MILESTONE 1.2: SYSTEM REQUIREMENTS

343.309, UE Software Engineering

Winter-Semester 2020

033 521

TOPIC

Entire System

Group Nr.2:

- **Omar Dueñas:** Subsystem II
K51849509, roqueluisd@me.com
- **Michael Lengauer**: Subsystem I
K11710940, lengauer.michael@gmail.com
- **Mario Lischka**: Subsystem III Traffic Flow
K11712790, Mario.lischka@gmx.at
- **Eduard-Florin Hogea**, Subsystem IV
K12019919, eduard.hogea00@e-uvt.ro
- **Lukas Wais**: Subsystem III Security
K11816105, lukas.wais@outlook.de

1. Requirements

a. For the whole system

ID	Requirement	Description	Tags	Priority (*/**/***)
1	Traffic control-detection communication	Status of traffic lights, traffic jams or road maintenance should be communicated to the other subsystems.	Communication	***
2	Only live analysis of the camera data	Due to the GDPR long time storage of video data is not allowed	GDPR	***
3	API between Traffic control and detection and Control System must offer 3 different data abstraction levels	3 Abstraction levels: No abstraction: raw live video feeds, sensor data, Medium abstraction: Object detection and count return only numeric value, High abstraction: Load estimation of requested location e.g. road, crossing, etc.	Abstraction	**
4	Road Maintenance schedule delivering	To avoid traffic jams and unexpected situations, a schedule should be delivered in advance. So that, traffic control can react on time and redirect traffic	Maintenance, Redirect	**

5	Develop an App for Road users	Road users can use the app to get through traffic faster, The subsystem can control the usage of the streets through giving different routes	User interface, Traffic flow	*
6	Develop an UI for the authorized controllers	The controllers should be able to control the traffic lights and insert roadblocks etc., through the UI of the control system	User interface, Traffic control	**
7	Getting to an emergency	For the emergency crew to be able to get to the accident as soon as possible, they need to know details about the traffic flow.	Emergency	***
8	Barrier free pedestrian detection / input system	Pedestrian detection sensors like buttons at crossings, must comply with regulations for use by people with sight handicaps, systems must make acoustic signals for blind interaction	vision impairment. Accessibility	**
9	Backups, Security	There must be hourly backups to prevent critical data loss.	backup	*

10	Encrypt subsystems communication	The communication between subsystems should be encrypted TSL to avoid external parties to manipulate the communication.	Encryption	***

b. Revised versions of the requirements per subsystem (if there were changes)

Subsystem 1

No Changes

Subsystem 2

No Changes (due to not correction of the first submission)

Subsystem 3

ID	Requirement	Description	Tags	Priority (*/**/***)
1	Find an algorithm for the best and fastest pathfinding	The algorithm should always give back the best and fastest way for the path definition	Pathfinding	**
2	Develop an UI for the Operators	The Operators must be able to change traffic lights and insert roadblocks etc.	Operator Program	**
3	Develop an App for Road Users	The Road Users should be informed about the fastest ways to their destination and any roadblocks	Road User Program	*
4	Implement Infrastructure for the control System	The control system should be able to hold and analyse the Data from other subsystems	Data storage	***
5	Implement connection to other subsystems	The control system should be able to receive and send data/commands from/to other subsystems	Data Exchange	***

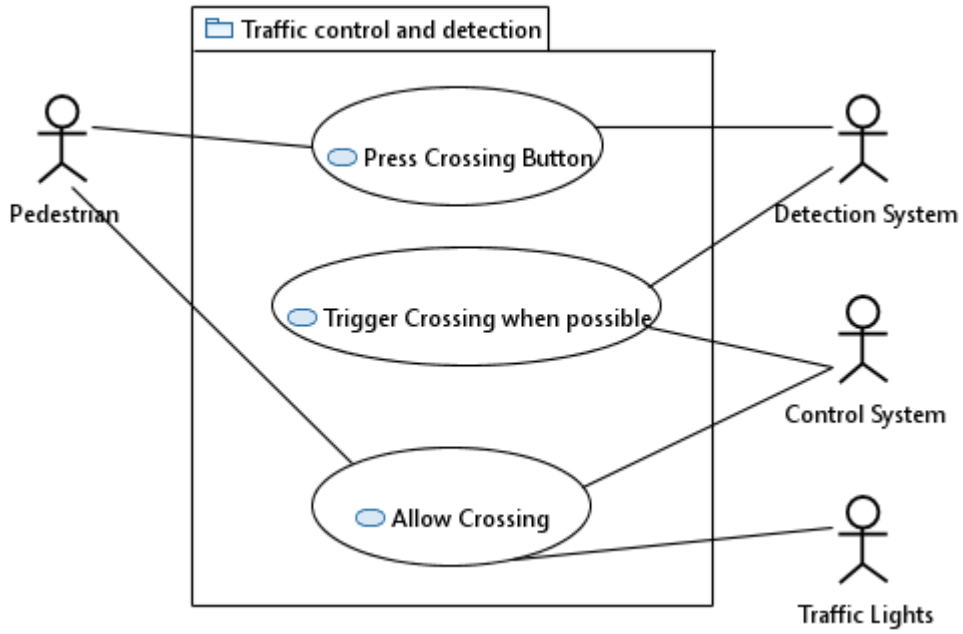
Subsystem 4

No Changes

2. Use case diagrams per subsystem

Subsystem 1

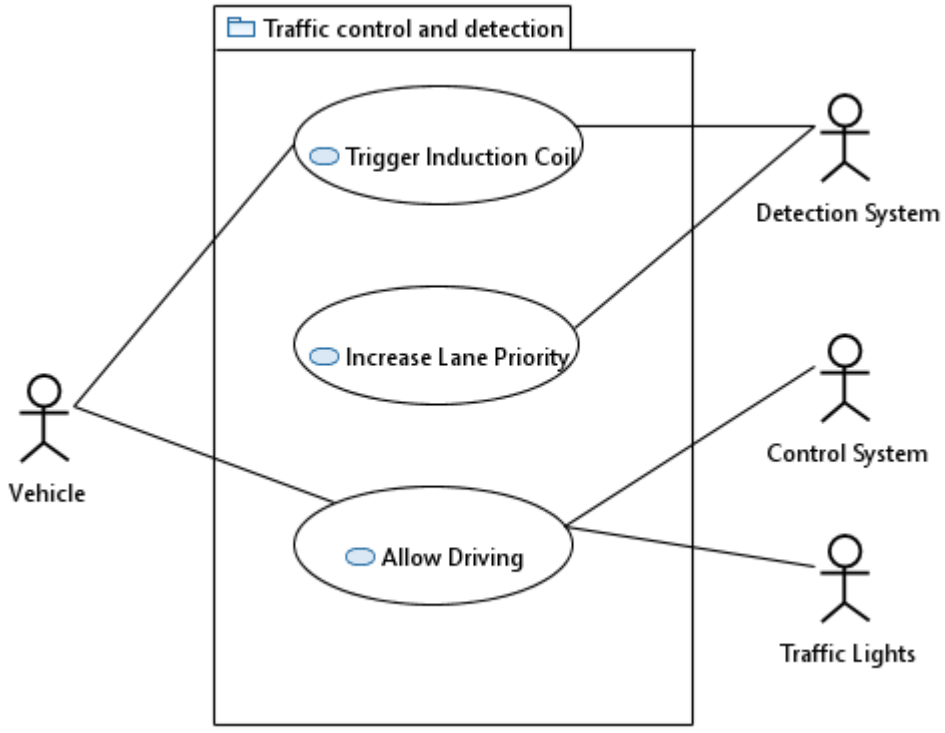
Scenario 1



Pedestrian crossing a walkway

Pedestrian walk to crossing presses the button, the detection system notifies the control system which orders the traffic lights to allow the crossing in the next possible slot. The Pedestrian crosses the walkway.

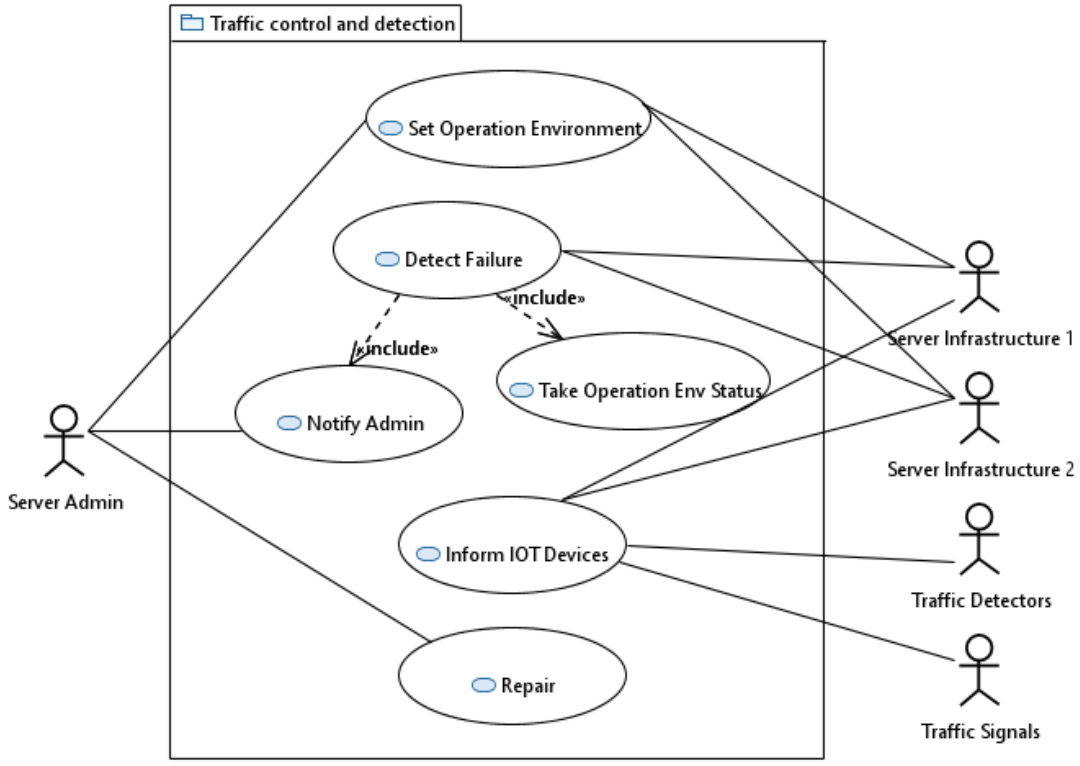
Scenario 2



Vehicle crossing a junction

A vehicle stops at a red light; the detection system senses the vehicle by the according induction coil. The detection system increases the priority for this lane to get a green light. The control system will adjust the timing if possible, accordingly, to minimise halt time. At the next time slot, the traffic lights turn green and the vehicle can go on.

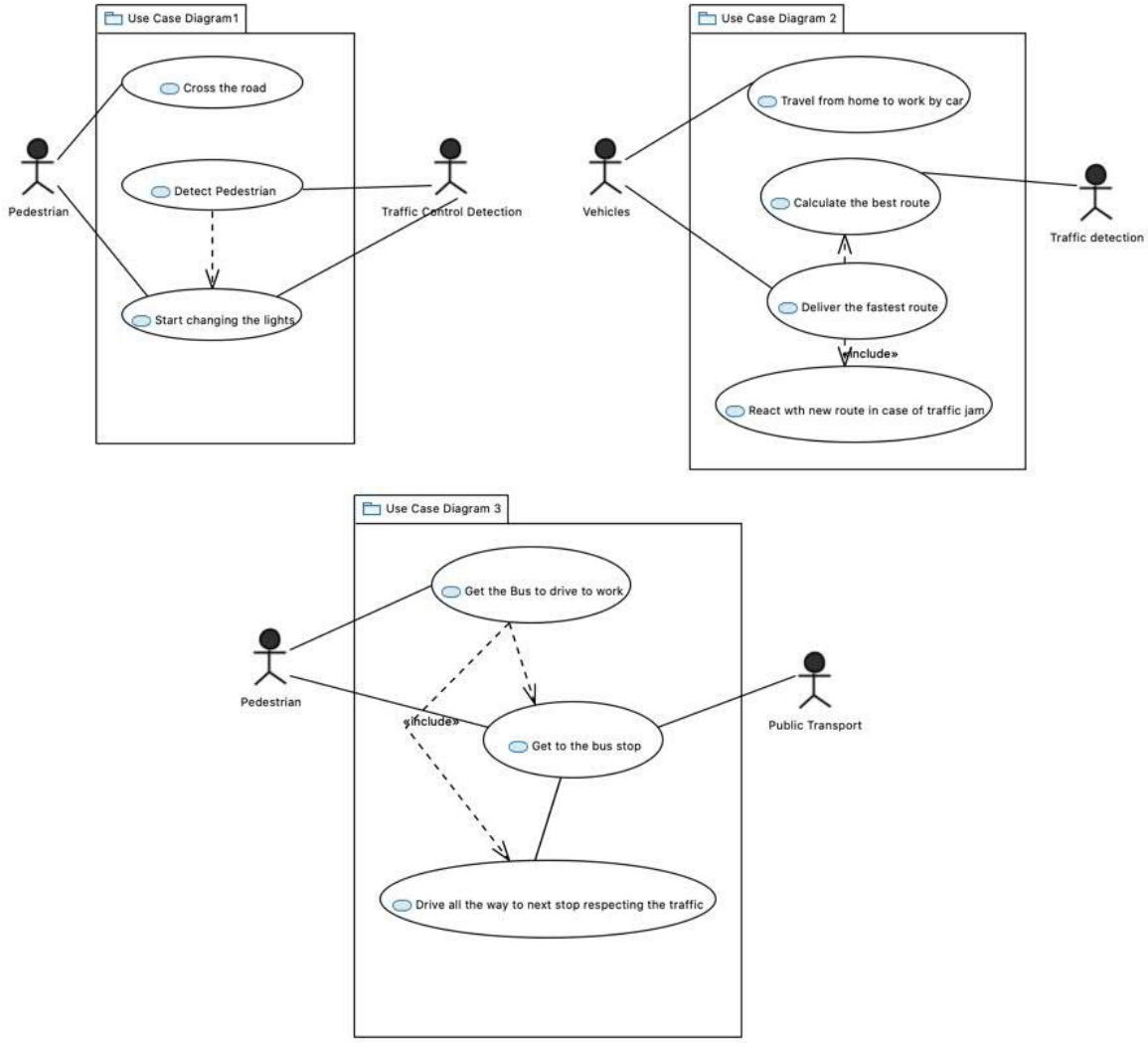
Scenario 3



Server failure, switch to redundant system

At system start, the server Administrator defines one of the systems as operating systems (another one is on standby), Systems constantly check if their sister system is still working. If they detect a failure in one or the other, they evidently notify the Admin, and if they are not the Operating system will take the status as the operating System. Taking this status includes notifying all traffic control and detection devices of the change. Finally, the Admin will take actions to bring the failed system up and running again.

Subsystem 2



Use Case Diagram 1

When pedestrians want to cross the streets, they should wait for the pedestrian lights to get green. The traffic control detection is responsible for this action, as it recognizes the pedestrian and initializes the process for the pedestrian lights to get green. Then it is safe to cross the street.

Use Case Diagram 2

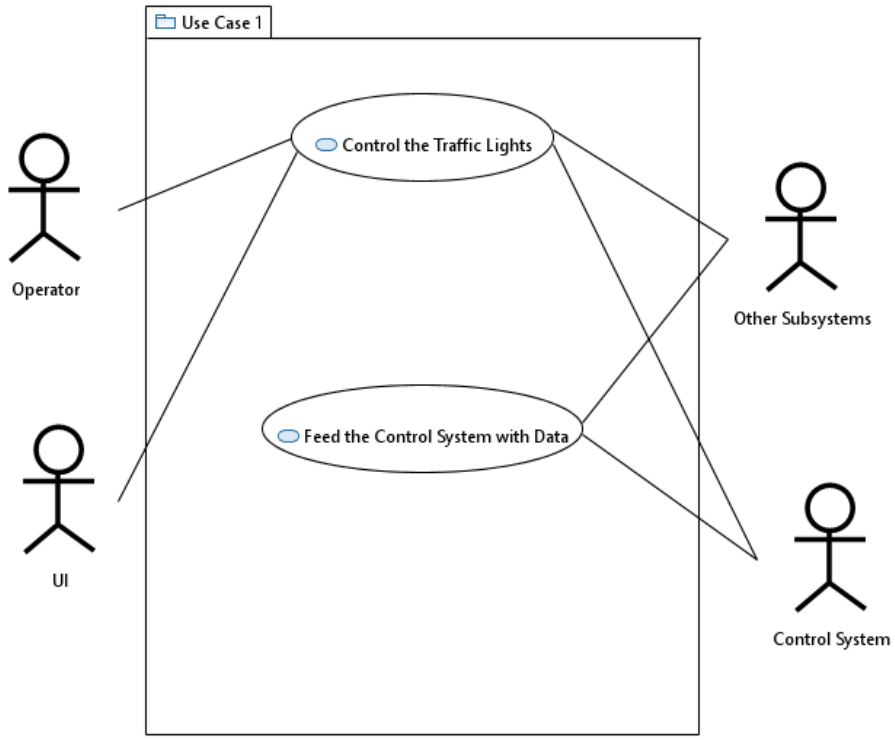
Vehicles owners should be able to travel from point A to B. For example, in the morning driving from home to work. With the traffic detection communication, the vehicle could get the best possible route to drive to work fatly. In case there are any sudden changes, the traffic detection should recalculate the route and inform the vehicle ASAP, to guarantee a safe and fast drive.

Use Case Diagram 3

Not everyone has their own car, therefore is public transport needed, also for getting to work in the morning. At first the pedestrian should make his way to the bus stop and wait there for the public transport to arrive. After that is just sitting and waiting for the other participant (in this case the bus -> public transport) to go through their process and so the pedestrian can get to the desired destination. The bus also must follow the traffic regulations.

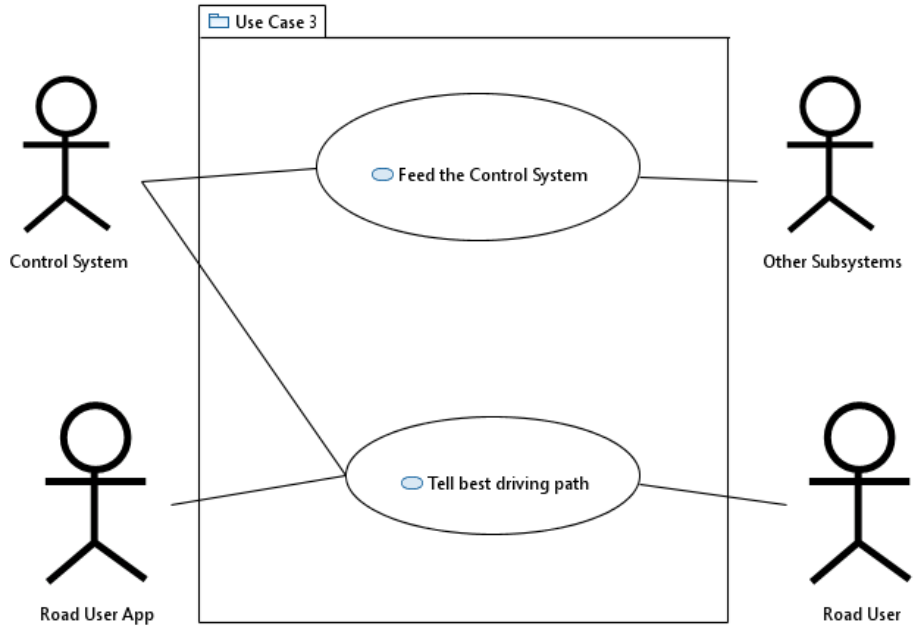
Subsystem 3

Scenario 1



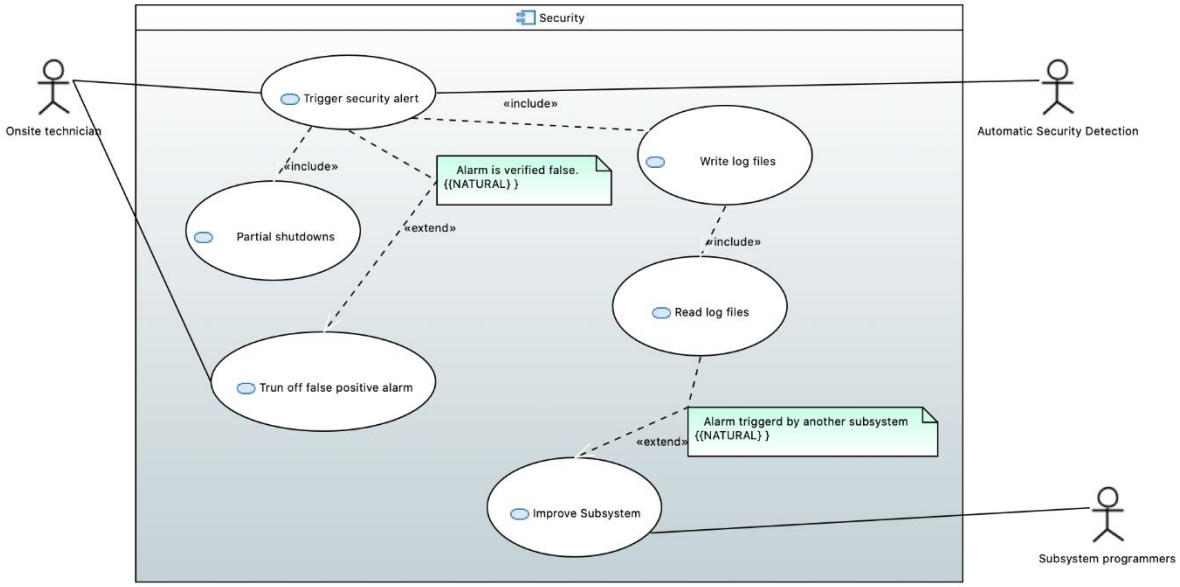
The traffic control subsystem detects a rapid increase of traffic jam and sends the data to the Control System. The Operator detects on the map that the traffic jam is coming from one road and controls the light (via UI fed by analysed data) so that this road has longer green phases.

Scenario 2



The traffic control subsystem feeds the control system with information about the traffic on the road. The road user wants to know the fastest way. The control system analyses the fastest way and sends it back

Scenario 3

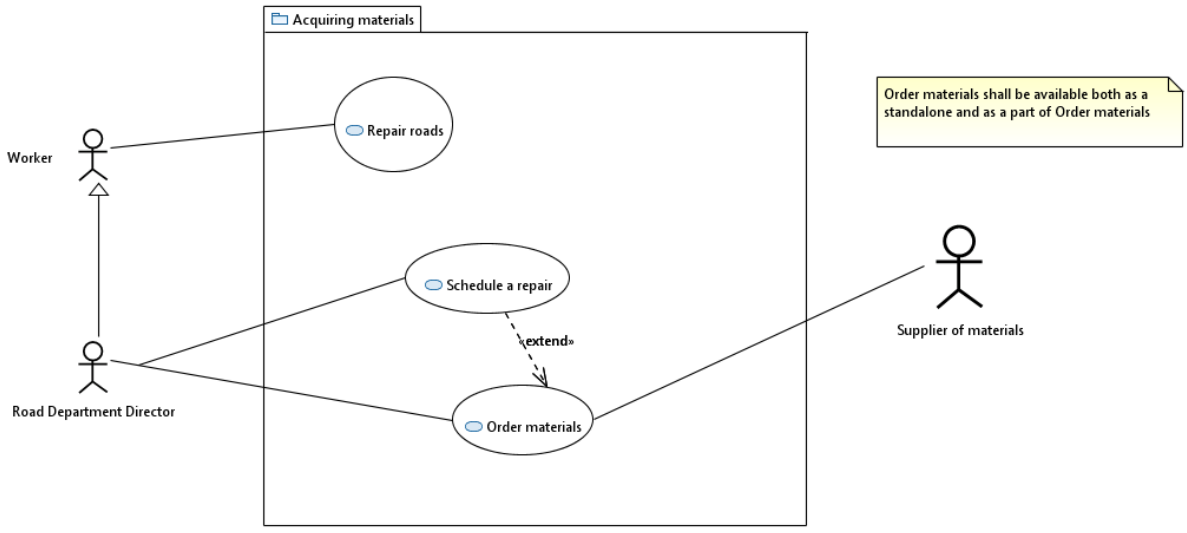


The use case is “Trigger a security alarm”. This is very bad, and it will hopefully never happen to anyone. But if it happens, we are prepared. Our participants are the onside technicians, the programmer of a subsystem, and the automatic security detection itself.

The onsite technician can turn off alarms if they are verified as false. Moreover, the triggered alarm does write log files. The programmer can read those files only if the alarm was triggered by his subsystem, where he is assigned to. Thus, he can improve it, or fix it, whatever is needed.

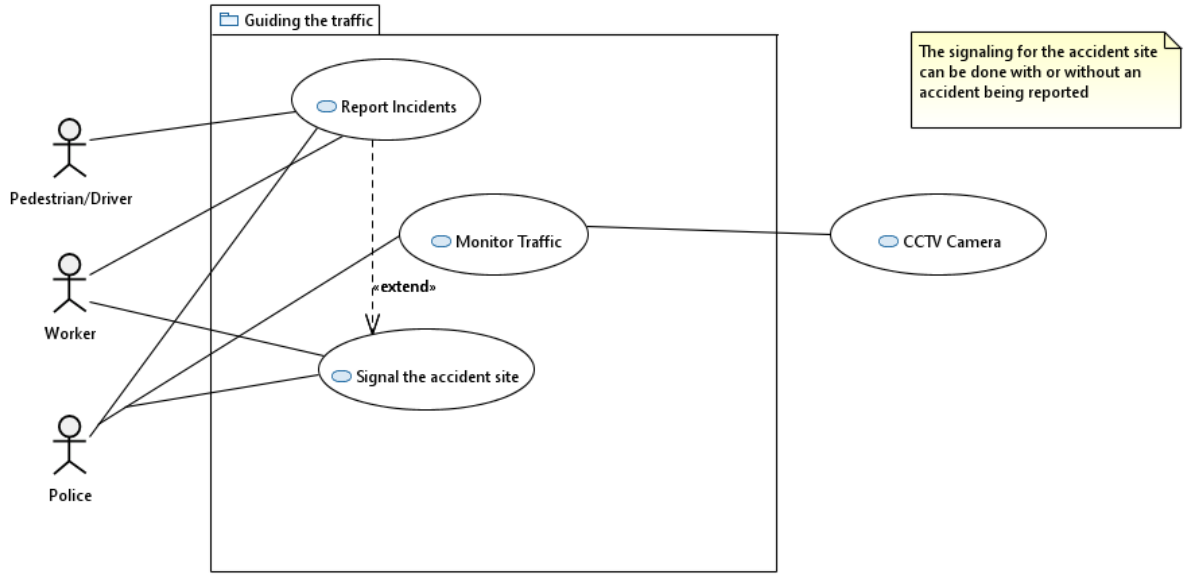
Subsystem 4

Scenario 1



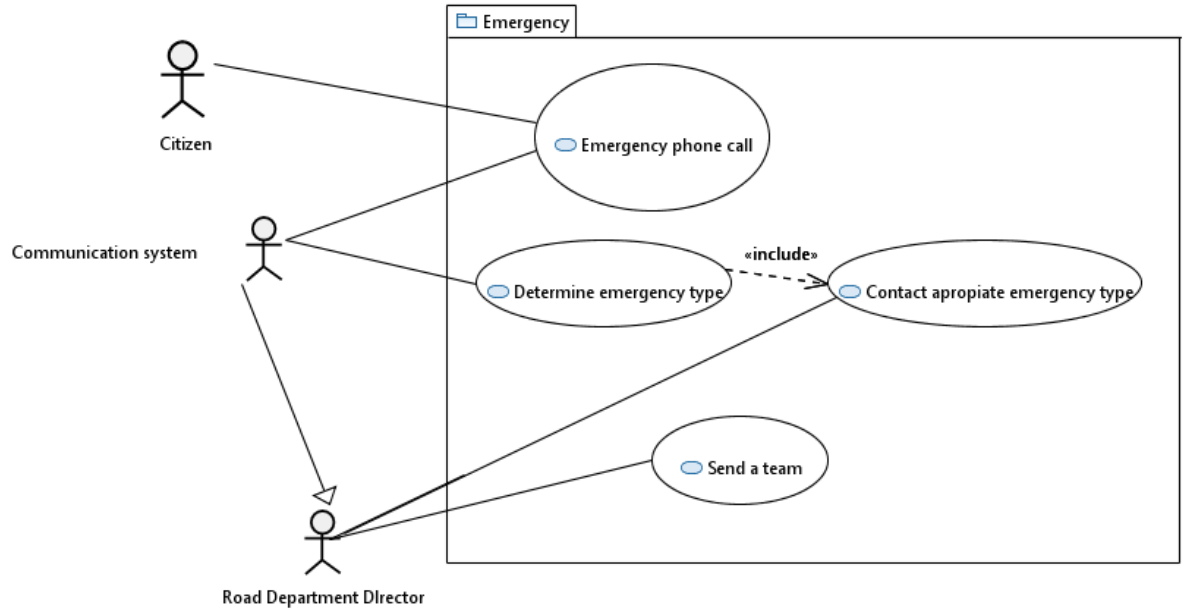
The first figure is representing how the acquiring materials process works. The use case diagram shows how the Road Department Director is giving the task to schedule the repair and order the materials. The last one is given to the Supplier which gives the materials needed.

Scenario 2



In the second figure the diagram is representing the pedestrian/driver who reports an incident. The incident is reported to the worker from the road department and the police. Which in return both signal the accident site. The police also monitor traffic and watches the CCTV Camera.

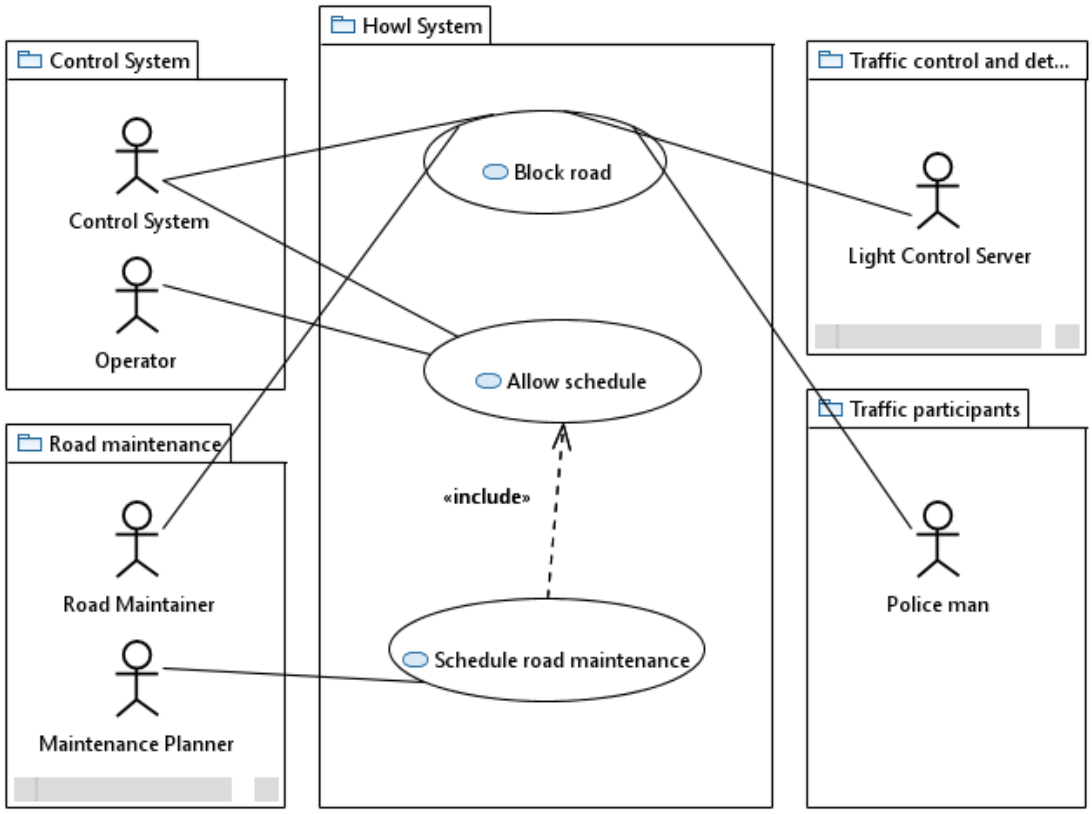
Scenario 3



The last Figure is showing us the emergency scenario. In this use case diagram, the Citizen reports via Emergency phone call. The Communication system determines what is the emergency type and contacts the Road Department Director who in return sends a team to the accident site.

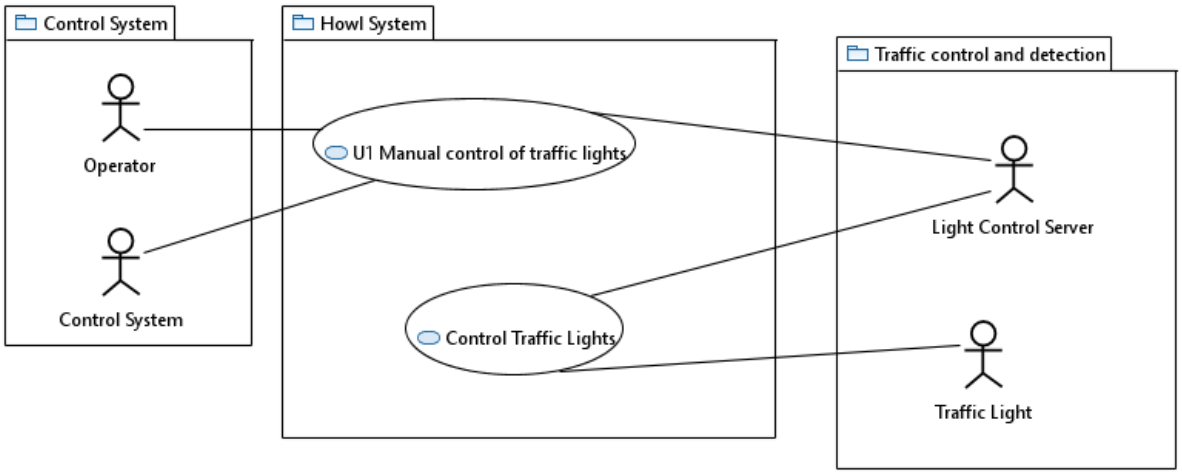
3. Use case diagrams for the whole system

Scenario 1



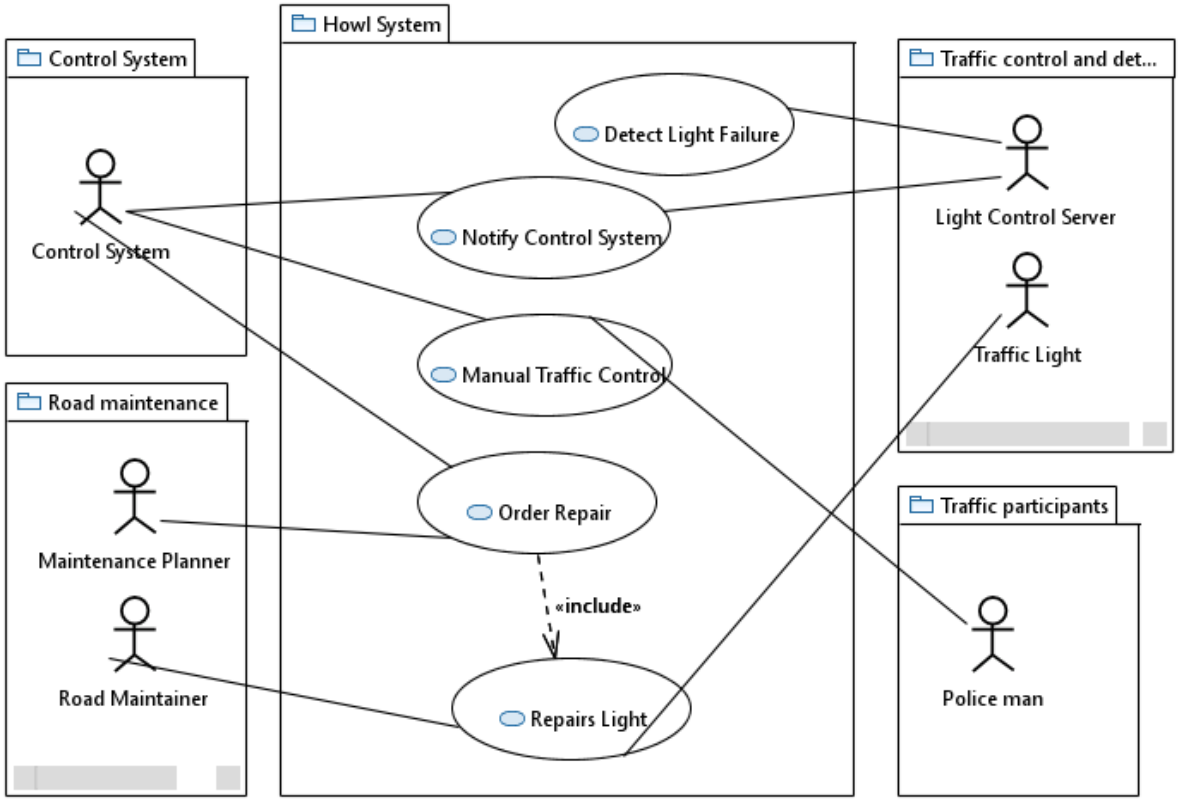
The Light Control Server feeds the Control System with fresh Data. The Maintenance Planner plans when to block the road and provides the information for the Control System. The Operator must accept schedule of the road maintenance. Just in case there are multiple temporary roadblocks the Maintenance Planner can define these in this step. The roadblocks are then inserted automatically by the Control System. As the roadblock is inserted Road Maintainer can start their work (first closing the road). The Policemen are only there in case of special roadblocks. The Light Control Server also gets the information about the blocked road and informs the road participants by overhead displays, that the road is closed.

Scenario 2



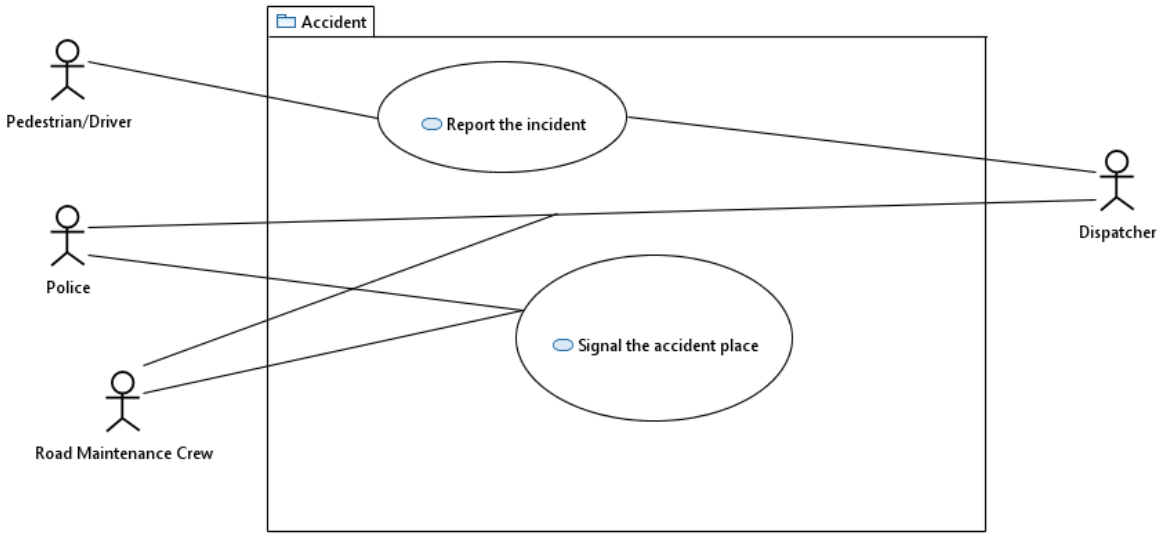
The Light Control Server feeds the Control System with data, so that the Operator has a correct map. The Operator changes an active traffic light to idle state (orange blinking) on his Interface. The Light Control Server receives the change of light state and tells the light to change.

Scenario 3



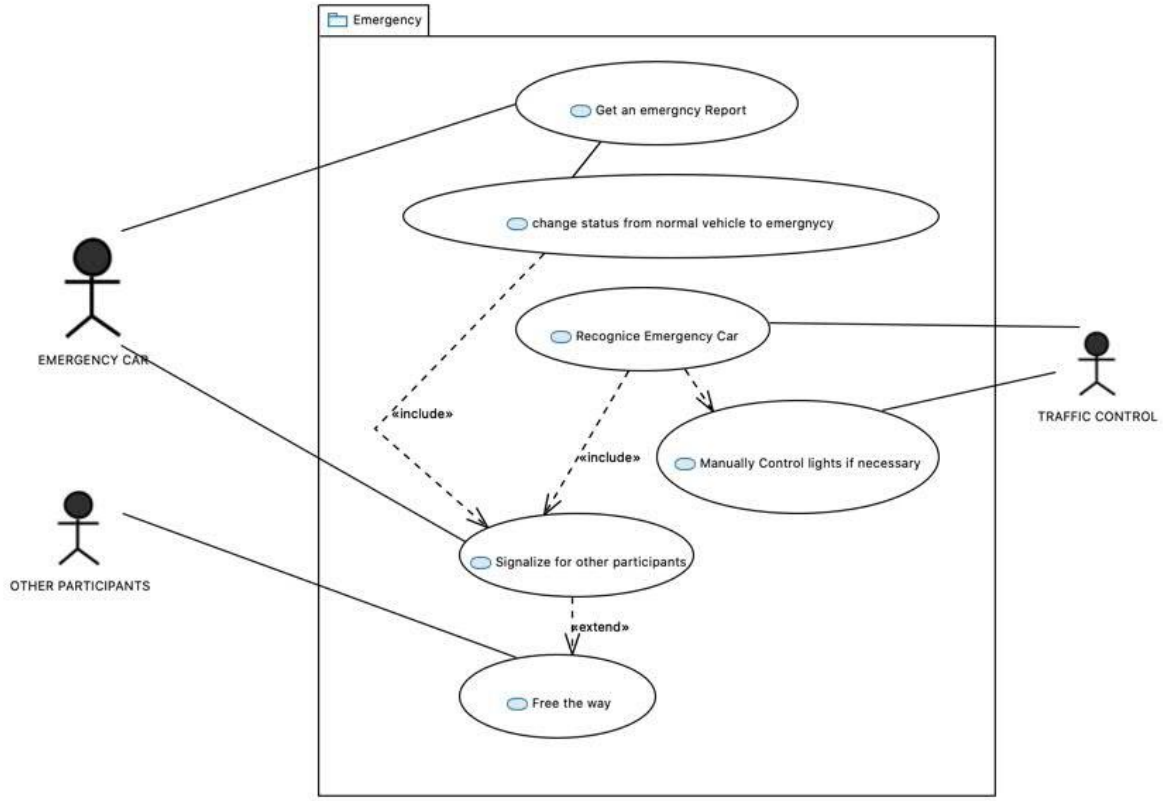
If a traffic light fails, the Light Control Server will detect this. This will trigger a notification to the Control System which will notify the police automatically. The police will control the failed traffic junction. The Control System will order the maintenance planer to send a repair crew to the affected location and repair the system.

Scenario 4



In this scenario, the pedestrian/driver reports the incident to the Dispatcher who in return reports it to the Police and the Road Maintenance Crew. The Road Maintenance Crew and the Police go to the place and signal the hazard accordingly to prevent another accident happening in that area.

Scenario 5



When an emergency car receives a call, it changes the status from a normal vehicle to an emergency one. The traffic control-detection should recognize the emergency car and intervene in case they need help coming through. The other participants will be alert, so they can behave properly (build an emergency line).