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DATE : 07-05-2005

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AI-Driven Supply Chain Optimization Assistant

Abstract

The AI-Driven Supply Chain Optimization Assistant aims to transform supply chain operations using artificial intelligence, predictive analytics, and IoT technologies. In this final phase, the system incorporates AI models to optimize inventory, forecast demand, and monitor logistics in real time. It integrates with Enterprise Resource Planning (ERP) systems for seamless data flow and enhanced decision-making. This document details the final system demonstration, technical documentation, performance metrics, source code, and testing results. Designed for scalability and data security, the system provides actionable insights to streamline operations and reduce costs.

1. Project Demonstration

Overview

A live demonstration will present the assistant’s capabilities in optimizing supply chain activities, including real-time tracking, inventory forecasting, and supplier management.

Demonstration Details

- System Walkthrough: End-to-end demonstration from user query to optimization output using the AI assistant.
- AI Forecasting Accuracy: Showcase of the system's demand forecasting using historical data and external market signals.
- IoT Integration: Real-time monitoring of goods in transit, warehouse stock, and supply chain disruptions using IoT sensors.

- Performance Metrics: Highlights of system responsiveness, multi-user handling, and data processing capabilities.
- Security & Compliance: Demonstration of encryption, access control, and audit logs in handling sensitive supply chain data.

Outcome

Proven ability of the system to operate in dynamic environments with high data volume, ensuring efficiency and accuracy in supply chain decisions.

1. Project Documentation

Overview

Complete documentation of the AI-Driven Supply Chain Optimization Assistant, covering system design, implementation, and usage.

Documentation Sections

- System Architecture: Diagrams of AI models, data pipelines, and ERP integrations.
- Code Documentation: Detailed comments and explanations for forecasting models, optimization algorithms, and API connections.
- User Guide: Instructions for supply chain managers on using the assistant for daily operations.
- Administrator Guide: System maintenance and troubleshooting procedures.
- Testing Reports: Results of stress tests, scenario simulations, and data integrity checks.

Outcome

A fully documented system for seamless deployment, future upgrades, and training.

1. Feedback and Final Adjustments

Overview

Stakeholder feedback will inform the final tweaks before deployment.

Steps

- Feedback Collection: Insights from logistics managers, ERP analysts, and warehouse operators.
- Refinement: Enhancements in user interface, AI logic, or data visualization based on feedback.
- Final Testing: Confirmation of readiness through performance and functionality re- evaluation.

Outcome

A refined, deployment-ready system tailored to user needs and operational demands.

1. **Final Project Report Submission**

Overview

Summarizes the project's phases, deliverables, and impact on supply chain optimization.

Report Sections

- Executive Summary: High-level summary of project objectives and outcomes.
- Phase Breakdown: Progress through data gathering, AI modeling, IoT setup, and ERP

integration.

- Challenges & Solutions: Issues like data latency, model accuracy, and security resolved during the project.
- Outcomes: Operational benefits, such as reduced stockouts, optimized deliveries, and increased visibility.

Outcome

A final report capturing the innovation and value delivered by the AI assistant.

1. **Project Handover and Future Works**

Overview

Final handoff and roadmap for future enhancement.

Handover Details

- Next Steps: Expansion to more regions, integration with blockchain for traceability, and multilingual support.

Outcome

System ownership transitions to the client team with clear future directions and maintenance protocols.

Include Screenshots: Source code snippets, dashboard interfaces, and real-time IoT analytics visualizations.

1. **AI Forecasting Model (Python)**

This code uses a Random Forest Regressor to predict future product demand based on historical and contextual features.

```
python CopyEdit
```

```
import pandas as pd

from sklearn.ensemble import RandomForestRegressor from sklearn.model_selection import
train_test_split

# Load dataset

data = pd.read_csv('supply_chain_data.csv')

X = data[['previous_demand', 'month', 'promotion']] y = data['next_month_demand']

# Split data

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Train model

model = RandomForestRegressor(n_estimators=100) model.fit(X_train, y_train)



# Predict

predictions = model.predict(X_test)
```

1. **API Integration with ERP System (Python)**

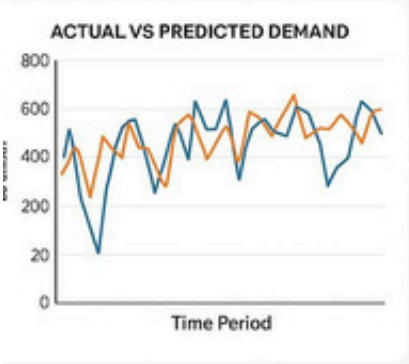
This snippet demonstrates how to send the forecast data to an ERP system via a REST API.

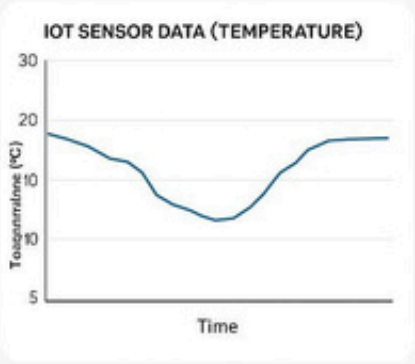
```
python CopyEdit

import requests



def send_forecast_to_erp(product_id, forecast_value): url =
"https://erp.company.com/api/update_forecast" payload = {

'product_id': product_id, 'forecast': forecast_value

}

headers = {'Authorization': 'Bearer YOUR_API_KEY'}

response = requests.post(url, json=payload, headers=headers) return response.status_code
```

1. **IoT Data Processor (Python)**

This code subscribes to an MQTT broker to receive real-time IoT data from sensors in the warehouse.

```
python CopyEdit import json

import paho.mqtt.client as mqtt



def on_message(client, userdata, message): data = json.loads(message.payload)
print(f"Received data: {data}")



client = mqtt.Client() client.on_message = on_message

client.connect("iot.broker.local", 1883) client.subscribe("warehouse/temperature")
client.loop_forever()
```


ACTUAL VS PREDICTED DEMAND
800
600
400
200
20
0
Time Period


IOT SENSOR DATA (TEMPERATURE)
30
20
10
10
5
Time


SUPPLY CHAIN DASHBOARD
AI Insights
Demand Forecast
Inventory Sta.
Stockout Risk
Moderate
Shipment Tracking
In Transit