

Project Requirement Specification (PRS)

AI-Driven Smart Point of Sale (POS) Decision Support System

1. Introduction

1.1 Purpose

This document defines the functional and non-functional requirements of the AI-Driven Smart POS system.

The system enhances traditional billing software by integrating:

- Demand Forecasting
- Customer Segmentation
- Product Recommendation
- Decision Support Dashboard

It will help retailers take smarter, data-driven decisions.

1.2 Problem Overview

Traditional POS systems only store transactions and manage inventory.

They **cannot**:

- predict future demand
- analyze customer behavior
- recommend products
- provide intelligent reports

This leads to overstocking, stockouts, and missed sales opportunities

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1.3 Proposed Solution

An AI-powered POS assistant that uses:

- **HA-LSTM** → sales prediction
- **RFM + K-Means** → customer grouping
- **Apriori / Collaborative Filtering** → recommendations
- **Dashboard** → real-time insights

as described in both the report and presentation

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2. System Overview

2.1 System Users

- **Manager**
- **Cashier**
- **Admin (optional in implementation)**

2.2 Major Capabilities

- ✓ Billing
- ✓ Inventory updates
- ✓ Forecast future demand
- ✓ Identify loyal / risky customers
- ✓ Suggest cross-sell items
- ✓ Visual analytics

3. Functional Requirements

3.1 Authentication

- System shall allow login for cashier and manager.
- Role-based access must be applied.

3.2 Billing & Transactions

- Add / remove products.
- Generate invoice.
- Update stock automatically.
- Store transaction in database.

3.3 Inventory Management

- Show available quantity.
- Alert for low stock.
- Suggest reorder based on forecast.

3.4 Demand Forecasting (HA-LSTM)

System shall:

- use historical sales

- predict future product demand
- show daily / weekly / monthly trends

Managers will use this for purchasing decisions

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3.5 Customer Segmentation (RFM + K-Means)

System shall compute:

- Recency
- Frequency
- Monetary value

and group customers into types like:

- Loyal
- New
- At-risk

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3.6 Product Recommendation

When billing is happening:

- suggest related products
- identify frequently bought combinations

This supports cross-sell and up-sell

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3.7 Dashboard & Reports

Manager should see:

- predicted demand
- sales performance
- top products
- customer clusters

- recommendation insights

Cashier should see:

- customer purchase info
- suggested items

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4. Non-Functional Requirements

4.1 Performance

- Transaction time < **500 ms**

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- Dashboard update latency < **1 sec.**

4.2 Accuracy

- Prediction accuracy target \geq **90%**

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4.3 Usability

- Simple UI.
- Minimum training for cashier.

4.4 Reliability

- System should not lose transactions.
- Automatic data backup.

4.5 Maintainability

- Modular API design.
- Easy model retraining.

4.6 Security

- Role-based access.
 - Secure database.
 - Customer data privacy.
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5. Hardware Requirements

- Computer / Laptop
- Minimum **8 GB RAM**
- Intel i5 or higher
- SSD recommended

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6. Software Requirements

- Python 3.9
- Pandas, NumPy
- Scikit-learn
- TensorFlow / Keras
- FastAPI / Flask
- MySQL / PostgreSQL
- Streamlit (Dashboard)

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7. System Modules

Module 1 – Data Preprocessing

Cleaning, formatting, encoding.

Module 2 – Forecasting Engine

HA-LSTM training + prediction.

Module 3 – Customer Analytics

RFM computation + clustering.

Module 4 – Recommendation Engine

Apriori / collaborative filtering.

Module 5 – Visualization

Manager & cashier dashboard.

(Modules confirmed in PPT)

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8. Data Requirements

Input:

- Invoice ID
- Date
- Product
- Quantity
- Price
- Customer ID

Output:

- Forecast values
- Segment labels
- Recommended items

9. Constraints

- Dependent on data quality
- Real-time latency challenges
- Model drift risk
- Privacy compliance

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10. Future Enhancements

- Dynamic pricing
- ERP integration
- Deep learning personalization
- Mobile app