Operating Systems (Fall 2023)

Elevator Simulation Project

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Due date: 29 Jan (2024)

Introduction:

The Elevator Simulation aims to design and implement a simplified yet comprehensive simulation of an elevator system. The project will simulate the operation of an elevator that integrates various scheduling algorithms within a multi-floor building, handling multiple passengers' requests, and enabling them to move between floors.

Key Functionality Points:

1. **Elevator Configuration by Manager:**
    - **Number of Floors Setting**: Implement functionality for the manager to set the number of floors within the building before initiating the simulation.
    - **Scheduling Algorithm Selection:** Allow the manager to specify the scheduling algorithm to be used for elevator task management (e.g., FCFS, SJF, RR, SRTF).
2. **Elevator and Floor Parameters:**
    - **Floor Height:** Define each floor's height as 3 meters to simulate the physical distance between floors within the building.
    - **Elevator Speed:** Set the elevator's speed to 1 meter per second to simulate its movement between floors.
3. **Elevator Operations:**
    - **Movement Management:** Implement the elevator's movement between floors based on the specified speed and floor height, managed according to the chosen scheduling algorithm.
    - **Passenger Request Handling:** Manage incoming passenger requests according to the selected scheduling algorithm, optimizing elevator tasks considering floor height and speed parameters.

4. **Floor Interactions:**
    - **Passenger Signaling:** Enable floors to signal the elevator about passengers waiting to board, considering the defined floor height and the elevator's speed.
    - **Elevator Arrival Notification**: Notify passengers waiting on floors about the elevator's arrival, factoring in the elevator's speed and floor height for efficient boarding.
5. **Passenger Interactions:**
    - **Requesting Elevator Service:** Allow passengers to call the elevator from their current floor, specifying their desired destination floor, considering the building's defined number of floors.
    - **Boarding and Destination Selection:** Enable passengers to enter the elevator, select their destination floor, and disembark upon arrival, factoring in floor height and elevator speed.
6. **Scheduling Algorithms Implementation:**
    - **Configurable Algorithm Execution:** Execute the selected scheduling algorithm according to the manager's choice, ensuring it considers parameters like floor height and elevator speed during operation.

Analysis:

- **Performance Evaluation**: Collect data on each scheduling algorithm's performance during the simulation runs, considering the floor height, elevator speed, and number of floors.
- **Comparative Analysis:** Analyze and compare the collected metrics based on configured parameters to determine algorithmic efficiencies and system performance (e.g., Passengers waiting time, elevator response time, …).

Bonus:

1. **Dynamic Passenger Generation:**
    - Implement a feature to dynamically generate passengers on different floors at random intervals.
2. **Visualization and GUI:**
    1. **Gantt Chart for Each Algorithm:**
        - Plot the scheduling of elevator tasks against time, showcasing when requests are received, processed, and completed by the elevator based on the selected algorithm.

- Each chart will illustrate how the elevator serves passenger requests over time, demonstrating the scheduling efficiency of the respective algorithm.

2. **Elevator Visualization:**

   - Develop a graphical representation of the elevator system.

Submission Guidelines:

- Your implementation reports should be in a PDF file including an explanation of your approach, key points of your implementation and results.
- You should upload your submissions at Quera. All of the files should be saved in a ZIP file named in this format: “Lastname-StudentNumber.zip”.
  Ex.: “Zamani-40230401.zip”