**The Open University of Sri Lanka**

**Department of Electrical and Computer Engineering**

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**Mini Project**

***Hospital Outpatient Queue Management System (OPD) – Sri Lanka***

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Hospital Outpatient Queue Management System (OPD) – Sri Lanka

# **System Description**

Public hospitals in Sri Lanka frequently experience long patient waiting times in Outpatient Departments (OPDs). Patients arrive randomly and proceed through multiple stages including registration, consultation, and pharmacy/payment. Delays at any stage create bottlenecks, reduce throughput, and negatively impact patient satisfaction.

The performance of the OPD system depends on:

* **Patient arrival rate** – varies by time of day and day of the week
* **Doctor availability** – number of doctors available for consultation
* **Service time per patient** – including registration, consultation, and payment

This system can be modeled as a queuing system (M/M/1 for single doctor or M/M/c for multiple doctors) to evaluate metrics such as:

* **Average patient waiting time**
* **Queue length**
* **Doctor utilization**

By modeling and analyzing the OPD workflow, we can identify bottlenecks, test interventions (like adding more doctors or registration counters), and optimize overall patient throughput.

# **Dataset**

* The dataset for this project, *Dataset.csv* provides the two key **inputs** such as **Arrival\_Time\_Min** and **Service\_Time\_Min.**
* This data is used to calculate the model's parameters like **average arrival rate** and **average service rate**.
* The model will then be used to calculate the performance **outputs**, such as **average waiting time, queue length,** and **doctor utilization**.
* This allows us to test our **objectives**, such as seeing how waiting times change when we increase the number of doctors.

***Note:***

Real waiting times and service durations are based on studies from Sri Lankan hospitals:

* **NHSL, Colombo:** median registration to consultation = 42 min, average total OPD time ~2 hours.
* **District hospitals (Gampaha):** mean morning waiting time 43–47 min, afternoon 18–31 min.

# **Performance Objectives**

The primary goals for evaluating the OPD system are:

* **Minimize patient waiting time** – reduce time from arrival to consultation completion.
* **Optimize doctor utilization** – ensure doctors are neither underutilized nor overburdened.
* **Identify peak load periods (bottlenecks)** – determine times of high congestion and their impact on waiting times.
* **Evaluate impact of adding resources** – analyze how adding doctors or registration counters affects performance.
* **Improve overall throughput** – increase the number of patients processed per hour without sacrificing service quality.

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