

Project: IoT-Based Smart Inventory & Warehouse Tracking System

Document Version: 1.2.0

Domain: Industrial Automation / Logistics

1. Purpose

This document defines the functional and technical requirements for the Smart Warehouse System, which uses IoT sensors and AI to track inventory levels, predict shortages, and automate restocking alerts.

2. Functional Requirements & Business Rules (BR)

- **BR_101 (Entry Log):** Every item entering the warehouse must be scanned via an RFID reader. The system must record the timestamp, item_id, and batch_number.
- **BR_102 (Stock Level Threshold):** Each category has a "Safety Stock" level. If the current stock drops below 20% of the maximum capacity, the system must trigger a REORDER_ALERT.
- **BR_103 (Temperature Control):** Perishable items (Category: FOOD) must be stored between 2°C and 8°C. If the IoT sensor reports a temperature outside this range for more than 15 minutes, a critical ENV_ALARM must be sent to the supervisor.
- **BR_104 (Priority Dispatch):** Orders must be fulfilled using the FEFO (First Expired, First Out) principle. The system must block any dispatch attempt of a newer batch if an older batch of the same product is available.

3. Data Processing & AI Requirements

- **AI_PRD_01 (Shortage Prediction):** The AI model shall analyze the last 6 months of dispatch data to predict potential stock-outs for the next 30 days.
- **AI_PRD_02 (Anomaly Detection):** The system must identify "Ghost Inventory" (items present in the database but not detected by RFID sweeps) and flag them with a DISCREPANCY_ERROR.

4. Technical Constraints (TR)

- **TR_201 (API Integration):** The system must interface with the GlobalERPProvider API. All data syncs must use OAuth 2.0 authentication.
- **TR_202 (Database Latency):** Inventory lookups must return results in less than 200ms to ensure real-time scanning at the loading docks.
- **TR_203 (Fail-Safe):** If the connection to the central server is lost, the local gateway must cache up to 10,000 transactions and sync them immediately upon reconnection.

5. User Roles & Permissions

Role	Permissions
Operator	Scan items, View stock levels, Generate labels.

Role	Permissions
Supervisor	Override FEFO blocks, Modify thresholds, View AI predictions.
Admin	Manage users, Database maintenance, API configurations.