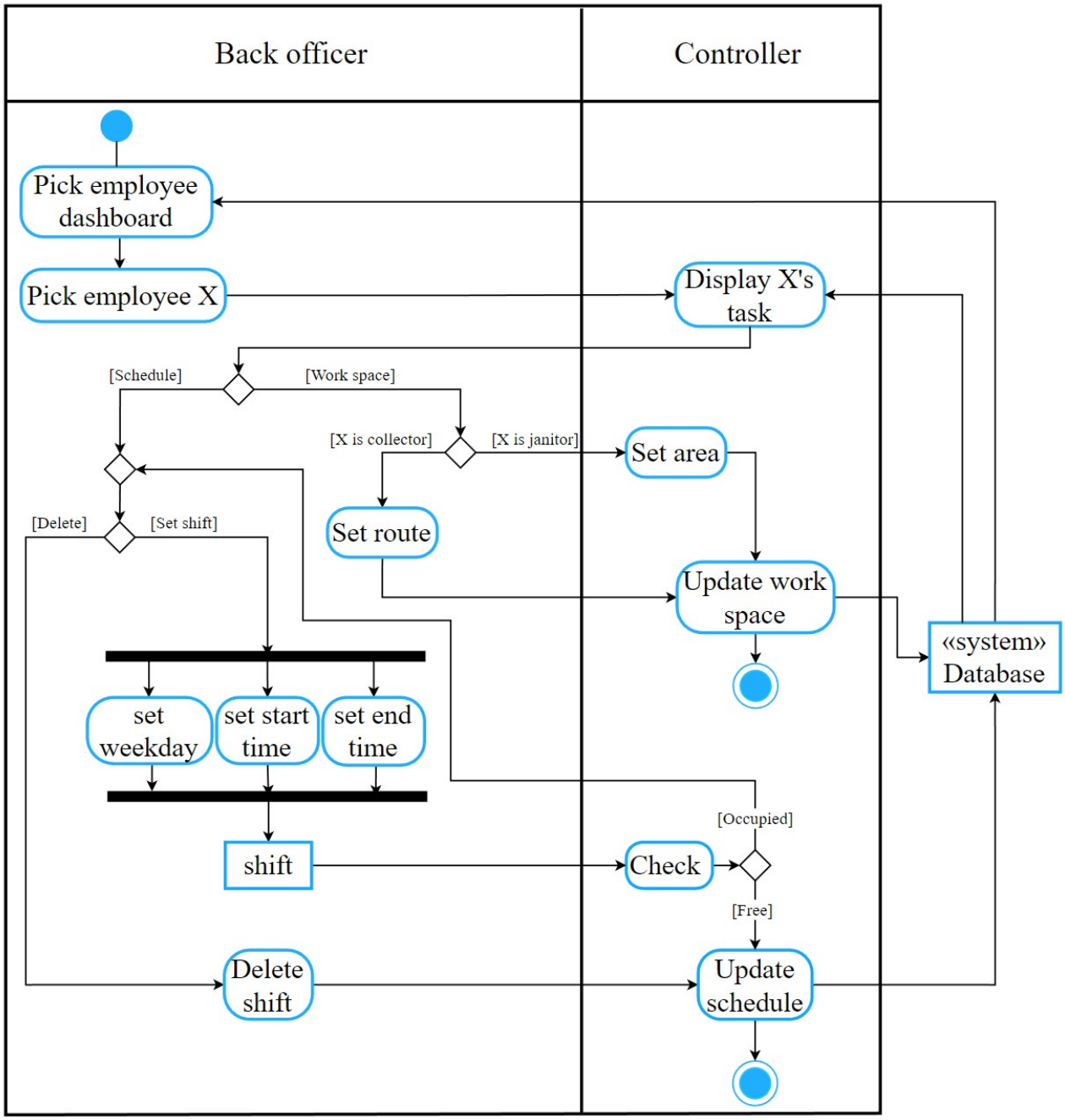
System Modeling

November 2022

1 Task Assignment from Business Perspective

Figure 1: Task Assignment Activity Diagram



Detailed in Figure 1 is an activity diagram for the `Task Assignment` module. It is shown using a business perspective, that is, via interaction between a back officer and the system. The activity starts at the employee dashboard from the back officer view, where they choose to further down an employee profile, called X. They will then face with multiple

options to advance, of which there are `Schedule` and `Work location` tabs. If the back officer goes with the former, he could then directly alter X's calendar, which comprises multiple weekly work shifts. For the latter, they will enter a map resolution of X's collecting area or route, depending on X's role as an employee being either a janitor or a collector. The back officer can adjust the collecting location to his will and submit new change to the system database, which also involves in display and query retrieval.

2 Route Planning Concept

The activity diagram sketched above only depicts partially what the *route planning module*, known simply as `Set route` in Figure 1, looks like from the perspective of a back officer. It includes route assignment from the back officer and optimization from the system without involvement from the collector, which is insufficient. In this section, we delve into the complete details of the module.

General Description

A route is a set of MCPs with paths between some of them. Each collector follows one route, started from the depot, to collect waste from the MCPs and transfer them to the treatment plant. This has been illustrated by Figure ??.

A back officer decides the set of MCPs that a collector is allowed to go through and store that as a route in the database. Also, we separate the notion of route from that of collector, so that a route can be created and stored first without a collector assigned to it. On duty, the collector queries the layout of those MCPs and optionally requires the system to re-route so that the following conditions are satisfied:

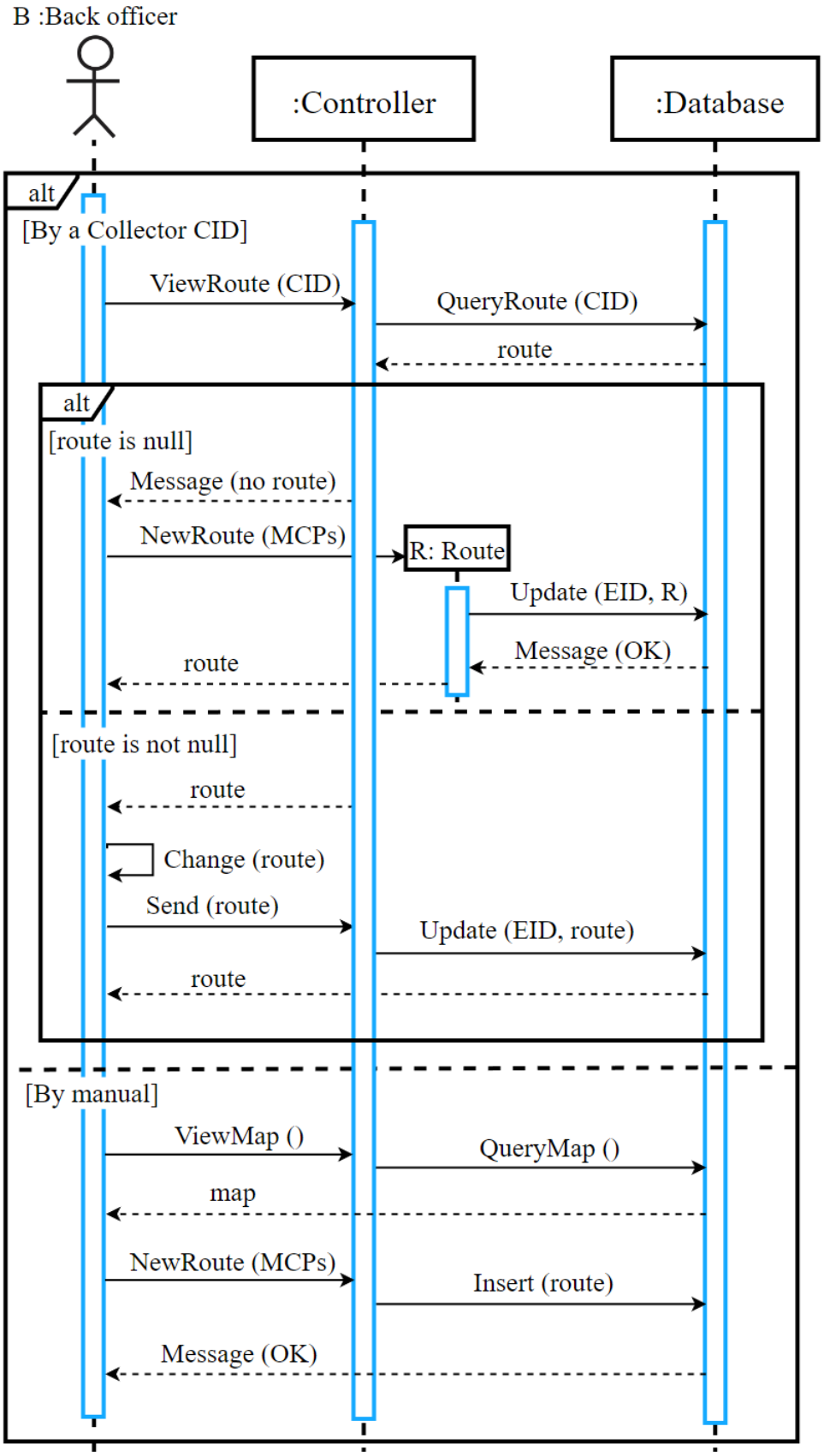
- Only MCPs with load more than 15% their capacity are chosen.
- The total load of the displayed MCPs doesn't exceed the capacity of the truck.
- The paths between connected MCPs are the shortest.

This optimization is done based on the information presumably updated by MCPs every 15 minutes. The path between two consecutive MCPs in the route is determined by the system to optimize fuel consumption, distance, etc. Dropping out some MCPs does not violate the precept the back officer made since their planned route is used as a premise and no new MCP is added to it. This mechanism softens the rigidity of predetermining a fixed route since the back officer does not know beforehand the precise load of every MCP each day of the upcoming week.

Sequence Diagram

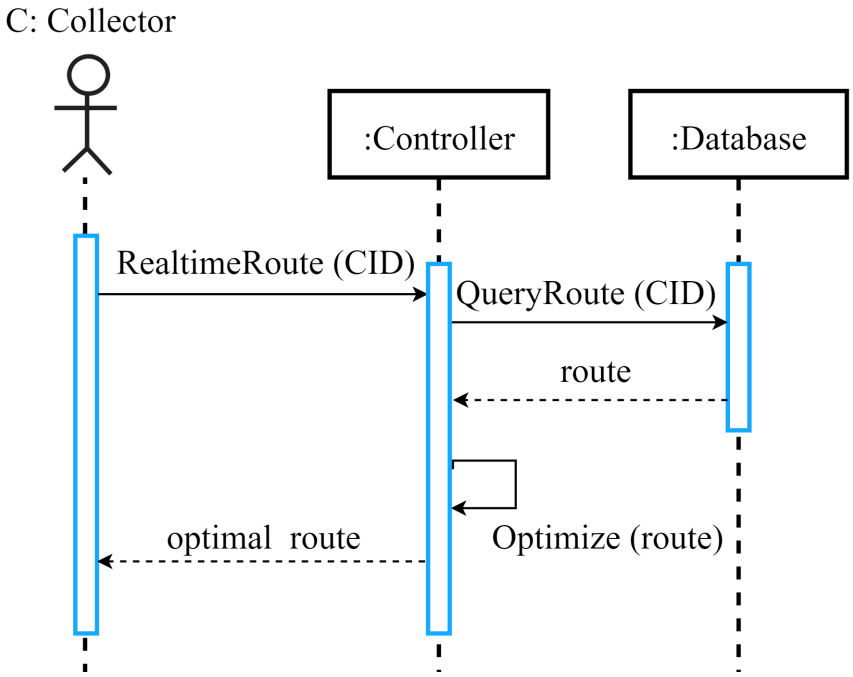
Below is the interaction between a back officer and the system when performing route planning:

Figure 2: Back Officer Route Planning



Then there is the realtime re-routing requested by a collector:

Figure 3: Realtime Re-routing



3 Task Assignment Class Diagram

Below, Figure 4 is a diagram depicting complete interaction between the system classes, including entities, UI and controller, within the task assignment module. Generally, entity classes make up an abstract layer that updates data to the UI, which in turn sends user events to controllers to handle, which is enabled to make change to the data. Task in this context refers to both schedule and work location, or route/area depending on the employee role. We separate the assignment of either objects and divide the UI as well as controller into sub components that handle schedule, route and area without interplay. This choice of design was reflected in our activity diagram, Figure 1, as back officers have options to display between schedule and work location before assigning them anew.

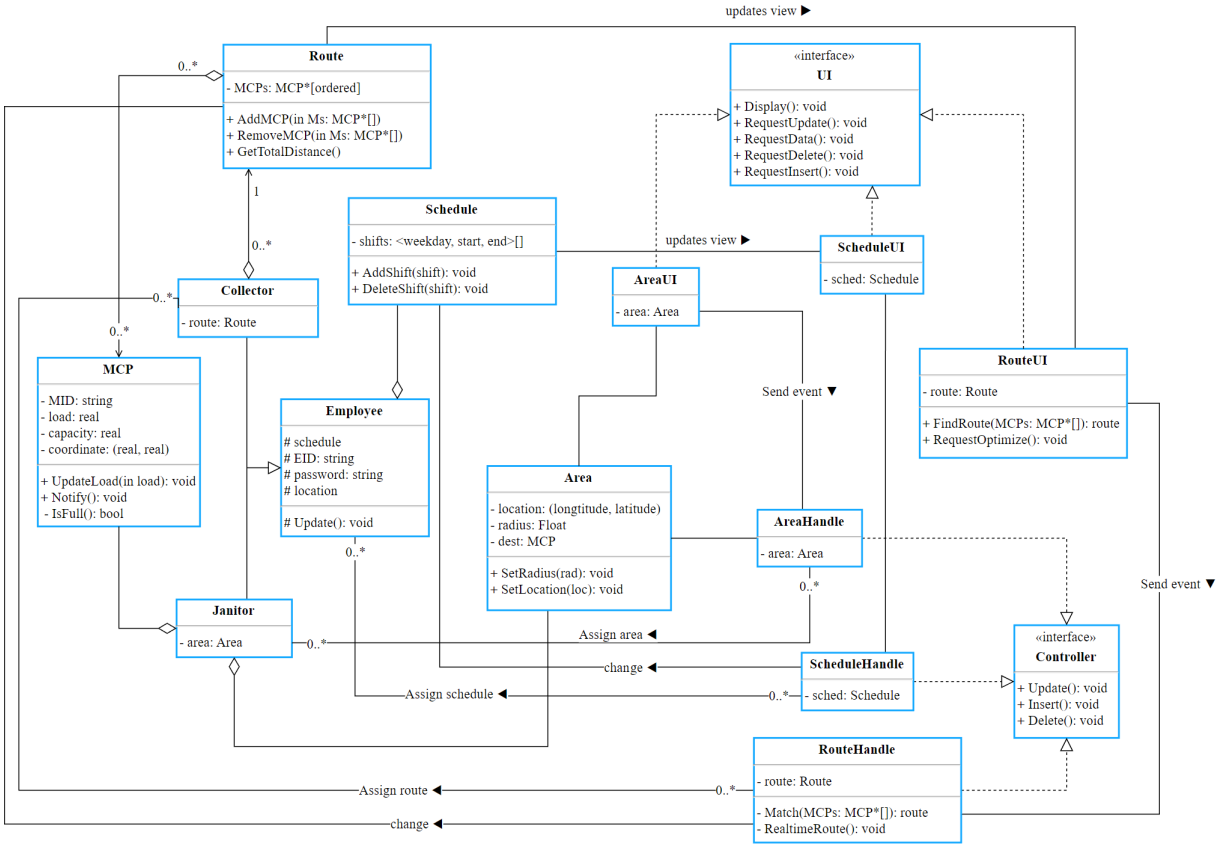


Figure 4: Task Assignment Class Diagram