HO CHI MINH UNIVERSITY OF TECHNOLOGY
FACULTY OF COMPUTER SCIENCE AND ENGINEERING
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SOFTWARE ENGINEERING

Assignment: Urban waste collection aid UWC 2.0

Task 5: Implementation - Sprint 2

Class CC01 – Group Gopher – Semester 222

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Ho Chi Minh city, 02/2023

Distribution

ID	Name	Contribution(%)	Final_report	Final_grade
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2053591	Nguyen Quang Vinh	25		
2053217	Le Quang Minh	25		
2011617	Nguyen Hoang Minh	25		

Task 1.1

Describe the domain context of Urban waste management in Vietnam. Who are relevant stakeholders? What are their current needs? In your opinion, what benefits UWC 2.0 will be for each stakeholder?

a. Domain context

In HCM city, people prioritize development and economic growth but not clean water and sanitation.Therefore, there are some problem :

- The worse separation in collecting garbage
- The trash on rivers is so much
- MCPs is always fully loaded and unclean frequently
- The cognition of citizen is not good at throwing rubbish
- The street is used as a MCP.

The evidence of that problems:

1. https://www.youtube.com/watch?v=juV0AWfp3Uo
2. https://www.youtube.com/watch?v=BsYdsbDHI5w&list=TLPQMTAwMjIwMjOfucueI1CM3g&index=2
3. https://www.youtube.com/watch?v=pKRsRi85rJs&list=TLPQMTAwMjIwMjOfucueI1CM3g&index=6
4. https://www.youtube.com/watch?v=Fu_GIKxRPOo&list=TLPQMTAwMjIwMjOfucueI1CM3g&index=8
5. https://www.youtube.com/watch?v=AVnsbzl2CdQ&list=TLPQMTAwMjIwMjOfucueI1CM3g&index=10

b. The stakeholders' requirements

- The back officers: they want to control central system and their staff
- The collectors: drive the vehicle and know work schedule
- The janitors: collect garbage and know work schedule
- The citizens: their road is cleaner and non-smelly

- The government: their environment is better
- The environmentalist & technician : their problem is solved.

c. The benefit of UWC 2.0:

- The back officers: manage the staff and system easier ,
- The collectors:know well about their work and it's easy to communicate with other
- The janitors: know well about their work and it's easy to communicate with other

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Task 1.2

Describe all functional and non-functional requirements that can be inferred from the project description. Draw a general use-case diagram for the whole system

a. Functional requirements

For the back officers:

- They access to all staff's information, vehicles' details and MCPs' properties
- They assign vehicle to janitor and collector
- They create a route for each collector
- They set MCPs to janitors and collectors
- They can send or receive the message of staff

For the collectors and janitors:

- They have work calendar

- They receive the notice of important information
- They have a detailed view of their tasks daily and weekly.
- They check in/out
- They communicate with others

b. Non-functional requirements

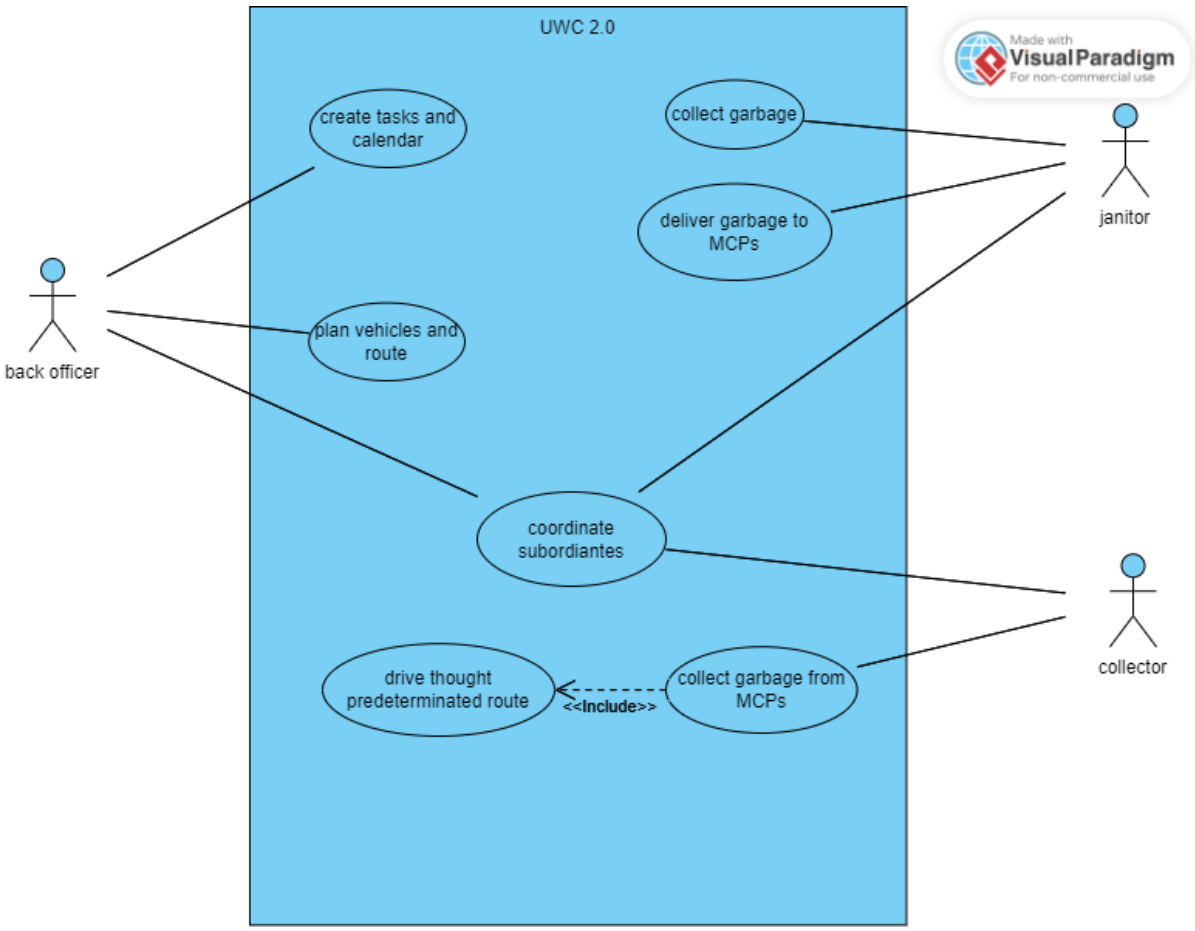
For the back officers:

- The information of MCPs must be updated every 15 mins with the availability of at least 95% of their operating time
- The route which is created is optimized in terms of fuel consumption and travel distance.

For the collectors:

- Know their vehicles
- Important information should be displayed on 1 view.
- The communication system should delay less than 1s.
- Be notified if MCPs are fully loaded.

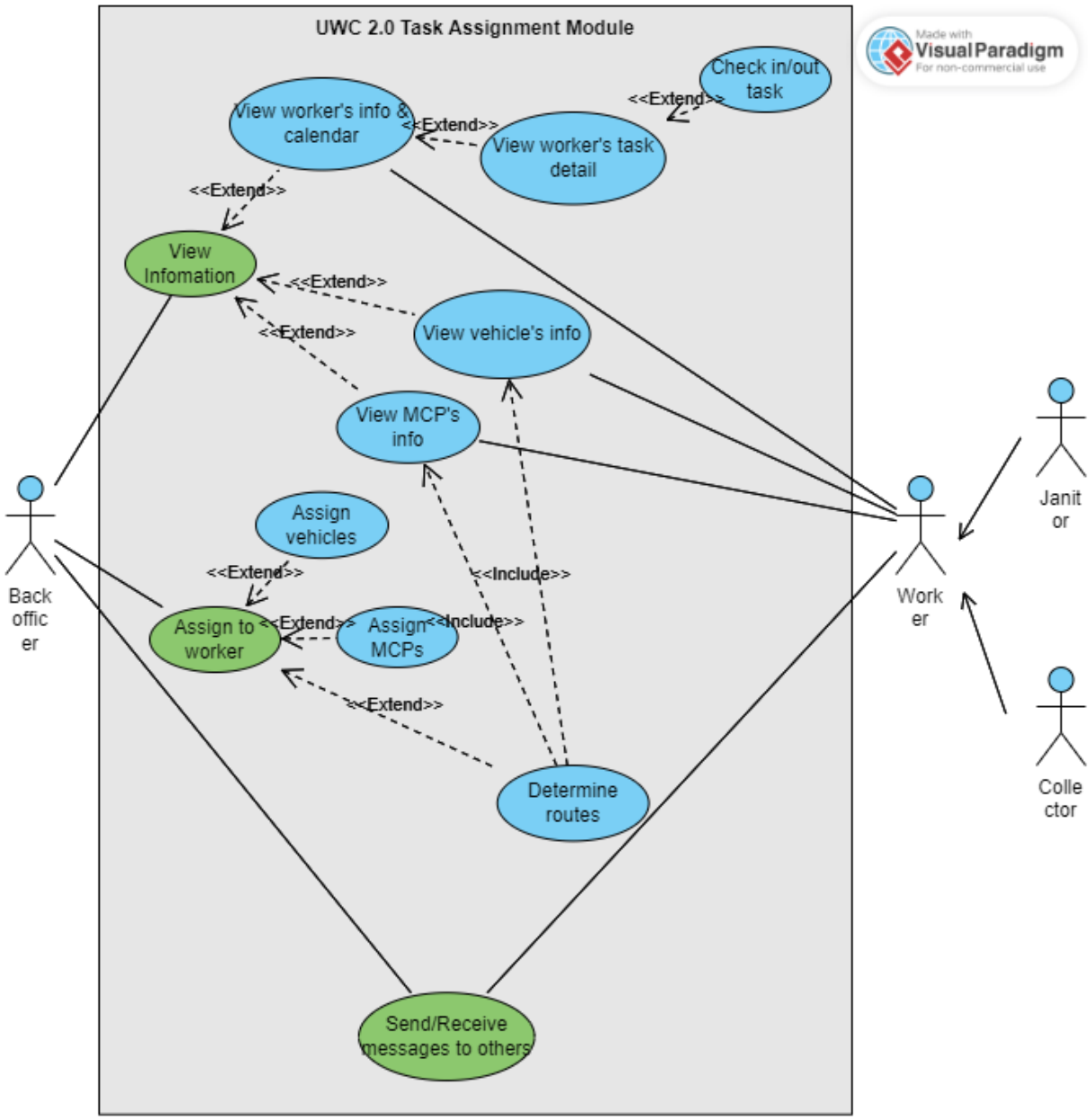
c. Use-case diagram for the whole system



Task 1.3

For the Task assignment module, draw its use-case diagram and describe the use-case using a table format

a. Task management module Use-case diagram


UWC 2.0 Task Assignment Module
Check in/out task
View worker's info & calendar
View worker's task detail
<<Extend>>
<<Extend>>
<<Extend>>
View Infomation
<<Extend>>
<<Extend>>
View vehicle's info
View MCP's info
Assign vehicles
<<Extend>>
<<Include>>
Assign to worker
<<Extend>>
Assign MCPs
<<Include>>
<<Extend>>
Determine routes
Send/Receive messages to others
Back offic er
Work er
Janit or
Colle ctor
Made with Visual Paradigm
For non-commercial use

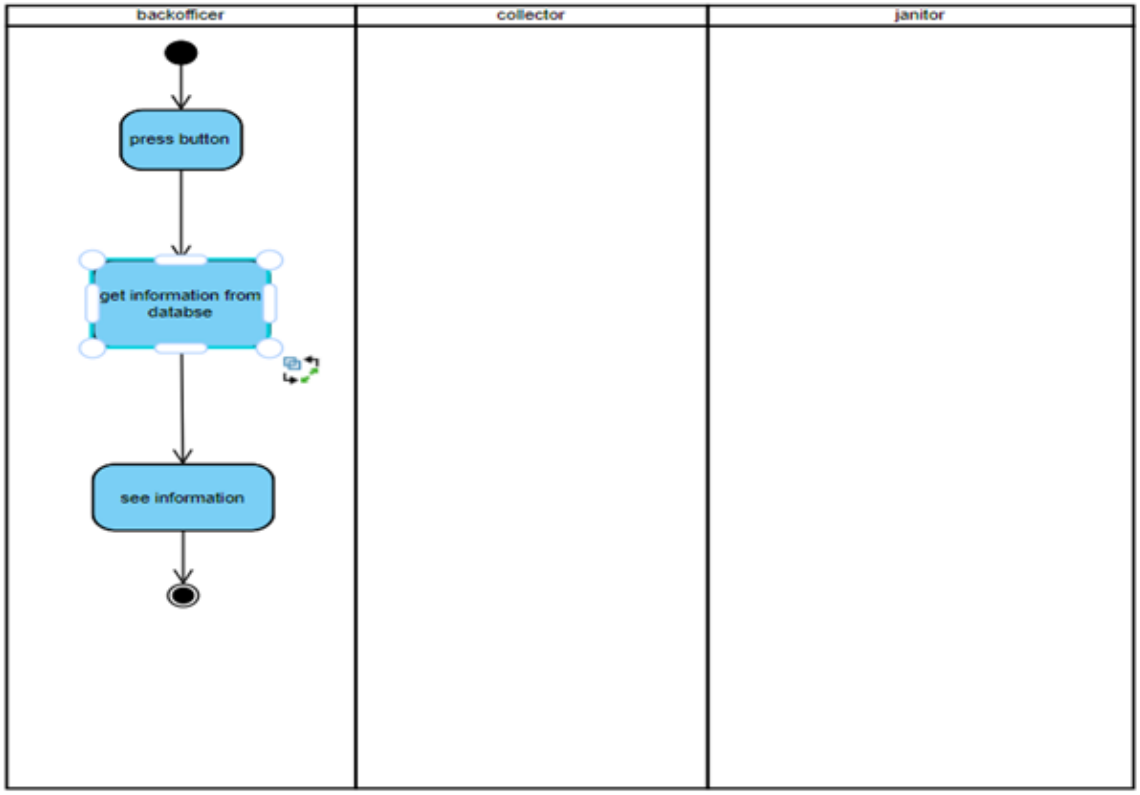
b. Use-cases table

Use case ID/ Name	UC-1 View information	UC-2 Assign to worker	UC-3 Send / Receive messages to others
Primary Actor	back officer	back officer	worker
Secondary Actors	none	none	back officer
Description	- Check information about staff, vehicles and MCPs.	- Back officer assigns details of tasks and calendars to janitors once a week. - Back officer assigns details of vehicles and routes to collectors once a month.	- Back officer create a system so that the worker and back officer can chat with others
Trigger	- Press the "information" button of each object on the web.	Back officers match the workers with the corresponding vehicles/MCPs/routes and press “confirm”.	- The users enter message and press "send" button in chat box
Preconditions	- The information about staff, vehicles and MCPs are kept up to date.	-The data about calendars, tasks, has been in the database and up-to-date every week. -Users can be authorized.	-The staff's data has been in the database. -The network is stable.
Postconditions	- The information about staff (their personal information, work calendar), vehicles (weight, capacity, fuel consumptions, quantity, …) and MCPs (quantity, capacity) are illustrated completely.	workers, back offices can view information about vehicles, MCPS and routes	-The message is in the database and logs.
Normal Flow	1. Back officer chooses an object to view information. 2. Back officer pressed the "information" button. 3. Information is shown.	1. Back officer checks whether the data is up-to-date. 2. Back officer views how many workers will be working in one week. 3. Back officers assign vehicles, MCPs and routes to each worker.	1.The user chooses receiver 2.The user enters messages. 3. the database receives message 4.the log registers the message 5.the messages are sent to receiver
Alternative Flow	None	None	none
Exception	- The network is broken. - Data about staff, vehicles or MCPs does not exist or update.	-The network is broken. - There is no worker at that day	-The network is broken. -The staff's data does not exist in the database.

Task 2.1

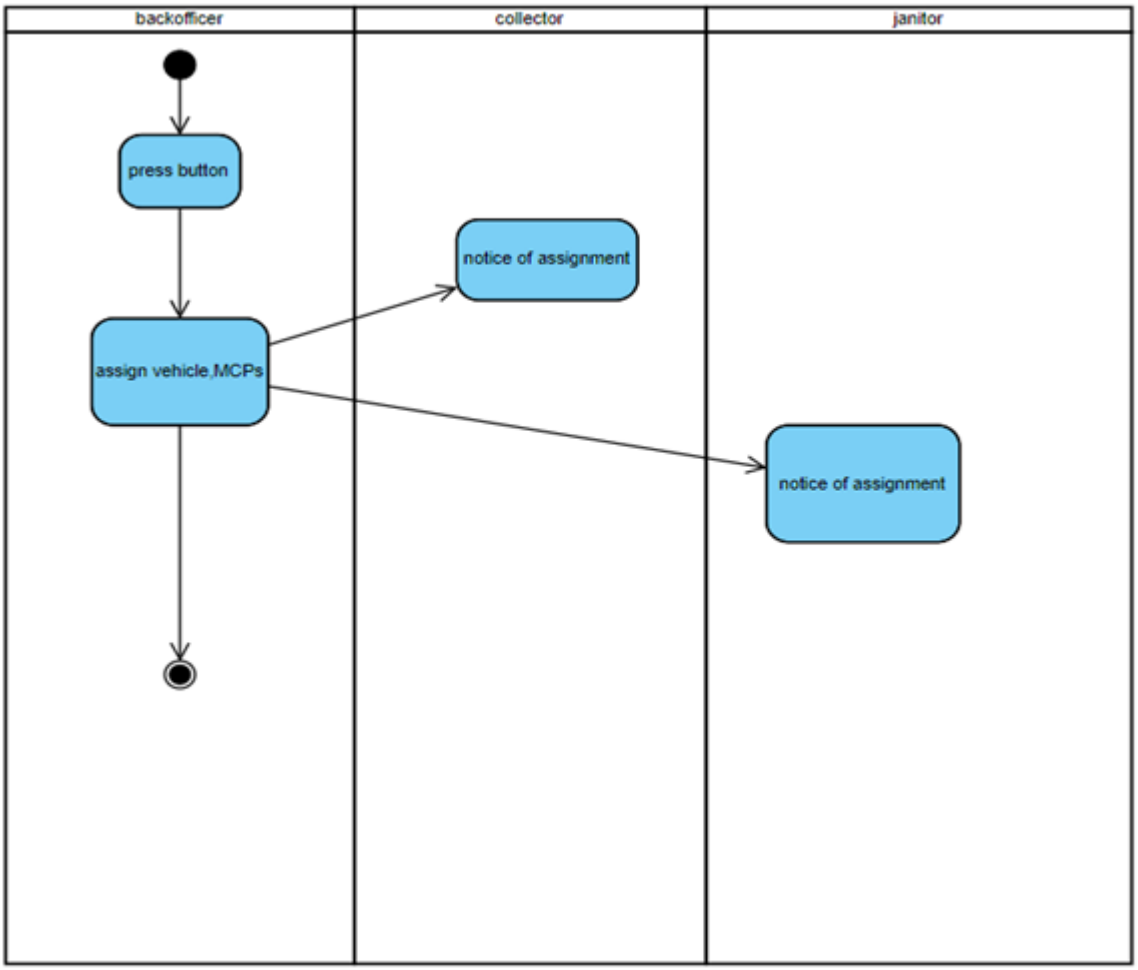
Draw an activity diagram to capture the business process between systems and the stakeholders in the Task Assignment module.

UC-1: View information



In this use-case, the back officer can see all information from MCPs, vehicles to Personal Information of staff. After pressing the button, the data in the database will be performed in the interface.

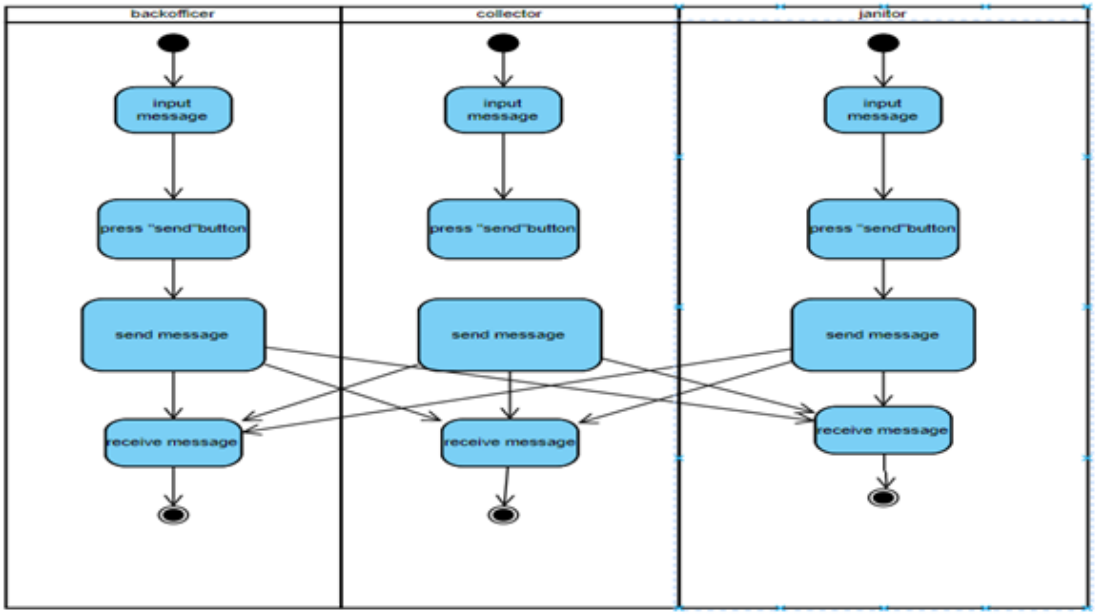
UC-2: Assign to worker



In user-case, the officer can assign vehicles also MCPs to staff and the staff will receive an announcement about this assignment.

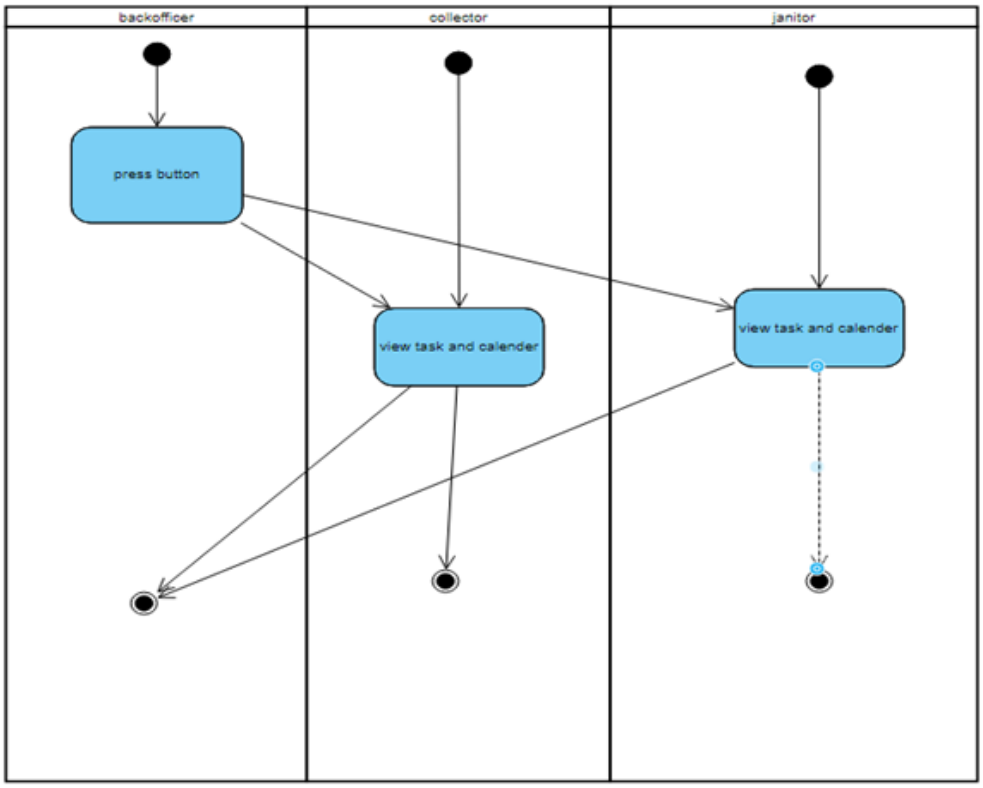
UC-3: Send / Receive messages to others

In this use-case, the chat system will transfer the message from one to another and this message will be stored in the database or log.



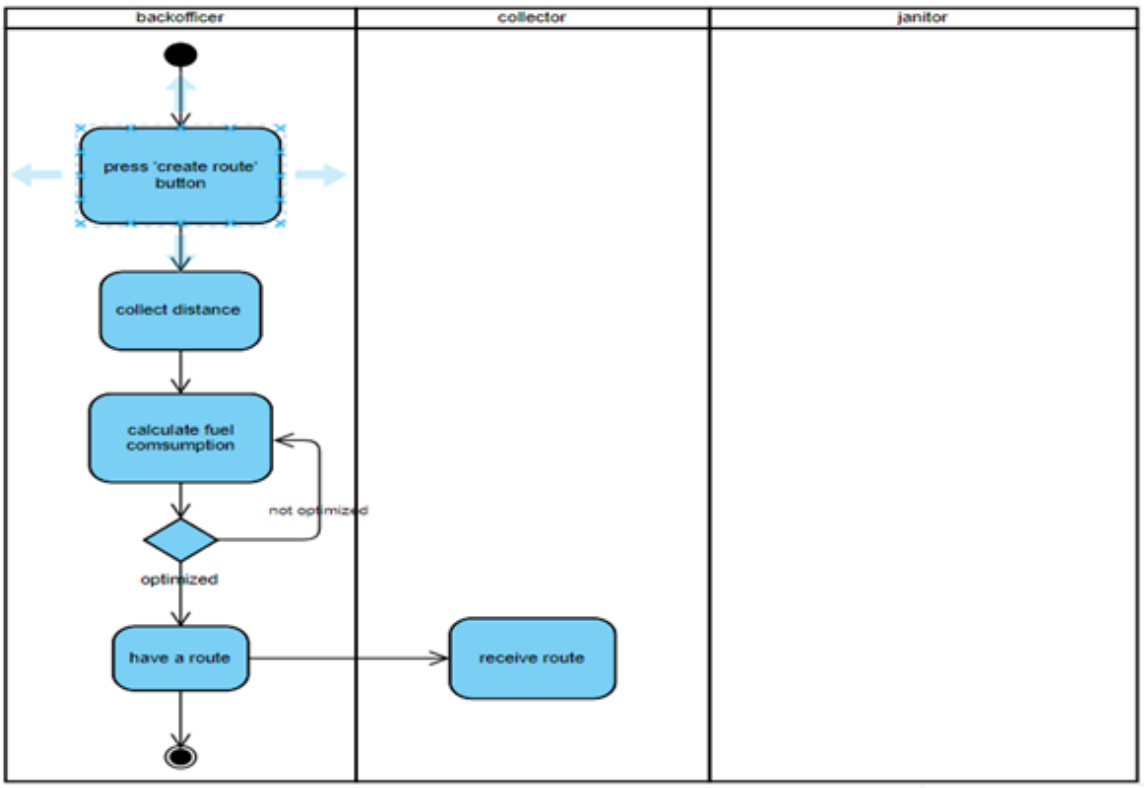
UC-4: View worker's task & calendar

In use-case, the back officer can view tasks and calendars of all workers while others just see their task and calendar.



UC-5:

Determine routes



In this use-case, the distance and fuel consumption will be collected before creating the optimized route and send it to collectors

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Task 2.2

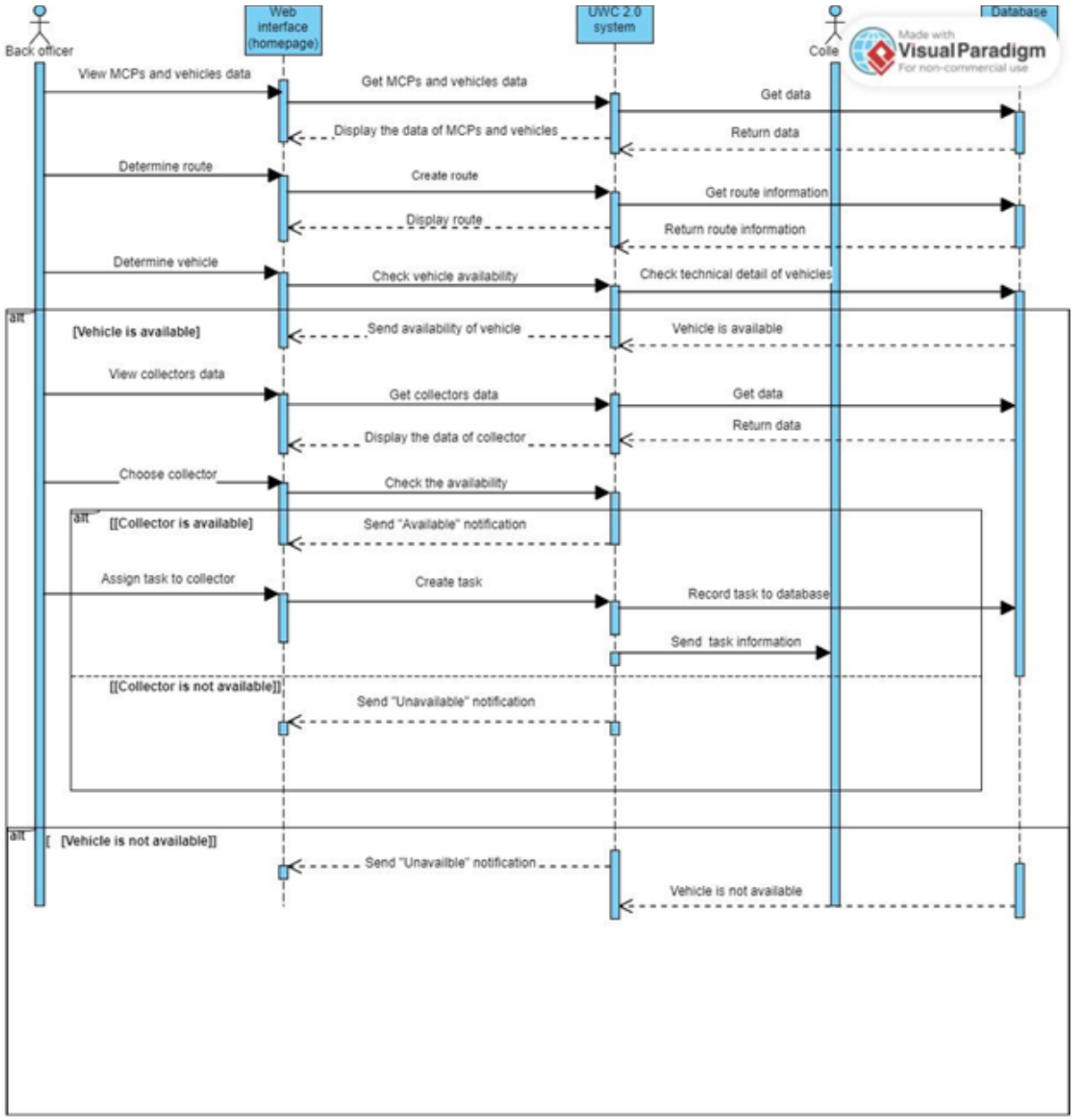
Think about a possible way for a back officer to assign vehicles to janitors and collectors. Draw a sequence diagram to visualize this process.

The back officer should consider some feature when assigning vehicles to janitors and collectors:

1. Determine the workload and location of each collector: Before assigning a vehicle, the back officer should consider the workload and location of each collector. For example, if a MCP has a larger workload, they may require a larger vehicle with more capacity.
2. Consider the technical details of each vehicle: The back officer should also consider the technical details of each vehicle, such as its weight, capacity, and fuel consumption. They may need to assign a particular type of vehicle based on the task requirements and the location of the collector.
3. Optimize routes for each collector: Once the back officer has assigned a vehicle to a collector, they should optimize the collector's route to minimize travel distance and fuel consumption. This could involve using a routing algorithm that takes into account the location of MCPs and the collector's assigned tasks.
4. Ensure real-time communication with collectors: The back officer should be able to communicate with collectors in real-time to make changes to assignments as needed. This could involve using a messaging system that allows for real-time communication with a delay of less than 1 second.

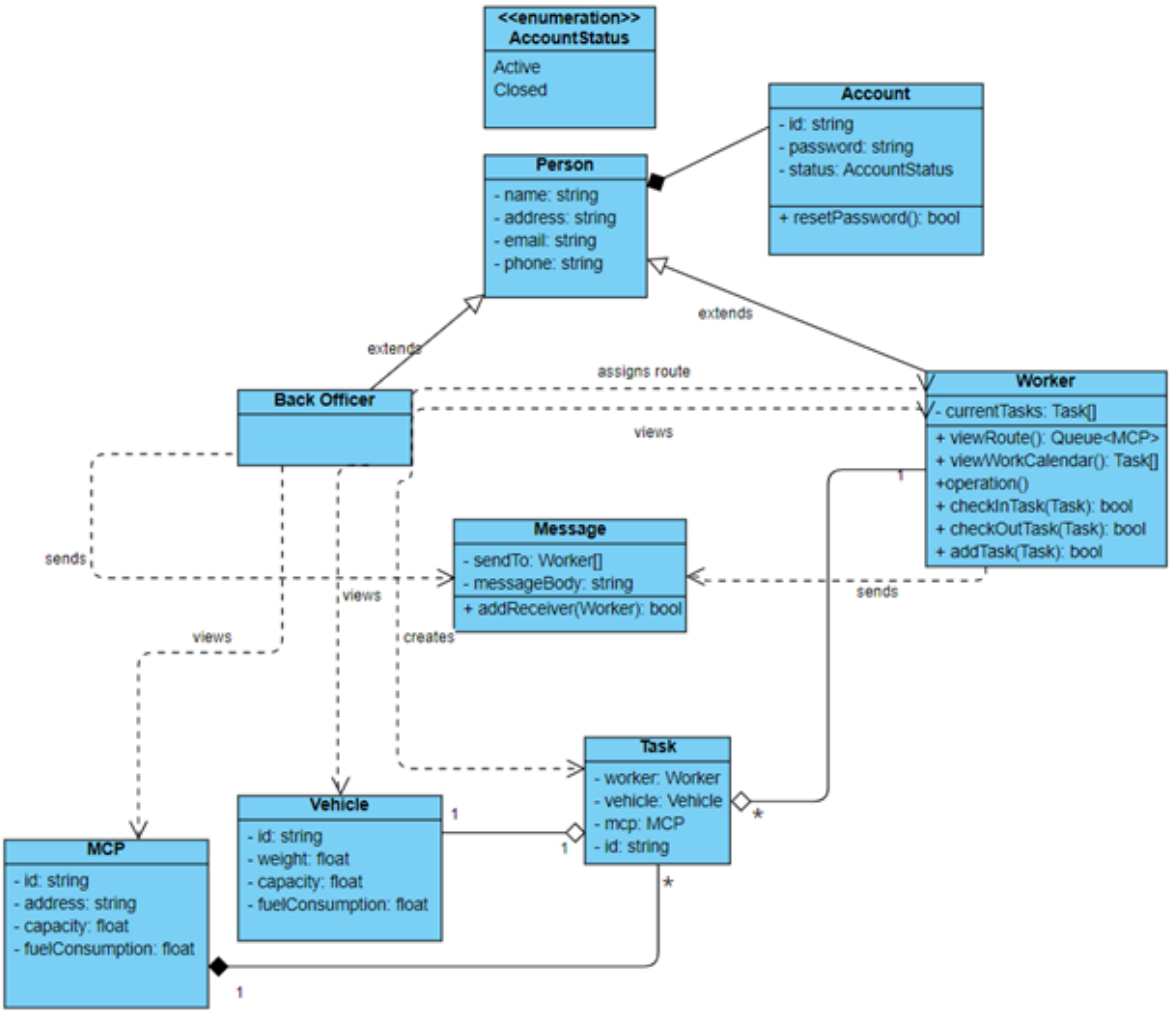
5. Monitor vehicle availability: The back officer should monitor the availability of vehicles to ensure that they are being used efficiently. If a vehicle is not being used, the back officer may need to reassign it to a different collector or to a different task altogether.

6. If there are any problems (broken vehicle, traffic jam, etc.) or collectors are not available at the moment. The system will send messages to the back officer so as to change the plan.



Task 2.3

Draw a class diagram of Task Assignment module as comprehensive as Possible.



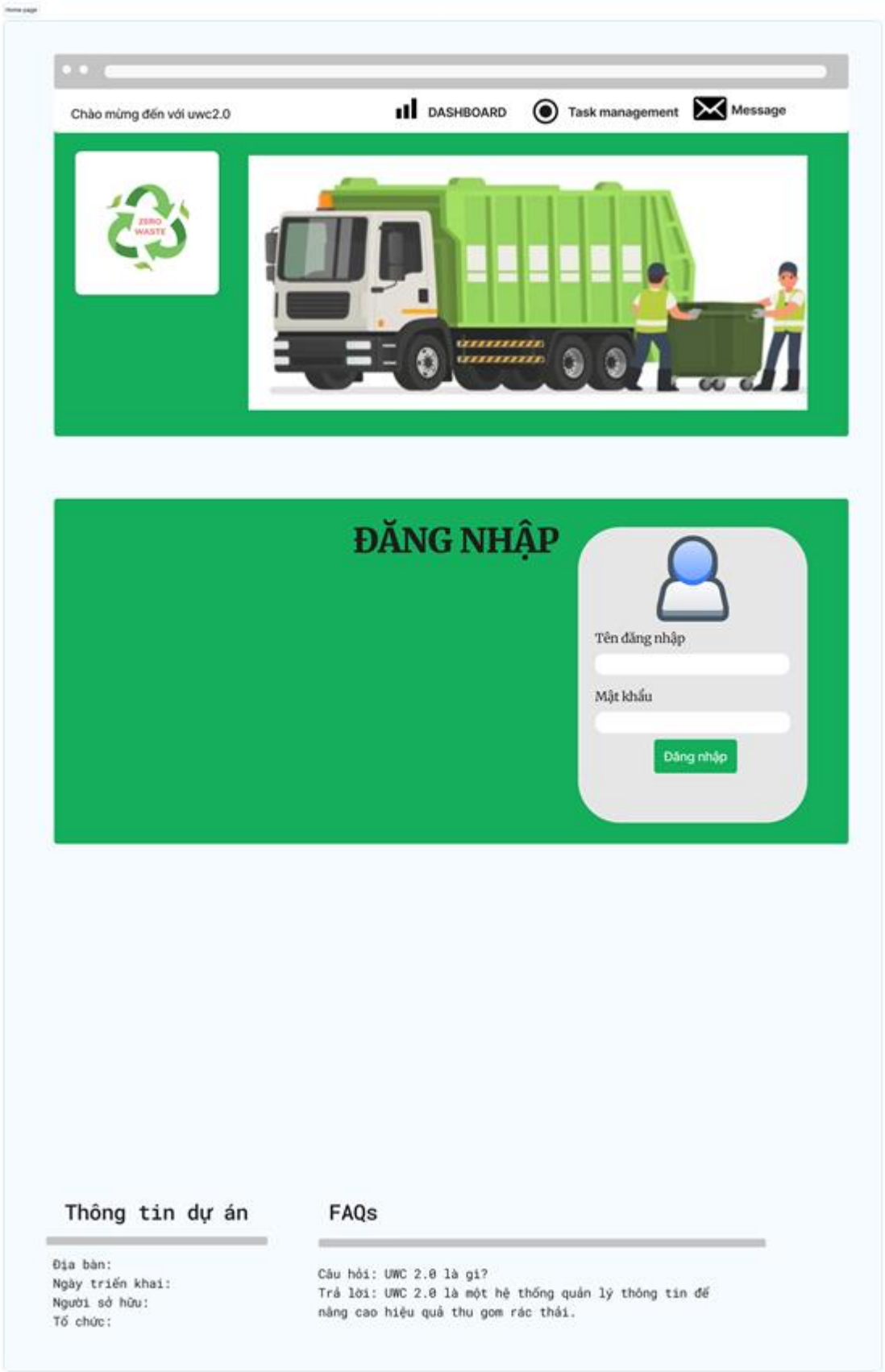
Task 2.4

Develop MVP 1 as user interfaces of either a Desktop-view central dashboard for Task Management for back-officers OR a Mobile-view Task assignment for Janitors and Collectors. Decide yourself what to include in the view. Use a

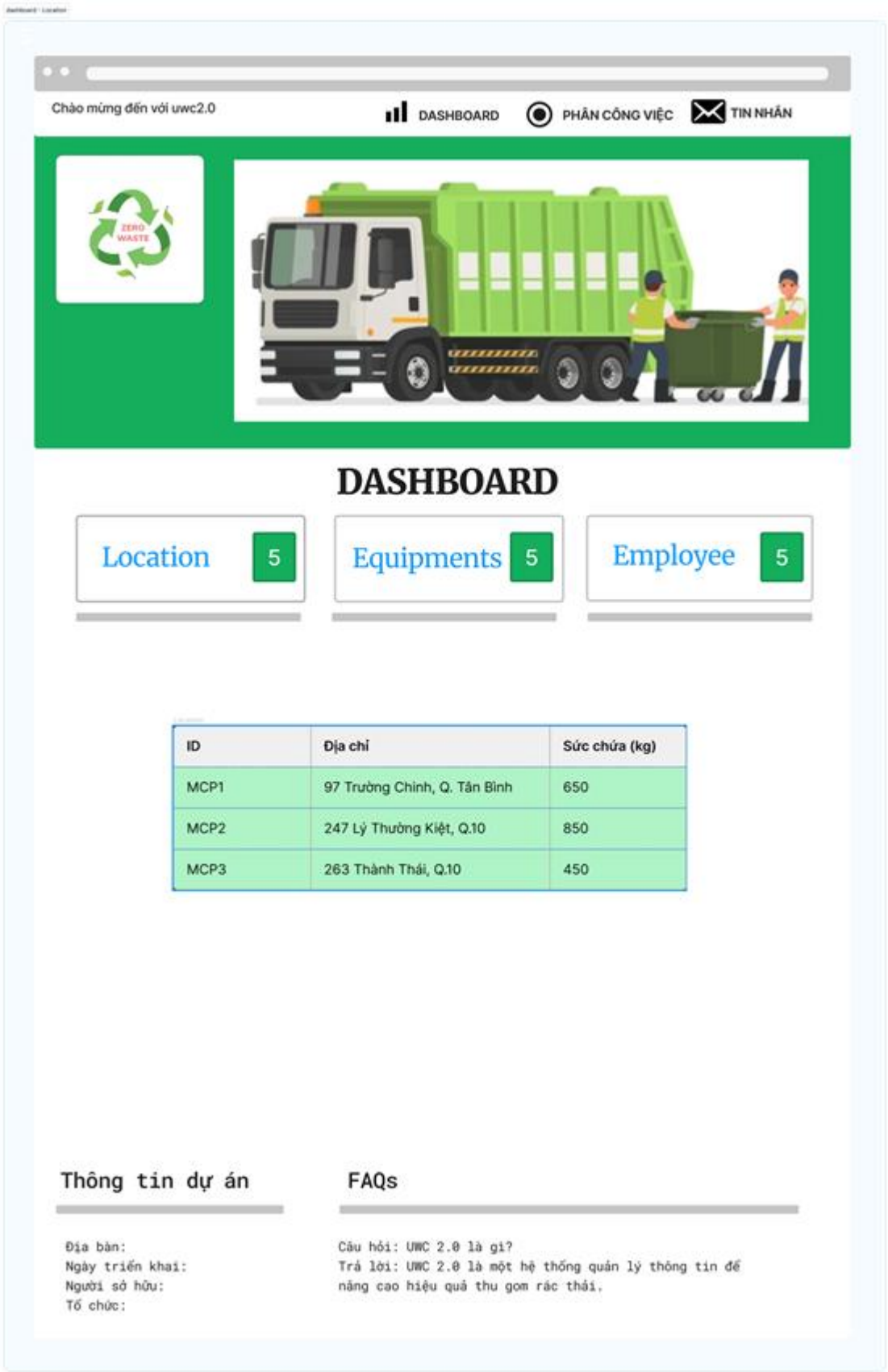
wireframe tools like Figma or Adobe XD, or Illustrator.

Desktop-view central dashboard for Task Management for Back Officer.

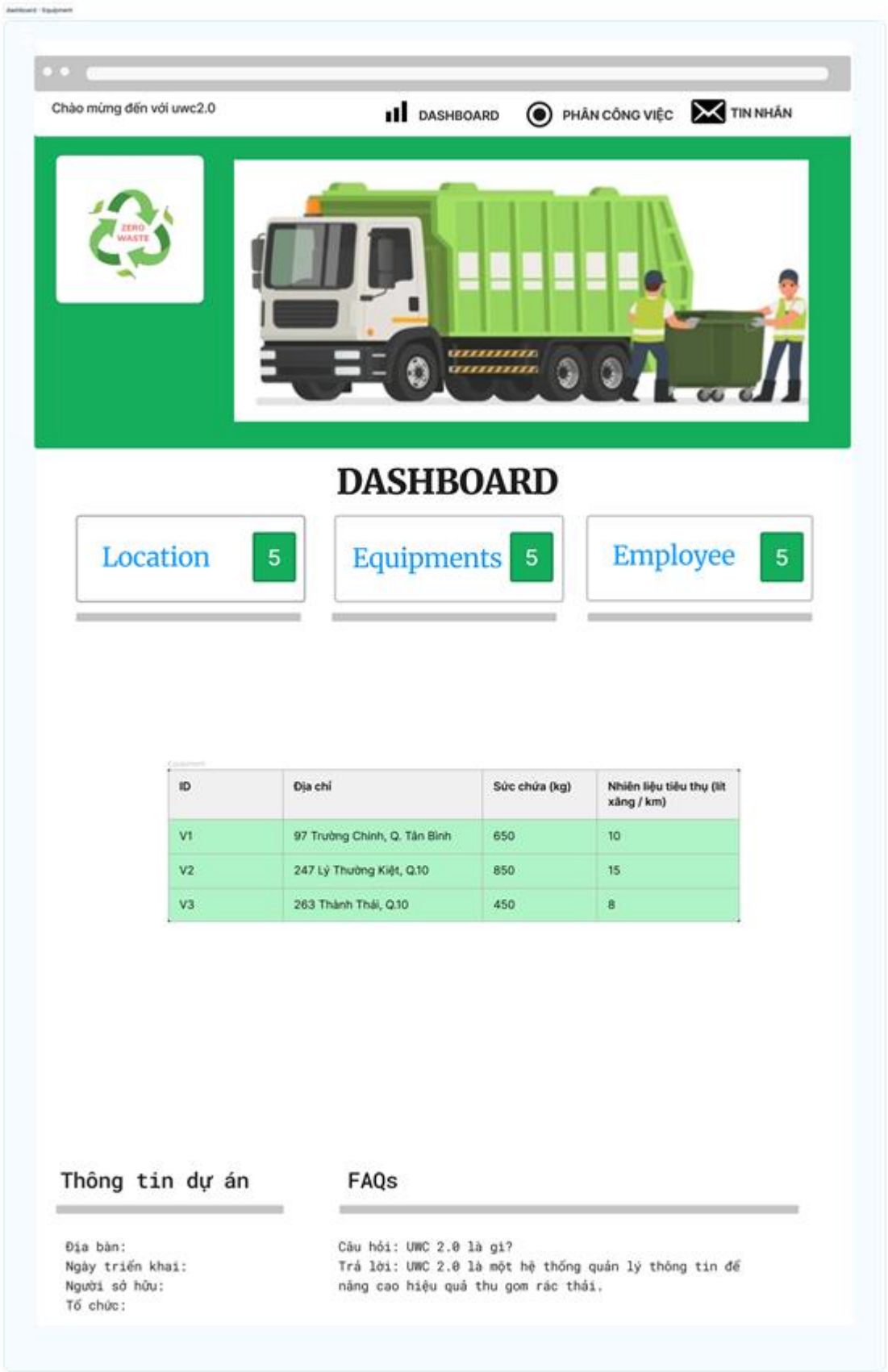
1. Home page and log-in interface



2. Dashboard (show specific information about location)



3. Dashboard (show specific information about equipment)



4. Dashboard (show specific information about employee)

Chào mừng đến với uwc2.0

DASHBOARD PHÂN CÔNG VIỆC TIN NHẮN

DASHBOARD

Location	5	Equipments	5	Employee	5

ID	Địa chỉ	Email	Số điện thoại
C1	97 Trường Chinh, Q. Tân Bình	abc@hotmail.com	0374128654
J1	247 Lý Thường Kiệt, Q.10	xyz@gmail.com	0301313243
J2	263 Thành Thái, Q.10	tre@outlook.com	0534685295

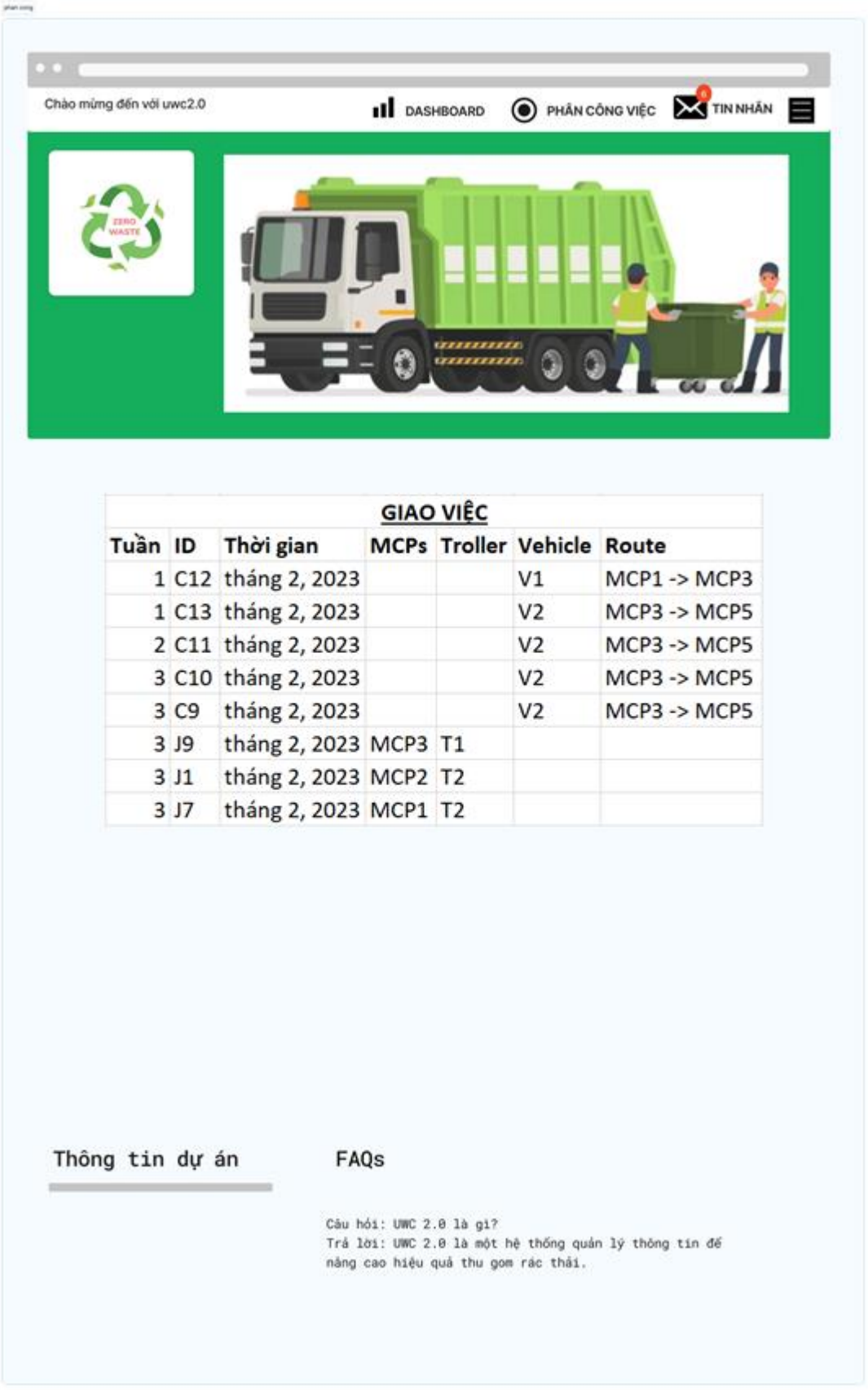
Thông tin dự án

Địa bàn:
Ngày triển khai:
Người sở hữu:
Tổ chức:

FAQs

Câu hỏi: UWC 2.0 là gì?
Trả lời: UWC 2.0 là một hệ thống quản lý thông tin để nâng cao hiệu quả thu gom rác thải.

5. Task management (viewed by Back Office)



GIAO VIỆC

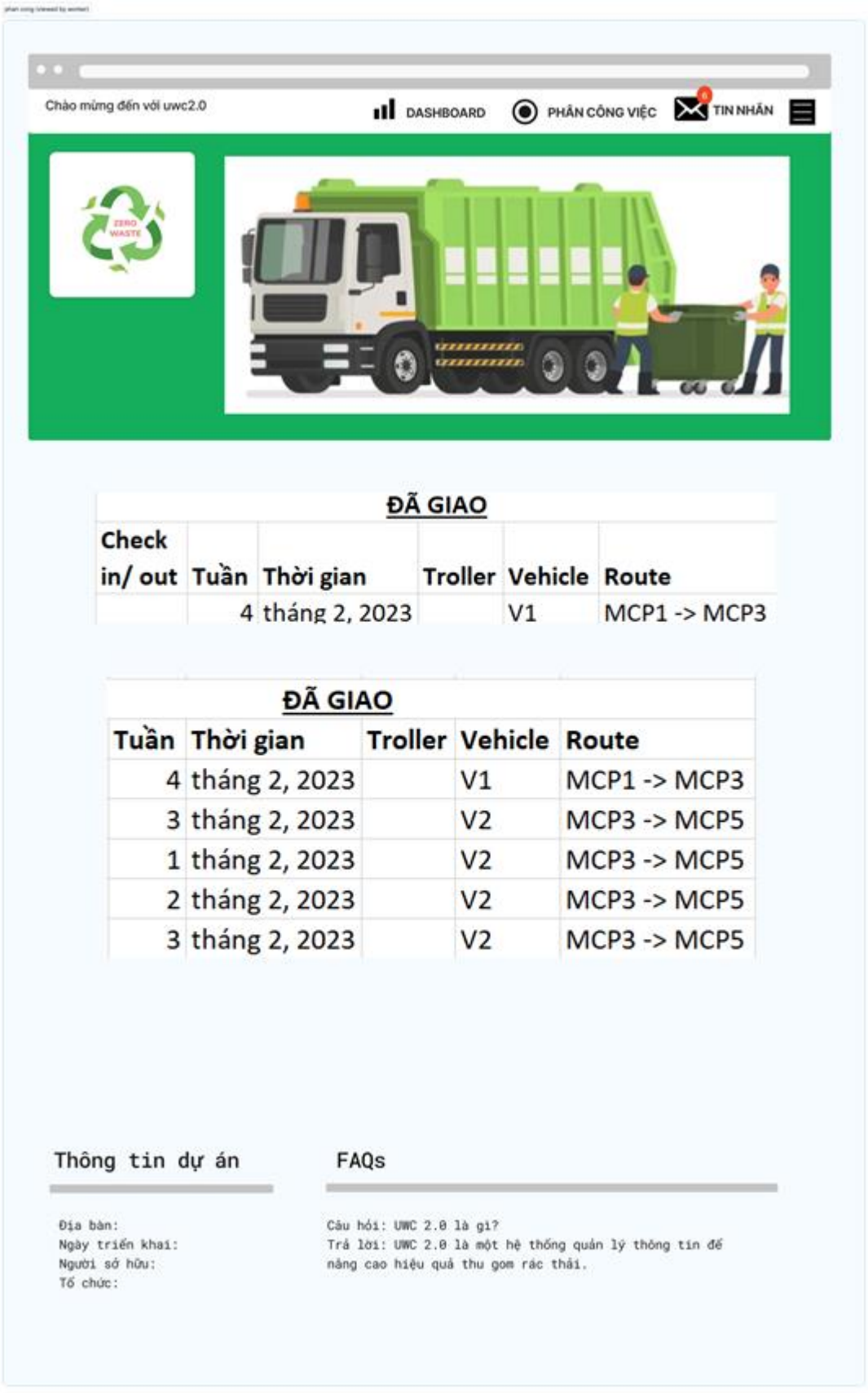
Tuần	ID	Thời gian	MCPs	Troller	Vehicle	Route
1	C12	tháng 2, 2023			V1	MCP1 -> MCP3
1	C13	tháng 2, 2023			V2	MCP3 -> MCP5
2	C11	tháng 2, 2023			V2	MCP3 -> MCP5
3	C10	tháng 2, 2023			V2	MCP3 -> MCP5
3	C9	tháng 2, 2023			V2	MCP3 -> MCP5
3	J9	tháng 2, 2023	MCP3	T1		
3	J1	tháng 2, 2023	MCP2	T2		
3	J7	tháng 2, 2023	MCP1	T2		

Thông tin dự án

FAQs

Câu hỏi: UWC 2.0 là gì?
Trả lời: UWC 2.0 là một hệ thống quản lý thông tin để nâng cao hiệu quả thu gom rác thải.

6. Task management (viewed by Back Office)



ĐÃ GIAO

Check in/ out	Tuần	Thời gian	Troller	Vehicle	Route
	4	tháng 2, 2023		V1	MCP1 -> MCP3

ĐÃ GIAO

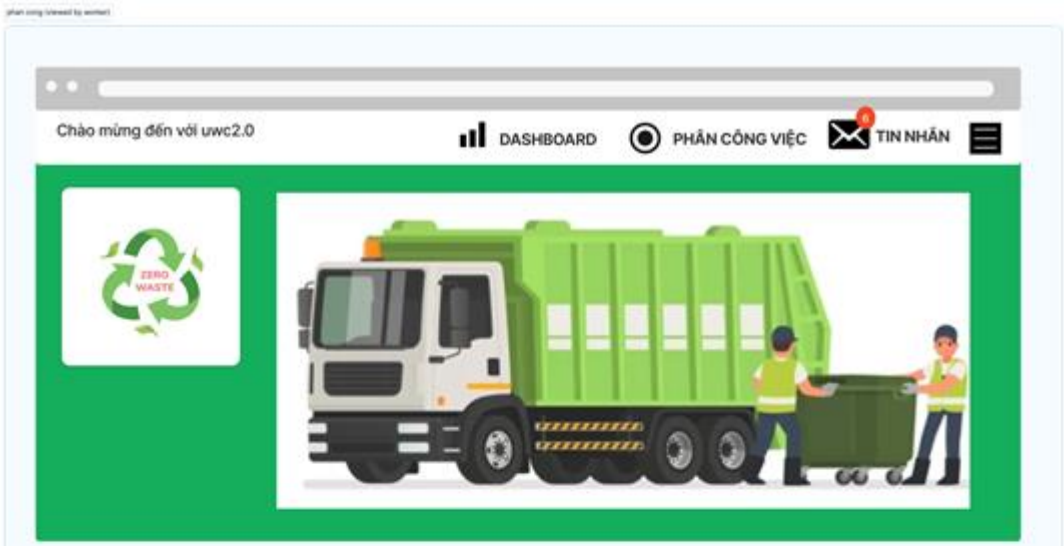
Tuần	Thời gian	Troller	Vehicle	Route
4	tháng 2, 2023		V1	MCP1 -> MCP3
3	tháng 2, 2023		V2	MCP3 -> MCP5
1	tháng 2, 2023		V2	MCP3 -> MCP5
2	tháng 2, 2023		V2	MCP3 -> MCP5
3	tháng 2, 2023		V2	MCP3 -> MCP5

Thông tin dự án

Địa bàn:
Ngày triển khai:
Người sở hữu:
Tổ chức:

FAQs

Câu hỏi: UWC 2.0 là gì?
Trả lời: UWC 2.0 là một hệ thống quản lý thông tin để nâng cao hiệu quả thu gom rác thải.



ĐÃ GIAO

Check in/ out	Tuần	Thời gian	Troller	Vehicle	Route
	4	tháng 2, 2023		V1	MCP1 -> MCP3

ĐÃ GIAO

Tuần	Thời gian	Troller	Vehicle	Route
4	tháng 2, 2023		V1	MCP1 -> MCP3
3	tháng 2, 2023		V2	MCP3 -> MCP5
1	tháng 2, 2023		V2	MCP3 -> MCP5
2	tháng 2, 2023		V2	MCP3 -> MCP5
3	tháng 2, 2023		V2	MCP3 -> MCP5

Thông tin dự án

Địa bàn:
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Câu hỏi: UWC 2.0 là gì?
Trả lời: UWC 2.0 là một hệ thống quản lý thông tin để nâng cao hiệu quả thu gom rác thải.

7. Message

TIN NHẮN

Thông tin dự án

Địa bàn:
Ngày triển khai:
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Tổ chức:

FAQs

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Trả lời: UWC 2.0 là một hệ thống quản lý thông tin để nâng cao hiệu quả thu gom rác thải.

These pictures are wireframes that are created by the Figma tool (https://www.figma.com/file/a1M4BmwU2s5CHEtiju0MNv/user-interfaces?node-id=0%3A1&t=5mu0u78d31XKZiU4-1). We can open links mentioned above to see our user interfaces.

REFERENCE:

1. **Header**

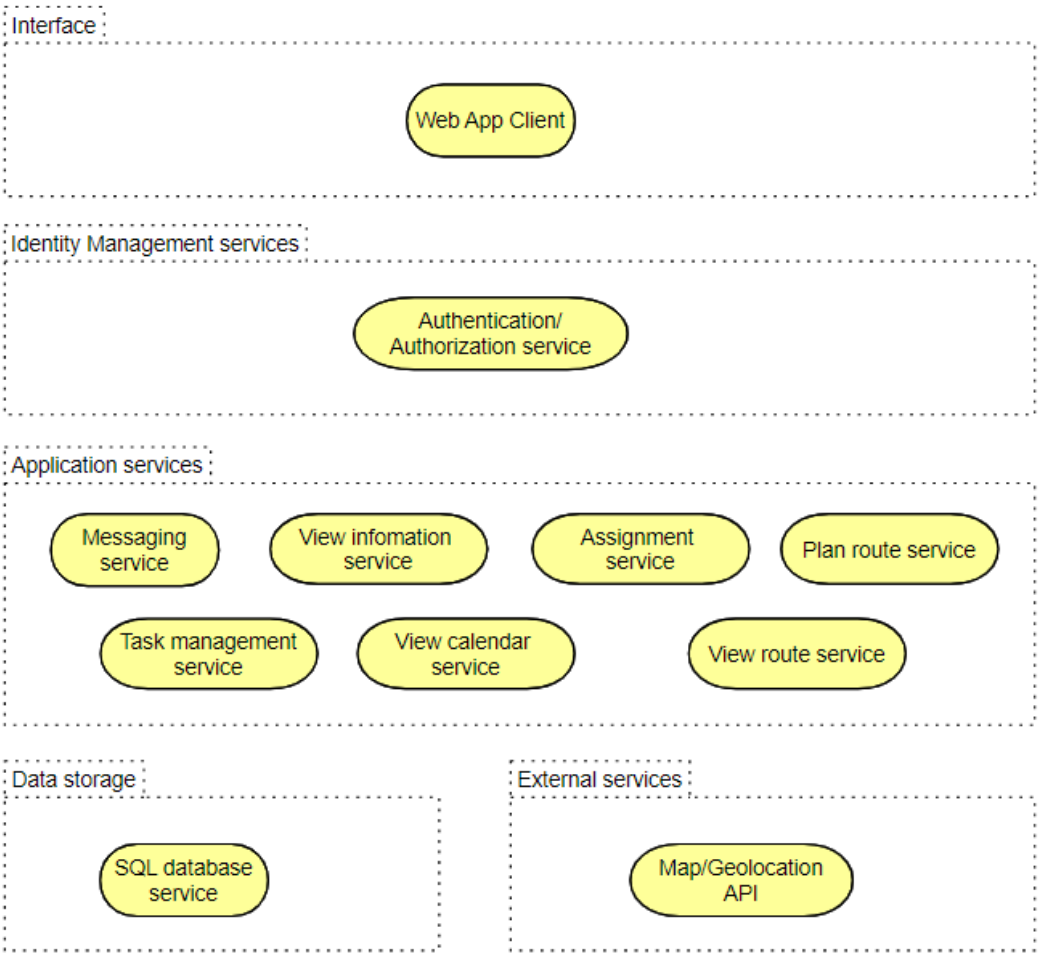
https://www.shutterstock.com/image-vector/garbage-truck-dustmen-scavengers-workers-clean-1463344889

2. **Logo**

https://www.freepik.com/premium-vector/zero-waste-sign-logo-symbol-zero-waste-conscious-consumption-concept-vector-illustration-flat-cartoon-style_24467149.htm

Task 3.1:

Use a layered architecture to design the UWC 2.0 system. Describe how you will present your User Interface. Describe how you will store your data. Describe how you will access external services/ APIs.



Presentation strategy

We tend to use dashboard layout to present our website. At the first glance, the user will log in or sign up in the authentication service page before moving to the main page. In the home page, there are some areas that are always presented like calendar, new notices, new tasks,.. because they are the services having higher priority than the others. Beside that, some services like view vehicle information, routes,.. can be accessed via the function cards. The interface and some specific functions can vary based on the type of user (back officer, collector, janitor).

Data storage approach

The data will be classified into types.

- User account: each user will have their own account to log in to, the account will make it easier for them to assign tasks, receive notification about tasks, send/receive messages, view information, ... Users must log in before interacting with the system.
- Message: the system tracks text messages by having message ID, contents, and time sent, ... for each message sent by users.
- MCPs: each MCPs has a unique ID with an address that helps the back officers and the workers to locate them to create route or to follow the route. Besides, there's also the availability of MCPs which is being updated every 15 minutes.
- Vehicle: have vehicle ID, Name, availability, and fuel consumption for that back officers can choose the vehicle that suits the route.
- Task: contain Task ID, requirements, responsible worker, route, date and time. Back officers can use this information to track the progress of tasks, workers can view this information, check in and out tasks while finishing their job.

Then, each type of data will be stored in a unique table in order to make it easier for query information.

API management

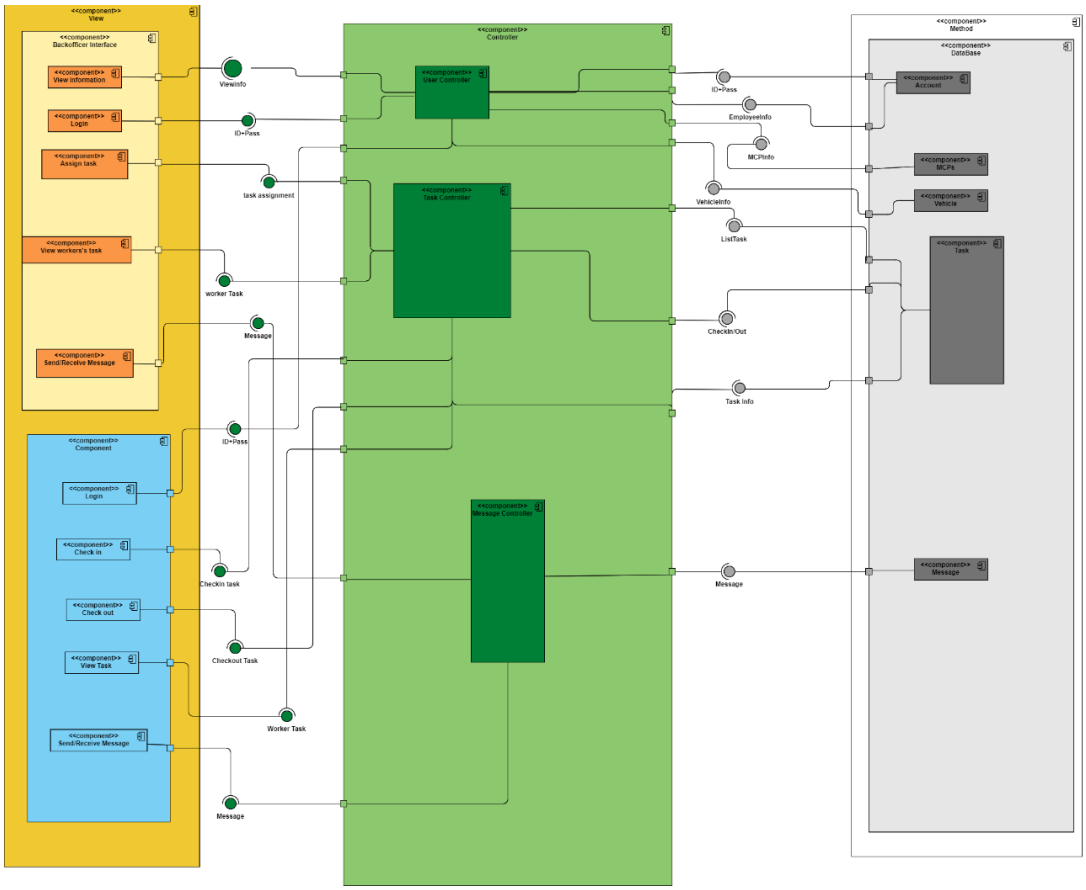
Our strategy to manage the API can be listed through several aspects:

- API Security: implement authentication and authorization mechanisms to control access to the API.
- API Monitoring: to ensure that your API is working correctly, monitoring the errors and performance issues is necessary. Furthermore, implementing monitoring tools that can alert some issues before they become serious problems.

- API Versioning: avoid breaking changes for existing users. Versioning allows us to roll out changes gradually and ensure that all users have time to update their applications.
- API Testing: the API must be tested thoroughly before releasing it to production to ensure that it is working correctly.

Task 3.2:

Draw a component diagram for the Task Assignment module



The system comprises three main sub-systems: View, Control, and Model.

- The View sub-system contains the Back_officer_Interface and Worker_Interface:

● The BackOfficer Interface component provides the interface for the back office to log in, view worker information, send/receive messages, assign and view worker tasks.

● The Worker Interface component provides the worker's interface to log in, check in, check out, send/receive messages and view worker tasks.

- The Control sub-system contains the user controller, task controller and message controller component:

● User controller component provides the interface for log-in and sign-up functions, manipulating account information. Gather account data from Model and render account information view.

Task controller component provides the interface for task creation, sending requests from back officers and rendering task review. This also helps assign tasks into the database.

● Message controller provides the interface for message sending requests including chat box opening, message sending, and message reporting.

- The Model sub-system contains a component Database with small components Employee, MCP, Vehicle, Task, Message:

●The Model sub-system provides interfaces for the controller to perform operations with the database, providing interfaces for the view to update data when it receives a message from the model and tracks text messages.

Task 4.1 & 4.2:

Setting up an online repository (github, bitbucket, etc) for version control. Adding documents, materials and folders for Requirement, System modeling and Architectural design. Use the selected version control system to report the changes to these files.

Link GitHub: https://github.com/vwaizer/hello_word

Task 4.3:

Conducted a usability test with the user interface you developed in MVP1.

USABILITY TEST REPORT

We have conducted a usability test with our participants to observe their behaviors and interactions with our MVP1. Here is a report documenting the key steps of the process.

Step 1: Recruit participants

In this step, we ask one of our friends to participate in the usability test. He was only told about the main purpose of the application, its functionalities, use cases, and features. We didn't reveal any details about the way to use the interface explicitly to ensure the authenticity hence the usefulness of the participant's feedback.

Step 2: Define tasks

In the testing process, we asked the participant to perform 2 tasks:

- *Task 1:* login as a worker (either janitor or collector), and view their current week's task assigned by the back officer and check in/check out for that day. After that, we required the tester to send a message to the back officer. Finally we asked him to log out of the account.
- *Task 2:* login as a back officer, reply to the message from the previous worker. Then, he had to assign an arbitrary worker to a new task of that week. After that, he navigated to the dashboard to view the information of a random janitor. Finally he logged out and ended the testing process.

Step 3: Define the test strategy

Between in-person and remote strategies, we chose to apply the *in-person* one to make the process more interactive and to observe the participant better.

Additionally, we also decided to use the *qualitative* method, because we focus more on the way users use the app, rather than on the quantitative metrics like time on task, which is less relevant to this system.

Step 4: Conduct the test

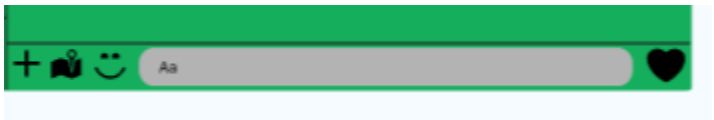
When conducting the 2 tasks of the test, we have documented the interaction and feedback from the tester. In particular:

- *Task 1:*

-The worker has problem in dashboard page, the tester does not know how to change to other page also other context in one page

uần	ID_nhanvien	Tên nhân viên	Thời gian	MCP	Troller	Route	Vehicle
1	C34	Dũng	Wednesday, February 8, 2023			R2	V1
1	J2	Tiến	Thursday, February 9, 2023	MCP10	T12		
1	C6	Hà	Friday, February 10, 2023			R1	V2
1	C12	Lan	Saturday, February 11, 2023			R2	V1
1	C13	Trung	Sunday, February 12, 2023			R4	V2
1	J1	Tín	Monday, February 13, 2023	MCP10	T11		
2	J5	Thiện	Tuesday, February 14, 2023	MCP11	T2		
2	C3	Nhi	Sunday, February 12, 2023			R4	V1

- The workers have difficulty in checking in /out.
- The user does not know how to send messages to others because there is not a “send” button in the navigation bar.



- *Task 2:*

The back offices need to deeply understand the information (workers, vehicles, how long they will assign the task) to have good management.

Tuần	ID_nhanvien	Tên nhân viên	Thời gian	MCP	Troller	Route	Vehicle
1	C34	Dũng	Wednesday, February 8, 2023			R2	V1
1	J2	Tiến	Thursday, February 9, 2023	MCP10	T12		
1	C6	Hà	Friday, February 10, 2023			R1	V2
1	C12	Lan	Saturday, February 11, 2023			R2	V1
1	C13	Trung	Sunday, February 12, 2023			R4	V2
1	J1	Tín	Monday, February 13, 2023	MCP10	T11		
2	J5	Thiện	Tuesday, February 14, 2023	MCP11	T2		
2	C3	Nhi	Sunday, February 12, 2023			R4	V1

It is difficult for the back offices to verify whether checking in / out of workers is true or false.

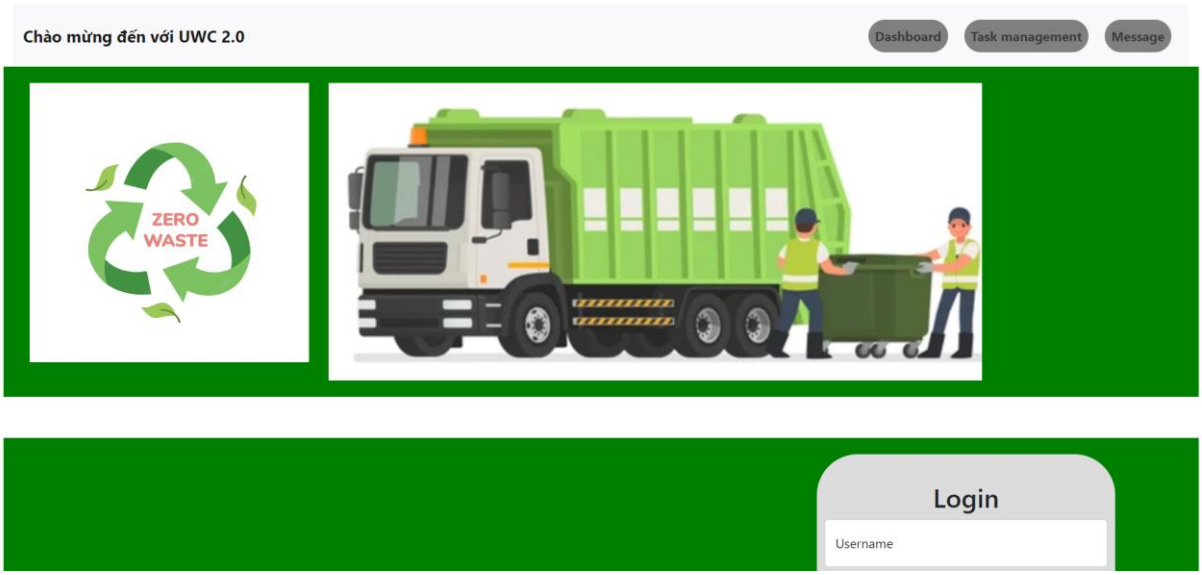
Step 5: Document feedback from testers

Overall, the tester said that the app is easy to navigate around and perform specific actions. However, there are some small parts needed to be modified to make the app more user-friendly, and we will implement them in the next version.

Task 5.1:

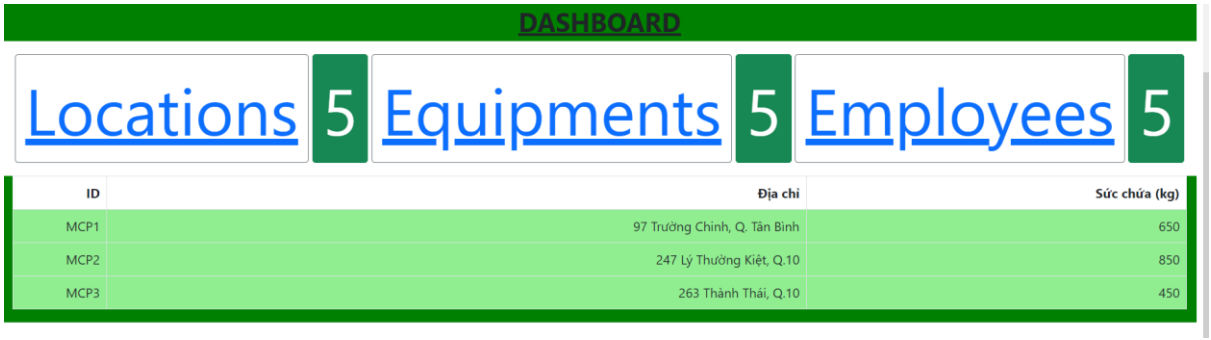
Develop MVP2 with input from Task 2.4 and Task 4.3. You are free to choose the programming language (HTML, Javascript, Python, C#, etc). It is not required to implement a database in the backend. Data can be hard coded in code files.

The below screenshot shows the UI of our website, which source code is stored at https://github.com/vwaizer/hello_word



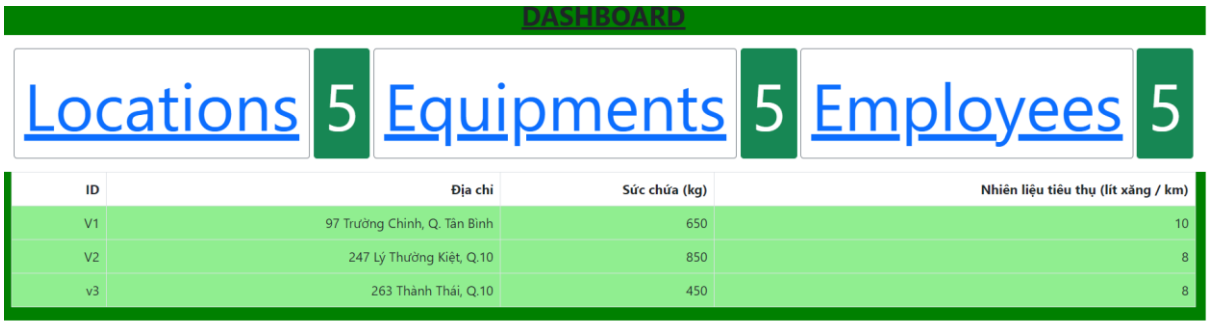
The first one is the Login page. In this page, user must fill in the Username field and Password field before login to use other services.

The next one is dashboard which update the information of each vehicle, MCP, janitor and collector.



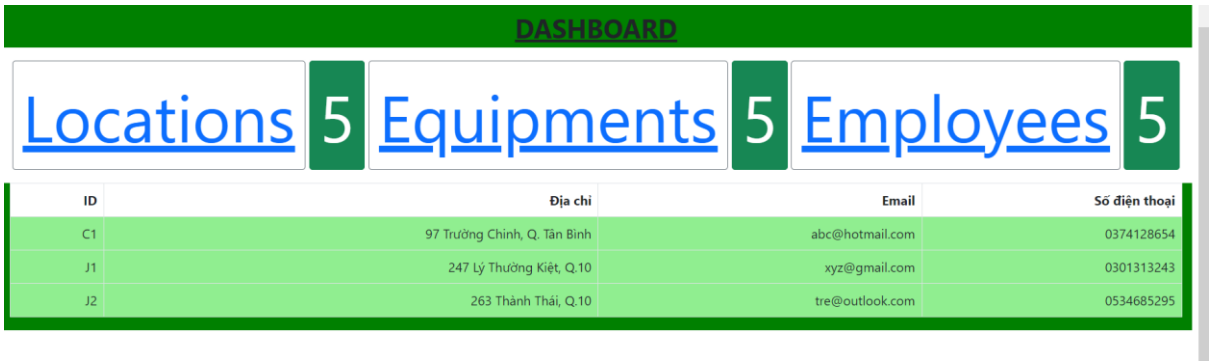
ID	Địa chỉ	Sức chứa (kg)
MCP1	97 Trường Chinh, Q. Tân Bình	650
MCP2	247 Lý Thường Kiệt, Q.10	850
MCP3	263 Thành Thái, Q.10	450

In this image, the information of all MCPs including ID, address and capacity are updated usually.



ID	Địa chỉ	Sức chứa (kg)	Nhiên liệu tiêu thụ (lít xăng / km)
V1	97 Trường Chinh, Q. Tân Bình	650	10
V2	247 Lý Thường Kiệt, Q.10	850	8
v3	263 Thành Thái, Q.10	450	8

This image is the dashboard which update the information of all vehicles including ID, address, capacity and fuel consumption.

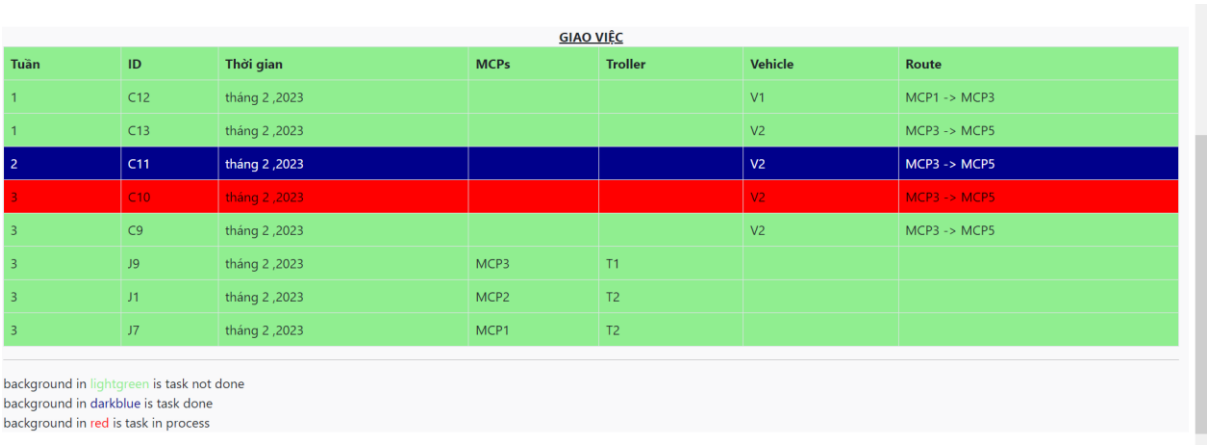


ID	Địa chỉ	Email	Số điện thoại
C1	97 Trường Chinh, Q. Tân Bình	abc@hotmail.com	0374128654
J1	247 Lý Thường Kiệt, Q.10	xyz@gmail.com	0301313243
J2	263 Thành Thái, Q.10	tre@outlook.com	0534685295

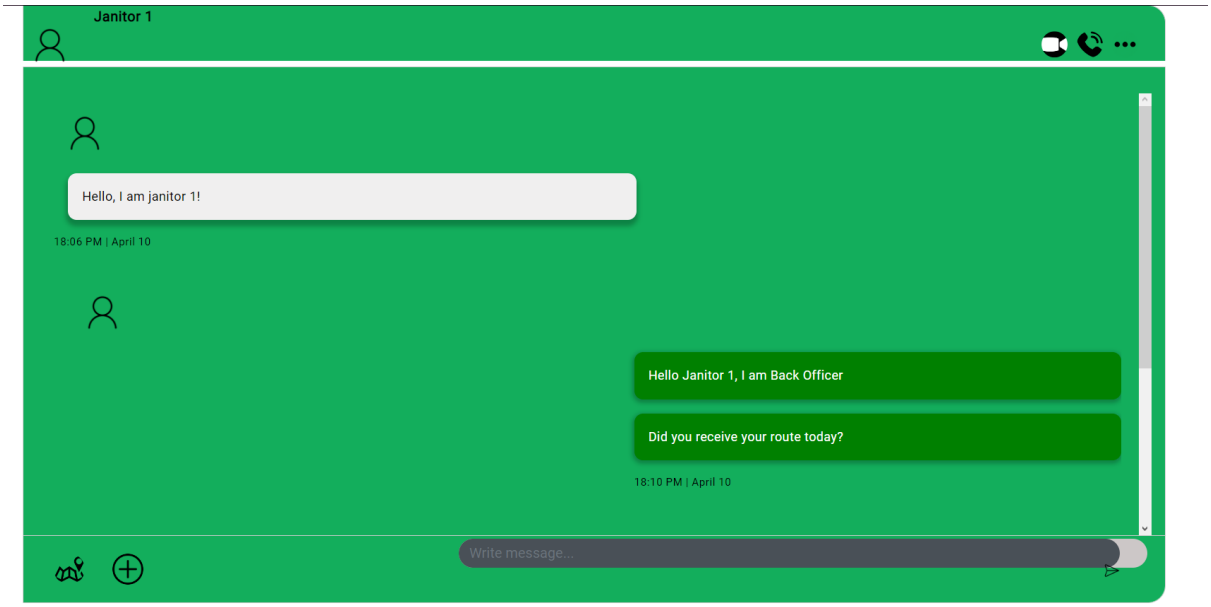
This image is the dashboard that update information of collectors and janitors including ID, address, email and phone number.

The next one is the page that back officer use to assign task to worker. In this panel, back officer can choose which route is not in progress, which workers and vehicle are available in order to create task. The scheduling time also is set in this step

The janitor and collector can easily check their task in the following page. In this table, the green row is the task that is not finished, the red one is the task that is in progress and the blue one is the done task.



Finally, our web application also provide the chat service that allow back officer communicate with worker.



Advantages

- Friendly user interface
- Easy to use
- Adapt with many devices

Disadvantages

- The back-end development and database are not completed
- The lack of connection with order application like Google Maps, …

Future plan

- Our team are planning on using Firebase in order to host online, online database and authorization system.
- We are also planning connect with Google Maps that help user easy to track the route in working progress