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| IT4010 – Research Project - 2024 |
| Topic Assessment Form |

Project ID : R25-062

1. Topic (12 words max)

Optimized Warehouse Management System Leveraging Industry 4.0 Technologies

2. Research group the project belongs to

SST - Software Systems & Technologies

3. Specialization of the project belongs to

Information Technology (IT)

4. If a continuation of a previous project:

Project ID	
Year	

5. Brief description of the research problem including references (200 – 500 words max) – references not included in word count.

Warehouses and retail showrooms play a crucial role in supply chains, but they often face specific, practical challenges that limit their efficiency. One key issue is the underutilization of storage space, where cubic meter (CBM) capacity is not fully leveraged due to poorly designed layouts or outdated storage methods. This results in wasted space and increased operational costs. Additionally, inventory management processes often fail to account for turnover rates or demand variations, leading to overstocking, understocking, and inefficiencies in replenishment cycles.

Sensitive or high-value items present another layer of complexity. These require precise handling and storage to prevent spoilage, theft, or damage, yet many existing systems do not incorporate robust risk mitigation strategies. Furthermore, year-end inventory evaluation practices are often inaccurate or time-consuming, complicating cost analysis and financial reporting. This lack of precision impacts decision-making, particularly in budgeting and forecasting.

These problems highlight the need for practical solutions that address the specifics of space utilization, inventory turnover, and loss prevention. A system designed to optimize CBM storage, dynamically adapt to inventory movement patterns, and provide accurate, timely data for cost management and risk mitigation could significantly improve efficiency and decision-making across both warehouse and showroom operations.

6. Brief description of the nature of the solution including a conceptual diagram (250 words max)

The proposed solution is a modular warehouse management system with four key components:

- **Storage Location Module:** Implements a zone-based storage strategy, categorizing products by turnover rate, size, and handling requirements. Each zone has specific storage rules and space utilization metrics.

- **Inventory Tracking Module:** Manages stock movement using storage methods (FIFO/LIFO etc...) based on product characteristics, with built-in analysis to prevent obsolescence.

- **Layout Optimization Module:** Uses ABC analysis to optimize product placement, considering picking frequency and travel distances. Incorporates traffic flow analysis for efficient material handling.

- **Reporting Module:** Generates regular performance metrics and cost analysis reports, streamlining year-end inventory evaluation through systematic data collection and validation processes.
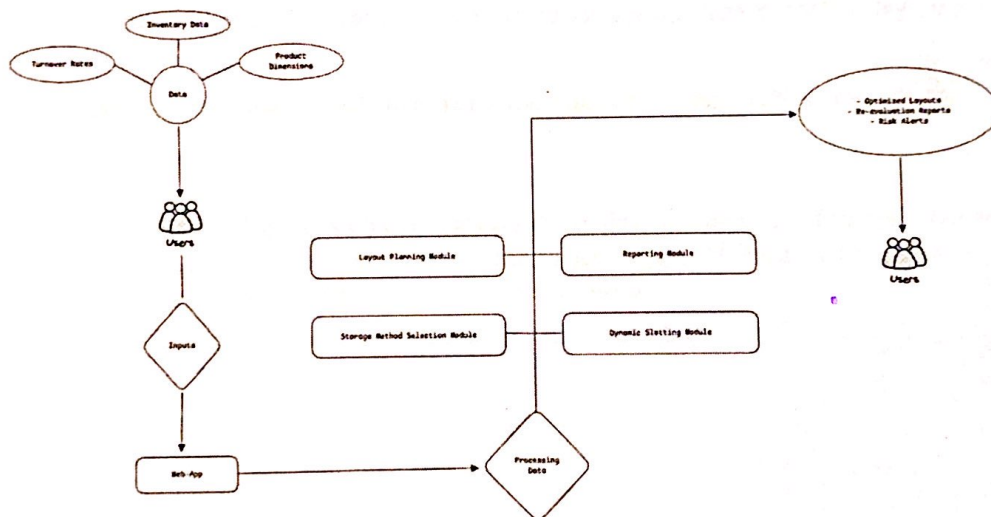
7. Brief description of specialized domain expertise, knowledge, and data requirements (300 words max)

Domain Expertise:

- **Warehouse Design:** Understanding efficient layout principles, including aisle spacing, storage height limits, and flow optimization.

- **Inventory Management:** Knowledge of inventory categorization and storage protocols, especially for perishable and high-value items.

- **Retail-Specific Operations:** Awareness of retail integration challenges, such as demand-driven inventory positioning.

Data Requirements:

- **Inventory Dimensions and Turnover Rates:** Detailed data on item sizes, weights, and movement frequencies.

- **Space Utilization Metrics:** Measurements of warehouse capacity, space usage, and congestion points.

- **Incident Reports:** Historical data on inventory damage, spoilage, or theft, categorized by zones and types.

- **Cost Records:** Financial data to evaluate the impact of storage inefficiencies and risk incidents.

Knowledge Integration:

Combining warehouse logistics with practical data-driven decisions requires a balance between theoretical storage models and real-world operational workflows. This ensures that solutions are not only space-efficient but also practical for everyday use.
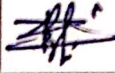
8. Objectives and Novelty

Main Objective:
To develop an optimized Warehouse Management System (WMS) that enhances space utilization, improves inventory turnover adaptability, streamlines year-end evaluations, and mitigates risks associated with sensitive goods.

Member Name	Sub Objective	Tasks	Novelty
A.A.S Salinda	Maximize warehouse space utilization.	- Analyze current warehouse layouts and constraints. - Develop algorithms for CBM-specific slotting. - Test optimized layouts for accessibility and usability	Focuses on leveraging cubic volume rather than area, introducing efficient vertical and modular storage solutions
P.D.M.P Palihena	Implement dynamic storage strategies.	- Define criteria for selecting FIFO, LIFO, or hybrid methods. - Create a framework for dynamic slotting based on turnover rates. - Validate system adaptability with real-world inventory scenarios.	Real-time adaptability in storage methods, ensuring optimized placement based on demand patterns.

| P.A.S Tharana | Develop strategies to safeguard sensitive or high-value inventory | - Identify vulnerabilities in warehouse operations (spoilage, theft, damage).
 - Propose physical and procedural security measures.
 - Create segregation policies for sensitive inventory. | Focuses on risk mitigation, enhancing security without additional technological overhead. |
| V.S De Silva | Streamline year-end inventory re-evaluation | - Develop a standardized framework for inventory valuation (e.g., ABC analysis).
 - Integrate re-evaluation methods with cost-flow tracking.
 - Collaborate with financial teams to ensure regulatory compliance. | Introduces a structured and efficient year-end valuation process, reducing manual errors and time consumption. |

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9. Supervisor details

	Title	First Name	Last Name	Signature
Supervisor	Dr	Samantha	Rajapaksha	
Co-Supervisor	Dr	Dinuka	Wijendra	01/07/2025
External Supervisor				
Summary of external supervisor's (if any) experience and expertise				

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This part is to be filled by the Topic Screening Staff members.

a) Does the chosen research topic possess a comprehensive scope suitable for a final-year project?

Yes	✓	No	

b) Does the proposed topic exhibit novelty?

Yes	✓	No	

c) Do you believe they have the capability to successfully execute the proposed project?

Yes	✓	No	

d) Do the proposed sub-objectives reflect the students' areas of specialization?

Yes	✓	No	

e) Supervisor's Evaluation and Recommendation for the Research topic:

> Need to study existing optimization Algorithm

Acceptable: Mark/Select as necessary

Topic Assessment Accepted	✓
Topic Assessment Accepted with minor changes*	·
Topic Assessment to be Resubmitted with major changes*	
Topic Assessment Rejected. Topic must be changed	

* Detailed comments given below

Comments

Staff Member's Name	Signature
Dr-Samanth	*(signature)*

*Important:

1. According to the comments given by the evaluator, make the necessary modifications and get the approval by the **Evaluator**.

2. If the project topic is rejected, identify a new topic, and request the RP Team for a new topic assessment.