OO Analysis and OO Design and Implementation Assignment

Semester 3 Embedded Systems

OO Analysis and OO Design

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Acronyms

Acronym	Meaning
ICT	→ Information and communication technologies

Table 1 – List of acronyms used throughout the report

Introduction

The assignment on which this document presents an overview of various types of ICT diagrams used to represent embedded systems. Embedded systems are computer systems that are integrated into devices or products and are used to perform a specific function or set of functions. They are commonly used in fields such as manufacturing, transportation, and healthcare. In the following sections, we will provide an overview of the different types of ICT diagrams used to represent embedded systems and provide examples of how they can be used.

Static Design: Elevator

Part 1.1: use case definition

For this part of the assignment, we are to create a Use Case diagram that relates to the given requirements in the assignment which is the elevator.

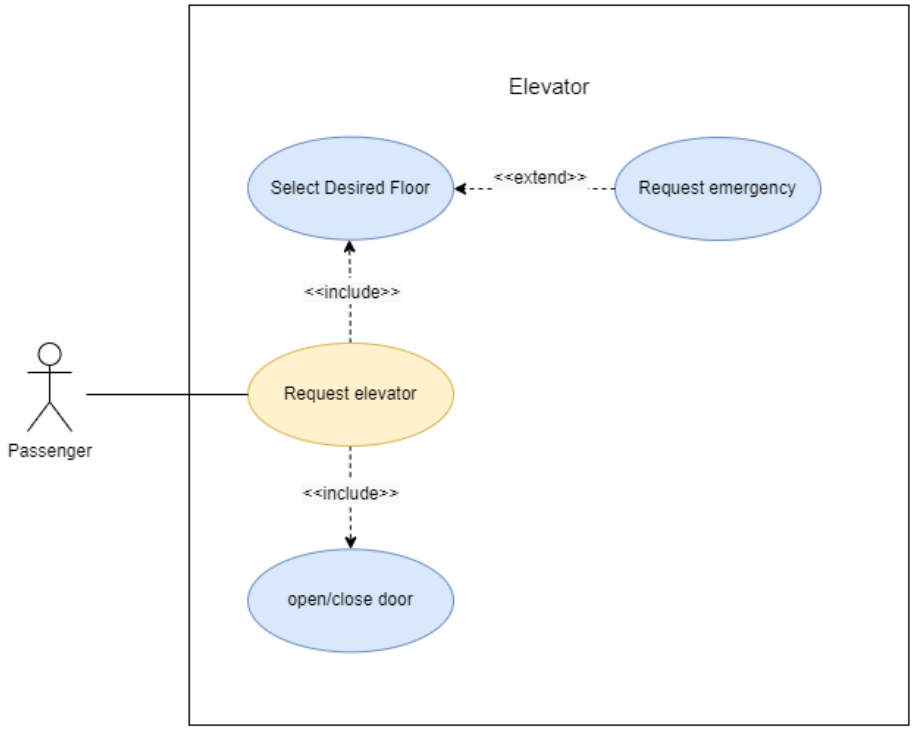

Figure 1 Elevator Use Case Diagram

For the above Use Case diagram, I have chosen the "passenger" as the main actor because the passenger is the one that mostly make use of the elevator. The purpose of the elevator is for transportation to save time and energy to getting to higher floors. It is also useful for transferring heavy objects to certain floors.

The primary function of the elevator system is to request the elevator from a certain floor for transportation. Secondary function of the elevator system can select the desired floor, open/close the elevator door and request in case of an emergency.

Part 1.2: working towards a class diagram

For part 1.2, we are to create a list object of relevance that relates to the system description for object discovery. To start off, we needed to research on how to design an object diagram.

The list of objects will be drawn with their association below. (Figure 2)

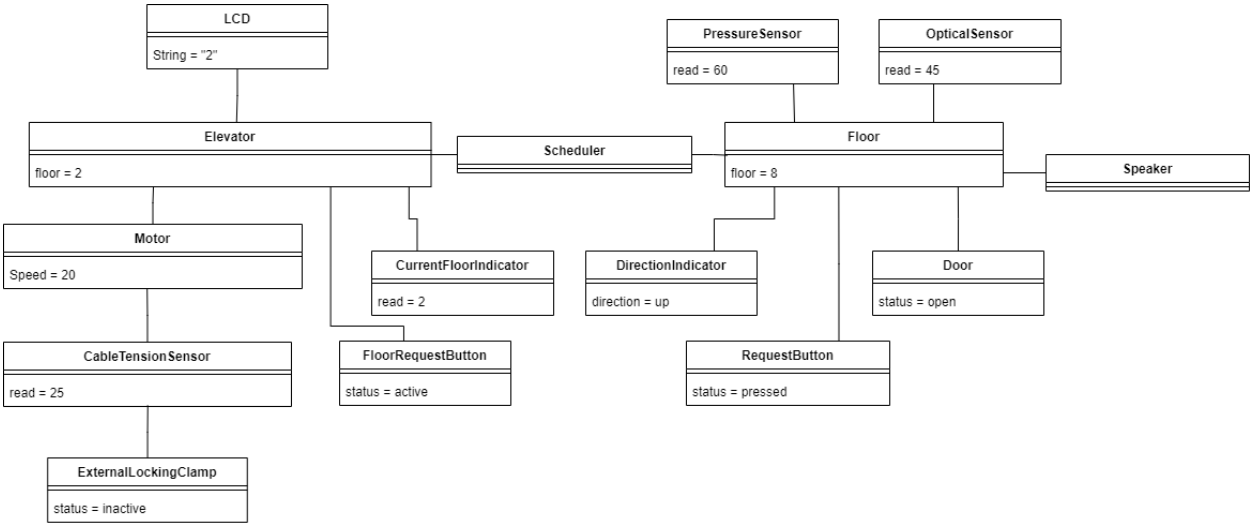

Figure 2 Object Diagram

After a lot of ideas and opinions, we have created a list of objects that can be of use for the system and fits the system description. With that we create a first-class diagram to define the classes needed for the system. The table shows the class and its responsibility for the system. (Table 1)

Class:	Responsibility:
Scheduler	Scheduler will be responsible of the working of elevator and floor. Scheduler will be responsible for sending nearest elevator to designate floor.
Elevator	Elevator will contain a set of buttons that the user can use to navigate and an indicator for user experience.
Floor	Floor will contain button for requesting, sensor for safety, sliding door for open/close, speaker and an indicator for the current floor and direction.

Door	Door is responsible for open/close, sensor for object detection and a timer for timeouts if the door is open for too long.
Button	This will be the base class for child class.
RequestButton	Inherits from Button class. Has the responsibility to handle requests and a feature to of backlight to indicate the user that the button is pressed.
FloorRequestButton	Inherits from Button class. Has the responsibility to handle request to go to a specific floor.
Indicator	This will be the base class for child class.
CurrentFloorIndicator	CurrentFloorIndicator class has the responsibility to display current floor.
DirectionIndicator	DirectionIndicator class has the responsibility to current direction of the elevator.
Sensor	This will be the base class for child class.
PressureSensor	Inherits from Sensor class. Monitors the pressure and gives signal if there is obstruction is detected.
OpticalSensor	Inherits from Sensor class. Monitors the optical signals on the floor and gives signal if there is obstruction detected.
LCD	LCD has the responsibility to display and update the users with necessary information.
Speaker	Speaker has the responsibility to update user when the user arrives to the designated floor.
ExternalLockingClamp	ExternalLockingClamp has the responsibility to stop and hold the elevator in case of emergency.

CableTensionSensor	CableTensionSensor has the responsibility to monitor the tension of the motor cable in case of a failure. It also communicates with ExternalLockingClamp to ensure safety.
Motor	Motor has the responsibility to for controller the movement of the elevator. It also communicates with CableTensionSensor to ensure safety.

Table 1 First Class Diagram

With the table above (Table 1), it is clear what is the responsibility for each class is. To give a more detailed information for the classes, we are required to define the operation for each class. The operations will be defined in a UML diagram. (Figure 3)

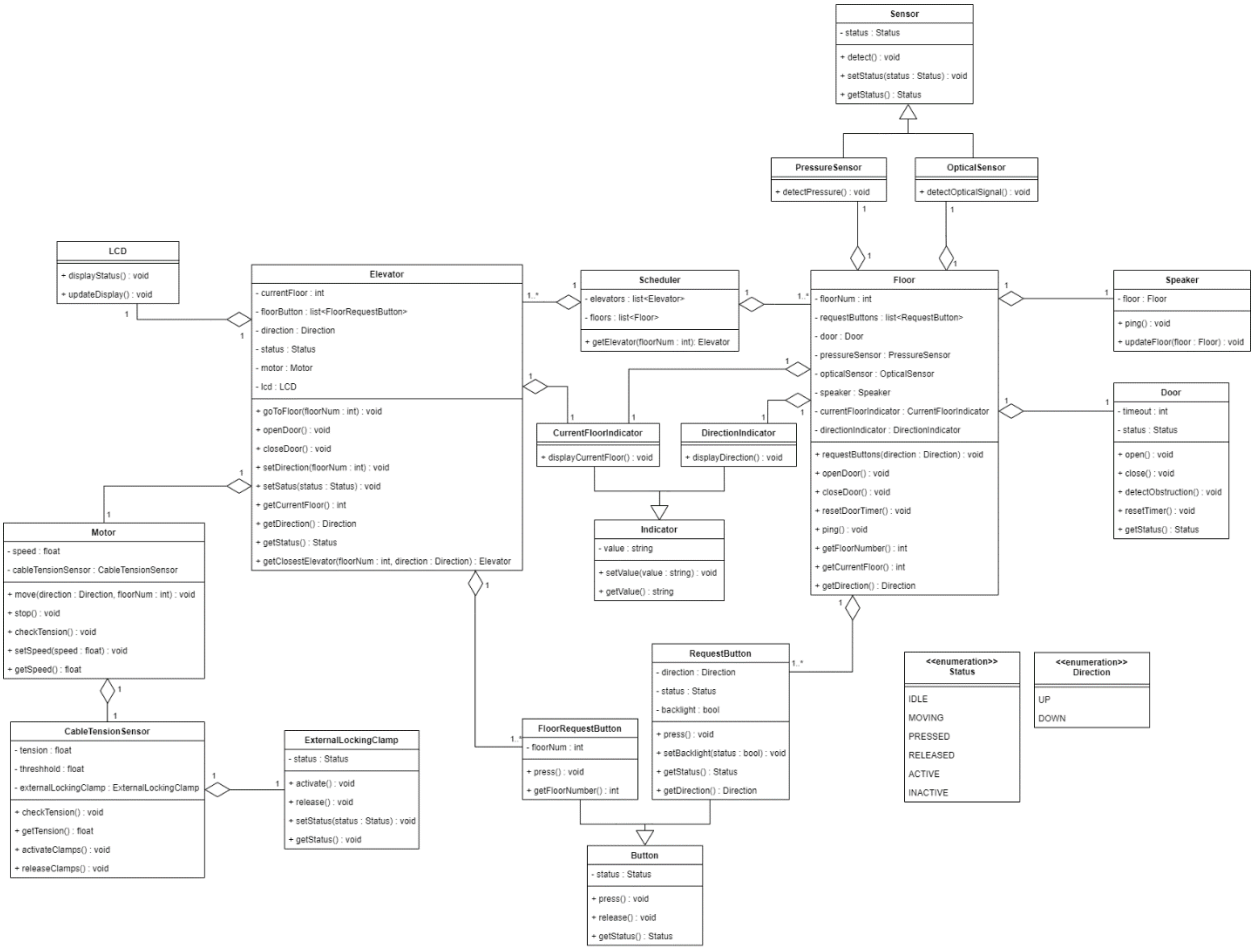

Figure 3 Elevator System UML Diagram

With that, the UML Diagram for the elevator system is created with defined tasks for each class. To complete the system, the system needs to undergo a situation where the user request for an elevator. The situation will be shown in a sequence diagram (Figure 4). The sequence diagram will verify the interaction between the classes.

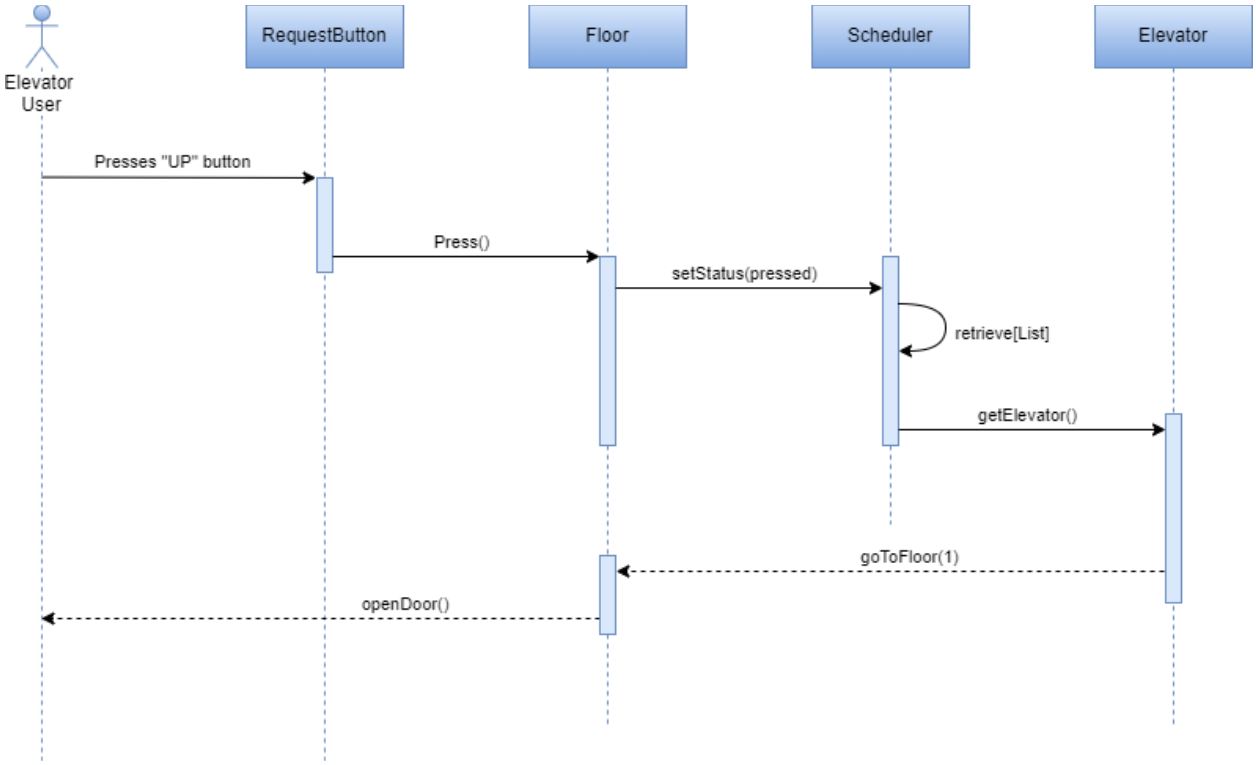

Figure 4 Elevator Sequence Diagram

In figure 4, the user requests an elevator using the request button. the scheduler will get the nearest elevator that is either idle or already going in the requested direction. The elevator will start moving to the requested floor. Once the elevator reaches the requested floor, the door will open for the user.

Conclusion

To conclude the assignment, it was a lot of brainstorming for the objects that needs or should be implemented in the design. With the feedback and opinions from the teacher, I managed to get an idea of how the system should react to a user request. It became clear and the system is well thought out. There is prototype (Figure 5) that contains early ideas of the system while reading the system description. Some ideas are considered like for example LED or Timer class

but they are just not relevant enough to be implemented in the design. All in all it was a great learning experience and it gave a better understanding on designing systems that can be used in the future.

Prototype class:

1. **Transfer passenger:** Elevator system will transfer its passengers to the desired floor
2. **Capacity of the elevator:** The elevator can only have a certain amount of people or amount of weight capacity.
3. **Elevator characteristics:**
   - Max weight/load,
   - How fast can the elevator transfer the passenger
   - How many passengers can the elevator car can take.
4. **Door:** Passenger can open/close door from inside and outside when it is available. When open for timeout period of 5 seconds, door will automatically close. Timer will restart if it detects obstruction.
5. **Buttons:**
   - Outside button: when button is pressed, the elevator car will go to your floor to pick you up
   - Inside button: select button to desired floor. There will be buttons to force open and close elevator car door only in STOP state. In case other cases, there will be button for emergency call.
6. **Display:** There will be a display inside and outside to show which floor is the elevator car while also showing the direction of the elevator. (Speaker that pings the arrival of the floor)
7. **Optimize the resource usage of the elevator:** For example in the morning all elevator is active and in the evening, 3 elevators are active. This way we can save electricity cost or elevator maintenance costs

Figure 5 Prototype description