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

SOFTWARE ENGINEERING (CO3001)

Capstone Project

"Urban waste collection aid - UWC 2.0"

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1 Task 1: Requirement elicitation

1.1 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?

1.1.1 The domain context of Urban waste management in Vietnam:

Urban waste management is one of several significant problems faced by many countries in the world, including Vietnam. An excellent waste management is one of the important points in Sustainable Development Goal (SDG) 11: sustainable cities and communities, and SDG 6: clean water and sanitation, which are the keys to sustainable development, according to the United Nations General Assembly. Nevertheless, there are some problems with the current waste management in Vietnam, especially in Ho Chi Minh City. On the one hand, as the infrastructure in HCM City is constantly being synchronized and strongly developed every day, which follows Part 2 of Section III in the Politburo's Resolution No 31-NQ/TW on orientations and tasks for the development of Ho Chi Minh City by 2030, with a vision to 2045, the amount of garbage that households and companies release into the environment is increasing. However, HCM city's waste management is still ineffective for which the country is making continuous efforts to manage the solid waste in an innovative and creative way. According to a survey, in 2018, the annual HCM City waste production comprised more than 800 thousand tons consisting of 46 percent from municipal sources, the remainder delivered from agriculture and industry. This leads to the creation of UWC 1.0, which fulfils the practical demand of a more thorough garbage managing process and the appearance of some new jobs, such as janitors, back officers and collectors at MCPs. On the other hand, the existing software product, which is UWC 1.0, has some drawbacks that limit janitors from working efficiently. For example, it does not signal to the back officer when an MCP is full capacity, so it is very time-consuming for janitors to go to a full MCP ; also, the route created by the software is sometimes not the most convenient one at that time. Therefore, the UWC 2.0 software will overcome those limitations and create an excellent garbage management for the city.

1.1.2 The relevant stakeholders:

The relevant stakeholders of the UWC 2.0 project include back officers, janitors, collectors, the service provider Y, the organisation X, and the super back officers. The back officers need to control the janitors and collectors. Back officers also need to have enough information of vehicles and all MCPs regularly. The janitors and collectors need to keep in contact with other workers at all time and send messages to others when in need. They also need to be informed about their work calendar and their task on a regular basis. The service provider Y needs to manage garbage collection with high efficiency. The organiser X needs to have an efficient and convenient information management system. The super back officers need to have an overview of the Task Management module and all the MCPs.

1.1.3 The benefits of UWC 2.0 for each stakeholder:

By applying the UWC 2.0 project, the stakeholders will receive many benefits. The back officers can have a better overview of janitors and collectors, as well as their work calendar. Back officers can also update the information of all the MCPs more regularly and can send messages to janitors and collectors faster. The janitors and collectors can communicate with other workers quicker and

can check-in and check-out, as well as have a detailed view of their task on their work calendar on a daily and weekly basis, without scrolling down on the device. The janitors will be assigned the most convenient route and be notified about which MCP to deliver garbage. The collectors will be announced about the vehicle they use and the MCPs they are assigned regularly. The service provider Y will improve efficiency of garbage collection. The organisation X will receive a much more efficient and convenient information management system, so they can save much time and effort. The super back officers will have a better view of the Task Management module and all the MCPs.

1.2 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

1.2.1 Functional requirements:

- As a back officer:
  - A back officer shall be able to create work calendar for collectors and janitors.
  - A back officer shall be able to send messages with information about collecting route and time to collectors and janitors.
  - A back officer shall be able to assign vehicles janitors and collectors.
  - A back officer shall be able to assign calendar and tasks for each team of janitors
  - A back officer shall be able to assign route for each vehicles to use.
  - A back officer shall be able to get information of vehicles technical details(weight, capacity, fuel consumption).
  - A back officer shall be able to know MCPs position, scope and information about their capacity.
- As a collector:
  - A collector shall be able to know his/her work calendar.
  - A collector shall be able to have a detail knowledge of his/her task on a daily and weekly basis.
  - A collector shall be able to send messages to or call other collectors, janitors and back officers.
  - A collector shall be able to check in, check out task every day.
  - A collectors shall be able to know which troller to use to collect garbage.
  - A collector shall be able to know which Major collecting points assigned to his/her.
- As a janitor:
  - A janitor shall be able to know his/her work calendar.
  - A janitor shall be able to have a detail knowledge of his/her task on a daily and weekly basis.
  - A janitor shall be able to send messages to or call other collectors, janitors and back officers.
  - A janitor shall be able to check in, check out task every day.

- A janitor shall be able to know which vehicle to use.
- A janitor shall be able to know which route assigned to him/her.
- A janitor shall be able to know which MCP to pick garbage from.

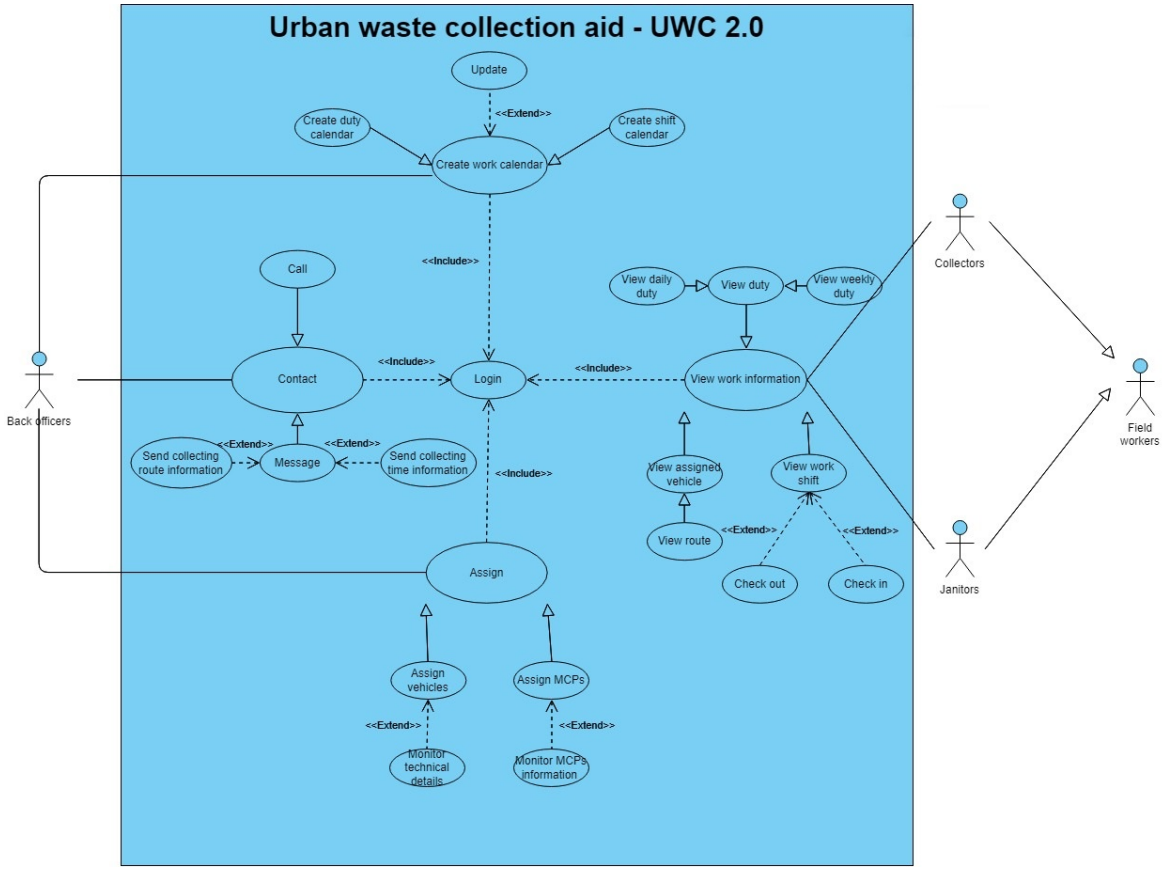
1.2.2 Non-functional requirements:

- Communication between janitors, collectors and back officers via message should be in real-time manner with delay less than 1 second.
- All important information about collector's and janitor's task should be displayed in one view (without scrolling down) and be accessed with only 1 (or the least) clicks.
- UWC 2.0 is expected to import and to use at least 95 percent of the existing data from UWC1.0.
- Task Management can call all (or up to 95 percent) of APIs made in UWC1.0.
- The system should be able to handle real-time data from at least 1000 MCPs at the moment and 10.000 MCPs in five years.
- UWC 2.0 system interfaces should be in Vietnamese, with an opportunity to switch to English in the future.
- The system can run for 8 consecutive hours with 5 consecutive concurrents without crashing.
- System can handle 10 concurrent connections, 100 messages sent by each, with error rate of missing message is 0.02 percent
- All the data should be correct and reliable at all time (at least 95 percent in a day).
- The response time of whole system is less than 2 seconds.
- UWC 2.0 can run on the following OS and devices:

  OS: Android and later, iOS, Windows 10.0,...

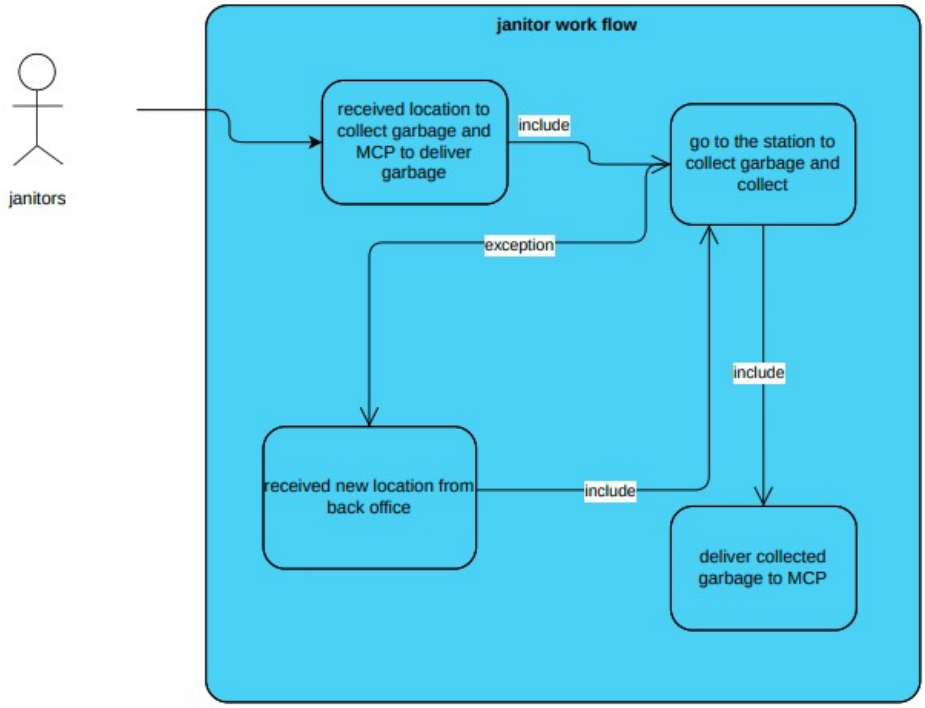
  Devices: iPhone 7.0 and later, iPad, computer,...

1.2.3 General use-case diagram for the whole system:



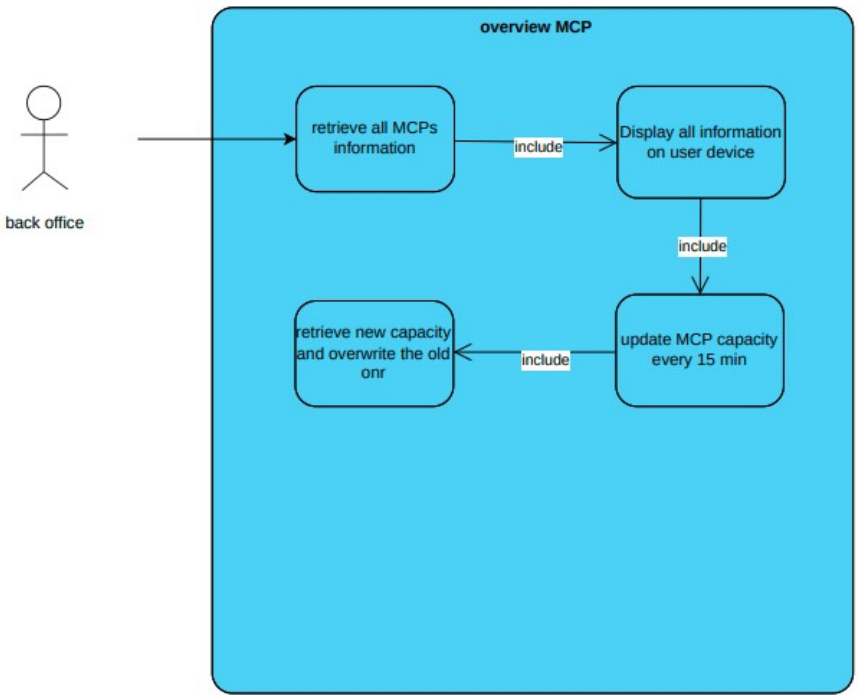
1.3 Task 1.3: For the Task assignment module, draw its use-case diagram and describe the use-case using a table format

1.3.1 Janitor's workflow



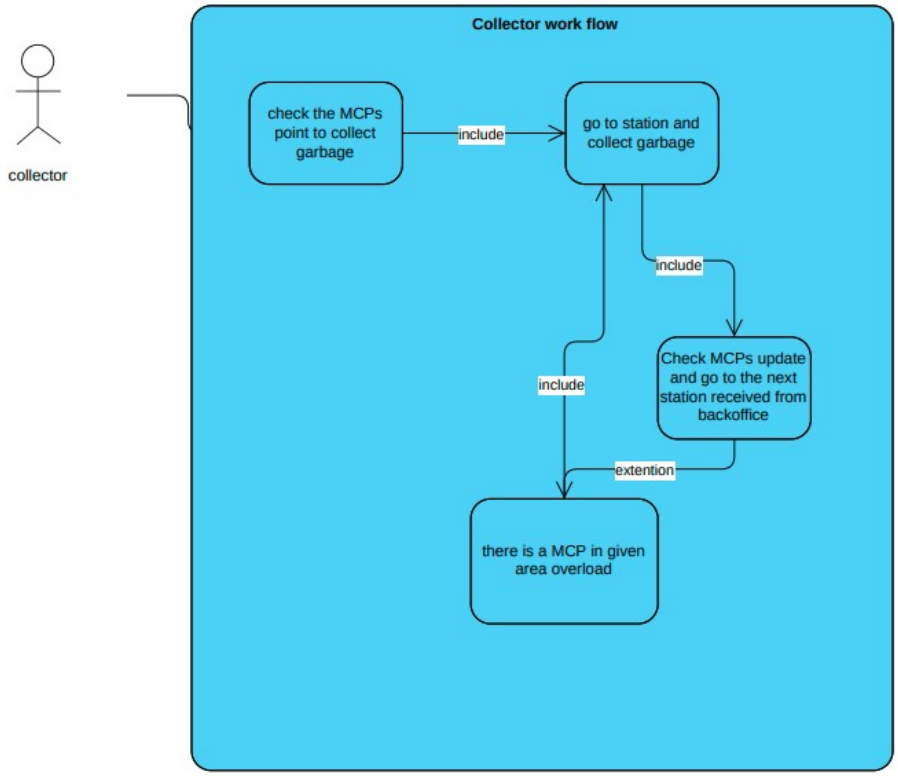
Use-case ID Use-case name	U1 Janitor work.
Use-case overview	Janitor work flow in day.
Actors	Janitors
Preconditions	The role of the user must be janitor.
Trigger	The back officers sent work location and MCP to janitor.
Steps	1. Received location to collect garbage and MCP to deliver garbage. 2. Go to the station to collect garbage and collect. 3. Deliver garbage collected to MCP.
Post conditions	The garbage is collected from the assigned area to MCP by janitor.
Exception flow	E2: janitor don't have any troller to work. E3: The MCP janitor was assigned is full.

1.3.2 Overview MCP



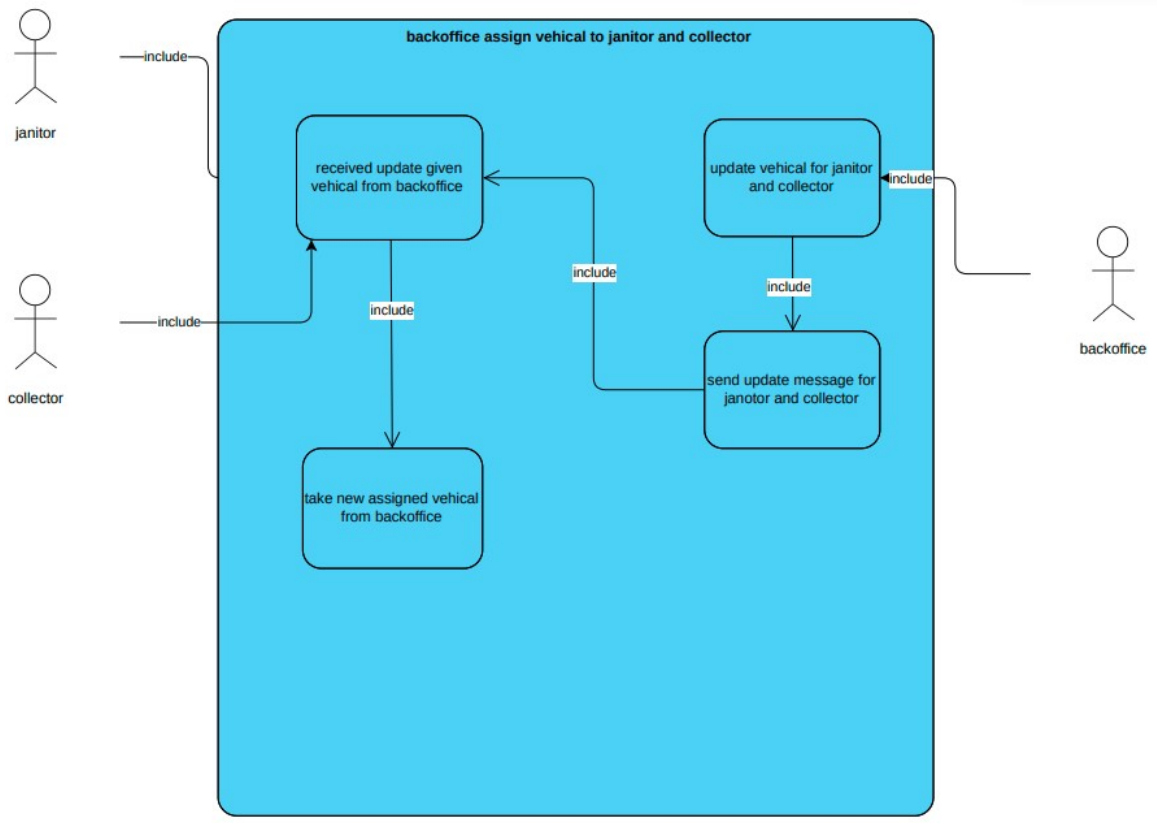
Use-case ID Use-case name	U2 Overview MCP.
Use-case overview	To provide information about Major collecting points (MCPs) and their current capacity.
Actors	Back officers.
Preconditions	1.The role of the user must be back officer. 2. Back officer is logged in and access to the “Task assignment” on the sidebar.
Trigger	User click MCP overview button.
Steps	1. Retrieve all MCP information. 2. Display all information on user device. 3. Update MCP capacity every 15 min then retrieve capacity from database and overwrite it.
Post conditions	Information is displayed on the screen of user’s device and updated every 15 minutes.
Exception flow	E1:The system fails to retrieve MCPs information. E3:The system fails to update MCPs information.

1.3.3 Collector workflow



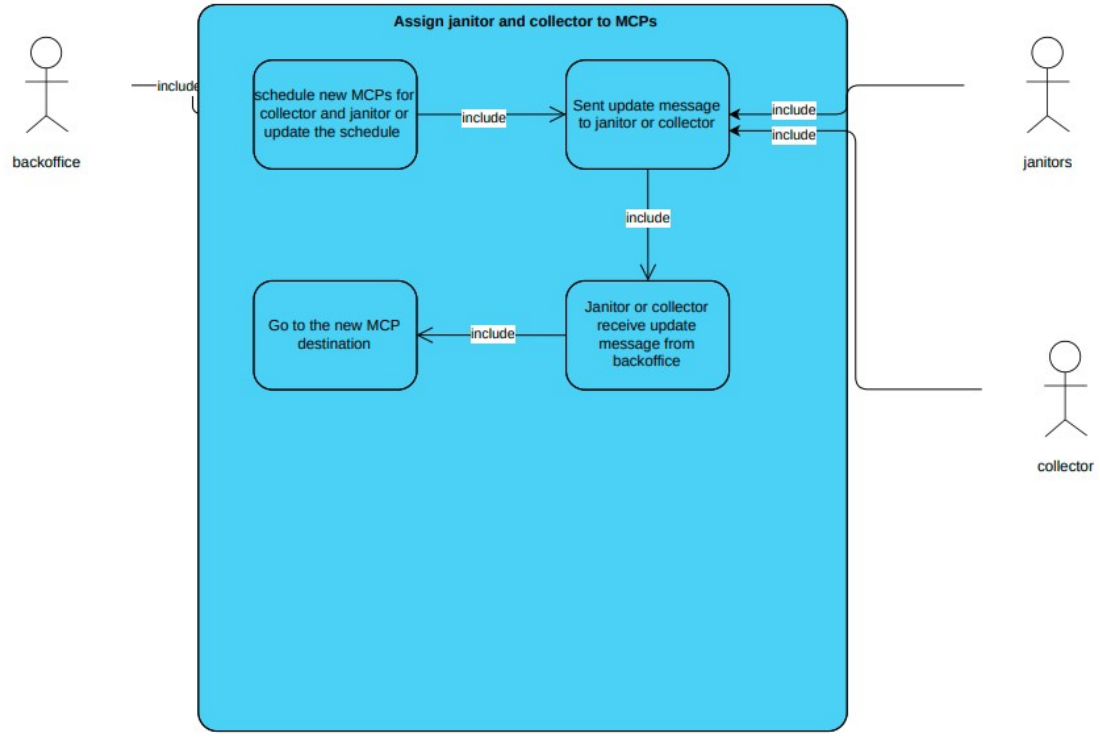
Use-case ID Use-case name	U3 Collector work.
Use-case overview	Provide and overview about collector work flow.
Actors	Collectors.
Preconditions	1. There must exist free vehicle. 2. The role of the user must be collector.
Trigger	Back officer assigns MCP to collector.
Steps	1. Check the MCP point to collect garbage. 2. Go to the MCP point the collect all garbage from janitors. 3. Check updated MCPs point, given MCPs point and go to the next place.
Post conditions	The garbage at assigned MCP is collected by collector.
Exception flow	E1: There is an MCP in assigned area overloaded.

1.3.4 Back officers assign vehicle to janitors and collectors



Use-case ID Use-case name	U4 Assign vehicle.
Use-case overview	Back officers assign new vehicles for janitors or collectors when their old vehicles got in trouble.
Actors	Back officers, collectors, janitors.
Preconditions	1. There must exist free vehicle. 2. The old vehicle got in trouble. 3. The assigner must be back officer.
Trigger	Some janitors or collectors don't have any vehicle to work.
Steps	1. Janitors update assigned vehicle for everyone. 2. Send update messages to janitors and collectors. 3. Janitors and collectors received message from back officers. 4. Collectors and janitors using new vehicle.
Post conditions	Every janitor and collector working must have a vehicle.
Exception flow	E1: No free vehicle.

1.3.5 Assign janitors and collectors to MCPs

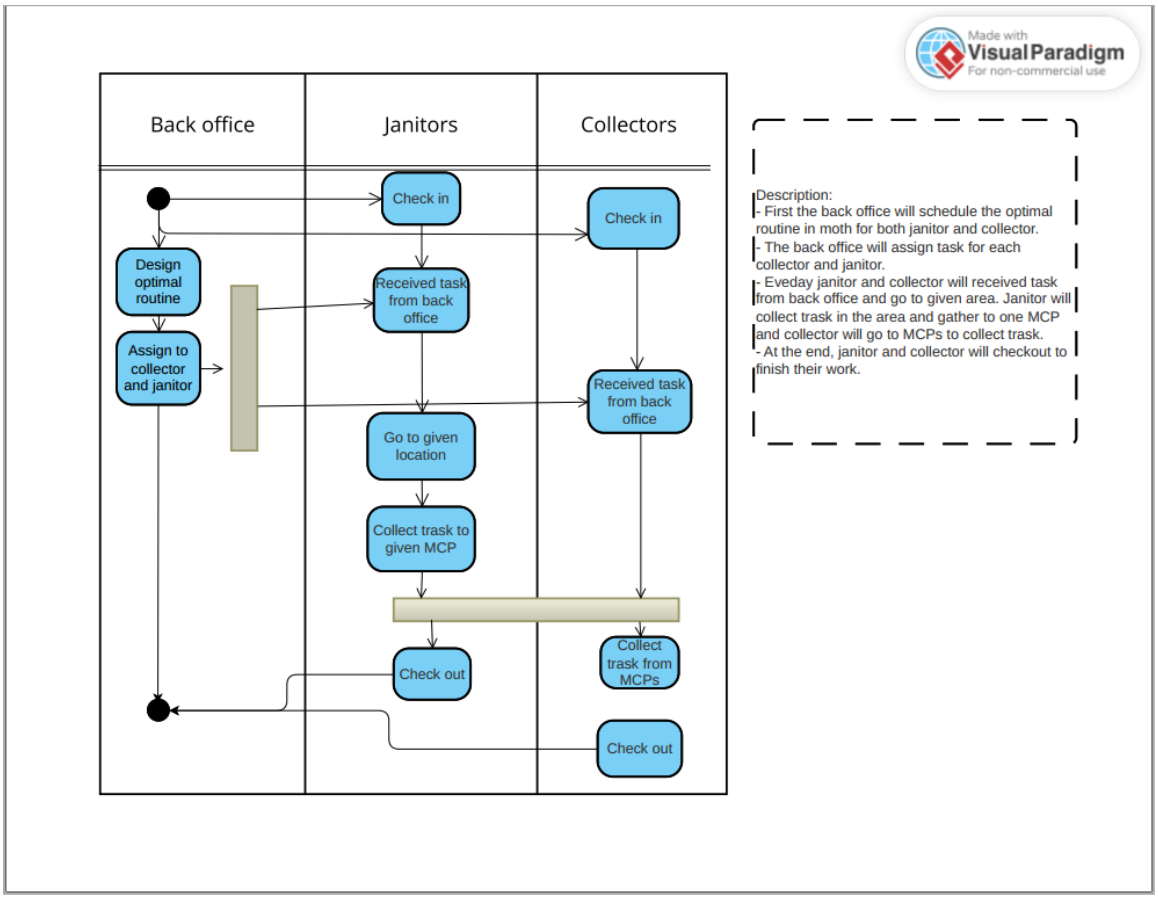


Use-case ID Use-case name	U5 Assign MCPs.
Use-case overview	Assign new MCPs for collectors and janitors.
Actors	Back officers, collectors, janitors.
Preconditions	The mobile app and website are ready to use.
Trigger	Some areas are too dirty (have too many garbage) so the people there are not enough.
Steps	1. Schedule new MCPs for collectors and janitors or update the MCP. 2. Send updated messages to janitors and collectors. 3. Janitors and collectors received message from back officers. 4. Collectors and janitors go to new MCPs.
Post conditions	Janitor and collector work at new MCP.
Exception flow	E1: All the MCPs are fully-loaded.

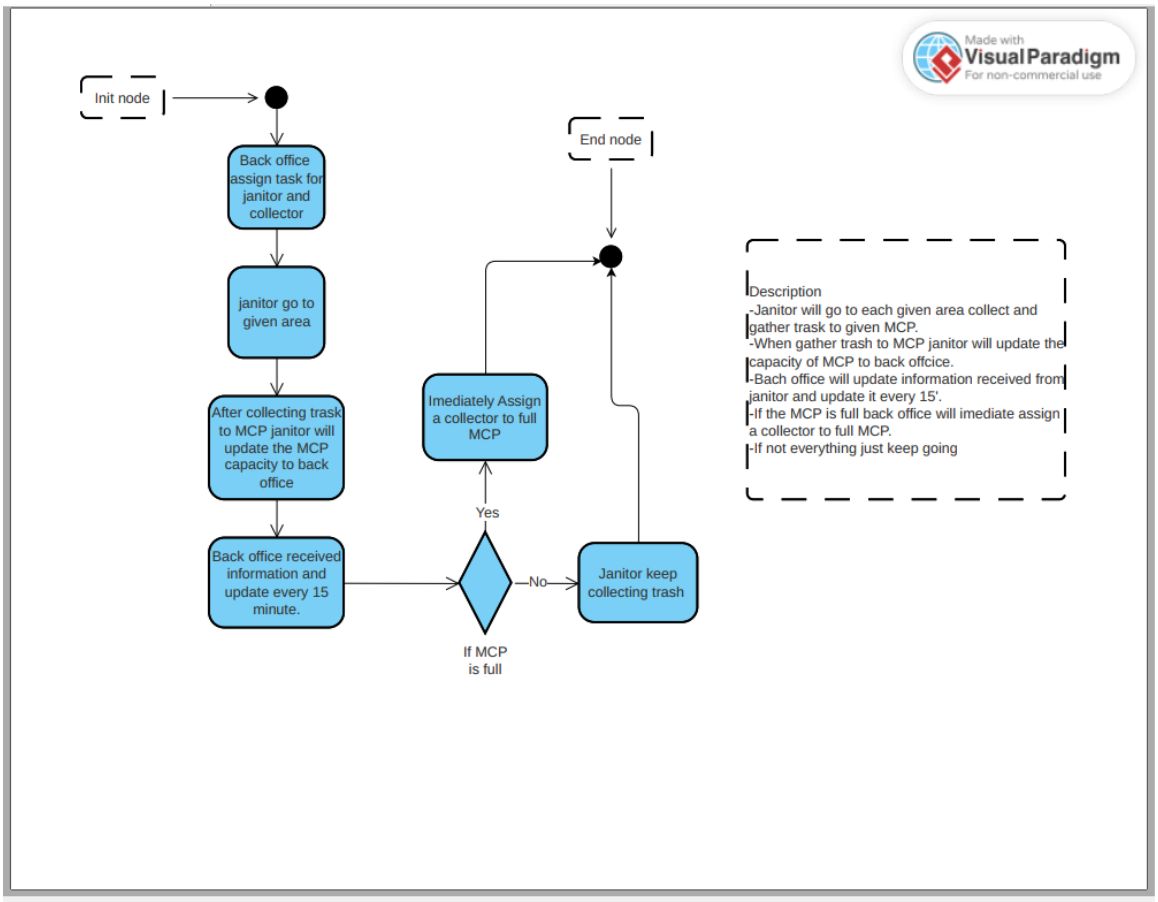
2 Task 2: System modeling

2.1 Task 2.1: Draw an activity diagram to capture the business process between systems and the stakeholders in Task Assignment module.

2.1.1 Back officers assign task to janitors and collectors, then janitors and collectors check in, do tasks and check out.

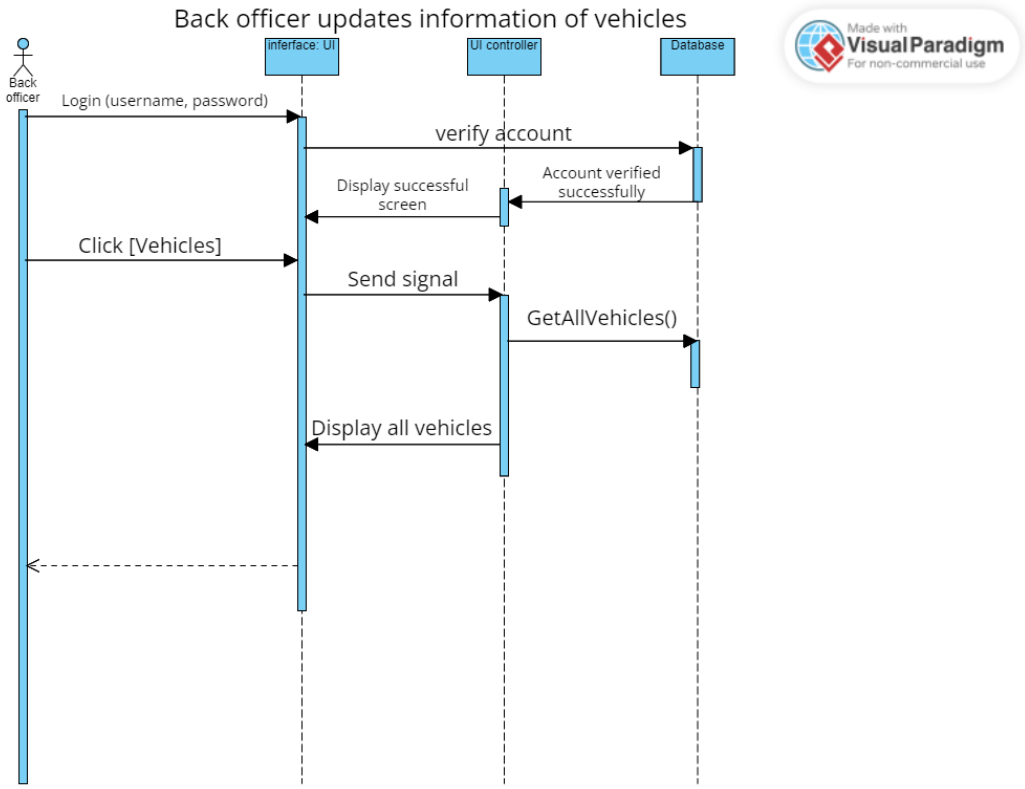


2.1.2 Janitors gather trash and update MCPs, back officer update MCPs every 15 minutes, a collector is assigned if an MCP is full.



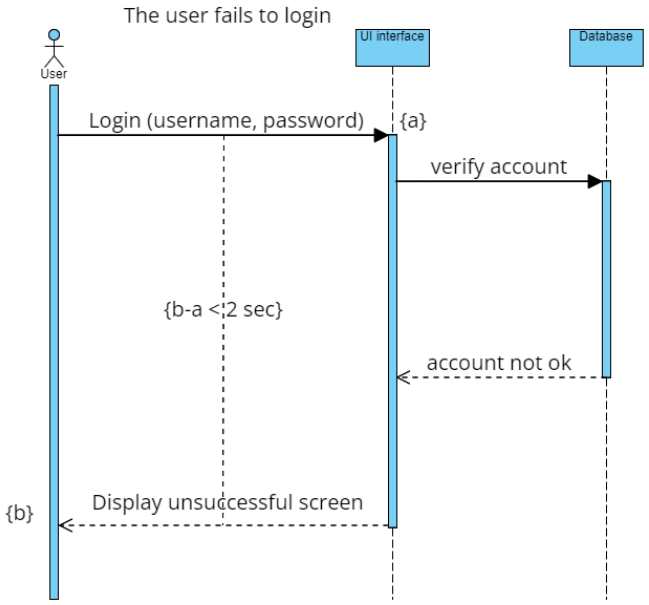
2.2 Task 2.2: Think about a possible way for a back officer to assign vehicles to janitors and collectors. Draw a sequence diagram to visualize this process.

2.2.1 Back officer updates information of vehicles



Description: At first, the back officer logins with his/her username and password. Then, the system will verify the account using the database. If the information is correct, the system sends a signal to the interface, and the screen displays a successful login result. After that, the back officer clicks "Vehicles" on the UI. The UI will then get all vehicles data from the database and display all of them on the UI for the back officer to view.

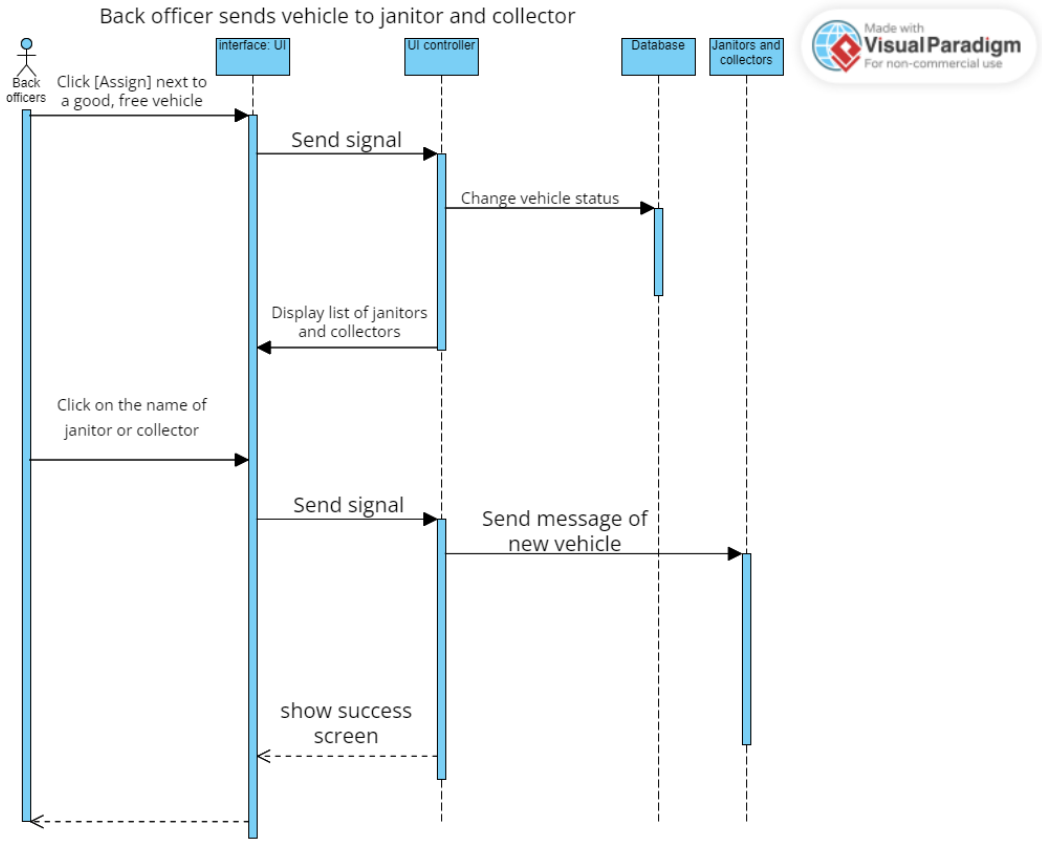
2.2.2 User fails to login



Made with VisualParadigm
For non-commercial use

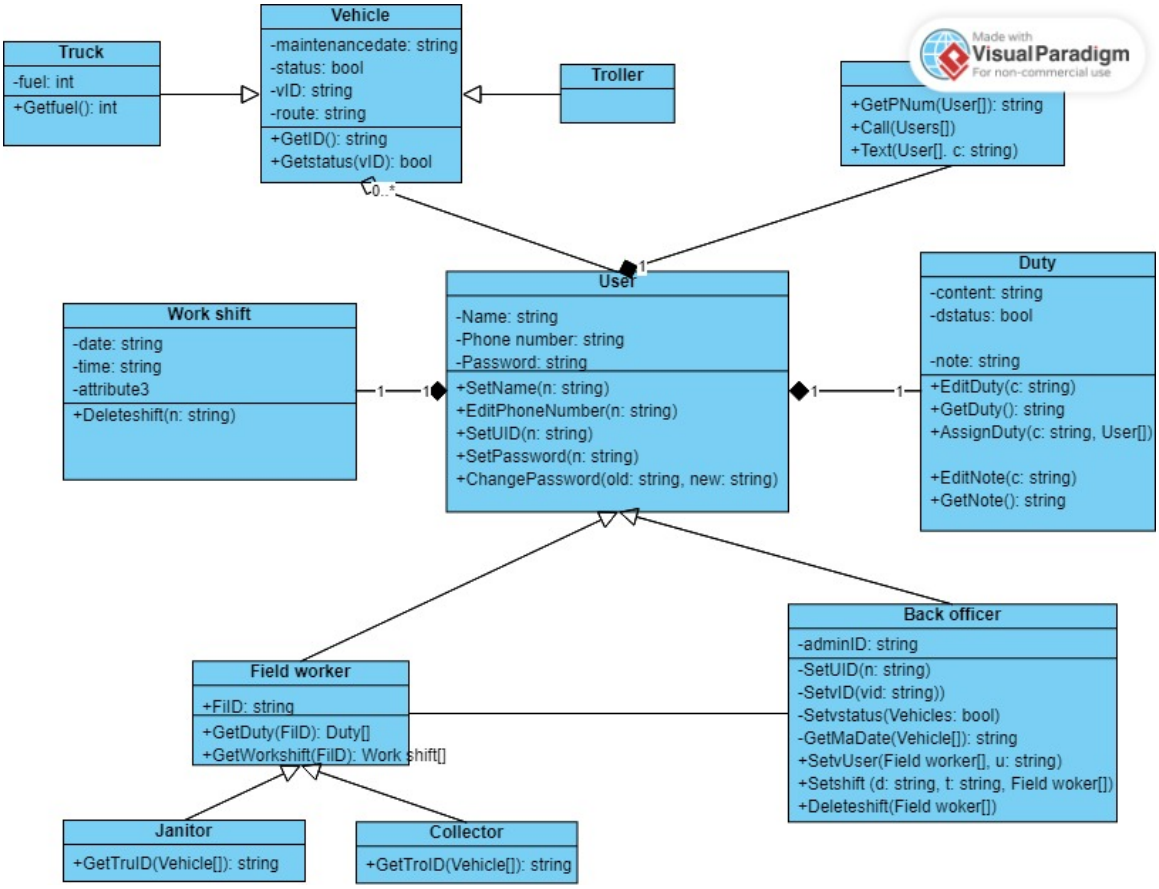
Description: If the information login is incorrect (because the username or password or both is typed wrong), the system sends a signal to the interface, and the screen displays an unsuccessful login result. The duration between the time user enters information and the time result appears must be smaller than 2 seconds.

2.2.3 Back officer sends vehicles to janitors and collectors



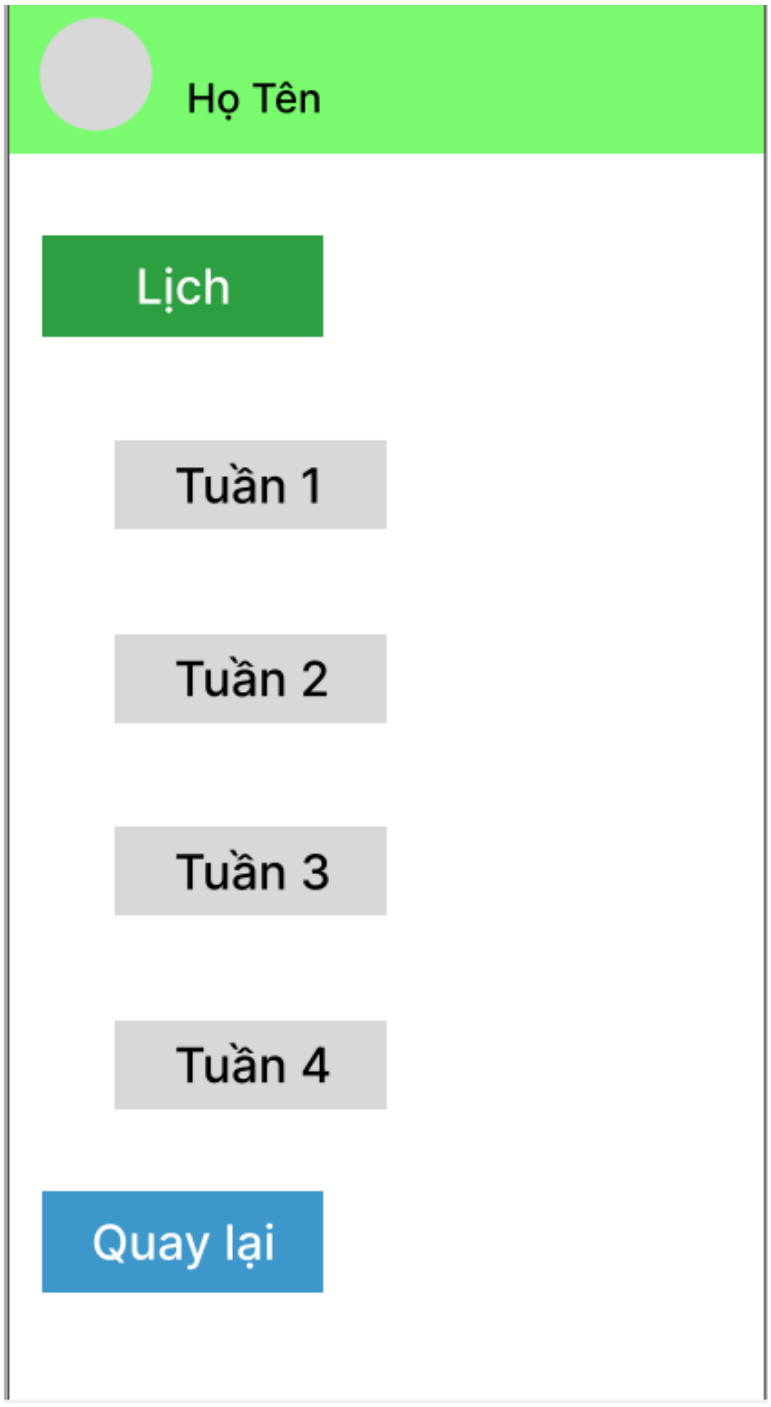
Description: When viewing all vehicles, the back officer chooses a good, free vehicle and clicks "Assign" next to it to choose the vehicle for the janitor or collector. The UI sends a signal to the UI controller, then changes the vehicle status in the database. The screen then displays the list of janitors and collectors. The back officer clicks on the name of the person he/she wants to assign the vehicle. The UI controller will send a message about the new vehicle to the janitor or collector, and the screen of the back officer displays a successful assigning result.

2.3 Task 2.3: Draw a class diagram of Task Assignment module as comprehensive as possible.



2.4 Task 2.4: Develop MVP 1 as user interfaces of a Mobile-view Task assignment for Janitors and Collectors.

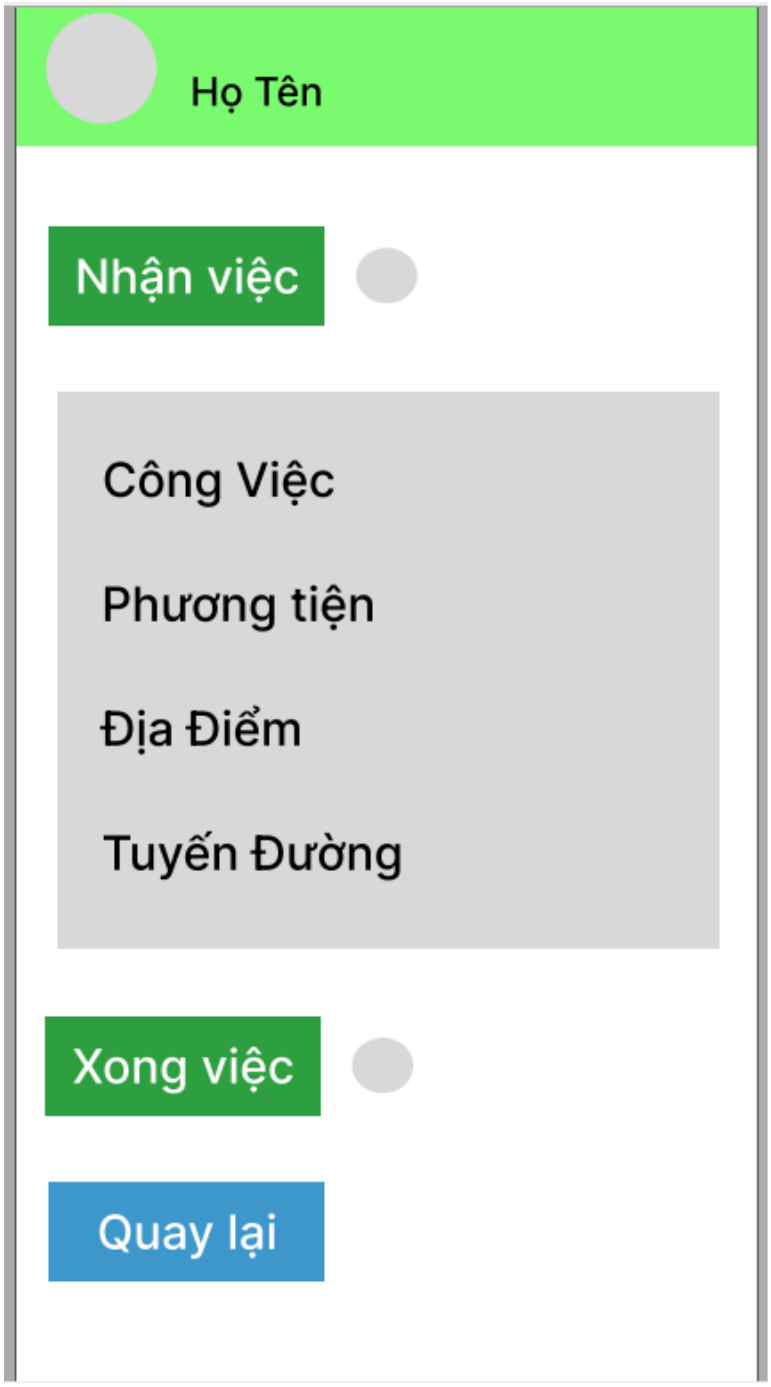
2.4.1 Home screen



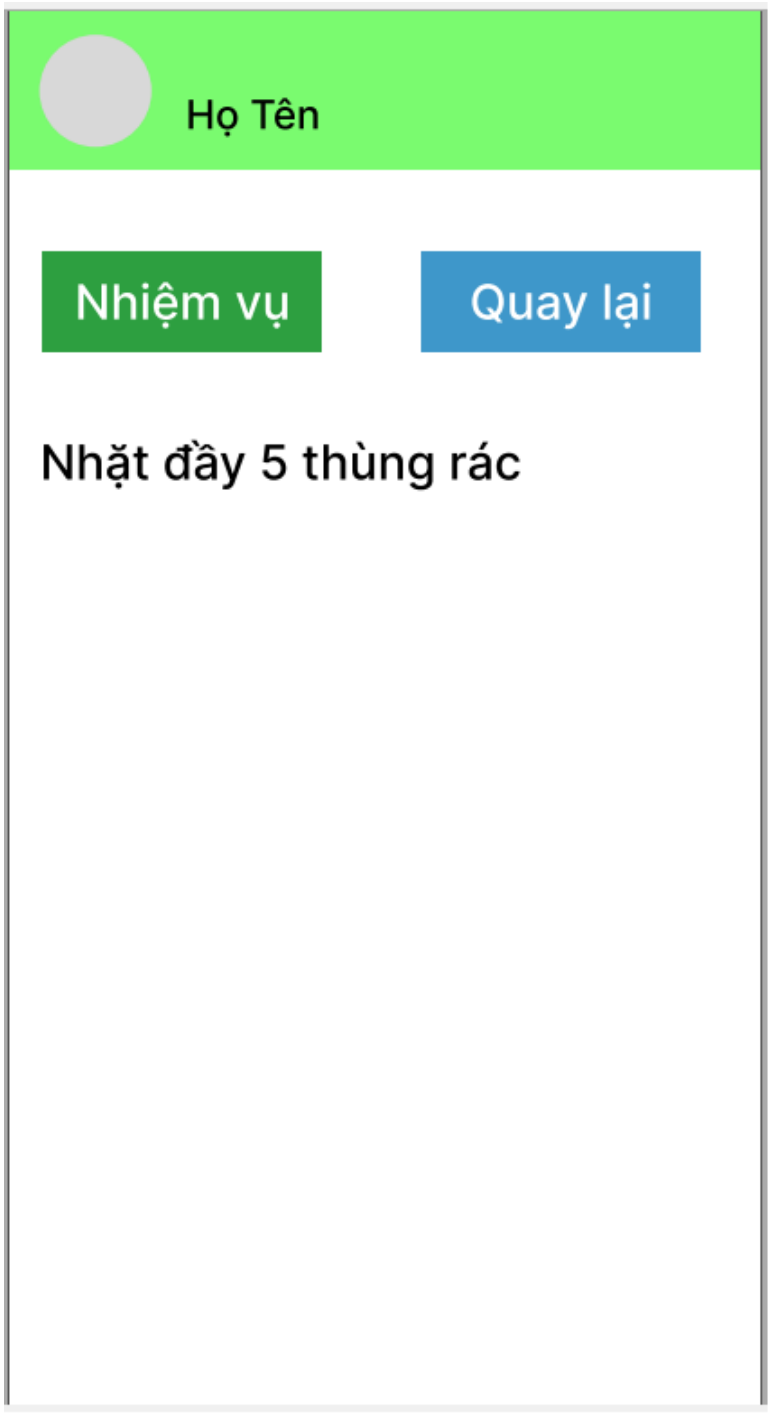
2.4.2 Screen 2

Họ Tên
Thứ hai
Thứ ba
Thứ tư
Thứ năm
Thứ sáu
Thứ bảy
Chủ nhật
Quay lại

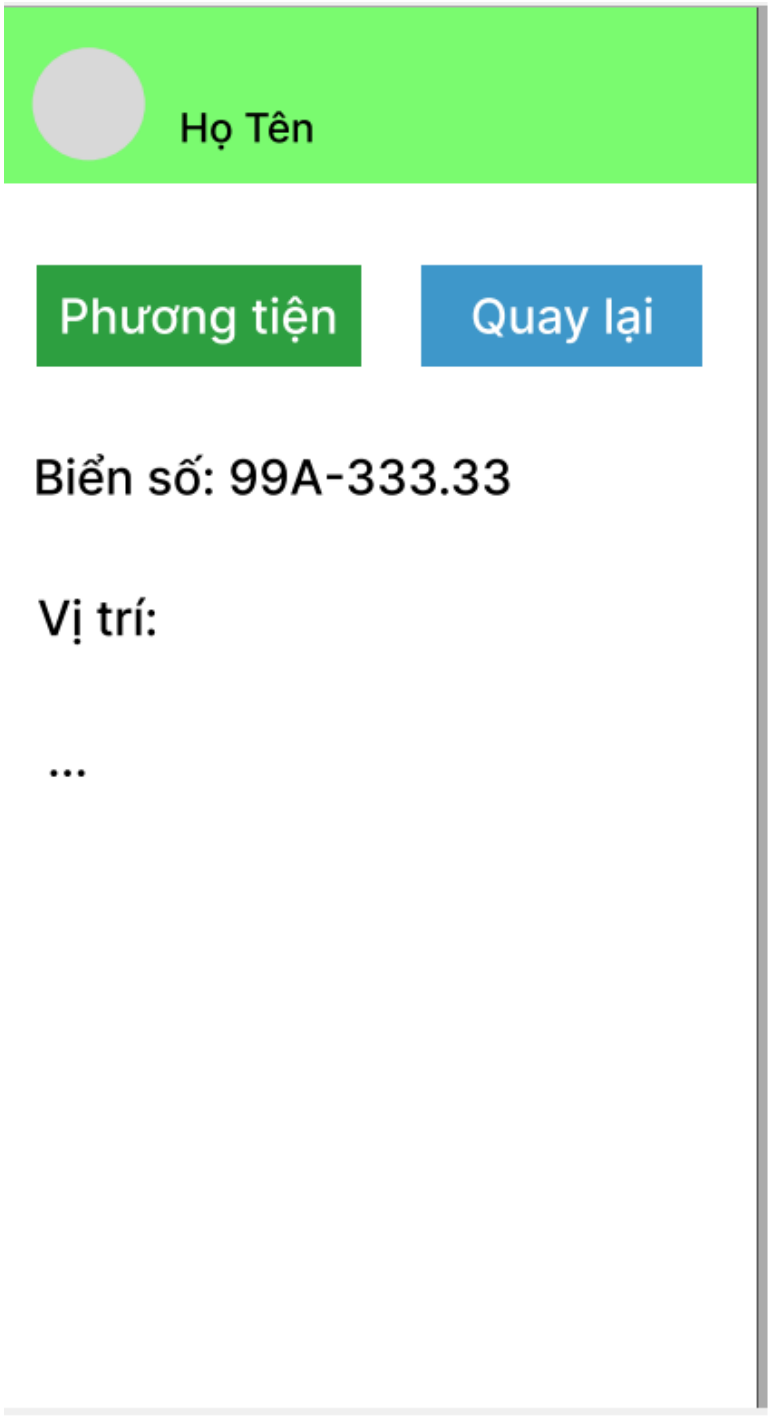
2.4.3 Screen 3

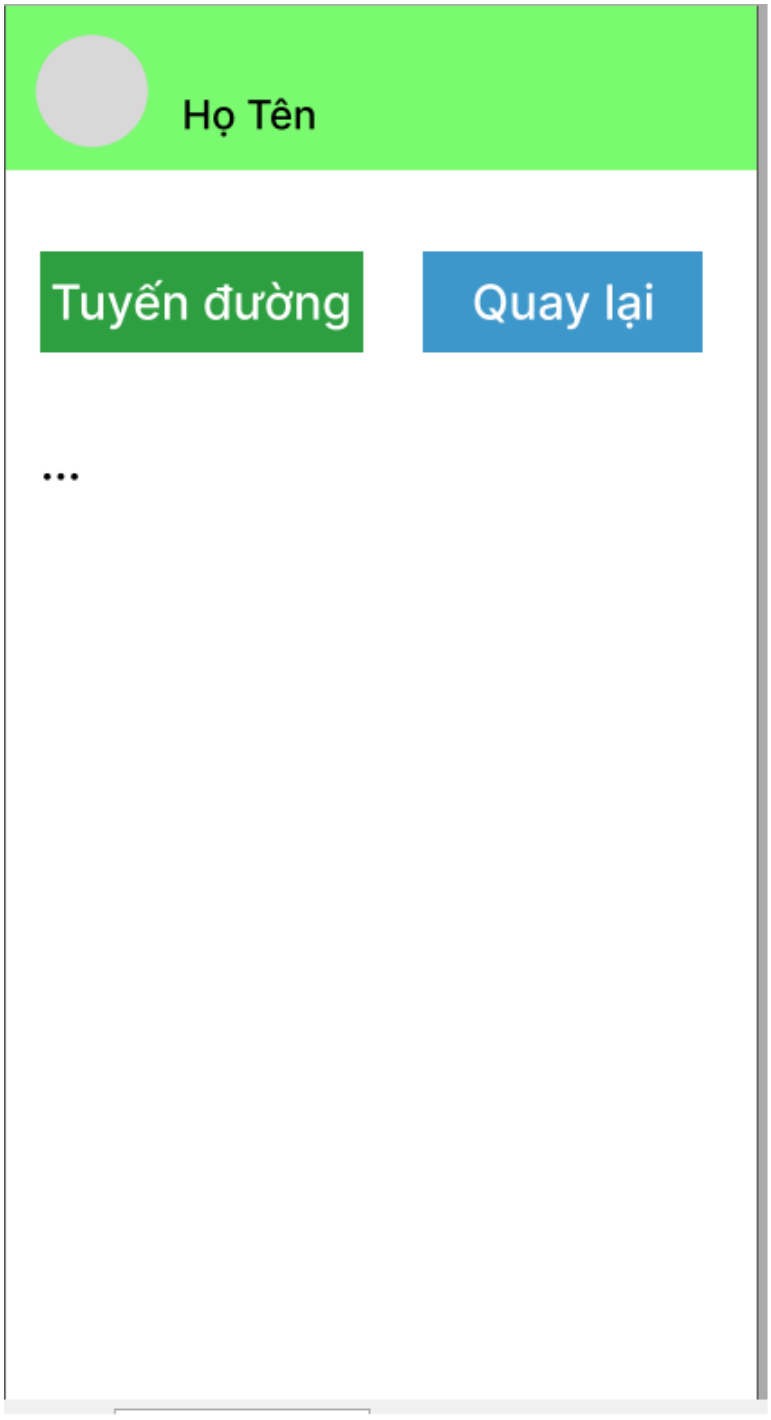

Họ Tên
Nhận việc
Công Việc
Phương tiện
Địa Điểm
Tuyến Đường
Xong việc
Quay lại

2.4.4 Screen 4



2.4.5 Screen 5



2.4.6 Screen 6

2.4.7 Screen 7