Software Requirements Specification (SRS)

Software Requirements Specification (SRS) for Production Management Optimization System (PMOS)

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Project Title: Production Management Optimization System (PMOS) for SMEs
Change Log: v1.1 – Added MoSCoW prioritization, NFR IDs/categories, detailed input/output/validation, more Use Cases, Data Models, detailed interfaces/error handling, acceptance criteria for NFR.

This SRS defines the functional and non-functional requirements for the PMOS, a lightweight digital platform to automate production tracking, integrate HR attendance, and provide real-time KPI visibility for Vietnamese SMEs. It is based on stakeholder inputs, gap analysis, and feasibility studies, focusing on specific, testable requirements without repeating high-level business objectives from the BRD or Requirement Gathering Report.

1. Introduction

1.1 Purpose

The purpose of this SRS is to specify the software requirements for the PMOS in detail, serving as a reference for development, testing, and validation. It ensures the system meets user needs for real-time production data management while remaining affordable and scalable for SMEs. This document focuses on "what" the system must do, enabling implementation without ambiguity.

1.2 Scope

The PMOS will automate data collection, integrate departments, and provide dashboards for a single production line pilot, with scalability options.

In-Scope:

- Real-time tracking of production output, downtime, and defects via mobile/tablet input.
- Integration with HR attendance for shift allocation.
- Automated calculation and display of KPIs (OEE, productivity rate, defect ratio).
- Role-based access for unified data viewing across HR, Production, QC, and Management.
- Automated alerts for low output or extended downtime.
- Automatic generation of daily/weekly reports in PDF/Excel.

Out-of-Scope:

- Full ERP replacement or integration with external supplier/accounting systems.
- Predictive maintenance or AI features.
- Hardware upgrades (e.g., IoT sensors) beyond existing devices.
- Company-wide rollout (limited to pilot line).

1.3 Definitions, Acronyms, and Abbreviations

- **OEE (Overall Equipment Effectiveness):** Metric calculating availability × performance × quality.
- **KPI (Key Performance Indicator):** Measurable values like productivity rate (output/hour) or defect ratio (%).
- **PMS/PMOS:** Production Management (Optimization) System.
- **HR:** Human Resources.
- **QC:** Quality Control.
- **SME:** Small and Medium-sized Enterprise.

- **API:** Application Programming Interface.
- **LAN:** Local Area Network.

1.4 References

- Business Requirements Document (BRD) v1.0.
- Functional Requirements Document (FRD) v1.0.
- Non-Functional Requirements Document (NFRD) v1.0.
- Gap Analysis Report.
- AS-IS Process Analysis.
- Feasibility and Requirement Analysis.
- Requirement Gathering Report.
- Stakeholder Mapping & Analysis.
- Solution SET-UP Document.
- IEEE 830-1998: Recommended Practice for Software Requirements Specifications.

1.5 Overview

Section 2 provides an overall description of the product. Section 3 details specific requirements, including functional, non-functional, and interfaces. Appendices include traceability matrix and supporting tables.

2. Overall Description

2.1 Product Perspective

The PMOS addresses inefficiencies in manual production management for Vietnamese SMEs, such as paper-based tracking, disconnected departments, and delayed reporting. It transitions from fragmented Excel/paper processes to a centralized digital system, improving data accuracy by 25% and reducing reporting time by 70%. As a lightweight alternative to heavy ERPs, it uses low-cost tools for quick deployment and scalability.

2.2 Product Functions

The system will:

- Capture and synchronize production data in real time.
- Integrate HR attendance for automated shift planning.
- Calculate and visualize KPIs on dashboards.
- Generate automated reports and alerts.
- Provide role-based access for collaboration.

2.3 User Classes and Characteristics

User Class	Characteristics	Needs
Factory Manager	Oversees operations, high influence, needs KPI insights for decisions.	Real-time dashboards, alerts, reports.
Production Supervisor	Daily planning, medium experience with tools, needs fast data entry.	Mobile input, shift allocation, downtime logging.
HR Officer	Attendance management, medium tech skills, needs data sync.	Integration with existing HR tools, payroll alignment.
QC Staff	Quality checks, low-medium tech, needs defect tracking.	Digital logging, trend analysis.
Operators/Line Leaders	Task execution, minimal digital experience, needs simple interface.	Tablet-based input, usability focus.

User Class	Characteristics	Needs
IT Support/Vendor	Technical setup, high skills, needs maintainability.	API integration, low-maintenance design.
CEO/SME Owner	Strategic oversight, high influence, needs ROI metrics.	High-level summaries, scalability.

2.4 Operating Environment

- **Hardware:** Android tablets/mobiles (e.g., Samsung Tab A, Lenovo M10), standard PCs.
- **Software:** Web-based with mobile responsiveness; compatible with Chrome, Edge; offline mode for data entry.
- **Network:** LAN or cloud (Google Cloud/Viettel Cloud); stable internet for sync, with auto-reconnect.
- **OS/Browser:** Android 10+, Windows 10+; modern browsers.

2.5 Design and Implementation Constraints

- Use low-code tools (Odoo, Google AppSheet, Power BI) for development.
- Budget limited to 35-55 million VND for pilot.
- Compliance with Vietnamese Decree 13/2023 (data protection) and ISO 9001 principles.
- No new hardware beyond affordable tablets; support existing infrastructure.

2.6 Assumptions and Dependencies

- Assumptions: Users complete 2-3 hour training; stable LAN/internet available; departments adopt digital over manual processes.
- Dependencies: HR provides attendance data via API/Excel; IT handles integration; management approves access policies.

3. Specific Requirements

3.1 External Interface Requirements

3.1.1 User Interfaces

- Intuitive, responsive UI for mobile/tablet/desktop.
- Simple forms for data entry (e.g., dropdowns for downtime reasons).
- Dashboards with visual charts (e.g., line graphs for trends).
- Multilingual support (Vietnamese/English).

3.1.2 Hardware Interfaces

- Compatible with Android tablets/mobiles for input.
- No direct hardware integration (e.g., no PLC sensors in phase 1).

3.1.3 Software Interfaces

- HR attendance import: Via POST /api/hr-attendance (JSON payload: {EmployeeID: string, Date: YYYY-MM-DD, Status: enum[Present/Absent]}); file format Excel (.xlsx, columns: EmployeeID, Date, ShiftStart, ShiftEnd, Status); error handling: Invalid file/format → return error message "Invalid Excel format – missing column X", log error, allow retry.
- Export reports: To PDF/Excel via GET /api/reports?type=pdf/excel&date=YYYY-MM-DD.
- Dashboard integration: With Power BI/Google Data Studio via OData feed.

3.1.4 Communications Interfaces

- Alerts via Zalo API (POST /zalo/alerts), email (SMTP), or in-app (WebSocket); secure HTTPS.

- Data sync over LAN/cloud with auto-save every 2 minutes; error handling: Connection fail → offline mode, retry every 1 min.

3.2 Functional Requirements

Functional requirements are grouped by module, with IDs for traceability. Each includes description, inputs/outputs/validation, Pre/Post-Conditions, and Priority (MoSCoW).

ID	Requirement	Description	Inputs/Outputs/Validation	Pre-Conditions	Post-Conditions	Priority
FR-01	Production Data Tracking	System shall record output, defect counts, downtime per shift/machine.	Inputs: Output (integer >0), DefectCount (integer ≥0), DowntimeMin (integer ≥0). Outputs: Stored record ID. Validation: Output >0 (error: "Output must be positive"); format: integers only.	User logged in as Supervisor/Operator.	Data synced to database; KPI updated.	Must
FR-02	HR Attendance Integration	System shall import attendance data and map to shifts.	Inputs: Via API/Excel (see 3.1.3). Outputs: Mapped shifts list. Validation: Check duplicate EmployeeID (error: "Duplicate entry").	HR data available.	Shifts auto-assigned; alerts for mismatches.	Must
FR-03	Downtime Logging	System shall log downtime with reasons.	Inputs: Reason (dropdown: 5 types – Maintenance, Material Delay, Operator Issue, Machine Failure, Other), DurationMin (integer ≥0). Outputs: % Downtime calculated (Duration/ShiftLength *100). Validation: Reason required; Duration >0.	Downtime event triggered.	Percentage calculated; alert if >30 min.	Must
FR-04	Defect Logging	System shall log defects tied to batch/shift/operator.	Inputs: DefectType (dropdown: 5 types – Scratch, Breakage, Misassembly, Color Error, Other), Count (integer ≥0). Outputs: Defect ratio (%). Validation: Count ≥0.	QC user logged in.	Defect ratio updated; trends visualized.	Should
FR-05	KPI Calculation	System shall auto-calculate OEE, productivity rate, defect ratio.	Inputs: From FR-01/03/04. Outputs: OEE (float 0-100), Productivity (output/hour, float), DefectRatio (%, float). Validation: All inputs present.	Data entered.	Metrics displayed on dashboard.	Must
FR-06	Dashboard Visualization	System shall display real-time KPIs with filters.	Inputs: Filter (date: YYYY-MM-DD, shift: enum[Morning/Afternoon]). Outputs: Charts (line/bar). Validation: Valid date range.	User logged in.	Charts refreshed every 5 minutes.	Must
FR-07	Automated Reports	System shall generate daily/weekly reports.	Inputs: Date range. Outputs: PDF/Excel file. Validation: Date valid.	Shift data complete.	Reports emailed/exported.	Should
FR-08	Alerts and Notifications	System shall send alerts for thresholds.	Inputs: Threshold check. Outputs: Notification text. Validation: Threshold met.	Threshold met.	Notification via Zalo/email.	Should

ID	Requirement	Description	Inputs/Outputs/Validation	Pre-Conditions	Post-Conditions	Priority
FR-09	Role-Based Access	System shall enforce permissions.	Inputs: User role. Outputs: Access granted/denied. Validation: JWT token valid.	User authenticated.	Access logged.	Must
FR-10	Unified Data Platform	System shall synchronize data across departments.	Inputs: Data update. Outputs: Synced view. Validation: No conflicts.	Data updated in one module.	Visible to authorized users.	Must

Example Use Case for FR-03 (Downtime Logging):

- **Actor:** Supervisor.
- **Pre-Condition:** Logged in, downtime event started.
- **Main Flow:** 1. Select machine/shift. 2. Input reason (dropdown) and duration. 3. System validates (duration >0). 4. Calculate % downtime. 5. Submit and sync.
- **Alternative Flow:** Custom reason if "Other" selected → free text field.
- **Exception Flow:** Invalid duration → error "Duration must be positive", retry.
- **Post-Condition:** Log saved; alert if >30 min; KPI updated.

Additional Use Case for FR-02 (HR Integration):

- **Actor:** System (automated).
- **Pre-Condition:** HR data uploaded.
- **Main Flow:** 1. Parse Excel/API. 2. Map EmployeeID to shifts. 3. Validate format. 4. Assign shifts.
- **Alternative Flow:** Partial data → process available, flag missing.
- **Exception Flow:** File error → log "Invalid format", notify HR, no import.
- **Post-Condition:** Shifts updated; mismatch alert sent.

3.3 Non-Functional Requirements

Each NFR has ID, description, measurable criteria/acceptance, and Priority.

ID	Category	Description	Measurable Criteria/Acceptance	Priority
NFR-PERF-01	Performance	Response time for interactions.	≤3 seconds for 95% (e.g., dashboard load); testable via load testing tool.	Must
NFR-PERF-02	Performance	Concurrent records handling.	1,000/hour peak; acceptance: No crash under simulation.	Must
NFR-SCALE-01	Scalability	User/data growth.	Handle 2x users/data without >10% slowdown; testable by scaling test.	Should
NFR-SEC-01	Security	Data encryption.	Encrypt at rest/transit using AES-256; acceptance: Audit log verifies encryption, penetration test passes.	Must
NFR-SEC-02	Security	Authentication.	Role-based JWT; acceptance: Unauthorized access denied in tests.	Must
NFR-USAB-01	Usability	Interface simplicity.	New users complete tasks <15 min post-training; acceptance: SUS score ≥80.	Must
NFR-RELI-01	Reliability	Uptime and recovery.	≥99%; backup/restore <30 min; acceptance: MTTR <30 min in failover test.	Must
NFR-MAINT-01	Maintainability	Updates.	<30 min without downtime; acceptance: Deploy test succeeds.	Should
NFR-PORT-01	Portability	Platform switching.	Run on Android/Windows; switch cloud/on-premise <1 day; acceptance: Migration test.	Could

ID	Category	Description	Measurable Criteria/Acceptance	Priority
NFR-INTER-01	Interoperability	Integration beyond HR.	Compatible with future ERP via REST API; acceptance: Mock integration test.	Should
NFR-EFF-01	Efficiency	Resource usage.	<50% CPU/memory peak on standard server; acceptance: Monitoring tool confirms.	Should
NFR-COMPL-01	Compliance	Data protection.	Adhere to Decree 13/2023; acceptance: Compliance audit passes.	Must

3.4 Database Requirements (Data Models)

System uses a relational database (e.g., PostgreSQL/MySQL). Key entities:

- **Shift Entity:** Fields: ShiftID (PK, integer), Date (date), OperatorID (FK, string), MachineID (FK, string), Output (integer >0), DefectCount (integer ≥0), DowntimeMin (integer ≥0), Status (enum[Active/Completed]).
- **Attendance Entity:** Fields: AttendanceID (PK, integer), EmployeeID (string), Date (date), Status (enum[Present/Absent/Late]), ShiftAssigned (FK, ShiftID).
- **Defect Entity:** Fields: DefectID (PK, integer), Type (enum[Scratch/Breakage/Misassembly/ColorError/Other]), Count (integer ≥0), BatchID (FK, string), ShiftID (FK).
- **Relationships:** One-to-Many (Shift → Defect/Attendance); ERD (text): Shift --< Defect; Shift --< Attendance.

Appendix A: Traceability Matrix

Req ID	Source (e.g., Gap/Interview)	Testable? (Acceptance)
FR-01	Gap Analysis #3, Production Supervisor Interview	Yes – Validate output >0 via unit test.
NFR-PERF-01	Feasibility Assessment, NFRD	Yes – Load test <3s.
... (full for all)	...	...

Appendix B: Supporting Tables

- From Solution SET-UP: System Components (summarized).
- From Gap Analysis: AS-IS vs TO-BE (key gaps only for reference).