2018-2019 FALL SEMESTER

CS 223 – DIGITAL DESIGN

PROJECT REPORT – 24.12.2018

SECTION: 1

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The physical modules that are used in this project:

- 4x4 Keypad on Beti Board: It is used to increase and decrease the number of passenger waiting on the floor. The 3, 6 and 9 keys on the keypad for decreasing the passengers in the floor 3, 2 and 1 respectively. The A, B and C keys on the keypad for increasing the passengers in the floor 3, 2 and 1 respectively.
- 8X8 RGB LED Display on Beti Board: It is used to display the number of passengers in the elevator and the floors, and the location of the elevator. First two columns from the left show the position of the elevator and each two rows from the bottom of these two columns represents Floor 0, Floor 1, Floor 2 and Floor 3 respectively. Rest of the LEDs represents the passengers at corresponding floor.
- Buttons that are BTNU, BTND and BTNC on the BASYS 3: These are used to execute and reset the scenario, reset the total elapsed time respectively.
- Seven-Segment Display on the BASYS 3: It is used to display the elapsed time and display the direction of the elevator. The most significant digit shows the direction as clockwise for up and counter clockwise for down. Rest of the digits shows the elapsed time as decimal number.

In this design, there are two different modules as project module and outputlogic module except from given modules such as SevSeg_4digit, display_8X8, keypad4X4 and ClockDivider that is given in Lab04. The outputlogic module generates the image_red and image_blue arrays according to the current state and the number of the passengers in elevator and the floors. At the project module, there is three always block. At the first always block, time is increased by counting and the nextstate variable is assigned to state variable. At the second always block; path is generated at the Floor 0, nextstate and direction are generated by checking the cases for more efficient algorithm, and the addition and subtraction of passengers is done. These cases are checked, and the path is generated according to these cases. For example, if there are 2 passengers at Floor 3 and Floor2, the path is generated as Floor 0 - Floor 1 - Floor 2 - Floor 3 and take the passengers - Floor 2 and take the passengers - Floor 1 - Floor 0 and the passengers leaves. At the third always block, the most significant digit of the Seven-Segment is generated to display the direction of the elevator according to the clock_direction that is generated by ClockDivider module as 250 ms.

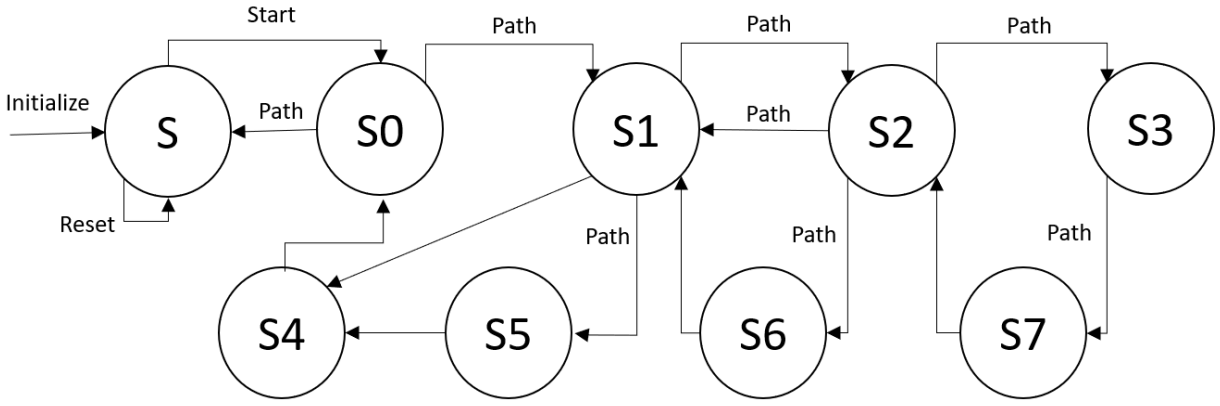

Figure 1 - FSM Diagram

- S: Initial state
- S0: Floor 0
- S1: Floor 1
- S2: Floor 2
- S3: Floor3
- S4: Discharge of the passengers at Floor 0
- S5: Loading the elevator with the passengers at Floor 1
- S6: Loading the elevator with the passengers at Floor 2
- S7: Loading the elevator with the passengers at Floor 3

There are eight states as S, S0, S1, S2, S3, S4, S5, S6 and S7. S is the initial state before the pressing the execute button. Addition and subtraction of the passengers at the floors can be done in this state. After pressing the execute button, that is start in this design, it continues with the S0 state as Floor 0. At the S0 state, it generates the path that is floors elevator will stop. According to the path, it continues with the floor states that are S1, S2 and S3 for Floor 1, Floor 2 and Floor 3 respectively. The elevator waits for three seconds at these states. If the elevator will stop at a floor and take the passengers, it will reach the corresponding state S1, S2 or S3 and continues with the S5, S6 and S7 for Floor 1, Floor 2 and Floor 3 respectively. S4 is the state that waiting for two seconds at the Floor 0 to make the passengers leave the elevator. For example, if the elevator will take three passengers from Floor 3 and take one passenger from Floor 2, the order of the state transitions is S-S0-S1-S2-S3-S7-S2-S6-S1- S4-S0. Elevator waits for 2 seconds and takes the passengers from the floor at the states S5, S6 and S7. If there will not be left any passenger at the floors, state transition order continues with S and stops the scenario and the timer.

SevSeg_4digit, display_8X8, keypad4X4 and ClockDivider modules are used in this project. display_8X8 and keypad4X4 modules are directly used without any changes. However, SevSeg_4digit is modified to display just one segment at the most significant digit of Seven-Segment. Also, ClockDivider is modified to change the most significant digit of Seven-Segment at every 250 ms.