SYSTEM REQUIREMENTS

a. Functional requirements

Category	Description

Back officers	• Login into the system on a computer as an officer.
	• CRUD function:
	  ○ Back officers can create, read, update and delete (CRUD function) information (name, age, date joined, deployed area, assigned vehicle, assigned MCP, availability status,) of collectors and janitors.
	  ○ Back officers can create, read, update, and delete information of schedules:
	  ▪ View schedules on a calendar (people, vehicles)
	  ▪ Create schedules on the calendar, assign people, vehicles, locations, routes to a schedule.
	  ▪ Automatically prevent overlapping schedules.
	  ▪ A schedule can be in draft mode or be officially published to employees.
	• Sorting functions:
	  ○ Staff information by name, age, date joined, availability status.
	  ○ Vehicles by weight, capacity, fuel consumption.
	  ○ MCPs by capacity, current status, location.
	• Searching for a vehicle, a person, or an MCP by ID and name.
	• Chat with any employee/group of employees or everyone via text messages.
	• Assign functions:
	  ○ Assign a collector to a vehicle by choosing the vehicle ID from a drop-down menu in the task assignment interface.
	  ○ Assign a vehicle to an MCP by choosing the MCP id from a dropdown menu.
	  ○ Assign janitor(s) to a MCP by choosing the MCP ID from a drop-down menu.
	• Update assignments whenever a data entry is deleted from a table.
	• Plan routes from a starting point to multiple points on a mapping interface, the most efficient route is automatically selected. Routes can be assigned to vehicles.

Collectors	• Log in as a Collector on the smartphone app. • View and modify personal information. • Check map for assigned routes and MCPs (information about MCPs is included into the map). • Change the status of those MCPs to not full after collecting trash from them. • Check the schedule table to view schedules and tasks (which route to take, which vehicle to operate on). • Chat with anyone via text messages, send distress signals to officers. • Scan a QR code in the allocated vehicle to check in.
Janitors	• Log in as a Janitor on the smartphone app. • View and modify personal information. • Check the schedule table to view schedules and tasks (which route to take, which MCP, stroller to work with). • Check map for assigned routes and MCPs (information about MCPs is included into the map). • Janitors can update the status of MCPs (not full or full) when they bring trash to them. • Scan a QR code at their troller's concentration point to check in/ check out. • Chat with anyone via text messages. send distress signals to officers.

b. Non-functional requirements:

Category	**Description**
Performance	• Communication between back-officers, janitors, and collectors is in a real-time manner, with at most 1000 ms delay under Vietnam's standard 4G/LTE connection speed. This includes messaging and general

	announcements made by back-officers. • New tasks assigned to collectors and janitors should be received and rendered on the mobile UI within at most 1000 ms. • Upon app refresh by a pull-down action or button's call-back, the time taken should be at most 1000 ms for data to reload and render. • Navigating to different pages on both desktop and mobile apps should re-render the UI in a maximum 300 ms delay. • The system can handle 100 simultaneous requests at a time, and 5000 requests on average per day. • The system's routing algorithm should return the results within at most 2000 ms.
Scalability	• The system can handle up to 10000 MCPs in 5 years' time.
Reliability and recoverability	• The probability of failures that require application restart should be less than 1%. • The system should support a recovery point objective of 1 hour. • The system should support a recovery time objective of 5 minutes.
Security	• The system should encrypt data in transit using HTTPS and logically isolate customer data. • The system should log employee access to systems that contain personal data.
Usability	• Ease of navigation: at most 6 items under the navigation drawer in the desktop-view central dashboard for back officers and at most 4 items under the bottom navigation bar for the mobile-view screen for janitors and collectors. All mentioned items should have descriptive labels and icons for intuitiveness. • At most 5 clicks/taps to use a certain feature in each UI page. • Back-officers, collectors, and janitors can grasp basic control of the system (key features and navigation) within 10 minutes of training.
Availability	• The percentage that the system is accessible to system

	users on a work day is no less than 95%.

Localization	• Language options: Vietnamese by default, with the ability to switch to English.
	• In-app measurements: correspond to SI units as follows:
	  • Distance: kilometers.
	  • Weight: kilograms.
	  • Volume: cubic meters.
	• Date-time format corresponds to Vietnamese standards.
	  • Date: dd/mm/yyyy.
	  • Time: GMT+7 time zone, formatted as hh::mm::ss on the 24-hour clock time.

Interoperability	• On the back officer's end, the system should work effectively on desktop and laptop machines running Windows, MacOS, and Linux operating systems. • On the collectors and janitors' end, the system should work effectively on mobile phones running Android and iOS operating systems via native applications. • The UWC 2.0 system should be interoperable with the existing UWC 1.0 system.