Winter2024 COMP3004 Assignment 3

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Due: 24/03/13

Part 1: Elevator Control System Use Case

Primary Actor: Passenger

Scope: Current floor, the Elevator

Level: User Level

Stakeholders and Interests:

> Passenger - wants to travel between floors using the elevator
>
> Building management – wants functional elevator
>
> Elevator installation company – wants the installed equipment to function, will be called in event of issue

Precondition: user is in a building with access to an elevator

Minimal Guarantees: the passenger will hit a button

Success Guarantees: the passenger will be able to travel between floors in a timely fashion without fear of injury

Trigger: the user presses the button

Main Success Scenario:

1. Passenger selects up or down call button and it lights up
2. Elevator arrives, bell rings, doors open for 10 seconds
3. Passenger enters elevator
4. Passenger selects desired floor
5. Doors close
6. Elevator begins moving to desired floor. The display updates the current floor display ringing at each floor
7. Elevator arrives at desired floor, doors open
8. Passenger disembarks elevator

> Passenger selects up or down call button and it lights up
> Elevator arrives, bell rings, doors open for 10 seconds
> Passenger enters elevator
> Passenger selects desired floor
> Doors close

Elevator begins moving to desired floor. The display updates the current floor display ringing at each floor
Elevator arrives at desired floor, doors open
Passenger disembarks elevator

Extensions:

1-8a. elevator has no electricity

1-8a1. Audio and text messages inform passengers of situation

1-8a2. Elevator back up battery lowers elevator to nearest floor

1-8b. fire in building or elevator

1-8a1. Fire alarm goes off informing passengers of situation

1-8a2. Elevator back up battery lowers elevator to nearest floor

3-7a. help button is pressed

3-7a1. the passenger is connected to building safety service through a voice connection. If there is no response from building safety within 5 seconds or if there is no response from a passenger a 911 emergency call is placed.

2a. elevator cab is already at the called floor, so bell rings and door opens

3a. elevator is full, return to beginning of Main Success Scenario

3b Overload alarm is triggered

3b1. passenger disembarks elevator, return to beginning of Main Success Scenario

4. passenger selects another option

4a. passenger selected close door button, doors close soon than they would otherwise

4b. passenger selects open door button, doors remain open longer than they would otherwise

5a. doors remain open

5a1. remove obstacle obstructing sensor.

5ab. Call elevator repair guy to fix sensor

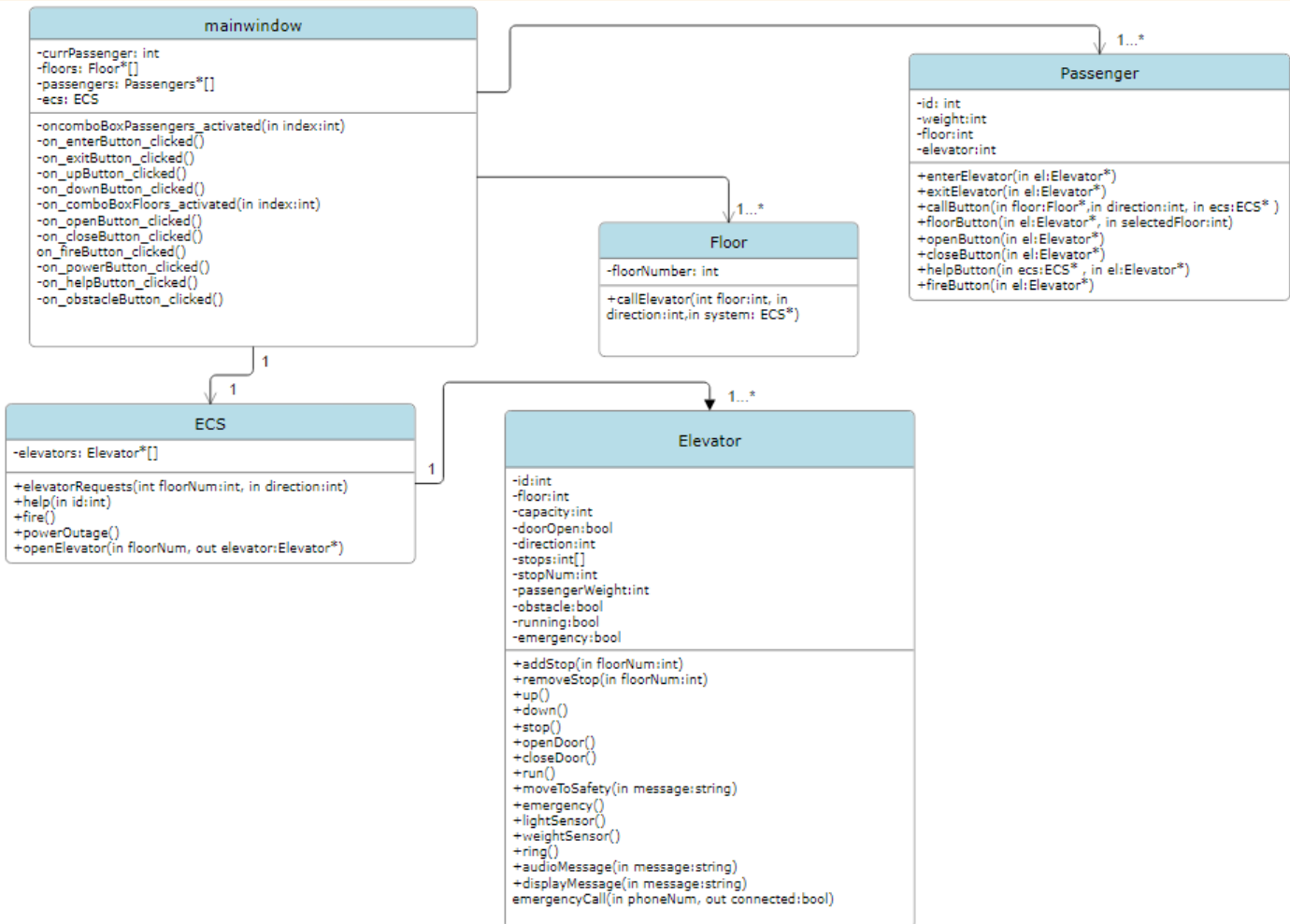5ab1. disable elevator until repair guy can fix

6a. someone move in the same direction closer to the end destination has called elevator

6a1. elevator does step 2-5

6b. some part of display doesn't work

6b1. elevator completes tasks without the damaged part of the display

Part 2: UML Class diagrams

mainwindow

-currPassenger: int
-floors: Floor*[]
-passengers: Passengers*[]
-ecs: ECS

-oncomboBoxPassengers_activated(in index:int)
-on_enterButton_clicked()
-on_exitButton_clicked()
-on_upButton_clicked()
-on_downButton_clicked()
-on_comboBoxFloors_activated(in index:int)
-on_openButton_clicked()
-on_closeButton_clicked()
on_fireButton_clicked()
-on_powerButton_clicked()
-on_helpButton_clicked()
-on_obstacleButton_clicked()

1...*

Passenger

-id: int
-weight:int
-floor:int
-elevator:int

+enterElevator(in el:Elevator*)
+exitElevator(in el:Elevator*)
+callButton(in floor:Floor*,in direction:int, in ecs:ECS*)
+floorButton(in el:Elevator*, in selectedFloor:int)
+openButton(in el:Elevator*)
+closeButton(in el:Elevator*)
+helpButton(in ecs:ECS* , in el:Elevator*)
+fireButton(in el:Elevator*)

1...*

Floor

-floorNumber: int

+callElevator(int floor:int, in direction:int,in system: ECS*)

1

1

ECS

-elevators: Elevator*[]

+elevatorRequests(int floorNum:int, in direction:int)
+help(in id:int)
+fire()
+powerOutage()
+openElevator(in floorNum, out elevator:Elevator*)

1

1...*

Elevator

-id:int
-floor:int
-capacity:int
-doorOpen:bool
-direction:int
-stops:int[]
-stopNum:int
-passengerWeight:int
-obstacle:bool
-running:bool
-emergency:bool

+addStop(in floorNum:int)
+removeStop(in floorNum:int)
+up()
+down()
+stop()
+openDoor()
+closeDoor()
+run()
+moveToSafety(in message:string)
+emergency()
+lightSensor()
+weightSensor()
+ring()
+audioMessage(in message:string)
+displayMessage(in message:string)
emergencyCall(in phoneNum, out connected:bool)

Part 3: UML sequence diagrams

Success Scenario 1: both passenger 1 and passenger 2 are getting on at the 1st floor, while passenger 2 is getting off at the 3rd floor and passenger 1 is getting off at the 4th floor. The elevator is on the 1st floor.

==View Success Scenario 1.png==

Success Scenario 2: Both passenger 1 and passenger 2 wants to get to the 2nd floor. Passenger 1 is requesting an elevator to go up from the 1st floor and passenger 2 will get on another elevator from the 4th floor and travel down to the 2nd floor. Elevator 1 is on the 1st floor and elevator 2 is on the 5th floor.

==View Success Scenario 2.png==

Help

<mark>View Safety Scenario Power Help.png</mark>

Door obstacles

<mark>View Safety Scenario Door Obstacle.png</mark>

Overload

<mark>View Safety Scenario Power Overload.png</mark>
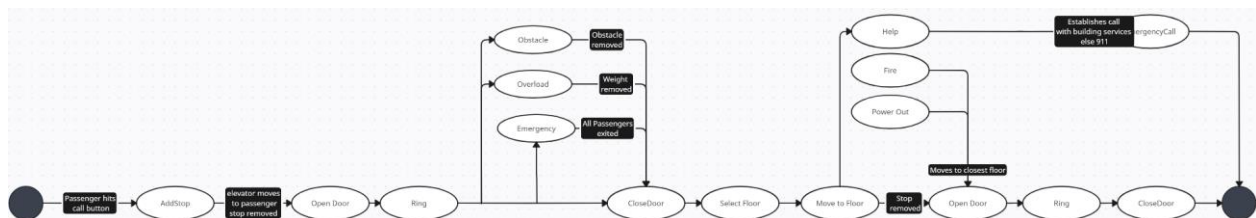
Fire

<mark>View Safety Scenario Fire.png</mark>
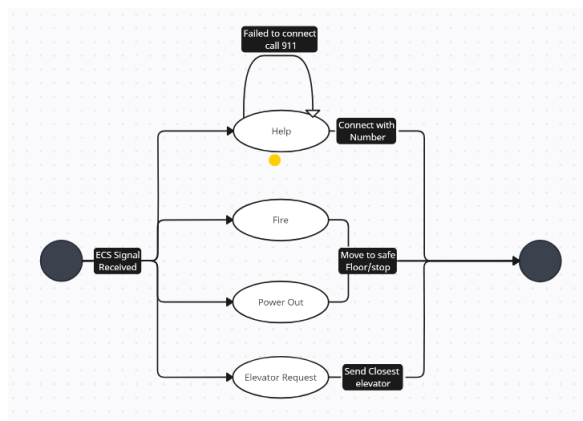
Power out

<mark>View Safety Scenario Power Outage.png</mark>

Part 4: UML state machine diagram

Elevator

Ecs

Part 5: Traceability Matrix

USE CASE 1

ID	Requirement Source	Use Case	implemented-by	tested-by
1	On each of the N floors is a pair of buttons marked "up" and "down"	Step 1	Passenger, Floor	GUI up and down buttons
2	When a button is pressed it illuminates, and remains illuminated, until an elevator arrives	Step 1-2	Passenger, Floor, Ecs, Elevator	Select up or down button
3	customers can request an elevator going in a certain direction	Step 1	Passenger, Floor, Ecs	GUI up and down buttons
4	When the elevator arrives, it rings a bell, opens its doors	Step 2	Floor, Elevator	call elevator and wait till it arrives
5	After 10 seconds, it rings the bell again, closes its doors	Step 5	Elevator, Ecs	Enter elevator and wait
6	Once on-board passengers select one or more destination floors using a panel of buttons; there is one button for every floor	Step 4	Passenger, Elevator	Floor combo box in gui
7	Elevator proceeds to another floor	Step 6	Elevator, Floor, Ecs	Select a floor in the gui combobox
8	The elevator has a display which shows passengers the current floor of the elevator.	Step 6	Elevator, Floor, Ecs	The terminal with display the elevators current floor
9	There is also a pair of buttons on the elevator control panel marked "open door" and "close door".	Extension 4ab	Elevator, Ecs, Passenger	GUI open and close
10	Inside the elevator there is also a help button linked to building safety service.	Extension 3-7a	Elevator, Ecs,	Gui help
11	Each elevator has a sensor that notifies it when it arrives at a floor.	Step 4	Elevator, Ecs	This is abstracted away in the simulation
12	The elevator control system should ensure that the group of elevators services all requests expeditiously	Step 1	Ecs	Ecs will send the closest non moving elevator or a elevator moving past in call floor in the call direction

13	Each elevator has a display and a audio system.	Step 2	Elevator, Floor, Ecs	Terminal will show elevator # n audio: and elevator # n display:
14	When the system receives a "Help" alarm signal from an elevator. The passenger is connected to building safety service through a voice connection	Extension 3-7a	Elevator, Ecs, Passenger	Simulation will always fail connection with building safety
15	if there is no response from building safety within 5 seconds or if there is no response from a passenger a 911 emergency call is placed.	Extension 3-7a	Elevator, Ecs	On fail with building safety simulation will 100% connect with 911
16	If the light sensor is interrupted when the door is closing, the control system stops the door from closing and opens it.	Extension 3-7a	Elevator, Ecs	Gui obstacle button when a door is open
17	If this occurs repeatedly over a short period of time, a warning is sounded over the audio system and a text message is displayed	Extension 5a	Elevator, Ecs	If Gui obstacle button is not click again messages will repeat and eventually audio messages will show
18	When the control system receives a "Fire" alarm signal from the building and commands all elevators to move to a safe floor.	Extension 1-8b	Elevator, Ecs,	when gui fire is selected and current passenger is not in an elevator. All elevators will receive fire signal if running they will give audio and text messages. If not running they will stop.
19	Similarly, a "Fire" alarm signal from the elevator itself will cause that elevator to go to a safe floor	Extension 1-8b	Elevator, Ecs	When gui fire is selected and current passenger is in an elevator. The current elevator will receive fire signal if running they will give audio and text messages. If not running they will stop
20	When there is a fire, audio and text message are presented to passengers informing them of an emergency and asking	Extension 1-8b	Elevator, Floor, Ecs	Terminal will deliver audio and text messages

	them to disembark once the safe floor is reached.			
21	If the sensors indicate that the passenger or cargo load exceeds the carrying capacity, the control system receives an "Overload" alarm signal from an elevator	Extension 3a	Elevator, Ecs	All 3 passenger must enter elavator overload will occur if weight is greater than 299, each passenger weighs 100
22	If overload is detected, the elevator does not move and an audio and a text messages are presented to passengers asking for the load to be reduced before attempting to move again.	Extension 3a	Elevator, Ecs	If a passenger does leave messages will repeat and eventually audio messages will show
23	When the control system receives a "Power Out" alarm signal, an audio and a text messages are presented to passengers informing them of the power outage.	1-8a	Elevator, Ecs	when gui power is selected and current passenger is not in an elevator. All elevators will receive fire signal if running they will give audio and text messages. If not running they will stop.
24	Each elevator is then moved to a safe floor and passengers are asked to disembark via audio and text messages. The battery backup power is sufficient to do all of this.	1-8a	Elevator, Floor, Ecs	Terminal will deliver audio and text messages

Part 6: Design explanation

I chose a more mixed design between the centralized and distributed patterns. When a floor calls an elevator the ECS determines the closest non moving elevator bore if a moving elevator is passing in the direction that the floor has indicated. The ECS also notifies all elevators of building wide issues such as a power outage or a fire, with the elevator itself handling overloads and obstacles. They both work together to handle the help button. I removed three classes I originally had in assignment 2 speaker, display, requests. The requests class became an array of integers within the elevator class each position in array representing a floor a one means the elevator must stop on that floor, 0 means it does not need to stop. Speaker and display classes both became functions within the elevator class display becoming one displaymessage(string message), speaker becoming three, audiomessages(string message),ring(), energencycall(string number). Another potentially notable decision I made was not to have connect calls as shown in the assignment 3 demo, this was because I watched a YouTube video demonstrating how to have buttons trigger events when pressed.