CS223

DIGITAL DESIGN

Laboratory Project

Smart Evacuation Elevator

Project Report

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Trainer Pack Number: 6

1. Physical Modules Used on Betiboard

In this project, three physical modules on betiboard, the 4x4 keypad, Seven-Segment Display and 8x8 Display were used. Also, as described in the project instructions, the buttons on Basys 3 were used for executing the scenario, resetting the system and resetting the time.

Other than the Clock Divider, within the top module, timers were used to count clock cycles so that in some parts of the code, such as the code for changing the the floor according to the current floor and the elevator direction, are executed once in every second. This could not be managed by using the Clock Divider module, because of the design of SystemVerilog.

Seven-Segment Display: The most significant digit of the elevator is used to display the direction of the elevator as given in the description of the project. The least significant three digits are used to count the time passed when the scenario is executed.

8x8 Display: The red leds on the 8x8 Display represent empty spaces in elevator whereas he red leds represents passenger.

4x4 Keypad: 6 buttons on 4x4 Keypad were used to add or remove passengers to / from desired floors. There is an addPassenger and a removePassenger button for each floor as in the project description.

2. Project Description

In this project, apart from the three modules described above, a Clock Divider was used as an external module to create a clock that changes value in 1 - second intervals. This module was planned to be used to count the travel and wait times on each floor, which are given as 3 seconds and 2 seconds respectively. The rest of the design was sysnthesised in a single top module. A finite state machine or a high level state machine was not used in this project, altough it was planned to be used. Instead, basic logic using if , else statements were used to design the desired functionality of the elevator. The logic for a timer reset, system reset and execution of scenario are present in the code, altough they may be working improperly due to some errors.

3. Project Design

An efficient elevator system was designed according to the given project description. On emergengy evacuation, the smart elevator first travels to the floors at which it has four passengers waiting, one by one, carrying the passengers to the ground floor. When there are no longer four or more passengers on any floor, the elevator checks all the floors for remaining passengers, and brings them to the ground floor starting from the top floor. On it's way back to the ground floor, it takes passengers from other floors if there are any, and if there is enough room in the elevator.

At first, the states were designed to be as follows:

Yet, I was able to decrease the number of states and divide them int two as follows: