Based on the real-world problems discussed in Chapter 1, Chapter 2 aims to delve deeper into the existing products and solutions that can help address these issues. Specifically, it will also analyze some detailed use cases of the Data Management System, as outlined in Section 2.2.

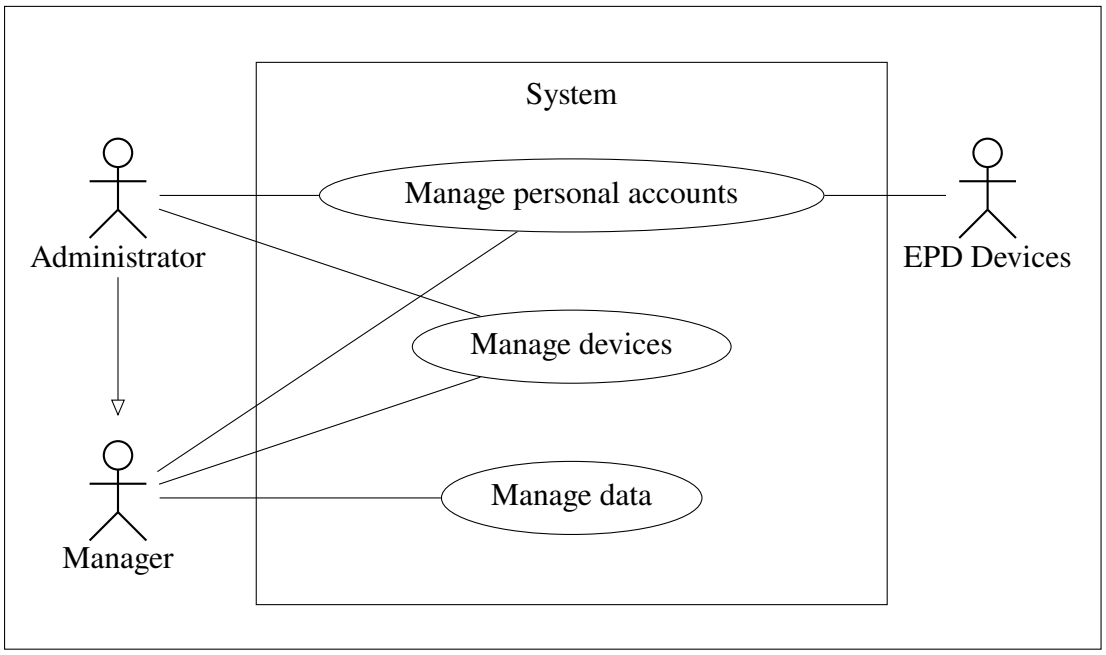
0.1 Status survey

Thông thường, khảo sát chi tiết về hiện trạng và yêu cầu của phần mềm sẽ được lấy từ ba nguồn chính, đó là (i) người dùng/khách hàng, (ii) các hệ thống đã có, (iii) và các ứng dụng tương tự. Sinh viên cần tiến hành phân tích, so sánh, đánh giá chi tiết ưu nhược điểm của các sản phẩm/nghiên cứu hiện có. Sinh viên có thể lập bảng so sánh nếu cần thiết. Kết hợp với khảo sát người dùng/khách hàng (nếu có), sinh viên nêu và mô tả sơ lược các tính năng phần mềm quan trọng cần phát triển.

0.2 Functional Overview

0.2.1 General use case diagram

The general use case diagram of Data and EPD Devices Management System is illustrated in Figure 1. As per the diagram, the system involves three main agents, namely The Manager, The Administrator, and the EPD devices. The Manager has the ability to manage EPD devices, data and their own accounts. The Administrator inherits the functions of the Manager and can also manage and test the devices more advanced. On the other hand, the EPD devices act as end-users and receive and display data on the screen. They also interact with the system via MQTT protocol.

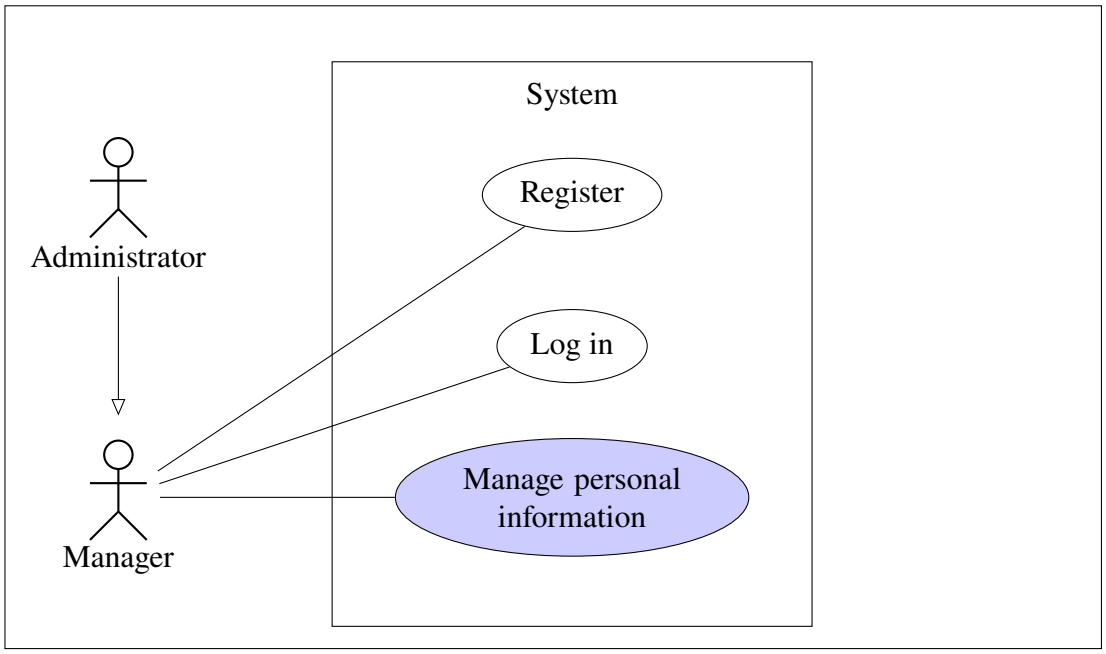


Hình 0.1: General use case diagram of the data management system

0.2.2 Detailed use case diagram

a, Detailed use case of User's Account Management function

Figure 2 below describes the detailed use case diagram of the User's Account Management function, including the Manager and Administrator. Users can create a new account, log in, and modify personal information.



Hình 0.2: Detailed use case of User's Account Management function

b, Detailed use case of Data Management function

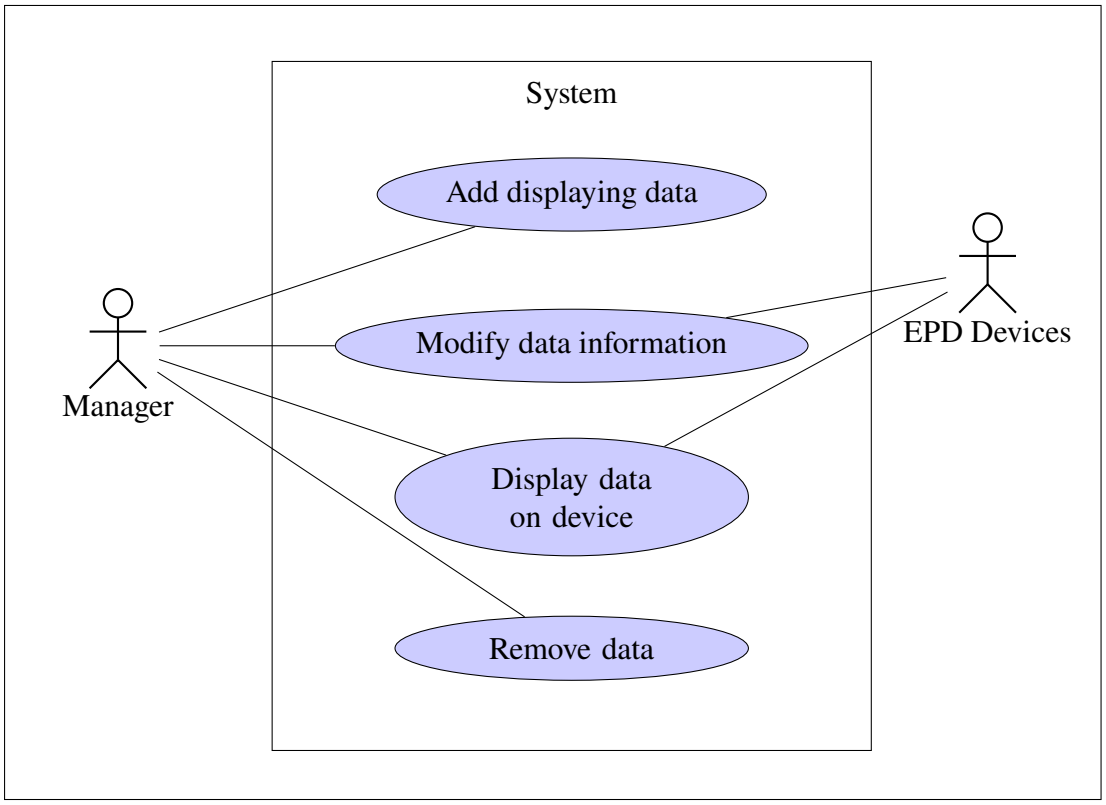
A detailed use case diagram of the Data Management function of the Manager is displayed in Figure 3. This function enables the Manager to view a list of data, add, modify, or remove data information, and choose whether to display the data on the device or not.

c, Detailed use case of Device Management function

Figure **??** illustrates the use case diagram of the Device Management function, showing 2 actors participating in the system. This function enables the Manager to view a list of devices add, modify, or remove device information. The Administrator, inheriting the functions of the Manager, can also debug the device after connecting it to the computer via a USB port.

0.2.3 Business process

In the system, there are many business processes, the most prominent are the process of adding data and displaying it on EPD devices, and the process of adding EPD devices to the system. Each flow demonstrates how the system communicates with the device via USB and the MQTT protocol, and how the device receives and



Hình 0.3: Detailed use case of Data Management function

processes data.

a, "Creating new device" flow

Figure **??** below shows the business process when the Manager creates and registers a new device to the system. This process requires the users to connect the EPD device to the computer via a USB port, choose from the list of connected devices, and then fill in the information before submitting it to the system. After the system receives the submitted data, it sends the data write request to the device via Serial Port. The device will connect to the internet with the information received, and then connect to MQTT Broker before publishing its connection status to the system.

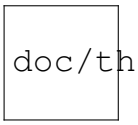
doc/thesis/EN/imgs/act_new-device.png

Hình 0.4: Quy trình tạo thiết bị mới.

b, "Creating and displaying new data" flow

Figure 6 below describes the business process when users add data to the system. First, the user will select the type of data they want to display, and then, based on the selected data type, the user will add the corresponding detailed information. Users

can also choose whether to allow display on the EPD device or not. If allowed, the system will get a list of devices connecting to the MQTT Server for the user to choose from, and the user will fill in additional information about how to display on the device. After receiving information from the user, the system will send MQTT messages via MQTT Broker, and the selected device will receive and display the information and send back the status to the system via MQTT protocol.



Hình 0.5: Quy trình tạo dữ liệu và hiển thị trên thiết bị.

0.3 Functional description

Sinh viên lựa chọn từ 4 đến 7 use case quan trọng nhất của đồ án để đặc tả chi tiết. Mỗi đặc tả bao gồm ít nhất các thông tin sau: (i) Tên use case, (ii) Luồng sự kiện (chính và phát sinh), (iii) Tiền điều kiện, và (iv) Hậu điều kiện. Sinh viên chỉ vẽ bổ sung biểu đồ hoạt động khi đặc tả use case phức tạp. ok kj ghj

ID	**Name**
UC01	Create new device
UC02	Modify device information
UC03	Remove device
UC04	Add new data
UC05	Modify data information
UC06	Remove data
UC07	Create account
UC08	Sign in

Bảng 1: Danh sách thư viện và công cụ sử dụng

0.3.1 Description of use case "Create new device"

ID	UC01	**Name**	Create new device
Actor	Manager, System, EPD device		
Pre-condition	The user logs into the system as a Manager. To create a new device and edit device information in case the device is not connected to the Internet, users need to connect the device to the computer via a USB port.		
Main scenario (success)	**No.**	**Executed by**	**Action**
	1	Manager	Select "New Device" function

Main scenario (success)	**No.**	**Executed by**	**Action**
	2	System	Retrieve and display the list of devices connected via USB
	3	Manager	Choose a device from the list
	4	System	Connect to the device via Serial Port
	5	System	Display the interface to enter device information
	6	Manager	Fill in the device information (described below *)
	7	Manager	Send a request to create a new device
	8	System	Store device information at the server and transmit data to the connected device
	8.1	System	Store device information at the server
	8.2	System	Transmit data to the EPD device
	8.2.1	Connected EPD device	Process the received information
	8.2.2	Connected EPD device	Connect to the Internet and MQTT Broker
	8.2.3	Connected EPD device	Send status information to the server
	8.2.4	System	Receive and edit information of the new device
	9	System	Notify successful device creation
Extensions	**No.**	**Executed by**	**Action**
	4a.	System	Error message: unable to connect to the device
	8.1a	System	Error message: need to enter all required fields of the device if the Manager misses any
	8.2.2a	System	If no update response is received from the device, save the device information

0.3.2 Description of use case "Modify device information"

ID	UC02	**Name**	Modify device information
Actor	Manager, System, EPD device		
Pre-condition	The user logs into the system as a Manager. To create a new device and edit device information in case the device is not connected to the Internet, users need to connect the device to the computer via a USB port.		
Main scenario (success)	**No.**	**Executed by**	**Action**
	1	Manager	Access Dashboard, select Device
	2	System	Retrieve and display the list of registered devices
	3	Manager	Choose a device from the list and select Edit
	4	System	Check the status of the device
	4.1	System	If the device is not connected to the system, display a message asking the user to connect the device via USB
	4.2	Manager	Connect the device via USB and choose from the list of connected devices
	5	System	Display the interface to enter device information (described below *)
	6	Manager	Fill in and send a request to change device information
	7	System	Save the new updated information
	7.1	System	If the device is connected via USB, transmit data to the connected EPD device
	7.2	System	If the device is connected to the MQTT server, send a request to change information on the device via the MQTT protocol
	8	Connected EPD device	Process the received information
	8.1	Connected EPD device	If the device is connected via USB, connect to the Internet and MQTT Broker
	9	Connected EPD device	Send status information to the server
	10	System	Receive and edit information of the new device
	11	System	Notify successful device information change
Extensions	**No.**	**Executed by**	**Action**
	4.2a.	System	Error message: unable to connect to the device
	7a.	System	Error message: need to enter all required fields of the device if Manager misses any

Main scenario (success)	**No.**	**Executed by**	**Action**
	10a.	System	If no update response is received from the device, save the device information

0.3.3 Description of use case "Remove a device"

ID	UC03	**Name**	Remove a device
Actor	Manager, System, EPD device		
Pre-condition	The user logs into the system as a Manager. To create a new device and edit device information in case the device is not connected to the Internet, users need to connect the device to the computer via a USB port.		
Main scenario (success)	**No.**	**Executed by**	**Action**
	1	Manager	Access the Dashboard, select Device
	2	System	Retrieve and display the list of registered devices
	3	Manager	Choose a device from the list and select Delete
	4	System	Display a warning asking the user to confirm deletion
	5	Manager	Confirm deletion of data
	6	System	Check the display status of the device
	6.1	System	If the device is not displaying data, remove the device from the system
	6.2	System	If the device is displaying data, send a request to delete data on the device via MQTT
	6.2.1	EPD Device	Process the received information, delete the displaying data information
	6.2.3	System	Remove device display information from the data
Extensions	7	System	Notify successful remove
	No.	**Executed by**	**Action**
	6a.	System	End the use case if the user confirms not to delete the device
	6.2.3a	System	Error message: unable to delete the device if an error occurs during deletion

0.3.4 Description of use case "Add new data"

ID	UC04	**Name**	Add new data
Actor	Manager, System, EPD device		
Pre-condition	The user logs into the system as a Manager. To create a new device and edit device information in case the device is not connected to the Internet, users need to connect the device to the computer via a USB port.		
Main scenario (success)	**No.**	**Executed by**	**Action**
	1	Manager	Select "New Data" function
	2	System	Display the interface to choose data type to add
	3	Manager	Choose the type of data from the list
	4	System	Display the interface to enter data information
	5	Manager	Fill in the data information (described below *)
	5.1	System	If the user chooses to display on a device, show the interface to select device and design
	5.2	Manager	Choose device to display, and choose the design
	6	Manager	Send a request to create new data
	7	System	Save new data information on the server
	7.1	System	If the user chooses to display data, transmit data to the connected EPD device
	7.2	EPD Device	Process the received information
	7.3	EPD Device	Display the data
	7.4	EPD Device	Send status information to the server
	7.5	System	Receive and update data information
	8	System	Notify successful creation of the data
Extensions	**No.**	**Executed by**	**Action**
	4a	System	Error: need to enter all required fields of the device if the Manager misses any
	5.1a	System	If there is no active devices, notify users and finish the use case
	7.1a	System	Error: Can’t write data to th device

0.3.5 Description of use case "Modify data information"

ID	UC05	**Name**	Modify data information
Actor	Manager, System, EPD device		
Pre-condition	The user logs into the system as a Manager. To create a new device and edit device information in case the device is not connected to the Internet, users need to connect the device to the computer via a USB port.		
Main scenario (success)	**No.**	**Executed by**	**Action**
	1	Manager	Access Dashboard, select Data
	2	System	Retrieve and display the list of data
	3	Manager	Choose a data from the list and select Edit
	4	System	Display the interface to enter data information
	5	Manager	Fill in the data information (described below *)
	5.1	System	If the user chooses to display on a device, show the interface to select device and design
	5.2	Manager	Choose device to display, and choose the design
	6	Manager	Send a request to update data
	7	System	Save the updated data on the server
	7.1	System	If the user chooses to display data, transmit data to the connected EPD device
	7.2	EPD Device	Process the received information
	7.3	EPD Device	Display the data
	7.4	EPD Device	Send status information to the server
	7.5	System	Receive and update data information
	8	System	Notify successful update
Extensions	**No.**	**Executed by**	**Action**
	4a	System	Error: need to enter all required fields of the device if the Manager misses any
	5.1a	System	If there is no active devices, notify users and finish the use case
	7.1a	System	Error: Can’t write data to th device

0.3.6 Description of use case "Remove data"

ID	UC06	**Name**	Remove data
Actor	Manager, System, EPD device		
Pre-condition	The user logs into the system as a Manager. To create a new device and edit device information in case the device is not connected to the Internet, users need to connect the device to the computer via a USB port.		
Main scenario (success)	**No.**	**Executed by**	**Action**
	1	Manager	Access Dashboard, select Data
	2	System	Retrieve and display the list of data
	3	Manager	Choose a data from the list and select Delete
	4	System	Display a warning asking the user to confirm deletion
	5	Manager	Confirm deletion of data
	6	System	Check the display status of the data
	6.1	System	If the data is being displayed, send a request to delete data on the device via MQTT
	6.2	EPD Device	Process the received information, delete the displaying data information
	6.3	System	Remove data information on the device
	7	System	Remove the data from the system
	8	System	Notify successful remove
Extensions	**No.**	**Executed by**	**Action**
	6a	System	End the use case if the user confirms not to delete the data
	7a	System	Error message: unable to delete the device if an error occurs during deletion

0.3.7 Description of use case "Create account"

ID	UC07	**Name**	Create account
Actor	Manager, System		
Pre-condition	The user logs into the system as a Manager. To create a new device and edit device information in case the device is not connected to the Internet, users need to connect the device to the computer via a USB port.		
Main scenario (success)	**No.**	**Executed by**	**Action**
	1	Manager	Go to the sign-up page

Main scenario (success)	**No.**	**Executed by**	**Action**
	2	System	Display the interface to fill user information
	3	Manager	Fill in the user information (described below *)
	4	Manager	Send a request to create new account
	5	System	Save new user information on the server
	6	System	Notify successful creation of the user, and direct to log-in page

0.3.8 Description of use case "Sign in"

ID	UC08	**Name**	Sign in
Actor	Manager, System		
Pre-condition	The user logs into the system as a Manager. To create a new device and edit device information in case the device is not connected to the Internet, users need to connect the device to the computer via a USB port.		
Main scenario (success)	**No.**	**Executed by**	**Action**
	1	Manager	Go to the sign-in page
	2	System	Display the interface to fill user email and password
	3	Manager	Fill in the user credentials
	4	Manager	Send a request to check account
	5	System	Notify successful log-in, and rederiect to dashboard page
Extensions	**No.**	**Executed by**	**Action**
	5a	System	Error: User's credentials are incorrect

0.4 Non-functional requirement

Given the unique nature of the system, where a user must manage a vast array of data across numerous devices in an open environment, system security is a top priority when facilitating communication between devices. Additionally, the system requires transparency and user-friendliness for new users, including those with physical impairments. Moreover, to operate reliably in large enterprise environments with numerous devices, users, and data, the system also demands high fault tolerance, ease of inspection, upgrades, and maintenance.

0.4.1 Security

0.4.2 Security

0.4.3 Security