SOFTWARE SPECIFICATIONS

Railway Control System

Group 1
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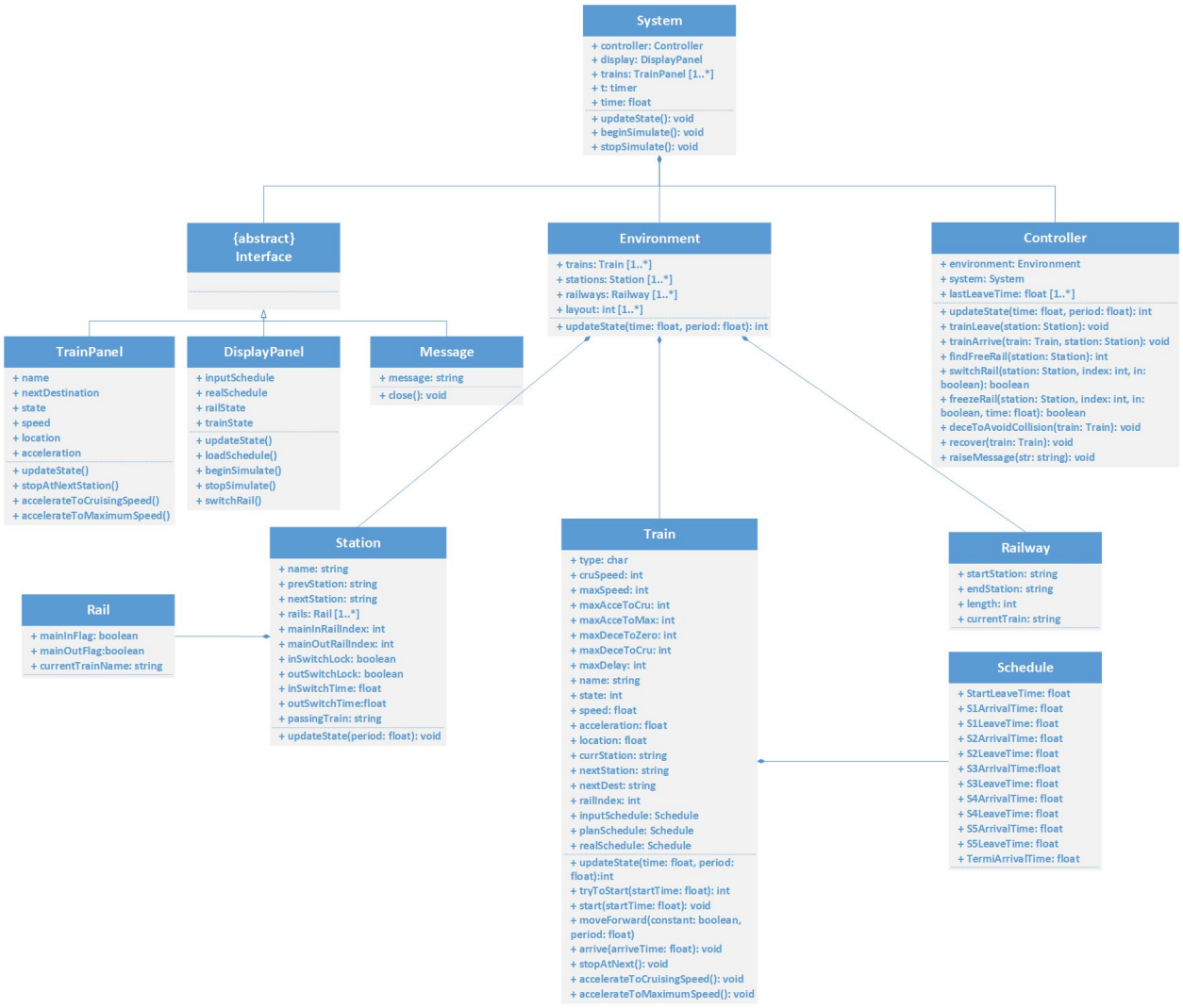
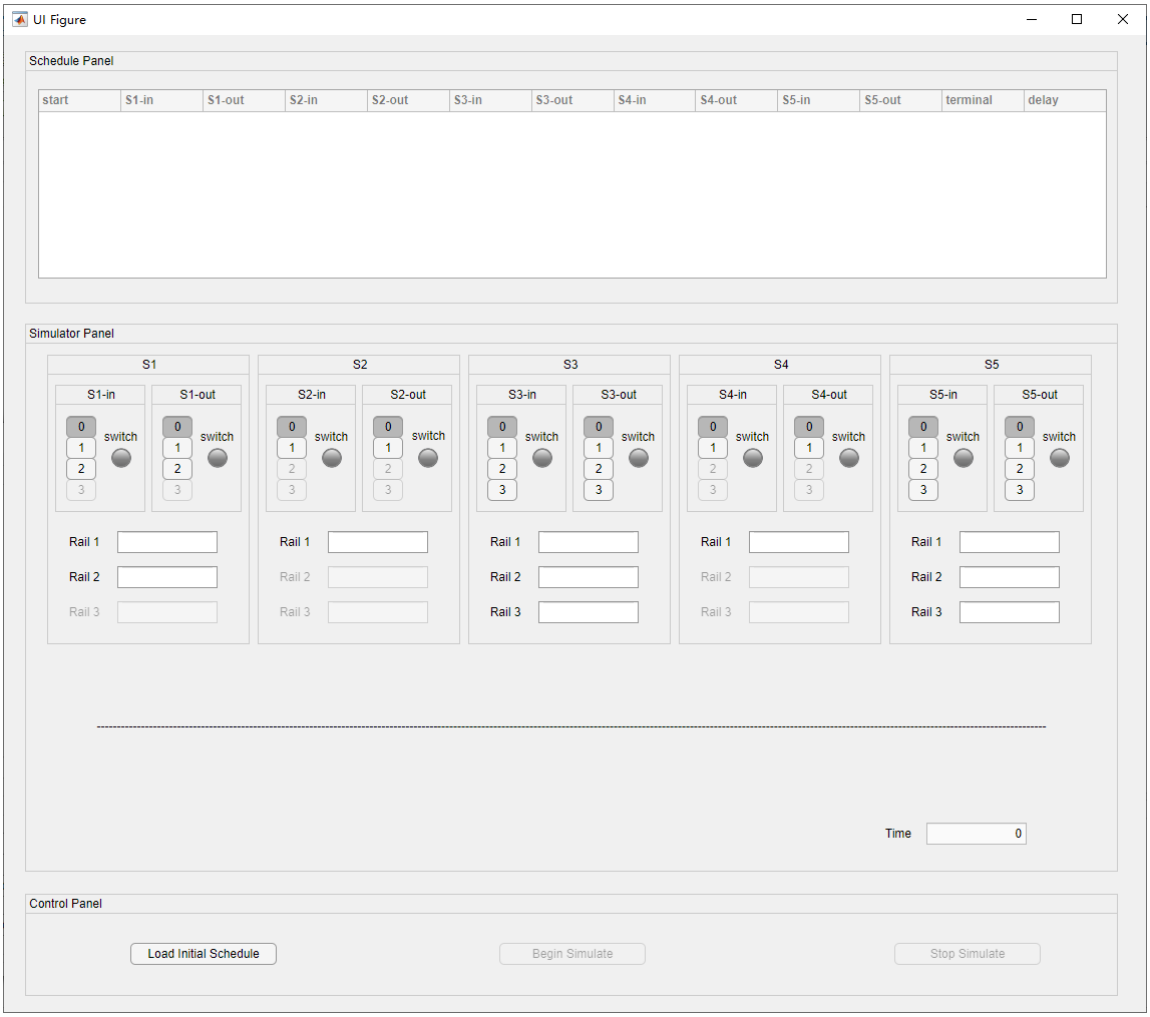
System Architecture

The system architecture is shown below:

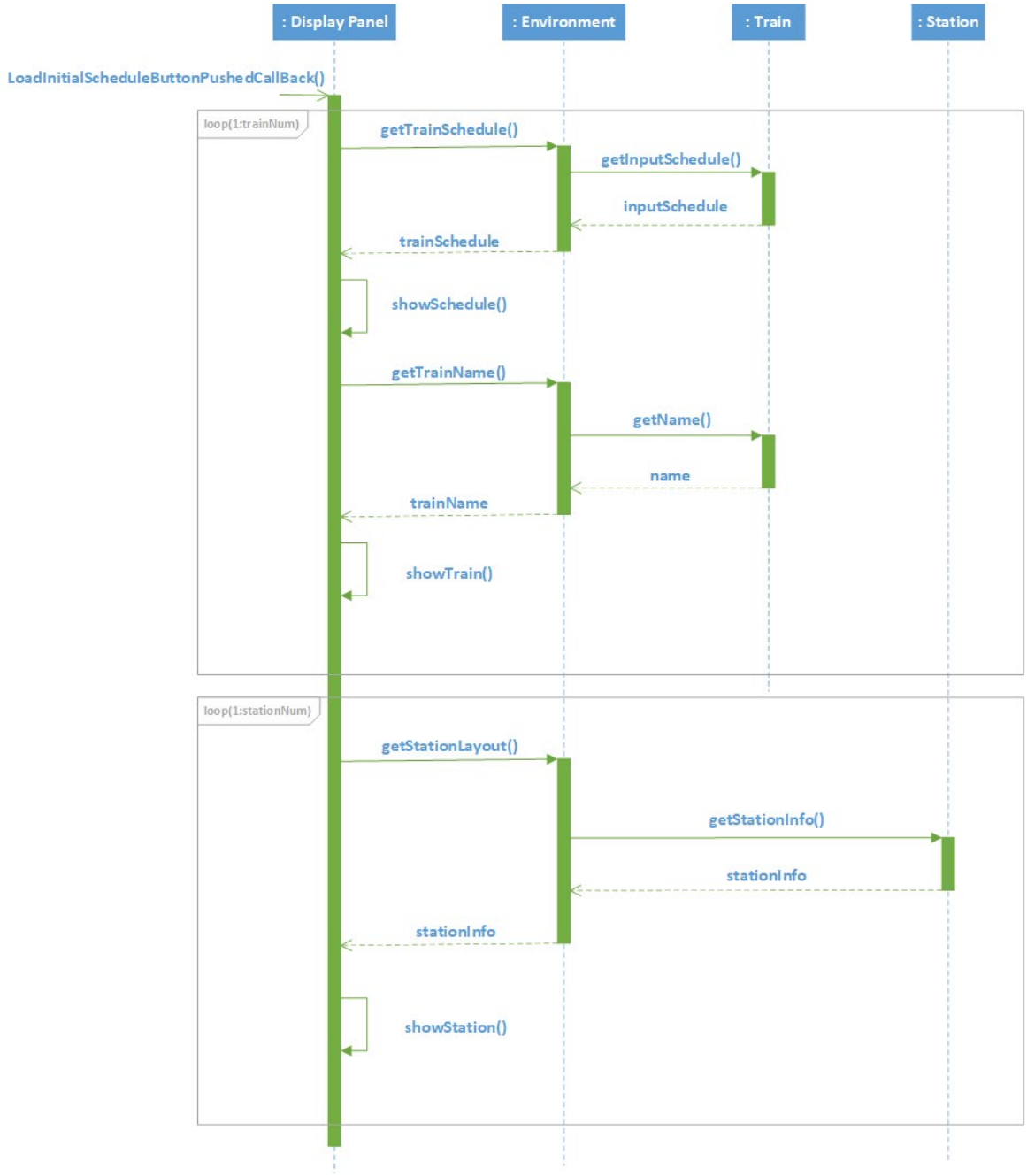


Software Specifications

S1: Display Panel Implementation

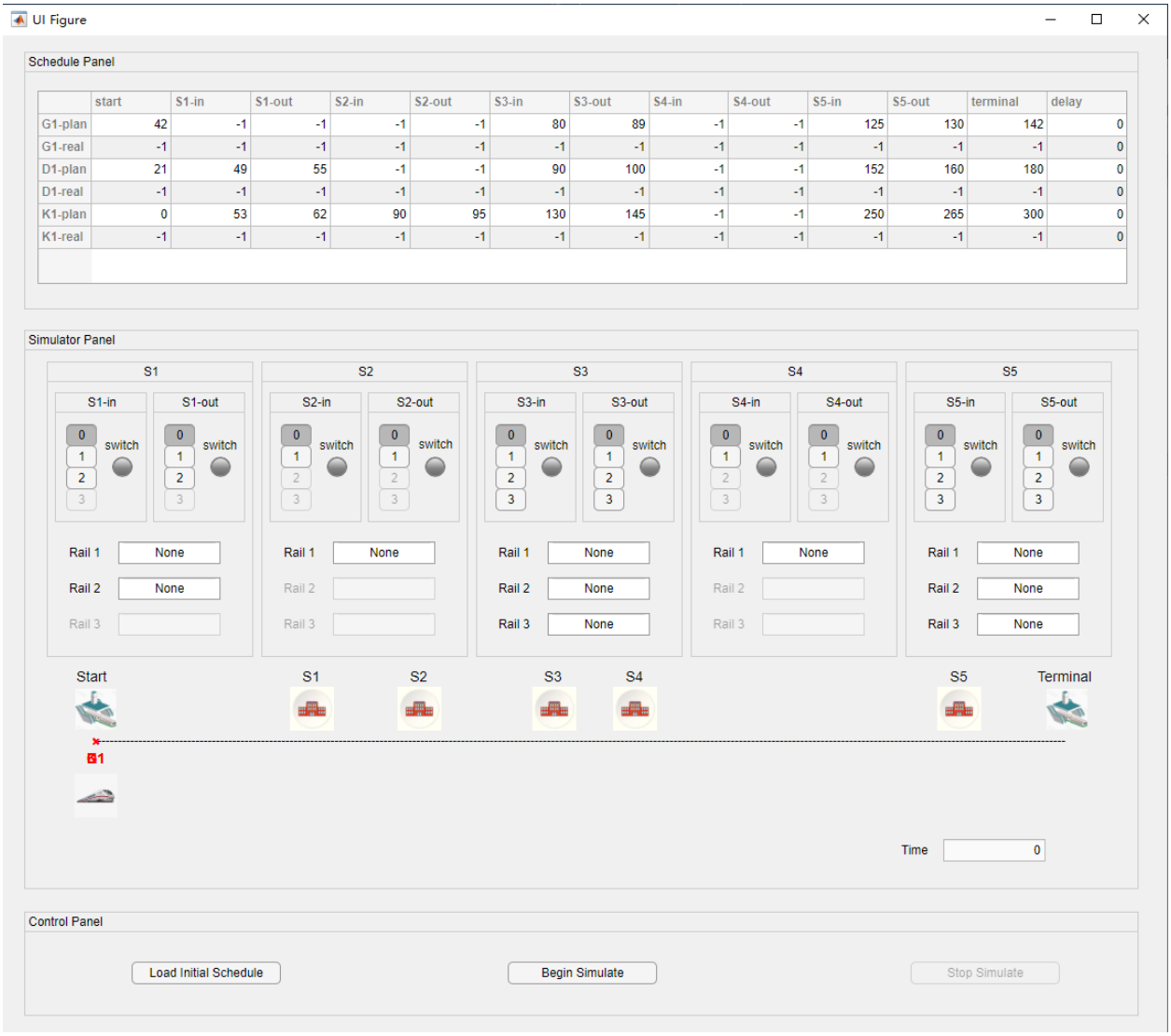


S1.1: Load input schedule and layout

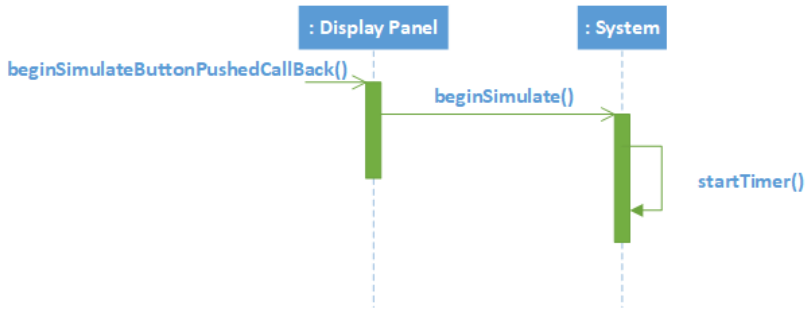


- S1.1.1: Load the schedule and layout
    1. Press 'Load Initial Schedule' button
    2. For each train:
        a. Show its input schedule on the schedule panel.
        b. Show its name and image at start station on the railway in simulator panel.
    3. For each station:
        a. Show its location on the railway in simulator panel. The position is calculated by the ratio between real railway length and the railway length in simulator panel.

The Display Panel should be like the following after loading the schedule and layout:



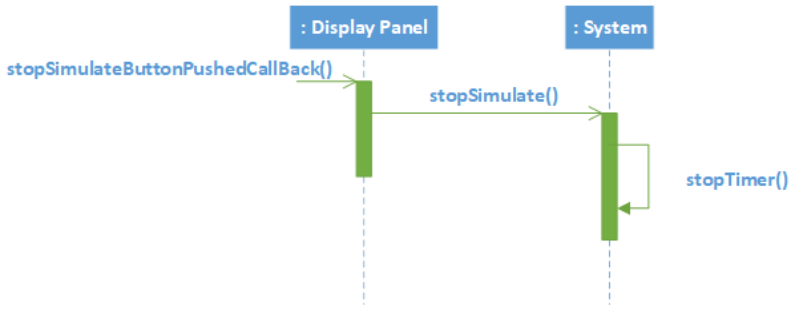
S1.2 Begin simulate



- S1.2.1: Begin simulate
    1. Press ‘Begin Simulate’ button.
    2. Send the signal to system.

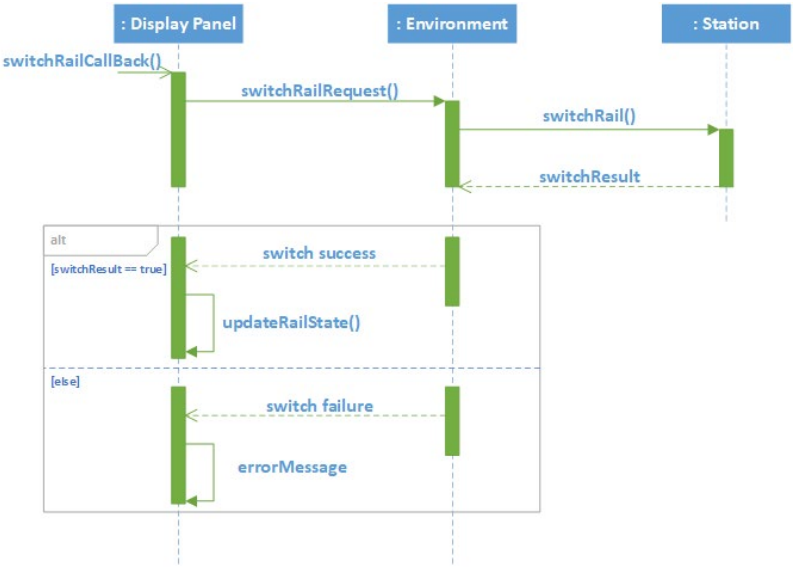
3. Start the system timer.

S1.3 Stop simulate



- S1.3.1: Stop simulate
    1. Press ‘Stop Simulate’ button.
    2. Send the signal to system.
    3. Stop the system timer.

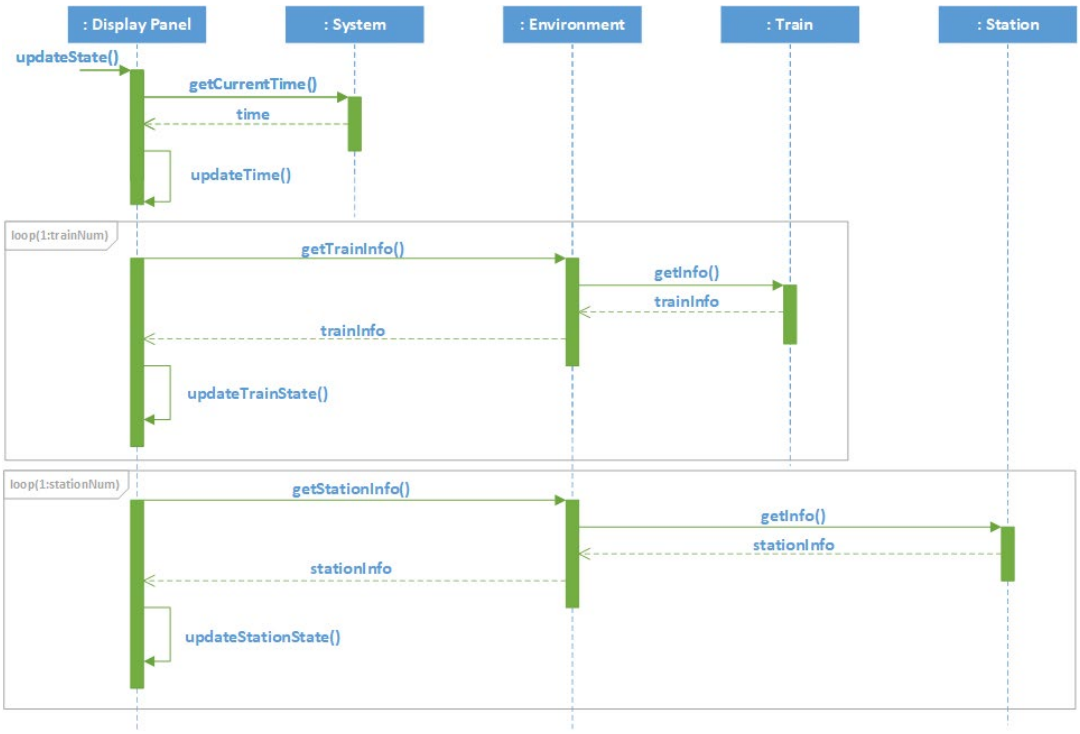
S1.4 Rail switching



- S1.4.1: Switch a rail
    1. Choose a rail to switch and press the rail index button.
    2. Send the switching request to environment.
    3. Send to station to switch the rail.
        a. If the switch lock is available, return a success result.
        b. If the switch lock is not available, return a failure result.
    4. Get the switch result.
        a. If the switch result is success, the Display Panel updates the rail state and the ‘switch lamp’.
        b. If the switch result is failure, the Display Panel doesn’t change anything.

S1.5 Update Display Panel

(This function will be executed every 0.1s)

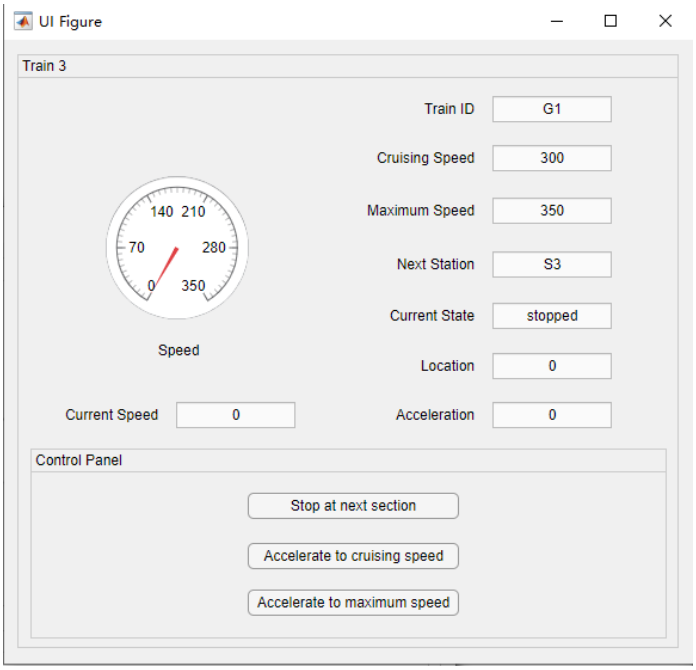


- S1.5.1: Update time
    1. Get the current time from the system.
    2. Update time displayed in simulator panel.

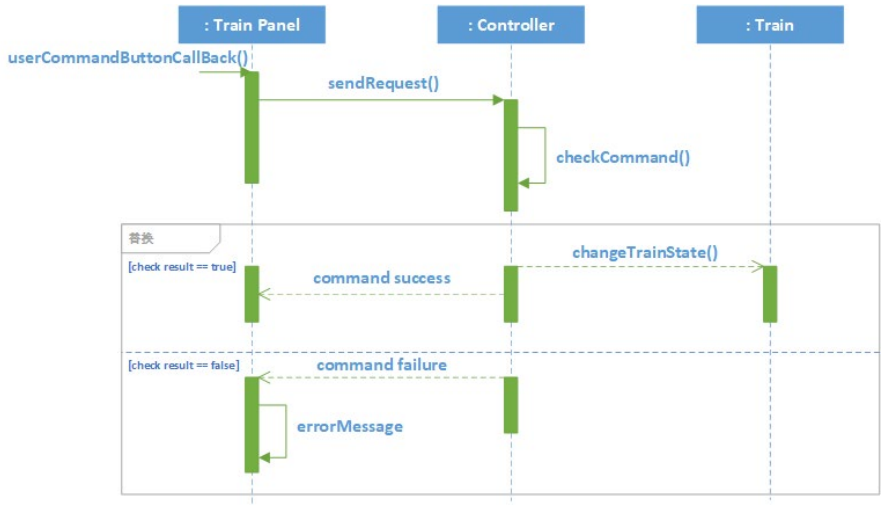
- S1.5.2: Update train information
    1. For each train
        a. Get current location and real schedule from environment.
        b. Update the position of the train on the railway in simulator panel.
        c. Update the real schedule in schedule panel.

- S1.5.3: Update station information
    1. For each station
        a. Get current rail at entry and exit and current train on each rail from environment.
        b. Update the rail state and current train name on each rail in simulator panel.

S2: Train Panel Implementation



S2.1 Send command manually



- S2.1.1: Stop the train at next station
    1. Press ‘Stop at next station’ button on the target train’s panel.
    2. Send the request to controller.
    3. Check if the command can be executed
        a. If the train is so fast that it cannot stop at the next station, reject the command.
        b. Accept the command otherwise.
    4. If the command is accepted, change the next destination of the train to the nearest next station.

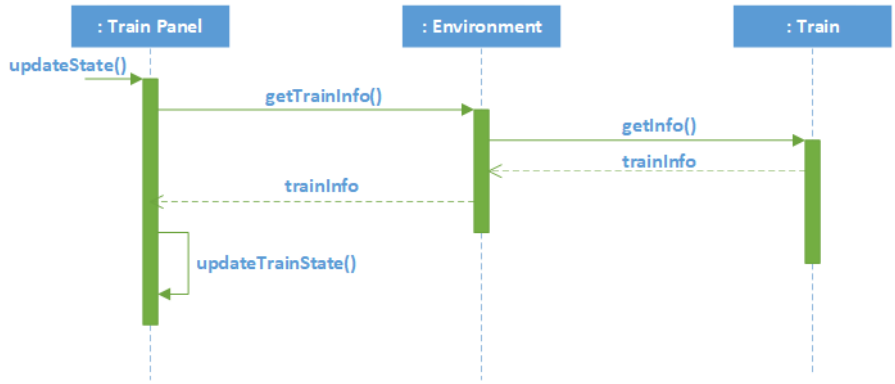
- S2.1.2: Accelerate the train to cruising speed

1. Press ‘Accelerate to cruising speed’ button on the target train’s panel.
2. Send the request to controller.
3. Check if the command can be executed
    a. If the train is avoiding collision, reject the command.
    b. If the train is stopping for arrival, reject the command.
    c. If the train is already accelerating, running with cruising speed or maximum speed, reject the command.
    d. Accept the command otherwise.
4. If the command is accepted, change the running state of the train to accelerate to cruising speed.

- S2.1.3: Accelerate the train to maximum speed
    1. Press ‘Accelerate to maximum speed’ button on the target train’s panel.
    2. Send the request to controller.
    3. Check if the command can be executed
        a. If the train is avoiding collision, reject the command.
        b. If the train is stopping for arrival, reject the command.
        c. If the train is already accelerating to maximum speed, or running with maximum speed, reject the command.
        d. Accept the command otherwise.
    4. If the command is accepted, change the running state of the train to accelerate to maximum speed.

S2.2 Update Train Panel

(This function will be executed every 0.1s)

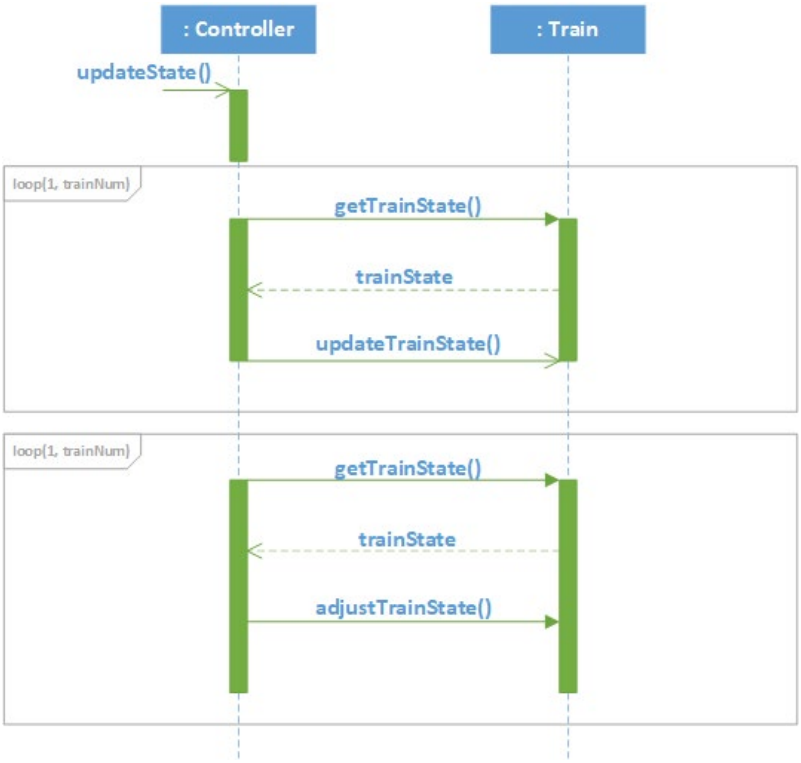


- S2.2.1: Update train information
    1. Get current running state of the train from the environment.
    2. Update the state, speed, location, acceleration information on the Train Panel.

S3: Controller Implementation

S3.1 Control the trains

(This function will be executed every 0.1s)

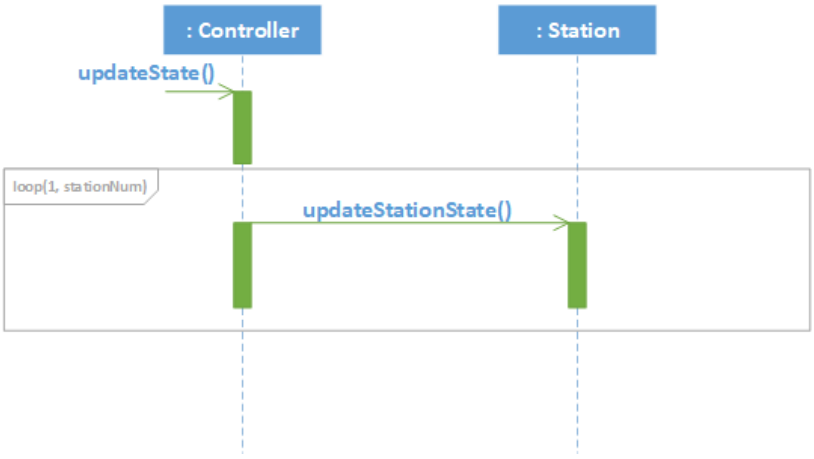


- S3.1.1: Moving the trains along the time
    1. The controller gets the running state of the train.
    2. The controller updates the state, speed, location and acceleration of the train at every time step according to previous running state

- S3.1.2: Detect potential collision and adjust the trains
    1. The controller gets the running state of the train after the update.
    2. The controller checks if there is potential collision or if the train should recover to normal running state. The adjustment rules are shown as below:
        a. If the train's speed is higher than its front train's speed and their distance is close, there is potential collision.
        b. If the train is decelerating to avoid collision and its speed is lower than its front train's, the train should stop decelerating.
        c. If the train is running with constant speed to avoid collision and its front train is accelerating, the train should recover to its normal running state.
        d. If the train is running with constant speed to avoid collision and now it is the 'head train' along the railway, the train should recover to its normal running state.
        e. If the train is avoiding collision and its front train has passed its destination, the train should recover to its normal running state.
        f. If a fast late train is avoiding collision, all its front trains should accelerate to their maximum speed for the fast late train.
    3. The controller adjusts the trains' running state and updates.

S3.2 Control the stations

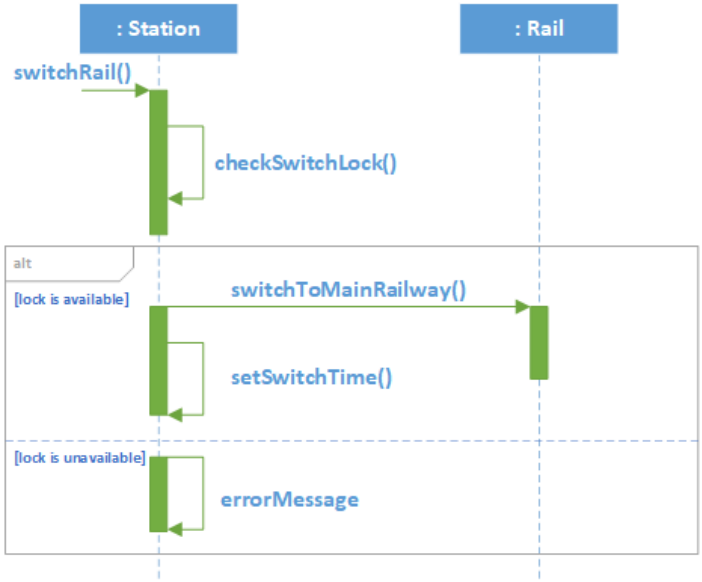
(This function will be executed every 0.1s)



- S3.2.1: Update station state
    1. The controller updates the switch time of each station's entry and exit.

S4: Station Implementation

S4.1 Switch the rails



- S4.1.1: Switch the rails
    1. When the switch rail request is received, the station first checks if the switch lock is available.
    2. If the lock is available, the station sets the switched rail to the main rail and set the switch time.
    3. Otherwise, the rails condition remain the same.