

ESE – SEMESTER PROJECT

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Team Heisenberg

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What is Truck Platooning?



Pros and Cons of Platooning

Pros

- Less number of drivers required.
- Capability to allow many trucks or other vehicles to accelerate or brake simultaneously and maintain constant gap between them.
- Platooning eliminates reacting distance needed for human reaction.

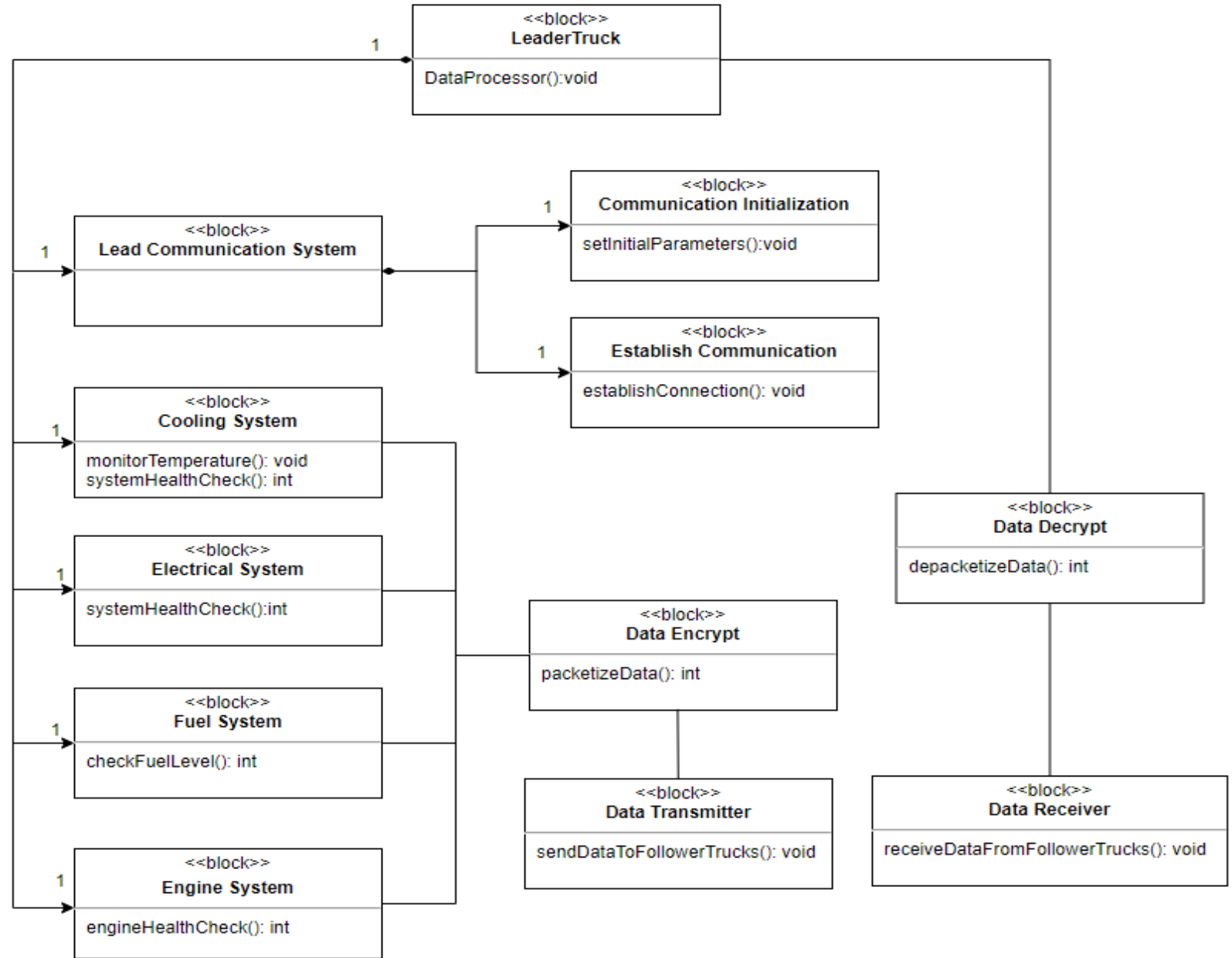
Cons

- Initial costs are high.
- Prone to system failures.
- Driver would feel less in control of following trucks.

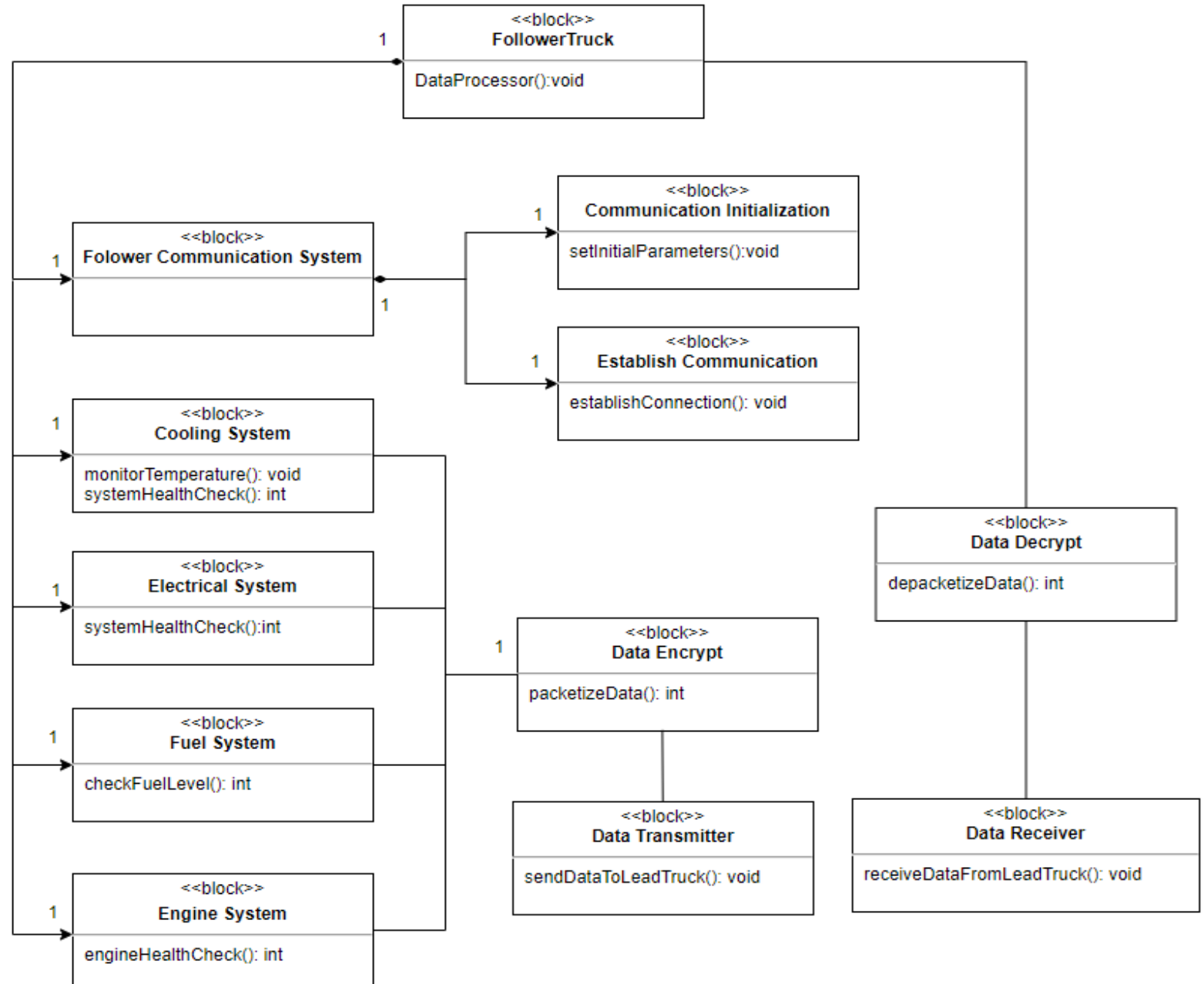
Requirements

Block Diagram

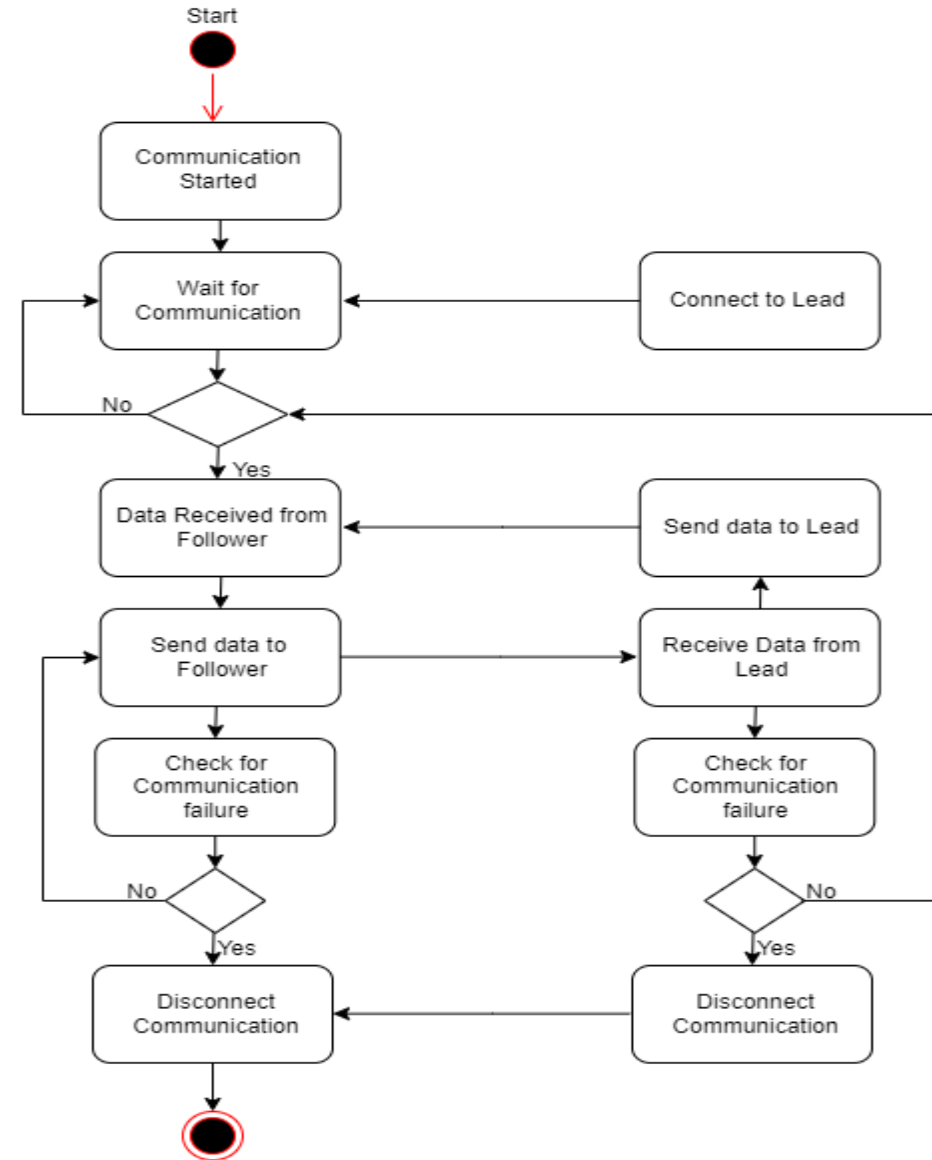
Lead Truck



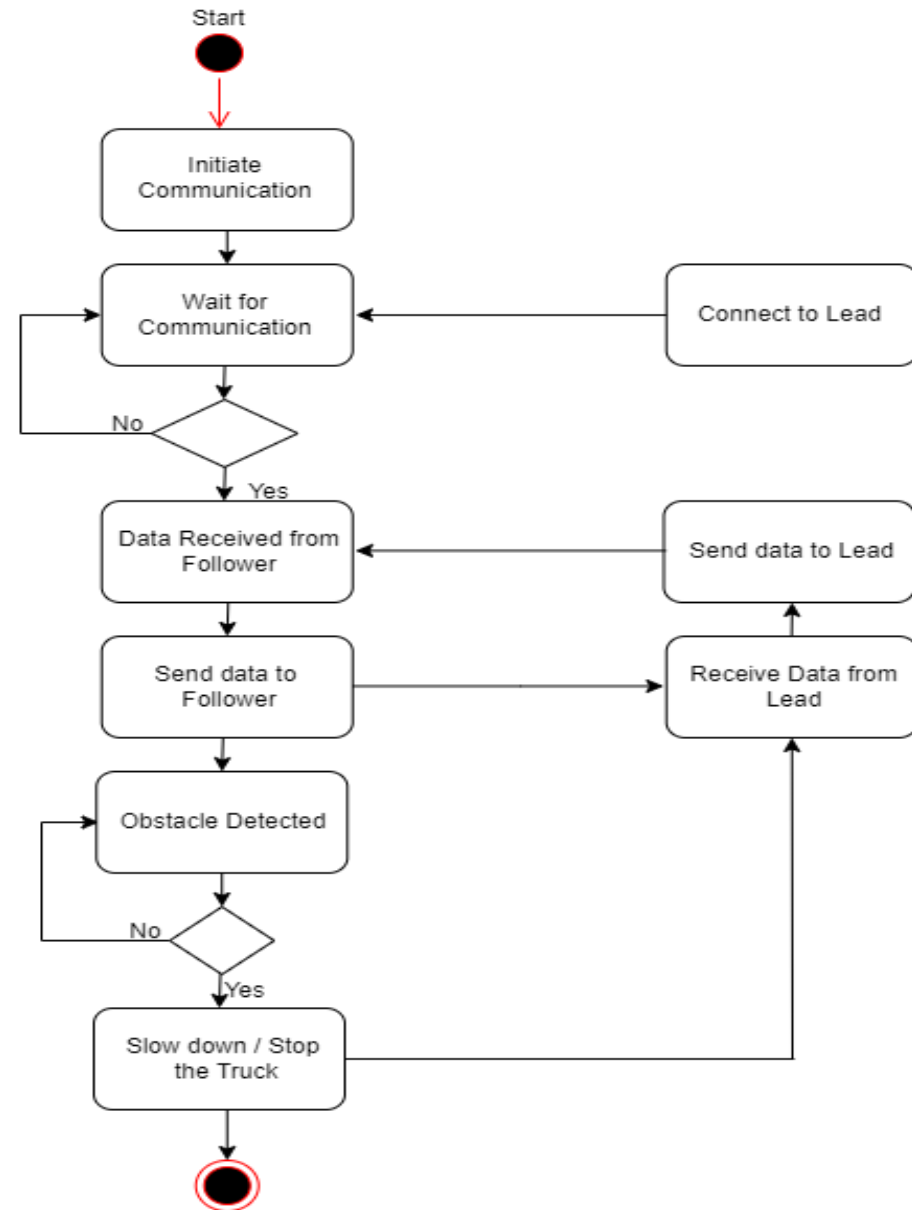
Block Diagram -Follower Truck



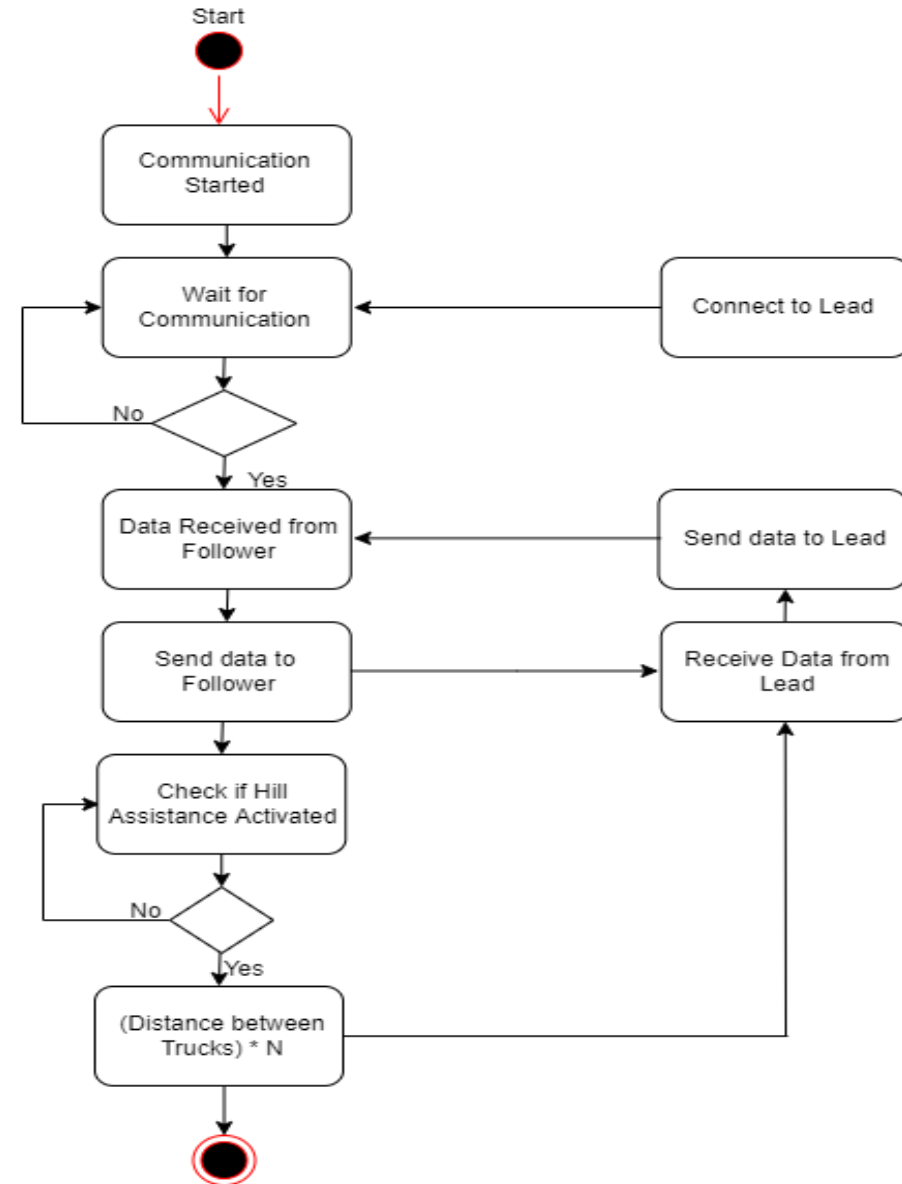
Activity Diagram -1



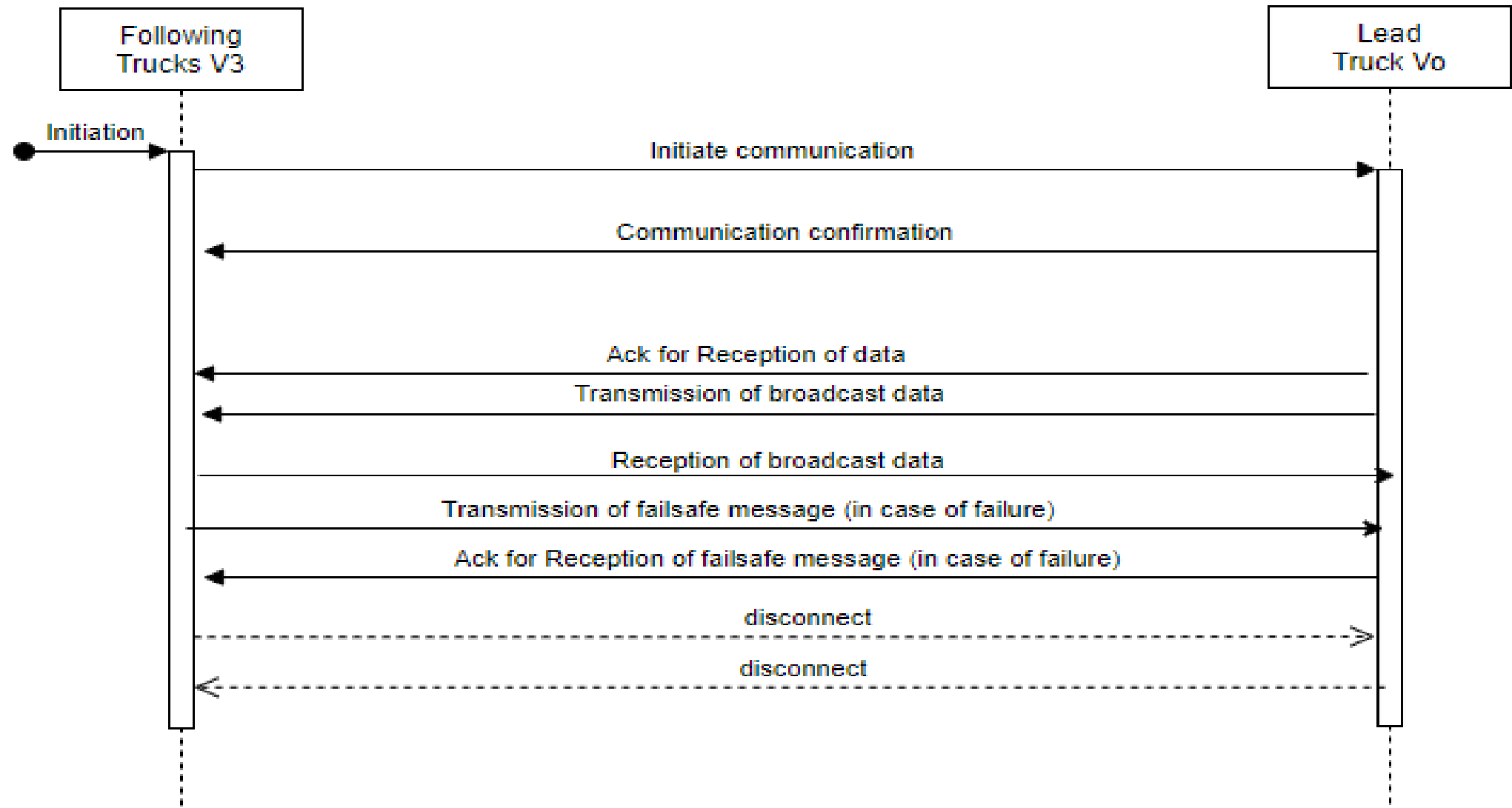
Activity Diagram -2



Activity Diagram -3

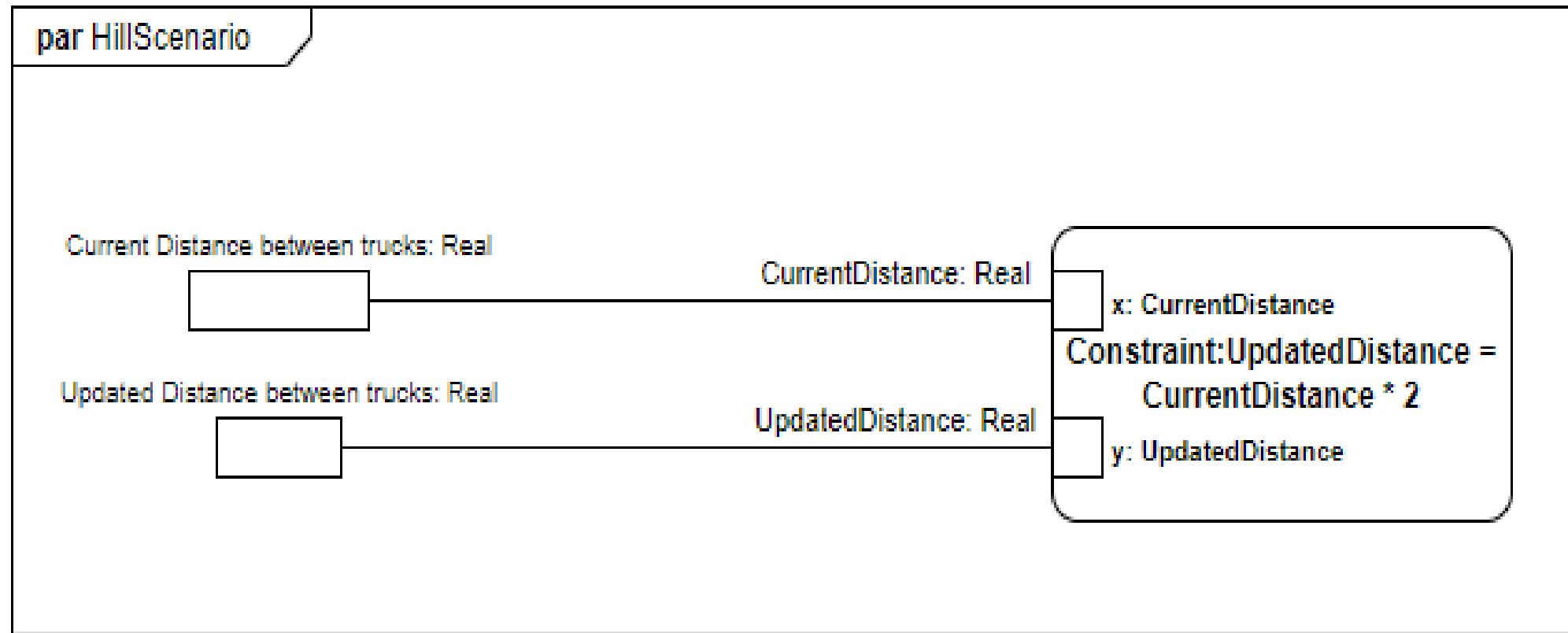


Sequence Diagram

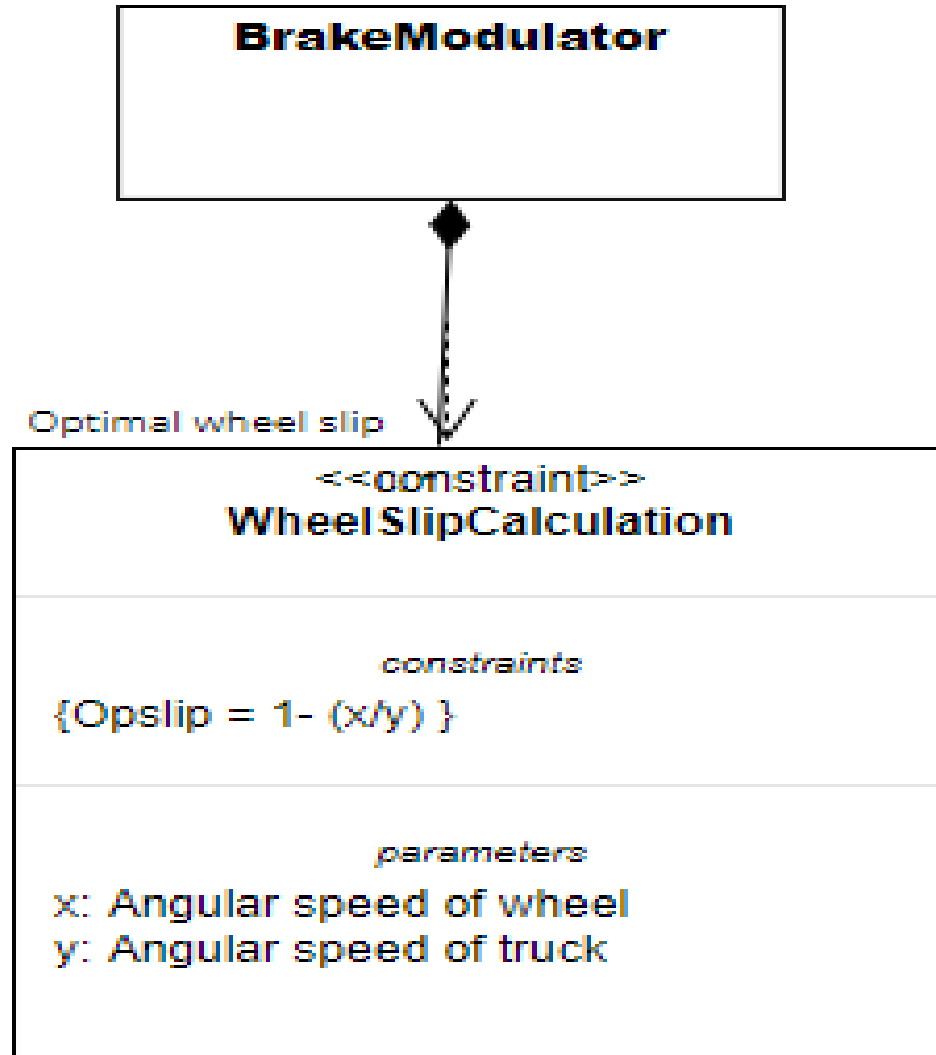


Parametric Constraints Diagram

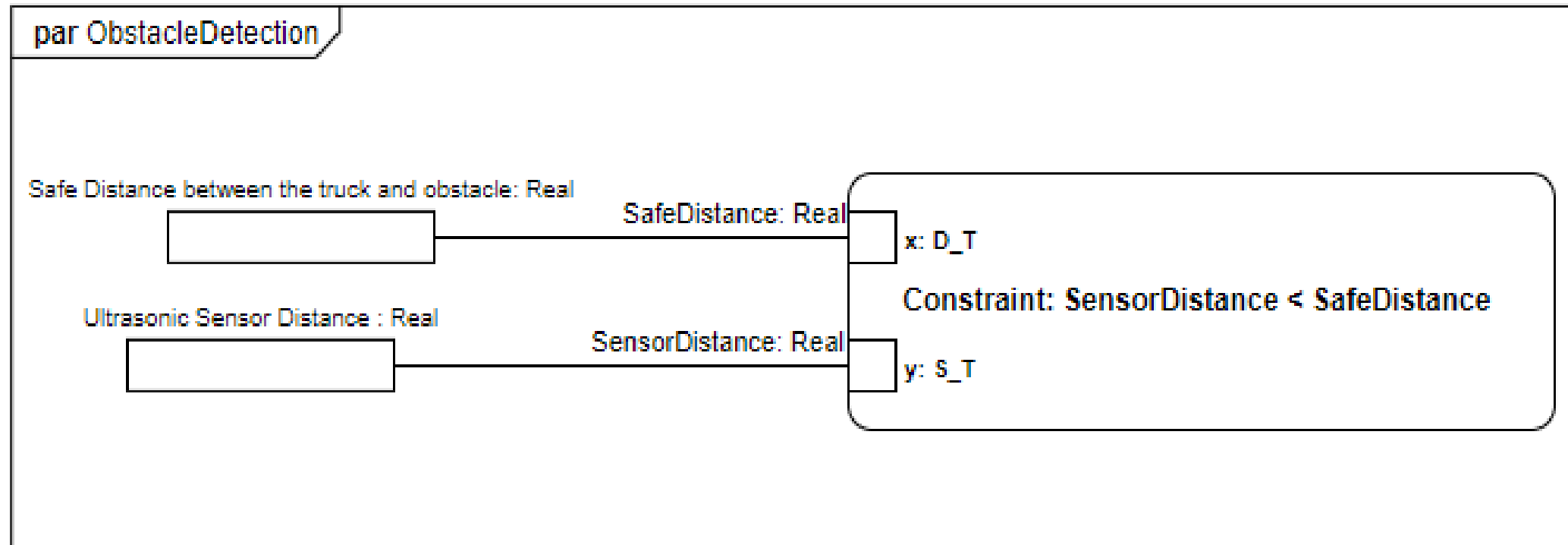
Hill Scenario



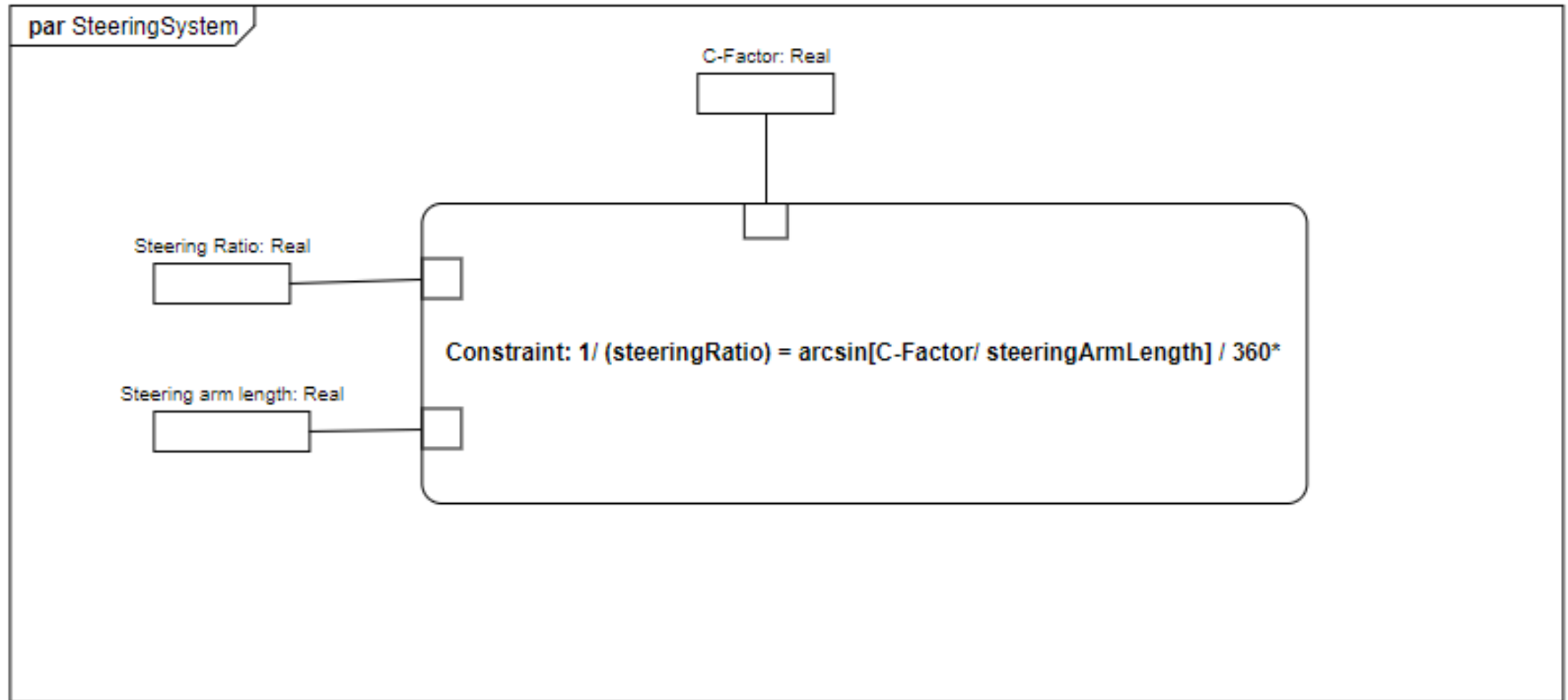
Brake Modulator



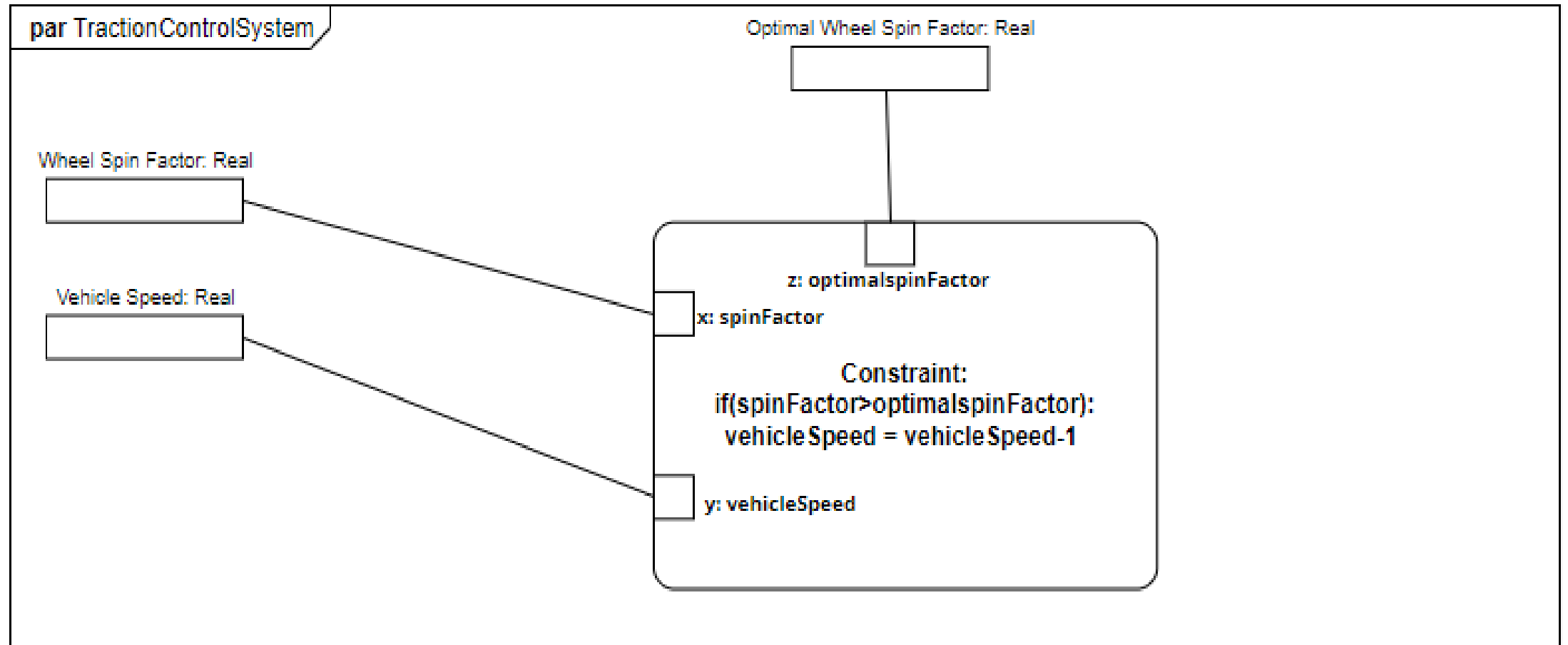
Obstacle Detection



Steering Control



Traction Control



Allocation Diagram

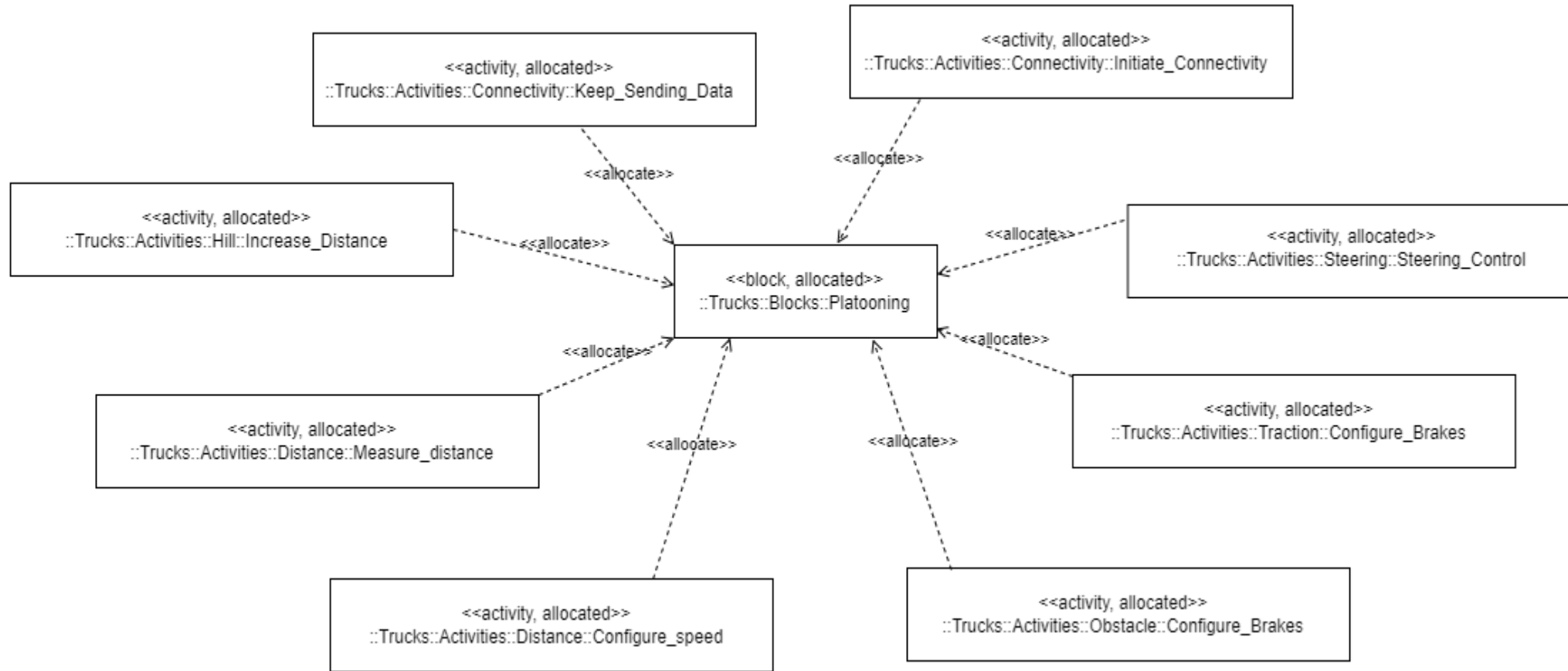
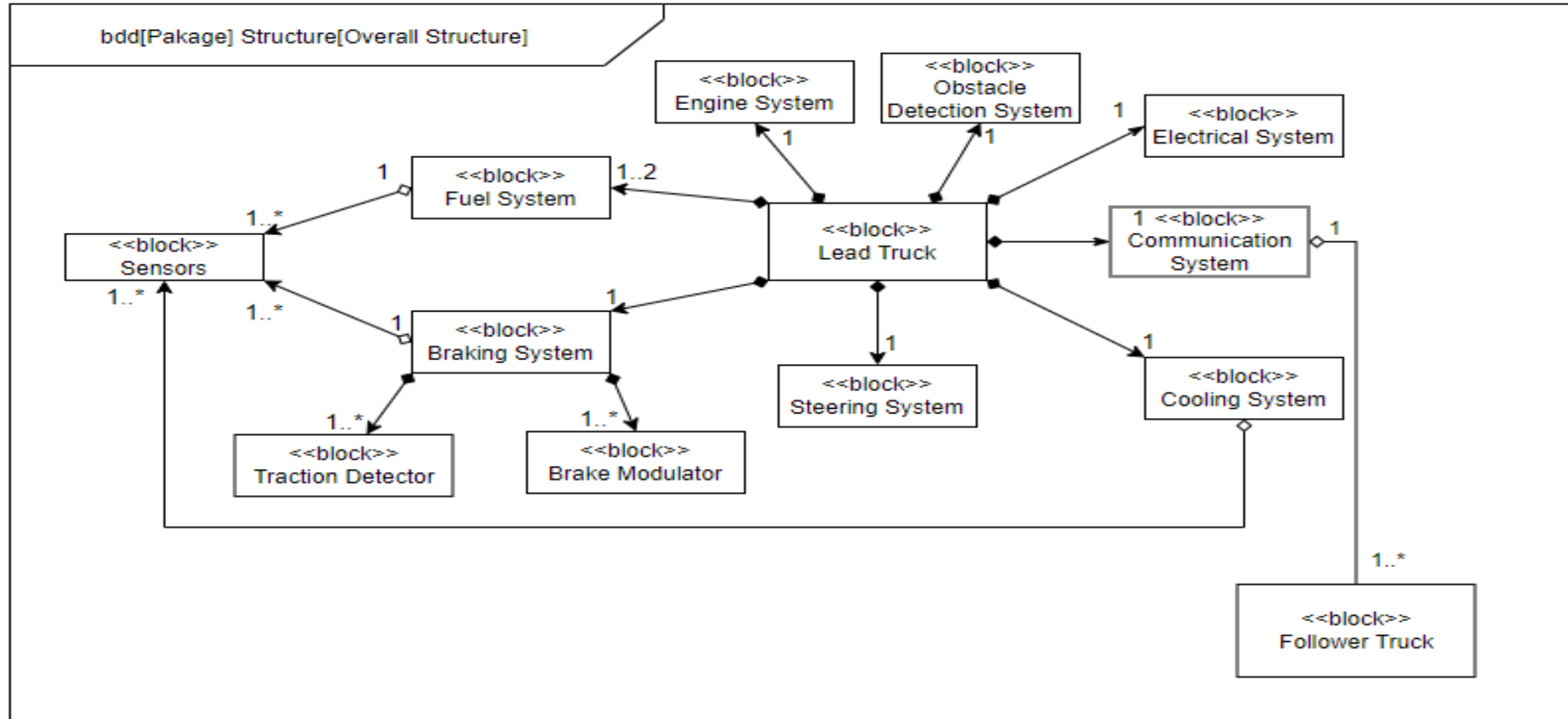
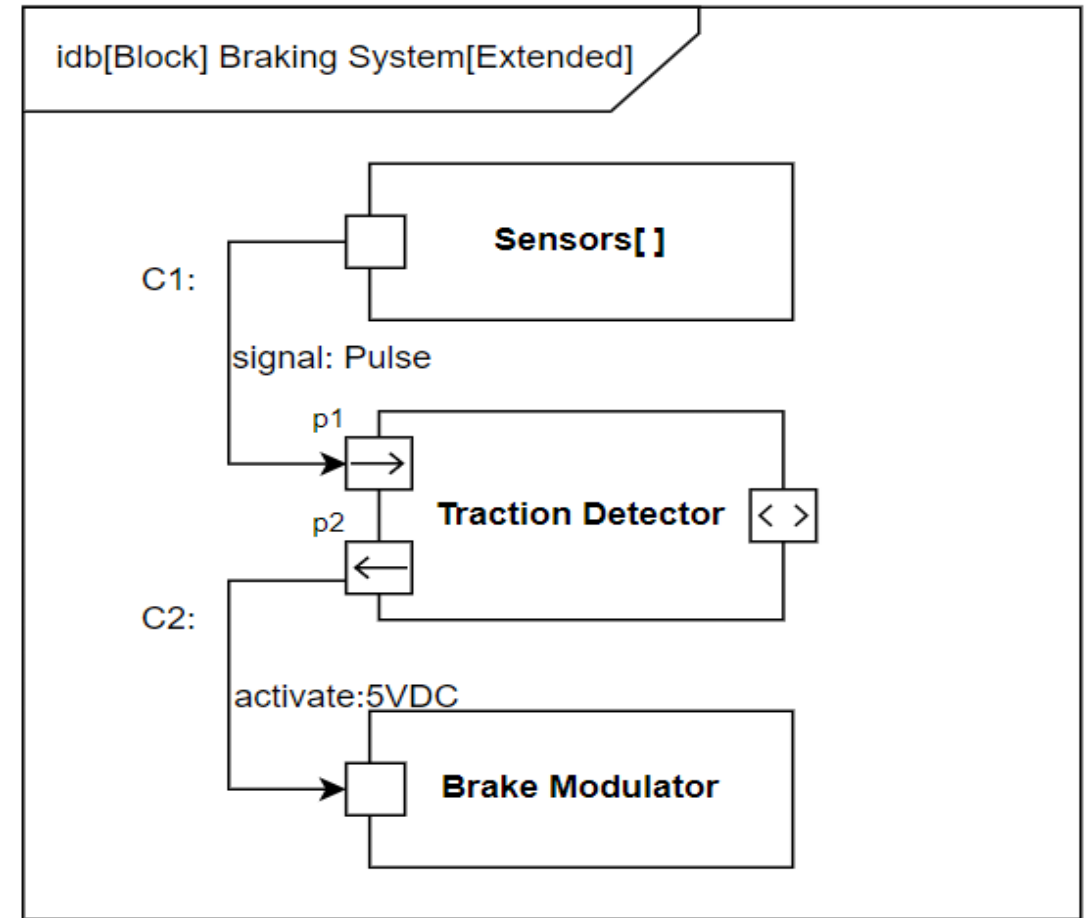
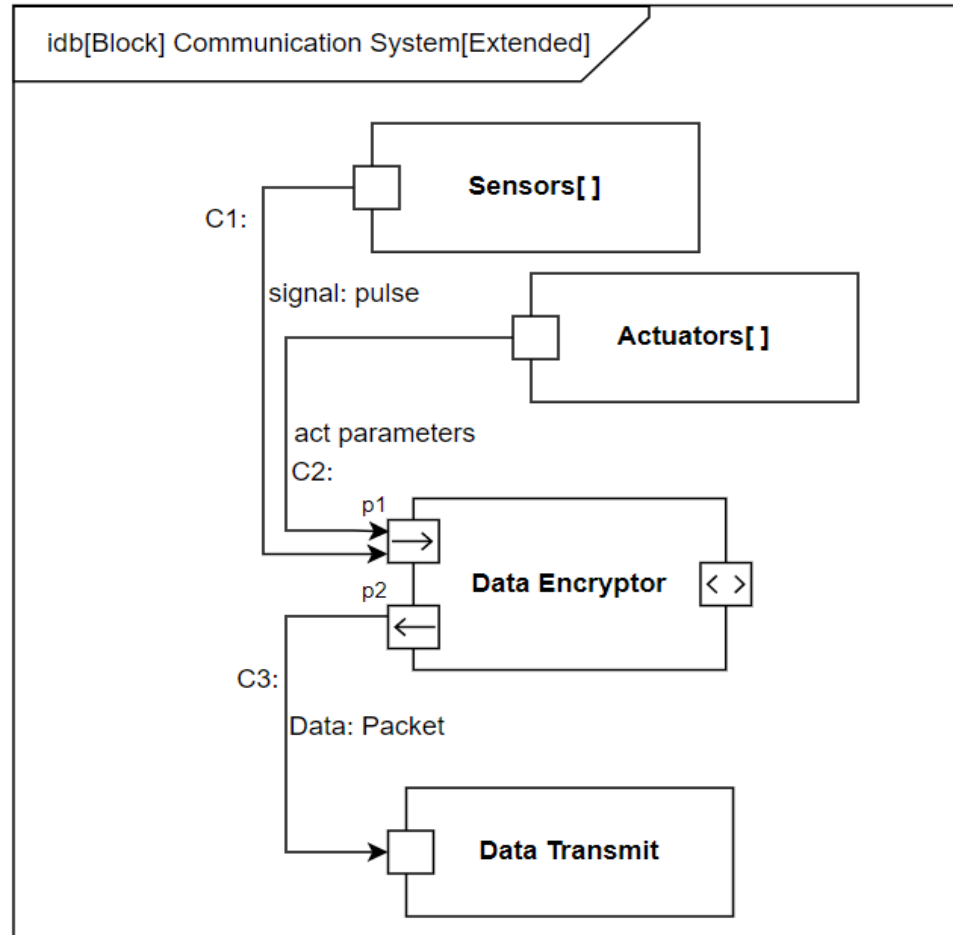


Fig 2. Allocation Diagram

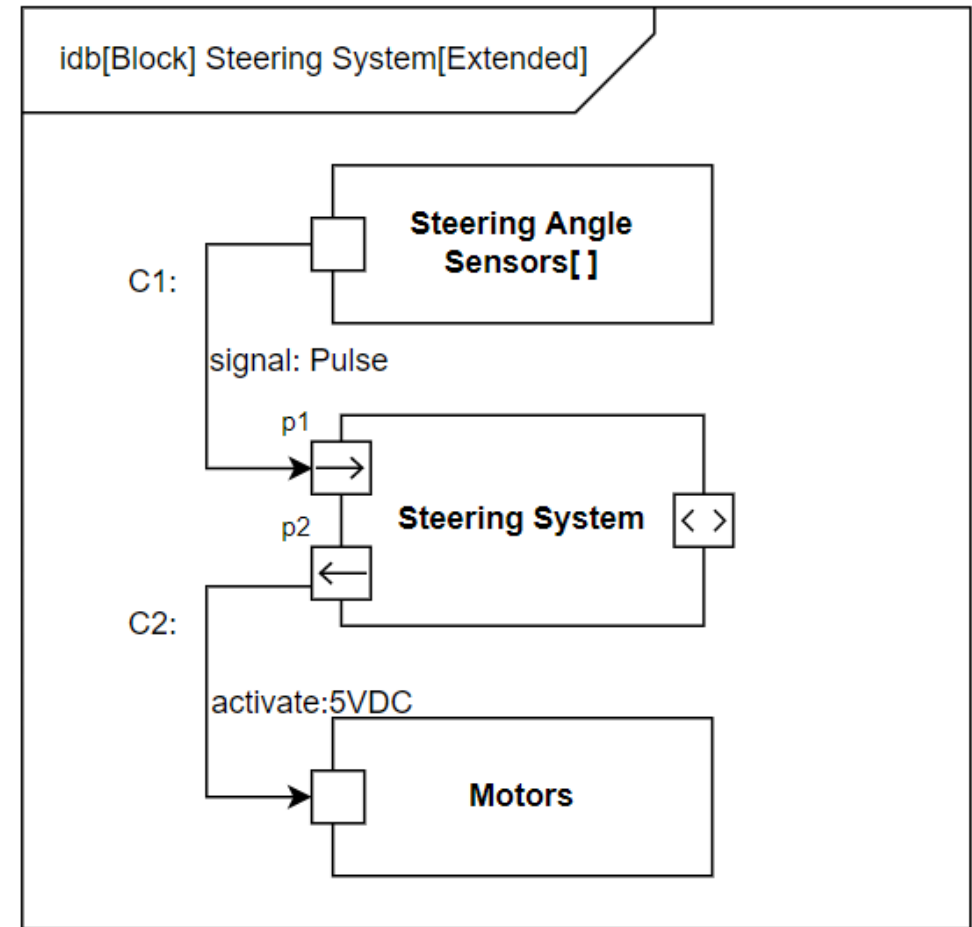
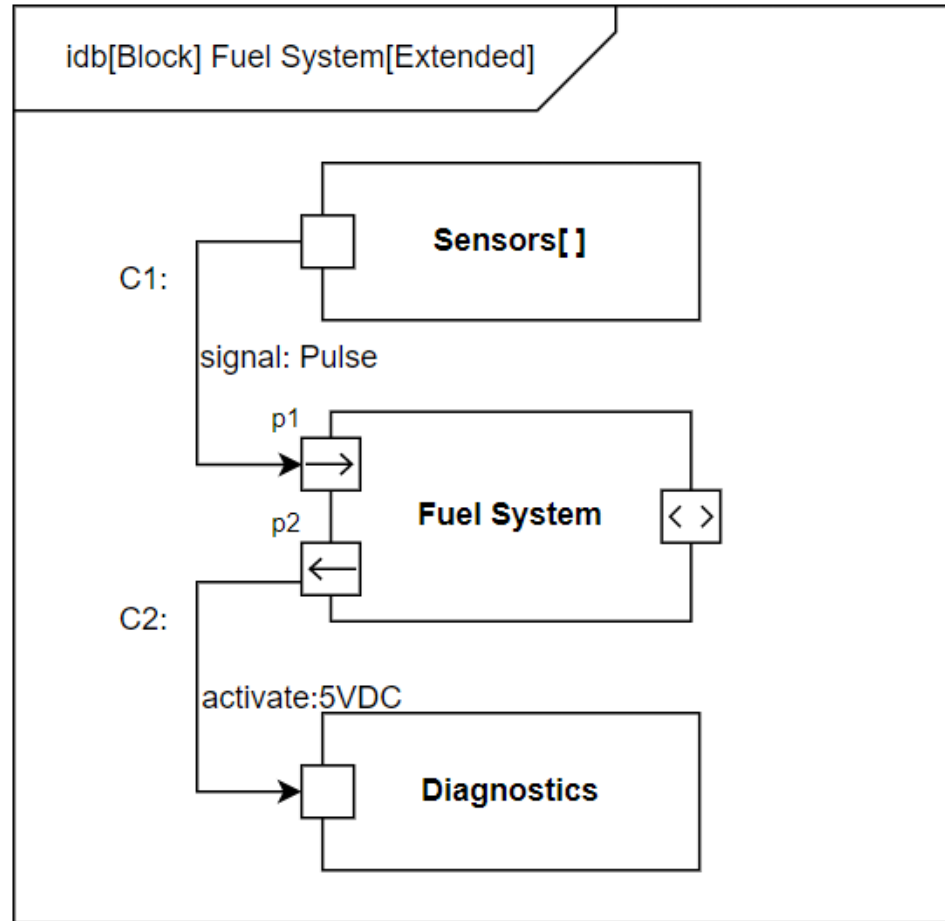
Main Block Diagram



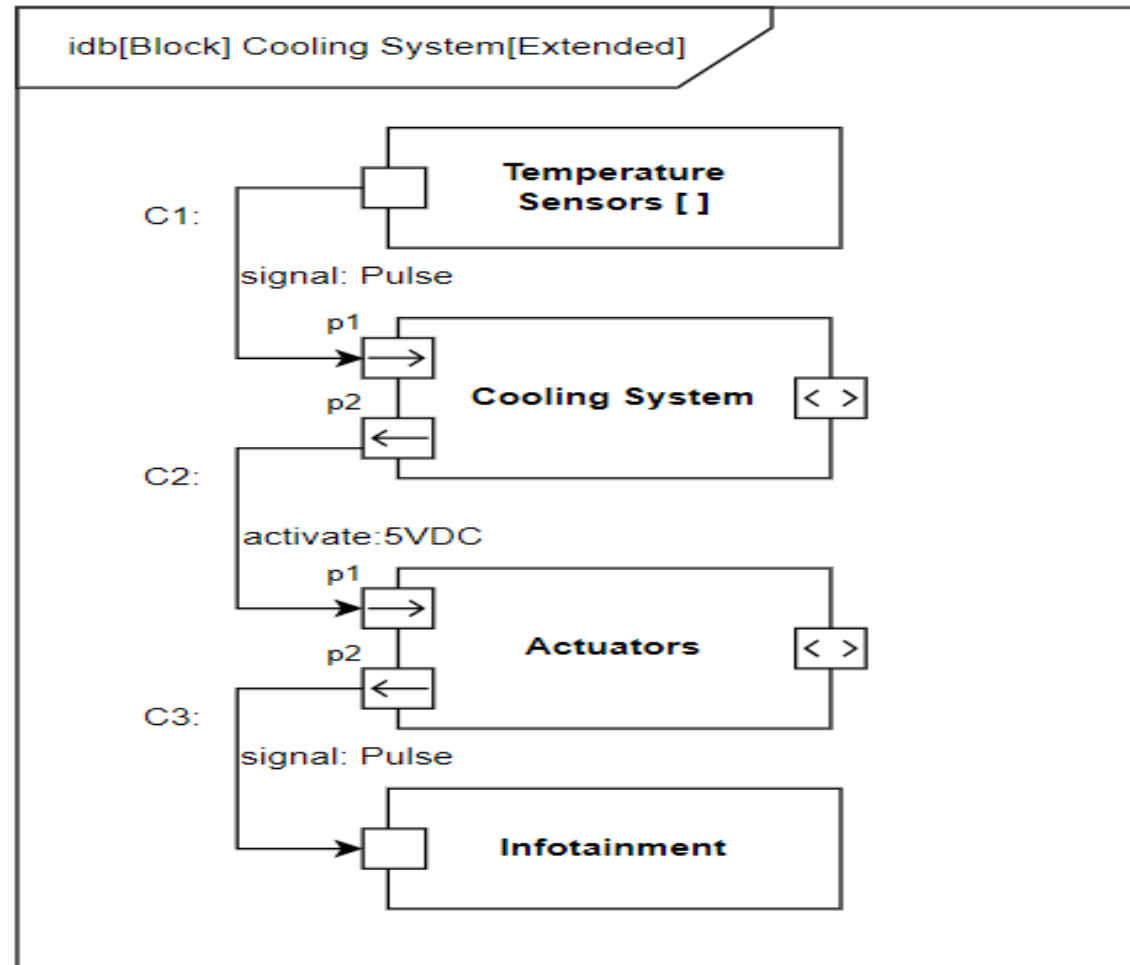
Internal Block Diagram



Internal Block Diagram

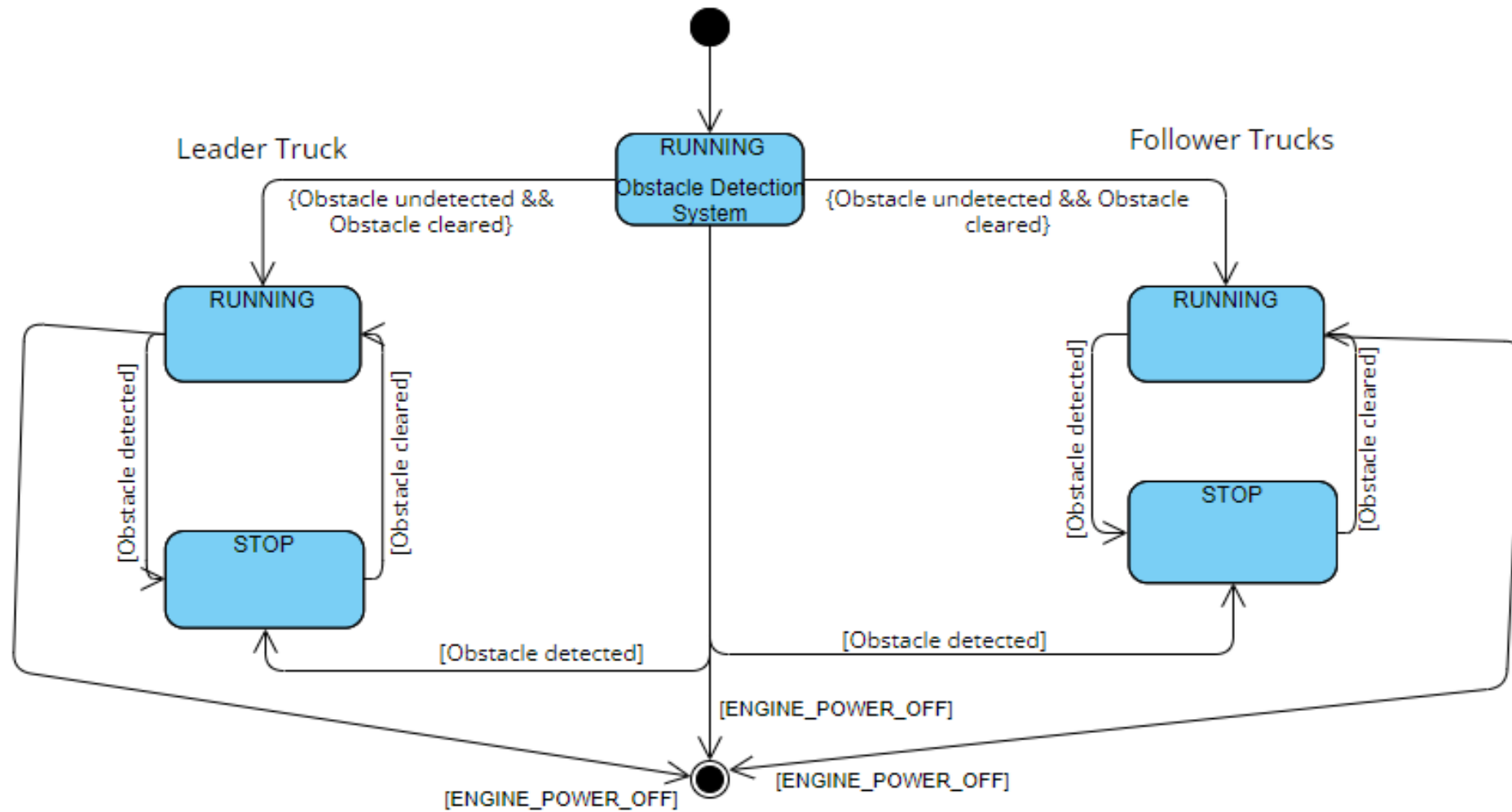


Internal Block Diagram

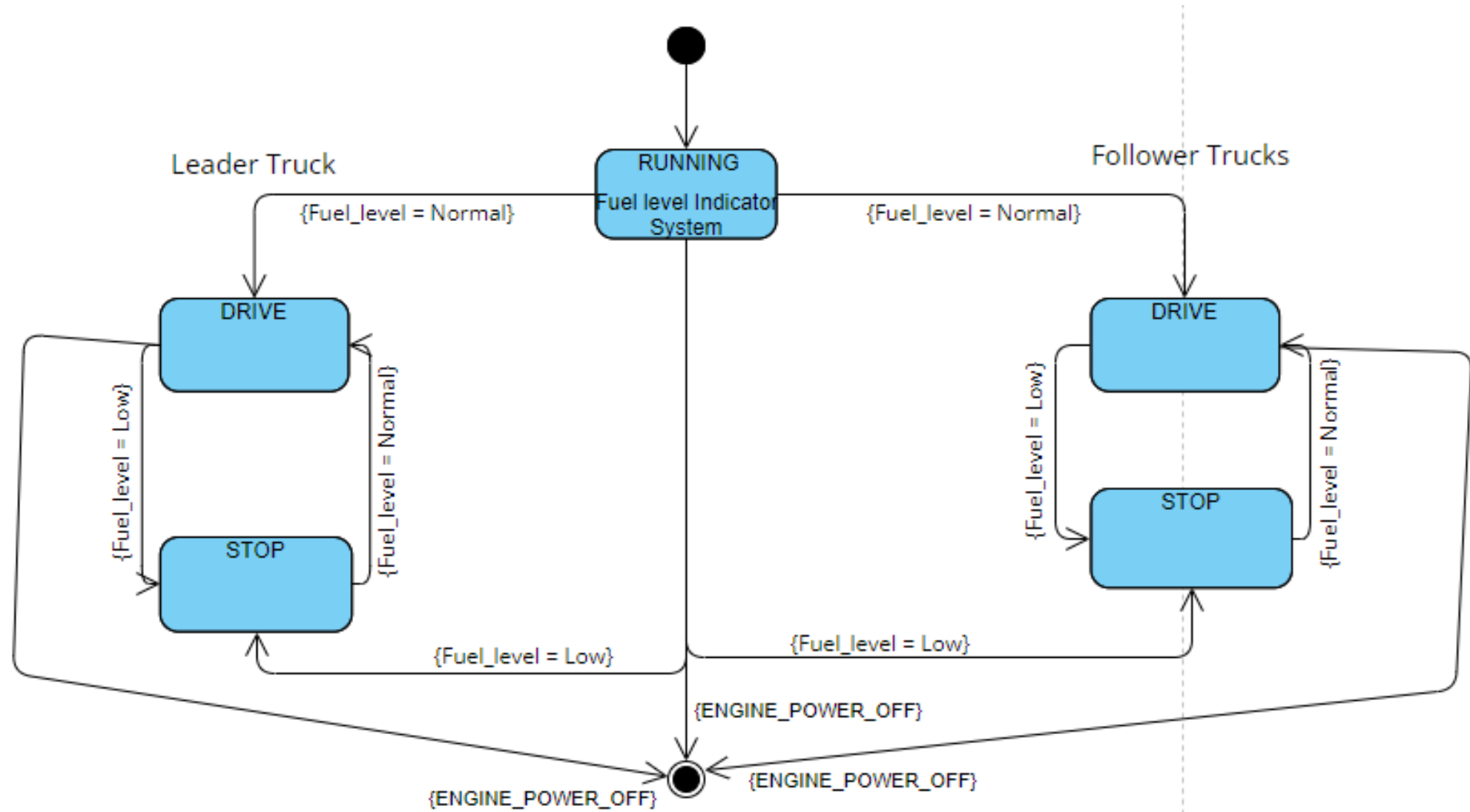


State Machines

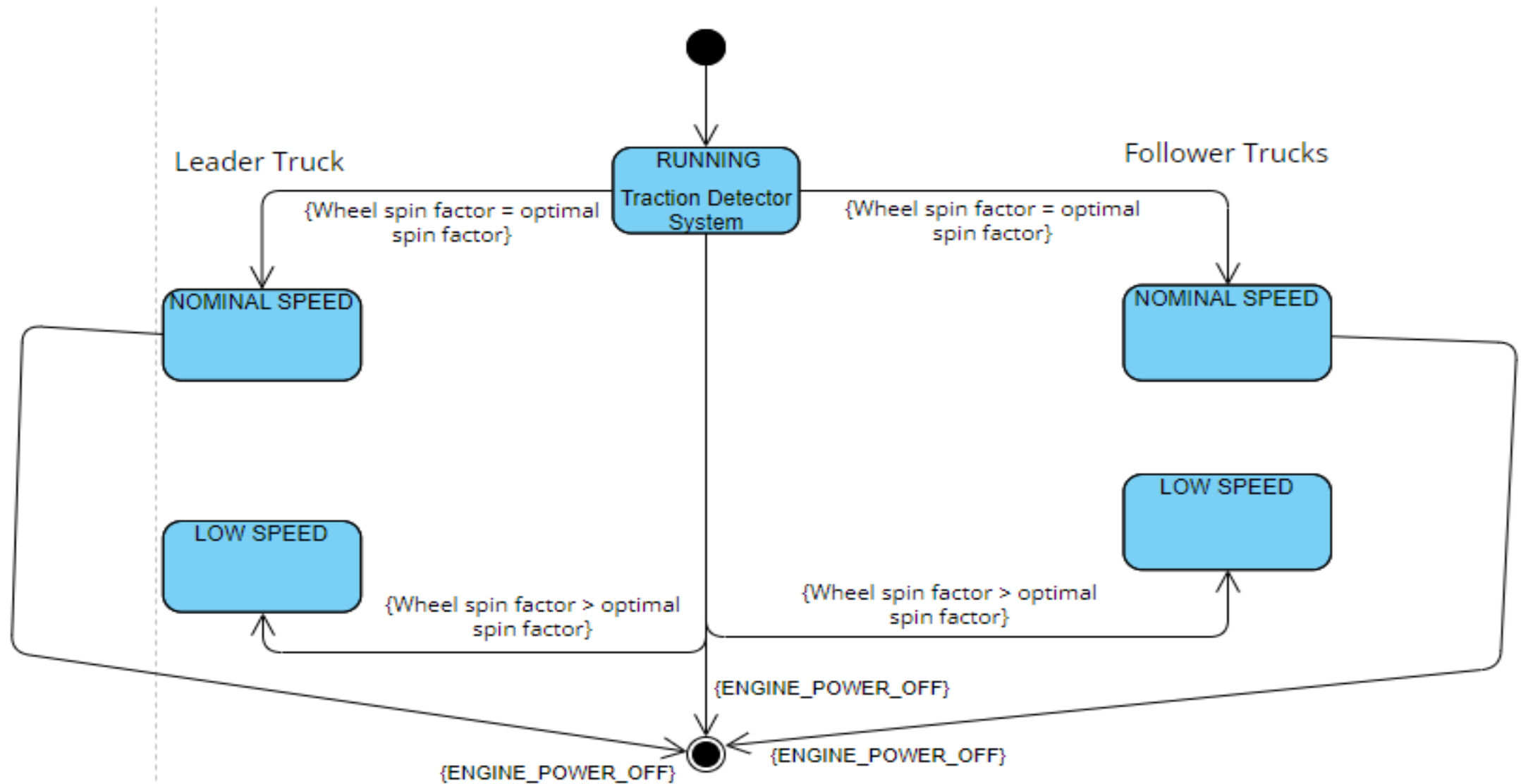
Obstacle Detection



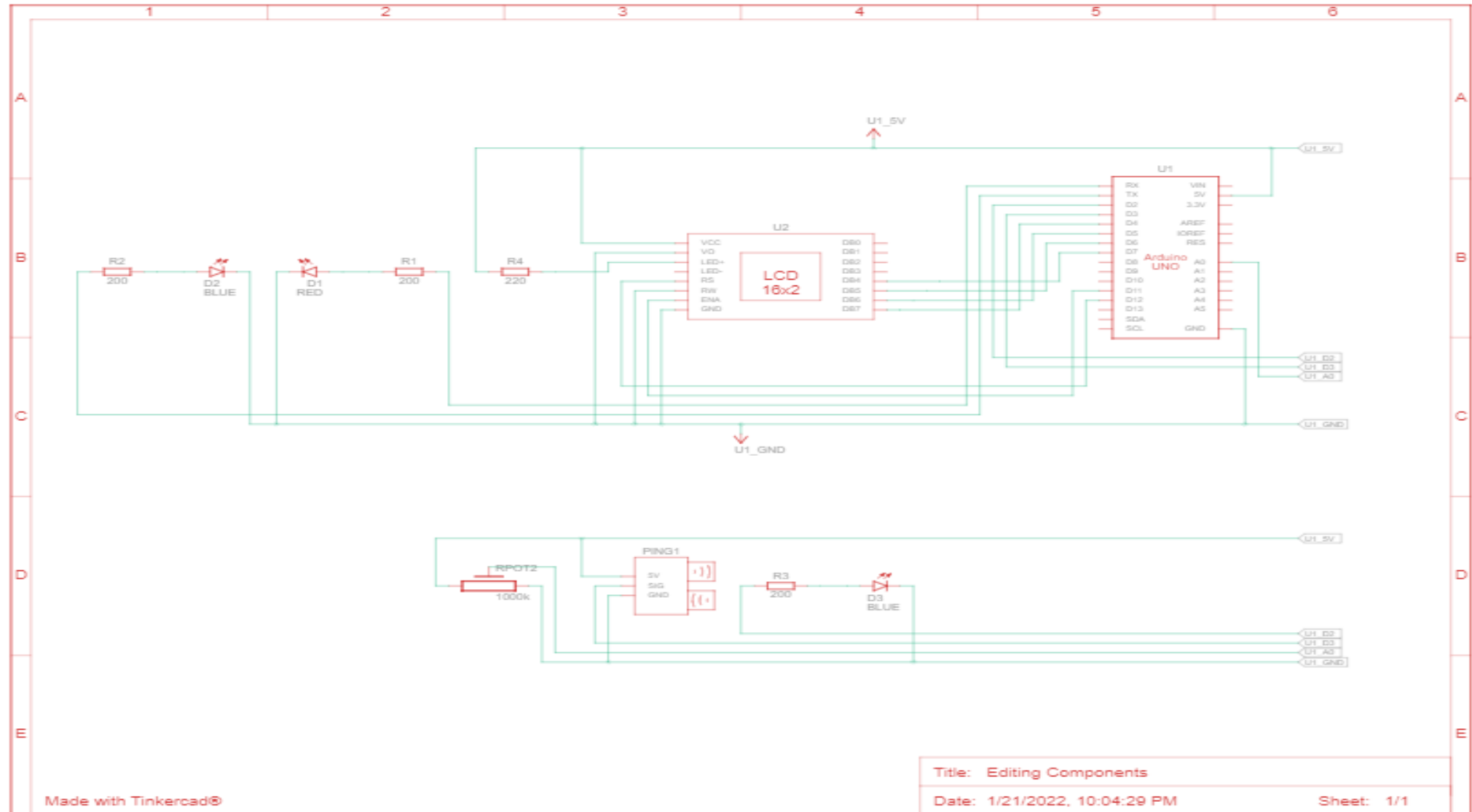
Fuel level indicator



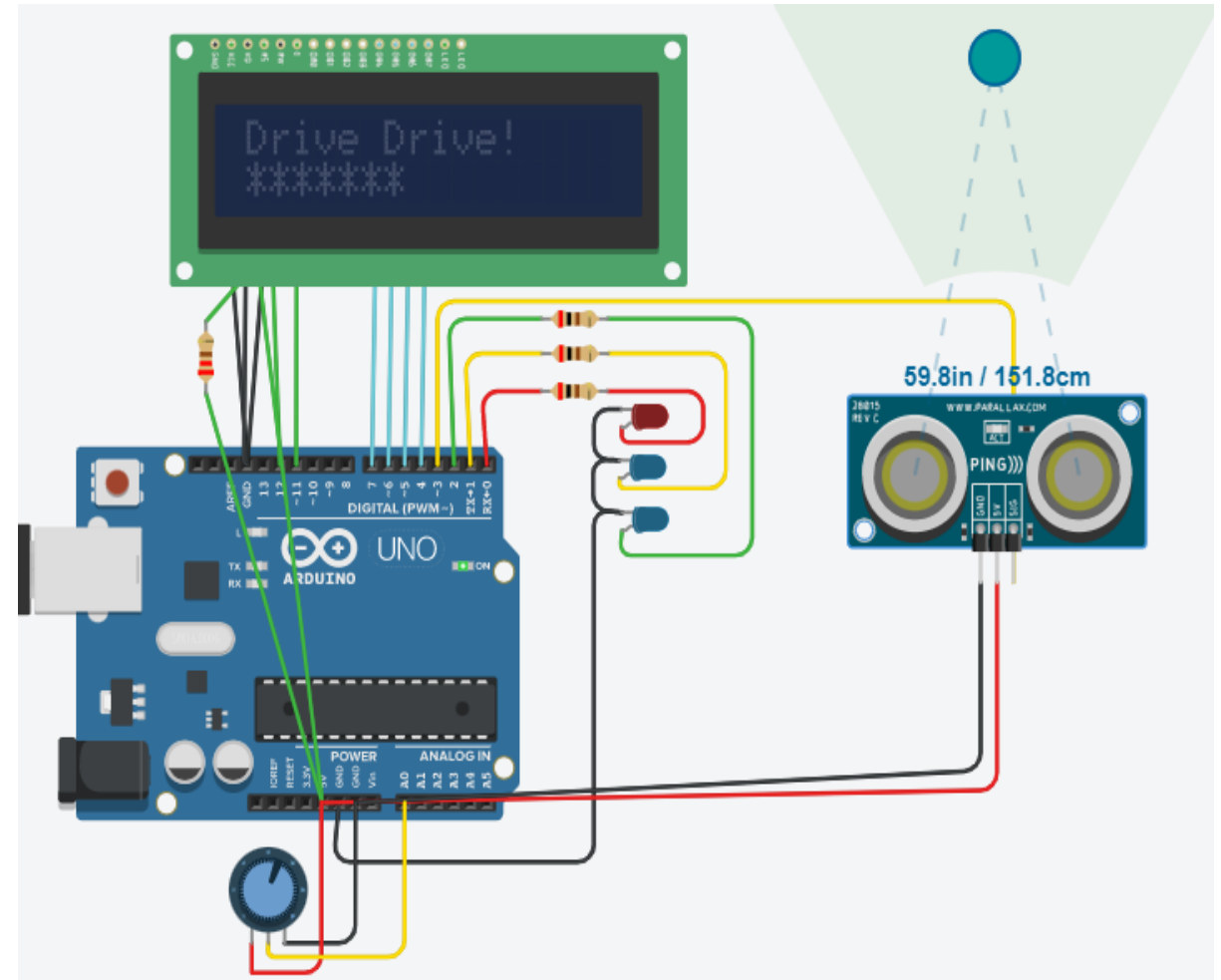
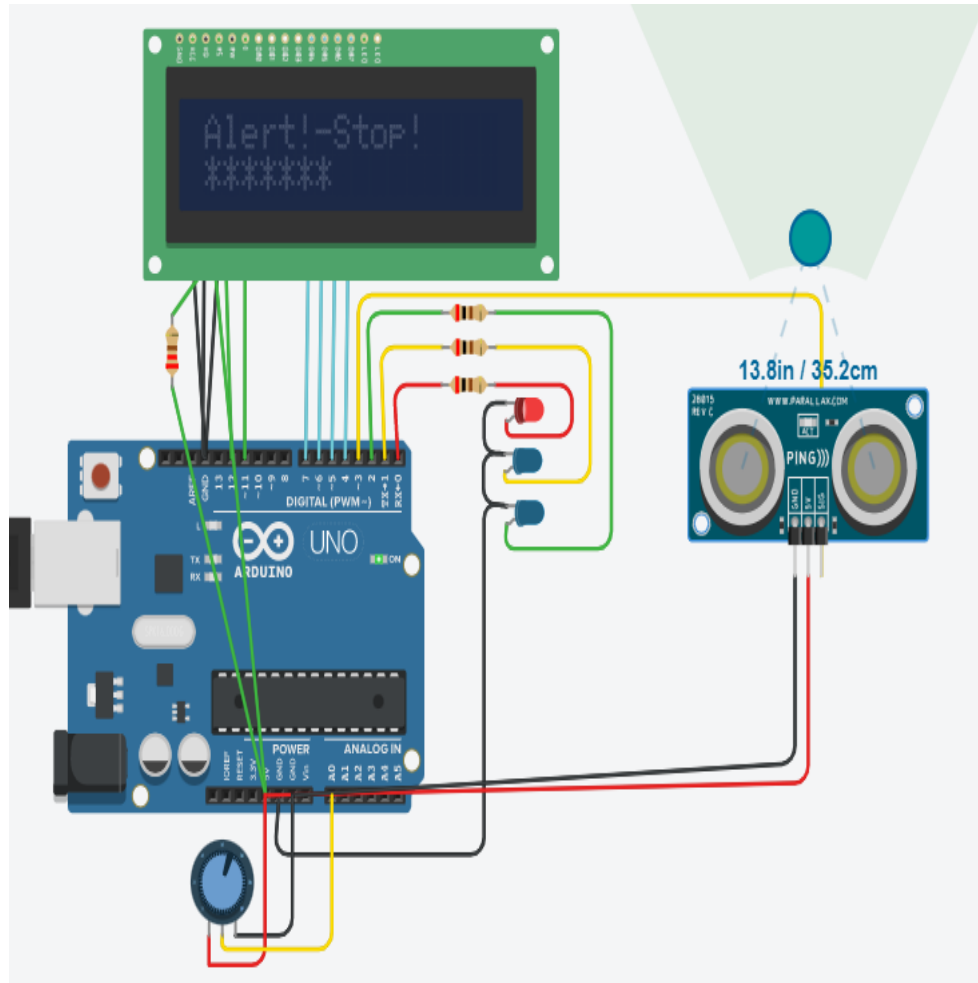
Traction Control



Tinkercad- Arduino



Simulations



Scheduling (using pycpa)

- Tasks defined for Obstacle Detection System:
T1: Monitoring the obstacles by emitting sound waves
T2: Sending the notification to the trucks
- Worst and Best response timings

```
Performing analysis started
```

```
Result:
```

```
Monitoring the obstacles by emitting sound waves: wcrt=6.990000, bcrt = 1.990000
```

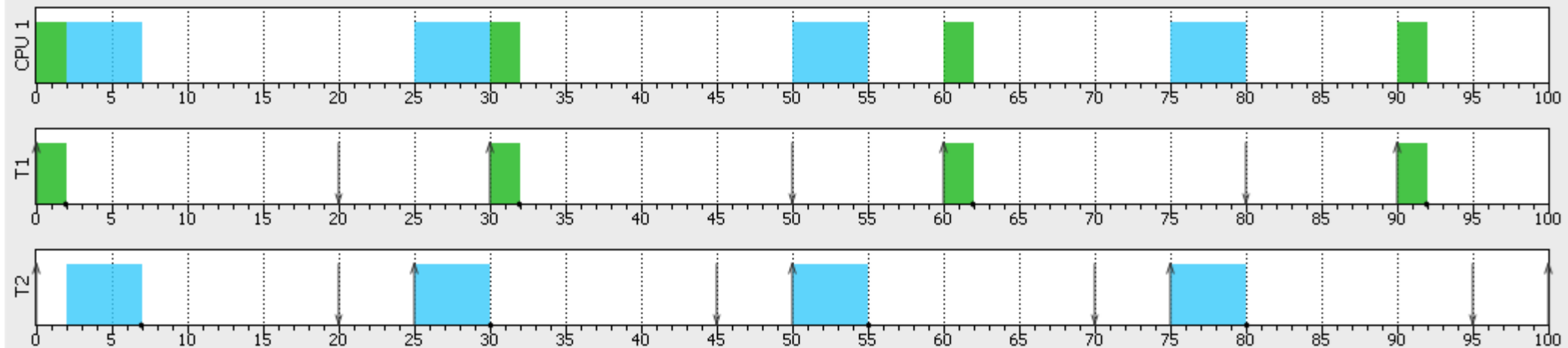
```
Sending the notification to the trucks : wcrt=6.990000, bcrt = 5.000000
```

```
^ ^ ^
```

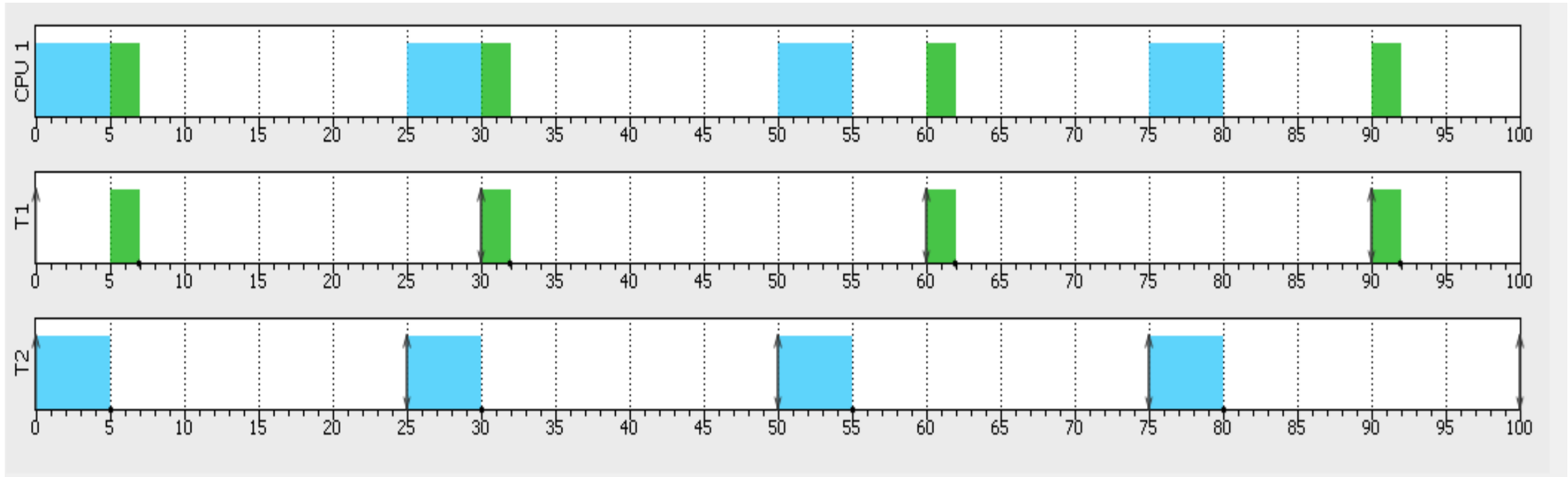
EDF and RM scheduling

scheduling.xml ✕								
General		Scheduler	Processors	Tasks				
id	Name	Task type	Abort on miss	Act. Date (ms)	Period (ms)	List of Act. dates (ms)	Deadline (ms)	WCET (ms)
1	T1	Periodic ▾	<input checked="" type="checkbox"/> Yes	0	30	-	20	1.99
2	T2	Periodic ▾	<input checked="" type="checkbox"/> Yes	0	25	-	20	5

EDF Timing diagram:



RM Timing diagram:



Unit Testing

```
Running main() from c:\a\1\s\thirdparty\googletest\googletest\src\gtest_main.cc
[=====] Running 6 tests from 1 test case.
[-----] Global test environment set-up.
[-----] 6 tests from TEST_FUNC
[ RUN     ] TEST_FUNC.TestCase1
-----
SRS ID : PLATOON_SRS_0001
-----
Requirement : Slave Trucks should notify Application whenever Reception Timeout Occurs, if not set Fault.
Category : Integration Test Case
Test Case 1 : Check if any Fault Detected during Transmission and Reception of Data.
Expected Result: 0
Actual Result: 0
Test Case 1: Passed
Analysis : The TimeoutNotification to be configured for every Packet in the Application to trigger the notification when any Packet is not received within the Configured Time.
-----
[ OK ] TEST_FUNC.TestCase1 (1 ms)
[ RUN ] TEST_FUNC.TestCase2
-----
SRS ID : PLATOON_SRS_0002
-----
Requirement : The Trucks should operate by maintaining Equidistance according to the Configured Values.
Category : Integration Test Case
Test Case 2 : Transmission of invalid Data when the Sensor is not able to provide a Valid value.(Eg: Faulty Sensor).
Expected Result: 1
Actual Result: 1
Test Case 2 : Passed
Analysis : Check the Malfunctioning of the Sensor.
-----
[ OK ] TEST_FUNC.TestCase2 (4 ms)
[ RUN ] TEST_FUNC.TestCase3
-----
SRS ID : PLATOON_SRS_0003
-----
Requirement : Transmission shall be stopped during the Power-OFF of the ECU.
Category : Integration Test Case
Test Case 3 : Master or Slave Truck face Power-OFF Condition.
Expected Result: 3
Actual Result: 3
Test Case 3 : Passed
Analysis : Trucks needs to Stop due to Hardware / Software Failure.
```

Unit Testing

```
-----  
SRS ID : PLATOON_SRS_0004  
-----
```

```
Requirement : Failure in the Braking System due to Low levels in the fluid Reservoir, Broken Wheel Speed Sensors or System is Turned OFF.
```

```
Category : Integration Test Case
```

```
Test Case 4 : To Check the Activation of ABS and EBS Systems.
```

```
Expected Result: 5
```

```
Actual Result: 5
```

```
Test Case 4 : Passed
```

```
Analysis : The Hardware / Software part of the ABS and EBS needs to be Corrected.
```

```
-----  
[ OK ] TEST_FUNC.TestCase4 (12 ms)
```

```
[ RUN ] TEST_FUNC.TestCase5  
-----
```

```
SRS ID : PLATOON_SRS_0005  
-----
```

```
Requirement : Any Failures detected in the Fuel System.
```

```
Category : Integration Test Case
```

```
Test Case 5 : To Check the performance of Fuel Filter, Carburetor and Fuel Pump.
```

```
Expected Result: 5
```

```
Actual Result: 5
```

```
Test Case 5 : Passed
```

```
Analysis : Issues related to Fuel System needs to be Corrected.
```

```
-----  
[ OK ] TEST_FUNC.TestCase5 (6 ms)
```

```
[ RUN ] TEST_FUNC.TestCase6  
-----
```

```
SRS ID : PLATOON_SRS_0006  
-----
```

```
Requirement : Any Failures detected in the Cooling System.
```

```
Category : Integration Test Case
```

```
Test Case 6 : To Check the Working of Temperature Sensor.
```

```
Expected Result: 5
```

```
Actual Result: 5
```

```
Test Case 6 : Passed
```

```
Analysis : Check the Malfunctioning of the Sensor.
```

```
-----  
[ OK ] TEST_FUNC.TestCase6 (4 ms)
```

```
[-----] 6 tests from TEST_FUNC (38 ms total)  
-----
```

```
[-----] Global test environment tear-down
```

```
[=====] 6 tests from 1 test case ran. (41 ms total)
```

```
[ PASSED ] 6 tests.
```

Thank You