

Comprehensive Technical Architecture and Operational Framework of the SUMASYS Supply Management System

The Supply Management System, professionally known as SUMASYS, is a centralized, web-based Laboratory Information Management System (LIMS) extension specifically developed to optimize the inventory lifecycle of reagent items and microbiological media at the Kalbe Nutritionals Analytical Center (QAAC).¹ SUMASYS was engineered to address critical operational inefficiencies in manual stock monitoring, such as the lack of real-time visibility, absence of minimum stock alerts, and high deadstock values, which reached approximately Rp 694 million in 2024.¹ By transitioning from decentralized spreadsheets to an integrated digital ecosystem, SUMASYS provides a single source of truth for inventory management, ensuring data integrity through barcode-driven transactions and automated procurement logic.¹

Core System Architecture and Technology Stack

SUMASYS is built on a modern, multi-tiered web architecture designed for high availability and cross-platform accessibility. The system is deployed as a responsive web application, allowing users to interact with the platform via standard desktop workstations or mobile devices within the laboratory environment.¹

Component	Specification	Description
Development Framework	PHP-based Logic	The core business logic and server-side operations are developed using PHP. ¹
Deployment Platform	Hostinger Cloud Hosting	The system is hosted on a professional cloud infrastructure (Hostinger) to ensure reliable uptime and multi-access capabilities across sub-laboratories. ¹
Interface	Responsive Web UI	Optimized for both desktop and smartphone usage to facilitate real-time data entry at the point of

		sampling or storage. ¹
Integration	Integrated Silo Database	A centralized database that aggregates stock data from the Microbiological, CPO, and CI sub-laboratories. ¹

Strategic Functional Modules

The system is organized into distinct functional modules that mirror the physical movement of reagents within the Analytical Center. These modules ensure that every item is tracked from the moment of receipt to its final consumption.¹

1. Item Received Module

This gateway module handles the intake of new reagents and media. Upon arrival at the laboratory, items are registered in the system.¹ This phase establishes the baseline for the inventory, capturing critical metadata including:

- Item Code and Description.¹
- Lot Number and Expiry Date (ED).¹
- Initial Quantity and Unit of Measure (UOM).¹

2. Item Usage and Barcode Integration

To prevent manual data entry errors and ensure "First Expired, First Out" (FEFO) adherence, SUMASYS utilizes barcode scanning technology.¹ When an analyst requires a reagent, they scan the item's barcode using a handheld scanner. The system then:

- Validates that the correct item is being used.¹
- Automatically decrements the quantity from the specific sub-laboratory's silo.¹
- Updates the real-time stock balance across the integrated network.¹

3. Integrated Stock Verification (Stock Opname)

The Stock Verification module replaces the previous 405-minute manual weekly audit with a streamlined digital process.¹ Analysts use the system to compare physical stock with the digital record. The scanner-based verification ensures that discrepancies are identified immediately, reducing the risk of "missed" items that contribute to deadstock.¹

Intelligent Business Logic and Procurement Formulas

The primary technical innovation of SUMASYS is its automated Purchase Request (PR) calculation engine. This logic eliminates manual guesstimation and ensures that re-stocking

occurs only when necessary, based on predefined safety levels. ¹

Automated PR Calculation Logic

The system monitors stock levels against Minimum (Min) and Maximum (Max) thresholds. When the current quantity ($Q_{current}$) falls below the Minimum threshold (Q_{min}), the system triggers a "Need PR" status and calculates the required re-stock quantity ($Q_{request}$). ¹

The logic follows these parameters:

- **Min Stock:** The safety level required to prevent analytical downtime. ¹
- **Max Stock:** The ceiling to prevent over-ordering and potential deadstock. ¹
- **Monthly Needs:** Historical consumption data used to adjust Min/Max values dynamically. ¹

Expiry Date (ED) Monitoring and FEFO Logic

SUMASYS includes a dedicated "ED Item Dashboard" that filters inventory based on the remaining shelf life. ¹ The system calculates the "Days to Expiry" (D_{expiry}) for every lot and provides visual alerts. This supports the FEFO (First Expired First Out) protocol, ensuring that older stock is prioritized for use, thereby minimizing waste and the formation of deadstock. ¹

Real-time Dashboard and Operational Visibility

The SUMASYS dashboard serves as a central monitoring hub, providing "at-a-glance" operational insights. ¹ It utilizes a simplified status logic for all inventory items:

Status Badge	Technical Condition	Management Action
Aman (Safe)	$Q_{current} >$	No action required; stock levels are optimal. ¹
Berlebi (Excess)	$Q_{current} >$	Alert for overstocking; prioritize consumption or stop PR. ¹
Need PR!	$Q_{current} \leq$	Immediate action required; trigger re-stock process. ¹

The dashboard also provides longitudinal trend visualizations of item usage and the total financial value of the current inventory, enabling data-driven decision-making for laboratory

leadership. ¹

Security Architecture and Regulatory Compliance

SUMASYS is designed to meet stringent corporate security and quality standards. The development and deployment process followed formal internal change management protocols. ¹

1. **Security Assessment:** The web environment is regularly scanned for vulnerabilities. Current MALWARE SCANNER results indicate "No Risk" and "Safe" status, ensuring the system is protected against security breaches. ¹
2. **Assessment Control:** The system is governed by Change Management Form (CMF) No: CM/2503/QAAC/003, which documents the formal approval and permanent implementation of the software by the IT Department. ¹
3. **Standard Operating Procedures (SOP):** All interactions with the system are standardized under the instruction SHP-WI-QACS-30, titled "*Digital Laboratory Stock Management Using SUMASYS*". ¹

System Performance and KPI Impact Analysis

The implementation of SUMASYS has yielded measurable improvements in laboratory productivity and financial efficiency. ¹

- **Financial Impact:** Deadstock value was reduced by 39%, decreasing from Rp 694 million in December 2024 to Rp 424 million by September 2025, resulting in a total saving (including development cost avoidance) of Rp 334.5 million. ¹
- **Operational Efficiency:** The time required for weekly stock opname was reduced by 91%, from 405 minutes down to 36 minutes. ¹
- **Productivity Gains:** General productivity related to stock management tasks increased by 91%, equivalent to saving ~25 hours of labor per month. ¹

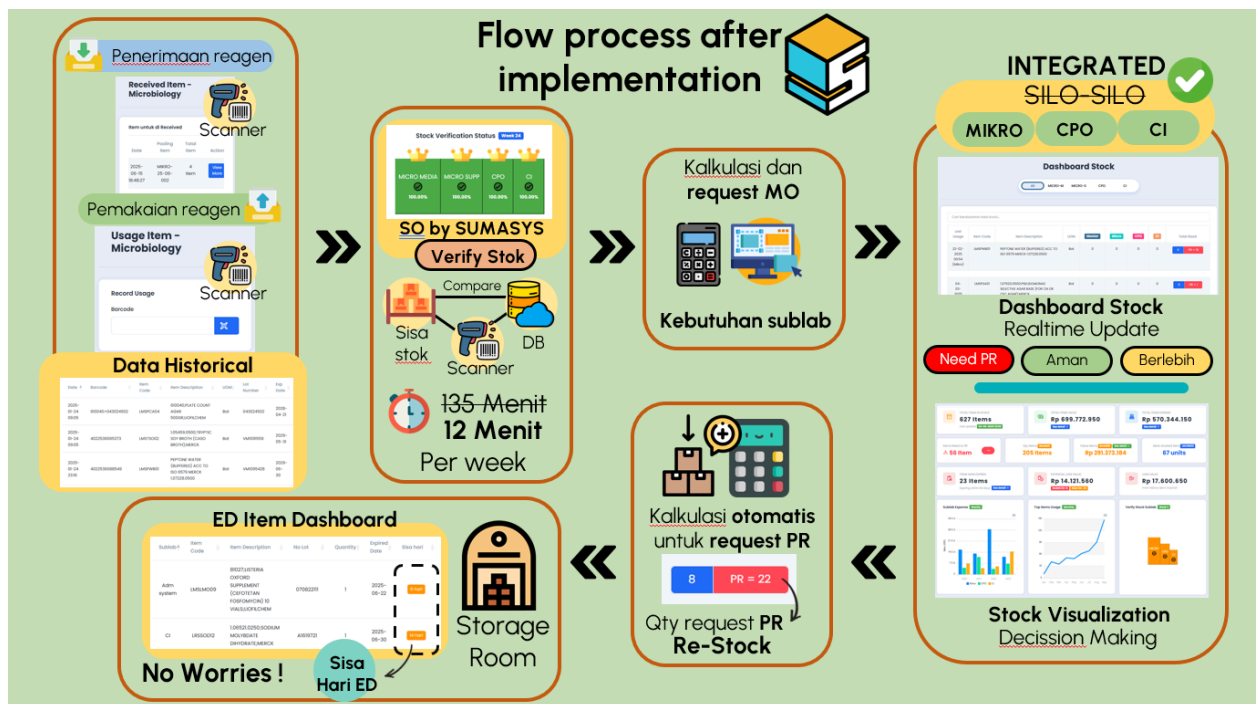
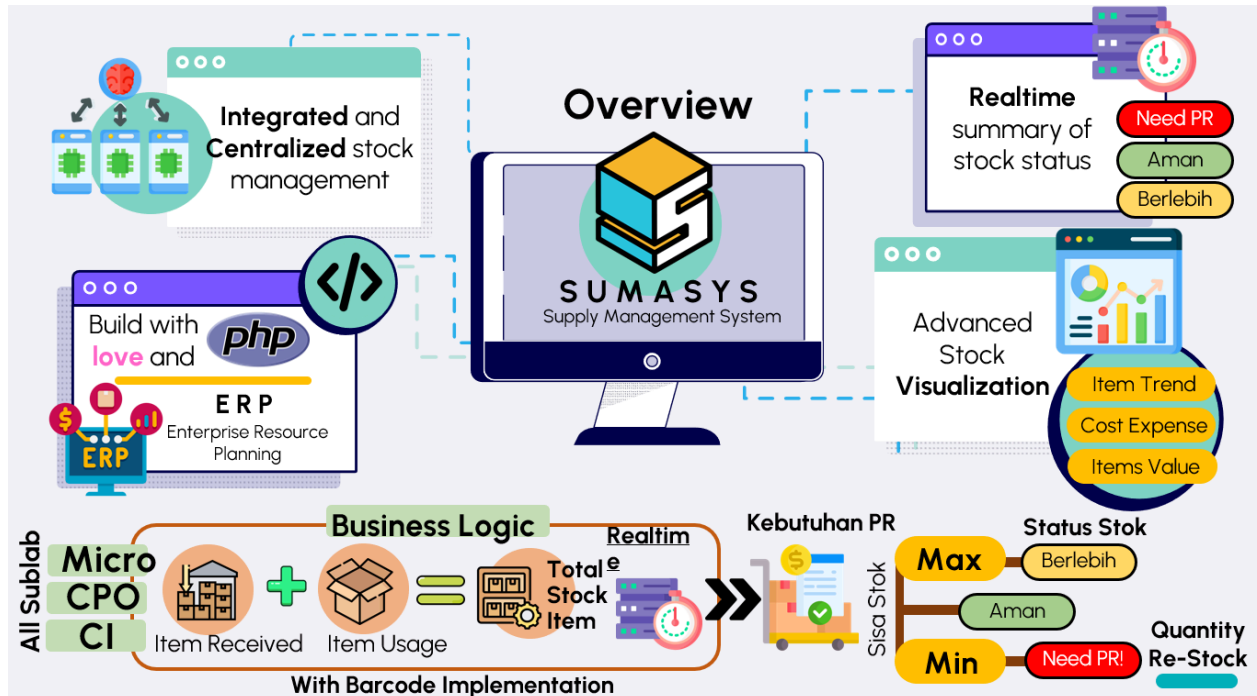
Future Roadmap: Integration with Oracle ERP

The final phase of the SUMASYS technical roadmap involves full integration with the company's Oracle ERP system. ¹ Future iterations (SUMASYS V3) will enable the platform to automatically generate "Move Orders" (MO) and "Purchase Requests" (PR) directly within Oracle, creating a seamless digital thread between laboratory inventory levels and the corporate procurement department. ¹

Karya yang dikutip

1. ADMINOVATION_QAAC_QCC.pdf

Screenshot documentation



3. Verify & Conclusion

Rencana Perbaikan

Faktor : Metode

What? **Rootcause**
Sumasys tidak memiliki fitur untuk melakukan stok opname by sistem.

Solution
Perlu module verifikasi stok "Verify Stok"

Why? Agar stok actual dapat divalidasi keberadaannya.

Re-Verify

Another Risk

Risk Analysis

1.	Stok sesuai	✓
2.	Efisiensi waktu	✓

3.	Sustain verify weekly	Lock dashboard bila terlewat
4.	Scanner barcode rusak	Built-in scanner with camera
5.	Barcode tidak terbaca	Built-in input barcode manual

Solution

Stock Verification Status **Week 5**

MICRO MEDIA	MICRO SUPP	CPO	CI
100.00%	100.00%	100.00%	100.00%

Accuracy tercapai **100%**

12 Menit

Evaluasi stok **5x lebih cepat**



Penerimaan reagen



Pemakaian reagen

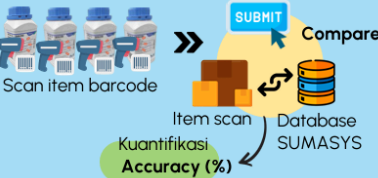


Stock Item Sublab



Evaluasi Target

SO by SUMASYS
Verify Stok



Ketidaksesuaian report

No	Code	Item Description	Unit	Saldo Awal	Saldo Akhir	Diff
0000000000	000000	ADRENALIN HEMORAGIS	ML	000000	000000	0
0000000000	000000	ADRENALIN ORGAS	ML	000000	000000	0
0000000000	000000	ADRENALIN ORGAS	ML	000000	000000	0
0000000000	000000	ADRENALIN ORGAS	ML	000000	000000	0
0000000000	000000	ADRENALIN ORGAS	ML	000000	000000	0

Tindak Lanjut Evaluasi

Verify Stok



Kalkulasi manual dan request MO



Kebutuhan sublab
Tidak ada kesalahan kalkulasi

Re-Stock

Stok Sesuai

ROLL OUT

MIKRO CPO CI

TOTAL WAKTU **36 Menit Per week**