undergone rigorous unit testing. This ensures that all functionalities operate as intended before they are integrated into the larger system.

Tools: Testing frameworks such as Jest have been utilized to automate unit testing, providing efficient and thorough validation of each module's codebase.

6.2 Integration Testing

Scope: The system's integration testing focused on validating the interaction between different modules. This testing phase ensured that data flows accurately and reliably between modules, maintaining system integrity and functionality.

Focus Areas: Key focus areas included testing data communication, ensuring that processes like order management, inventory updates, and financial tracking were correctly interlinked and operated smoothly across the system.

6.3 User Acceptance Testing (UAT)

Scope: User Acceptance Testing was conducted with selected end-users representing different departments within the manufacturing company. This testing phase confirmed that the ERP system meets the specific business requirements and workflows of the company.

Feedback Loop: A feedback loop was established to gather insights from UAT participants. Based on this feedback, iterative improvements were made to the system design and functionality, ensuring that the final product aligns with user expectations and needs.

7. Deployment and Implementation

7.1 Deployment Strategy

Staging Environment: A staging environment was set up to replicate the production environment, allowing for final testing before the system goes live. This environment ensured that any lastminute issues were identified and resolved without affecting the live system.

Production Deployment: The ERP system's deployment followed a phased approach to minimize downtime and ensure a smooth transition from legacy systems to the new platform. This strategy allowed for careful monitoring and adjustment during the initial rollout, reducing the risk of disruptions.

7.2 Training and Support

User Training: Comprehensive training materials, including user manuals, tutorials, and Handson workshops, were developed to guide end-users through the system's functionalities. Training sessions were conducted to ensure that all users are comfortable and proficient with the new ERP system.

Support Plan: A dedicated support structure was established to provide ongoing assistance to users post deployment. This includes a helpdesk, regular system updates, and maintenance services to address any issues and ensure the system continues to meet the company's evolving needs.

8.Appendix

ERP: Enterprise Resource Planning

CRUD: Create, Read, Update, Delete

RBAC: Role Based Access Control

UAT: User Acceptance Testing

KPI: Key Performance Indicator