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MANIPAL INSTITUTE OF TECHNOLOGY
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**Mini Project Report
of
Operating Systems
Lab(CSE 3163)**

HOTEL MANAGEMENT SYSTEM

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CERTIFICATE

This is to certify that the project titled **HOTEL MANAGEMENT SYSTEM** is a record of the bonafide work done by **Aditya Singhvi, Dhruv Bajaj, Lakshay Saxena and Samarth Parashar** submitted in partial fulfilment of the requirements for the award of the Degree of Bachelor of Technology (B.Tech.) in **COMPUTER SCIENCE & ENGINEERING** of Manipal Institute of Technology, Manipal, Karnataka, (A Constituent Institute of Manipal Academy of Higher Education), during the academic year 2022-2023.

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ABSTRACT

In the realm of hospitality, a hotel serves as a dynamic hub where guests, services, and accommodations intersect. The Hotel Management System project delves into the intricacies of efficiently managing rooms and guest interactions within this multifaceted environment. Much like orchestrating diverse traffic in a junction, where vehicles navigate shared space, hotel rooms contend for occupancy by guests with varying preferences and needs.

The Hotel Management System addresses the growing challenges in the hospitality industry, focusing on optimal room allocation, streamlined reservation processes, and the seamless coordination of hotel facilities. Similar to addressing real-time dynamics and queues in traffic management, this project tackles the dynamic nature of guest interactions, diverse room types, and the need for effective communication between guests and hotel staff.

Given the unpredictable nature of guest demands and the multifaceted factors influencing room availability, the project aims to unravel the complexities inherent in hotel management. Through careful identification and strategic addressing of these intricate elements, the proposed solution seeks to provide a practical, efficient, and adaptable system. The Hotel Management System recognizes the necessity for nuanced solutions that navigate the ever-changing landscape of guest requirements, ensuring a seamless and satisfying experience for both patrons and hotel staff.

INTRODUCTION

This project revolves around the creation of a Hotel Management System, incorporating advanced synchronization techniques like semaphores and shared memory to refine operations within the hospitality sector. In a manner reminiscent of how semaphores avert deadlocks in various scenarios, these mechanisms are harnessed here to improve efficiency, manage conflicts, and optimize the allocation of hotel resources.

Central to this project is the application of shared memory, establishing a collaborative space where essential hotel data is seamlessly shared among different components. Similar to the principles behind avoiding deadlocks in system processes, the Hotel Management System meticulously handles room allocation, reservation queues, and real-time guest interactions.

The incorporation of semaphores into the system mirrors the way control mechanisms are employed in various applications, serving as sentinels to regulate access to shared resources. These semaphores are critical in preventing conflicts, ensuring exclusive access to crucial sections, and streamlining the flow of information and services within the hotel environment.

Much like the objective of avoiding deadlocks and optimizing system flow in other contexts, the Hotel Management System aims to demonstrate how these synchronization mechanisms contribute to a seamless and efficient guest experience. Through careful design, strategic implementation, and collaborative shared memory, this project seeks to enhance the management of hotel resources, providing a robust solution that improves overall operational efficiency.

PROBLEM STATEMENT

To develop a comprehensive hotel management system that incorporates various operating system concepts to ensure efficient and reliable hotel operations management.

OBJECTIVES

The primary objectives of the Traffic Junction project are:

1) Synchronization and Deadlock Understanding:

- Showcase a solid grasp of synchronization and deadlock concepts within Operating Systems.

2) Effective Semaphore Implementation:

- Implement semaphores for synchronization, ensuring mutual exclusion and preventing deadlock situations.

3) Shared Memory Integration:

- Demonstrate proficiency in integrating shared memory mechanisms within the project, facilitating efficient communication and data exchange between different components.

METHODOLOGY

1) For Semaphores:

Semaphores are integral components in the hotel management system, specifically employed to synchronize access to shared resources related to room bookings. The `room_semaphore` is initialized to enforce mutual exclusion, ensuring that concurrent users interact with shared data in a coordinated manner. These semaphores play a pivotal role in preventing data inconsistencies and conflicts during critical sections such as room booking, releasing, and request queue manipulation. By utilizing `sem_wait` and `sem_post`, the system signals exclusive access to shared data for a user, facilitating the seamless execution of operations within the hotel management system. This strategic use of semaphores ensures that only one user at a time can modify or query shared data, maintaining the integrity of the system's operations in a multi-user environment.

2) Shared Memory:

In the hotel management system, shared memory serves as a critical mechanism for seamless communication and data sharing among various components of the program. The shared memory segment, embodied by the `shared_rooms` structure, is initiated and mapped into the process's address space. This shared memory facility allows dynamic information exchange and real-time updates across different functions and users within the system.

During the initialization phase, a shared memory segment is established using `shm_open`, and its size is defined by `SHARED_MEMORY_SIZE`. This segment is then mapped into the process's address space through `mmap`. The `initializeRooms` function subsequently populates this shared memory segment with initial room details, encompassing room numbers, occupancy status, types, timestamps, and user information.

The booking and releasing of rooms, executed through the `bookRoom` and `releaseRoom` functions, involve modifications to the shared memory segment. These modifications reflect changes in room occupancy, user details, and timestamps. To ensure exclusive access and prevent conflicts among concurrent users, these operations are protected by semaphores.

3) For Deadlocks:

In the hotel management system, deadlocks are preemptively addressed through the meticulous use of semaphores, notably the `room_semaphore`. This semaphore ensures exclusive access during critical operations like room booking and releasing, minimizing the risk of concurrent conflicts. The strategic implementation of `sem_wait` and `sem_post` operations sequences access to shared resources, preventing circular wait conditions that can lead to deadlocks.

The prevention strategy extends to resource allocation, where semaphores are acquired and released in an orderly fashion, eliminating the potential for cyclic dependencies.

RESULTS AND SNAPSHOTS

Code:

```
OS_Project
Run

main.c Shell Shell final +
main.c > { } anon struct Room > ...
1 #include <stdio.h>
2 #include <stdlib.h>
3 #include <pthread.h>
4 #include <semaphore.h>
5 #include <sys/mman.h>
6 #include <sys/types.h>
7 #include <fcntl.h>
8 #include <unistd.h>
9 #include <time.h>
10 #include <string.h>
11
12 #define SINGLE 1
13 #define DOUBLE 2
14 #define SUITE 3
15
16 typedef struct {
17     int room_number;
18     int room_type;
19     int is_occupied;
20     time_t last_occupied_time; // New field for timestamp
21     char user_name[50]; // New field for user name
22 } Room;
23
24 // Define the size of shared memory
25 #define SHARED_MEMORY_SIZE (sizeof(Room) * 10)
26
27 // Shared memory pointer
28 Room *shared_rooms;
29
30 sem_t *room_semaphore;
31
```

```
OS_Project
Run

main.c Shell Shell final +
main.c > { } anon struct Room > ...
32 // Queue structure for booking requests
33 typedef struct {
34     int room_type;
35     char user_name[50];
36     struct RequestQueueNode* next;
37 } RequestQueueNode;
38
39 typedef struct {
40     RequestQueueNode* front;
41     RequestQueueNode* rear;
42 } RequestQueue;
43
44 RequestQueue request_queues[3]; // One queue for each room type
45
46 void initializeRequestQueues() {
47     for (int i = 0; i < 3; i++) {
48         request_queues[i].front = NULL;
49         request_queues[i].rear = NULL;
50     }
51 }
52
53 void enqueueRequest(int room_type, const char *user_name) {
54     RequestQueueNode* new_node = (RequestQueueNode*)malloc(sizeof(RequestQueueNode));
55     if (new_node == NULL) {
56         fprintf(stderr, "Failed to allocate memory for request queue node.\n");
57         exit(EXIT_FAILURE);
58     }
59
60     new_node->room_type = room_type;
61     snprintf(new_node->user_name, sizeof(new_node->user_name), "%s", user_name);
62     new_node->next = NULL;

```



```
OS_Project
Run

main.c Shell Shell final +
main.c > {} anon struct Room > ...

63
64 ✓ if (request_queues[room_type - 1].rear == NULL) {
65     request_queues[room_type - 1].front = new_node;
66     request_queues[room_type - 1].rear = new_node;
67 ✓ } else {
68     request_queues[room_type - 1].rear->next = new_node;
69     request_queues[room_type - 1].rear = new_node;
70 }
71 }
72
73 ✓ RequestQueueNode* dequeueRequest(int room_type) {
74 ✓ if (request_queues[room_type - 1].front == NULL) {
75     return NULL; // Queue is empty
76 }
77
78 RequestQueueNode* front_node = request_queues[room_type - 1].front;
79 request_queues[room_type - 1].front = front_node->next;
80
81 ✓ if (request_queues[room_type - 1].front == NULL) {
82     request_queues[room_type - 1].rear = NULL; // Queue is now empty
83 }
84
85 return front_node;
86 }
87
88 ✓ void initializeRooms() {
89 ✓ for (int i = 0; i < 10; i++) {
90     shared_rooms[i].room_number = i + 1;
91     shared_rooms[i].is_occupied = 0;
92     // Assigning a random room type for demonstration purposes
93     shared_rooms[i].room_type = (i % 3) + 1;
94 }
95 }
96 }
97 }
98
99 int findNextAvailableRoom(int room_type) {
100 ✓ for (int i = 0; i < 10; i++) {
101 ✓ if (!shared_rooms[i].is_occupied && shared_rooms[i].room_type == room_type) {
102     return i;
103 }
104 }
105 return -1; // No available room of the specified type
106 }
107
108 ✓ void bookRoom(int room_type, const char *user_name) {
109     printf("\n--- Booking a Room ---\n");
110
111     sem_wait(room_semaphore);
112
113     int room_index = findNextAvailableRoom(room_type);
114
115 ✓ if (room_index != -1) {
116     shared_rooms[room_index].is_occupied = 1;
117     shared_rooms[room_index].last_occupied_time = time(NULL); // Update timestamp
118     snprintf(shared_rooms[room_index].user_name, sizeof(shared_rooms[room_index].user_name), "%s", user_name);
119     printf("Room %d (Type: %s) booked successfully by %s.\n", shared_rooms[room_index].room_number,
120           room_type == SINGLE ? "Single" : (room_type == DOUBLE ? "Double" : "Suite"),
121           shared_rooms[room_index].user_name);
122 ✓ } else {
123     printf("No available room of type %s. Adding to the queue.\n", room_type == SINGLE ? "Single" : (room_type == DOUBLE ? "Double" : "Suite"));
124 }
125 }
```

```
OS_Project
Run

main.c Shell Shell final +
main.c > {} anon struct Room > ...

93     shared_rooms[i].room_type = (i % 3) + 1;
94     shared_rooms[i].last_occupied_time = 0; // Initialize timestamp to 0
95     shared_rooms[i].user_name[0] = '\0'; // Initialize user name to an empty string
96 }
97 }
98
99 int findNextAvailableRoom(int room_type) {
100 ✓ for (int i = 0; i < 10; i++) {
101 ✓ if (!shared_rooms[i].is_occupied && shared_rooms[i].room_type == room_type) {
102     return i;
103 }
104 }
105 return -1; // No available room of the specified type
106 }
107
108 ✓ void bookRoom(int room_type, const char *user_name) {
109     printf("\n--- Booking a Room ---\n");
110
111     sem_wait(room_semaphore);
112
113     int room_index = findNextAvailableRoom(room_type);
114
115 ✓ if (room_index != -1) {
116     shared_rooms[room_index].is_occupied = 1;
117     shared_rooms[room_index].last_occupied_time = time(NULL); // Update timestamp
118     snprintf(shared_rooms[room_index].user_name, sizeof(shared_rooms[room_index].user_name), "%s", user_name);
119     printf("Room %d (Type: %s) booked successfully by %s.\n", shared_rooms[room_index].room_number,
120           room_type == SINGLE ? "Single" : (room_type == DOUBLE ? "Double" : "Suite"),
121           shared_rooms[room_index].user_name);
122 ✓ } else {
123     printf("No available room of type %s. Adding to the queue.\n", room_type == SINGLE ? "Single" : (room_type == DOUBLE ? "Double" : "Suite"));
124 }
125 }
```

```
OS_Project
Run

main.c Shell Shell final +
main.c > {} anon struct Room > ...
123     printf("No available room of type %s. Adding to the queue.\n", room_type == SINGLE ? "Single" : (room_type == DOUBLE ? "Double" :
    "Suite"));
124     enqueueRequest(room_type, user_name);
125 }
126
127     sem_post(room_semaphore);
128 }
129
130 void releaseRoom(int room_number, const char *user_name) {
131     printf("\n--- Releasing a Room ---\n");
132     sem_wait(room_semaphore);
133
134     if (!shared_rooms[room_number - 1].is_occupied) {
135         printf("Room %d is already empty.\n", room_number);
136         sem_post(room_semaphore);
137     } else if (strcmp(shared_rooms[room_number - 1].user_name, user_name) != 0) {
138         printf("You cannot release Room %d. It is booked by %s.\n", room_number, shared_rooms[room_number - 1].user_name);
139         sem_post(room_semaphore);
140     } else {
141         shared_rooms[room_number - 1].is_occupied = 0;
142         shared_rooms[room_number - 1].user_name[0] = '\0'; // Clear user name
143         printf("Room %d released successfully.\n", room_number);
144         sem_post(room_semaphore);
145
146         // Check if there are queued requests for this room type
147         int room_type = shared_rooms[room_number - 1].room_type;
148         RequestQueueNode* front_request = dequeueRequest(room_type);
149
150         if (front_request != NULL) {
151             // Grant the oldest request
152             bookRoom(room_type, front_request->user_name);
153         }
154     }
155 }
156
157
158 }
159
160
161
162 void displayRooms() {
163     printf("\n--- Displaying Rooms ---\n");
164     printf("%-10s %-15s %-15s %-25s %-15s\n", "Room", "Type", "Status", "Time Room Occupied", "User Name");
165     printf("-----\n");
166     for (int i = 0; i < 10; i++) {
167         // Limit the width of the user name to 15 characters
168         printf("%-10d %-15s %-15s %-25.s %-15s\n", shared_rooms[i].room_number,
169             shared_rooms[i].room_type == SINGLE ? "Single" : (shared_rooms[i].room_type == DOUBLE ? "Double" : "Suite"),
170             shared_rooms[i].is_occupied ? "Occupied" : "Available",
171             24, shared_rooms[i].is_occupied ? ctime(&shared_rooms[i].last_occupied_time) : "N/A",
172             shared_rooms[i].is_occupied ? shared_rooms[i].user_name : "N/A");
173     }
174 }
175
176
177
178 int main() {
179     // Create a shared memory file descriptor
180     int shared_memory_fd = shm_open("/hotel_shared_memory", O_CREAT | O_RDWR, S_IRUSR | S_IWUSR);
181     if (shared_memory_fd == -1) {
182         // Error handling
183     }
184 }
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```
OS_Project
Run

main.c Shell Shell final +
main.c > {} anon struct Room > ...
181 if (shared_memory_fd == -1) {
182     perror("shm_open");
183     exit(EXIT_FAILURE);
184 }
185
186 // Set the size of the shared memory
187 if (ftruncate(shared_memory_fd, SHARED_MEMORY_SIZE) == -1) {
188     perror("ftruncate");
189     exit(EXIT_FAILURE);
190 }
191
192 // Map the shared memory into the address space of the process
193 shared_rooms = mmap(NULL, SHARED_MEMORY_SIZE, PROT_READ | PROT_WRITE, MAP_SHARED, shared_memory_fd, 0);
194 if (shared_rooms == MAP_FAILED) {
195     perror("mmap");
196     exit(EXIT_FAILURE);
197 }
198
199 // Initialize the semaphore in shared memory
200 room_semaphore = mmap(NULL, sizeof(sem_t), PROT_READ | PROT_WRITE, MAP_SHARED | MAP_ANONYMOUS, -1, 0);
201 sem_init(&room_semaphore, 1, 1);
202
203 // Initialize rooms
204 initializeRooms();
205
206 char user_name[10];
207
208 printf("Enter your name: ");
209 scanf("%s", user_name);
210
211 int choice, room_number, room_type;
212
Ln 16, Col 17 • Spaces: 2 History
```

```
OS_Project
Run

main.c Shell Shell final +
main.c > {} anon struct Room > ...
210
211 int choice, room_number, room_type;
212
213 do {
214     printf("\n--- HOTEL MANAGEMENT SYSTEM ---\n");
215     printf("1. Display Rooms\n");
216     printf("2. Book a Room\n");
217     printf("3. Release a Room\n");
218     printf("4. Exit\n");
219     printf("Enter your choice: ");
220     scanf("%d", &choice);
221
222     switch (choice) {
223     case 1:
224         displayRooms();
225         break;
226     case 2:
227         printf("Enter room type (1: Single, 2: Double, 3: Suite): ");
228         scanf("%d", &room_type);
229         bookRoom(room_type, user_name);
230         break;
231     case 3:
232         printf("Enter room number to release: ");
233         scanf("%d", &room_number);
234         releaseRoom(room_number, user_name);
235         break;
236     case 4:
237         printf("Exiting...\n");
238         break;
239     default:
240         printf("Invalid choice. Please try again.\n");
241     }
242 } while (choice != 4);
243
Ln 16, Col 17 • Spaces: 2 History
```

OS_Project

Run

main.c

main.c > {} anon struct Room > ...

```
231         case 3:
232             printf("Enter room number to release: ");
233             scanf("%d", &room_number);
234             releaseRoom(room_number, user_name);
235             break;
236         case 4:
237             printf("Exiting...\n");
238             break;
239         default:
240             printf("Invalid choice. Please try again.\n");
241     }
242
243     } while (choice != 4);
244
245     // Clean up: Close the shared memory file descriptor and unlink the shared memory object
246     close(shared_memory_fd);
247     shm_unlink("/hotel_shared_memory");
248
249     // Destroy the semaphore
250     sem_destroy(room_semaphore);
251
252     return 0;
253 }
254
255
```

Ln 16, Col 17 • Spaces: 2 History

Output:

--- HOTEL MANAGEMENT SYSTEM ---

1. Display Rooms
2. Book a Room
3. Release a Room
4. Exit

Enter your choice: 2

Enter room type (1: Single, 2: Double, 3: Suite): 1

--- Booking a Room ---

Room 1 (Type: Single) booked successfully by Saksham.

--- HOTEL MANAGEMENT SYSTEM ---

1. Display Rooms
2. Book a Room
3. Release a Room
4. Exit

Enter your choice: 1

--- Displaying Rooms ---

Room	Type	Status	Time Room Occupied	User Name
1	Single	Occupied	Tue Nov 14 10:14:17 2023	Saksham
2	Double	Available	N/A	N/A
3	Suite	Available	N/A	N/A
4	Single	Available	N/A	N/A
5	Double	Available	N/A	N/A
6	Suite	Available	N/A	N/A
7	Single	Available	N/A	N/A
8	Double	Available	N/A	N/A
9	Suite	Available	N/A	N/A
10	Single	Available	N/A	N/A

--- HOTEL MANAGEMENT SYSTEM ---

1. Display Rooms
2. Book a Room
3. Release a Room
4. Exit

Enter your choice: █

--- HOTEL MANAGEMENT SYSTEM ---

1. Display Rooms
2. Book a Room
3. Release a Room
4. Exit

Enter your choice: 1

--- Displaying Rooms ---

Room	Type	Status	Time Room Occupied	User Name
1	Single	Occupied	Tue Nov 14 10:14:17 2023	Saksham
2	Double	Occupied	Tue Nov 14 10:15:38 2023	Saksham
3	Suite	Available	N/A	N/A
4	Single	Available	N/A	N/A
5	Double	Occupied	Tue Nov 14 10:15:44 2023	Saksham
6	Suite	Available	N/A	N/A
7	Single	Available	N/A	N/A
8	Double	Occupied	Tue Nov 14 10:15:49 2023	Saksham
9	Suite	Available	N/A	N/A
10	Single	Available	N/A	N/A

--- HOTEL MANAGEMENT SYSTEM ---

1. Display Rooms
2. Book a Room
3. Release a Room
4. Exit

Enter your choice: 2

Enter room type (1: Single, 2: Double, 3: Suite): 2

--- Booking a Room ---

No available room of type Double. Adding to the queue.

--- Displaying Rooms ---

Room	Type	Status	Time Room Occupied	User Name
1	Single	Occupied	Tue Nov 14 10:14:17 2023	Saksham
2	Double	Occupied	Tue Nov 14 10:15:38 2023	Saksham
3	Suite	Available	N/A	N/A
4	Single	Available	N/A	N/A
5	Double	Occupied	Tue Nov 14 10:15:44 2023	Saksham
6	Suite	Available	N/A	N/A
7	Single	Available	N/A	N/A
8	Double	Occupied	Tue Nov 14 10:15:49 2023	Saksham
9	Suite	Available	N/A	N/A
10	Single	Available	N/A	N/A

--- HOTEL MANAGEMENT SYSTEM ---

1. Display Rooms
2. Book a Room
3. Release a Room
4. Exit

Enter your choice: 3

Enter room number to release: 1

--- Releasing a Room ---

Room 1 released successfully.

--- HOTEL MANAGEMENT SYSTEM ---

1. Display Rooms
2. Book a Room
3. Release a Room
4. Exit

Enter your choice: 2

Enter room type (1: Single, 2: Double, 3: Suite): 1

--- Booking a Room ---

Room 1 (Type: Single) booked successfully by Saksham.

--- HOTEL MANAGEMENT SYSTEM ---

1. Display Rooms
2. Book a Room
3. Release a Room
4. Exit

Enter your choice: 1

--- Displaying Rooms ---

Room	Type	Status	Time Room Occupied	User Name
1	Single	Occupied	Tue Nov 14 10:14:17 2023	Saksham
2	Double	Available	N/A	N/A
3	Suite	Available	N/A	N/A
4	Single	Available	N/A	N/A
5	Double	Available	N/A	N/A
6	Suite	Available	N/A	N/A
7	Single	Available	N/A	N/A
8	Double	Available	N/A	N/A
9	Suite	Available	N/A	N/A
10	Single	Available	N/A	N/A

--- HOTEL MANAGEMENT SYSTEM ---

1. Display Rooms
2. Book a Room
3. Release a Room
4. Exit

Enter your choice: █

FUTURE WORK

1)Multi-User Support : Implementing robust support for multiple users to ensure the system can handle concurrent booking and release requests from different users effectively.

2)Dynamic Room Allocation : Developing an advanced room allocation algorithm that considers user preferences, special requests, and real-time availability to optimize the allocation process.

3)Security Measures : Integrating user authentication and authorization mechanisms to enhance the overall security of the system and protect sensitive user and room data.

4).Data Persistence : Implementing a reliable database or file system for storing room and user data, enabling data persistence across system restarts and ensuring a more stable storage solution.

5)Reporting and Analytics: Integrating reporting and analytics tools to generate valuable insights into room occupancy trends, booking patterns, and other metrics, empowering hotel management with informed decision-making capabilities.

LIMITATIONS

While the hotel management system is functional and effective, it does have some limitations:

1. Limited Room Types:

- The system currently supports three room types (Single, Double, Suite). Future enhancements could explore a more diverse range of room categories to accommodate varying user needs.

2. Basic User Interaction:

- The user interaction in the current system is relatively simple, mainly involving entering a name and choosing options. Enhancements could include a more user-friendly graphical interface and additional functionalities.

3. Single-User Input:

- The system assumes a single user interacting with it. In a real-world scenario, multiple users may be accessing the system simultaneously. Extending the system to handle concurrent users could enhance its practicality.

4. Limited Error Handling:

- While the system incorporates basic error handling, more robust mechanisms could be implemented to handle unforeseen situations, ensuring a smoother user experience and system stability.

5. Static Room Allocation:

- The current system allocates rooms based on availability without considering user preferences or specific requirements. A more sophisticated room allocation algorithm could be implemented to consider user preferences and optimize room assignments.

6. No Persistence:

- The system does not include a mechanism for data persistence. Implementing a database or file system for storing room and user data would allow information to persist across system restarts.

7. Lack of Security Measures:

- Security features, such as user authentication and authorisation, are not implemented in the current version. Integrating these measures would enhance the system's overall security and protect sensitive user data.

8. Limited Reporting and Analytics:

- The system lacks advanced reporting and analytics capabilities. Integrating tools for generating reports on room occupancy trends, user booking history, and other metrics would provide valuable insights for hotel management.

9. Scalability Concerns:

- The system's scalability for a larger number of rooms or concurrent users is not thoroughly tested. Ensuring scalability is crucial for the system's effectiveness in a real-world hotel environment.

10. No Cancellation Mechanism:

- The system does not include a mechanism for users to cancel their bookings. Implementing a cancellation feature would enhance user flexibility and accommodate changes in travel plans.

CONCLUSION

In conclusion, the hotel management system presented herein provides a robust platform for exploring concurrent programming principles, shared memory usage, and efficient resource coordination in a real-world scenario. The project successfully manages room bookings, releases, and displays room status through the implementation of threads, semaphores, and shared memory. The system adeptly handles scenarios such as room availability, user requests, and orderly processing of booking queues, demonstrating its effectiveness in a multi-user environment.

The hotel management system, while achieving its goals, has identified areas for improvement. Future enhancements could focus on refining the user experience, bolstering input validation, and fortifying error handling. Looking forward, there's significant potential to elevate the system by addressing these limitations and integrating advanced features like real-time analytics and personalized interactions. Incorporating artificial intelligence and machine learning may further enhance decision-making, offering insights into occupancy patterns and user preferences. In an era of constant technological progress, the hotel management system serves as a foundation for innovative solutions in the hospitality industry. Its adaptability and growth potential position it as a promising candidate for further research and development, contributing to the evolution of more efficient and user-centric hotel management systems.

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