Embedded Systems (CS684)
Assignment 1A

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Functionalities:

The Lift complies with all the requirements that were given that are:

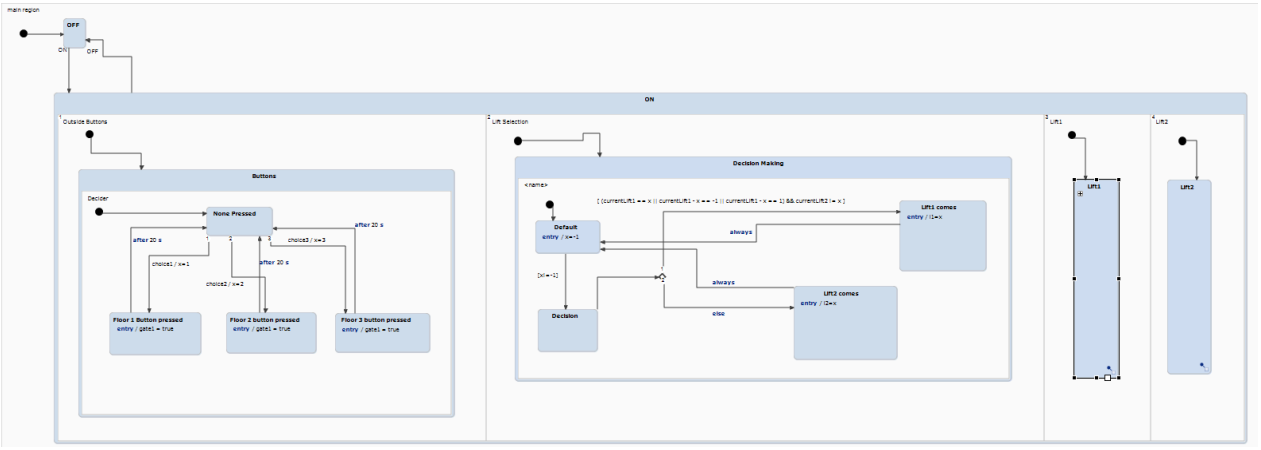
- There are 2 lifts that together form the elevator system, Proper coming and incoming of lifts are decided based on from which floor the lift is being called and which lift is currently the nearest.
- It is based on the fact that the building where this lift is being operated has 3 floors. Represented by 1,2,3 in the statechart.
- The lifts have a safety application which makes it move only when its gates are closed.
- The Floor also has the feature of selecting the floor to go from inside the lift other than the feature of calling the lift from any floor.

Strategies and Assumptions made while designing the statechart:

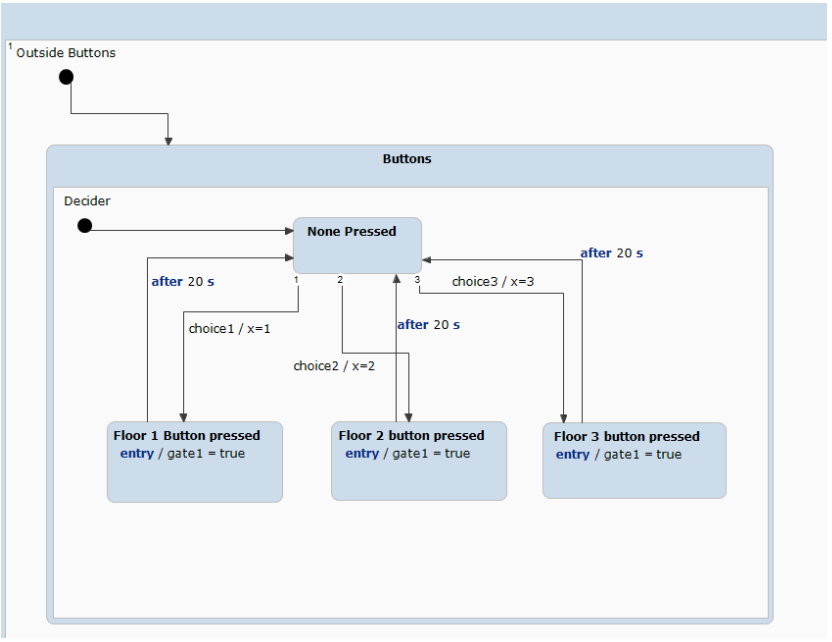
- The whole lift system has 2 states initially ON and OFF, which is turned by event ON and OFF respectively.

- When we enter the on stage there are 4 concurrent or AND states which are namely:
    1. Outside buttons
    2. Lift Selection
    3. Lift1
    4. Lift2

The functionality of these states are as follows:



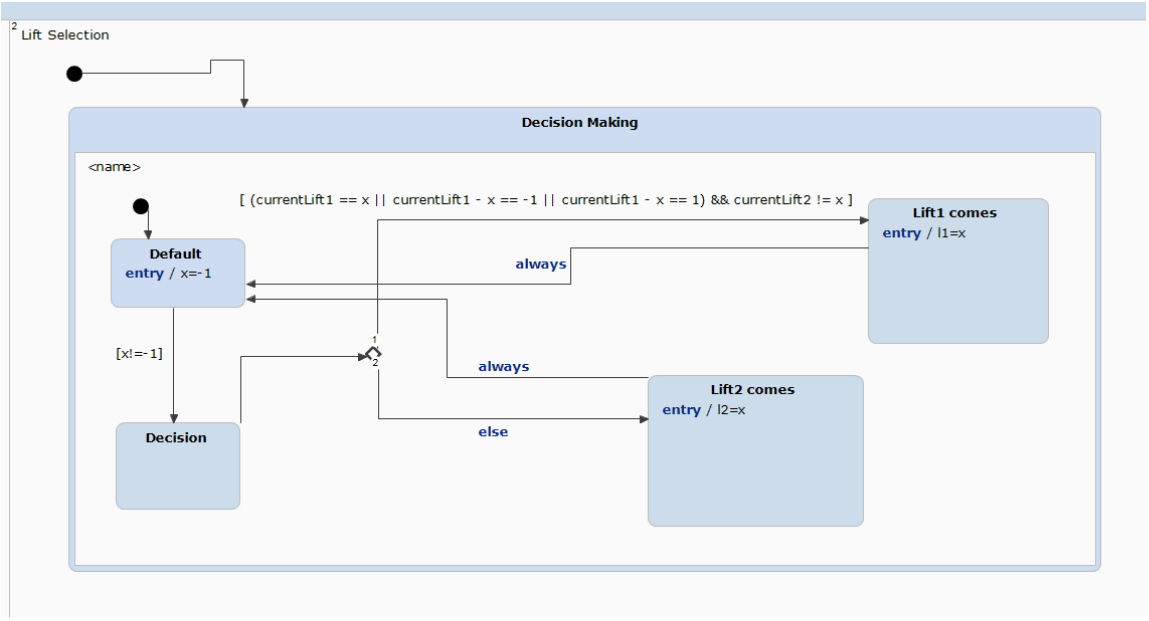
- **<u>Outside Buttons:</u>** All the 3 floors have 3 states representing them and a not pressed button by default representing no button pressed.. There are three events: choice1, choice2 and choice3 which are triggered as we select the floor respectively and then a variable x is set on the basis of the choice we made. When pressed the buttons went back to not pressed after 20 seconds. The floors are represented by 1,2,3 which is given to x.



- **<u>Lift Selection:</u>** This state is used to find which state is going to receive the request after the button is pressed from outside based on which lift is closer from the floor the list is called. The default value of x was set to -1 indicating that when nothing is pressed or no lift is called there is no request. When x is not equal to -1 then we know a button was pressed hence we move to the state and decide on the condition of:

[(currentLift1 == x || currentLift1 - x ==-1 || currentLift1-x == 1) && currentLift2 !=x]

The variables currentLift1 and currentLift2 represent the current lift position of the lifts which helps in making the decision, on which we enter 2 states Lift 1 comes or Lift 2 comes.



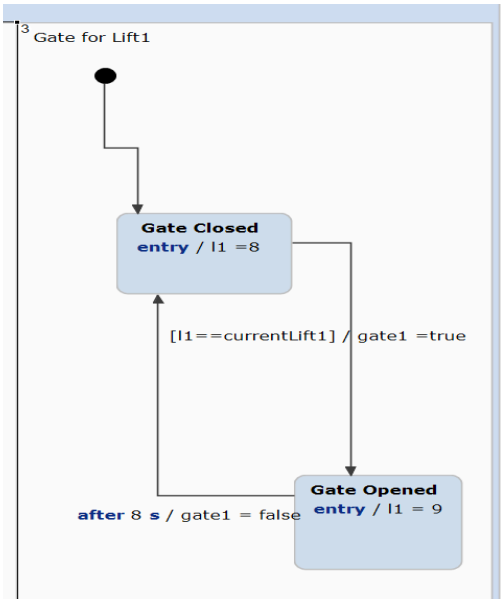
- **<u>Lift 1 and Lift 2:</u>** Both these lifts have identical inside features so it can be explained similarly by just replacing the variable names ending with 1 or 2.

There are 3 concurrent states which can be opened on a new page by clicking on the state bottom right. These are namely:

1. Floor Selection
2. Working
3. Gate

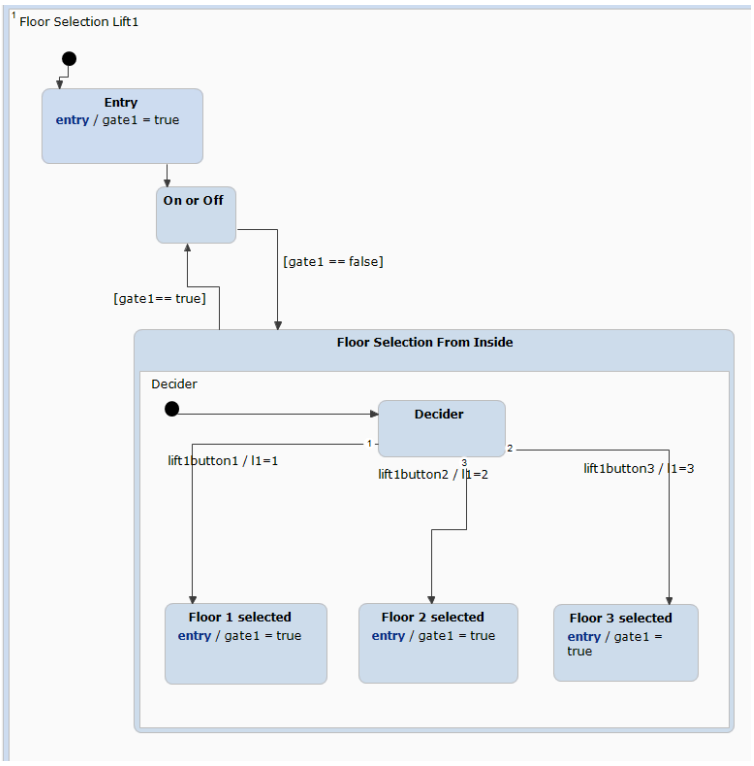
1. **<u>Gate for Lift:</u>**

In this I have added 2 variables l1, which signifies the destination of the lift now, so when the lift is at the current floor then the lift gate opens and gate1 is set to true and after 8 seconds the door closes automatically and gate1 is set to False. By default I have made the lift destination 8 which is considered when the door is closed.



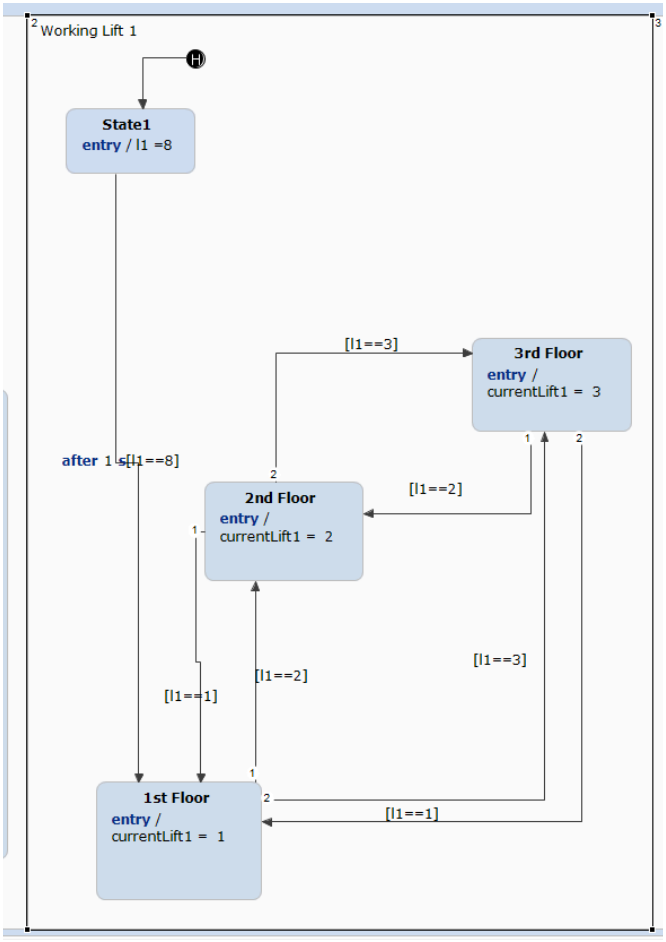
2. **Floor Selection:**

Now when the user is Inside he can select a floor of his destination here gate1 variable is used to see if the gate is currently closed or not. If it is closed then only we can select the floor and then only the lift will move. Then there are three events lift1button1, lift1button2, lift1button3 which signifies which floor the user decides from inside the lift. The control is then passed through the Working of the lift. It will change the lift destination variable l1 accordingly.



3. **Working of Lift**:

By default I consider the destination as l1=8. By default in the starting the lifts are in floor1 but then there is a history node who stores the value of the lift current position. All the three states represent the current position of the lift and the transitions are made on the destinations which are triggered during floor selection.



SImulation:

There is a dummy event named myEvent that is created but not utilised in the state machine which is used to simulate the state machine. If I don't use it , the state machine will produce some output but will take additional time to generate it. If we click it it will give output spontaneously.

When we run the simulation by default the transition goes to the OFF state.

Another important part is that we can’t press inside buttons until the gate is closed, which takes 8 seconds (looking at the safety criteria), or to avoid that we have to press myEvent button.

Note if a button doesn’t works on the first click, do a double click.

Sr No.	Input Event	Output Description
1	ON	The transition goes to the on state and all other concurrent states' default states.
2	OFF	The control again goes back to the off state.
3	ON	Same thing as (1) happens which indicates the proper working of the Lift.
4	choice2	The third floor is selected and the first lift comes. Selecting the first lift we see that The lift reaches the 2nd floor gate1 is opened, gate1 is then closed,
5	lift1button3	The lift then reaches the 3rd floor and the gate opens and closes after 8 seconds.
6	choice1	As at the starting the lift is at the first floor, The second lift’s gate opens and closes in 8 seconds.
7	lift2button3	The lift 2 reaches the 3rd floor and the gate2 is opened for 8 seconds and then it closes.
8	lift2button1	The user changed his mind and went to the 1st floor again. Then the 1st floor door opens, the door closes again in 8 seconds.
9	choice2	User calls lift from the second floor, Lift 1 comes at 2nd floor door opens and closes in 8 seconds
10	lift1button3	Lift 1 goes to the 3rd floor and the door opens and closes in 8 seconds.
11	choice3	Lift 1 is already on the third floor so the door opens and closes.
12	lift1button1	Lift1 goes to the first floor and the door opens and after 8 seconds the door closes.
13	OFF	The lift is off, but we can see that the lift’s current position which is 1 and 1 respectively is saved.

14	ON	We turned on the lift again and can see the lift is still at it's it current state, This is due to the history state at the working of the list state.
15	choice3	The lift 2 comes by default to floor 1, the door opens and closes in 8 seconds.
16	lift2button2	When the door is closed, then we press this button, the lift goes to floor 2. The door opens and then closes in 8 seconds.
17	choice1	The lift 1 gate opens and closes in 8 seconds.
18	lift1button3	The lift 1 goes to the third floor, the gate opens and closes in 8 seconds.
19	OFF	The lift is off, but the current position of lift 1 and lift 2 is 3 and 2 respectively.
20	ON	The lift is On again.