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CS7680
HW1
Task B

Overview

I chose to base my elevator design off of a hydraulic elevator that has an emergency mode when a passenger hits the emergency button within the elevator. Given that this was the elevator, I thought it was best to implement a Program State Machine Model (PSM) to capture the elevator's design accurately. Choosing this model also allows me to illustrate the normal and emergency modes of the elevator and all the required functions of the assignment within the design.

Hardware

The elevator is powered by a hydraulic piston that is located at the bottom of the elevator which pushes the elevator up or down to desired floor.

Given that there are *m* floors in the building the elevator system is being installed in and there will be *one* elevator per floor, the hardware required is listed below:

- Main controller → *Receives all input requests, dictates the direction of the elevator, and communicates with other elevator components*
- Frequency controller → *Dictates the speed at which the elevator moves, receives commands from the main controller*
- Hydraulic piston
- Hydraulic cylinder
- Hydraulic pump
- Oil heater/cooler
- Oil reservoir
- Shaft
- Shaft ventilation

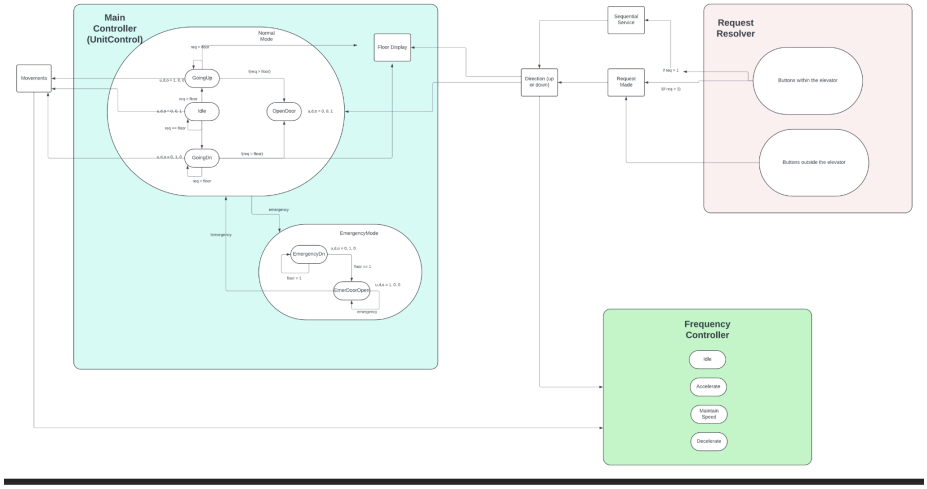
  There will be a single elevator car that will transport passengers from floor to floor. The car is propelled by the hydraulic system. The elevator car will be made up *three* walls, *one* base floor, and *one* ceiling. The front of the car will have *two* sliding doors.

- Single Car Elevator parts:
  - 2 sliding doors for each floor → 2 * *m* doors
  - Sensors for the doors
  - Door motor (that controls the opening and closing of the doors)
  - Destination control panel that will hold all the buttons (buttons will include all *m* floors, open and close, and emergency)
  - Digital display panel above the control panel that will tell the user which floor they are currently on and will also update the floors as they travel to their destination
  - Lights on ceiling
- Display panel outside the elevator above the doors on each floor. On the general floors the panel will have two arrows and if the elevator is traveling the appropriate arrow will

illuminate to represent the elevator's travel direction. For the top and bottom floors the display will only have one arrow that points in the direction opposite of where the floor is located. Therefore, there will be *two* unique panels for the bottom and top floors. The total general panels can be calculated from *(m - 2)*.

- Buttons:
    - All buttons will be an *illuminated push button switch*. These buttons have switches with a built-in LED.
    - Buttons will be placed on the destination control panels within the elevator as well as outside the elevator.
    - For the panels outside the elevator, the top and bottom floors will have a single button on their panels while the other floors will have two buttons.
    - The control panel within the elevator will have buttons for all the *floors*, to *open* and *close* doors, and *for an emergency*.

<u>Design Model</u>



- The *main controller* displays the four states: {idle, up, down, open door}. It receives requests from the passengers through communication with the request resolver. The main controller also directly tells the frequency controller when and how to move.
- The *request controller* is made up of two panels, one panel for the buttons within the elevator and the other for buttons outside the elevator. The display light on each floor and on the elevator is alerted by the request resolver to indicate which direction it should light. If there are more than one requests from within the elevator they get put into the sequential service to be handled accordingly.
- The *frequency controller* receives commands from the main controller on how to handle the motor control of the elevator.

Reference Sources:
http://www.electrical-knowhow.com/2012/04/hydraulic-elevators-basic-components.html
https://www.house-design-coffee.com/residential-elevators.html