Introduction

Elevators, a cornerstone of modern urban infrastructure, have transformed the way we navigate multi-story buildings, offering unparalleled convenience and access. Their operational precision is vital to ensuring efficient vertical transportation while prioritizing passenger safety.

Our focus lies in the creation of a System Verilog Finite State Machine (FSM) that governs an elevator control system. This system caters to the intricate demands of multi-story buildings, balancing passenger requests and security measures.

The elevator control system outlined herein adheres to a comprehensive set of requirements. These include accommodating user floor selections, managing passenger priority requests, providing an emergency stop mechanism, employing limit sensors for floor range supervision, orchestrating a well-structured finite state machine, developing a user-friendly interface, and subjecting the system to rigorous testing and simulation.

Assumptions Made

These assumptions provide context for understanding how the elevator control system functions in various scenarios. Let's break down each assumption:

1. Direction Persistence

The first assumption, about the elevator not changing direction until it completes all requests in that direction, is crucial for maintaining efficiency in elevator operations. This means that if the elevator is moving upward, it will continue to serve requests going upward until there are no more requests in that direction. The same applies when moving downward. This behavior aligns with the concept of the elevator prioritizing requests in the direction it's currently moving.

2. Idle State

The assumption that the elevator stops and becomes idle after serving all requests at the latest destination floor is a practical one. It ensures that the elevator doesn't keep moving unnecessarily once all passenger requests have been fulfilled. The idle state is a crucial part of the system's operation as it signifies that the elevator is available for new requests.

3. Door Control Signal

The assumption that arrival sensors generate a control signal for opening the lift door for a clock timer upon reaching the destination floor is a standard feature in elevator systems. It ensures that the doors remain open for a sufficient time to allow passengers to enter and exit the elevator safely. This safety feature is essential for preventing accidents and ensuring passenger convenience.

Collectively, these assumptions provide a clear understanding of the elevator control system's behavior and operation. They set the foundation for defining the system's states, transitions, and logic, as well as for designing test scenarios to validate the system's performance. Additionally, they align with common practices in elevator control systems, ensuring that the designed system operates efficiently and safely in a multi-story building.

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Modified Priority Algorithm Implementation and Functionality

1. Priority Algorithm Overview

The Elevator Control System has been significantly improved through the implementation of a modified priority algorithm. This algorithm introduces key enhancements to request handling, aiming to optimize elevator operations by intelligently prioritizing user requests based on proximity and direction, thereby overcoming the limitations of the traditional First-Come-First- Serve (FCFS) approach.

2. Proximity-Based Prioritization

- Directional Priority

One of the primary enhancements is the introduction of directional priority. This feature ensures that the elevator considers the direction it's currently moving in and prioritizes requests that align with this direction. Specifically:

When the elevator is moving upwards, it gives higher priority to requests for higher floors in the same upward direction.

When the elevator is moving downwards, it prioritizes requests for lower floors in the same downward direction.

3. Efficient Movement Planning

- Direction Adjustment

To ensure efficient response to prioritized requests, the elevator dynamically adjusts its movement direction based on the highest-priority request identified by the algorithm. If, for instance, the elevator is currently moving upward but a higher-priority request is in the downward direction, the elevator will alter its course to serve this priority request optimally.

4. Handling Multiple Requests

- Optimized Order

In scenarios where multiple users request different floors in the same direction, the elevator control system is designed to optimize the order in which these requests are fulfilled. The system prioritizes requests that minimize the distance traveled, ensuring that passengers are picked up and dropped off efficiently, further reducing travel time and energy consumption.

5. Emergency System Integration

- Emergency Stop

In the interest of passenger safety, the elevator system incorporates an emergency system that allows passengers to activate an emergency stop button when necessary. When this button is activated, the elevator comes to a controlled halt, saving the current direction and status. This ensures a safe response to emergencies.

In summary, the implementation of the modified priority algorithm within the Elevator Control System represents a substantial improvement in elevator operations. By intelligently prioritizing requests based on proximity and direction, the system reduces travel times, conserves energy, and enhances the overall passenger experience. The seamless integration of an emergency system ensures that safety is not compromised while maximizing efficiency in elevator operations.