

**Bachelor of Software Engineering Honors’ Degree Programme**

**The Open University of Sri Lanka**

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**EEX5362 - Performance Modelling**

**Mini Project - Deliverable 01 - Report**

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**Performance Analysis of an E-commerce Warehouse**

**1. System Identification**

The system will be used analyze a complex e-commerce warehouse and logistics network. The main challenges for a system like this are to efficiently manage the complete order management process from start to finish. from the moment a customer places an order to the moment it is dispatched for deliver the process should be efficient.

The process of the system has measurable performance characteristics because of the,

* Variable demand: Number of orders can change even throughout the day because of factors like seasonal sales or holidays
* Large product range: The warehouse manages different stock keeping units /ids with different storage needs, packing and picking methods.
* Interdependent processes: The whole system is a connected chain of different processes of order receiving, item picking, packing and shipping. A delay in one area can affect the entire order completion process.
* Resource limitations: There are only a limited number of resources, including human resources, packing stations or machines, etc.

The goal is to process a high volume of diverse orders quickly and accurately while managing costs and resources effectively.

**Data Sets**

To analyze this system, the following two datasets will be used:

1. Logistics Warehouse Dataset,

Original source / URL: ‘<https://www.kaggle.com/datasets/ziya07/logistics-warehouse-dataset>’

This dataset provides operational data from the warehouse, including information on inventory levels, shipment tracking, processing times, and warehouse logistics. This will be used to model the internal warehouse processes.

2. Retail Sales Dataset,

Original source / URL: ‘<https://www.kaggle.com/datasets/mohammadtalib786/retail-sales-dataset>’

This dataset provides data on customer orders, sales figures, product details, and dates. This will be used to model the "input" to the system. The demand and flow of customer orders that the warehouse must satisfy.

A logical mapping will be created between the 2 datasets to simulate the completion of incoming orders.

**2. Performance Objectives**

The primary goal of this analysis is to model the warehouse's operations to identify opportunities for optimization. The key performance objectives are,

1. Maximize throughput,

* Measure the total number of orders successfully picked, packed, and dispatched per shift or per day.
* Objective is to Identify strategies like new picking routes or staffing changes to increase this number.

2. Minimize shipping time,

* Measure the average time from when an order is received by the system to when it is loaded onto a delivery truck.
* Objective is to reduce this average time and also reduce the variance and make processing times more predictable.

3. Identify and analyze bottlenecks,

* Measure the queue lengths and wait times at each major process step such as waiting for a picker or waiting for a packing station, etc.
* Objective is to pinpoint which specific process is the primary bottleneck that limits overall system throughput.

4. Optimize resource allocation:

* Measure the percentage of time spent busy vs. idle of key resources like pickers, packers, and packing stations.
* Objective is to determine the optimal number of staff or stations needed to meet demand without excessive cost or idle time.
* For example, "What is the impact on throughput if we add 3 more packing stations?"