

Smart Supply Chain Cost Analytics and Profit Prediction System for Micro-SMEs



R26-IT-026

Information Technology (IT)
Sri Lanka Institute of Information Technology

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PROPOSAL FEEDBACK AND IMPROVEMENTS

PROPOSAL FEEDBACK :

1. **Need stronger research novelty.**
2. **Need practical SME-focused solution.**
3. **Limited analytical capabilities in initial design.**
4. **Need clear AI/ML integration.**
5. **Need better system scalability.**
6. **Need improved commercialization strategy.**

IMPROVEMENTS MADE

1. **Added 4 advanced analytical novelty modules.**
2. **Developed a complete mobile POS system.**
3. **Integrated forecasting and analytics features.**
4. **Added smart recommendation functionality.**
5. **Implemented scalable Node.js + MongoDB architecture.**
6. **Added commercialization and SME business model.**

PROBLEM, IMPACT AND BENEFICIARIES

Main Problems Faced by SMEs :

- SMEs use traditional POS systems.
- No future demand prediction.
- Difficult to track profits and costs.
- Inventory wastage happens frequently.
- No customer behavior analysis.
- No smart product recommendations.

Impact / Gravity of the Problem :

- Financial losses increase.
- Product wastage becomes higher.
- Stock shortages affect sales.
- Poor business decisions occur.
- Customer satisfaction decreases.
- Business growth becomes slower.

PROBLEM, IMPACT AND BENEFICIARIES

Beneficiaries :

- Bakery owners
- Café owners
- Small retail businesses
- Business managers
- Cashiers and staff
- Customers

RESEARCH GAP AND PROPOSED SOLUTION

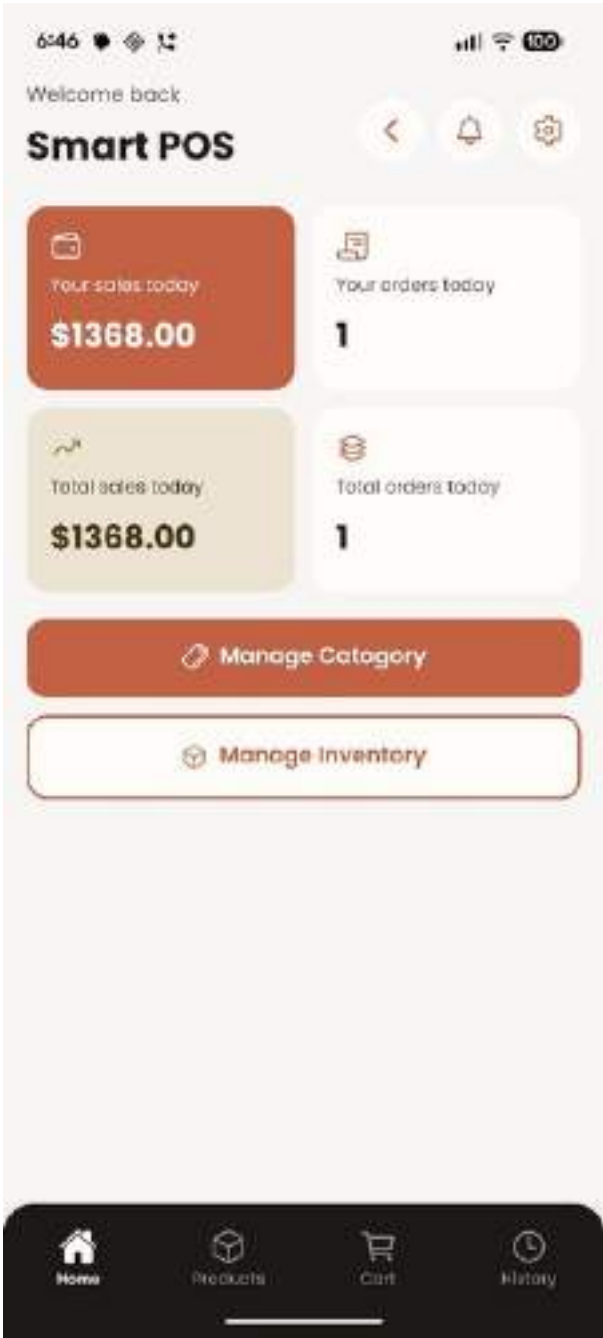
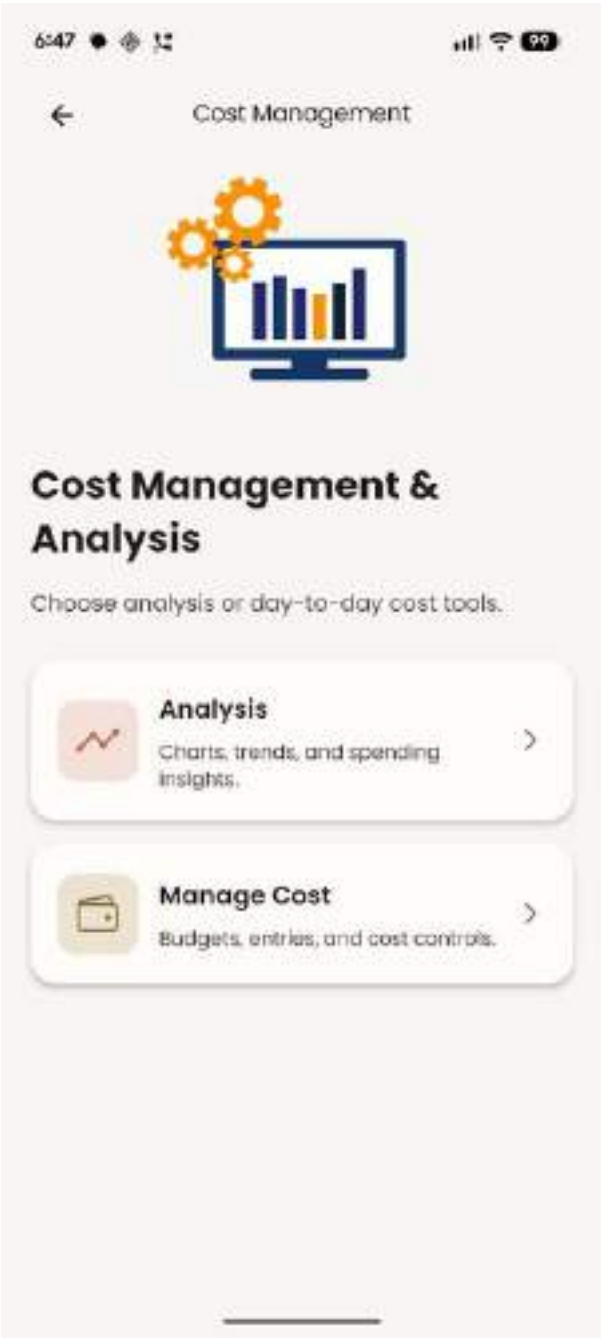
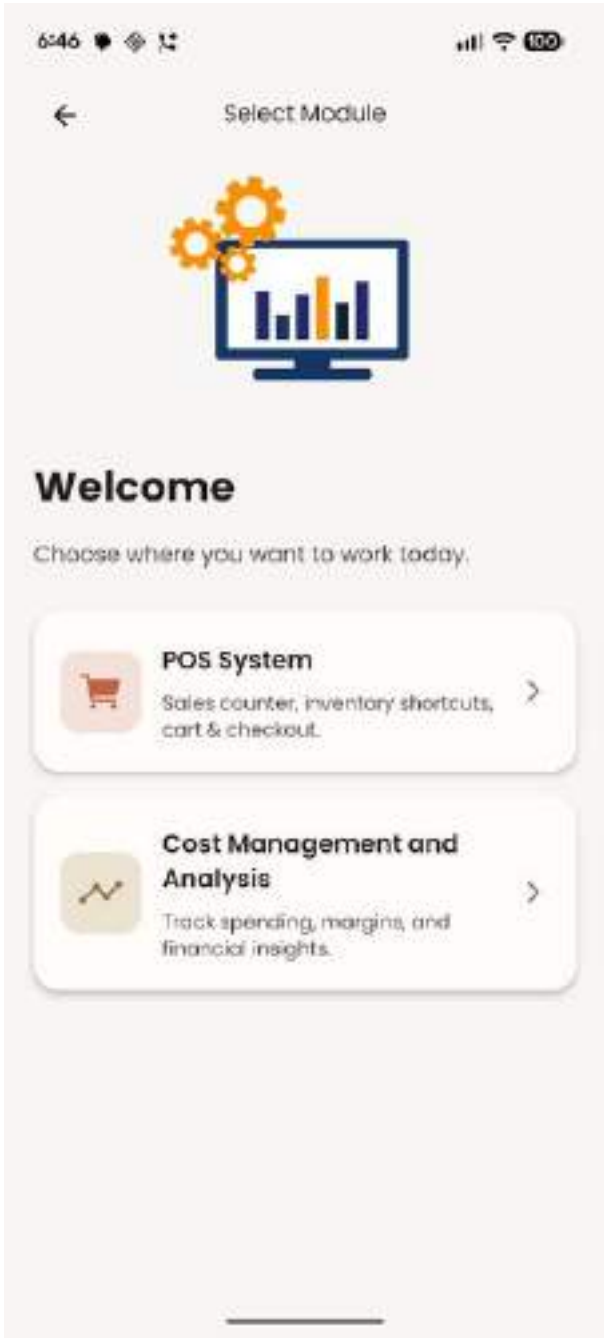
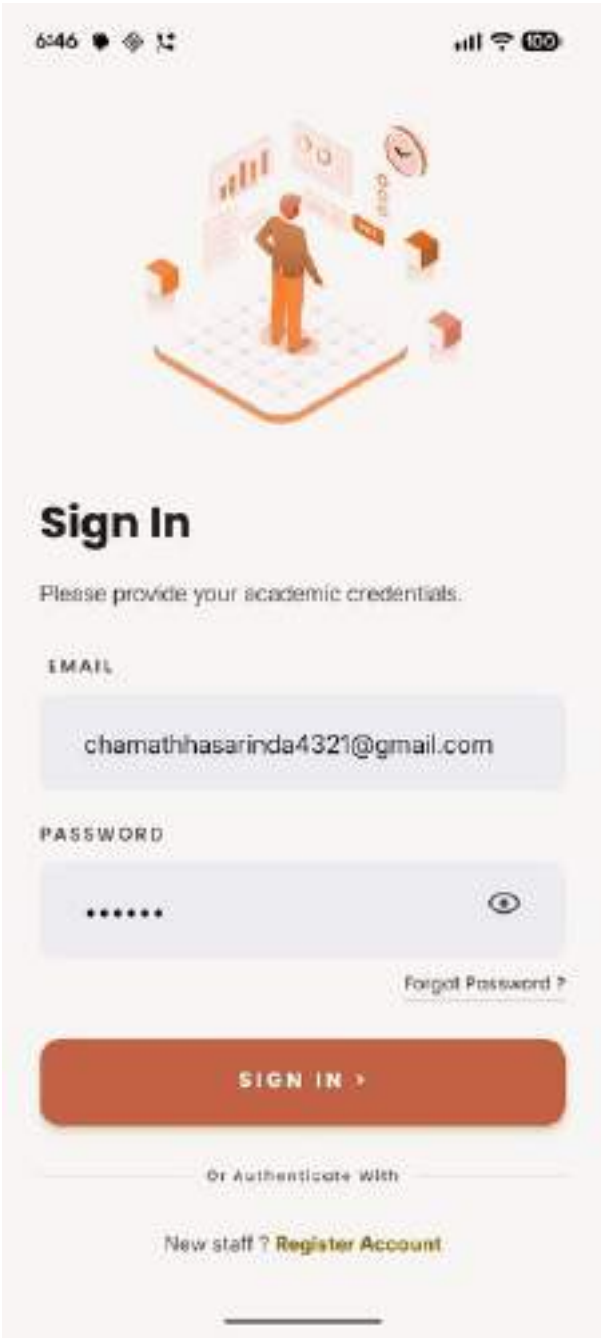
Research Gap :

- Existing POS systems only manage transactions.
- Most SME systems lack AI-based forecasting.
- Customer purchasing patterns are underutilized.
- Traditional systems provide limited business insights.
- No integrated platform for analytics and POS.
- Real-time recommendation features are rarely available for SMEs.

Proposed Solutions :

- Develop an AI-powered Smart POS system for SMEs.
- Predict future product demand using forecasting models.
- Analyze customer behavior and sales patterns.
- Generate smart product recommendations during checkout.
- Provide real-time business insights and dashboards.
- Improve decision-making using data-driven analytics.

OVERALL SYSTEM DESIGN EXCELLENCE



Video Demo

SmartCost POS



System blueprint



AI-Powered
Business Intelligence

Inventory
Balancing

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Business Performance Prediction System



BUSINESS PERFORMANCE PREDICTION SYSTEM

- Predict future product cost and sales.
- Analyze ingredient cost variations.
- Estimate future profit and margin.
- Generate intelligent risk alerts.
- Support data-driven business decisions.
- Improve financial planning for SMEs.

HOW SOLUTION ADDRESSES SUB PROBLEM / PROTOTYPE

- Predicts future product demand using sales data
- Analyzes ingredient cost fluctuations
- Estimates future profit and margin
- Generates intelligent financial alerts
- Displays real-time analytics dashboards
- Supports proactive business decision-making
- Reduces operational and financial risks
- Improves inventory and production planning

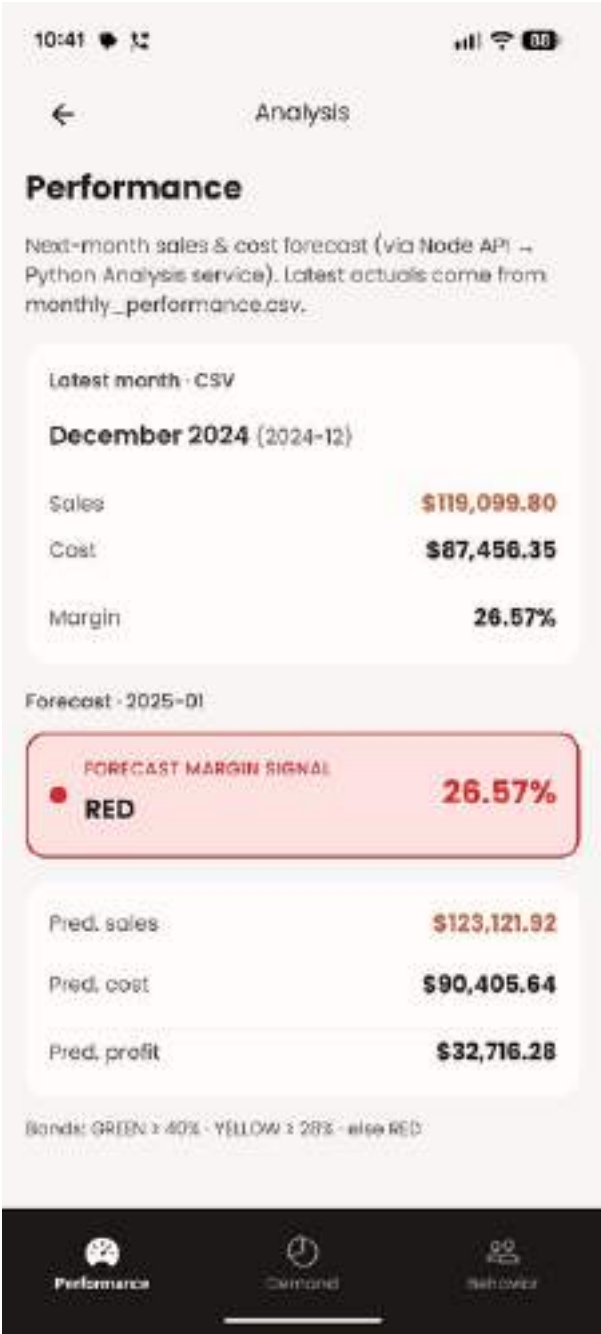
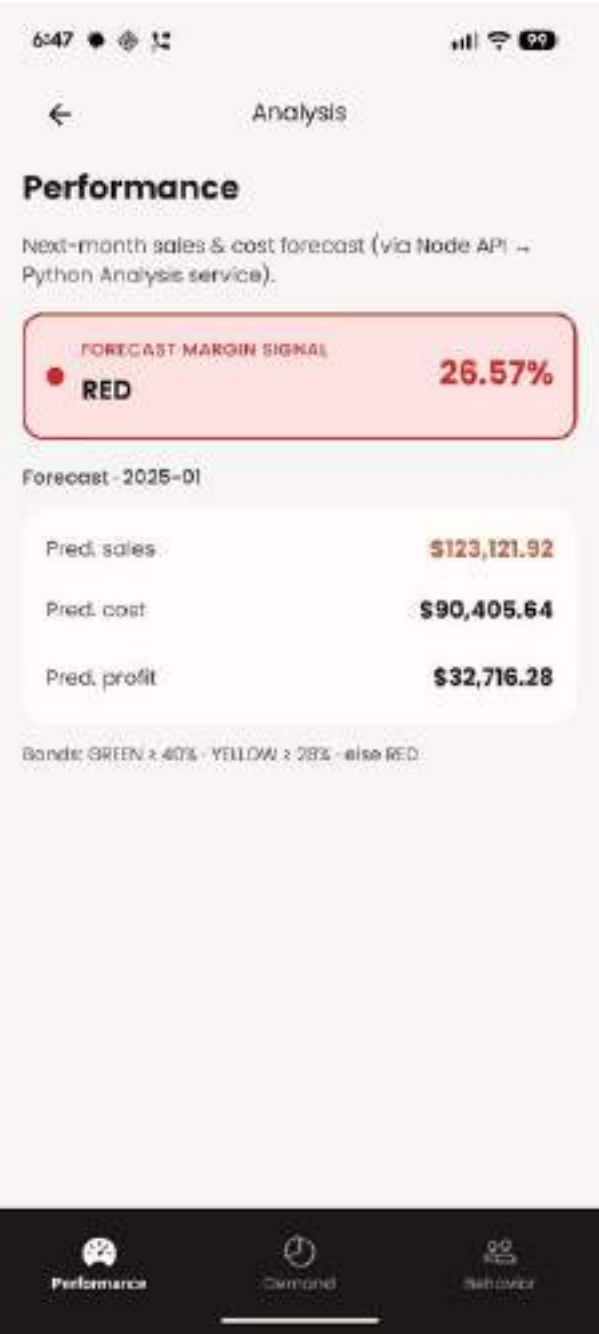
USER REQUIREMENTS ADDRESSED

- **Real-time sales and cost tracking**
- **Future demand and profit prediction**
- **Smart financial alert generation**
- **Improved inventory management**
- **Faster data-driven business decisions**

DESIGN EXCELLENCE / CONTRIBUTION

- Integrated POS, cost management, and AI analytics in one platform
- Developed intelligent profit and business performance prediction system
- Implemented real-time forecasting and financial alert mechanisms
- Designed scalable hybrid architecture using Node.js, Python, and MongoDB
- Enhanced SME decision-making through predictive analytics and business intelligence

PROTOTYPES



CURRENT PROGRESS

Component	Current PP1 Progress	Evidence
Sales & Cost Dataset Preparation	Created business sales and cost dataset with weekly profit and expense records for performance analysis	Excel dataset / preprocessing workflow
Business Performance Prediction Model	Implemented forecasting model to predict future business profit, revenue, and performance trends	Prediction outputs / forecasting charts
Profit & Risk Analysis	Developed profit analysis and risk alert mechanism to identify possible financial declines and margin reductions	Profit graphs / alert outputs
System Integration	Connected business prediction workflow with backend APIs and analytics dashboard for real-time performance monitoring	API responses / dashboard UI / architecture workflow

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**Customer Behavior
Analysis & Sales Insights**



Customer Behavior Analysis & Sales Insights

- Analyze customer purchasing behavior using POS data.
- Identify top-selling and slow-moving products.
- Detect peak sales hours and business trends.
- Generate real-time sales insights and analytics.
- Support data-driven marketing and inventory decisions.
- Improve operational efficiency for SMEs.

HOW SOLUTION ADDRESSES SUB PROBLEM

- Identifies top-performing products
- Detects slow-moving inventory items
- Analyzes peak sales periods
- Generates sales trend reports
- Provides visual analytics dashboards
- Supports smarter inventory decisions
- Improves customer behavior understanding

USER REQUIREMENTS ADDRESSED

- **Real-time sales insights**
- **Product performance analysis**
- **Peak sales time identification**
- **Better inventory monitoring**
- **Faster business decision-making**

DESIGN EXCELLENCE / CONTRIBUTION

- Developed intelligent sales analytics module for SMEs
- Implemented customer behavior pattern analysis using POS data
- Generated real-time business insights and trend visualizations
- Integrated analytics dashboards with mobile POS system
- Improved operational planning through data-driven insights

PROTOTYPES

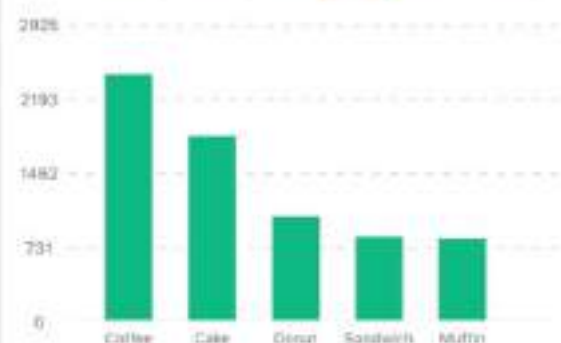
Sales Insights

Real-time POS Analytics

PDF Save

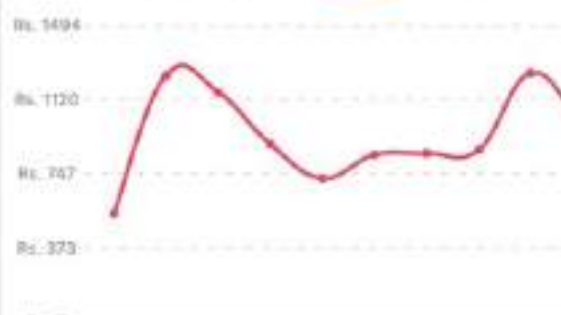
Top-Selling Products

1D 3D 7D 2W 1M 6M 1Y



Sales Trend

1D 3D 7D 2W 1M 6M 1Y



Peak Sales Hours

Busiest times of the day

1D 3D 7D 2W 1M 6M 1Y



Top Items per Period

Morning Segment (2802 total)

Coffee	904 sold
Cake	641 sold
Donut	380 sold

Afternoon Segment (2876 total)

Coffee	895 sold
Cake	716 sold
Donut	393 sold

Evening Segment (2077 total)

Coffee	638 sold
Cake	478 sold
Donut	266 sold

Coffee	638 sold
Cake	478 sold
Donut	266 sold
Sandwich	244 sold
Muffin	239 sold
Tea	212 sold

Slow-Moving Products

Items needing attention

1D 3D 7D 2W 1M 6M 1Y

Tea	Rs. 1940.00 revenue	776 sold
Muffin	Rs. 2475.00 revenue	825 sold
Sandwich	Rs. 4635.60 revenue	843 sold
Donut	Rs. 2076.00 revenue	1039 sold
Cake	Rs. 7340.00 revenue	1835 sold

Sales Data

+ Manual Entry

Advanced Filters

09/05/2026, 20:53:02 Rs. 11.00

4 Items (Donut, Coffee)

Edit Delete

09/05/2026, 20:33:02 Rs. 11.00

3 Items (Donut, Sandwich, Coffee)

Edit Delete

09/05/2026, 19:56:02 Rs. 20.50

6 Items (Muffin, Coffee, Coffee, Cake)

Edit Delete

09/05/2026, 19:45:02 Rs. 26.00

6 Items (Sandwich, Cake, Coffee, Cake)

Edit Delete

09/05/2026, 19:12:02 Rs. 13.00

3 Items (Sandwich, Donut)

Insights History

2026-05-06 11:53

Delete

Top Product

Coffee

Peak Hour

Morning

Leading Customer Segment

Morning Coffee Buyers

2026-05-05 10:46 PM

Delete

Top Product

Butter cake

Peak Hour

Morning

Leading Customer Segment

Morning Coffee Buyers

2026-05-05 10:46 PM

Delete

Top Product

Coffee

Peak Hour

Morning

Leading Customer Segment

Morning Coffee Buyers



Dashboard



Orders



History



Dashboard



Orders



History



Dashboard



Orders



History



Dashboard



Orders



History



Dashboard



Orders



History

CURRENT PROGRESS

Component	Current PP1 Progress	Evidence
Transaction Data Preparation	Collected and prepared sales transaction dataset for customer behavior and sales pattern analysis	Excel dataset / preprocessing workflow
Sales Pattern Analysis	Implemented analysis for top-selling products, slow-moving products, and category performance tracking	Sales reports / analytical charts
Peak Time & Trend Analysis	Developed time-based analysis to identify peak sales hours and customer purchasing trends	Trend graphs / dashboard outputs
System Integration	Connected analytics module with backend APIs and sales insights dashboard for real-time visualization	API responses / dashboard UI / architecture workflow

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Product Demand Prediction



Product Demand Prediction

- Predict future product demand using historical POS data.
- Analyze seasonal sales patterns and trends.
- Generate accurate short-term demand forecasts.
- Support inventory and production planning.
- Reduce product wastage and stock shortages.
- Improve operational efficiency for SMEs.



HOW SOLUTION ADDRESSES SUB PROBLEM / PROTOTYPE

- Predicts future product demand trends
- Identifies seasonal sales variations
- Reduces overproduction and wastage
- Supports accurate inventory planning
- Minimizes stock shortage risks
- Generates real-time forecasting insights
- Improves production decision-making



USER REQUIREMENTS ADDRESSED

- Future demand prediction capability
- Better inventory management
- Reduced product wastage
- Improved production planning
- Faster data-driven business decisions

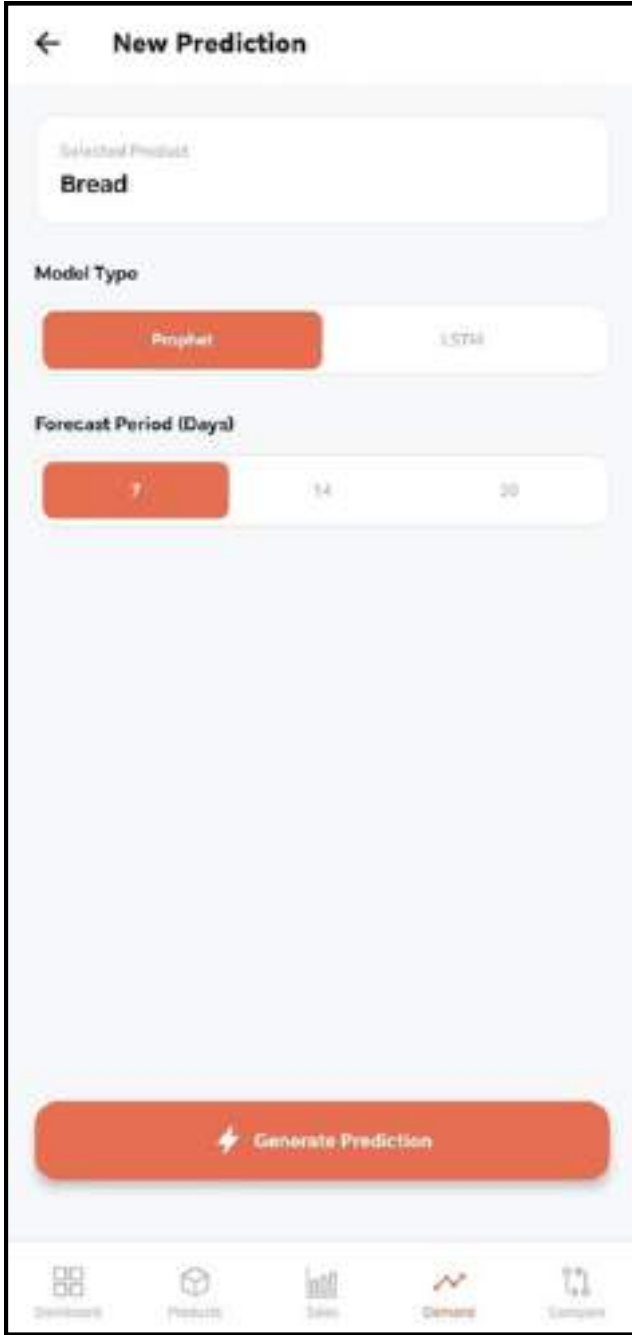
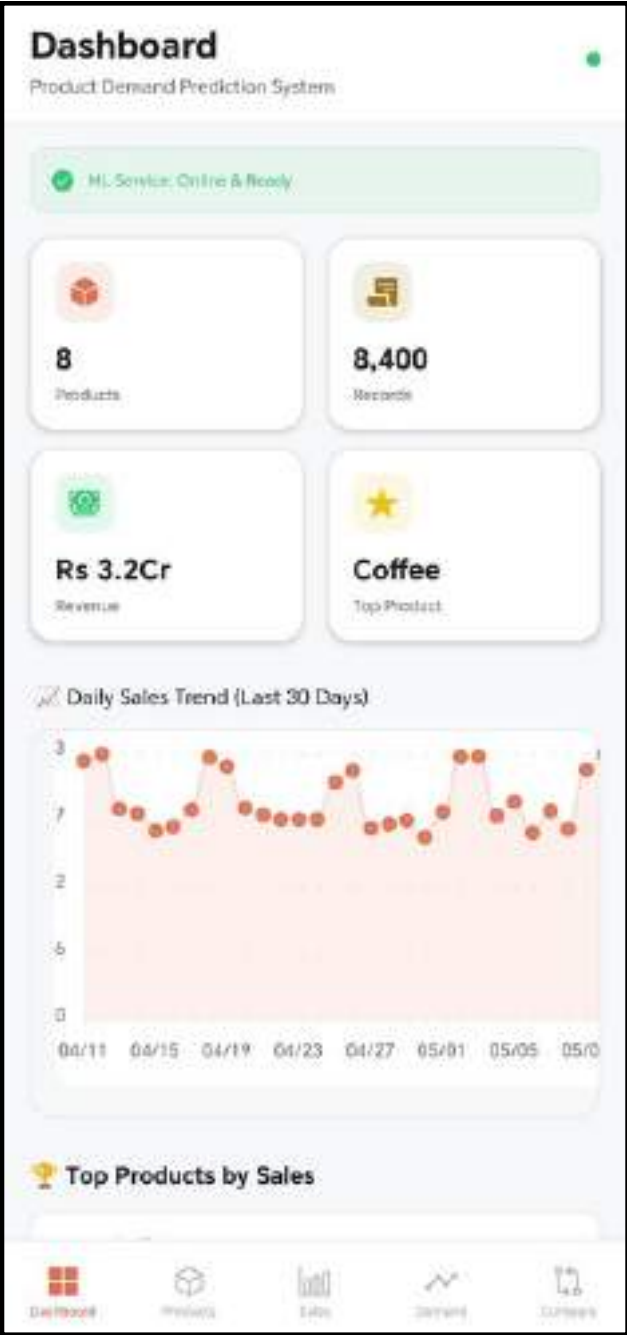


DESIGN EXCELLENCE / CONTRIBUTION

- Developed AI-based demand forecasting module for SMEs
- Implemented time-series forecasting using Prophet and ARIMA
- Generated real-time demand prediction insights
- Integrated machine learning analytics with POS system
- Improved operational planning through predictive analytics



PROTOTYPES



CURRENT PROGRESS

Component	Current PP1 Progress	Evidence
Dataset Preparation	Created large-scale bakery/café sales dataset with seasonal and weekly demand patterns for model training	Excel dataset / preprocessing workflow
Prophet Forecasting Model	Implemented and trained Prophet model for product demand forecasting with future prediction generation	Prediction outputs / forecasting charts
Neural Network Model	Developed and trained neural network (MLP/LSTM-style) model for demand prediction and accuracy evaluation	RMSE / MAE results / prediction graphs
System Integration	Connected ML prediction workflow with backend APIs and Demand Dashboard prototype for real-time forecasting	API responses / dashboard UI / architecture workflow

RISK MITIGATION

Risk	Mitigation
Lack of real SME bakery sales dataset	Use synthetic POS datasets and publicly available retail forecasting datasets for initial model training
Low prediction accuracy during early stages	Improve dataset quality, increase training data size, and tune forecasting model parameters
Model training or prediction service failures	Implement model retraining workflow, API error handling, and backup prediction models
Seasonal demand fluctuations affecting forecasts	Include weekly, monthly, and festive seasonal patterns in Prophet and neural network training

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Smart Order Recommendation System



Smart Order Recommendation System

- Analyze customer purchasing patterns from POS data.
- Identify frequently bought product combinations.
- Generate real-time product recommendations during checkout.
- Support cross-selling and upselling opportunities.
- Improve customer experience and sales performance.
- Enhance intelligent decision-making in SMEs.

HOW SOLUTION ADDRESSES SUB PROBLEM / PROTOTYPE

- Identifies frequently purchased product pairs
- Generates real-time checkout recommendations
- Supports cross-selling opportunities
- Improves average order value
- Reduces missed sales opportunities
- Enhances customer purchasing experience
- Provides intelligent recommendation insights

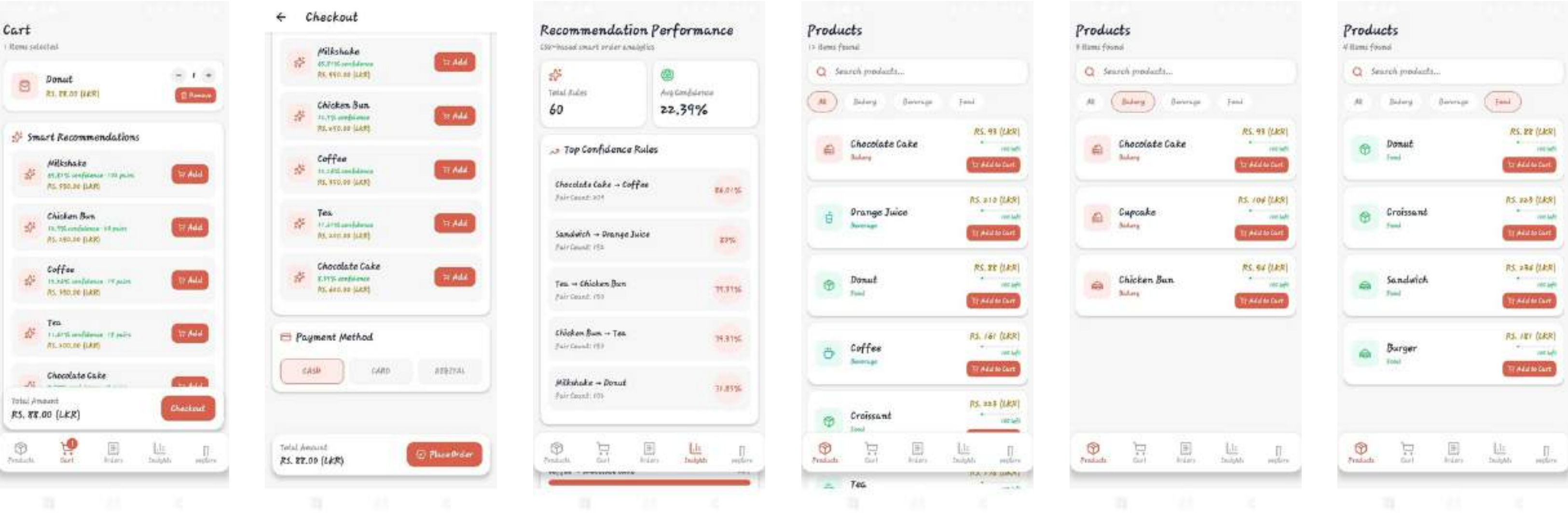
USER REQUIREMENTS ADDRESSED

- **Real-time product recommendations**
- **Faster checkout assistance**
- **Improved customer experience**
- **Increased sales opportunities**
- **Smarter POS transaction support**

DESIGN EXCELLENCE / CONTRIBUTION

- Developed intelligent recommendation module using transactional data
- Implemented association rule mining for product relationship analysis
- Generated real-time product suggestions during checkout
- Integrated recommendation engine with mobile POS system
- Improved SME sales performance through smart upselling strategies

PROTOTYPES



CURRENT PROGRESS

Component	Current PP1 Progress	Evidence
Transaction Dataset Preparation	Collected and prepared transactional order dataset for recommendation analysis and pattern identification	Excel dataset / preprocessing workflow
Association Rule Mining	Implemented association-based recommendation logic to identify frequently purchased product combinations	Recommendation outputs / rule analysis
Smart Recommendation Engine	Developed recommendation module to generate related product suggestions during checkout	Recommendation cards / prediction results
System Integration	Connected recommendation workflow with backend APIs and POS interface for real-time recommendation generation	API responses / POS UI / architecture workflow

Commercialization

Market Size

- Growing SME digital transformation market worldwide
- Increasing demand for AI-powered business analytics systems
- Large number of bakeries, cafés, and retail SMEs in Sri Lanka
- Rising adoption of mobile POS systems in small businesses
- SMEs increasingly require data-driven decision-making tools
- Untapped market for affordable AI-based POS solutions in South Asia

Commercialization

Customer Persona

- Bakery owners managing daily sales and inventory
- Café owners seeking smarter business insights
- Small retail shop owners using POS systems
- Business managers needing sales analytics and forecasting
- Cashiers requiring faster checkout and recommendation support
- SMEs looking for affordable AI-powered business tools

Commercialization

Unique Solution

- Combines POS operations with AI-powered analytics
- Provides demand forecasting for future sales prediction
- Generates real-time customer behavior insights
- Includes smart order recommendation during checkout
- Integrates business performance prediction with cost analysis
- No existing SME POS system combines all these AI features in one platform

Commercialization

Cost Recovery Model

1. **Subscription Model:** Monthly plans for SMEs to access POS and analytics features.
2. **Freemium Model:** Basic POS features free with premium AI analytics packages.
3. **Premium Analytics Plans:** Advanced forecasting, insights, and recommendation modules available as paid features.
4. **API Integration Services:** Provide API access for third-party POS and business platforms.
5. **SaaS Business Model:** Cloud-based system with scalable monthly or yearly subscription packages.

OVERALL RISK MITIGATION

- Regular database backups to prevent data loss.
- Input validation to reduce system errors.
- Secure API communication for data protection.
- Model retraining to improve prediction accuracy.
- Cloud-based scalable architecture for high performance.
- User authentication and access control for system security.

Thank You

