EEX5362 Performance Modelling

Deliverable 01

Name: M.N.T.Perera

Reg\_No: 521434988

S\_No: s92074988

**System Details and Performance Objectives**

**System Title -** **Public Bus Transportation Scheduling and Dispatch System**

1. High-Level Problem Description

The Public Bus Transportation Scheduling and Dispatch System is designed to manage and optimize the operations of city bus services within a metropolitan area. The system coordinates multiple bus routes, schedules, and depots to ensure efficient passenger transport across the city.  
  
Currently, the transportation department faces issues such as uneven passenger load distribution, delays due to inefficient scheduling, long passenger waiting times, and high idle times for buses. The objective of the proposed system is to model and analyze bus route operations to identify performance bottlenecks, improve scheduling, and optimize the utilization of available buses and drivers.  
This system is complex because it involves

* Multiple interacting components: buses, routes, depots, passengers
* Dynamic data: traffic flow, demand fluctuations
* Performance trade-offs: cost vs. speed vs. satisfaction
* Scalability requirements for different city sizes.

2. Dataset Description

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| --- | --- | --- |
| Dataset Name | Description | Example Fields |
| Bus Schedule Data | Information about bus routes and times | Bus\_ID, Route\_No, Start\_Time, End\_Time, Stops, Frequency |
| Passenger Demand Data | Records of average passenger counts per time slot | Stop\_ID, Date, Time, Avg\_Passengers, Peak\_Indicator |
| Route Performance Data | Travel and delay statistics | Route\_No, Avg\_Speed, Delay\_Time, Distance, Fuel\_Consumption |
| Resource Allocation Data | Details of bus and driver assignments | Driver\_ID, Bus\_ID, Shift\_Start, Shift\_End, Depot\_ID |

3. Performance Objectives

Minimize Passenger Waiting Time – Reduce average waiting time per passenger at each bus stop during both peak and off-peak hours.

**Use Buses Effectively** – Ensure all buses are properly used, with less idle time and no overcrowding.

Reduce Trip Delays – Identify and minimize average delay times across all routes by analyzing traffic and schedule patterns.

Optimize Resource Allocation – Improve allocation of buses and drivers to match varying passenger demand while maintaining service reliability.

Enhance System Scalability – Ensure the system can adapt to increased routes or passenger volumes without significant degradation in performance.

4. Expected Outcomes

* **Improved passenger satisfaction**  
  When waiting times and delays are reduced, passengers experience more reliable service, leading to higher satisfaction and trust in the transport system.
* **Better fleet scheduling**  
  By analyzing data and simulations, the system can allocate buses more efficiently, reducing idle time and ensuring the right number of buses operate on each route.
* **Reduced congestion at bus stops**Optimized scheduling spreads passenger flow more evenly across time, preventing overcrowding and improving boarding efficiency.
* **Enhanced resource utilization**  
  The simulation helps ensure buses, drivers, and fuel are used effectively, minimizing waste and lowering operational costs.
* **Scalable framework for future expansion**  
  The model can easily be adjusted for new routes or increased passenger demand, ensuring long-term flexibility and sustainability.