Elevator Design Narrative

There are four main components to my elevator design model: Floor Buttons, Elevator Buttons, Request Resolver, and Elevator.

Floor Buttons: There are two buttons on each floor outside of the elevator to request an elevator going up, or an elevator going down (except for the top and bottom floors, which only have one such button, to go down or up respectively). When pressed, these buttons light up and send a request to the request resolver with the requested floor number (based on what floor the button was pressed on) and the requested direction. When the elevator communicates to the resolver that that request has been cleared (which occurs once the doors open on that floor), the button ceases to be lit up and returns to its idle state. Attached to these buttons, there is also a display to show what floor the elevator is on, and what direction it is moving (this information is also received from the request resolver, as communicated by the elevator).

Elevator Buttons: Inside the elevator, there is a button for each floor that can be traveled to. When one of these buttons is pressed, it lights up and sends a request to the request resolver with the requested floor number (in this case, since there is no requested direction, the direction is null). When the elevator communicates to the resolver that that request has been cleared (which occurs once the doors open on that floor), the button ceases to be lit up and returns to its idle state. Attached to these buttons, there is also a display to show what floor the elevator is on (this information is also received from the request resolver, as communicated by the elevator).

Request Resolver: The request resolver receives requests from both Floor Buttons and Elevator Buttons, and uses an algorithm to sort these requests and send them one by one to the elevator. New requests sent to the request resolver are sorted into the queue as they are received. When the elevator communicates to the request resolver that the last request has been cleared, the resolver sends the next request. It also then communicates to the floor/elevator button panels when their requests have been cleared. The logic used for ordering requests is as follows:

1. All Down/null requests that are lower than the current floor (sorted from high to low)
2. Lowest Up request
3. All Up/null requests that are higher than the current floor (sorted from low to high)
4. Highest Down request
5. Repeat

By following this algorithm, all requests will eventually be served, and the elevator constantly goes up from the lowest requested floor to the highest, and then down from the highest requested floor to the lowest, and avoids the inefficiency of going rapidly back and forth between up and down requests.

Elevator: The elevator transitions between its 4 states (IDLE, UP, DOWN, OPEN) based on the requests it receives from the request resolver, as well as the current floor. Current floor and direction (when moving) are communicated to the request resolver regularly in order to be sent to the displays. The elevator starts out in the IDLE state. When the elevator receives a request, it transitions to UP or DOWN based on the direction of the request, and then transitions to OPEN once the current floor matches the requested floor. In the OPEN state, the doors open for a set amount of time, and then automatically close. If there is anything blocking the doors from closing (as determined by some sort of pressure sensor), they re-open and repeat until they can close. Once the elevator has reached the OPEN state, it communicates to the request resolver that that request has been cleared, and the request is then replaced with the next request, sent by the resolver, and the elevator once again transitions to UP or DOWN accordingly. If the request resolver is empty (there are no requests), the elevator transitions back to the IDLE state and awaits a new request. The elevator does not need to concern itself with the direction it is moving in, or the directions of the requests, because that logic is all handled/sorted by the request resolver. The elevator just needs to know which floor to go to next, and transition between states accordingly by the given logic.