PW: ‘Smart’ Traffic Lights

By

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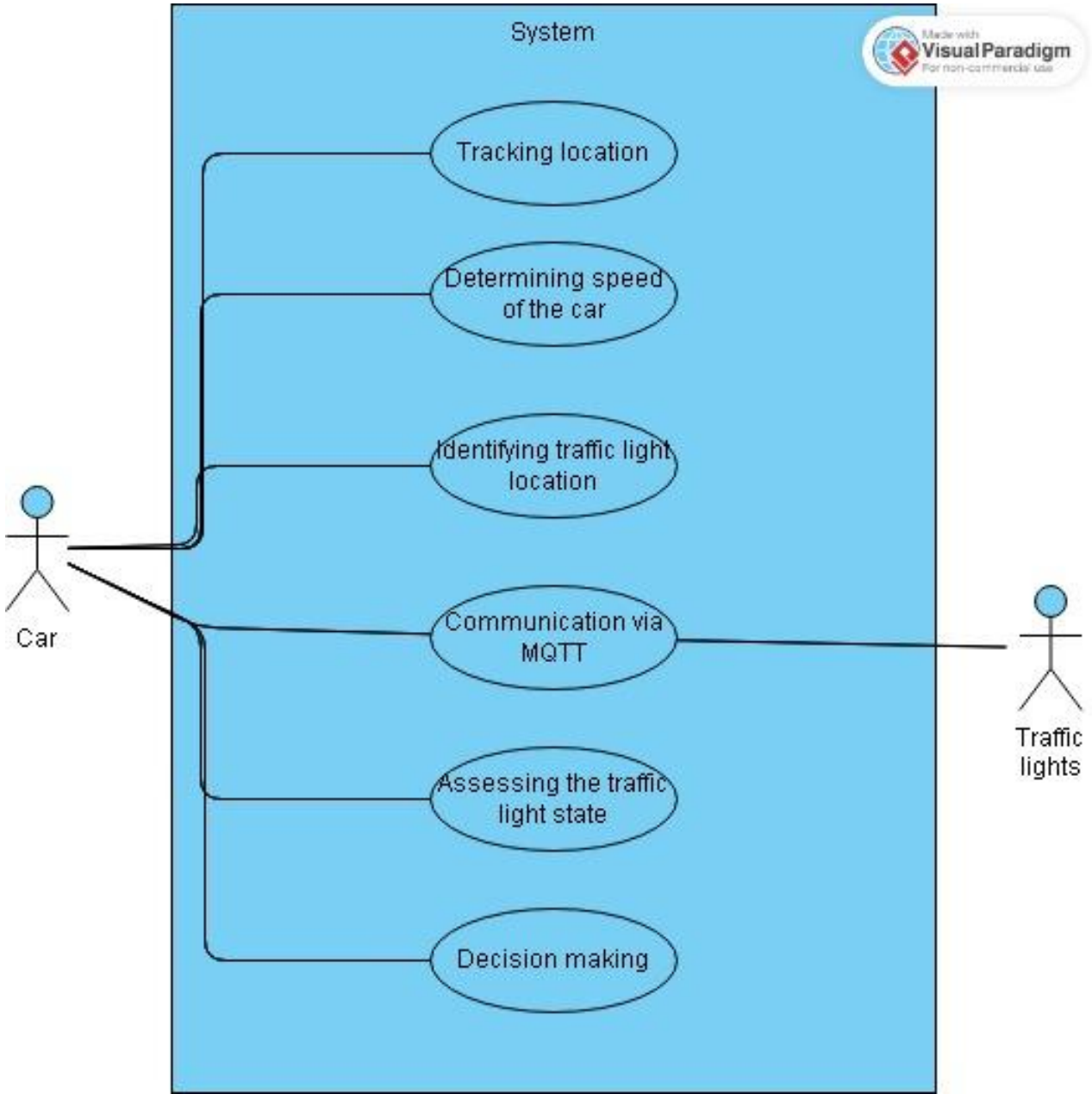
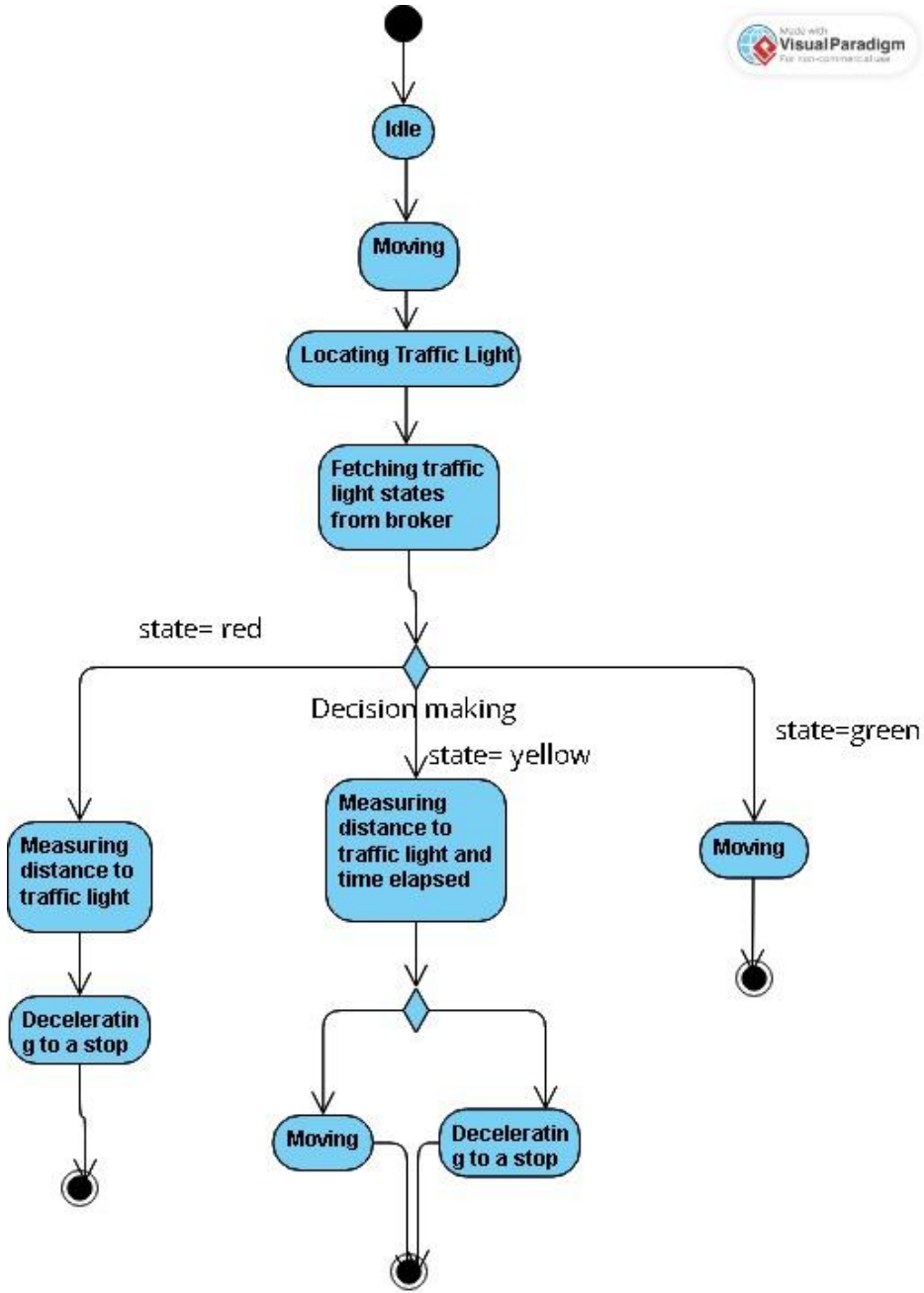
Scope of the project

1. An autonomous line following car.
2. Determining the speed and location of the car.
3. Determining the location of the traffic light system.
4. Establishing communication with traffic light via MQTT communication.
5. Gauging distance from the traffic light.
6. Making a decision based on the traffic light state.

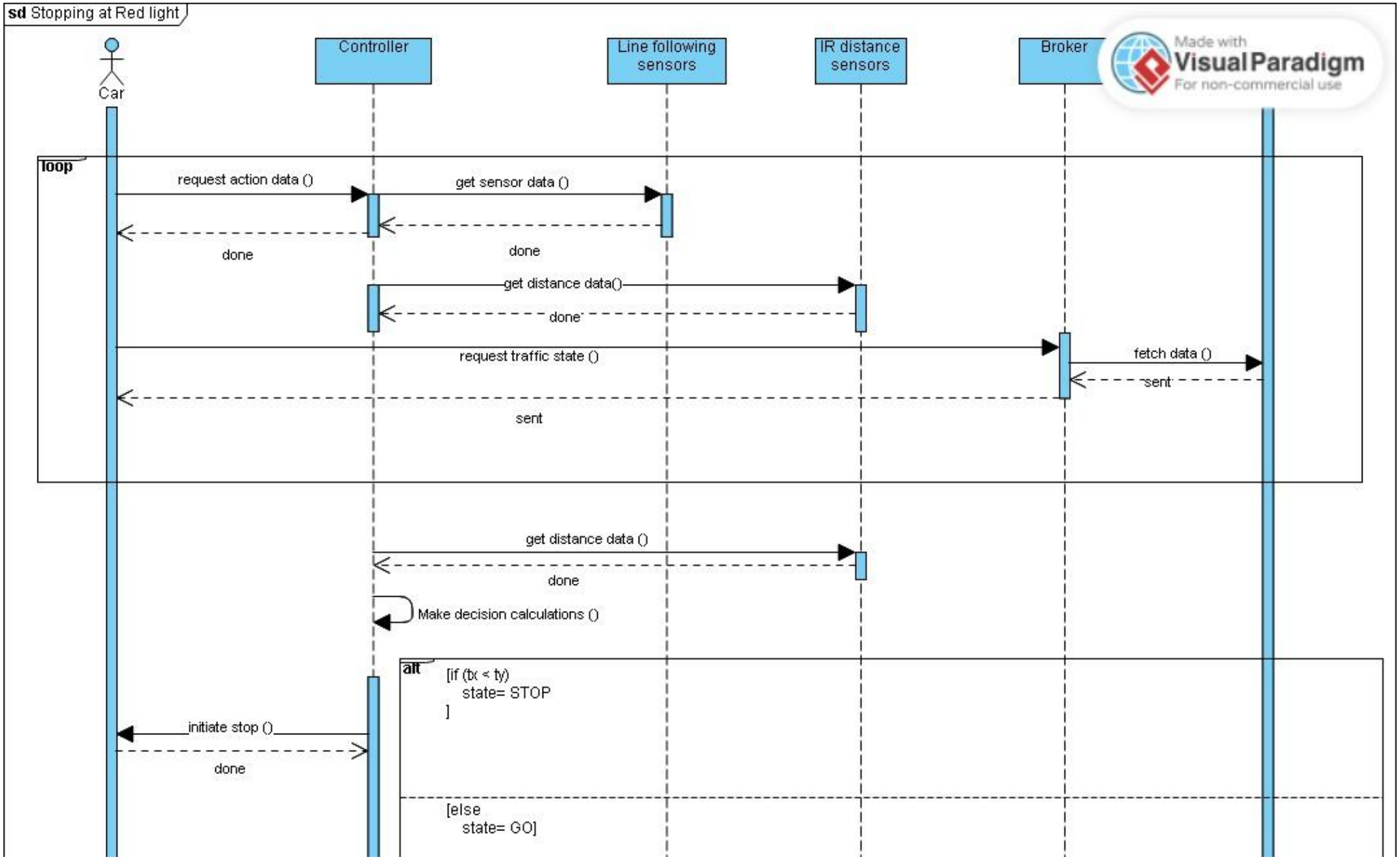
Use-case Diagram



Activity Diagram



Sequence Diagram



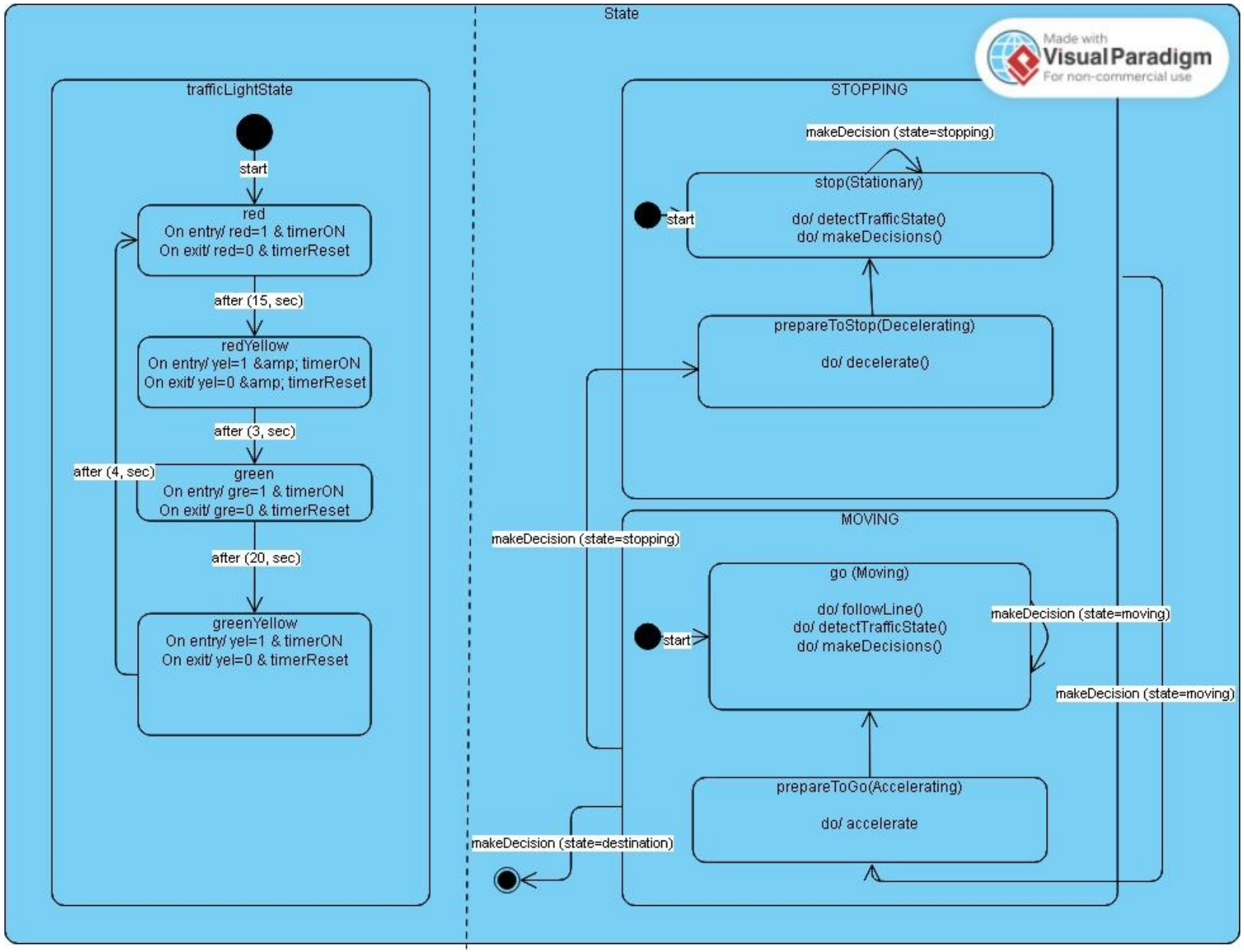
Traffic Light

- red: the signal stays RED for 15 seconds.
- redYellow : After it stays RED for 15 seconds, the YELLOW light turns on and stays on for 3 seconds.
- green : After YELLOW light stays for 3 seconds, the GREEN light turns on and stays on for 20 sec.
- greenYellow: After Green light stays on for 20 seconds,the YELLOW light turns on and stays on for 4 seconds and goes back to RED.

Making Decision Logic

- ty= time remaining till next state = 15 - time elapsed since first triggered to red.
- ty_redYellow = 3 sec (as a buffer time)
- tx = time required to reach the signal at current speed (distance it needs to travel = distance till signal - 1 m)
- t_decel = stopping time for the deceleration
- **ty + ty_redYellow < tx + t_decel = initiate stop () : the car has to stop and wait for green signal.**
- **ty+ ty_redYellow > tx+ t_decel: = continue going () the car does not have to stop, since the signal will change within that time.**
- Assumptions:
- sensors are accurate.
- message passing are instantaneous.
- -calculations and executions are instantaneous.

State Machine Diagram



UPPAAL Model