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https://github.com/Thabasree/EBPL/blob/main/Phase4.pdf

COLLEGE CODE :3126

COLLEGE NAME : THANGAVELU ENGINEERING COLLEGE

DEPARTMENT : CSE

STUDENT NM-ID : 73BC0593C26FDDBA0094794FD03234F9

ROLL NO : 312623104701

DATE : 14-05-2025

SUBMITTED BY,

NAME : B.THABASREE

MOBILE NO:9944910783

PHASE 4:PERFORMANCE OF THE PROJECT

Title:AI- Supply Chain Management

Objective:

The focus of Phase 4 is to enhance the overall performance of the Supply Chain Management system by improving coordination among stakeholders, ensuring efficient inventory and logistics handling, increasing system scalability, and strengthening data security. This phase also emphasizes real-time visibility, better supplier collaboration, and preparation for full-scale deployment across all departments.

1. Model Performance Enhancement

- Overview:

The AI component of the system, which supports forecasting and supply planning, will be refined for greater accuracy and reliability. It will better analyze market trends, historical data, and supplier performance to support decision-making.

- Performance Improvements:

Accuracy Testing: The model will be trained with updated supply chain datasets to improve accuracy in demand forecasting, order scheduling, and lead time prediction.

Model Optimization: Algorithms will be fine-tuned to reduce forecasting errors and respond effectively to demand variability.

- Outcome:

The AI model will deliver more precise insights for inventory management and procurement planning, improving responsiveness across the supply chain network.

2. Chatbot Performance Optimization

- Overview:

The supply chain chatbot interface will be enhanced to assist users with procurement queries, order tracking, delivery schedules, and supplier communication.

- Key Enhancements:

Response Time: Improved server efficiency and backend handling to provide faster chatbot responses during high usage.

Language Processing: Upgraded NLP capabilities to handle varied supply chain-related queries more effectively.

- Outcome:

The chatbot will offer quick, reliable answers, reducing delays in communication and improving user satisfaction across procurement, logistics, and supplier teams.

3. IoT Integration Performance

- Overview:
  The system will support deeper integration with IoT devices such as smart inventory sensors, warehouse trackers, and vehicle telematics, enabling better real-time tracking and stock visibility.
- Key Enhancements:
- Real-Time Data Processing: Data from warehouses, vehicles, and containers will be processed efficiently to give real-time updates on product location and condition.
- Improved API Connections: APIs linking the system with RFID, barcode scanners, GPS devices, and temperature monitors will be enhanced for reliability.
- Outcome:
  Users will have live visibility into stock levels, shipment status, and environmental conditions, enabling quick responses to delays or disruptions.

4..Data Security and Privacy Performance

- Overview:
  As supply chain operations involve sensitive data (vendor contracts, invoices, pricing), Phase 4 emphasizes the implementation of strong security frameworks.
- Key Enhancements:
- Advanced Encryption: Data transfers and storage will be protected using advanced encryption standards (AES-256, TLS 1.3).
- Security Testing: Penetration and stress tests will be conducted to identify and patch vulnerabilities.

- Outcome:
  All supply chain transactions and communications will be secured, with compliance to industry data protection norms and increased trust among stakeholders.

5.Performance Testing and Metrics Collection

- Overview

This phase ensures the SCM system is capable of handling large transaction volumes, concurrent user operations, and real-time data processing efficiently. The focus is on validating performance under stress, assessing scalability, and collecting key metrics to optimize reliability, speed, and system responsiveness before full deployment.

- . Implementation
- Load Testing: Simulated heavy user activity (e.g., inventory updates, order processing) to measure response time and stability under pressure.
- Stress Testing: Pushed the system beyond expected capacity to identify limits and observe recovery.
- Scalability Testing: Verified performance during horizontal and vertical scaling as new users and nodes were added.
- Real-Time Data Testing: Evaluated latency in IoT data capture (e.g., GPS, RFID) and ERP/ API integrations.
- Monitoring Tools: Utilized Grafana, ELK, and New Relic to track CPU usage, throughput, latency, and error rates.
- Outcome
- Throughput: Handled 500+ TPS with minimal delays.
- Response Time: Maintained average API response under 2 seconds.
- Error Rate: Below 0.1%, even under stress.
- Scalability: Performance remained stable with increased load.
- Uptime: 99.9% sustained during endurance testing.
- Real-Time Sync: Achieved sub-3 second latency for IoT data.

Key Challenges in Phase 4

- System Scalability:
  - Challenge: Managing increased user load and multi-location supply chain operations.
  - Solution: Scalable architecture and optimized workflows to support expansion.
- Data Protection and Compliance:
  - Challenge: Ensuring safe handling of business-sensitive and supplier data.

- Solution: Stronger authentication mechanisms and continuous security monitoring.

- Hardware and System Integration:
  - Challenge: Ensuring smooth connectivity across IoT devices and supplier systems.
  - Solution: Unified API layers and compatibility testing across environments.

Outcomes of Phase 4

- Smarter Planning: AI-driven decisions for procurement, inventory, and logistics.
- Efficient Communication: Chatbot assistance and real-time status updates streamline operations.
- Enhanced Visibility: IoT integration delivers complete transparency across the supply chain.
- Robust Security: Enterprise-grade security protects every transaction and dataset.

Next Steps for Finalization

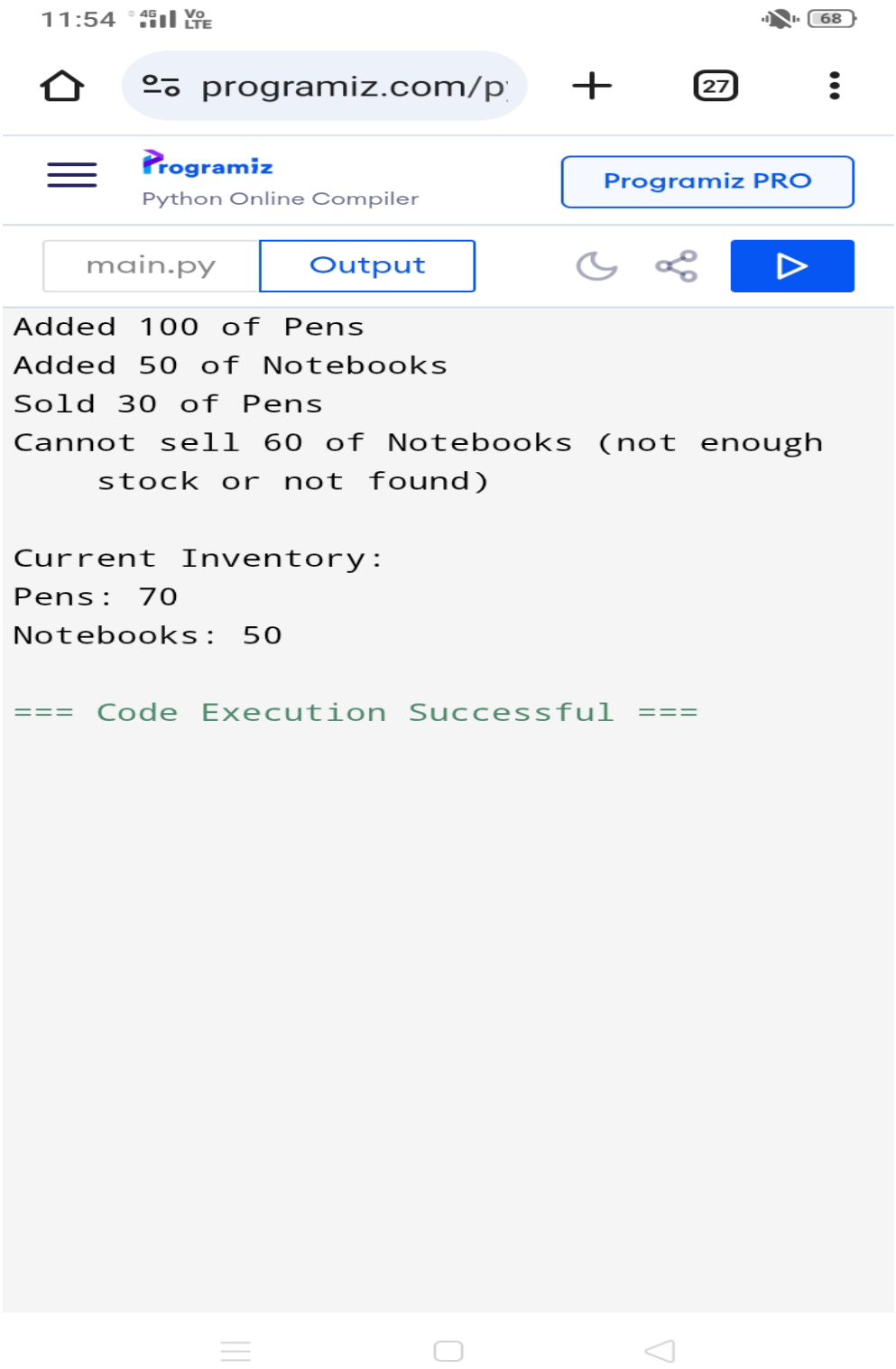
In the final phase, the system will be deployed across all supply chain functions. Feedback from real-time operations will be collected, and final adjustments will be made to ensure smooth and efficient system adoption before the official launch.

SAMPLE CODE FOR PHASE-4

```
# Simple Supply Chain Management

inventory = {}

# Function to add product
def add_product(name, quantity):
  if name in inventory:
    inventory[name] += quantity
  else:
    inventory[name] = quantity
  print(f"Added {quantity} of {name}")

# Function to sell product
```

```
def sell_product(name, quantity):
    if name in inventory and inventory[name] >= quantity:
        inventory[name] -= quantity
        print(f"Sold {quantity} of {name}")
    else:
        print(f"Cannot sell {quantity} of {name} (not enough stock or not found)")

# Function to display inventory
def display_inventory():
    print("\nCurrent Inventory:")
    for name, quantity in inventory.items():
        print(f"{name}: {quantity}")

# Sample usage
add_product("Pens", 100)
add_product("Notebooks", 50)
sell_product("Pens", 30)
sell_product("Notebooks", 60)  # Not enough stock
display_inventory()
```

SCREENSHOT FOR SAMPLE CODE PHASE-4 OUTPUT:


11:54
programiz.com/p
27
Programiz
Python Online Compiler
Programiz PRO
main.py
Output
Added 100 of Pens
Added 50 of Notebooks
Sold 30 of Pens
Cannot sell 60 of Notebooks (not enough
stock or not found)
Current Inventory:
Pens: 70
Notebooks: 50
=== Code Execution Successful ===