OOP_PCOM7E September 2022 Object Oriented Programming

Unit 7 Summative Assessment: System Design

The three operations selected are: (1) starting (2) navigation and (3) parking. The reason is that starting and parking means the beginning and the end of the driving process while navigation is one of the most important features of an autonomous car (Reddy, 2019).

To start a car, the driver identity has to be verified. The verifying agent requests the driver to show a driving license and his face for verification (IDnow, N.D.). Passengers are separate to three age groups by the weight sensor – Infant & toddler, Child, Adult. Children or below cannot sit in the front seat for safety (Amie, 2021) nor infants and toddlers must not use car seats at back seats (Centre for Disease control and Prevention, 2022), otherwise car engine cannot be started. While children at back seats are only encouraged to use booster seat that cause a bling sound but does not affect initiating. The driver sets destination and the fuel control system will check adequacy. In addition, doors locks and safety belts are checked. If the passenger next to the door is an infant, toddler or a child, child lock will automatically on. To initiate driving, the driver has to push down the brake, shift to the correct gear and leave the foot to cause the car to move. (RAC, 2022).

To navigate the car, we need a map and a real time system which provide traffic condition (Carmenta TrafficWatch, N.D.). Car location from GPS and destination are sent to the navigation and traffic watch system and the shortest routes by distance and by time are proposed. The fuel control system will estimate the fuel required. If the expected remaining fuel after the journey drops to 25% or below (Boulder Tyre, 2020), reminder appears and proposes the third route which contain a fuel station. It is up to the driver to select the desire route. In case a traffic condition is detected or a change in destination, repeat route calculation and proposal.

The parking process starts when the GPS detects that it is about to arrive at the destination. The system will check with driver if a parking space is provided at the destination. If not, public car parking spaces availability is checked and nearest two car parks with price will be proposed for driver to choose. After the driver is drop off at the destination, the car will go to the car parking space driverless (New China TV, N.D.). Web camera is automatically switched on during the driverless process. Whenever an obstacle is encountered, the car stopped slowly (unless at ermergency such as human is closed ahead). Meanwhile, the LIDAR sensors (Zhou & Sun, 2019) detect and calculate the shape, size, scales, motion, etc. of the obstacles and reveals its identity. If the object is moving, the car will wait and continue when it is removed. If it is a static object, after waiting for X minutes, re-calculate alternative route or locate another car parking slot in the same car park. LIDAR sensors are used for proper parking too. After complete parking, the navigation and traffic watch system will report the final location to the driver for later pick-up.

The use diagrams, class diagrams, sequence diagrams, state transit diagrams and activity diagrams of the three operations above are attached.

Reference:

Reddy, P. P. (2019) Driverless Car: Software Modelling and Design using Python and Tensorflow.

Zhou, Z. Q. & Sun, L. (2019) Metamorphic testing of driverless cars. University of Wollongong

Amie (2021) When can a child sit in the front seat of the car? [Available from: https://saferide4kids.com/blog/can-children-sit-in-the-front-seat-car/#:~:text=It%20is%20safest%20%E2%80%94%20and%20best,they%20are%2013%20years%20old.&text=The%20Centers%20for%20Disease%20Control,13%20in%20the%20back%20seat.] Accessed on 6 November 2022.

Centre for Disease control and Prevention**.** (2022) Keep Child Passengers Safe on the Road **[Available from:** https://www.cdc.gov/injury/features/child-passenger-safety/index.html#:~:text=Buckle%20all%20children%20ages%2012%20and%20younger%20in%20the%20back%20seat.&text=Never%20place%20a%20rear%2Dfacing%20car%20seat%20in%20front%20of,matter%20how%20short%20the%20trip.**]** Accessed on 1 November 2022.

Boulder Tyre. (2020) Don't Run Your Car When it's Low on Gas [Available from: https://bouldertire.com/blog/view/don-t-run-your-car-when-it-s-low-on-gas] Accessed on 1 November 2022.

RAC. (2022) How to drive an automatic car - step by step guide [Available from: https://www.rac.co.uk/drive/advice/learning-to-drive/how-to-drive-an-automatic/] Accessed on 5 November 2022.

IDnow. (N.D.) Fully automated for the fastest identity verification [Available from:

https://www.idnow.io/autoident-express-fully-automated-identity-verification-with-a-powerful-document-learning-] Accessed on 2 November 2022.

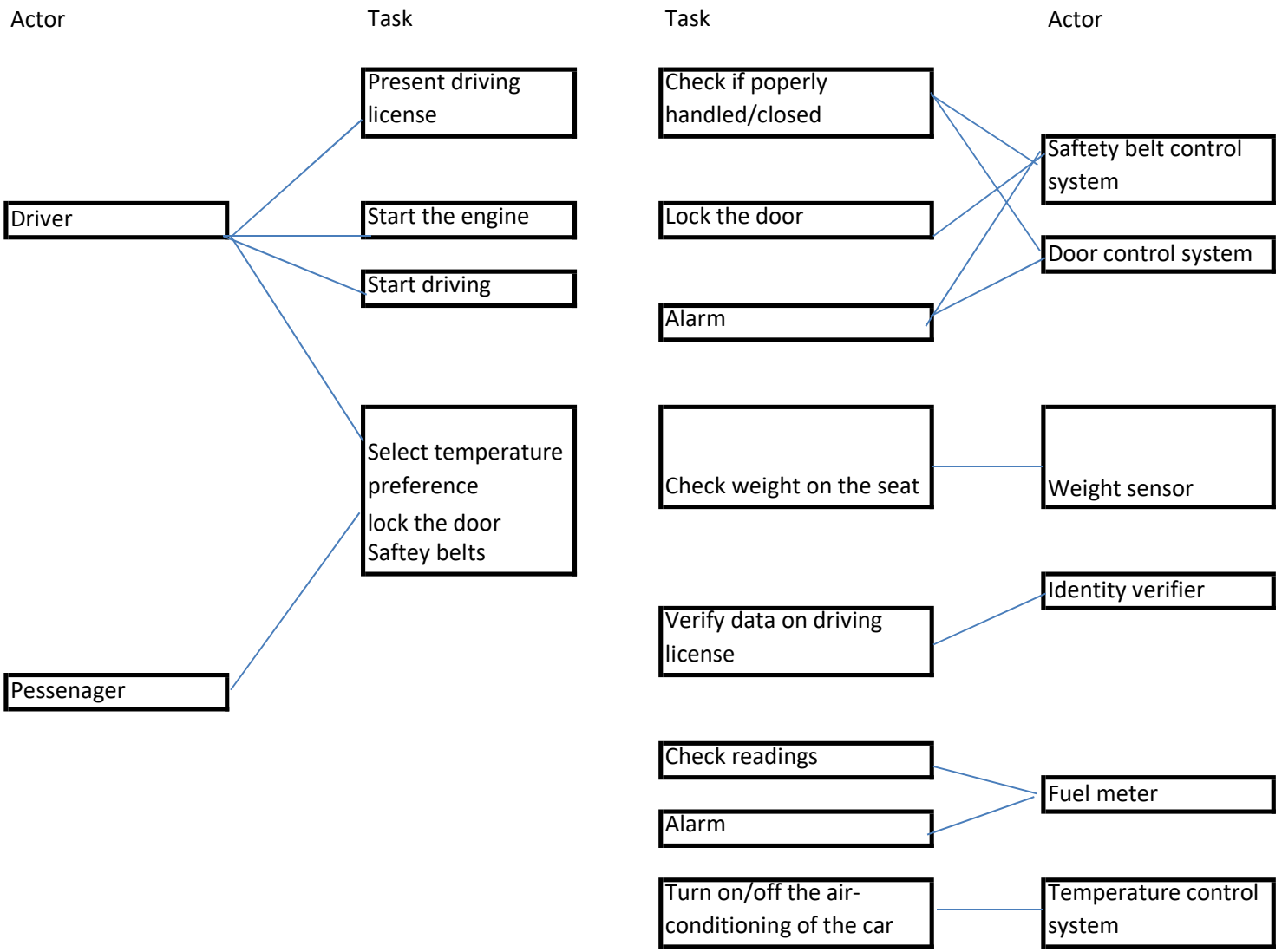
Carmenta TrafficWatch. (N.D.) [Available from: https://carmenta.com/en/automotive/carmenta-trafficwatch/?gclid=Cj0KCQjwk5ibBhDqARIsACzmgLQGjK88miy-Ty4_YD_bKCKzoD-Qu7S5Kv54yQn1yXjPwzSlYyqy7kYaAhchEALw_wcB] Accessed on 1 November 2022.

New China TV. (N.D.) How self-driving car completes parking [Available from: https://www.youtube.com/watch?v=GKxFZQxCB8M] Accessed on 6 November 2022.

Index

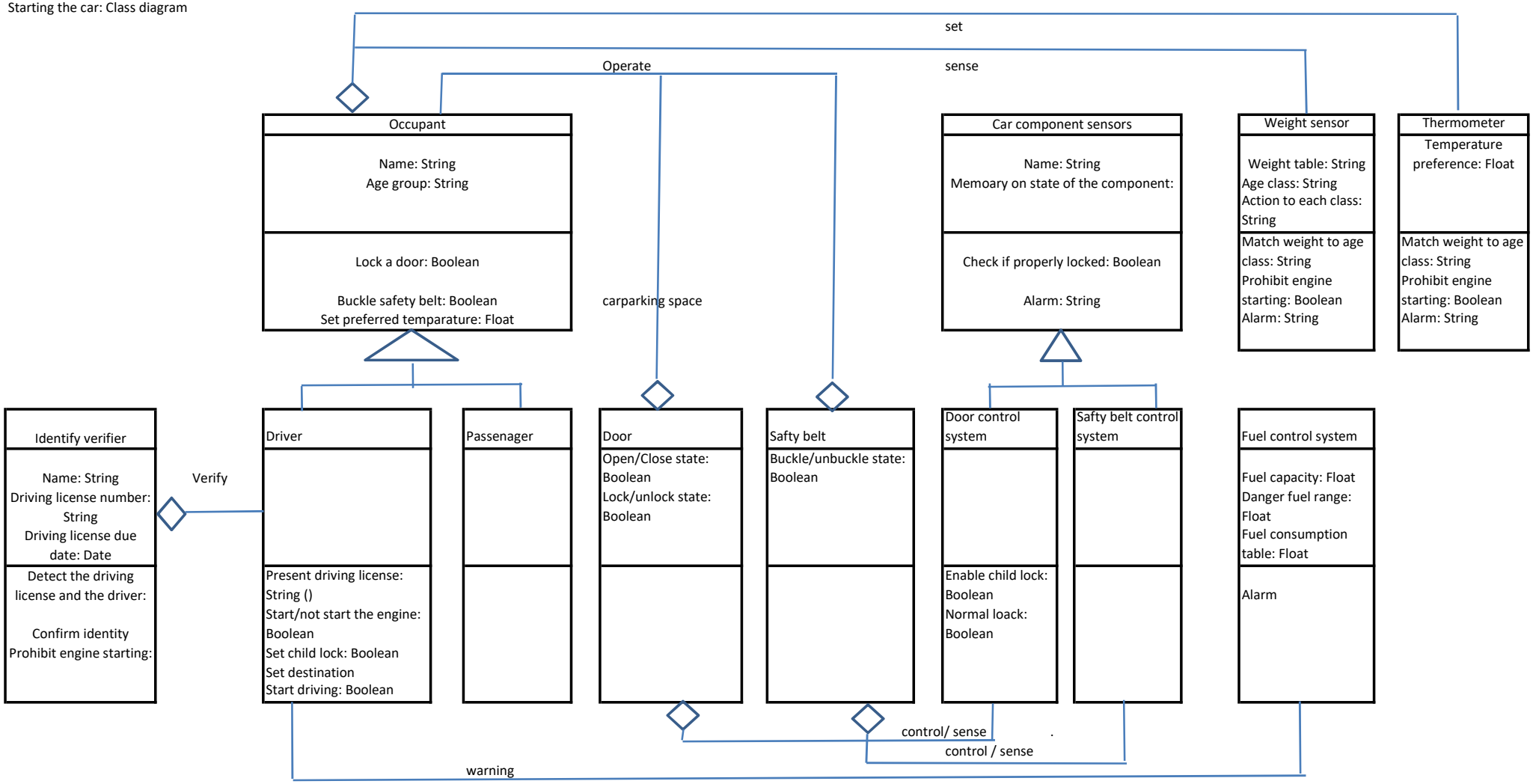
OOP_PCOM7E September 2022 Object Oriented Programming
Unit 7 Summative Assessment: System Design

Starting the car: Use diagram



OOP_PCOM7E September 2022 Object Oriented Programming
Unit 7 Summative Assessment: System Design

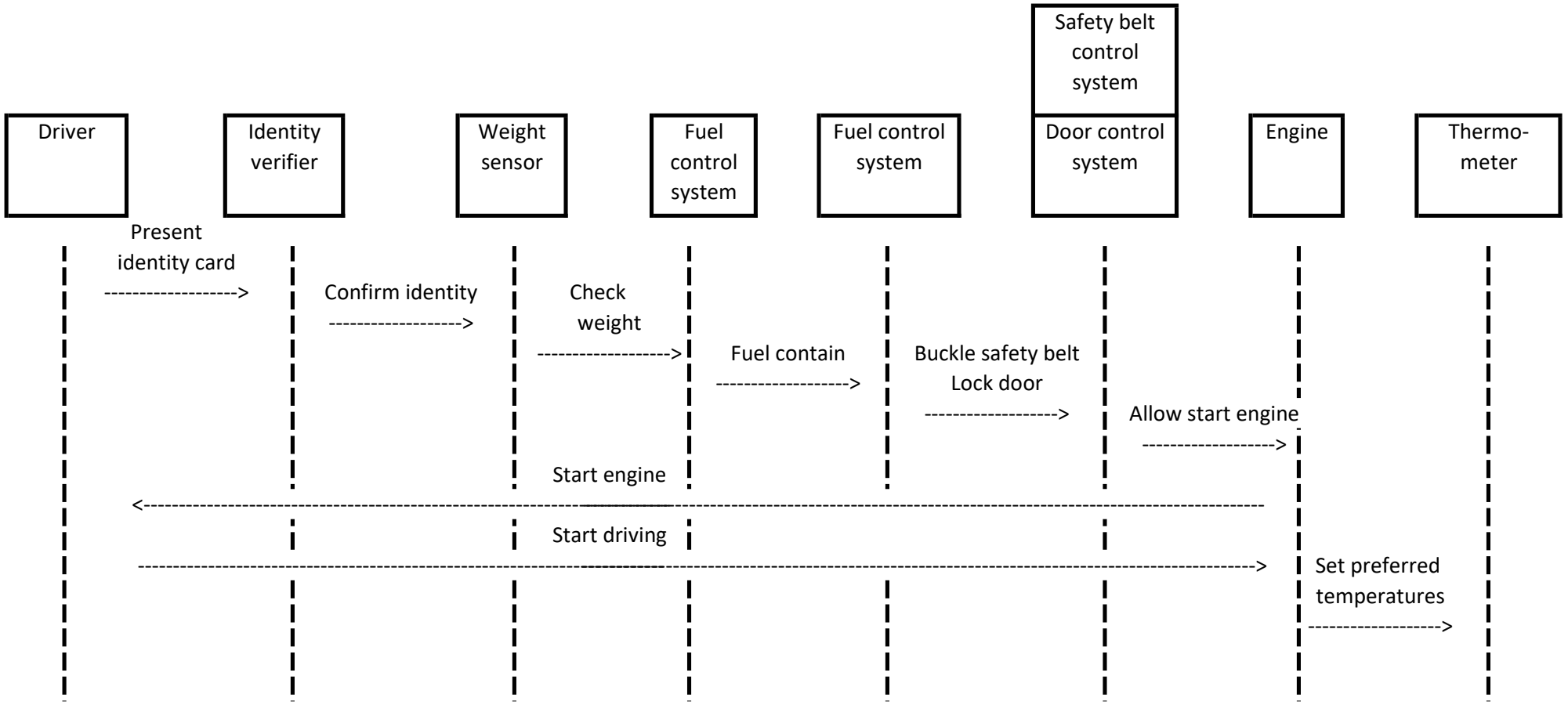
Starting the car: Class diagram



OOP_PCOM7E September 2022 Object Oriented Programming

Unit 7 Summative Assessment: System Design

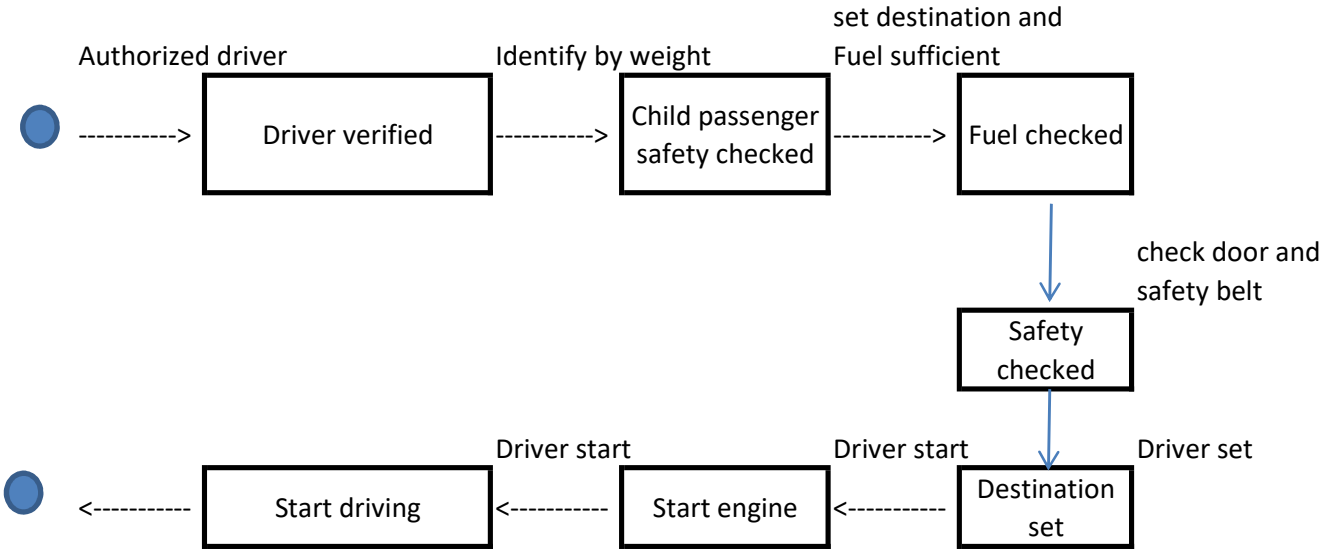
Starting the car: Sequence diagram



OOP_PCOM7E September 2022 Object Oriented Programming
Unit 7 Summative Assessment: System Design

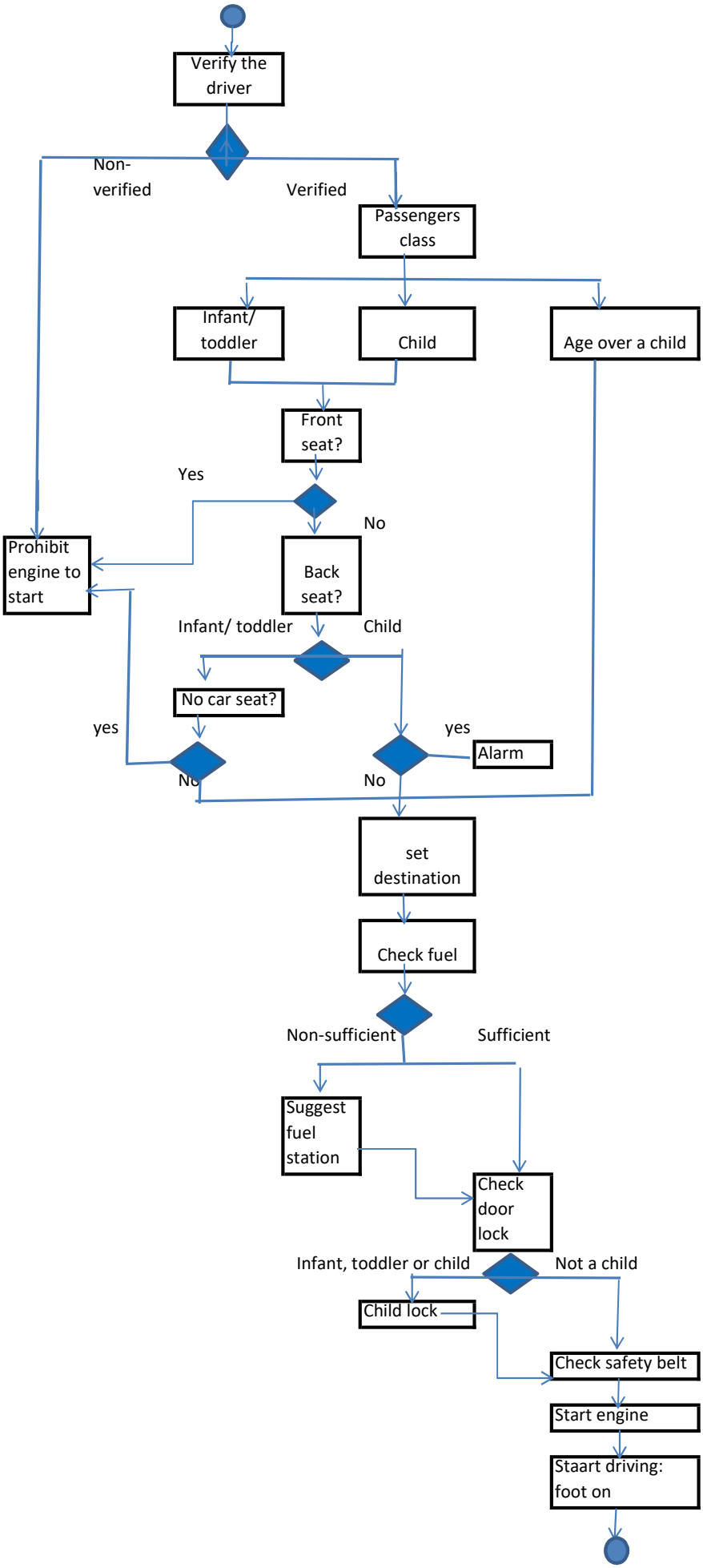
Starting the car: State Transit diagram

Initiate driving



OOP_PCOM7E September 2022 Object Oriented Programming
Unit 7 Summative Assessment: System Design

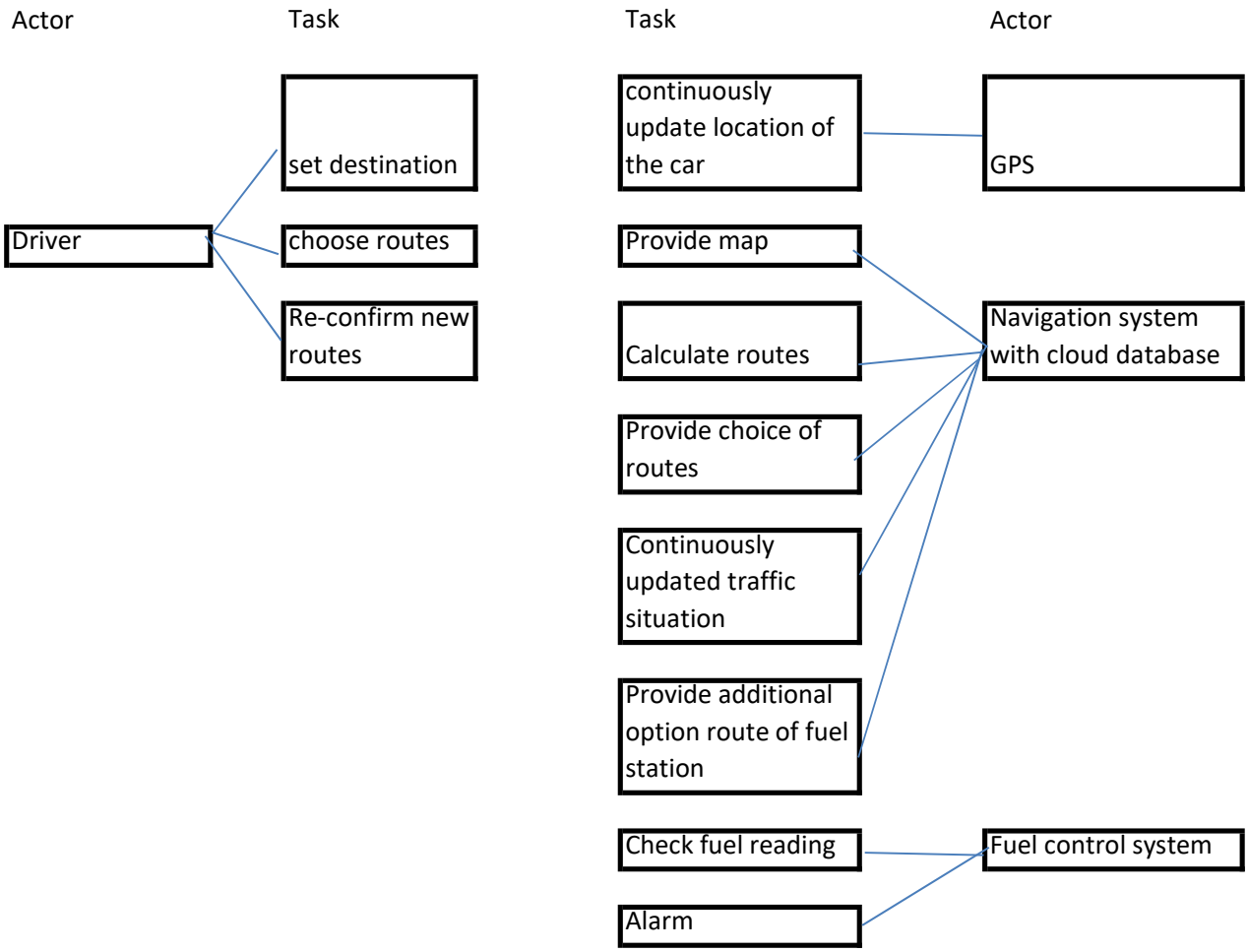
Starting the car: Activity diagram



OOP_PCOM7E September 2022 Object Oriented Programming

Unit 7 Summative Assessment: System Design

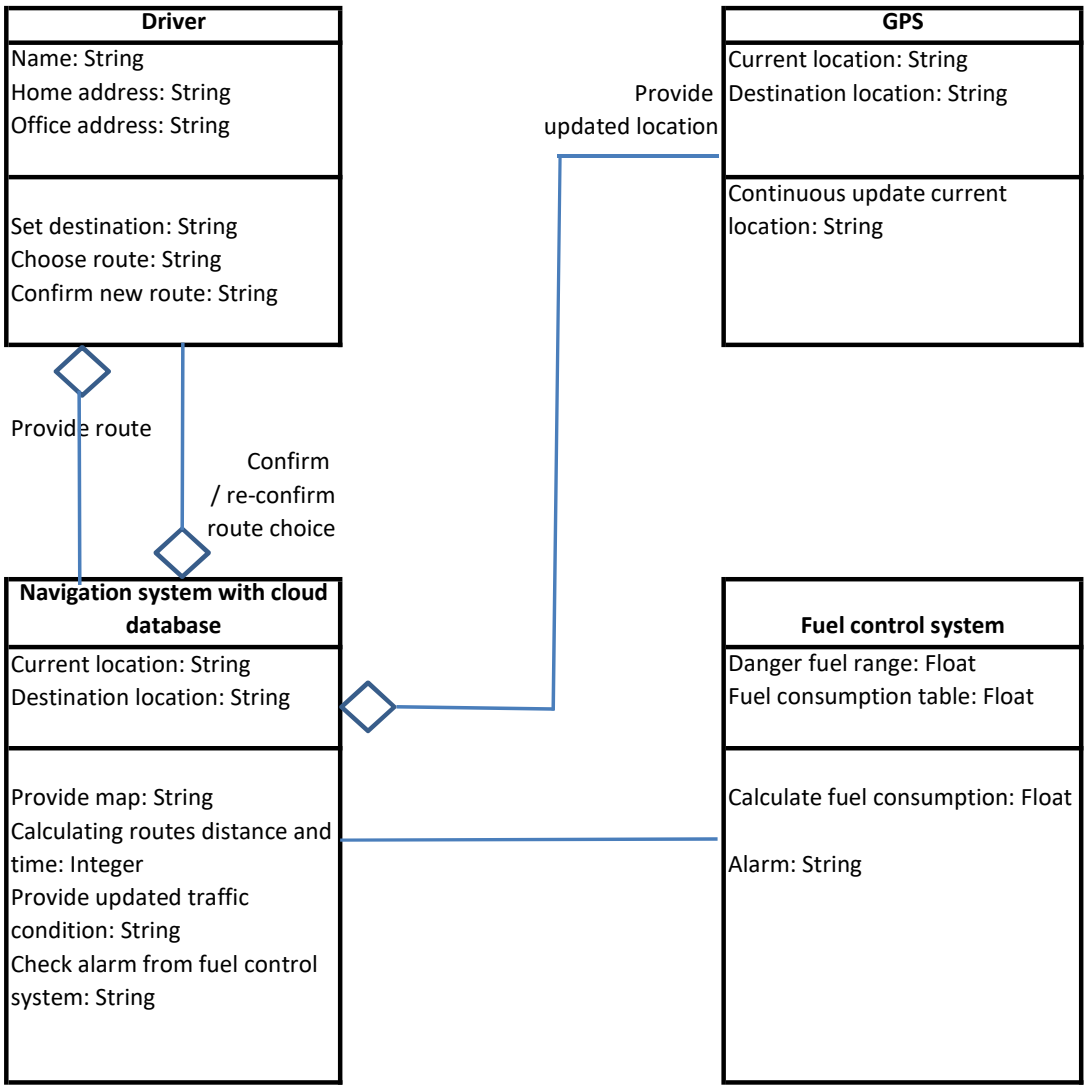
Navigation: Use diagram



OOP_PCOM7E September 2022 Object Oriented Programming

Unit 7 Summative Assessment: System Design

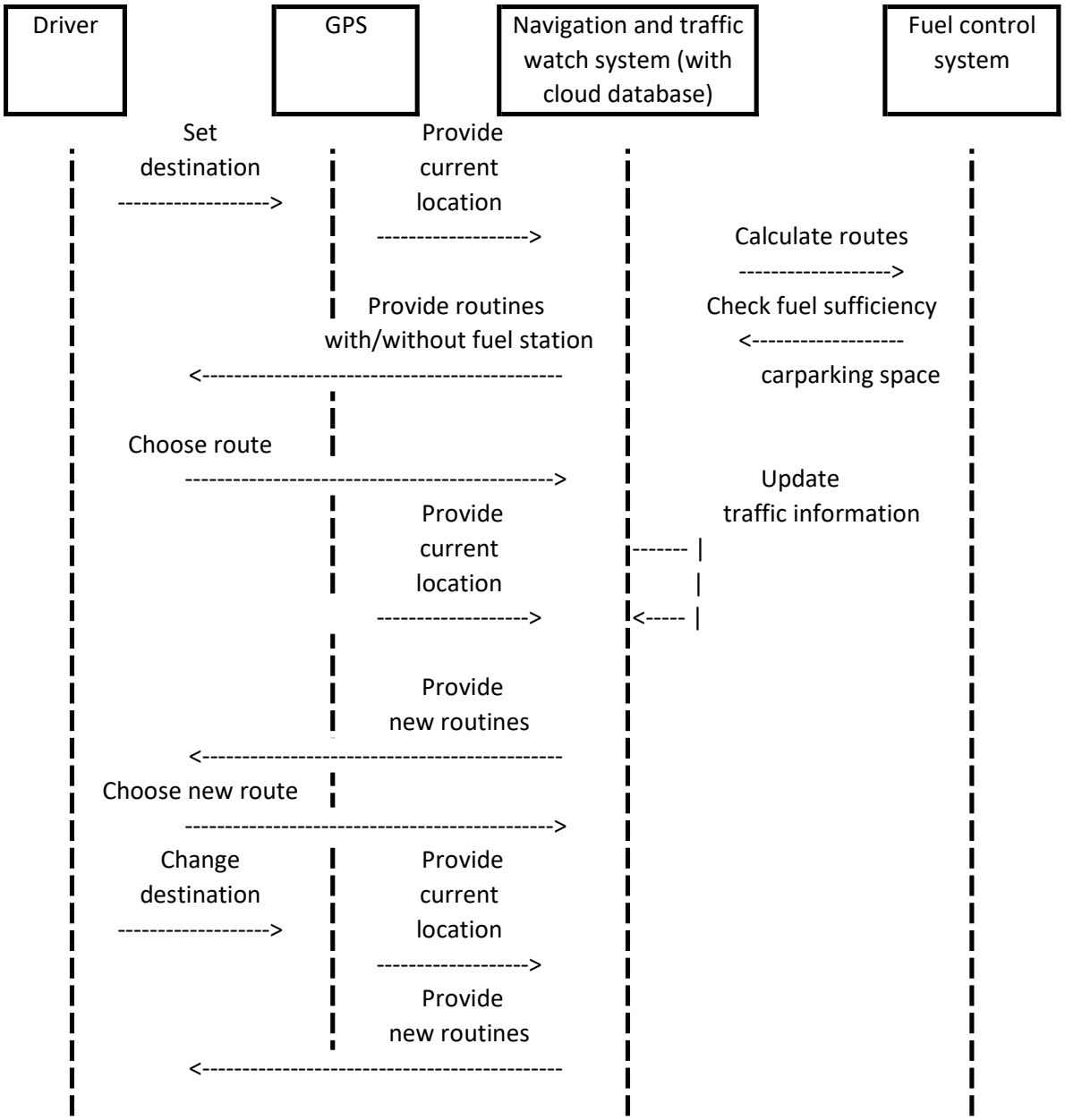
Navigation: Class diagram



OOP_PCOM7E September 2022 Object Oriented Programming

Unit 7 Summative Assessment: System Design

Navigation: Sequence diagram

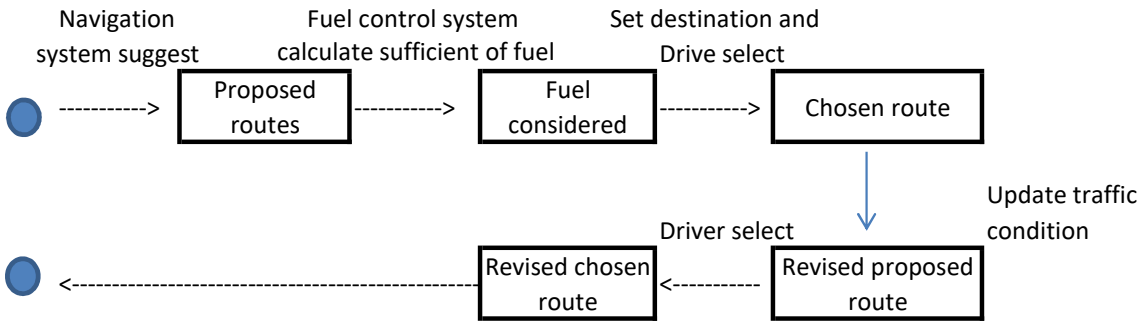


OOP_PCOM7E September 2022 Object Oriented Programming

Unit 7 Summative Assessment: System Design

Navigation: State Transit diagram

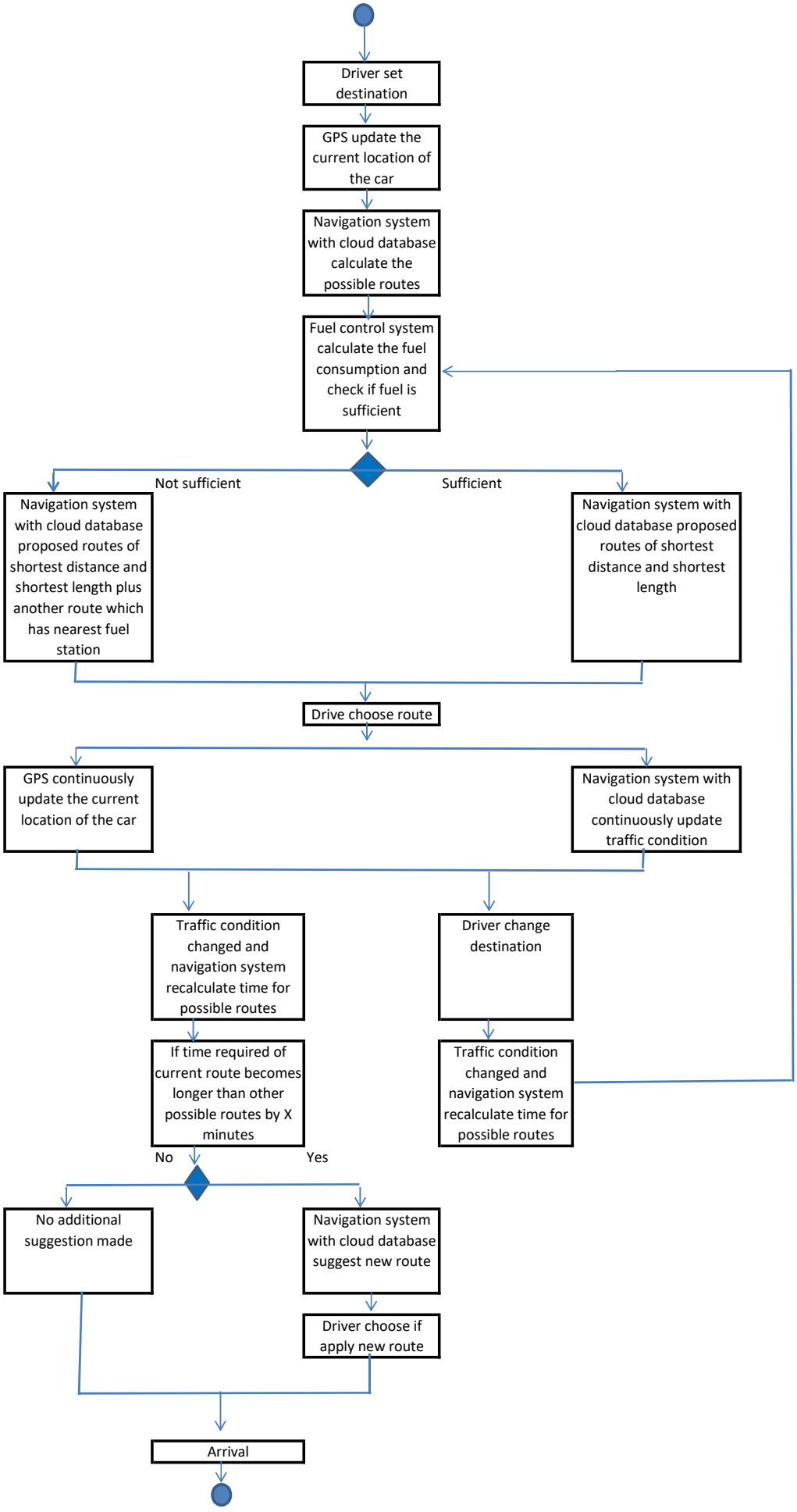
Routes



OOP_PCOM7E September 2022 Object Oriented Programming

Unit 7 Summative Assessment: System Design

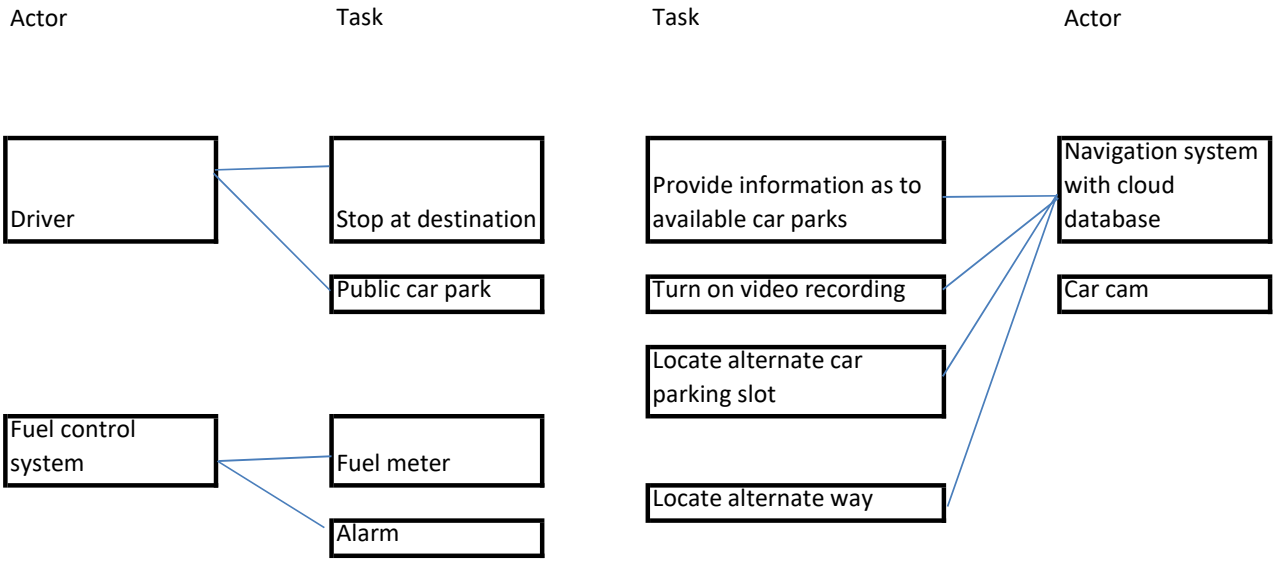
Navigation: Activity diagram



OOP_PCOM7E September 2022 Object Oriented Programming

Unit 7 Summative Assessment: System Design

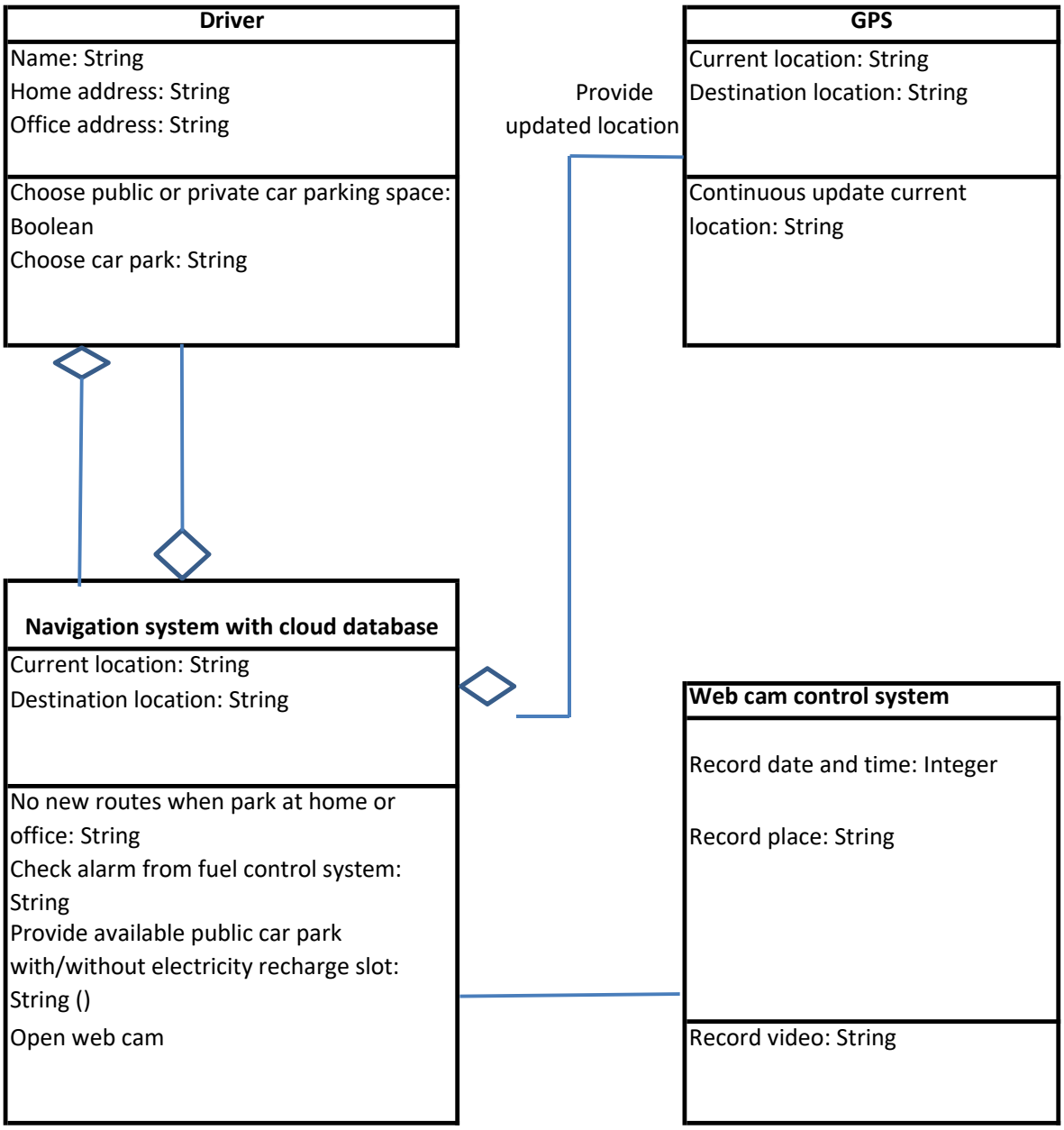
Parking a car: Use diagram



OOP_PCOM7E September 2022 Object Oriented Programming

Unit 7 Summative Assessment: System Design

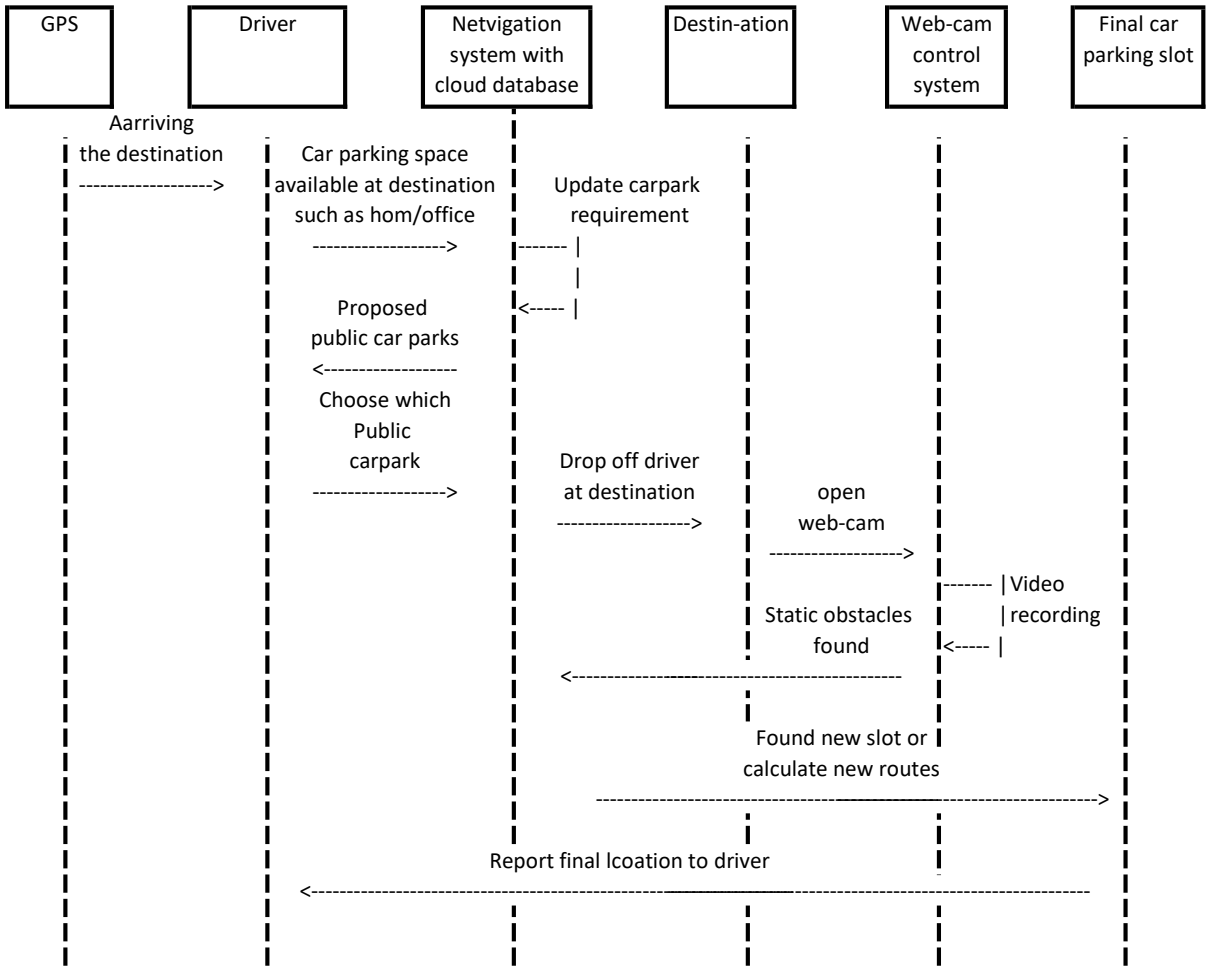
Parking a car: Class diagram



OOP_PCOM7E September 2022 Object Oriented Programming

Unit 7 Summative Assessment: System Design

Parking a car: Sequence diagram

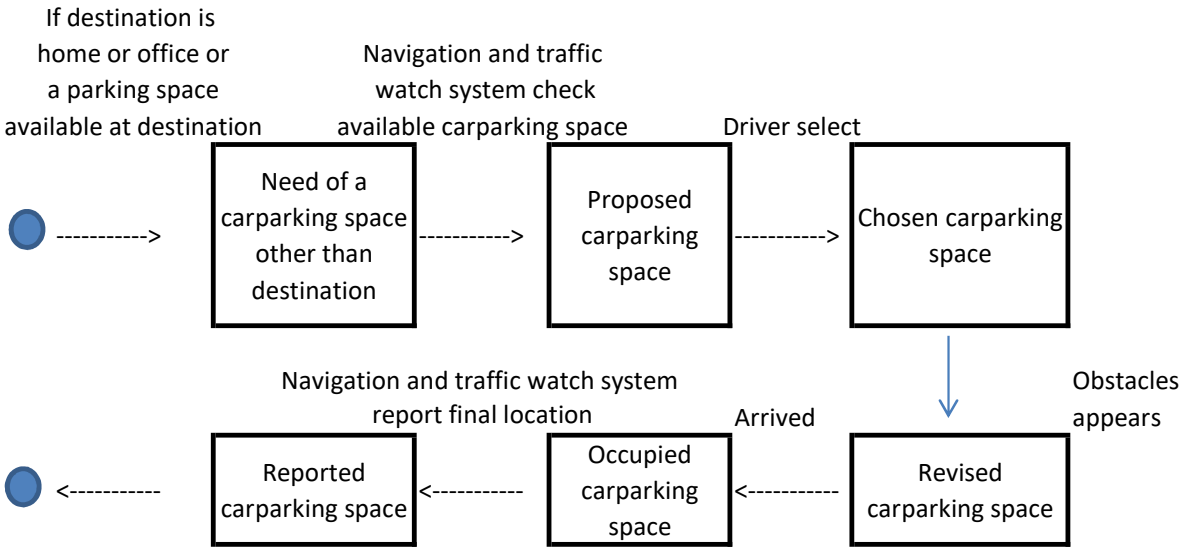


OOP_PCOM7E September 2022 Object Oriented Programming

Unit 7 Summative Assessment: System Design

Parking a car: State Transit diagram

Carparking space



OOP_PCOM7E September 2022 Object Oriented Programming

Unit 7 Summative Assessment: System Design

Parking a car: Activity diagram