JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY NOIDA

NOIDA B.TECH V SEMESTER

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING AND INFORMATION TECHNOLOGY

OT Management System

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Abstract

The aim of this project is to design an Operation Theatre (OT) Management System integrated with an efficient disk scheduling algorithm, namely the C-SCAN (Circular SCAN) algorithm. This system handles the surgery queue management and allocates surgeries to operation theatres while ensuring optimal use of available resources. The primary goal is to minimize the overall processing time of surgery requests by scheduling surgeries based on priority and reducing waiting time, achieved using C-SCAN. The system simulates the operation theatre scheduling process as a disk scheduling problem, where the "head" moves through the requests in a circular manner, optimizing the surgery assignments and improving system throughput.

Introduction

Hospital management systems, particularly in the context of operation theatre management, face the challenge of efficiently scheduling surgeries to optimize resource utilization. These systems must manage the flow of surgery requests, taking into account various factors like surgery priority, theatre availability, and surgery duration.

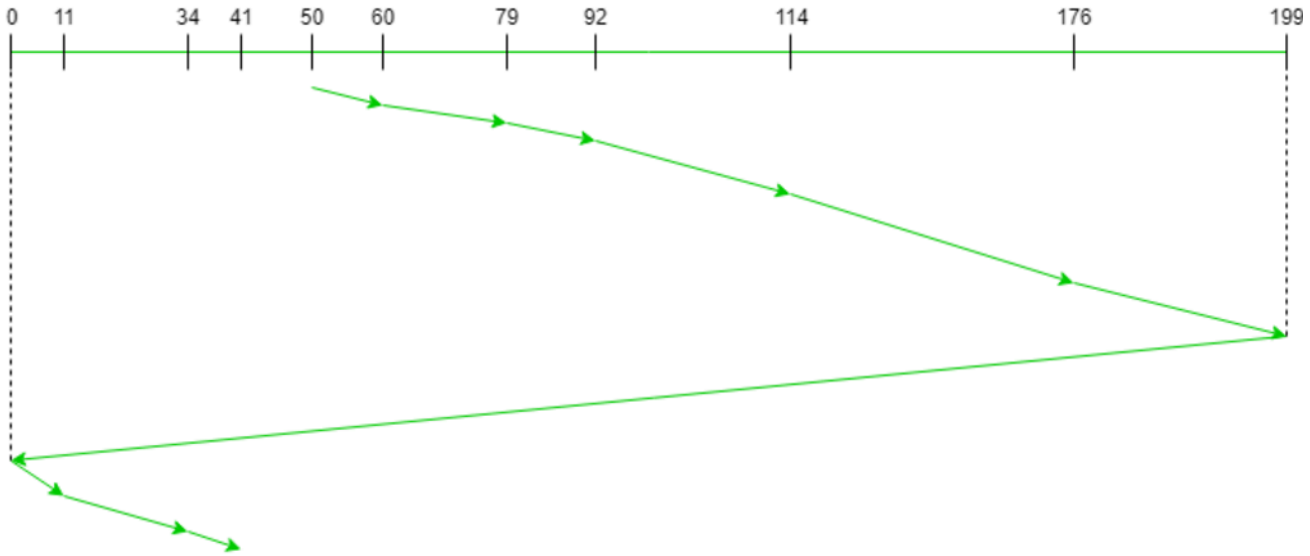
This project focuses on implementing a solution where surgery requests are treated as disk access requests in a disk scheduling system. The C-SCAN algorithm is used to simulate the scheduling of surgeries in an OT. C-SCAN is an efficient disk scheduling algorithm that minimizes seek time by moving the "head" in one direction across all requests, looping back to the beginning once the end is reached.

In this project, the surgeries are treated as disk requests with IDs, and the priority is used to determine the order of processing. This ensures that surgeries with higher urgency are processed first, and the system optimizes the use of available operation theatres. The integration of this disk scheduling technique helps automate and improve the efficiency of OT management.

Working Procedure of the Algorithm

C-SCAN Algorithm: Overview

The Circular SCAN (C-SCAN) disk scheduling algorithm is a variation of the SCAN algorithm. The SCAN algorithm moves the disk head in one direction (e.g., towards higher-numbered tracks) until it reaches the end of the disk. Upon reaching the end, the head is reversed and moves towards the beginning of the disk. In C-SCAN, however, when the disk head reaches the end, it returns to the beginning without serving the requests in the reverse direction. This makes the algorithm simpler and more efficient for systems where requests are distributed over a wide range.



How C-SCAN Applies to OT Management

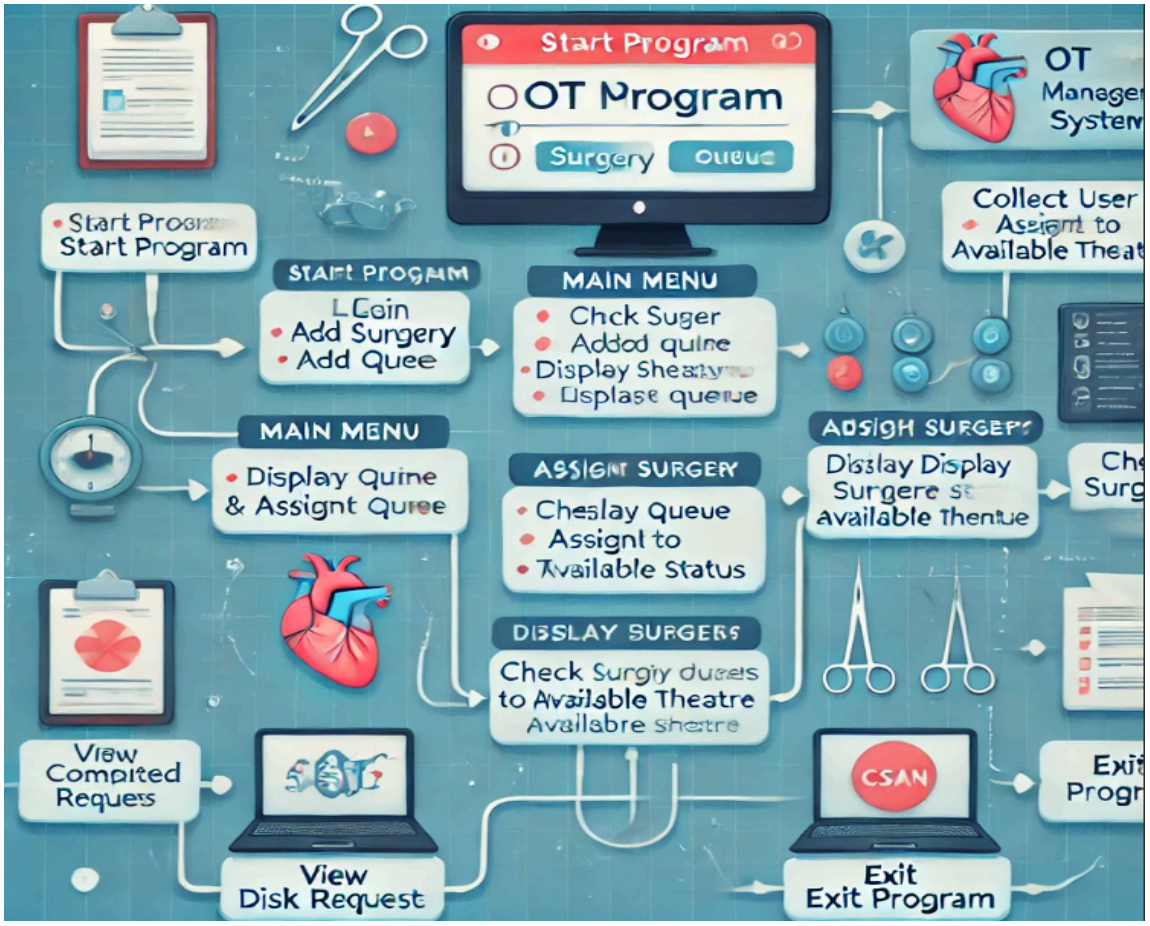
In the OT Management System, surgery requests are modeled as disk requests with assigned IDs, which represent the surgery's urgency and the operation theatre's assigned time. These IDs are processed according to their priority, where higher-priority surgeries are assigned to available theatres first.

The steps followed by the C-SCAN algorithm in this project are as follows:

1. **Input**: The system receives the surgery queue, where each surgery request has a unique ID and associated priority.

2. **Processing**: The surgery IDs are treated like disk sector addresses. The system begins processing the surgery requests in one direction, serving the requests in order until the highest ID is reached. Upon reaching the end of the queue, the system loops back to the beginning and continues serving the remaining requests.
3. **Output**: The system calculates the total seek time and average seek time, which measure the efficiency of the scheduling process. These metrics help assess the performance of the surgery scheduling algorithm.

The circular movement of the disk head minimizes idle times and unnecessary backtracking, ensuring more predictable scheduling behavior.



Implementation

System Design and Architecture

The OT Management System is implemented in C++, leveraging object-oriented principles to model different entities in the system. The system is designed to handle the following key components:

1. **Surgery Management**: Each surgery has a set of attributes including patient details, doctor information, surgery priority, and estimated duration. This data is stored in a priority queue to ensure that high-priority surgeries are always handled first.
2. **C-SCAN Disk Scheduling**: The surgery IDs are processed as disk requests. The system utilizes the C-SCAN algorithm to handle surgery scheduling based on these IDs. The disk head movement mimics the processing of surgery requests, optimizing the queue.
3. **Theatre Management**: The system keeps track of the available operation theatres and assigns surgeries to these theatres based on availability. This ensures that no theatre is double-booked.
4. **Role-Based Authentication**: The system features role-based access control (RBAC) with Admin and Staff users. Admin users have additional privileges such as the ability to add new theatres and manage surgery queues, while staff members can only view the queue and assign surgeries.

Key Functions

- **addSurgery()**: This function allows adding a surgery request to the queue. It collects details like patient name, doctor name, surgery type, and priority.
- **assignSurgery()**: Once the surgeries are sorted, this function assigns the surgery to an available theatre.
- **manageDiskRequests()**: This function implements the C-SCAN algorithm, processing surgery requests based on their IDs, minimizing the total seek time.
- **displayQueue()**: This function shows the current state of the surgery queue, ordered by priority.
- **displayTheatreStatus()**: This function shows the current status (available or occupied) of each theatre.

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------------------------------
---- OT Management System ----
------------------------------
1. Login
2. Add Surgery
3. Assign Surgery
4. Display Surgery Queue
5. Display Theatre Status
6. View Completed Surgeries
7. Manage Disk Requests (C-SCAN)
8. Exit
Enter your choice: 1
Enter your User ID: 123
User ID 123 has been added as Employee.
```

```
------------------------------
---- OT Management System ----
------------------------------
1. Login
2. Add Surgery
3. Assign Surgery
4. Display Surgery Queue
5. Display Theatre Status
6. View Completed Surgeries
7. Manage Disk Requests (C-SCAN)
8. Exit
Enter your choice: 1
Enter your User ID: 789
User ID 789 has been added as Employee.
------------------------------
---- OT Management System ----
------------------------------
1. Login
2. Add Surgery
3. Assign Surgery
4. Display Surgery Queue
5. Display Theatre Status
6. View Completed Surgeries
7. Manage Disk Requests (C-SCAN)
8. Exit
Enter your choice: 1
Enter your User ID: 789
```

```
Enter your choice: 1
Enter your User ID: 789
Welcome back, User ID 789!
------------------------------
---- OT Management System ----
------------------------------
1. Login
2. Add Surgery
3. Assign Surgery
4. Display Surgery Queue
5. Display Theatre Status
6. View Completed Surgeries
7. Manage Disk Requests (C-SCAN)
8. Exit
Enter your choice: 2

Enter Surgery Details:
ID: 1234
Patient Name: neha
Doctor Name: akhil
Specialization: orthopaedic
Priority (1-10, 10 = Highest): 5
Estimated Duration (hours): 1
Surgery for neha has been added to the queue.
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---- OT Management System ----
------------------------------
1. Login
2. Add Surgery
3. Assign Surgery
4. Display Surgery Queue
5. Display Theatre Status
6. View Completed Surgeries
7. Manage Disk Requests (C-SCAN)
8. Exit
Enter your choice: 2

Enter Surgery Details:
ID: 4563
Patient Name: mihika
Doctor Name: ravi
Specialization: cardiologist
Priority (1-10, 10 = Highest): 10
Estimated Duration (hours): 3
Surgery for mihika has been added to the queue.
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---- OT Management System ----
------------------------------
1. Login
2. Add Surgery
3. Assign Surgery
4. Display Surgery Queue
5. Display Theatre Status
6. View Completed Surgeries
7. Manage Disk Requests (C-SCAN)
8. Exit
Enter your choice: 2

Enter Surgery Details:
ID: 8756
Patient Name: samarth
Doctor Name: ayush
Specialization: orthopaedic
Priority (1-10, 10 = Highest): 3
Estimated Duration (hours): 1
Surgery for samarth has been added to the queue.
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---- OT Management System ----
------------------------------
1. Login
2. Add Surgery
3. Assign Surgery
4. Display Surgery Queue
5. Display Theatre Status
6. View Completed Surgeries
7. Manage Disk Requests (C-SCAN)
8. Exit
Enter your choice: 4

Current Surgery Queue:
ID: 4563, Patient: mihika, Doctor: ravi, Specialization: cardiologist, Priority: 10,
    Status: Pending, Duration: 3 mins
ID: 1234, Patient: neha, Doctor: akhil, Specialization: orthopaedic, Priority: 5, Status
    : Pending, Duration: 1 mins
ID: 8756, Patient: samarth, Doctor: ayush, Specialization: orthopaedic, Priority: 3,
    Status: Pending, Duration: 1 mins
```

```
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---- OT Management System ----
------------------------------
1. Login
2. Add Surgery
3. Assign Surgery
4. Display Surgery Queue
5. Display Theatre Status
6. View Completed Surgeries
7. Manage Disk Requests (C-SCAN)
8. Exit
Enter your choice: 5

Theatre Status:
Theatre 1: Available
Theatre 2: Available
Theatre 3: Available
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---- OT Management System ----
------------------------------
1. Login
2. Add Surgery
3. Assign Surgery
4. Display Surgery Queue
5. Display Theatre Status
6. View Completed Surgeries
7. Manage Disk Requests (C-SCAN)
8. Exit
Enter your choice: 6
No completed surgeries.
------------------------------
---- OT Management System ----
------------------------------
1. Login
2. Add Surgery
3. Assign Surgery
4. Display Surgery Queue
5. Display Theatre Status
6. View Completed Surgeries
7. Manage Disk Requests (C-SCAN)
8. Exit
Enter your choice: 7
```

```
--- Disk Scheduling Operations ---
Total Seek Time: 8955
Average Seek Time: 2985
```

Result

The OT Management System successfully integrates the C-SCAN algorithm for surgery scheduling, resulting in efficient surgery queue management. The key results from this system include:

1. **Efficient Scheduling**: The C-SCAN algorithm significantly reduces the total seek time and minimizes the time spent backtracking, which in turn optimizes the use of available theatres.
2. **Priority Handling**: The system ensures that higher-priority surgeries are always processed first, preventing delays in urgent cases.
3. **Theatre Assignment**: The system guarantees that surgeries are assigned to available theatres based on priority, ensuring maximum theatre utilization.
4. **Performance Metrics**: The system calculates the total seek time and average seek time for each surgery scheduling, providing valuable insights into the efficiency of the algorithm.

For example, if the surgery requests are scheduled with IDs 1, 3, 5, 8, and the starting head position is 3, the system computes the total seek time based on C-SCAN and assigns surgeries to the available theatres accordingly.

Conclusion

The OT Management System using the C-SCAN disk scheduling algorithm provides an efficient way to handle surgery scheduling based on priority. By simulating surgery requests as disk access requests, the system optimizes resource allocation and minimizes wait times, ensuring that surgeries are processed in the most efficient manner possible. The use of C-SCAN helps in minimizing seek time and ensures fairness in processing all requests, making it a valuable approach for hospitals with multiple operating theatres.

This system can be extended to include real-time data processing, dynamic scheduling, and other advanced features like predictive scheduling based on historical data. The integration of disk scheduling techniques in hospital management not only improves

operational efficiency but also provides a model for automating complex scheduling tasks in real-world systems.

References

1. Tanenbaum, A. S. (2009). *Modern Operating Systems* (3rd ed.). Prentice Hall.
2. Silberschatz, A., Galvin, P. B., & Gagne, G. (2018). *Operating System Concepts* (9th ed.). Wiley.
3. C++ Programming. (n.d.). Cplusplus.com. Retrieved from www.cplusplus.com
4. C-SCAN Disk Scheduling. GeeksforGeeks. Retrieved from www.geeksforgeeks.org
5. Hospital Management System. (2020). ResearchGate. Retrieved from www.researchgate.net