VIETNAM NATIONAL UNIVERSITY, HO CHI MINH CITY
UNIVERSITY OF TECHNOLOGY
FACULTY OF COMPUTER SCIENCE AND ENGINEERING

SOFTWARE ENGINEERING (CO3001)

Assignment

UWC 2.0

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Member list & Workload

No.	Fullname	Student ID	Problems	Percentage of work
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1 Business Context

1.1 Introduction

Sustainable Development Goal (SDG) 11: Sustainable Cities and Communities and SDG 6: Clean Water and Sanitation both list urban waste management as one of the major issues that many nations around the world confront and are thus working to address. Developing countries that continue to place a high priority on development and economic expansion are accorded special consideration. Solid waste management is expensive and inefficient in urban settings. Governments and organizations place a strong emphasis on improving garbage collection and management due to the positive effects it has on cities, societies, and the environment.

Although UWC 1.0 is a respectable system, there are still several flaws, leading to the development of UWC 2.0. Compared to UWC 1.0, UWC 2.0 is a more fully developed version.

Back officers, Collectors, and Janitors can all handle information and work schedules more effectively and conveniently with UWC 2.0. It also allows the administration of vehicle information and trash collecting stations, making it a practical and affordable operation solution. Additionally, UWC 2.0 incorporates a messaging feature that enables contact information to be updated quickly and effectively to aid in the problem-solving process.

1.2 Relevant Stakeholders: What problems and needs do they currently face?

Waste collection is frequently delegated to a professional waste management organization. In a typical waste collection process, there are three major parties involved:

- **Back officers** who operate a central system to create a calendar and coordinate front collectors and janitors
- **Collectors** who operate various types of vehicles
- **Janitors** who manually collect trash from Major Collecting Points (MCPs).

Back Officers

Needs	Problems
- Real-time messages for tasks assignments - Have an overview of Janitors' and Collectors' work calendars - Have an overview of vehicles and their technical details - Have an overview of all MCPs and information about their capacity	- Significant communication delay - Not having an accessible working calendar of Collectors/Janitors, - Management module, route arrangement are labor intensive - Inefficient task distribution - Insufficient amount of features and statistics - Technical equipment and MCPs status is unavailable

Collectors and Janitors

Needs	Problems
- Have an overview of their work calendar - Have a detail view of their task on a daily and weekly basic - Be able to communicate with collectors, other janitors and back officers - Check in / check out task every day - Be notified about the MCPs if they are fully loaded - Feedback about their task to balance the work arrangement - Be informed of the state of their equipment/vehicle if there are any problems - Optimized predetermined route	- Not having an accessible working calendar nor an friendly calendar display - Assignment schedules between janitors/collectors may overlap - Slow/suboptimal task distribution - Difficulties in checking work shifts - Unstable notification and communication system - Vehicles/trollers and MCPs status is unavailable - Wasting the resources (gasoline, time, ...) - Duplicate the MCPs or collect path

1.3 UWC 2.0 benefits

UWC 2.0 is anticipated to address the aforementioned issues of relevant stakeholders, namely back officers, collectors and janitors, with:

- High response means of communication will help to solve a sudden problem quickly and in a timely manner.
- Make an efficient operation and cost reduction
- Friendly working calendar display
- Automatic and adaptable task distribution
- Speed up employee information retrievals
- Deliver insightful statistics for working progress
- Frequently update MCPs/vehicles status
- Can check and confirm their next tasks
- Check in/out daily tasks with ease
- Work route will be completely optimized avoiding traffic congestion

1.4 Requirements

1.4.1 Functional Requirements

Back officers	- Be able to access the software using an admin account. - Can manage and retrieve employee information and work schedule (resume, days off,etc). - Be able to manage all vehicle details (weight, capacity, fuel consumption, etc). - Have information of all MCPs capacity (should be updated every 15 minutes). - Be able to assign vehicles to collectors and janitors. - Be able to assign janitors and collectors to MCPs. - Can assign routes which are optimized in terms of fuel consumption and distance for each collector. - A communication channel with collectors and janitors.
Collectors and Janitors	- Keeping track of the work schedule, daily tasks, and weekly tasks all on one page without having to scroll down. - Have access to and control over personal information stored on the system. - A communication channel. - A system for task reports and daily attendance checks. - Have the ability to send feedback about the status of MCPs.

1.4.2 Non-functional Requirements

Performance	- Janitors and collectors can receive messages from back officers in real time with delay less than 1 second. - Having the capacity to manage 1000 users' feedback at once. - System's response time must be less than 1 second. - The time it takes to fully load all images, text, and other content, should be as short as possible, ideally within a few seconds. - Data latency less than 100 milliseconds (Message system).
Reliabilities	- The failure rate of real-time access is 0.003 (3 fail access out of 1000 access). - The system must work at all time. - The inaccessible time must less than 15 minutes in operating time (from 7 a.m to 5 p.m), and must be less than 30 minutes outside working time.
Security	- Alert for server infiltration. - The integrity of data should be ensured, such as user information and other critical data, and minimize the risk of data loss or corruption. - Grant access and privileges depends on accounts' type (Back officer and Employee). - Prevent XSS (Cross-site scripting) attacks.
Ease of use	- Users' guide is available within the application. - Be able to use all features of the program with proficiency after 30 minutes of training. - User-friendly interface, with an intuitive layout and easily understandable language. - Be able to switch languages between Vietnamese and English.

1.4.3 Use-case Diagram for the whole system

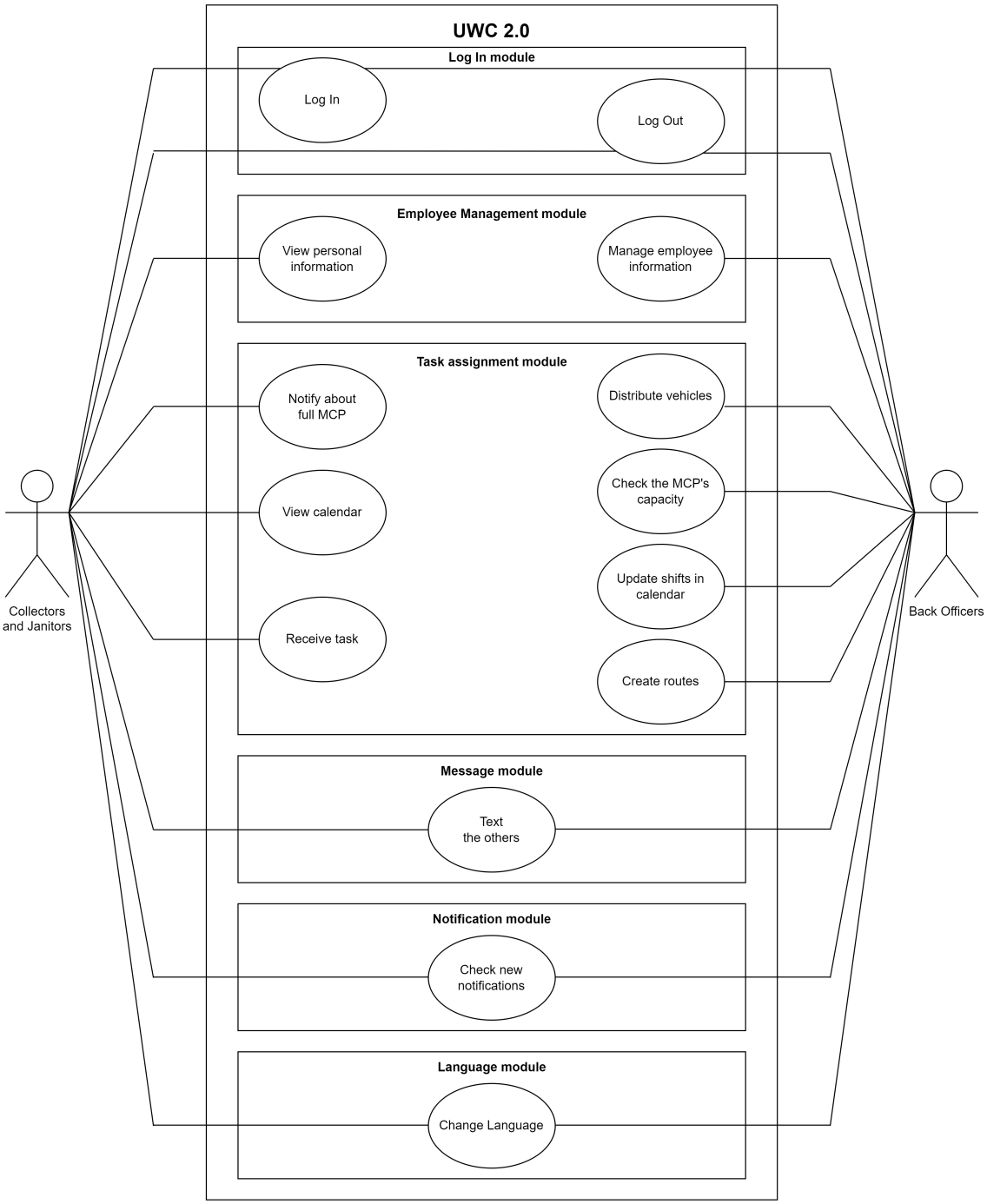

Figure 1. Use-case Diagram for the whole system

Table of actors

No.	Actor
1	Back officers
2	Collectors and Janitors

Table of Use-Cases

Use-case ID	Use-case name	Description
1	Log in	Collector, Janitor and Back Officer use to log into UWC 2.0.
2	Log out	Collector, Janitor and Back Officer use to log out UWC 2.0.
3	View personal information	Collector and Janitor can have an a summary of their personal information.
4	Manage employee information	Back Officer can add or eliminate a staff, as well as manage the working schedule and personal information.
5	Notify about full MCP	Collector and Janitor are notified to get to the assigned location where MCPs are fully loaded to collect the garbage.
6	View calendar	Collector and Janitor can turn on the calendar to view their working day.
7	Receive task	Collector and Janitor receive list of tasks to do in the day.
8	Distribute vehicles	Back Officer distributes vehicles to the fully loaded MCPs' location.
9	Check the MCP's capacity	Back Officer manages the status of MCPs to see whether it is fully loaded.
10	Update shifts in calendar	Back Officer assigns tasks for the staff in their calendar.
11	Create routes	Back Officer navigates the routes for the vehicles.
12	Text the others	Collector, Janitor and Back Officer can communicate with the others via messages, including the following operations: Send, receive and view messages.
13	Check new notifications	List of notifications is visible to Collector, Janitor and Back Officer from "Update notification" use-case.
14	Change language	Collector, Janitor and Back Officer can alter between English and Vietnamese.

1.5 Task management module use case diagram

1.5.1 Use case diagram

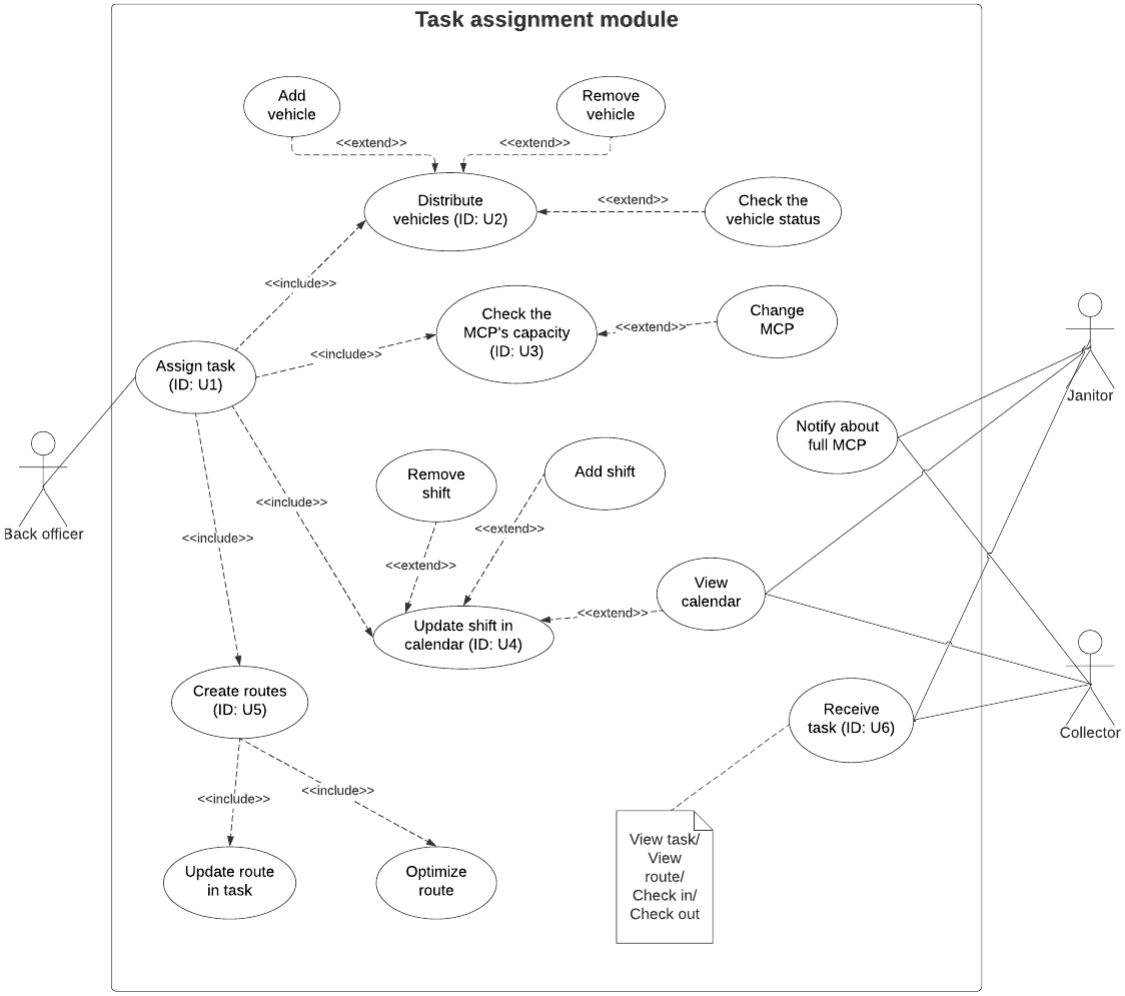

Figure 2. Use-case diagram

1.5.2 Table description

Use-case ID Use-case Name	U1 **Assign task**
Use-case overview	Back officer check some information related to Task and distribute for janitors and collectors
Actor	Back officer
Precondition	- System is running - Vehicle's status and MCPs' capacity have already been updated - Internet Connection is stable
Trigger	Back officer click on "Arrange Task" button
Steps	1. Check vehicles' status and MCPs' capacity 2. Arrange tasks for employers 3. Update information about tasks on the users' calendars
Post conditions	Required information about tasks is updated adequately on employers' screens
Exception flow	None

Use-case ID Use-case Name	U2 **Distribute vehicles**
Use-case overview	Back officer check all of vehicles and distribute for collectors
Actor	Back officer
Precondition	- System is running - Vehicle's status have already been updated - Internet Connection is stable
Trigger	Manage Back officer click on "Manage vehicles" button
Steps	1. Have information about vehicles(well-worked or need to fix) 2. Select vehicle by ID and put to the calendar 3. Display vehicle's ID on users' devices
Post condition	Required information about vehicles' IDs are displayed on collectors' calendars
Exception flow	- Several vehicles are just bought, so they don't have their IDs - Back officer enters new vehicles on the management list and create new IDs - Distribute new and old vehicles for staff

Use-case ID Use-case Name	U3 **Check the MCP's capacity**
Use-case overview	Back officer check MCPs' capacity in order to notify to collectors or to change the MCP
Actor	Back officer
Precondition	- System is running - MCPs' capacity is updated every 15 minutes - Internet Connection is stable
Trigger	Manage Back officer click on "Manage MCP" button
Steps	1. Display MCPs' capacity on back officer's screen 2. If it is full, notify to the collectors and rearrange the location (if necessary) 3. If it is not full, update to the map to let janitors know
Post condition	Required information about MCP is accurate and real-time updated, notified continuously on employers' screens
Exception flow	None

Use-case ID Use-case Name	U4 **Update shift in calendar**
Use-case overview	The back officer arrange shifts of the staff and will be updated to each calendar
Actor	Back officer
Precondition	- System is running - Already discuss with the staff about their shift - Internet Connection is stable
Trigger	Manage Back officer click on "Update Shift" button
Steps	1. Select staff by ID of the staff 2. Choose the shift that they have to work for each day 3. Save and update 4. Return to home screen
Post condition	The calendar must be able to check for overlapping events, handle important notes and real-time sync with popular calendars like Google, Apple and Outlook
Exception flow	None

Use-case ID Use-case Name	U5 **Create routes**
Use-case overview	Back officer create route and send that position on map to janitors and collectors
Actor	Back officer
Precondition	- System is running - All routes' status is updated - Internet Connection is stable
Trigger	Back officer click on "Create route" button
Steps	1. Choose the ID of the vehicle 2. Select the destination 3. The algorithms will autonomously calculate the shortest path 4. After 1s, the path will be displayed
Post condition	Required well sync with Google map, the position of the route is displayed on employers' screens
Exception flow	None

Use-case ID Use-case Name	U6 **Receive task**
Use-case overview	Collectors and janitors will receive the tasks and view the details of the tasks
Actor	Collectors and Janitors
Precondition	- System is running - The back officer assign some tasks - Internet Connection is stable
Trigger	After the back officer assigns the task
Steps	1. The staff choose the icon "My tasks" 2. The system will display all the tasks of the staff 3. There are some options beside the task such as : a tick box to check out, a hamburger icon to view detail, a location icon to view a map 4. After viewing the map, the staff chooses the "X" button to end viewing, the system will return to the home screen
Post condition	All the information related to the task must be updated frequently
Exception flow	None