

# Workshop1

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# Derivables

This document outlines the functional and system requirements for the agent's environment simulation and its learning process using reinforcement learning.

## System Requirement Document

The system requires sensors and actuators that can simulate the interaction between an autonomous agent and its environment, allowing the application of Q-Learning and DQN-based algorithms. The system must be modular and compatible with frameworks like Gymnasium.

## Functional Specifications

### Sensors

- **Proximity:** It is used to detect how near is another vehicle.
- **Camera:** It helps to respect traffic lights and signals.
- **Tachometer:** It measures the current vehicle speed, and in consequence the current speed in that road.
- **Clock:** To measure the time.

### Actuators

- **Steering wheel:** It changes the directions of conduction in the environment.
- **Wheels:** Allows environment displacement.

## Reward Functions

- **Traffic laws:** There are traffic lights, speed limits and traffic signals that must be respected.
- **Time:** The objective is to get from a point A to B in the shortest time possible.

## Use Cases

### Speed

The agent interacts with the environment measuring current speed on the road, with the objective of learning speed patterns in the different roads and at the different times, and allowing the agent to pursue the goal of completing its displacement in the shortest time.

## Vehicles

The agent also interacts with other vehicles that are part of the environment, analyzing its proximity to regulate the agent displacement and the agent speed.

## High-Level Architecture

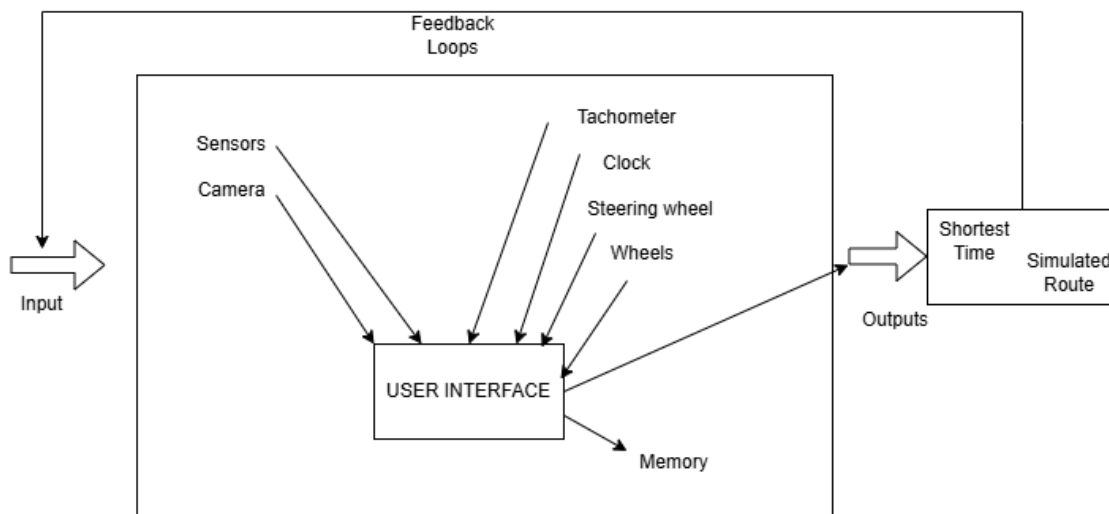


Figure 1

## Preliminary Implementation Outline

### Key Potential Frameworks

- **Minigrid:** It is lightweight grid-based, and it is suitable because a first prototype could provide the navigation the simulation requires.
- **Gymnasium:** Because it has more features than Minigrid like continuous space navigation, which can lead to a better-looking simulation, making it easier to understand.
- **Stable-Baseline3:** Because it has good documentation and provides the features to develop the learning process the agent needs. It also integrates well with Gym.

# Timeline

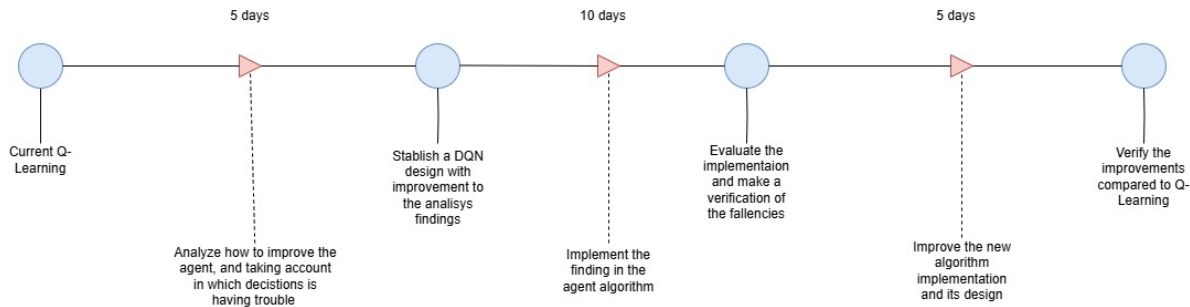


Figure 2

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