The Open University of Sri Lanka

Bachelor of Software Engineering Honours

EEX5362 Performance Modelling

Mini Project - Deliverable 01

A Healthcare Appointment Scheduling and Queue Management System

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Selected system: Healthcare Appointment Scheduling and Queue Management System.

1. High Level Problem

In many hospitals and clinics, the process of scheduling patient appointments and managing queues is inefficient and unorganized. Patients often experience long waiting times because of overlapping appointments, unexpected delays, and inconsistent doctor availability.

At the same time, medical staff such as doctors and nurses may face uneven workloads some being overbooked while others remain underutilized. These issues reduce the hospital's overall efficiency and directly affect patient satisfaction.

The main challenge is that current scheduling systems often do not consider real-time changes such as late arrivals, no-shows, or extended consultation times. As a result, patient queues grow longer, service delivery slows down, and hospital resources are not used effectively.

This problem makes it essential to design a system that can accurately track patient flow, doctor performance, and waiting times helping hospitals identify performance bottlenecks and improve scheduling efficiency.

2. System Overview

To address the above issues, the proposed solution is a Healthcare Appointment Scheduling and Queue Management System. This system models the daily operations of a hospital's outpatient department (OPD). It manages patient appointments, tracks arrivals, and monitors doctor performance across multiple departments such as General Medicine, Pediatrics, Cardiology, Dermatology, and Orthopedics.

The system keeps records of each patient's appointment time, arrival time, consultation start and end times, and assigned doctor. These details allow the analysis of performance factors such as, Average waiting time per patient, Doctor and consultation room utilization, Queue length over time, and Appointment schedule adherence.

By analyzing these metrics, the system can help identify where delays occur and how hospital efficiency can be improved through better resource allocation and scheduling strategies

3. Dataset Description

Link:

A synthetic dataset containing 500 patient appointment records was generated using Python. The data was generated with randomized but realistic time intervals between 8:00 AM and 5:00 PM for a single working day. Patients can arrive early or late relative to their scheduled time. Waiting times range between 0 - 20 minutes, and consultation durations range between 5 - 20 minutes.

Each record includes,

1. **Patient ID:** A unique ID for each patient.
2. **Appointment Time:** The time slot assigned to the patient.
3. **Arrival Time:** The actual time the patient arrived at the hospital.
4. **Doctor:** The doctor who handled the consultation.
5. **Service Start / End Time:** When the consultation actually started and ended.
6. **Waiting Time:** How long the patient waited before being served.
7. **Consultation Duration:** The length of the consultation in minutes.
8. **Department:** The department the patient visited

4. Performance Objectives

1. **Minimize Average Waiting Time**
   Reduce the average duration that patients wait before being attended by doctors.
2. **Maximize Doctor Utilization**
   Ensure doctors' working hours are effectively utilized with minimal idle time between consultations.
3. **Optimize Throughput**
   Increase the number of patients served per hour without compromising consultation quality.

4. **Enhance Appointment Scheduling Accuracy**

   Improve the match between scheduled and actual consultation start times to minimize overlaps.

5. **Ensure Scalability and Reliability**

   Design a system capable of supporting multiple doctors and departments simultaneously, maintaining stable performance as the number of appointments grows.

5. Conclusion

In conclusion, the Healthcare Appointment Scheduling and Queue Management System provides an effective way to study and improve hospital performance. By analyzing key metrics such as waiting time, doctor utilization, and appointment accuracy, the system helps identify inefficiencies and supports data-driven decision-making. This approach can lead to smoother operations, better use of resources, and a more satisfying experience for both patients and medical staff.