Faculty of Engineering Technology

Department of Electrical & Computer Engineering

Bachelor of Software Engineering

The Open University of Sri Lanka

EEX5362 – Performance Modeling

Mini Project -Deliverable-01

Performance Modeling and Evaluation of Gemi Gedara Online Food Delivery System

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GitHub Repository: https://github.com/indunil-jay/EEX5362-MP

1. System Overview

The Gemigedara restaurant operates in Kurunegala, Sri Lanka, offering dine-in and online delivery services through UberEATS and its proprietary mobile application. Operating daily from 9:00 AM to 11:00 PM, the restaurant handles an average of 150–500 online orders per day. Orders are fulfilled by independent couriers using bikes and cars.

The online delivery process involves multiple stages such as order placement, restaurant acceptance, food preparation, courier assignment, pickup, and delivery. Each stage contributes to the total performance outcome and customer experience.

2. System Characteristics and Measurable Components

The Gemigedara system can be modeled as a multi-stage queueing process where each order transitions through several queues before completion. Each stage introduces potential processing delays and waiting times that affect throughput.

Stage	Description	Measurable Metric
Order Placement & Confirmation	Customer places order via app	API latency, confirmation delay
Restaurant Acceptance & Preparation	Restaurant reviews and prepares order	Preparation time
Courier Assignment	Restaurant reviews and prepares order	Matching latency
Pickup & Delivery	Courier collects and delivers order	Delivery time, courier waiting time
Post-Delivery Confirmation	System acknowledgment of delivery	Total fulfillment time

3. Dataset Description

The dataset https://github.com/indunil-jay/EEX5362-MP contains 11,752 item-level records from September 1 to 30, 2025. Each record corresponds to an individual food item within an order, containing timestamps, courier information, distance, delivery fee, and customer satisfaction indicators. This dataset enables performance modeling and bottleneck detection.

4. Performance Aspects and Objectives

The Gemigedara food delivery process includes multiple interdependent stages, each affecting system responsiveness, throughput, and customer satisfaction. The following performance objectives have been defined for detailed analysis:

1. Response Time Optimization

- Objective: Reduce the total time taken for an order to progress through all system stages, from placement to completion.
- Rationale: Faster response and fulfillment improve customer satisfaction and reduces order abandonment.
- Metrics:
  - API latency (ms)
  - Order confirmation time (s)
  - Total fulfillment time (min)

2. Throughput Maximization

- Objective: Increase the number of orders successfully processed and delivered per operational hour.
- Rationale: Ensuring high throughput during peak hours enhances scalability and operational efficiency.
- Metrics:
  - Orders processed per hour
  - Average completion rate (%)
  - Orders delayed beyond target time (%)

3. Bottleneck Identification

- Objective: Determine which stages (e.g., preparation, courier assignment, or delivery) contribute most to delays.
- Rationale: Identifying bottlenecks allows targeted optimization in critical stages.
- Metrics:
  - Average queue waiting time per stage
  - Stage-wise processing time distribution
  - Idle time ratios (courier and kitchen)

4. Courier Utilization and Assignment Efficiency

- Objective: Optimize courier allocation and minimize idle time while maintaining on-time delivery performance.
- Rationale: Efficient courier dispatches reduce operational costs and improves delivery predictability.

- Metrics:
  - Courier waiting time (min)
  - Courier utilization rate (%)
  - Average delivery time by distance band (0–5 km, 5–10 km, >10 km)

5. Delivery Cost and Distance Efficiency

- Objective: Ensure that the delivery fee structure accurately reflects distance and maintains profitability.
- Rationale: Aligning cost and distance helps achieve a sustainable pricing model and cost optimization.
- Metrics:
  - Delivery fee vs. distance correlation
  - Gross margin per delivery
  - Cost-to-revenue ratio

6. Reliability and Customer Experience

- Objective: Maintain consistency in order, accuracy and delivery timeliness under varying conditions.
- Rationale: Reliability drives customer retention and platform trust.
- Metrics:
  - On-time delivery rate (%)
  - Order accuracy (%)
  - Complaint ratio and type
  - CSAT and NPS scores

7. Scalability under Peak Load

- Objective: Evaluate system performance as order volume scales from 150 to 500+ daily orders.
- Rationale: Understanding system behavior under stress is critical for planning infrastructure capacity.
- Metrics:
  - Average fulfillment time during high-load periods
  - Queue length trends
  - Resource utilization (%)

5. References
- https://github.com/indunil-jay/EEX5362-MP