Software Engineering Workshop 2A
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Assignment 2
Design Manual

Group COMP2121E2

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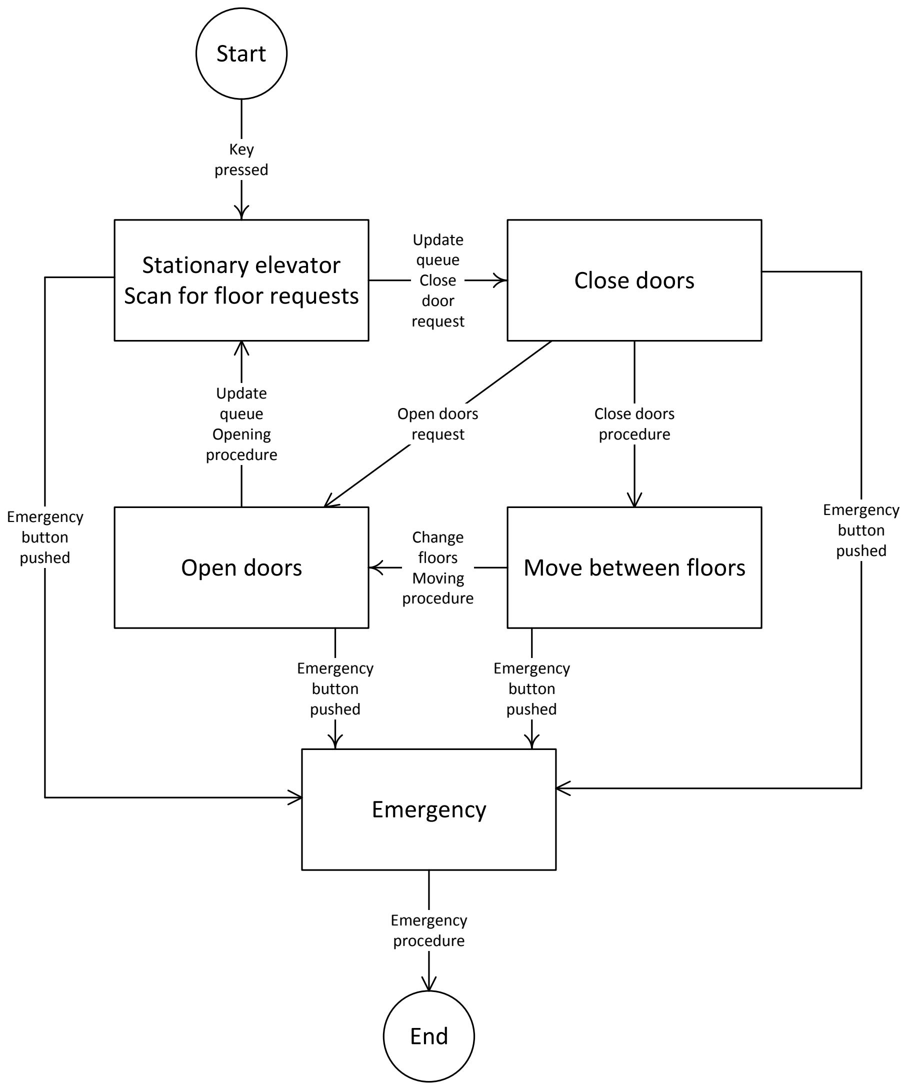
1 System control flow



2 Data structures

The floors that are next to visit are stored in a priority queue. Unlike most concrete implementations however, the priority queue that is implemented is not efficient and the *priority* is not strictly speaking used when adding to the queue. When adding to the queue, we simply add to the end of the queue and then sort the queue after adding. This is not strictly a priority queue, but for all intensive purposes it can be treated like one. The *priority* of the queue is dependant on which direction the elevator is headed in. If the direction is up, the queue is sorted in increasing order. If the order is down, it is sorted in decreasing order. The direction is determined when a key is pressed when the queue is empty, adding the number to the queue making it of size 1 and then calculating the direction relative to the current floor. Empty the queue is empty again, the direction cannot change.

3 Algorithms

To sort the queue, we use a bubble sort. The bubble sort we implemented was a very simple one, although we managed to avoid getting a $T(n) = n^2$ bubble sort and wrote a $T(n) = \frac{n(n+1)}{2}$ which is good. To do this we needed another register to store the index of the end of the array, but it had to decrease after every iteration to achieve the ideal time complexity.
Because we didn't implement a priority queue properly, we ended up with a $O(n) = n^2$ (or $T(n) = n + \frac{n(n+1)}{2}$ to be more specific) insert speed instead of the normal $O(n) = \log n$. It doesn't really matter too much since the largest queue we could possibly have has a size of 9 (there are 10 floors and you can't add the floor you're on to the queue).

4 Module specifications

4.1 Stationary

While the lift is stationary, it listens for floor requests from the keypad and processes them into the queue. The elevator remains stationary until it gets a floor request and then moves to the closing phase after 3 seconds. However, the lift will stay stationary indefinitely if the open button # is held down. When the close button PB0 is pressed, it will ignore the entire stationary phase and move straight to the closing phase.

4.2 Closing

During the closing phase you can still listen for keypad input and it will add the floor request to the queue. Also, pressing the # key will force the closing process to abort and jump to the opening phase.

4.3 Moving

While the elevator is moving, the only input that can be taken is floor requests and the emergency button. This is because it is unsafe to be able to open the doors while the elevator is moving and the doors should already be closed when moving. It takes two seconds to move between floors and the current state of the floor is updated on the LCD.

4.4 Opening

While a door is opening, it can still take keypad input to add to the queue. The closing and opening button have been disabled during this phase since it doesn't make sense to let those buttons work. After the door completely opens, it returns back to the stationary phase and pops the head of the queue.

4.5 Emergency

During anytime of the operating of the elevator, the emergency button PB1 can be pressed to turn on an emergency signal. The elevator doors will close regardless of what state they were in, the floor request queue will be cleaned out and the elevator will head straight to floor 0. Upon reaching floor 0, the doors will open for a brief period of time before closing again. During an emergency, the LCD will display ”Emergency Call 000”, the LEDs will flicker and the system will lock down completely until a reset is activated.