Affan Husain Beg
101182533

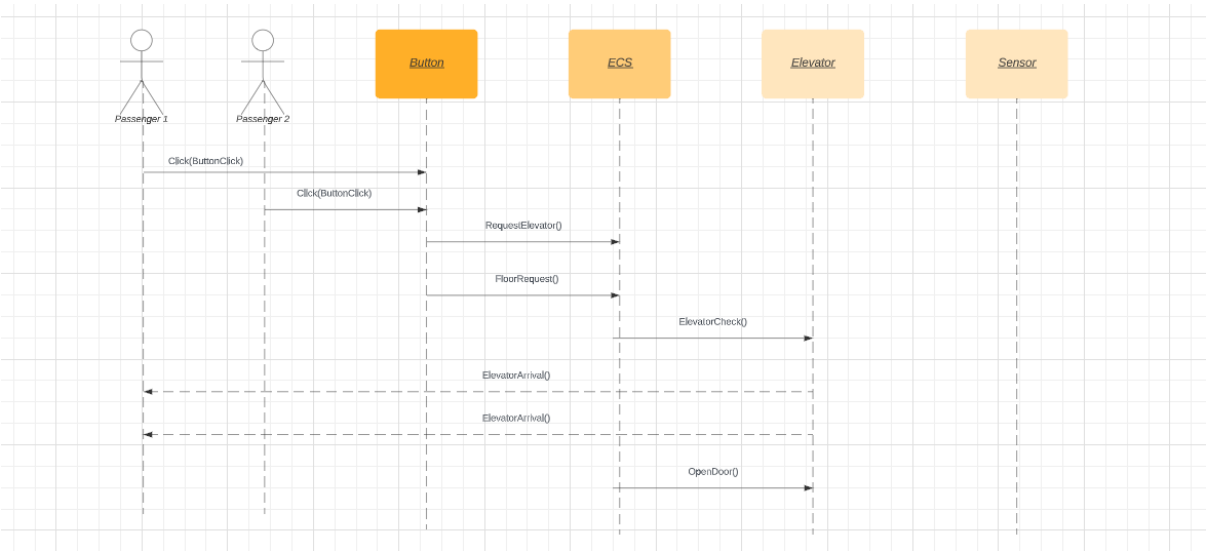
Use cases:

Use Case 1: Request Elevator
Primary Actor: Passenger
Scope: Elevator System
Level: User Goal
Stakeholders and Interests:

- **Passenger:** Wants to request a floor and reach the desired floor.
- **Elevator System:** Needs to receive and process the request from the passenger.

Precondition: None
Minimal Guarantee: Elevator system gets a request
Success Guarantee: Elevator arrives at the desired floor.
Main Success Scenario:

1. Passenger presses a button to call the elevator, they can either press up or down
2. Whatever button they pressed is now lit up until the elevator shows up
3. The request is sent to the ECS (Elevator Control System) and the ECS checks which elevator is available and checks for overlapping request at the same time
4. Once the elevator is chosen then the elevator moves to the desired floor
5. The elevator reaches the desired floor and a sound is made from the elevator alerting the passenger that the elevator has arrived. At the same time, the button's light turns off.
6. Elevator door opens and passenger enters elevator



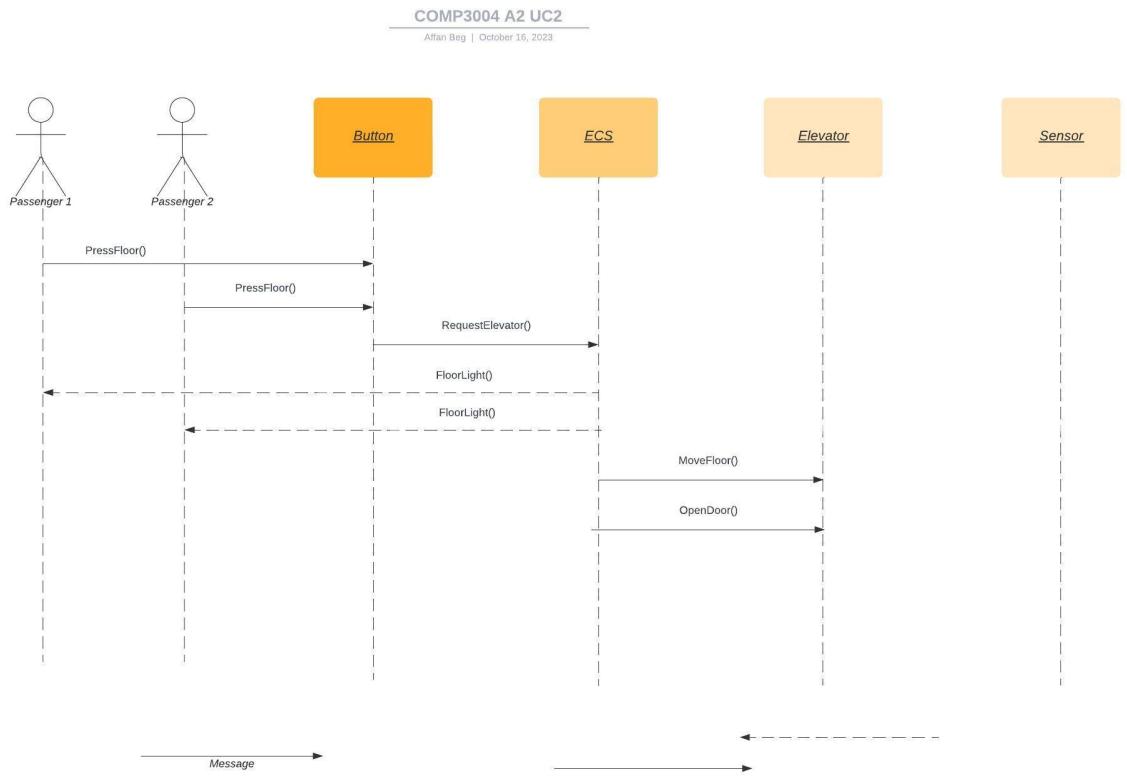
Use Case 2: Enter Elevator
Primary Actor: Passenger
Scope: Elevator System
Level: User Goal
Stakeholders and Interests:

- **Passenger:** Wants to enter the elevator and reach the destination floor.
- **Elevator System:** Needs to allow passengers to board the elevator and reach destinations.

Precondition: Elevator has arrived at the floor.
Minimal Guarantee: Passenger enters the elevator safely.
Success Guarantee: Passenger selects and reaches the desired floor.

Main Success Scenario:

1. Elevator comes to the passengers floor and the door opens
2. Passenger enters the elevator and presses the desired floor they want to go to and the button they pressed gets lit.
3. Elevator receives the request and the elevator starts moving to the desired floor
4. The elevator stops on the floor and the door opens
5. Passenger exits the elevator safely



Use Case 3: Emergency Help
Primary Actor: Passenger
Scope: Elevator System
Level: User Goal
Stakeholders and Interests:

- **Passenger:** Wants to seek help in an emergency.
- **Elevator System:** Needs to provide a mechanism for passengers to request assistance.

Precondition: Passenger has an emergency inside the elevator.
Minimal Guarantee: Help request is sent to building management.
Success Guarantee: Building management responds or forwards it to the appropriate emergency services.
Main Success Scenario:

1. Passenger has an emergency while in the elevator. For example, a medical emergency or a mechanical problem in the elevator.
2. Passenger uses the emergency communication intercom system installed in the elevator.
3. The elevator attempts to connect to the building emergency security desk.
4. The emergency operator, then, communicates with the passenger and tries to assist them.
5. If the situation is out of the operator's hands, the operator contacts 911 emergency services for help.

Extensions:

2a. The emergency intercom system is not working.

2a1. Passenger tries alternative means of communication if available. (e.g mobile phone or screaming)

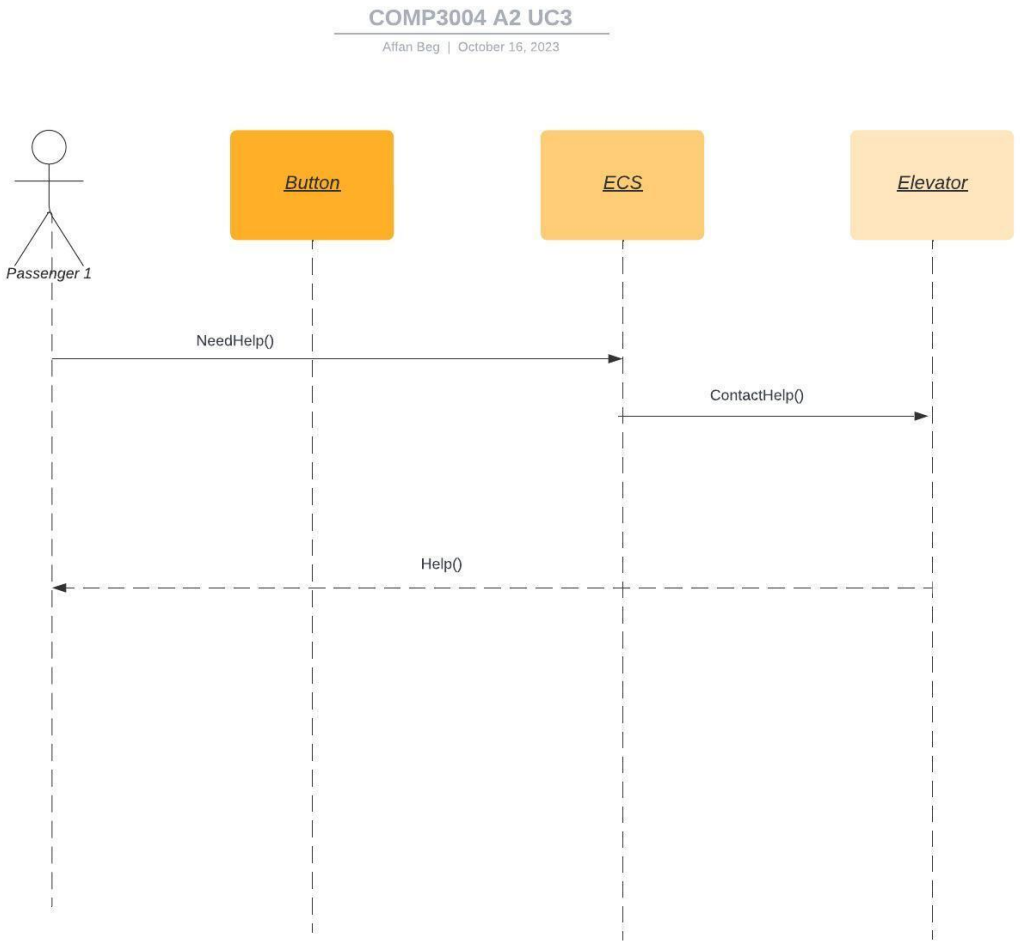
4a. Operator cannot understand the nature of the emergency.

4a1. The operator tries to locate the elevator and assess the situation.

5a. The situation is beyond the scope of the operator to handle.

5a1. Operator contacts external emergency services (e.g., 911) to request immediate assistance.

5a2. Operator stays on the line with the passenger, providing support until help arrives.



Use Case 4: Door Obstacle
Primary Actor: Elevator Control System
Scope: Elevator System
Level: System Function
Stakeholders and Interests:

- **Elevator Control System:** Needs to prevent door accidents.

Precondition: An obstacle is detected by the sensor while the elevator door is closing.
Minimal Guarantee: Elevator door stops closing.
Success Guarantee: The door stays open until the obstacle is removed..
Main Success Scenario:

1. While the passenger is about to depart, the door closes as usual
2. The sensors on the elevator's door detects an obstacle obstructing the door's path.
3. The sensor sends this to the ECS and the door stops from closing and stays open.
4. A message is prompted to the passenger through the speaker in the elevator, informing the passenger to either remove the obstacle or safely exit the elevator.
5. If the obstacle is removed then the sensors detect it and the door starts closing and resumes normal operation.

6. If the obstacle cannot be removed then the passenger safely gets off the elevator and the door stays open until the issue is resolved.
7. This whole process ensures the passenger's safety

Extensions:

2a. The sensor detects an obstacle but fails to communicate with the ECS.

2a1. ECS initiates a system alert to notify the building office about the sensor malfunction.

2a2. Elevator door is left open and remains inoperable until the sensor issue is resolved.

4a. Passenger does not respond to the warning message.

4a1. ECS issues repeated warnings.

4a2. If the passenger still doesn't respond, ECS contacts building security or management for assistance.

6a. The obstacle is removed, but the door does not resume normal operation.

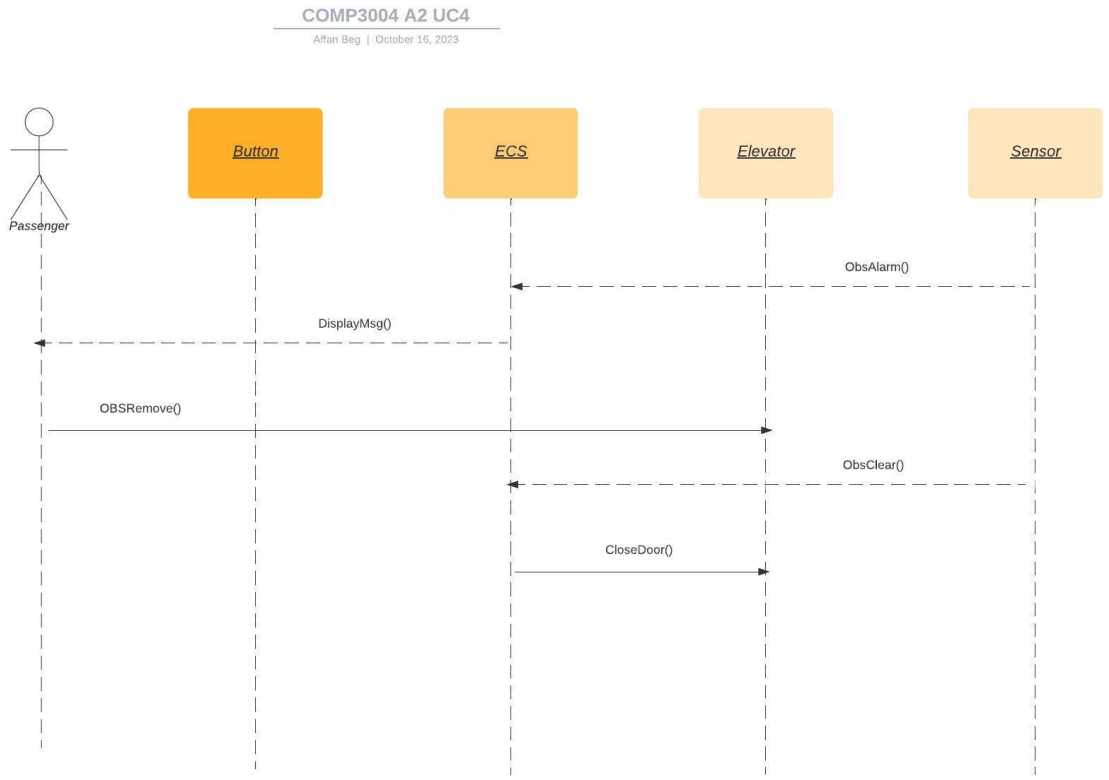
6a1. ECS initiates a system alert to notify the building office about the sensor malfunction.

6a2. Elevator door is left open and remains inoperable until the sensor issue is resolved.

6b. Passenger tries to force the door to close after the obstacle is removed.

6b1. ECS detects the attempt and prevents the door from closing, issuing a safety warning.

6b2. If the attempts persist, ECS stops the elevator operation until inspected by maintenance.



Use Case 5: Overload Alarm
Primary Actor: Elevator Sensor
Scope: Elevator System
Level: System Function
Stakeholders and Interests:

- **Elevator Control System:** Needs to prevent the elevator from overloading weight.

Precondition: The elevator's sensors detect an overload.
Minimal Guarantee: Elevator does not move, and a warning message is displayed.
Success Guarantee: Passengers reduce the load, and the elevator operates normally.
Main Success Scenario:

1. Just before the elevator door closes with the passenger in it.
2. The elevator pressure sensor detects that the weight has exceeded.
3. Elevator sends a request to the ECS and the elevator stops the door from closing and notifies the passenger about it.
4. The passenger takes appropriate actions to reduce weight.
5. If weight is reduced the ECS tells the elevator to function normally.
6. If the weight is not reduced then the elevator stays open and does not function until the weight is brought down.

Extensions:

2a. The elevator pressure sensor malfunctions, giving a false overload indication.

2a1. Elevator remains inoperable until the sensor issue is resolved.

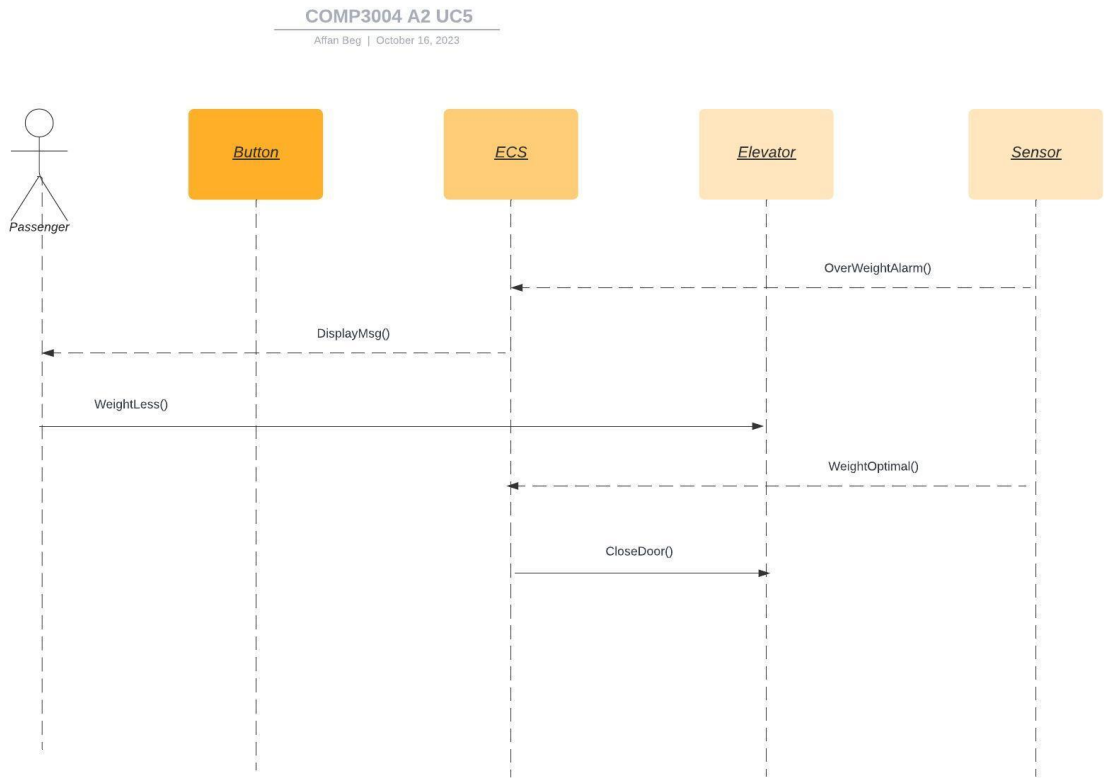
4a. Passenger does not respond to the overload warning message.

4a1. ECS issues repeated warnings.

4a2. If the passenger still doesn't respond, ECS stops the elevator functions.

6a. ECS mistakenly interprets that the weight is not reduced even though it is.

6a1. Elevator remains inoperable until the weight reduction is confirmed.



Use Case 6: Fire Alarm
Primary Actor: Building or Elevator
Scope: Elevator System
Level: System Function
Stakeholders and Interests:

- Building: Needs to ensure passenger safety during a fire emergency.
- Elevator Control System: Needs to coordinate elevator response during a fire alarm.

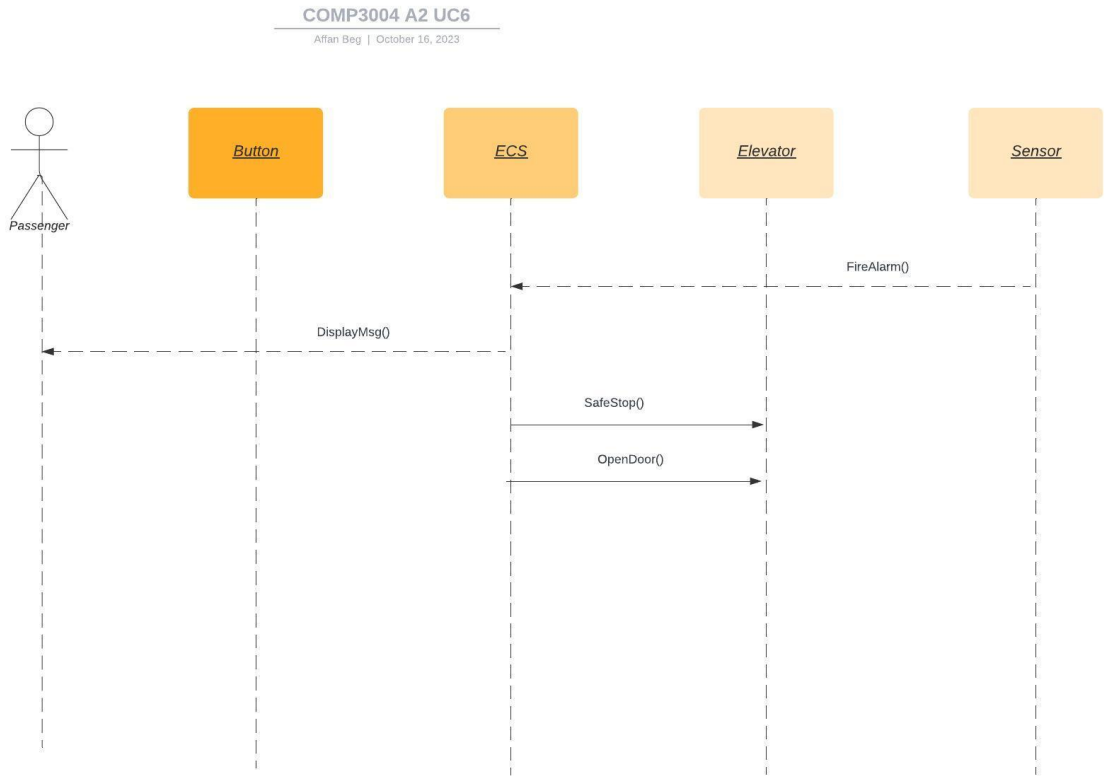
Precondition: Fire alarm is triggered in the building or an elevator.
Minimal Guarantee: Elevators move to a safe floor.
Success Guarantee: Passengers are informed of the emergency and safely exit the elevator.
Main Success Scenario:

1. Fire alarm is triggered in the elevator or in the building
2. Alarm notifies the ECS and ECS notifies the passengers in the elevator
3. Depending on the situation ECS is going to tell the elevator to either not depart, or safely stop
4. Once the elevator is stopped the door is then open and notifies passengers to leave the elevator and use the staircase to exit the building safely.

5. The elevator doesn't function until the fire alarm stops.

Extensions:

2a. The alarm system fails to notify the ECS.
    2a1. Elevator remains inoperable until the communication issue is resolved.
    2a2. ECS contacts building manager.
4a. Passengers hesitate to exit the elevator during a fire alarm.
    4a1. ECS issues repeated warnings and instructions through the elevator speaker.
    4a2. If passengers still hesitate, ECS contacts building management for assistance or emergency services.
5a. The elevator door fails to open after stopping.
    5a1. ECS contacts building management.
    5a2. Elevator remains inoperable until the door mechanism issue is resolved.



Use Case 7: Power Outage
Primary Actor: Elevator Control System
Scope: Elevator System
Level: System Function
Stakeholders and Interests:

- Elevator Control System: Needs to handle power outages safely.
- Passenger: Needs to be notified that there is a power outage.

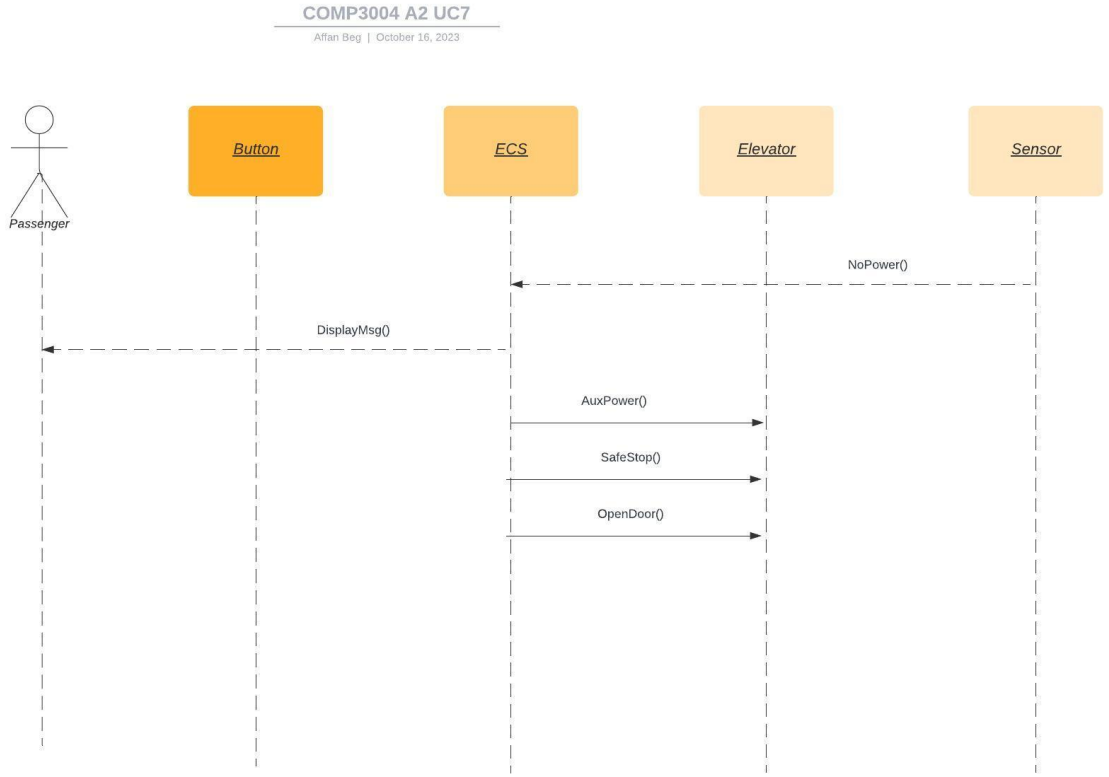
Precondition: Power outage occurs.

Minimal Guarantee: Passengers are informed of the power outage.
Success Guarantee: Elevators are moved to a safe floor, and passengers disembark.
Main Success Scenario:

1. A power outage happens in the building which affects the elevator functions.
2. ECS immediately changes the power source from the building to a backup generator
3. Passengers inside will be notified about it.
4. The elevator, then, stops at the nearest floor.
5. Elevators prompt the passenger to exit the elevator.
6. Elevator stops functioning till power is restored.

Extensions:

2a. The backup generator fails to activate after the power outage.
    2a1. ECS system attempts to inform building management if it has enough power.
    2a2. Elevator remains inoperable until the backup generator issue is resolved.
5a. Passengers refuse to exit the elevator during a power outage.
    5a1. ECS issues repeated warnings and instructions through the elevator speaker.
    5a2. If passengers still refuse to exit, ECS contacts building security or management for assistance.
6a. Power is restored, but the elevator fails to resume normal operation.
    6a1. ECS contacts building management to help resolve the issue.
    6a2. Elevator remains inoperable until the issues are resolved.

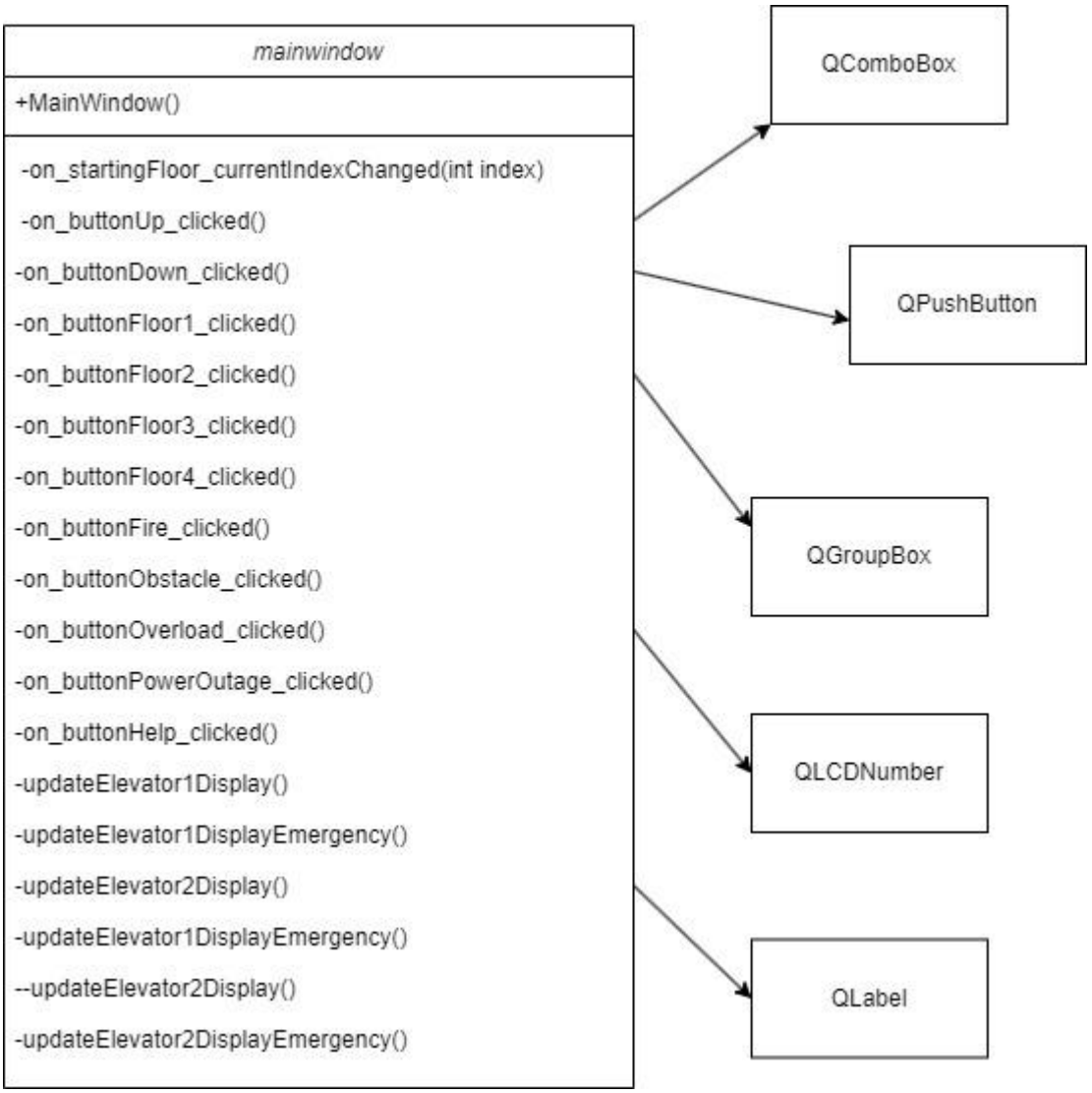


Traceability Matrix:

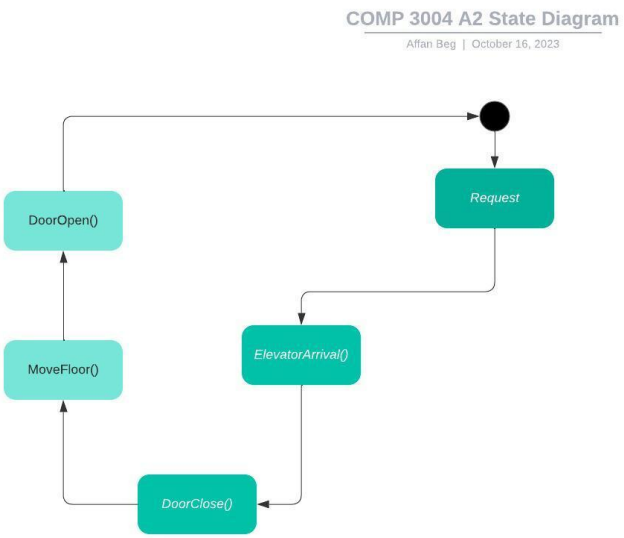
ID	Requirement	Fulfilled By	Test	Related Use Case	Description	Implemented By	Tested By
1	The ECS must work for M elevators and N floors	ECS	N/A	UC1	Every floor should have a up and down button to navigate the elevator which is all done by ECS	Qt simulation of the elevators	Qt creator and tested manually by developer
2	When elevator is called, ECS should notify the passenger about it	ECS	ButLight()	UC1	When the elevator is called the button should illuminate	Qt simulation of the elevators	Qt creator and tested manually by developer
3	When elevator is called, it can take multiple destinations	ECS	RequestFloor()	UC2	When passenger is in the elevator, they should be able to press multiple floors	Qt simulation of the elevators	Qt creator and tested manually by developer
4	ECS should connect the passenger to the appropriate person	ECS	ContactHelp()	UC3	When passenger has an emergency they can contact the appropriate person and seek help	Qt simulation of the elevators. GUI: buttonHelp	Qt creator and tested manually by developer
5	Sensor should tell when the elevator is overweight	Sensor	OverWeightAlarm()	UC5	When the passengers exceed the weight limit in the elevator then the ECS should not close door until its lowered	Qt simulation of the elevators GUI: buttonOverload	Qt creator and tested manually by developer
6	Sensor should not close door if there as an obstacle obstructing it's path	ECS, Sensor	ObsAlarm()	UC4	When there is an obstacle stopping the door, the door shouldn't close until it is removed.	Qt simulation of the elevators GUI: buttonObstacle	Qt creator and tested manually by developer

7	ECS should safely stop the elevator for passengers during a fire situation	ECS, Sensor	FireAlarn()	UC6	When there is a fire detected by the sensor then the elevator should stop safely to the closest floor and the passengers should exit the elevator	Qt simulation of the elevators GUI: buttonFire	Qt creator and tested manually by developer
8	ECS should switch to backup generator incase of a power outage	ECS, Sensor	NoPower()	UC7	When there is a power outage sensed by the sensor then the ECS should switch on the backup generator	Qt simulation of the elevators GUI: buttonPower	Qt creator and tested manually by developer

UML Diagram:


mainwindow
+MainWindow()
-on_startingFloor_currentIndexChanged(int index)
-on_buttonUp_clicked()
-on_buttonDown_clicked()
-on_buttonFloor1_clicked()
-on_buttonFloor2_clicked()
-on_buttonFloor3_clicked()
-on_buttonFloor4_clicked()
-on_buttonFire_clicked()
-on_buttonObstacle_clicked()
-on_buttonOverload_clicked()
-on_buttonPowerOutage_clicked()
-on_buttonHelp_clicked()
-updateElevator1Display()
-updateElevator1DisplayEmergency()
-updateElevator2Display()
-updateElevator1DisplayEmergency()
--updateElevator2Display()
-updateElevator2DisplayEmergency()
QComboBox
QPushButton
QGroupBox
QLCDNumber
QLabel

State Diagram:



Textual Explanation:

Request Elevator:

- passenger->button(clickButton)
- Button->ECS RequestElevator() (Checks if up or down button was pressed)
- Button->ECS FloorRequest() (sends what floor to come to ECS)
- ECS ->Elevator ElevatorCheck() (ECS sends request to elevator and it sees which one is available)
- Elevator ->Passenger ElevatorArrival() (Elevator is sent out to the designated floor)
- ECS->Elevator OpenDoor()

Enter Elevator:

- Passenger ->Button PressFloor() (Checks what floor is pressed and sends it to Elevator)
- ECS ->Button FloorLight() (Stays lit until elevator reaches desired floor)
- Sensor->Elevator CloseDoor()
- ECS->Elevator MoveFloor() (Elevator moves to the desired floor)

Safety Scenario: Emergency Help

- Passenger -> ECS NeedHelp() (Passenger uses the intercom to communicate)
- ECS -> Elevator ContactHelp() (Contacts the appropriate person)
- Elevator -> Passenger Help() (Connects the person with the passenger through the intercom)

Safety Scenario: Obstacle Alarm if there is an obstacle

- Sensor -> ECS ObsAlarm() (Sends information to ECS)
- ECS -> Passenger DisplayMsg()
- Waits until obstacle is removed OR Passenger -> Elevator ObsRemove()
- Sensor -> ECS ObsClear() (Sensor tells ECS that the obstacle is clear)
- ECS -> Elevator CloseDoor()

Safety Scenario: Overweight Alarm

- Sensor -> ECS OverWeightAlarm()
- ECS -> Passenger DisplayMsg()
- Passenger -> Elevator WeightLess()
- Sensor -> ECS WeightOptimal()
- ECS -> Elevator. CloseDoor()

Safety Scenario Fire Alarm:

- Sensor -> ECS FireAlarm()
- ECS -> Passenger DisplayMsg()
- ECS -> Elevator SafeStop() (Safely stops the elevator at the nearest floor)
- ECS -> Elevator DoorOpen()

Safety Scenario Power Outage:

- Sensor -> ECS NoPower()
- ECS -> Passenger DisplayMsg()
- ECS ->. Elevator AuxPower()
- ECS -> SafeStop()
- ECS -> Elevator DoorOpen()