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Web-Based Supply Chain Management System: Empowering Enterprises with Real-Time Data and Performance Dashboards



Abstract: - The proposed system aims to enhance efficiency, accuracy, and transparency in supply chain operations through a centralized platform that supports multiple stakeholders, including suppliers, warehouse staff, sales personnel, and customers. The system allows for real-time inventory tracking, order management, shipment monitoring, role-based access control, and detailed reporting. Development was guided by the Agile methodology, enabling iterative refinement based on continuous feedback. The system's architecture emphasizes scalability, modularity, and data security. By leveraging open-source technologies, the platform provides a cost-effective solution that can be adapted for small to medium-sized enterprises. The system was evaluated through practical implementation and comparison with similar academic projects, and results indicate its potential to significantly reduce manual errors, improve operational coordination, and support strategic decision-making in supply chain environments.

Keywords: Real-Time Inventory Tracking, Supply Chain Management, Web-Based System, Strategic decision-making.

I. INTRODUCTION (HEADING 1)

In today's complex business environment, managing supply chains efficiently is critical to the smooth functioning of organizations. The increasing complexity of global supply chains demands innovative solutions that can streamline operations, enhance transparency, and improve decision-making. This research presents a web-based Supply Chain Management System (SCMS) that leverages modern digital technologies to optimize supply chain processes. The system uses Flask, a lightweight and modular framework, to provide a scalable and flexible web application platform [1]. PostgreSQL is utilized as the backend database to ensure reliable and high-performance data storage with strong data integrity [2].

The SCMS integrates real-time dashboards that allow users and administrators to visualize key performance indicators (KPIs), thus promoting operational transparency and enabling timely decision-making [3]. Furthermore, the adoption of semantic data modeling approaches enhances interoperability among supply chain stakeholders, fostering seamless communication and coordination [4]. The system is designed to address common inefficiencies found in traditional, manual supply chain workflows by improving processes such as inventory tracking, order fulfillment, supplier communication, and shipment monitoring.

By implementing an Agile development methodology, the system is continuously refined based on user feedback, ensuring that it evolves to meet the dynamic needs of businesses. The SCMS not only enhances operational efficiency but also provides a cost-effective solution for small to medium-sized enterprises, promoting a seamless integration of supply chain functions across various stakeholders.

II. PROBLEM STATEMENT

Traditional supply chain management systems exhibit various operational inefficiencies that negatively impact organizational performance and customer satisfaction. The management of inventory presents a significant challenge. Numerous businesses face challenges in maintaining precise, real-time stock level records, which can result in product shortages or surpluses. These issues impede order fulfillment, leading to customer dissatisfaction and heightened costs. A notable issue exists in the communication gaps between suppliers and customers. Ineffective communication channels frequently lead to misunderstandings about order requirements, resulting in shipment errors and delays in delivery. Additionally, businesses frequently encounter difficulties in accurately monitoring shipments and orders. Organizations face challenges in monitoring product movement without integrated, real-time tracking capabilities, resulting in unforeseen delays and diminished customer trust.

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Moreover, the fragmentation of data among various supply chain entities adversely affects customer service and order management. Businesses face challenges in addressing customer inquiries, handling returns, and coordinating order fulfillment. This project proposes a centralized, web-based Supply Chain Management System that integrates inventory, orders, shipment tracking, and customer service processes into a single platform, thereby addressing existing gaps.

III. STUDY OBJECTIVES

This study aims to develop and implement a centralized, web-based Supply Chain Management System (SCMS) designed to address critical inefficiencies in traditional supply chain operations. Specifically, the objectives of the study are; To enhance inventory management by providing real-time, accurate tracking of stock levels. To Improve communication between suppliers and customers by establishing dedicated, role-specific portals, ensuring clear, structured communication. To enable real-time tracking of shipments and orders by integrating dynamic dashboard functionalities that offer continuous visibility into the movement of goods. To streamline customer service and order management processes by consolidating data flows across different supply chain actors.

IV. LITERATURE REVIEW

Supply Chain Management (SCM) has evolved significantly over the years, with modern digital technologies playing a crucial role in transforming traditional supply chain processes. The integration of web-based platforms, real-time data tracking, and semantic modeling has become central to optimizing supply chain operations. This literature review explores the key developments in SCM, focusing on the use of technology to enhance efficiency, reduce errors, and improve stakeholder coordination.

The shift from traditional SCM methods to web-based solutions has gained momentum due to the need for real-time data visibility and enhanced coordination among supply chain stakeholders. A significant study by Giri and Choudhury (2022) emphasizes the growing importance of web-based SCM platforms in providing a centralized view of the supply chain, allowing real-time monitoring of inventory, orders, and shipments. These systems offer scalability, flexibility, and cost-efficiency, making them particularly attractive for small and medium-sized enterprises (SMEs) [5]. Web-based SCM systems provide benefits such as faster decision-making, improved accuracy, and streamlined communication across the supply chain. For example, the use of dashboards in real-time monitoring has been shown to improve operational transparency and enable swift responses to market changes [6].

Real-time data analytics is a key enabler of modern supply chain systems. According to a study by Hafiz et al. (2023), real-time dashboards allow stakeholders to track key performance indicators (KPIs) instantly, facilitating better decision-making. These systems offer insight into stock levels, shipment statuses, and supplier performance, which ultimately enhances supply chain visibility and responsiveness [7]. The application of real-time data not only supports the operational aspects of the supply chain but also plays a vital role in strategic decision-making by providing a clearer picture of market demands and performance. Semantic data modeling has emerged as an essential tool for improving the interoperability and coordination between various supply chain stakeholders. Traditional data models often face challenges in enabling seamless data exchange between systems due to differences in terminology, structure, and format. Albani and D'Atri (2011) highlighted the role of semantic data models in overcoming these challenges by providing a unified understanding of data across different platforms, thus fostering smoother communication among supply chain partners [8]. By standardizing data representation, semantic models enhance the accuracy and efficiency of information exchange, promoting better integration of supply chain processes.

The Agile methodology, originally used in software development, has found its application in supply chain management systems. The iterative and feedback-driven approach of Agile allows SCM systems to be continuously improved and adapted to changing business needs. A study by Ramzy et al. (2022) discusses how Agile methodologies have been integrated into SCM systems to foster flexibility and responsiveness. The iterative nature of Agile development ensures that supply chain systems remain aligned with the dynamic requirements of the industry, enabling businesses to quickly adapt to disruptions and shifting market conditions [9,10].

While the adoption of digital and web-based SCM systems has significantly improved operational efficiency, there are still several challenges that need to be addressed. According to Giri and Choudhury (2022), issues related to data privacy, security, and system integration continue to hinder the full potential of SCM technologies. Additionally, the complexity of managing vast amounts of real-time data and ensuring its accuracy remains a challenge, especially for SMEs with limited resources. Future research is needed to explore advanced technologies

such as artificial intelligence and blockchain to further enhance the transparency, security, and scalability of SCM systems [11,12].

V. METHODOLOGY

The Agile Model is a widely used framework in software development and project management. It emphasizes iterative progress through short cycles, referred to as Sprints, allowing teams to adapt and improve their work continuously[13]

Key Elements of the Agile Model:

1. Development and Design Phases:

The model alternates between Development and Design phases. During each Sprint, features are developed, and the design is revisited to accommodate feedback or improvements. This iterative process ensures that the system evolves in a controlled, manageable manner.[14]

2. Sprint Cycles:

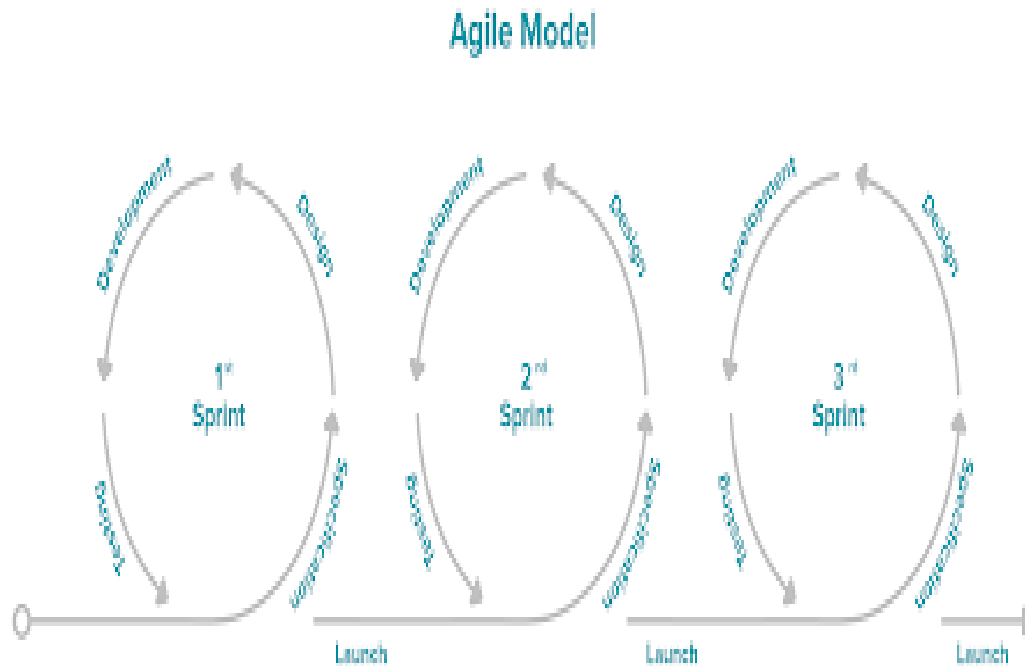
Each Sprint is a time-boxed period (typically 1–4 weeks) where specific tasks or deliverables are completed. The first Sprint starts with planning and initial development, the second Sprint builds upon that with further development and adjustments, and the third Sprint focuses on refining and launching the product.

3. Launch:

After each cycle, the product undergoes testing and is launched. This allows stakeholders to receive feedback quickly and adjust the development in the subsequent sprints.[15]

4. Iterative Nature:

The Agile methodology encourages iterative progress, meaning each cycle improves the product incrementally based on feedback from the previous one. This leads to a more responsive approach to changes in project scope or requirements.[16]



VI. RESULTANTS AND DISCUSSION

A. Analysis:

Analysis Process Diagrams:

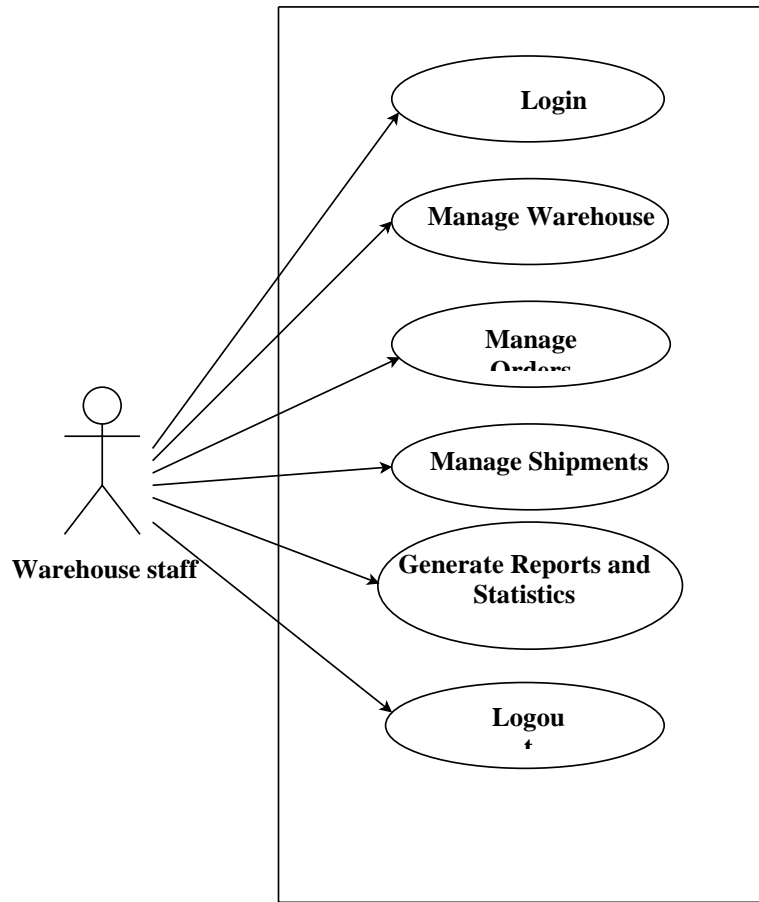


Fig.1 Use case Diagram Warehouse staff

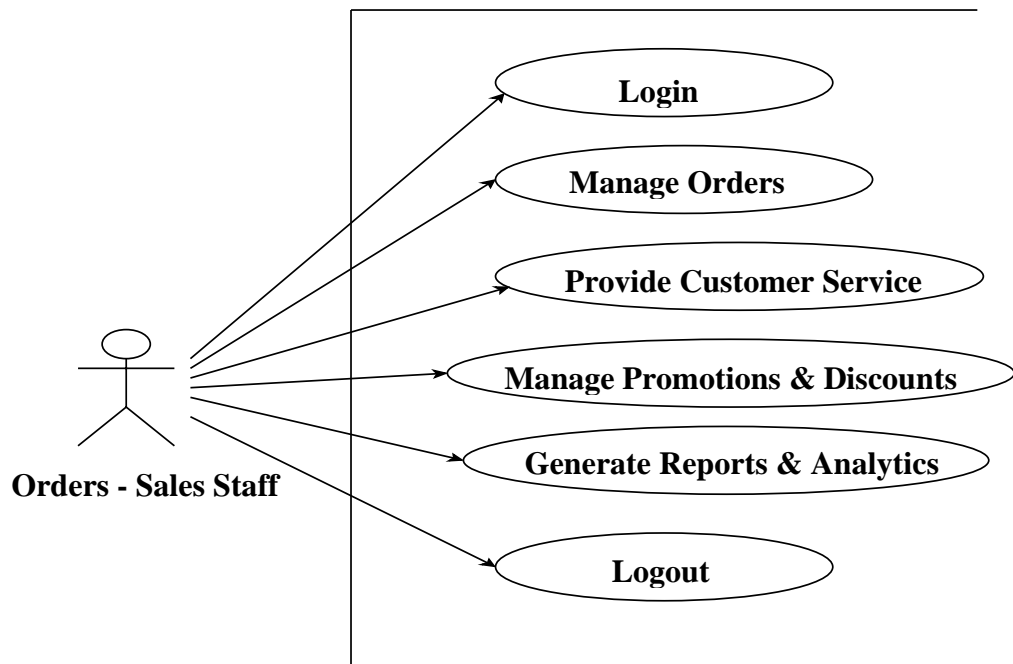


Fig.2 Use case Diagram Orders - Sales Staff

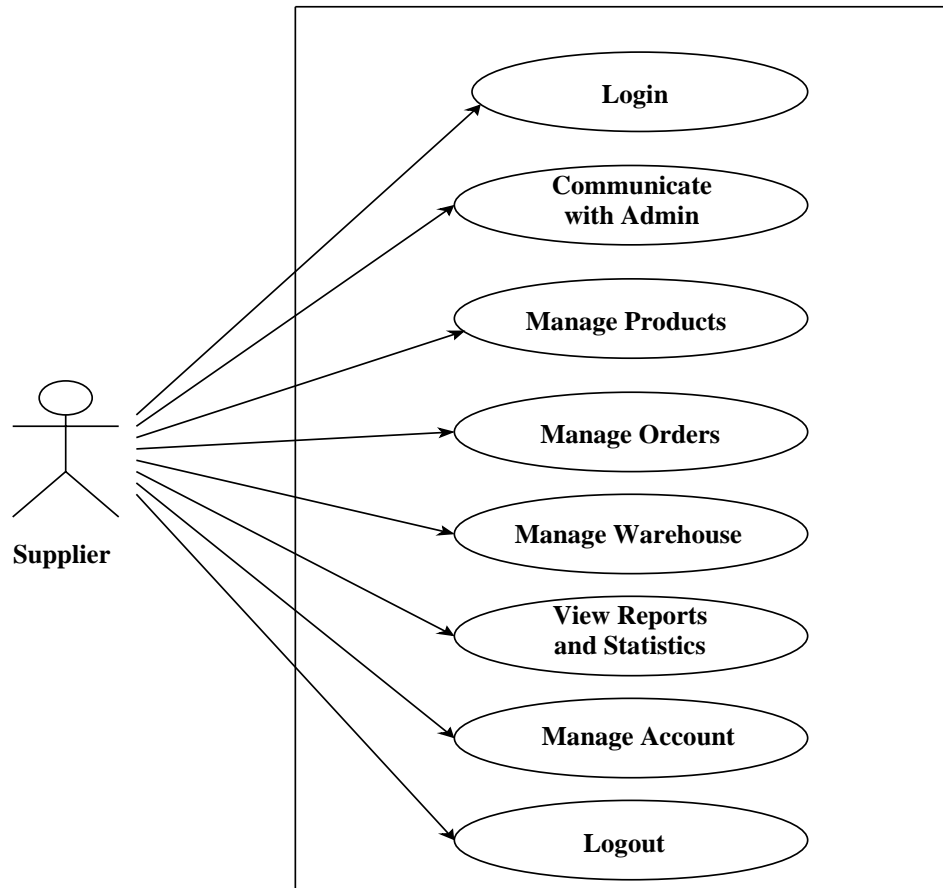


Fig.3 Use case Diagram Supplier

System Database Analysis

Table 1 Entities in the Database

Entity	Description
Users	The user table contains account information for customers, suppliers, and warehouse employees.
Suppliers	Suppliers are the entities that provide products. Each supplier has information such as name, address, and rating.
Warehouse	The warehouse represents the places where products are stored. It includes information such as the warehouse location, available quantity, and stored products.
Products	Products are the items provided by suppliers. They include a description, unit price, and product ID.
Orders	Orders represent the purchases made by customers. They contain information such as order date, status, and customer ID.
Customers	Customers are the individuals or entities that place orders. Their information includes name, address, and phone number.
Shipping	Shipping represents the process of delivering orders. It includes information such as shipping company, shipping date, and tracking number.
Returns	Returns represent the process of returning orders. It includes information such as return reason, return date, and order ID.

Table 2 System Database Analysis

Entity	Attributes	Primary Constraints
Users	(User ID, Username, Email, Password, Created_at, Role)	Primary Key (User ID)
Suppliers	(Supplier ID, User ID, Supplier Name, Supplier Address, Supplier Rating, Phone Number, Email)	Primary Key (Supplier ID)
Products	(Product ID, Product Name, Product Description, Unit Price, Supplier ID)	Primary Key (Product ID)
Orders	(Order ID, Order Date, Customer ID, Order Status)	Primary Key (Order ID)
Warehouse	(Warehouse ID, Quantity Available, Storage Location, Product ID, User ID)	Primary key (Warehouse ID)
Customers	(Customer ID, Customer Name , Customer Address, Phone Number, Email, User ID)	Primary Key (Customer ID)
Order Details	(Order Detail ID, Product ID, Quantity Ordered, Unit Price)	Primary Key (Order Detail ID)
Shipping	(Shipping ID, Order ID, Shipping Date, Tracking Number, Shipping Company)	Primary Key (Shipping ID)
Returns	(Return ID, Order ID, Return Date, Return Reason)	Primary Key (Return ID)

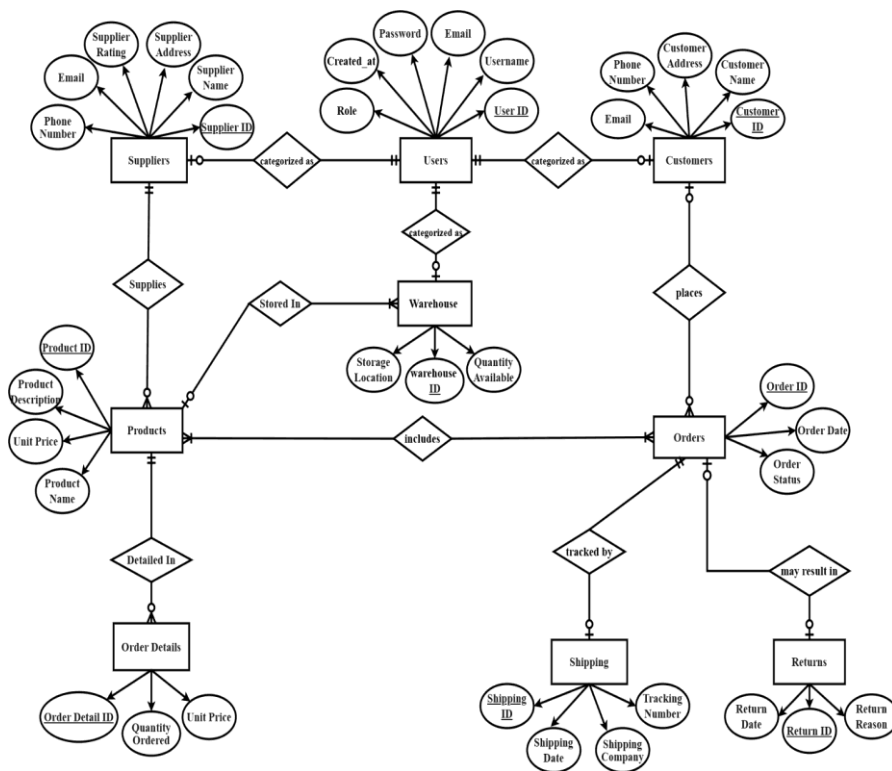


Fig.4 ER Diagram

B. Database Design

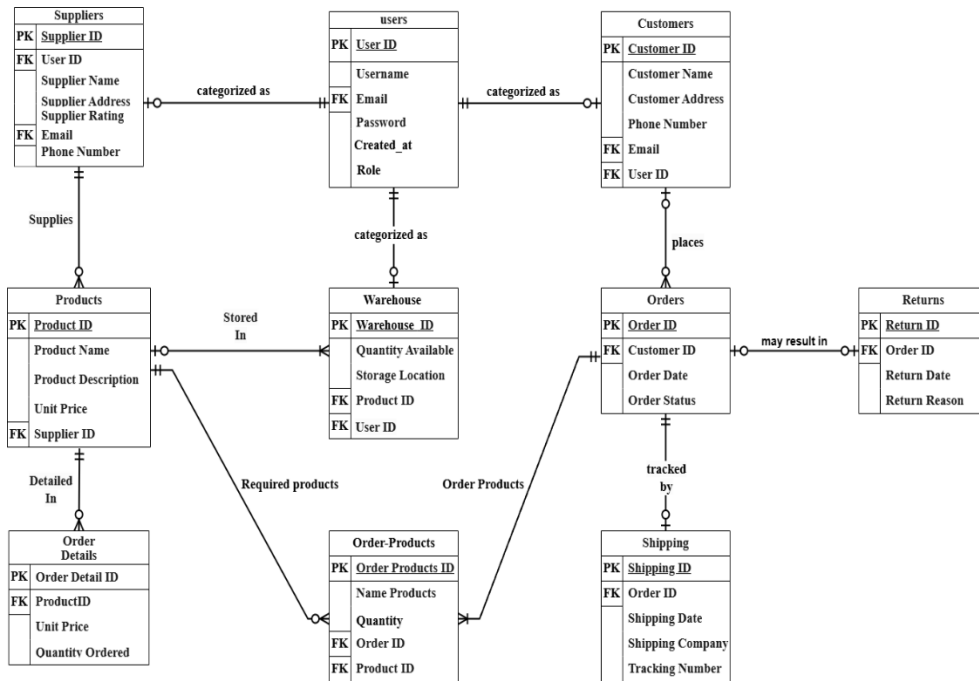


Fig.5 Relational Schema

C. User interface desgin

Supply Reports								
Supplier ID	Supplier Name	Email	Product ID	Product Name	Unit Price	Warehouse ID	Warehouse Location	Quantity Available
4	MIS4	MIS4@kku.sa	98	TP-Link Archer AX6000 Router	\$300.0	122	Saudi Arabia	24
4	MIS4	MIS4@kku.sa	99	Cisco ISR Router	\$1000.0	122	Saudi Arabia	40
4	MIS4	MIS4@kku.sa	100	Palo Alto Networks PA-220 Firewall	\$800.0	122	Saudi Arabia	57
4	MIS4	MIS4@kku.sa	101	Fortinet FortiGate 40F	\$700.0	122	Saudi Arabia	92
4	MIS4	MIS4@kku.sa	102	Synology DiskStation DS920+	\$500.0	122	Saudi Arabia	150
4	MIS4	MIS4@kku.sa	103	QNAP TS-453D	\$700.0	122	Saudi Arabia	200
4	MIS4	MIS4@kku.sa	104	Arduino Uno	\$25.0	118	Saudi Arabia	548
4	MIS4	MIS4@kku.sa	105	NVIDIA Jetson Nano	\$88.0	118	Saudi Arabia	392
4	MIS4	MIS4@kku.sa	106	Meta Quest 3	\$499.0	118	Saudi Arabia	38

Fig.6 Supplier Reports

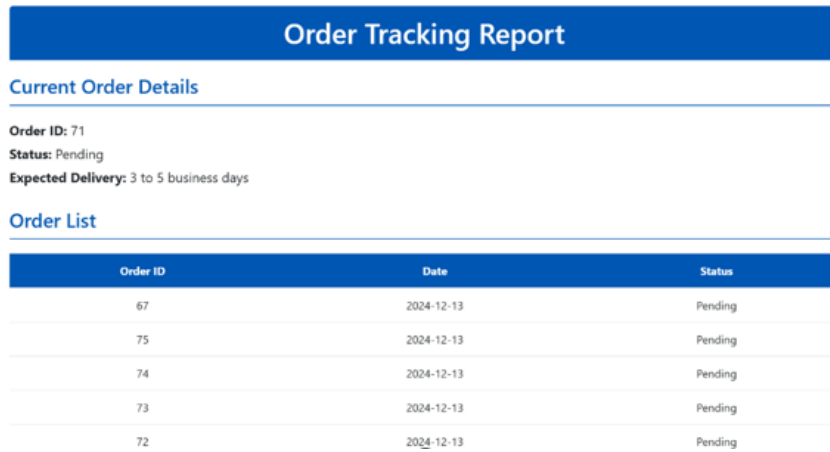


Fig.7 Customer Reports

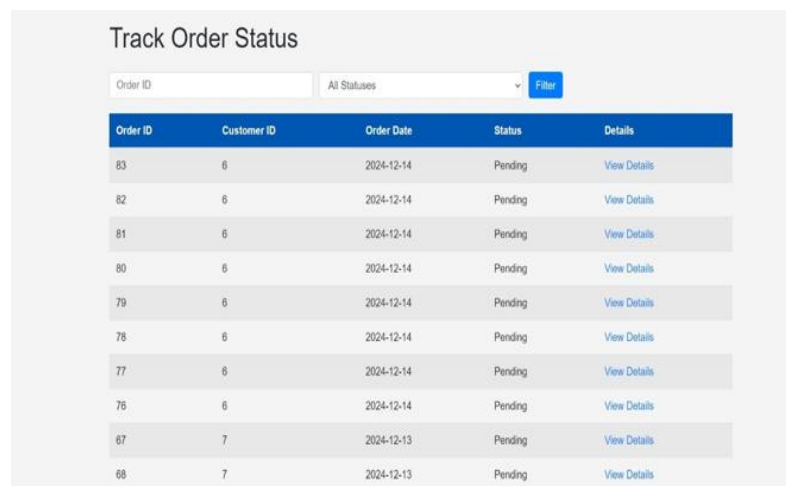


Fig.8 Tracking the status of orders by the sales staff



Fig.9 Supply Chain Management System Dashboard

The image you've uploaded shows a Supply Chain Management System Dashboard, which provides key metrics and visualizations of the system's operations. Here's a breakdown of the key elements shown:

1. Total Orders:

This represents the total number of orders processed in the system. It indicates the volume of transactions the system is handling over a specific period.

2. Pending Shipments:

The number of shipments that are yet to be completed or dispatched. This metric helps in tracking how many orders are awaiting shipment.

3. Active Suppliers:

This shows the number of suppliers currently providing goods or services to the system. It's a key metric for understanding the number of active business partners involved in the supply chain.

4. Inventory Value:

This indicates the total value of goods currently in the system's inventory. It's crucial for managing stock levels and assessing the financial worth of the available inventory.

5. Monthly Orders Graph:

The graph shows the trend of orders placed over the months, showing how the number of orders fluctuates over time. This can be used to identify trends in demand and make informed decisions about inventory and supply needs.

6. Inventory Distribution (Pie Chart):

This pie chart shows how inventory is distributed across different categories such as:

- Electronics
- Furniture
- Food
- Clothing

It helps in visualizing which category makes up the largest portion of the inventory, offering insights into product focus and market trends.

This dashboard provides a high-level overview of the key metrics that help manage and optimize supply chain operations.

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