MINISTRY OF EDUCATION AND TRAINING

FPT UNIVERSITY

Capstone Project Document

Applying IOT for managing household gas cylinder

<SWP490_G22>	
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- Hanoi, <Dec>/<2020> -

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Last but not least, we would like to thank FPT University for giving us this precious opportunity to constantly study and improve ourselves. What we learned through this project will be the basis for us to work well after graduation.

Definition and Acronyms

Acronym	Definition
BA	Business Analysis
BR	Business Rule
ERD	Entity Relationship Diagram
GUI	Graphical User Interface
PM	Project Manager
SDD	Software Design Description
SPMP	Software Project Management Plan
SRS	Software Requirement Specification
UAT	User Acceptance Test
UC	Use Case
API	Application Program Interface
IOT	Internet of things

I. Project Introduction

1. Overview

1.1 Project Information

- Project name: **Applying IOT for managing household gas cylinder**
- Project code: **Gas-Meter**
- Project group name: **SWP490_G22**
- Product type: IOT, Website and Mobile Application.

1.2 Project Team

a. Supervisor

Full Name	Email	Phone Number	Title
Phan Duy Hung	HungPD2@fe.edu.vn	0975597339	Lecturer

b. Team Members

Full Name	Email	Mobile	Role
Nguyen Huu Phuong	PhuongNHSE05047@fpt.edu.vn	0357123633	Leader
Nguyen Hai Dang	DangNHSE05366@fpt.edu.vn	0967611312	Member
Tran Ngoc Thanh	ThanhTNse04960@fpt.edu.vn	0378972120	Member
Vu Duy Hung	HungVDse05582@fpt.edu.vn	0365386210	Member
Nguyen Manh Ha	HaNMHE130235@fpt.edu.vn	0944036163	Member

2. Product Background

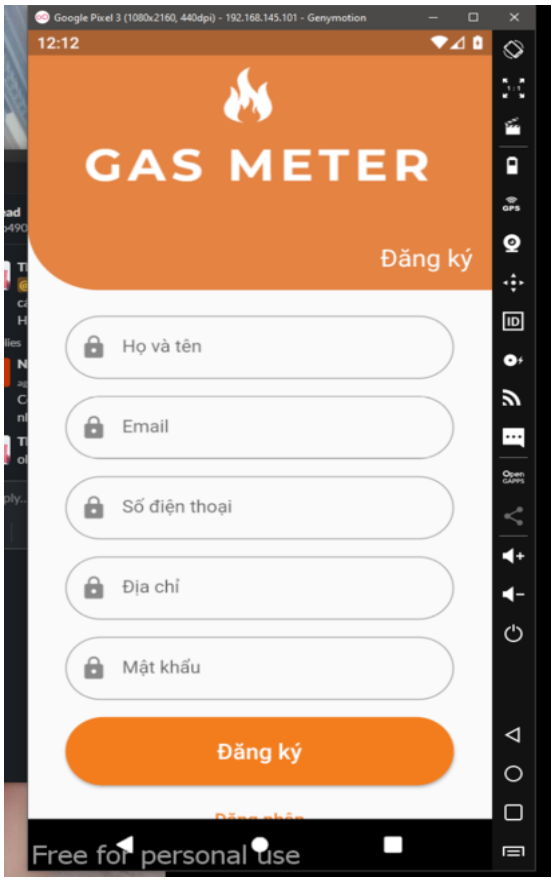
Today, many families are still using gas for cooking and warming during winter. Since they would buy gas at the gas stores, it is essential to have a software that support managing gas exchanges between the store and the customers. Also, there are risks that related to safety while using gas – leaked gas can easily start a fire or explosion. Therefore, we aim to develop a system that manages anything related to manage gas situation between stores and customers.

3. Existing Systems

3.1 Mobile application

This software can be downloaded on Google Play.In the future, we can develop on App Store. The mobile app is used by the customers of the gas store. If an user is a new user, he/she can register an account through the app and login. From the app:

- User can check the following parameters: gas concentration, temperature, remaining gas, ...
- Users also receive risk notifications and warnings when there is a fire hazard
- Update location user through the app.

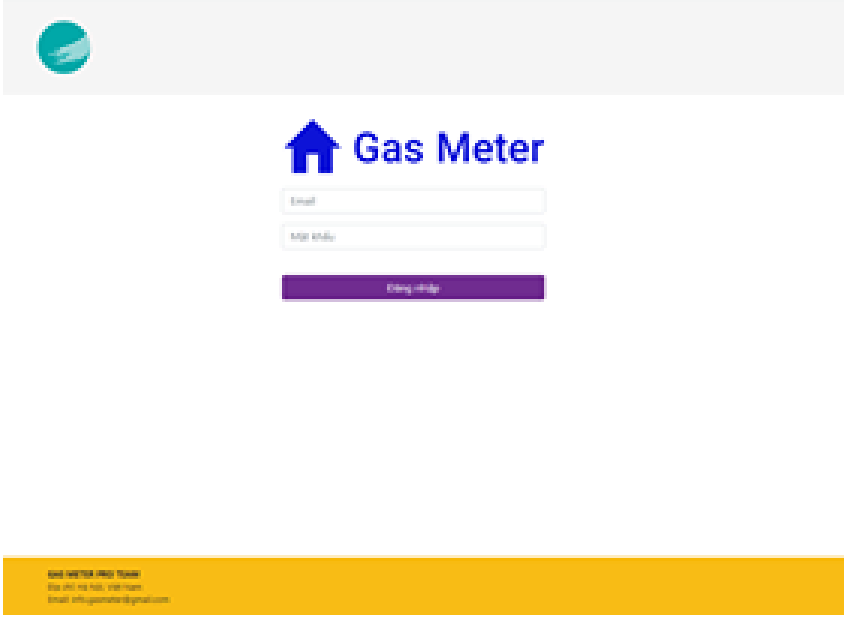


Advantages	*Disadvantages*
GUI is user-friendly, suppost language: VietNamese.	Available only on Android
Freeware, public on Google Play	Need internet to take notification
Handy, simple, easy to use anytime, anywhere	

3.2 Web application

This software is published publicly on the Internet and it is freeware. It covers bussiness aspects that a gas store would face in a real life situation, such as creating, reading, updating and deleting gas cylinder informations, etc... This software supports only remote access and all data stored on a server. The server uses Database-as-a-Service (DaaS), which brings many benefits such as Security, High Availability, less configuration. That’s a good option and example for us to consider using DaaS.

Advantages	*Disadvantages*
GUI is user-friendly, support language: Vietnamese	Only support remote access (Web), no support for offline use (Desktop apps)
There is always an employee flow the website 24/7	Only support via hotline, not via facebook, zalo, etc…
As long as the internet is available, it can be accessed at all times.	Low security, easy to attack by hackers



3.3 Backend system

Backend system is made base on Spring Boot. Spring Boot is a project developed by JAV (java language) in Spring framework ecosystem. It helps our programmers to simplify the process of programming an application with Spring, focusing only on developing business for the application.

3.4 Embedded system

Backend system is made base on Arduino. Arduino is an open-source electronics platform based on easy-to-use hardware and software. It's simple and accessible user experience, bring many benefits such as high Availability, less configuration. That's a good option and example for us to consider using Adruino.

4. Business Opportunity

Today every apartment in Vietnam has at least one gas stove. So this is a good opportunity for the gas trading industry in Vietnam to develop.

However, the safety issue when using the gas stove is a very important issue for users. As for businesses, they need to manage the amount of gas consumed as well as their customers.

To solve this problem, an IoT system will help users keep track of indicators such as temperature in the room, amount of gas, ... There is also a web service that helps stores to manage customer management as well as the amount of gas sold.

5. Software Product Vision

With the Applying IOT for managing household gas cylinder system (Gas-Meter), we aim to optimize the operational structure of managing gas cylinder for each customer, both versions of the software brings the best result and experience to our customer. Specifically, in the Web Application version, the software assists management functions of gas cylinder which are currently using by customers for admin from head to toe while the Mobile Application version provides to the customers the ability of knowing the situation of his/her current gas so that he/she could contact the store when there is any problem. The system supports both the stores and the customers of the stores in terms of managing problem with gas cylinder.

6. Project Scope & Limitations

Gas-Meter is not system give me information about gas cylinder, temperature environment, warning when there is fire or explosion on the phone has a web-based management system that helps the gas-store operate easily and flexibly.

6.1 Major Features

- Mobile application:
  - Role: User
    - Allows users to view and change personal information
    - Allows users to monitor device information such as: gas concentration, remaining gas, ambient temperature, and device battery
    - Send notification for user.
- Web application:
  - Role: Store

- Allows Store to manage list user information that belongs to your store
- Allows Store to manage list contract information that belongs to your store
- Allows Store to manage list broken device information that belongs to your store
- Allows Store to view map show location of devices and it’s status

- Role: Admin
  - Allows Admin to manage list store.
  - Allows Admin to manage list user information in each store
  - Allows Admin to manage list contract information in each store
  - Allows Admin to manage list all broken device information
  - Allows Admin to view map show location of devices and it’s status

II. Project Management Plan

1. Overview

1.1 WBS & Estimation

#	WBS Item	Complexity	Est. Effort (man-days)
1	***Pre-Initiating Phase***		***3***
1.1	Select project manager	Simple	0.5
1.2	Determine the role of team members	Simple	0.5
1.3	Choose topic	Simple	1.5
1.4	Register Capstone Project	Simple	0.5
2	***Initiating Phase***		***5***
2.1	Kick off	Simple	0.5
2.2	Identify stakeholders	Medium	1
2.3	Meet instructor	Simple	1
2.4	Develop project introduction document	Simple	2.5
3	***Planning Phase***		***14***
3.1	Define scope	Simple	1.5
3.2	Choose working model process	Simple	1.5
3.3	Select tools and techniques	Simple	1.5
3.4	Develop project schedule	Medium	3
3.5	Develop risk management plan	Medium	3
3.6	Organize project resources	Simple	1.5

3.7	Develop software project management plan	Simple	2
4	***Executing***		***299***
4.1	**<u>Iteration 1: Develop main functions</u>**		**171**
4.1.1	Analysis	Complex	5
4.1.2	Requirements		10
4.1.2.1	Software Requirement Specifications	Medium	5
4.1.2.2	Software Design Requirements	Medium	5
4.1.3	Design		10
4.1.3.1	Design UI	Medium	5
4.1.3.2	Design database	Medium	5
4.1.4	Coding		105
4.1.4.1	Back-end	Complex	30
4.1.4.2	Web Application	Complex	30
4.1.4.3	Mobile Application	Complex	30
4.1.4.4	Fix bugs	Medium	15
4.1.5	Testing		39
4.1.5.1	Create test cases for unit test	Medium	5
4.1.5.2	Unit test	Medium	10
4.1.5.3	Create test cases for integration test	Medium	3
4.1.5.4	Integration test	Medium	5

4.1.5.5	Create test cases for system test	Medium	3
4.1.5.6	System test	Medium	5
4.1.5.7	Create test cases for acceptance test	Medium	3
4.1.5.8	Acceptance test	Medium	5
4.1.6	Evaluation	Simple	2
4.2	**Iteration 2: Develop all functions**		**128**
4.2.1	Analysis	Complex	5
4.2.2	Requirements		10
4.2.2.1	Software Requirement Specifications	Medium	5
4.2.2.2	Software Design Requirements	Medium	5
4.2.3	Design		8
4.2.3.1	Design UI	Medium	3
4.2.3.2	Design database	Medium	5
4.2.4	Coding		80
4.2.4.1	Back-end	Complex	30
4.2.4.2	Web Application	Complex	30
4.2.4.3	Mobile Application	Complex	10
4.2.4.4	Fix bugs	Medium	10
4.2.5	Testing		23
4.2.5.1	Create test cases for unit test	Medium	3

4.2.5.2	Unit test	Medium	5
4.2.5.3	Create test cases for integration test	Medium	2
4.2.5.4	Integration test	Medium	3
4.2.5.5	Create test cases for system test	Medium	2
4.2.5.6	System test	Medium	3
4.2.5.7	Create test cases for acceptance test	Medium	2
4.2.5.8	Acceptance test	Medium	3
4.2.6	Evaluation	Simple	2
5	***Monitoring and Controlling***		***11***
5.1	Meet instructor	Simple	1
5.2	Progress Report	Simple	10
6	***Closing***		***48***
6.1	Complete final report	Medium	25
6.2	Prepare for final project presentation	Medium	20
6.3	Present final project	Medium	2
6.4	Project completed	Simple	1
		Total Estimated Effort (man-days)	***380***

1.2 Project Objectives

Objectives:

- This project must be finished by 12/20/2020.
- All team members have to follow the task assigned by the PM.
- All team members give their best effort to complete the project.
- Project team members learn new knowledge, new technology

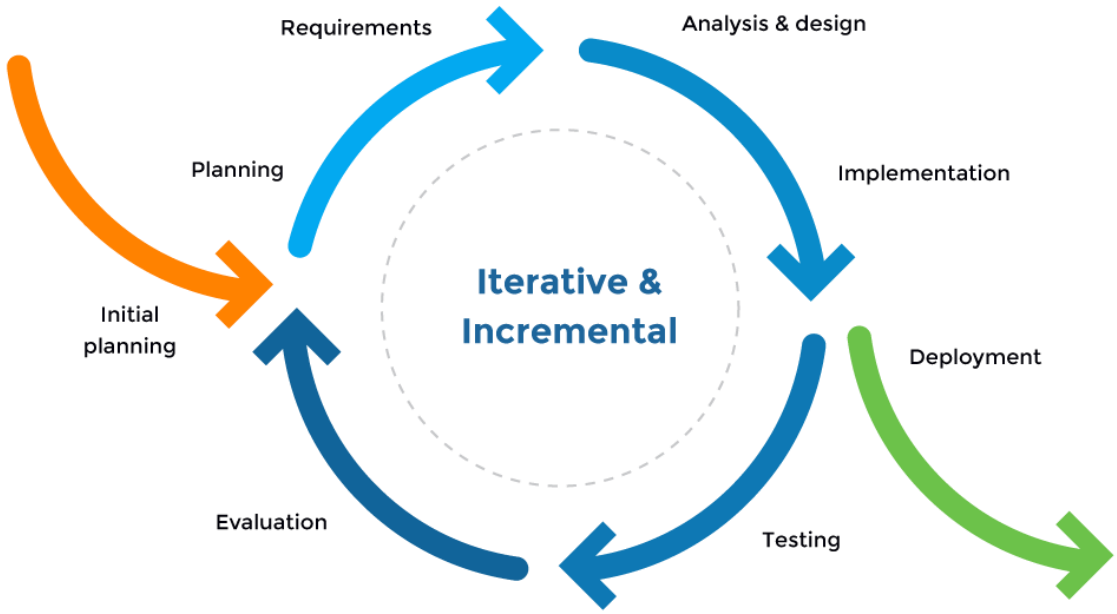
1.3 Project Risks

#	Risk Description	Impact	Possibility	Response Plans
1	Project team misunderstand the requirements	High	Low	Have regular meetings to make sure the team understand the requirements and know what they need to do
2	Team members lack technical skills and knowledge	High	Medium	Coding sub-team leader finds out to train the skills that members are lacking, team members study by themselves
3	Source code is conflicted	Medium	High	Use backup version, discuss with other members and continue to work
4	Team members does not complete project on time	High	Medium	Ask for support measures from supervisor
5	One or more team members abandon the project	High	Low	Find out the reasons, persuade them and reallocate tasks

2. Management Approach

2.1 Project Process

After careful research, the project will apply **Iterative & Incremental Model** to the system development process.



In an Iterative & Incremental model, initially, a partial implementation of a total system is constructed so that it will be in a deliverable state. Increased functionality is added. Defects, if any, from the prior delivery are fixed and the working product is delivered. The process is repeated until the entire product development is completed. The repetitions of these processes are called iterations. At the end of every iteration, a product increment is delivered.

The reasons for the project to choose this model are:

- You can develop prioritized requirements first.
- Initial product delivery is faster.
- Customers get important functionality early.
- Lowers initial delivery cost.
- Each release is a product increment, so that the customer will have a working product at hand all the time.
- Customers can provide feedback to each product increment, thus avoiding surprises at the end of development.
- Requirements changes can be easily accommodated.

2.2 Quality Management

- Defect Prevention:
    - Once a defect is found, the related person in charge should be notified immediately.
    - The defect must be assessed carefully such as “how bad is the defect?”, “how long does it take to fix the defect?”.
    - The deadline for fixing defects must be clearly stated.
- Reviewing:
    - The person in charge must be honest and show no favor over any member. If something goes wrong, that person must notify the person who takes responsibility for that defect.
    - The defect must be logged on Bug Tracking software with detail such as priority.
    - The person who takes responsibility for the found defects must take actions accordingly.
- Unit Testing:
    - The person in charge must prepare test cases carefully and accurately. The test cases must match well with the system.
    - The defect must be logged on Bug Tracking software with detail such as priority.
    - The person who takes responsibility for the found defects must take action accordingly.
- Integration Testing
    - The person in charge must prepare test cases carefully and accurately. The test cases must match well with the system and architecture design.
    - The defect must be logged on Bug Tracking software with detail such as priority.
    - The person who takes responsibility for the found defects must take action accordingly.
    - Internal modules within the system work smoothly.
- System Testing
    - The person in charge must prepare test cases carefully and accurately. The test cases must match well with the system and system design.
    - The defect must be logged on Bug Tracking software with detail such as priority.
    - The person who takes responsibility for the found defects must take action accordingly.

    - System testing test cases cover the entire system functionality and the communication under development with external systems.
- Acceptance Testing
    - The person in charge must prepare test cases carefully and accurately. The test cases must match well with the system and business requirements.
    - The person who takes responsibility for the found defects must take action accordingly.
    - The defect must be logged on Bug Tracking software with detail such as priority.
    - If there are customers, customers should take part in Acceptance testing.
    - The test should cover non-functional issues such as load and performance defects.

2.3 Training Plan

Training Area	**Participants**	**When, Duration**	**Waiver Criteria**
Bitbucket, Source Tree	All team members	14/09/2020 (1 day)	Mandatory
Angular 8 (Front-end for Web)	All team members	21/09/2020 - 27/09/2020 (1 week)	Mandatory
Spring Boot (Back-end for Web and Mobiles)	All team members	28/09/2020 - 04/10/2020 (1 week)	Mandatory
Fluter (for Android)	Nguyễn Hải Đăng	05/10/2020 - 08/10/2020 (4 days)	Mandatory
Arduino IDE(for Embedded system)	Nguyễn Hữu Phương	01/10/2010 - 08/10/2020 (1 week)	Mandatory
Coding Convention & Bug Logging Convention	All team members	10/10/2020 (1 day)	Mandatory

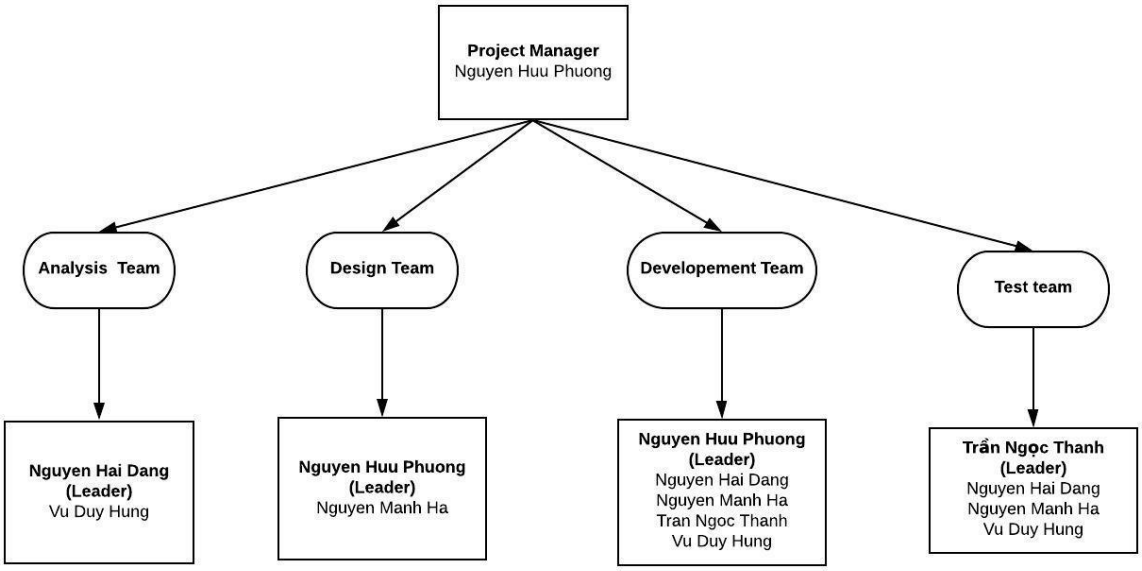
3. Master Schedule

#	**Deliverable**	**Due Date**	**Deliverable Scope**
1	Project Plan	10/05/2020	Project Schedule, Risk Management Plan, Resources Management Plan
2	SRS	10/12/2020	SRS
3	Design	10/26/2020	Architecture Design, Detailed Design, Database
4	Iteration 1	11/09/2020	Code & Unit test, System test cases
5	Iteration 2	11/23/2020	Code & Unit test, System test cases

6	UAT Package	11/30/2020	Codes, System test reports
7	Final Package	12/15/2020	Final Codes & documents, User manual

4. Project Organization

4.1 Team & Structures



4.2 Roles & Responsibilities

Role	**Responsibility**
Project Manager	Nguyen Huu Phuong
Analysis Leader	Nguyen Hai Dang
Analysis Member	Vu Duy Hung
Design Leader	Nguyen Huu Phuong
Design Member	Nguyen Manh Ha
Technical Leader	Nguyen Huu Phuong
Test Leader	Tran Ngoc Thanh
Test Member	Nguyen Hai Dang, Nguyen Manh Ha, Vu Duy Hung

5. Project Communication

5.1 Communication Plan

Communication Item	**Who/ Target**	**Purpose**	**When, Frequency**	**Type, Tool, Method(s)**

Weekly Meeting	Team members Supervisor	Review members' work achievements during the week and report the project's progress and status.	Every Monday	Face to Face
Daily Meeting	Team members	Report the progress that members achieved each day.	Daily	Messenger, Slack, Microsoft Team , Gmail
Unscheduled Meeting	Team members	Occurred when there's a critical problem that need to be resolved immediately		Google Meet

5.2 External Interface

a. FU Contacts

Function	Contact Person (name, position)	Contact address (email, telephone)	Responsibility
Supervisor	Phan Duy Hung	HungPD2@fe.edu.vn 0975597339	- Give instruction to project team - Review deliverables - Supervise project status

b. Customer Contacts

Function	Contact Person (name, position)	Contact address (email, telephone)	Responsibility
Supervisor	Phan Duy Hung	HungPD2@fe.edu.vn 0975597339	- Give instruction to project team - Review deliverables - Supervise project status

6. Configuration Management

6.1 Tools & Infrastructures

Programming languages	Angular8, Java Spring Boot.
Framework	Spring Boot, Flutter
API	Java Spring Boot
DBMS	MySQL
IDEs/Editors	Arduino IDE, Visual Studio Code, Intellij IDE
UML tools	Lucid Chart, Visual Paradigm, draw.io

Version Control	Source Tree
Deployment server	Google Cloud Platform, centOS 7
Project management tool	Bitbucket

6.2 Document Management

We use Bitbucket and Source Tree as our primary tool for sharing, editing and version control of our documents, along with Status Reports with-in each document.

It allows us to see what is changed in the documents and who is responsible for that change, reverse and simultaneously compare between versions of the document.

6.3 Source Code Management

For version control of our source code, we use Bitbucket. It tracks the changes team members make to files, so we have a record of what has been done, and we can revert to specific versions should we ever need to. Bitbucket also makes collaboration easier, allowing changes by multiple people to all be merged into one source.
Bitbucket also features branches that provide an isolated environment for every change to our codebase. When a team member wants to start working on something—no matter how big or small—he creates a new branch. This ensures that the master branch always contains production-quality code.

III. Software Requirement Specification

1. Overall Description

1.1 Product Overview

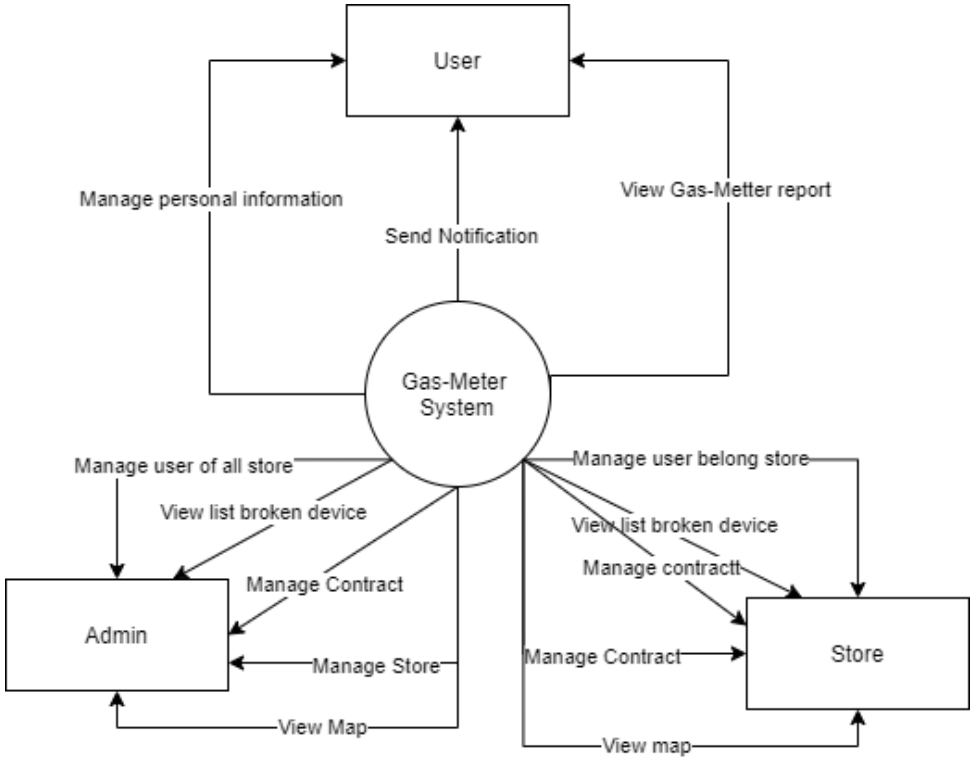


Figure : Functional overview of Gas-Metter

Gas-Meter is a system that helps users to monitor their home gas tank warning device. It also helps store and admin manage objects such as customers or contracts. The context diagram below illustrates the external entities and system interfaces for release 1.0. The system is expected to develop a number of other functions such as: chatting, sending store advertise to users, eventually becoming a gas management system and gas store service.

1.2 Business Rules

No	Description
B01	Phone number cannot be empty
B02	Phone number must have from 10 digits.
B03	Email cannot be empty.
B04	Each email may be used for only one account.
B05	Password cannot be empty
B06	Password must contain at least 6 characters
B06	Admin can manage broken device, store and User.
B07	Store manage contract, broken device and user.

2. User Requirements

2.1 Use Case Diagram

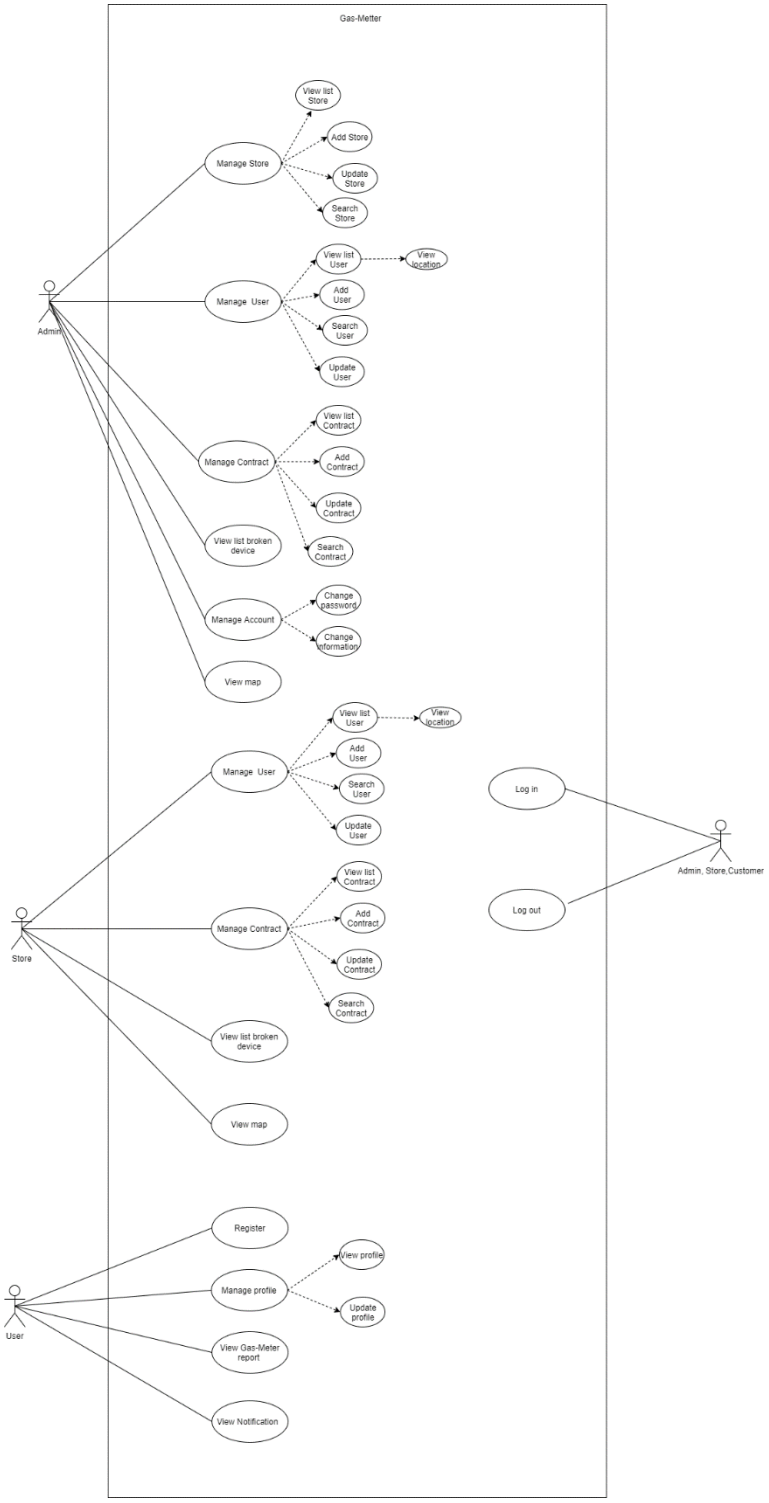


Figure 2.1: Use-case diagram

2.2 Use-case list

ID	Actor	Function	Glossary
UC-01	User	Login	User Login into system.
UC-02	User	Logout	User Logout system.
UC-03	User	Register	User or gas store's employee register account gas-meter.
UC-04	User	View profile	User view his or her profile
UC-05	User	Edit profile	User edit his or her profile
UC-06	User	View gas-report	User can view gas-report include: gas concentration, device battery, weight gas cylinder.
UC-07	User	View notification	User can view notification
UC- 08	Store	Login	Employee of store Login into system
UC-09	Store	Logout	Employee of store Logout into system
UC-10	Store	View list User	Store view list User belong store
UC-11	Store	Create User	Store create new user in store
UC-12	Store	Search User	Store can search User
UC-13	Store	Update User	Store edit information of User
UC-14	Store	View location of user	Store view location of user in map
UC-15	Store	View list contract	Store can view list device in store.
UC-16	Store	Add contract	Store create contract
UC-17	Store	Edit contract	Store edit information of contract
UC-18	Store	Search contract	Store search contract
UC- 19	Store	View list broken device	View list broken device
UC-20	Store	View map	Store view location of device belong of store and status of them
UC-21	Admin	Login	Admin Login in system
UC-22	Admin	Logout	Admin Logout the system
UC-23	Admin	View list store	Admin can view list store
UC-24	Admin	Create Store	Admin can create store
UC-25	Admin	Search Store	Admin search store
UC-26	Admin	Update Store	Admin update store

UC-27	Admin	View list User	Admin view list User in all store
UC-28	Admin	Create User	Admin create new user.
UC-29	Admin	Update User	Admin update one User
UC-30	Admin	Search User	Admin update user.
UC-31	Admin	View location user	View location of user in map
UC-32	Admin	View list contract	Admin can view list all list contract for each store.
UC-33	Admin	Create a contract	Admin create a contract
UC-34	Admin	Update a contract	Admin update a contract
UC-35	Admin	Search contract	Admin search contract
UC-36	Admin	View list broken- device	Admin view list broken device of all store
UC-37	Admin	View map	Admin view location of all device and status of them
UC-38	Admin	Changed Password	Admin changed password.
UC39	Admin	Changed information Admin	Admin change information.

Table 2.2: Use-case list

2.2.1 User

2.1.1.1 Login

Use Case ID	UC-01		
Use Case Name	Login to System		
Creator	ThanhTN	**Date Created**	2020/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	User		
Description	Login an account using email and password		
Pre-conditions	- User can access the system. - User has already registered an account. - User is currently not Loged into the system.		
Post-conditions	- User is Loged into the system. - User is redirected to Homepage.		

Normal Flow	1. From the app. 2. The system loads the Login page. 3. User enters “Email” and “Mật khẩu”. 4. User clicks "Đăng nhập" button. 5. The system checks your input data. If User entered true, User will be Login successful. 6. The system redirects User to the Home page.
Alternative Flows	N/A
Exceptions	*EXC1: At step 3 of normal flow, User leaves “Email” blank, then proceeds to step 4.* The system displays the error message "Bạn phải nhập email. ". User is not Loged in. *EXC2: At step 3 of normal flow, User leaves “Mật khẩu” blank, then proceeds to step 4.* The system displays the error message “Bạn phải nhập mật khẩu". User is not Loged in *EXC3: At step 3 of normal flow, User enters invalid Login credentials, then proceeds to step 4.* The system displays the error message "Số điện thoại hay mật khẩu không chính xác. Hãy nhập lại". User is not Loged in.
Priority	High
Frequency of Use	High
Business Rules	Email cannot empty Password cannot be empty
Other Information	N/A

2.1.1.2 Logoutde

Use Case ID	UC-02		
Use Case Name	Logout	**Date Created**	2020/10/10
Creator	ThanhTN	**Last Updated**	2019/10/10
Version	1.0		
Actor	User		
Description	Logout of the account		

Pre-conditions	- User accesses to the system. - User is currently Loged in.
Post-conditions	User is Loged out of the system.
Normal Flow	1. In “Trang chủ Gas Meter” screen, select the menu with the three-tile icon in the upper right corner. 2. User clicks "Đăng xuất". 3. The system will redirect User to the Home page.
Alternative Flows	N/A
Exceptions	N/A.
Priority	Medium
Frequency of Use	Medium
Business Rules	N/A

2.1.1.3 Register

Use Case ID	UC-03		
Use Case Name	Register		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Primary Actor	User	**Secondary Actors**	N/A
Description	Create a new account		
Pre-conditions	- User can access the system - User is currently not Loged in.		
Post-conditions	- The account is added to the system. - User is automatically Loged into the system. - User is redirected to Login page.		

Normal Flow	1. From the homepage, the User clicks on button "Đăng ký". 2. The system will load the Register page. 3. User fills information into the required form. 4. User clicks "Đăng kí".
Alternative Flows	N/A
Exceptions	*EXC1: At step 3 of normal flow, User leaves "Họ và tên" blank, then proceeds to step 4.* The system displays the error message "Hãy nhập họ và tên". User is not registered *EXC2: At step 3 of normal flow, User leaves email blank, then proceeds to step 4.* The system displays the error message " Hãy nhập Email ". User is not registered *EXC3: At step 3 of normal flow, User leaves "Số điện thoại" blank, then proceeds to step 4.* The system displays the error message "Hãy nhập số điện thoại". User is not registered *EXC4: At step 3 of normal flow, User leaves "Địa chỉ" blank, then proceeds to step 4.* The system displays the error message "Hãy nhập địa chỉ". User is not registered *EXC5: At step 3 of normal flow, User leaves "Mật khẩu" blank, then proceeds to step 4.* The system displays the error message "Hãy nhập mật khẩu". User is not registered *EXC6: At step 3 of normal flow, User enters an invalid "Số điện thoại", then proceeds to step 4.* The system displays the error message "Số điện thoại bị sai". User is not registered. *EXC7: At step 3 of normal flow, User enters a valid" Số điện thoại" that already exists in the system.* The system displays the error message "Số điện thoại này đã tồn tại! Mời bạn nhập số điện thoại khác". User is not registered.

	EXC8: At step 3 of normal flow, User enters a "Mật khẩu" that has below 8 characters. The system displays the error message " Mật khẩu phải có ít nhất 8 ký tự". User is not registered. .
Priority	High
Frequency of Use	High
Business Rules	N/A
Other Information	N/A

2.1.1.4 View profile

Use Case ID	UC-04		
Use Case Name	View Profile		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	User		
Description	View personal profile		
Pre-conditions	- User accesses the system. - User is currently Loged in.		
Post-conditions	System displays the User profile page.		
Normal Flow	1. In "Gas Meter homepage" screen, select the menu with the three-tile icon in the upper right corner. 2. User click"Cá nhân". 3. The system will redirect User to the profile page.		
Alternative Flows	N/A		
Exceptions	N/A		
Priority	Medium		
Frequency of Use	High		
Business Rules	N/A		
Other Information	N/A		

2.1.1.5 Update profile

Use Case ID	UC-05		
Use Case Name	Updated Profile		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	User		
Description	User update personal information		
Pre-conditions	Client is on the app mobile Client is Loging in Client is on their profile page		
Post-conditions	The User change their information successfully		
Normal Flow	1. In “Gas Meter homepage” screen, select the menu with the three-tile icon in the upper right corner. 2. User click”Cá nhân”. 3. The system will redirect User to the profile page. 4. User change their profile. 5. The system will redirect User to the Profile page		
Alternative Flows	N/A		
Exceptions	*EXC1: At step 3 of normal flow, User leaves full name blank, then proceeds to step 4.* The system displays the error message "Họ và tên không được để trống ". User is not changed profile. *EXC2: At step 3 of normal flow, User leaves email, then proceeds to step 4.* The system displays the error message "Email’ không được để trống ". User is not changed profile. *EXC3: At step 3 of normal flow, User leaves “Địa chỉ” blank, then proceeds to step 4.* The system displays the error message "Địa chỉ không được để trống". User is not changed profile.		

	EXC4: At step 3 of normal flow, User leaves "Mật Khẩu" blank, then proceeds to step 4. The system displays the error message "Mật khẩu không được để trống ". User is not changed profile.
Priority	Medium
Frequency of Use	Low
Business Rules	N/A
Other Information	N/A

2.1.1.6 View Gas-Meter report

Use Case ID	UC-06		
Use Case Name	View Gas-report		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	User		
Description	User view gas-report.		
Pre-conditions	User is currently Loged in.		
Post-conditions	The User view gas-report include: gas concentration, device battery, weight gas cylinder.		
Normal Flow	1. After user Login, the system redirect to gas-report page.		
Alternative Flows	N/A		
Exceptions	*N/A*		
Priority	Medium		
Frequency of Use	Low		
Business Rules	N/A		
Other Information	N/A		

2.2.1.7 View Notification

Use Case ID	UC-07
Use Case Name	View Notification

Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	User		
Description	User view notification.		
Pre-conditions	User is currently Loged in.		
Post-conditions	The User view notification from store.		
Normal Flow	1. In “Gas Meter homepage” screen, select the menu with the three-tile icon in the upper right corner. 2. User click”Thông báo”. 3. System display notification screen.		
Alternative Flows	N/A		
Exceptions	*N/A*		
Priority	Medium		
Frequency of Use	Low		
Business Rules	N/A		
Other Information	N/A		

2.1.2 Store

2.1.2.1 Store Login

Use Case ID	UC-08		
Use Case Name	Login to System		
Creator	ThanhTN	**Date Created**	2020/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	Store		
Description	Login an account using email and password		
Pre-conditions	- Store can access the system. - Store has already registered an account. - Store is currently not Loged into the system.		
Post-conditions	- Store is Loged into the system. - Store is redirected to Homepage.		

Normal Flow	1. Store access website management. 2. The system loads the Login page. 3. Store enters “Email” and “Mật khẩu”. 4. Store clicks "Đăng nhập" button. 5. The system checks your input data. If User entered true, User will be Login successful. 6. The system redirects Store to the Home page.
Alternative Flows	N/A
Exceptions	*EXC1: At step 3 of normal flow,* Store *leaves “Email” blank, then proceeds to step 4.* The system displays the error message "Bạn phải nhập Email". Store is not Loged in. *EXC2: At step 3 of normal flow,* Store *leaves “Mật khẩu”blank, then proceeds to step 4.* The system displays the error message “Bạn phải nhập mật khẩu". Store is not Loged in *EXC3: At step 3 of normal flow,* Store *enters invalid Login credentials, then proceeds to step 4.* The system displays the error message "Email hoặc mật khẩu không chính xác. Hãy nhập lại". Store is not Loged in.
Priority	High
Frequency of Use	High
Business Rules	Store name cannot be empty Password cannot be empty
Other Information	N/A

2.1.2.2 Store Logout

Use Case ID	UC-09		
Use Case Name	Logout	**Date Created**	2020/10/10
Creator	ThanhTN	**Last Updated**	2019/10/10
Version	1.0		
Actor	Store		
Description	Logout of the account		

Pre-conditions	- Store accesses to the system. - Store is currently Loged in.
Post-conditions	Store is Loged out of the system.
Normal Flow	1. From the website header, Store moves cursor above the top right corner, with the store's personal icon. 2. Store clicks "Đăng xuất". 3. The system will redirect User to the Home page.
Alternative Flows	N/A
Exceptions	N/A.
Priority	Medium
Frequency of Use	Medium
Business Rules	N/A

2.2.2.3 View list user belong store

Use Case ID	UC-10		
Use Case Name	View List User		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	Store		
Description	View list User in store		
Pre-conditions	- Store accesses the system. - Store is currently Loged in. -User belong store.		
Post-conditions	System displays list User belong store.		
Normal Flow	1. From the web header, Store click”Danh sách khách hàng” button. 2. The system will redirect store list User page.		
Alternative Flows	N/A		
Exceptions	N/A		

Priority	Medium
Frequency of Use	High
Business Rules	N/A
Other Information	N/A

2.1.2.3 Add user

Use Case ID	UC-11		
Use Case Name	Add User		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	Store		
Description	Add new user in store		
Pre-conditions	- Store accesses the system. - Store is currently Loged in. -User belong store.		
Post-conditions	- The User is added to the system. - User is automatically Loged into the system.		
Normal Flow	1. From the web header, Store click”Danh sách khách hàng” button. 2. The system will redirect store list user page. 3. Store click”Thêm mới” icon in the header. 4. The system redirect register page. 5. Store input data in page. 6.Store click”Thêm mới” in register page. 7. Store input data User. 8. Store click “Đồng ý”. 9.System send redirect to list User page.		
Alternative Flows	N/A		
Exceptions	*EXC1: At step 5 of normal flow, User leaves “Họ và tên” blank, then proceeds to step 6.* The system displays the error message "Hãy nhập họ và tên”. User is not registered *EXC2: At step 5 of normal flow, User leaves email blank, then proceeds to step 6.* The system displays the error message " Hãy nhập Email ". User is not		

	registered *EXC3: At step 5 of normal flow, User leaves "Số điện thoại" blank, then proceeds to step 6.* The system displays the error message "Hãy nhập số điện thoại". User is not registered *EXC4: At step 5 of normal flow, User leaves "Địa chỉ" blank, then proceeds to step 6.* The system displays the error message "Hãy nhập địa chỉ". User is not registered *EXC5: At step 5 of normal flow, User leaves "Mật khẩu" blank, then proceeds to step 6.* The system displays the error message "Hãy nhập mật khẩu". User is not registered *EXC6: At step 5 of normal flow, User enters an invalid "Số điện thoại", then proceeds to step 6.* The system displays the error message "Số điện thoại bị sai". User is not registered. *EXC7: At step 5 of normal flow, User enters a valid" Số điện thoại" that already exists in the system.* The system displays the error message "Số điện thoại này đã tồn tại! Mời bạn nhập số điện thoại khác". User is not registered. *EXC8: At step 5 of normal flow, User enters a "Mật khẩu" that has below 8 characters.* The system displays the error message " Mật khẩu phải có ít nhất 8 ký tự". User is not registered.
Priority	Medium
Frequency of Use	High
Business Rules	N/A
Other Information	N/A

2.1.2.4 Update user

Use Case ID	UC-12		
Use Case Name	Update User		
Creator	ThanhTN	**Date Created**	2019/10/10

Version	1.0	**Last Updated**	2019/10/10
Primary Actor	Store	**Secondary Actors**	N/A
Description	Update information User complete.		
Pre-conditions	- Store can access the system - Store is currently not Loged in.		
Post-conditions	- The information of User is update to the system. - System redirect to list User page		
Normal Flow	1. From the homepage, the User clicks on button "Danh sách khách hàng". 2. The system will load the List User page. 3. Store click the User want to update 4. Store click “Update” icon 5.System load update page 6.Store input information 7.After Store input data, Store click “Thay đổi” 8.System display messenger ”Bạn có muốn update thông tin” 9.System redirect to list User page.		
Alternative Flows	N/A		
Exceptions	*EXC1: At step 7 of normal flow, store leaves “Họ và tên” blank, then proceeds to step 8.* The system displays the error message "Hãy nhập họ và tên”. User is not registered *EXC2: At step 7 of normal flow, store leaves email blank, then proceeds to step 8.* The system displays the error message " Hãy nhập Email ". User is not registered *EXC3: At step 7 of normal flow, store leaves “Số điện thoại” blank, then proceeds to step 8.* The system displays the error message "Hãy nhập số điện thoại". User is not registered *EXC4: At step 7 of normal flow, store leaves “Địa chỉ” blank, then proceeds to step 8.* The system displays the error message "Hãy nhập địa chỉ”. User is not registered *EXC5: At step 8 of normal flow, User click “Đồng ý”, then proceeds to step 9.*		

	The system is changed. User is changed. System display new list User *EXC6: At step 8 of normal flow, User click "Từ Chối", then proceeds to step 9.* *The system is not changed. The system redirect in list User page*
Priority	High
Frequency of Use	High
Business Rules	N/A
Other Information	N/A

2.1.2.5 Search user

Use Case ID	UC-13		
Use Case Name	Search User		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	Store		
Description	Search User in store by name.		
Pre-conditions	- Store accesses the system. - Store is currently Loged in. -User belong store.		
Post-conditions	System displays list User belong store after search.		
Normal Flow	1. From the web header, Store click"Danh sách khách hàng" button. 2. The system will redirect list User page of store. 3. Store click"Tìm kiếm" field in the header. 5. Store input name in search field. 6.System display result after search.		
Alternative Flows	N/A		
Exceptions	*Exc1: Store leave blank "Tìm kiếm" field, then click search* *Expected: The system display all list User.* *Exc2: Store input special character, html, javascript…* *Expected: The system display alert: "Bạn nhập sai"*		
Priority	Medium		

Frequency of Use	High
Business Rules	N/A
Other Information	N/A

2.1.2.6 View location of user

Use Case ID	UC-14		
Use Case Name	View location of user		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	Store		
Description	Display location device on map.		
Pre-conditions	- Store accesses the system. - Store is currently Loged in. -User belong store.		
Post-conditions	System displays location of user on map.		
Normal Flow	1. From the web header, Store click"Danh sách khách hàng" button. 2. The system will redirect list User page of store. 3. Store find user want to view location. 5. Store click "Vị trí" button of user . 6.System display location of user.		
Alternative Flows	N/A		
Exceptions	*N/A*		
Priority	Medium		
Frequency of Use	High		
Business Rules	N/A		
Other Information	N/A		

2.1.2.7 View list contract

Use Case ID	UC-15		
Use Case Name	View List Contract		
Creator	ThanhTN	**Date Created**	2019/10/10

Version	1.0	**Last Updated**	2019/10/10
Actor	Store		
Description	View list Contract belong store		
Pre-conditions	- Store accesses the system. - Store is currently Loged in. -Contract belong store.		
Post-conditions	System displays list device belong store.		
Normal Flow	1. From the web header, Store click"Danh sách hợp đồng" button. 2. The system will redirect store list contract page.		
Alternative Flows	N/A		
Exceptions	N/A		
Priority	Medium		
Frequency of Use	High		
Business Rules	N/A		
Other Information	N/A		

2.1.2.8 Add new contract

Use Case ID	UC-16		
Use Case Name	Add Contract		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	Store		
Description	Store add contract to system		
Pre-conditions	- Store accesses the system. - Store is currently Loged in.		
Post-conditions	Add new contract in system.		
Normal Flow	1. From the web header, Store click"Danh sách hợp đồng " button. 2. The system will redirect store list contract page. 3. Store click"Thêm mới" icon in the header. 4. The system redirect register page.		

	5. Store input data in page. 6.Store click"Thêm mới" in register page. 7. System display message"Bạn có muốn thêm hợp đồng này". 8. Store click "Đồng ý". 9.System send redirect to list contract page.
Alternative Flows	N/A
Exceptions	*N/A*
Priority	Medium
Frequency of Use	High
Business Rules	N/A
Other Information	N/A

2.2.2.10 Update contract

Use Case ID	UC-17		
Use Case Name	Update contract		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Primary Actor	Store	**Secondary Actors**	N/A
Description	Update information Device complete.		
Pre-conditions	- Store can access the system - Store is currently not Loged in.		
Post-conditions	- The information of contract is update to the system. - System redirect to list contract page		
Normal Flow	1. From the homepage, the User clicks on button "Danh sách hợp đồng". 2. The system will load the List contract page. 3. Store click the contract want to update 4. Store click "Sửa" button. 5.System load update page 6.Store input information 7.After Store input data, Store click "Thay đổi" 8.System display messenger "Bạn có muốn update thông tin" 9.System redirect to list contracts page.		

Alternative Flows	N/A
Exceptions	*N/A*
Priority	High
Frequency of Use	High
Business Rules	N/A
Other Information	N/A

2.1.2.9 Search contract

Use Case ID	UC-18		
Use Case Name	Search contract		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	Store		
Description	Search contract.		
Pre-conditions	- Store accesses the system. - Store is currently Loged in.		
Post-conditions	System displays list contract belong store after search.		
Normal Flow	1. From the web header, Store click"Danh sách hợp đồng" button. 2. The system will redirect list contract page of store. 3. Store click"Tìm kiếm" field. 5. Store input data in search field. 6.System display result after search.		
Alternative Flows	N/A		
Exceptions	*Exc1: Store leave blank "Tìm kiếm" field, then click search* *Expected: The system display all list contract.* *Exc2: Store input special character, html, javascript…* *Expected: The system display alert: "Bạn nhập sai"*		

Priority	Medium
Frequency of Use	High
Business Rules	N/A
Other Information	N/A

2.1.2.10View list broken device

Use Case ID	UC-19		
Use Case Name	View list broken device		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Primary Actor	Store	**Secondary Actors**	N/A
Description	Display list broken device belong store		
Pre-conditions	- Store can access the system - Store is currently not Loged in.		
Post-conditions	- Display list broken device of store		
Normal Flow	1. From the homepage, the User clicks on button "Danh sách thiết bị hỏng". 2. The system will load the list broken device page.		
Alternative Flows	N/A		

2.1.2.11View map

Use Case ID	UC-20		
Use Case Name	View map		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Primary Actor	Store	**Secondary Actors**	N/A
Description	Display location of device in the map and status of them.		
Pre-conditions	- Store can access the system		

	- Store is currently not Loged in.
Post-conditions	- Display list broken device of store
Normal Flow	1. From the homepage, the User clicks on button "Bản đồ". 2. The system will load the location of device one map.
Alternative Flows	N/A

2.1.3 Admin

2.1.3.1 Login

Use Case ID	UC-21		
Use Case Name	Admin to System		
Creator	ThanhTN	**Date Created**	2020/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	Admin		
Description	Login an account		
Pre-conditions			
Post-conditions	- Admin is Loged into the system. - Admin is redirected to Homepage.		
Normal Flow	1. From the website , Admin go to Login website. 2. The system loads the Login page. 3. Admin enters “Tên đăng nhập” and “Mật khẩu”. 4. Admin clicks "Đăng nhập" button. 5. The system checks your input data. If admin entered true, admin will be Login successful. 6. The system redirects admin to the Home page.		
Alternative Flows	N/A		

Exceptions	*N/A*
Priority	High
Frequency of Use	High
Business Rules	
Other Information	N/A

2.1.3.2 Logout

Use Case ID	UC-22		
Use Case Name	Logout	**Date Created**	2020/10/10
Creator	ThanhTN	**Last Updated**	2019/10/10
Version	1.0		
Actor	Admin		
Description	Logout of the account		
Pre-conditions	- Admin accesses to the system. - Admin is currently Loged in.		
Post-conditions	Admin is Loged out of the system.		
Normal Flow	1. From the website header, User moves cursor above the top right corner, with the Admin's personal icon. 2. Admin clicks "Đăng xuất". 3. The system will redirect Admin to the Home page.		
Alternative Flows	N/A		
Exceptions	N/A.		
Priority	Medium		
Frequency of Use	Medium		
Business Rules	N/A		

2.1.3.3 View list store

Use Case ID	UC-23

Use Case Name	View list store		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	Admin		
Description	View list		
Pre-conditions	- Admin accesses the system. - Admin is currently Loged in.		
Post-conditions	System displays list store.		
Normal Flow	1. From the web header, Admin click"Danh sách Cửa Hàng" button. 2. The system will redirect store list store page.		
Alternative Flows	N/A		
Exceptions	N/A		
Priority	Medium		
Frequency of Use	High		
Business Rules	N/A		
Other Information	N/A		

2.1.3.4 Add store

Use Case ID	UC-24		
Use Case Name	Add User		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	Admin		
Description	Create new store		
Pre-conditions			
Post-conditions	- The Store is added to the system. - Store is automatically Loged into the system.		

Normal Flow	1. From the web header, Admin click”Danh sách Cửa hàng” button. 2. The system will redirect store list store page. 3. Admin click ”Thêm mới” icon . 4. The system redirect register store page. 5. Admin input data in page. 6. Admin click ”Thêm mới” in register store page. 7. Admin input data store. 8. Admin click “Đồng ý”. 9.System send redirect to list store page.
Alternative Flows	N/A
Exceptions	*N/A*
Priority	Medium
Frequency of Use	High
Business Rules	N/A
Other Information	N/A

2.1.3.5 Update store

Use Case ID	UC-25		
Use Case Name	Update User		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Primary Actor	Store	**Secondary Actors**	N/A
Description	Update information User complete.		
Pre-conditions	- Admin can access the system		
Post-conditions	- The information of store is update to the system. - System redirect to list store page		

Normal Flow	1. From the homepage, the Admin clicks on button "Danh sách Cửa hàng". 2. The system will load the List Store page. 3. Admin click the store want to update 4. Admin click “Update” icon 5.System load update page 6.Admin input information 7.After Admin input data, Admin click “Thay đổi” 8.System display messenger “Bạn có muốn update thông tin” 9.System redirect to list store page.
Alternative Flows	N/A
Exceptions	*N/A*
Priority	High
Frequency of Use	High
Business Rules	N/A
Other Information	N/A

2.1.3.6 Search store

Use Case ID	UC-26		
Use Case Name	Search Store		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	Store		
Description	Search Store.		
Pre-conditions	- Admin accesses the system. - Admin is currently Loged in.		
Post-conditions	System displays list store.		

Normal Flow	1. From the web header, Admin click"Danh sách cửa hàng" button. 2. The system will redirect store list store page. 3. Admin click"Tìm kiếm" icon . 5. Admin input name in search field. 6.System display result after search.
Alternative Flows	N/A
Exceptions	*Exc1: Admin leave blank "Tìm kiếm" field, then click search* *Expected: The system display all list User.* *Exc2: Admin input special character, html, javascript…* *Expected: The system display alert: "Bạn nhập sai"*
Priority	Medium
Frequency of Use	High
Business Rules	N/A
Other Information	N/A

2.1.3.7 View list user

Use Case ID	UC-27		
Use Case Name	View List User		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	Admin		
Description	View list User		
Pre-conditions	- Admin accesses the system. - Admin is currently Loged in.		
Post-conditions	System displays list User.		
Normal Flow	1. From the web header, Admin click"Danh sách khách hàng" button. 2. The system will redirect list user page. 3. On the left side of the website have a slide bar which display list store. Admin click "store" want to view customer. 4. System display list customer belong to store.		
Alternative Flows	N/A		
Exceptions	N/A		

Priority	Medium
Frequency of Use	High
Business Rules	N/A
Other Information	N/A

2.1.3.8 Add user

Use Case ID	UC-28		
Use Case Name	Add User		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	Admin		
Description	Create new user.		
Pre-conditions	- Admin accesses the system. - Admin is currently Loged in.		
Post-conditions	- Admin is added to the system. - Store is automatically Loged into the system.		
Normal Flow	1. From the web header, Admin click"Danh sách khách hàng" button. 2. The system will redirect list user page. 3. On the left side of the website have a slide bar which display list store. Admin click "store" want to create user. 4. System display list customer belong to store. 5. Admin click "Thêm mới "icon. 6.System display register user page. 7. Admin input data in system. 8. After input data, Admin click "Thêm" button. System display message"Bạn có muốn them người dùng này" 9. Admin click "Đồng ý". System display new list user belong store. New user add to system.		
Alternative Flows	N/A		
Exceptions	*N/A*		
Priority	Medium		
Frequency of Use	High		
Business Rules	N/A		

Other Information	N/A

2.1.3.9 Search user

Use Case ID	UC-29		
Use Case Name	Search User		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	Admin		
Description	Search User.		
Pre-conditions	- Admin accesses the system. - Admin is currently Loged in.		
Post-conditions	System displays list User after search.		
Normal Flow	1. From the web header, Admin click"Danh sách khách hàng" button. 2. The system will redirect list User page. 3. On the left side of the website have a slide bar which display list store. Admin click "store" want to search user. 4. System display list user belong store which admin choose. 5. Admin input data in search field. 6.System display result after search.		
Alternative Flows	N/A		
Exceptions	*Exc1: Admin leave blank "Tìm kiếm" field, then click search* *Expected: The system display all list User.* *Exc2: Admin input special character, html, javascript…* *Expected: The system display alert: "Bạn nhập sai"*		
Priority	Medium		
Frequency of Use	High		
Business Rules	N/A		
Other Information	N/A		

2.1.3.10Update user

Use Case ID	UC-30
Use Case Name	Update User

Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Primary Actor	Store	**Secondary Actors**	N/A
Description	Update information User complete.		
Pre-conditions	- Admin can access the system - Admin is currently not Loged in.		
Post-conditions	- The information of User is update to the system. - System redirect to list User page		
Normal Flow	1. From the homepage, Admin clicks on button "Khách hàng". 2. The system will load the List User page. 3. On the left side of the website have a slide bar which display list store. Admin click “store” want to update user. 4. Admin click the User want to update 5.Admin click “Update” icon 6.System load update page 7.Admin input information 8.After Store input data, Admin click “Thay đổi” 9. User is update. System redirect to list User page.		
Alternative Flows	N/A		
Exceptions	*N/A*		
Priority	High		
Frequency of Use	High		
Business Rules	N/A		
Other Information	N/A		

2.1.3.11View location of user

Use Case ID	UC-31
Use Case Name	View location of user

Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	Admin		
Description	Display location of device on map and status of device.		
Pre-conditions	- Store accesses the system. - Store is currently Loged in. -User belong store.		
Post-conditions	System displays location device on map.		
Normal Flow	1. From the web header, Store click"Danh sách khách hàng" button. 2. The system will redirect list User page of store. 3. On the left side of the website have a slide bar which display list store. Admin click "store" want to view user. System display list user belong that store. 4. Admin find user want to view location. 5. Admin click "Vị trí " button of user . 6.System display location of user on map.		
Alternative Flows	N/A		
Exceptions	*N/A*		
Priority	Medium		
Frequency of Use	High		
Business Rules	N/A		
Other Information	N/A		

2.1.3.12View list contract

Use Case ID	UC-32		
Use Case Name	View List Contract		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	Store		
Description	View list Contract each store		
Pre-conditions	- Contract accesses the system. - Admin is currently Loged in.		

Post-conditions	System displays list device belong store.
Normal Flow	1. From the web header, Store click"Danh sách hợp đồng" button. 2. The system will redirect store list contract page. 3. On the left side of the website have a slide bar which display list store. Admin click "store" want to view contract. 4. System display list contract belong that store which user choose.
Alternative Flows	N/A
Exceptions	N/A
Priority	Medium
Frequency of Use	High
Business Rules	N/A
Other Information	N/A

2.1.3.13Add contract

Use Case ID	UC-33		
Use Case Name	Add Contract		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	Admin		
Description	Admin add contract to system		
Pre-conditions	- Admin is currently Loged in.		
Post-conditions	Add new contract in system.		
Normal Flow	1. From the web header, Store click"Danh sách hợp đồng " button. 2. The system will redirect store list contract page. 3. On the left side of the website have a slide bar which display list store. Admin click "store" want to add new contract. System display list contract belong store what admin choose. 4. Admin click"Thêm mới" icon .		

	5. The system display register page. 6. Admin input data in page. 7. Admin click"Thêm mới" in register page. 8. System display message"Bạn có muốn thêm hợp đồng này". 9. Admin click "Đồng ý". 10.System send redirect to list contract page of store what admin choose.
Alternative Flows	N/A
Exceptions	*N/A*
Priority	Medium
Frequency of Use	High
Business Rules	N/A
Other Information	N/A

2.1.3.14 Update contract

Use Case ID	UC-34		
Use Case Name	Update contract		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Primary Actor	Admin	**Secondary Actors**	N/A
Description	Update information Device complete.		
Pre-conditions	- Store can access the system - Store is currently not Loged in.		
Post-conditions	- The information of contract is update to the system. - System redirect to list contract page		
Normal Flow	1. From the homepage, the Admin clicks on button "Danh sách hợp đồng". 2. The system will load the List contract page. 3. On the left side of the website have a slide bar which display list store. Admin click "store" want to add update contract. System display list contract belong store what admin choose. 4. Admin find the contract want to update 5. Admin click "Sửa" icon 6.System load update page		

	7. Admin input information 8.After Admin input data, Store click “Thay đổi” 9.System display messenger ”Bạn có muốn update thông tin” 10.System redirect to list contracts page of store what admin choose. User update success.
Alternative Flows	N/A
Exceptions	*N/A*
Priority	High
Frequency of Use	High
Business Rules	N/A
Other Information	N/A

2.1.3.15Search contract

Use Case ID	UC-35		
Use Case Name	Search contract		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Actor	Admin		
Description	Search contract.		
Pre-conditions	- Admin accesses the system. - Admin is currently Loged in.		
Post-conditions	System displays list contract belong store after search.		

Normal Flow	1. From the web header, Amin click"Danh sách hợp đồng" button. 2. The system will redirect list contract page of store. 3. On the left side of the website have a slide bar which display list store. Admin click "store" want to add update contract. System display list contract belong store what admin choose. 4. Admin click"Tìm kiếm" field. 5. Admin input data in search field. 6.System display result after search.
Alternative Flows	N/A
Exceptions	*Exc1: Store leave blank "Tìm kiếm" field, then click search* *Expected: The system display all list contract.* *Exc2: Store input special character, html, javascript…* *Expected: The system display alert: "Bạn nhập sai"*
Priority	Medium
Frequency of Use	High
Business Rules	N/A
Other Information	N/A

2.1.3.16View list broken device

Use Case ID	UC-36		
Use Case Name	View list broken device		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Primary Actor	Store	**Secondary Actors**	N/A
Description	Display list broken device belong store		
Pre-conditions	- Admin can access the system - Admin is currently not Loged in.		
Post-conditions	- Display list broken device of store		

Normal Flow	1. From the homepage, the User clicks on button "Danh sách thiết bị hỏng". 2. The system will load the list broken device page. 3. On the left side of the website have a slide bar which display list store. Admin click “store” want to view list broken device. 4. System display list broken device belong store which Admin ch
Alternative Flows	N/A

2.1.3.17View Map

3 Use Case ID	UC-37		
Use Case Name	View map		
Creator	ThanhTN	**Date Created**	2019/10/10
Version	1.0	**Last Updated**	2019/10/10
Primary Actor	Store	**Secondary Actors**	N/A
Description	Display location of device in the map and status of them.		
Pre-conditions	- Store can access the system - Store is currently not Loged in.		
Post-conditions	- Display list broken device of store		
Normal Flow	1. From the homepage, the User clicks on button "Bản đồ". 2. The system will load the location of device and store one map. Display information of them if admin hover it.		
Alternative Flows	N/A		

2.2.3.18Changed password

Use Case ID	UC-38		
Use Case Name	Logout	**Date Created**	2020/10/10
Creator	ThanhTN	**Last Updated**	2019/10/10
Version	1.0		

Actor	Admin
Description	Logout of the account
Pre-conditions	- Admin accesses to the system. - Admin is currently Loged in.
Post-conditions	Admin is Loged out of the system.
Normal Flow	1. From the website header, User moves cursor above the top right corner, with the Admin's personal icon. 2. Admin clicks "Đổi mật khẩu". 3. The system will dislay change password page. 4. Admin change password. 5.System send redirect to homepage. Password changed complete.
Alternative Flows	N/A
Exceptions	N/A.
Priority	Medium
Frequency of Use	Medium
Business Rules	N/A

2.2.3.19Changed Admin information

Use Case ID	UC-39		
Use Case Name	Logout	**Date Created**	2020/10/10
Creator	ThanhTN	**Last Updated**	2019/10/10
Version	1.0		
Actor	Admin		
Description	Logout of the account		
Pre-conditions	- Admin accesses to the system. - Admin is currently Loged in.		

Post-conditions	Admin is Loged out of the system.
Normal Flow	1. From the website header, User moves cursor above the top right corner, with the Admin's personal icon. 2. Admin clicks "Thay đổi thông tin". 3. The system will dislay change password page. 4. Admin change information . 5.System send redirect to homepage. Information changed complete.
Alternative Flows	N/A
Exceptions	N/A.
Priority	Medium
Frequency of Use	Medium
Business Rules	N/A

3. Functional Requirements

3.1 System Functional Overview

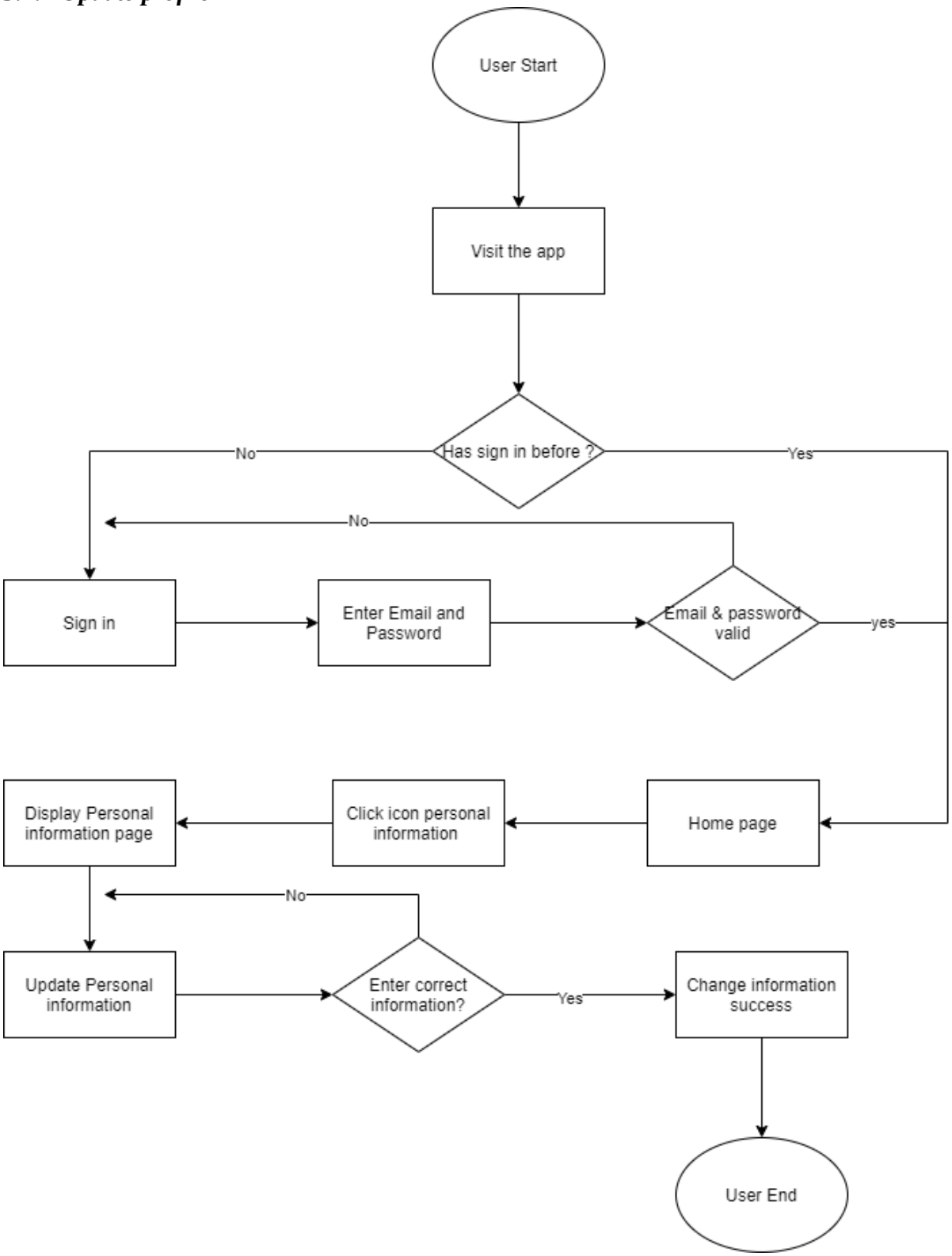
3.1.1 Screen Authorization

Function	User	Store	Admin
Register	✓		
View User information	✓	✓	✓
Update user information	✓	✓	✓
View Gas-meter report	✓	✓	✓

View notification	✓		
View list user		✓	✓
Add new user		✓	✓
Search user		✓	✓
View location of user		✓	✓
View list store			✓
Add new store			✓
Update Store			✓
Search Store			✓
View Contract		✓	✓
Create Contract		✓	✓
Update Contract		✓	✓
Search Contract		✓	✓
View map		✓	✓
View list broken device		✓	✓
Change Password			✓

3.2 System Flowchart

3.2.1 Update profile



Firgure 3.2.1 : Update profile flowchart

3.2.2 View Gas-Meter report

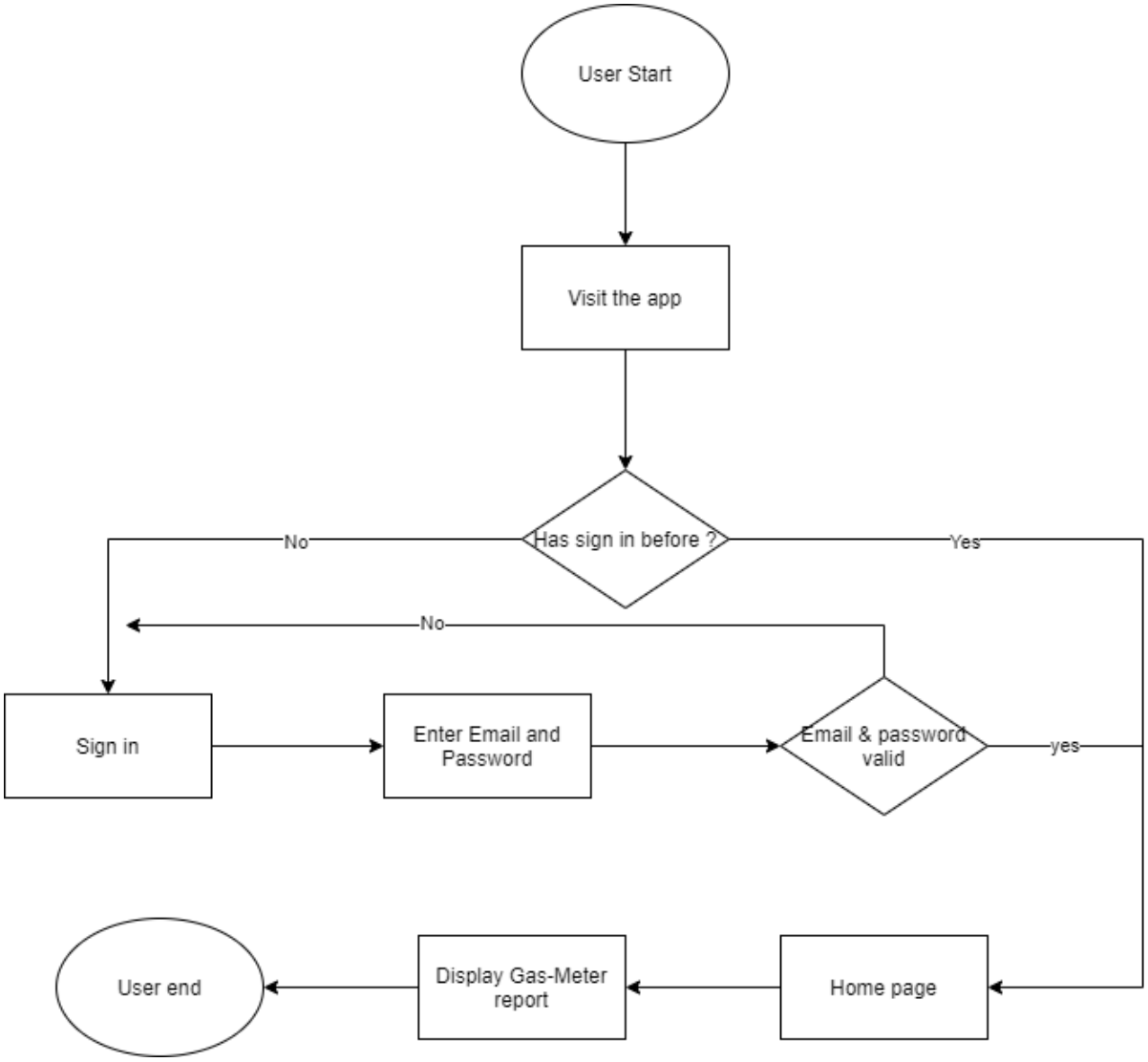


Figure 3.2.2: View Gas-Meter report flow chart

3.2.3 View notification

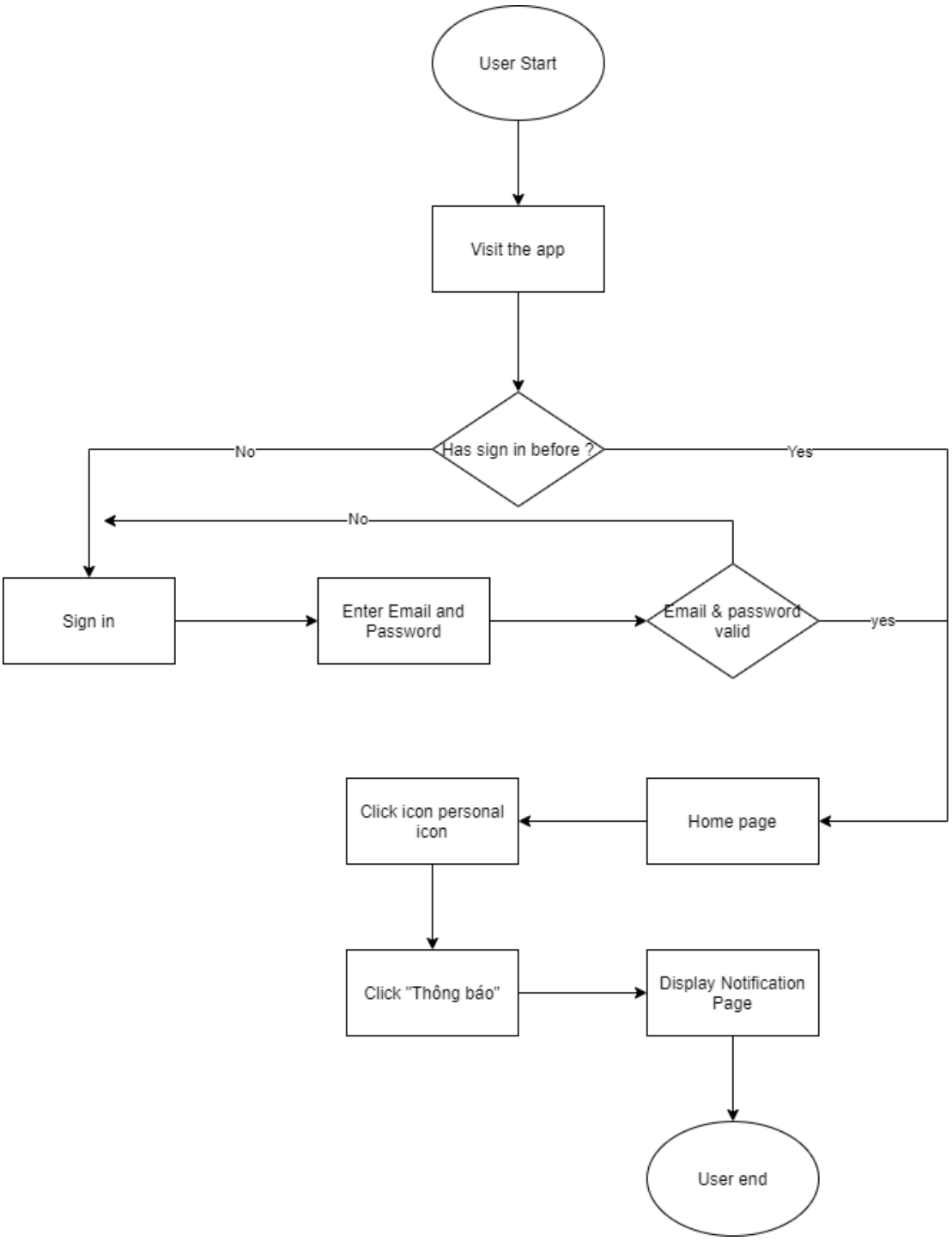


Figure 3.2.3 : View Notification Flow chart

3.2.4 Manage User

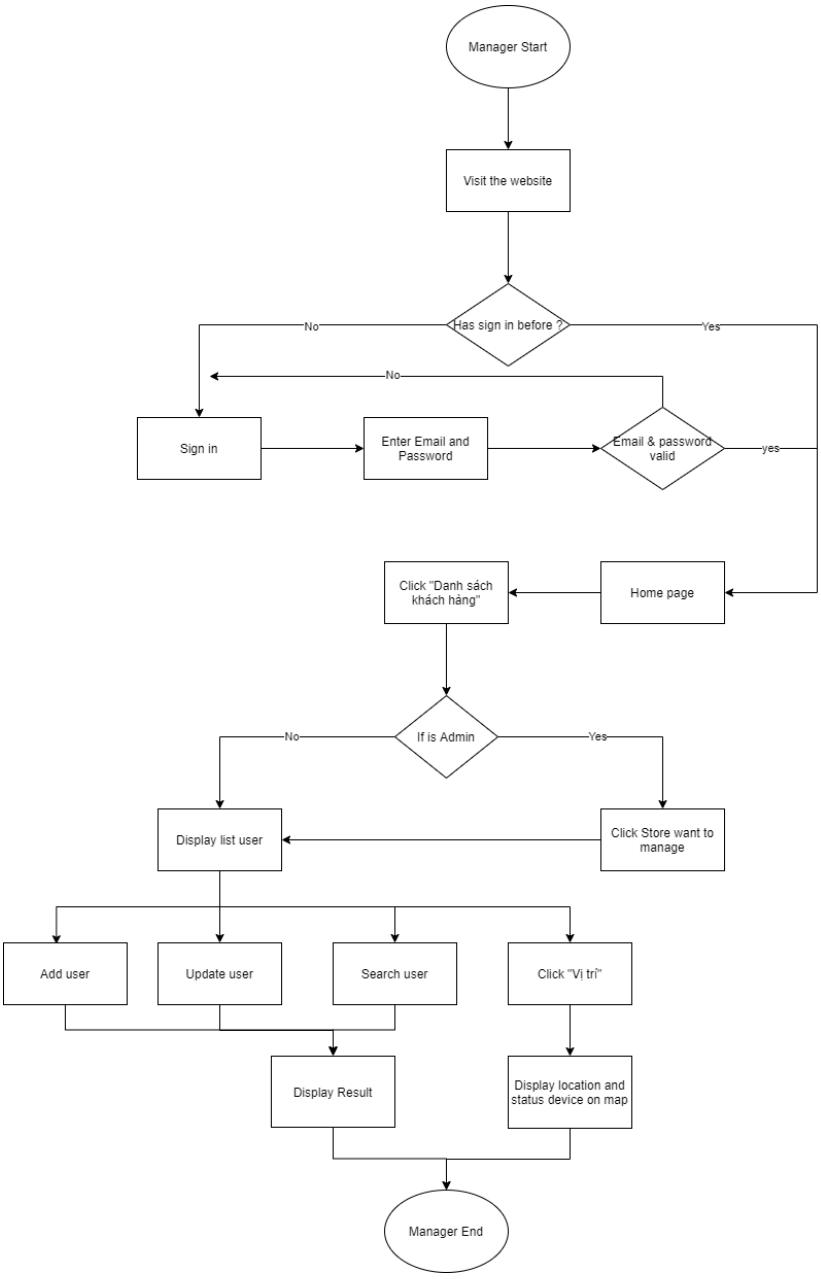


Figure 3.2.4: Manage user flow chart

3.2.5 Manage Contract

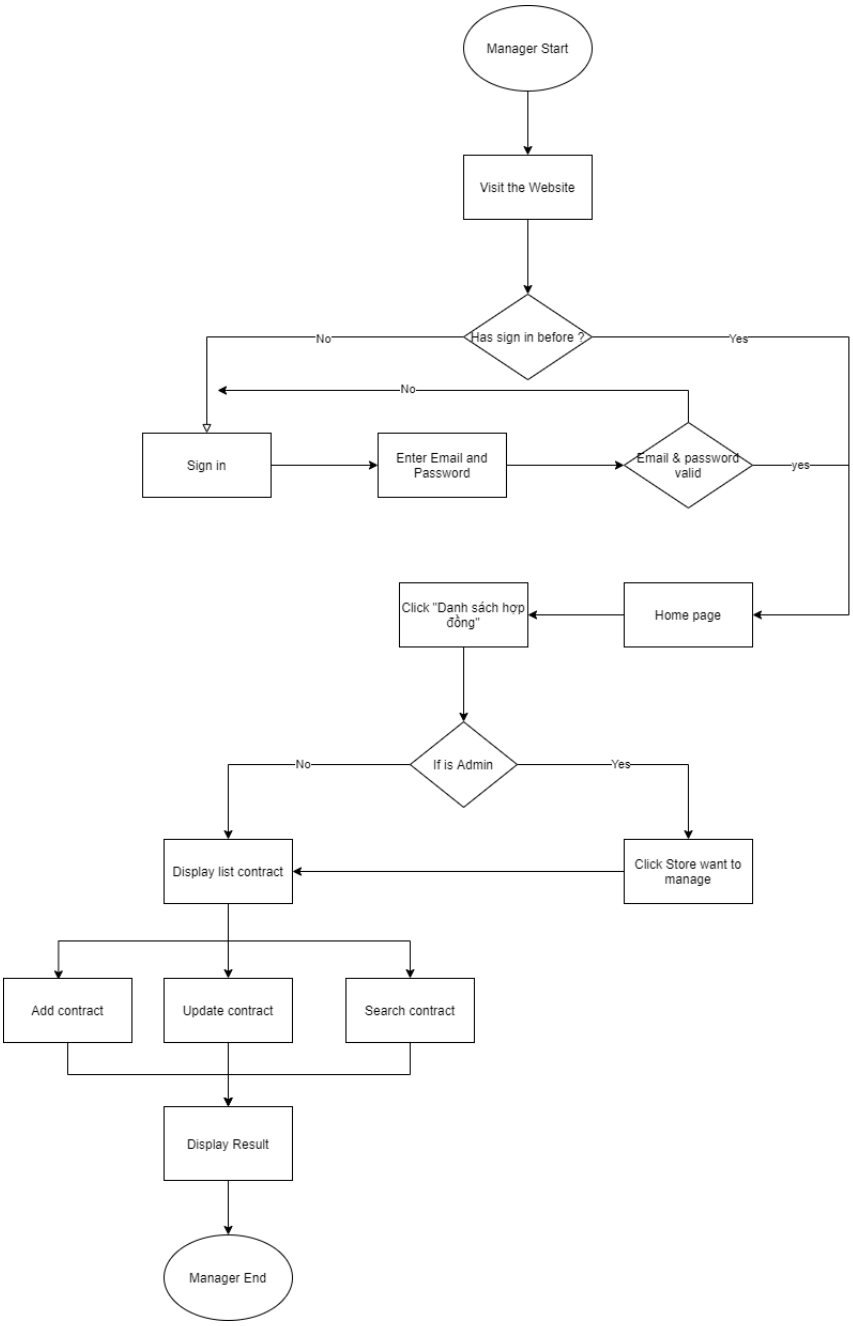


Figure 3.2.5: Manage contract flow chart

3.2.6 View list broken device

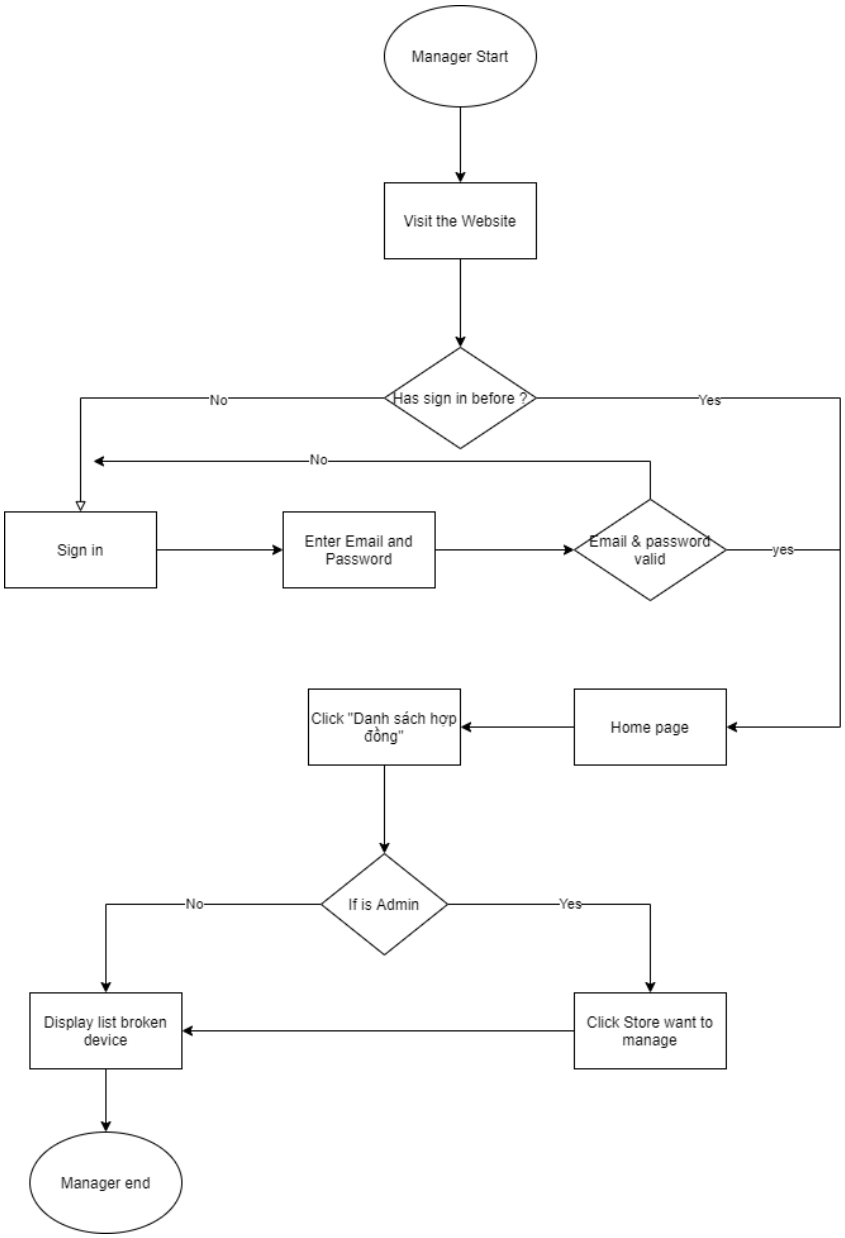


Figure 3.2.6 : View list broken device flow chart

3.2.7 View map

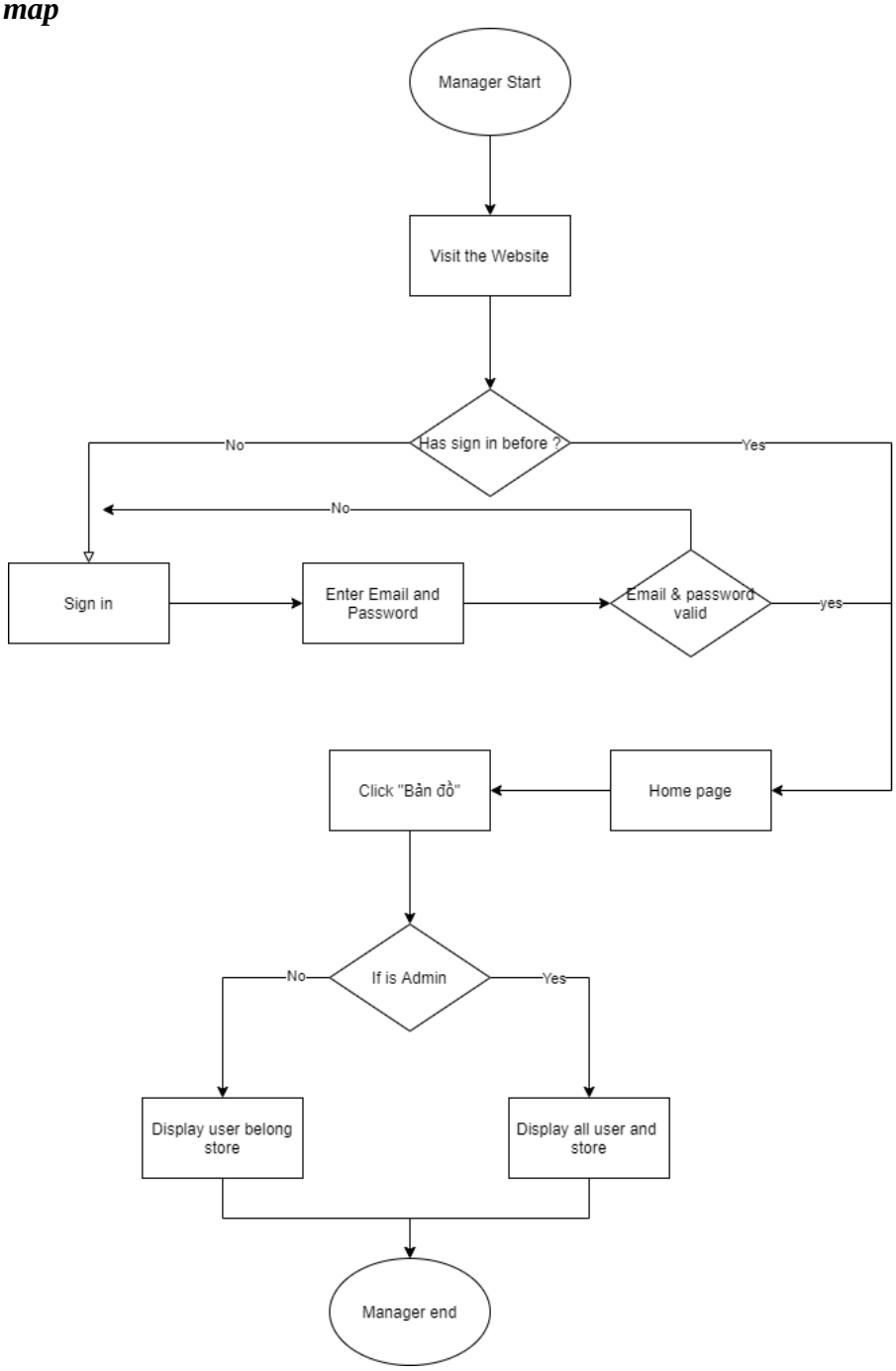


Figure3.2.7 : View map flow chart.

3.2.8 Change Admin password

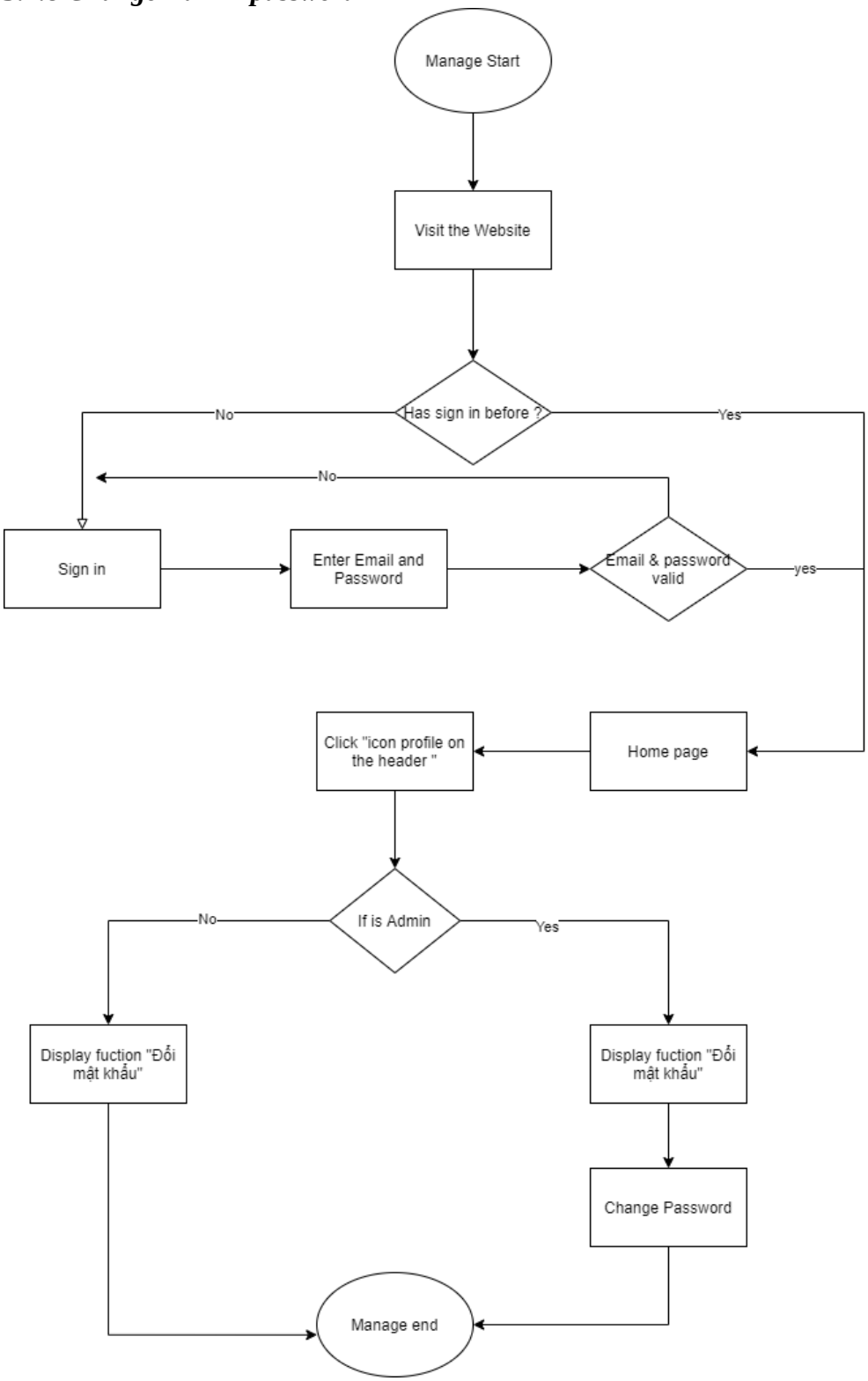


Figure 3.2.8 : Change Admin flow chart

3.3 Entity Relationship Diagram

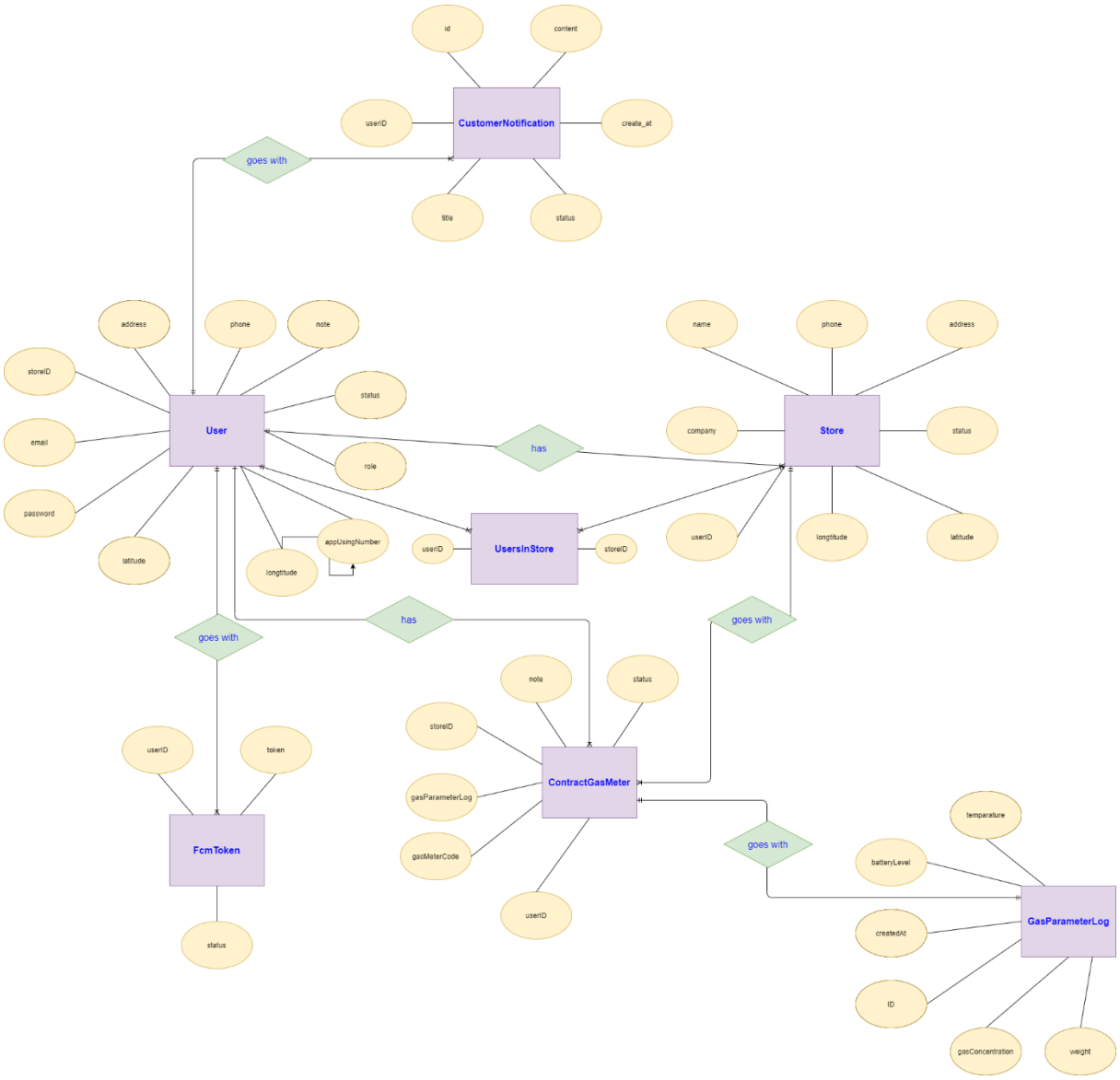


Figure 3.3: Entity Relationship Diagram

IV. Software Design Description

1. Overall Description

This document's purpose is to describe the technical design of the GasMeter application. This will give the developer team the overview of the system's architecture so they can understand how the system should be implemented and the way the system works. This document will consist of:

- System Architectural Design
- Detailed System Design
- Sequence Diagrams
- Description of all class
- User Interface Designs
- Database Design

1.1 Assumptions

This system is designed to base on these following assumptions:

- Web-servers run on CentOS which supports Internet connection.
- Chrome web browser.
- Database using MySQL.
- Users with phone devices running Android operating system.

1.2 Design Constraints

- End-user's Environment: Windows, Android.
- Support languages: Vietnamese.
- Web application and mobile application must be responsive and snappy.
- The user's phone must have a stable connection to the int ernet.

1.3 [Technology Suggestion]

- Database: MySQL.
- Web Application: Angular 8.
- Mobile Application: Flutter.
- Server: Java Spring Boot.

2.System Architecture Design

2.1 Overall Architecture

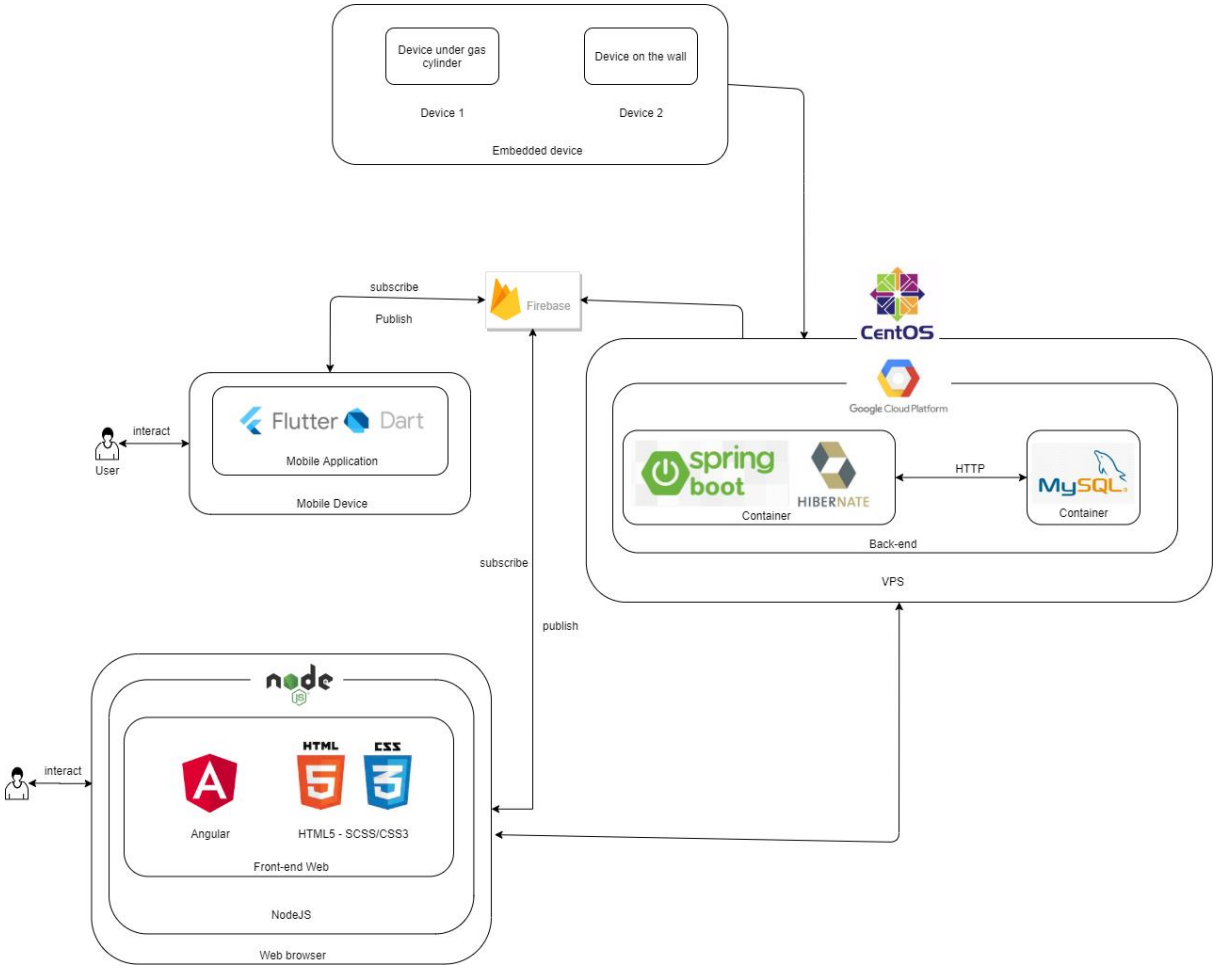


Figure 2.1: System Architecture

2.2 System Architecture Explanation

2.2.1 Flutter

Figure 2.2.1 Flutter

Flutter is new Google SDK for mobile devices that helps developers and designers quickly build apps for mobile devices (Android, iOS). In our project, we use flutter to develop mobile application.

2.2.2 Firebase

Figure 2.2.2: Firebase

Firebase is an excellent backend option for app development. The Google-owned platform has evolved over the years to power lots of apps with cutting-edge features. The platform offers many tools and services that allow developers to perform tasks faster and more efficiently. Firebase handles the backend hassles, so the developers have more time to create excellent frontend features for their apps. In our project, firebase The firebase server is where the data will be stored: user's profile, account, Gas-meter information … It updates data from the sensor controller or from the controller module. With the changes measured by the sensor, the controller will make the comparison. If there is an abnormality, it will notify by sending the message to the clients. When firebase receives a request to retrieve data, it will retrieve the user's data and display it on the screen of the application.

2.2.3 Spring Boot

Figure 2.2.3 Spring Boot.

Spring boot is an outstanding project in the Spring Framework ecosystem, which is the fastest way to create a standalone REST service. Spring boot simplifies the configuration, in particular, Spring Boot self-configures all by providing specific behaviors. In our project, we use Java Spring Boot for designing backend system.

2.2.4 MySQL

Figure 2.2.4: MySQL

MySQL is the world's most popular open source database management system (RDBMS). MySQL is fast, stable, easy to use, and works on a variety of operating systems. In our project, we use MySQL for database management.

2.2.5 Angular

Figure 2.2.5: Angular

Angular is a javascript framework developed by google to build Single Page Applications (SPA) using JavaScript, HTML and TypeScript. Angular provides built-in features for animations, http services, and has features like auto-complete, navigation, toolbar, menus, and more. Code is written in TypeScript, compiled into JavaScript, and displayed similarly in the browser. In our project, we use Angular to develop front-end.

2.2.6 HTML5 + SCSS/CSS3

Figure 2.2.6: HTML5+SCSS/CSS3

HTML (Hypertext Markup Language) is a platform that helps users to design website elements, structure pages, categories or design applications... So, the main function of this platform is to create layouts, and website format. CSS (Cascading Style Sheets) is a simple mechanism for adding styles (colors, fonts, ...) to web documents. The layout of our website is designed by HTML5.

2.2.7 Hibernate

Figure 2.2.7: Hibernate

Hibernate framework is an open source, lightweight ORM (Object Relational Mapping) solution. Hibernate helps to simplify the development of java applications to interact with a database. ORM tools simplify data creation, data manipulation, and data access. It is a programming technique for mapping an object to the data stored in a database.

2.2.8 CentOS

Figure 2.2.9: CentOS

CentOS is a premium operating system supported by its own community. Because of its resemblance to RHEL, CentOS is a perfect programming environment and is one of the

dominant Linux distributions in the world of Linux. CentOS provides a stable environment. As a result, CentOS delivers an enterprise-grade server experience. The Red Hat sponsored operating system uses the same source code as found in RHEL. CentOS uses the RPM package manager. We use centOS for server.

2.2.9 Google Cloud Platform

Figure 2.2.9: Google Cloud Platform

An instance is a virtual machine (VM) hosted on Google's infrastructure. You can create an instance by using the Google Cloud Console, the gcloud command-line tool, or the Compute Engine API.

You can consult here: *https://cloud.google.com/compute/docs/instances*

2.2.11 Embedded Device

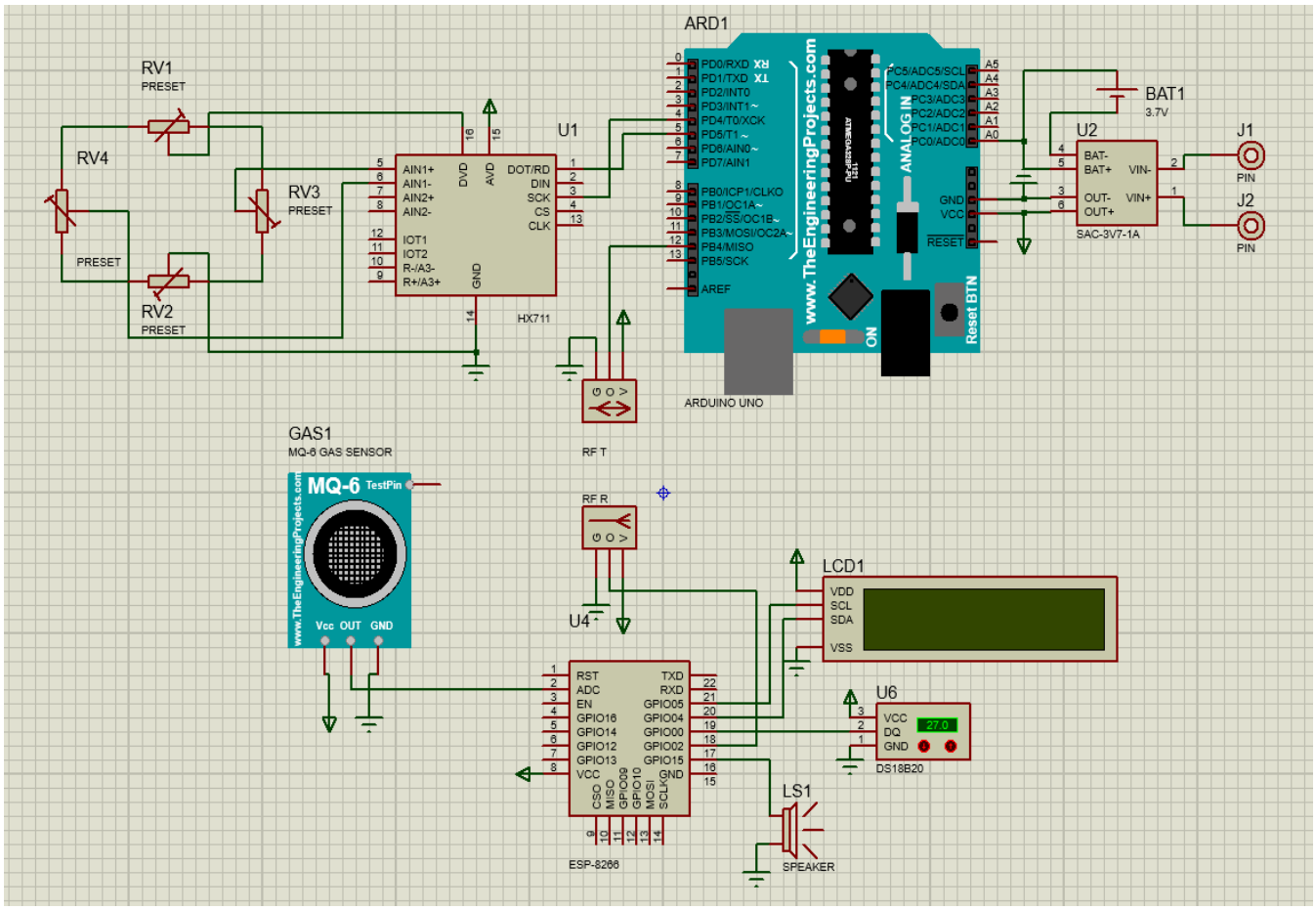
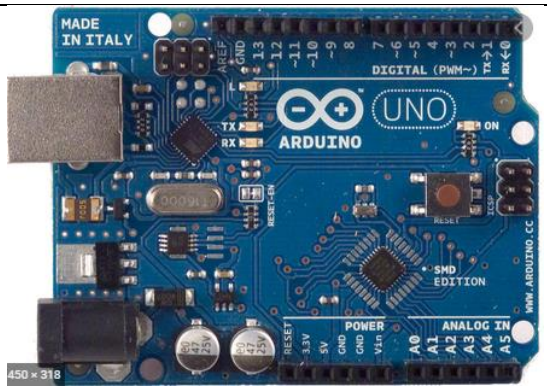


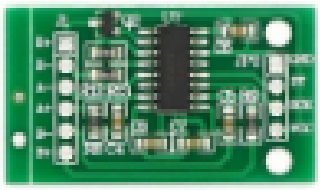
Figure 2.2.11: Embedded Device

Modular designs such as device under gas cylinder, device on the wall and some protective devices, increase connectivity described in the picture above.

Using Esp32 as a processor because it has a wifi connection function, supports firebase data warehouse connection, helps control and transfer data information to users conveniently, but the price of esp32 is cheap and easy to buy.

Hardware devices

Name	***Image***	***Information***
Node MCU ESP8266		• CPU: Xtensa Dual-Core 32-bit LX6 microprocessor • Wireless connectivity: ○ Wi-Fi: 802.11 b/g/n/e/i ○ Bluetooth: v4.2 BR/EDR and BLE • USB – 1x micro USB port for power and programming • Misc – BOOT and EN buttons, red (power) and blue (GPIO2) LEDs • Power Supply – 5V via USB or Vin pin • Dimensions – 51.4 x 28.3 mm • ***Used for getting parameter to send to firebase***
Arduino Uno R3		• Microcontroller: ATmega328P Clock Speed: 16MHz • Operating Voltage: 5V • Digital I/O: 14 • Analog Inputs: 6 • Flash Memory: 32 KB (ATmega328P) 0.5 KB is used by the bootloader • EEPROM: 1 KB (ATmega328P) • SRAM: 2KB (ATmega328P) • ***Used for reading signals, managing sensors and controlling motors***

LoadCell 50Kg LC3434-50		• Size: 34mmX34mm. • Load capacity: 50kg. • ***Feature:*** Gravity sensor for electronic scales.
Loadcell sensor WITH 24 bit ADC – HX711		• Operating voltage: 2.7 ~ 5VDC • Current consumption: <1.5 mA • Sampling rate: 10 - 80 SPS (customized) • Resolution: 24 bit ADC • Voltage resolution: 40 mV • Dimensions: 38 x 21 x 10 mm • ***Feature:*** ADC 24bit Loadcell HX711 ADC converter circuit is used to read resistance value changed from Loadcell sensor (usually very small can not read directly by VĐK) with 24bit ADC resolution and switch to 2-wire communication (Clock) and Data) to submit data to the Microcontroller, suitable for use with load cells in weighing applications.

1-cell backup battery charging circuit - 18650 3.7v battery		•
433Mhz RF Transceiver		Aplication: • Automated Meter Reading (AMR) • Wireless sensor • Industrial Automation • The control of traffic signal • Wireless handheld terminal • Remote control and monitoring • The management of cars • Wire Replacement • Oil and Gas Detection. • The control of robot
Gas Sensor Module LPG / Butane / Propan MQ6		• Operating source: 5V • Data type: Analog • Wide detection range • Fast response speed and high sensitivity • Simple circuit • Stable when used for a long time • Can detect flammable LPG gases such as methane, propane. • **Feature:** LPG / Butane / Propan Gas Sensor Module MQ6 is a highly and widely applicable module. The module detects low

		concentrations of flammable gases, is good for warning and firefighting applications, helps to detect gas leaks and can detect some toxic gases in low concentration.
Buzz 5V		Function is to create sound
LCD screen 0802		• Operating voltage: 5VDC • Screen: 8 lines, 2 characters • Dimensions: 58.0 x 32.0 x 14.0 mm • Font size: 2.45 x 5.00mm • Dot size: 0.45 x 0.50m • **Feature:** Blue 0802 5V LCD display 2 lines of 8 characters each, LCD monitor with contrast adjustment, integrated green backlight.

3. System Detailed Design

3.1 Login

a. Class Diagram

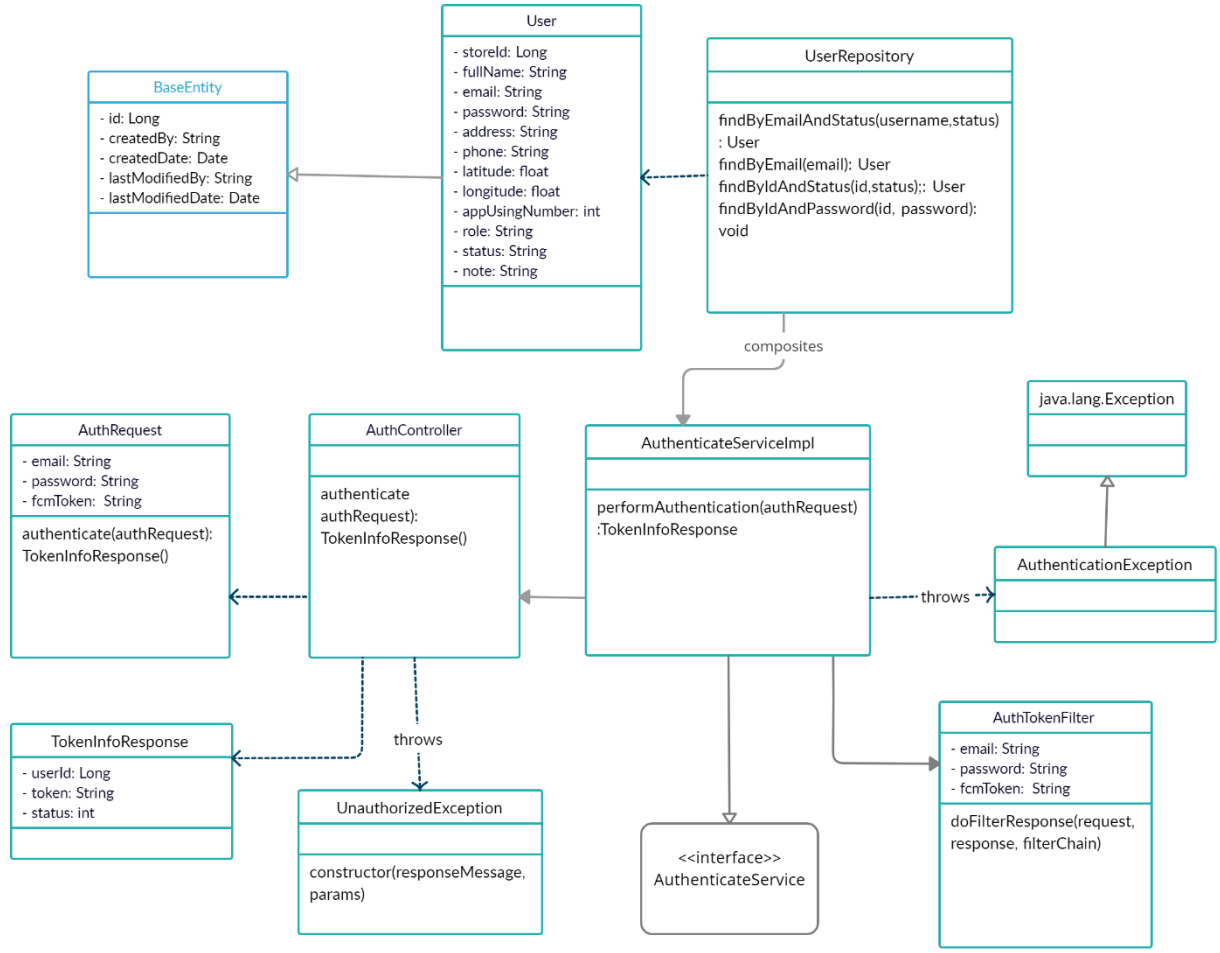


Figure 3.1.1 Login Class Diagram.

b. Class Specification

No	Class Name	Method	Description
1	BaseEntity		The default class of entity, which was inherited by many other entity class.
2	User		User class, which is related to login process.
3	AuthRequest	Authenticate(authRequest): TokenInfoResponse ()	Data request from client send to server.
4	AuthController	authenticate authRequest() TokenInfoResponse()	Direction of flow for api.
5	AuthenticateServiceIplm	performAuthentication(authRequest): TokenInfoResponse	Contains authentication methods detail.

6	UserRepository	findByEmailAndStatus(username, status): User	The method is used to check the database table if there is any user who has the information that.
		findByEmail(email): User	The method is used to check the database table if there is any user who has the information that.
		findByIDAndStatus(id, status): User	The method is used to check the database table if there is any user who has the information that.
		findByIDAndPassword(id,password): void	The method is used to check the database table if there is any user who has the information that.
7	AuthTokenFilter	doFilterResponse(request, response,filterChain)	Filter user by role
8	TokenInfoResponse		Return information of user with a jwt token for authentication.
9	AuthentiactionException		Handle exception when authentication.
10	UnauthentiactionException		Handle exception except authenticationException.
11	<<interface>> AuthenticateService		Interface to define methods of authentication.

c. Sequence Diagram(s)

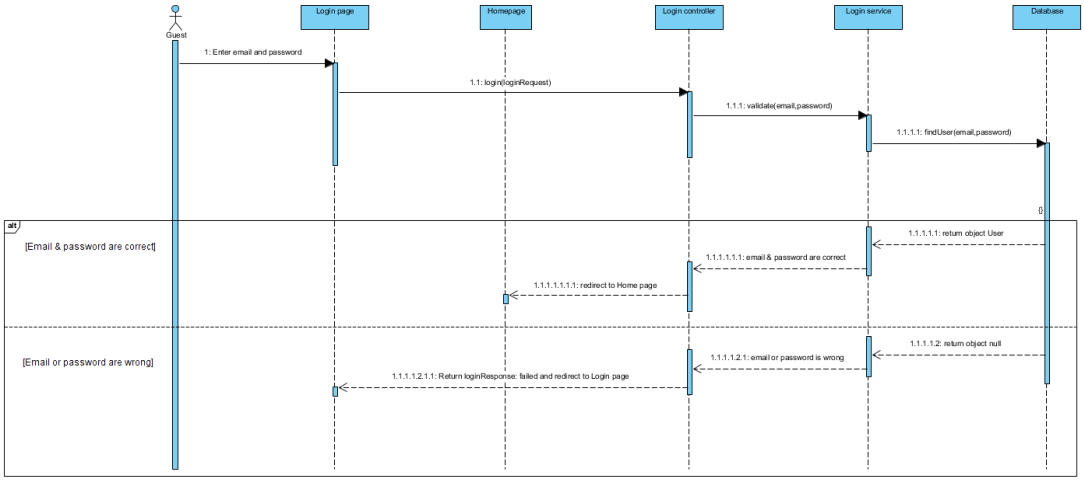
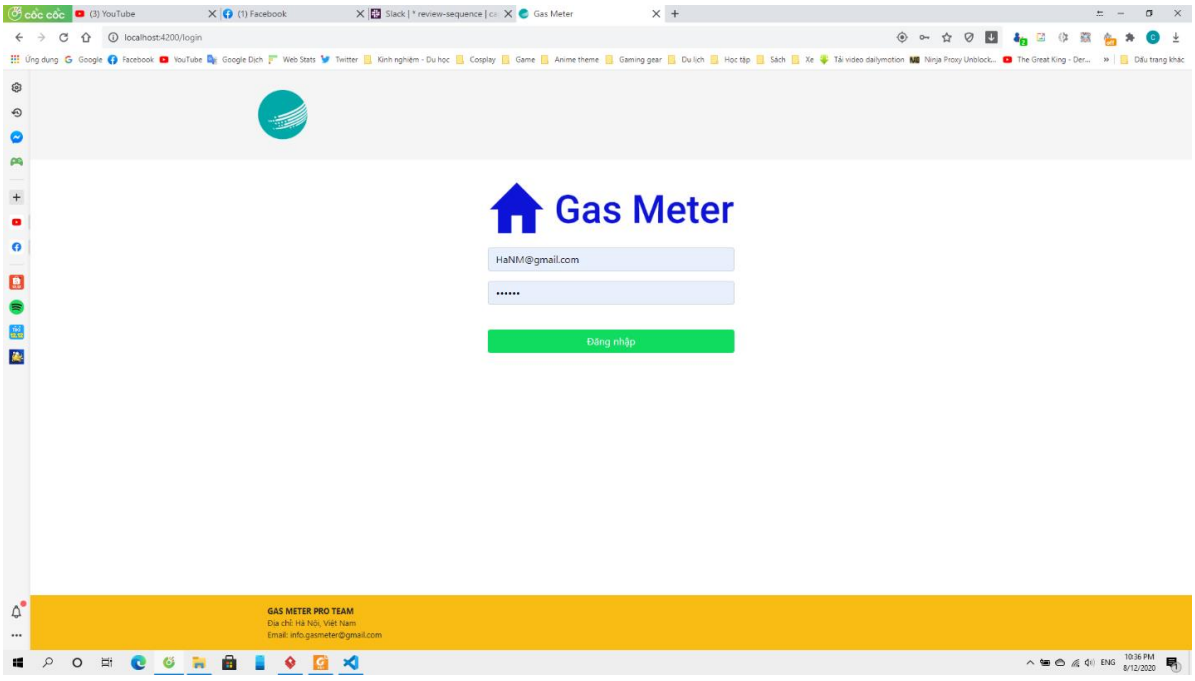


Figure 3.1.1 Login Sequence Diagram.

d. Design

Firgure 3.1.2: Login Screen.

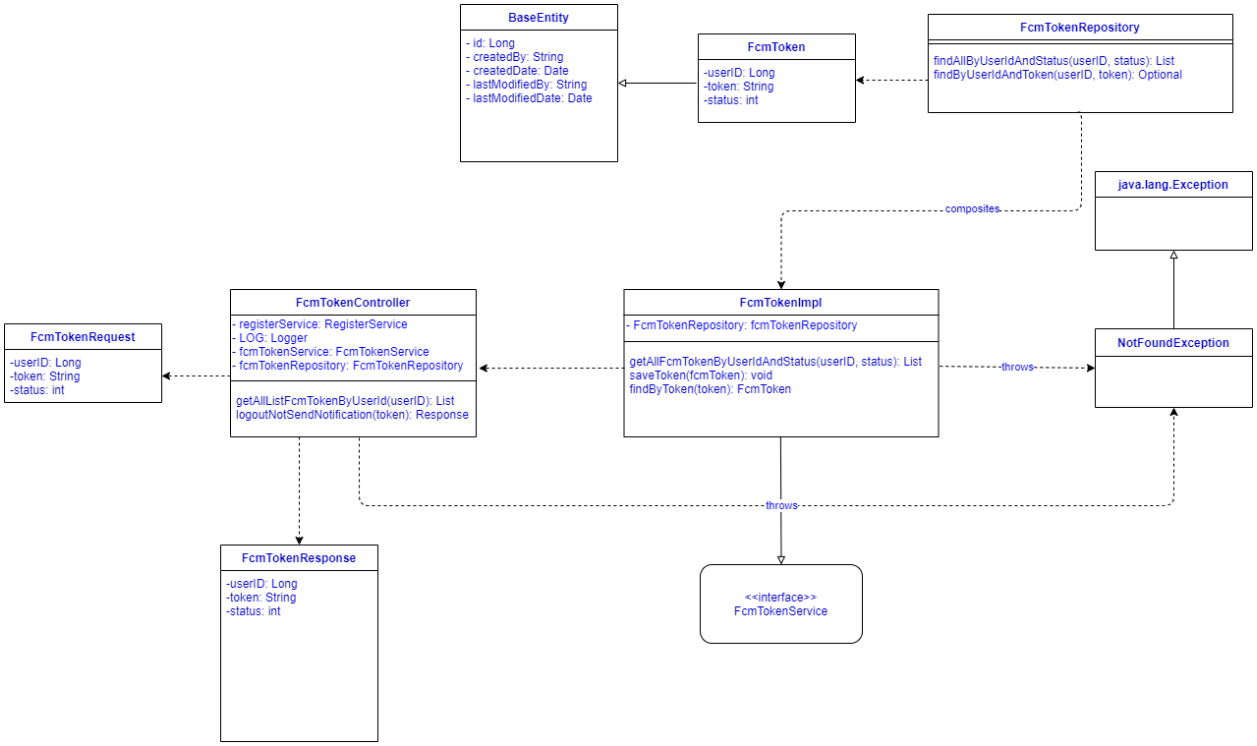


Firgure 3.1.3: Manager Login.

3.2 Logout

a. Class Diagram

[This part presents the class diagram for the relevant feature]

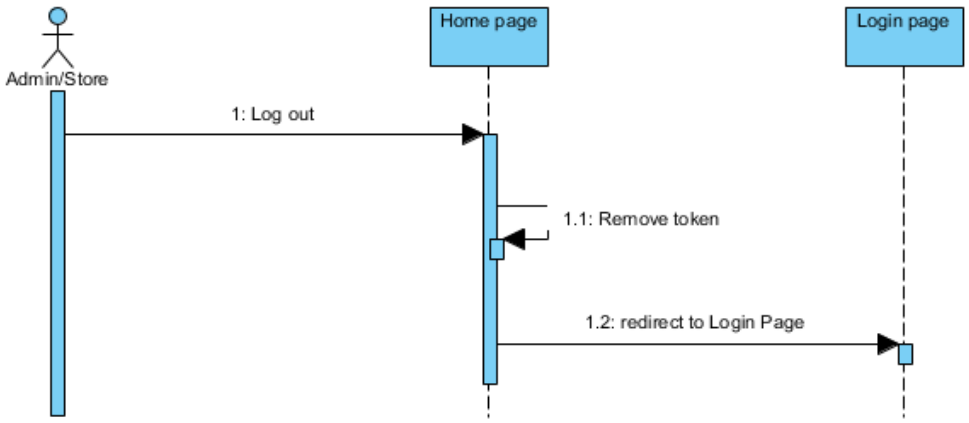


b. Class Specification:

No	Class Name	Method	Description
1	BaseEntity		The default class of entity, which was inherited by many other entity class.
2	FcmToken		FcmToken class, which is related to log out process.
3	FcmTokenRepository	findAllByUserIdAndStatus (userID, status): List	Method to find token by userID if this user is active.
		saveToken(fcmToken): void	Get token by userID.
4	FcmTokenImpl	getAllFcmTokenByUserIdAndStatus(user ID, status): List	Get all FCM Token in system.
		saveToken(fcmToken): void	Save token
		findByToken(token): FcmToken	Find by token
5	FcmTokenController	getAllListFcmTokenByUserId(userID): List	Get all Fcm tokens by userID
		logoutNotSendNotification(token): Response	Find and update status for found tokens.
		getOneUser(ID): List	Get one user by userID.
		updateUser(id,userRequest, token): ResponseEntity	Update data of user.
6	FcmTokenRequest		Request data from client.

7	FcmTokenResponse		Response data from server.
8	<<interface>> FcmTokenService		Interface to define method of user.

c. Sequence Diagram(s)



Firgure 3.2.1: Logout Sequence Diagram.

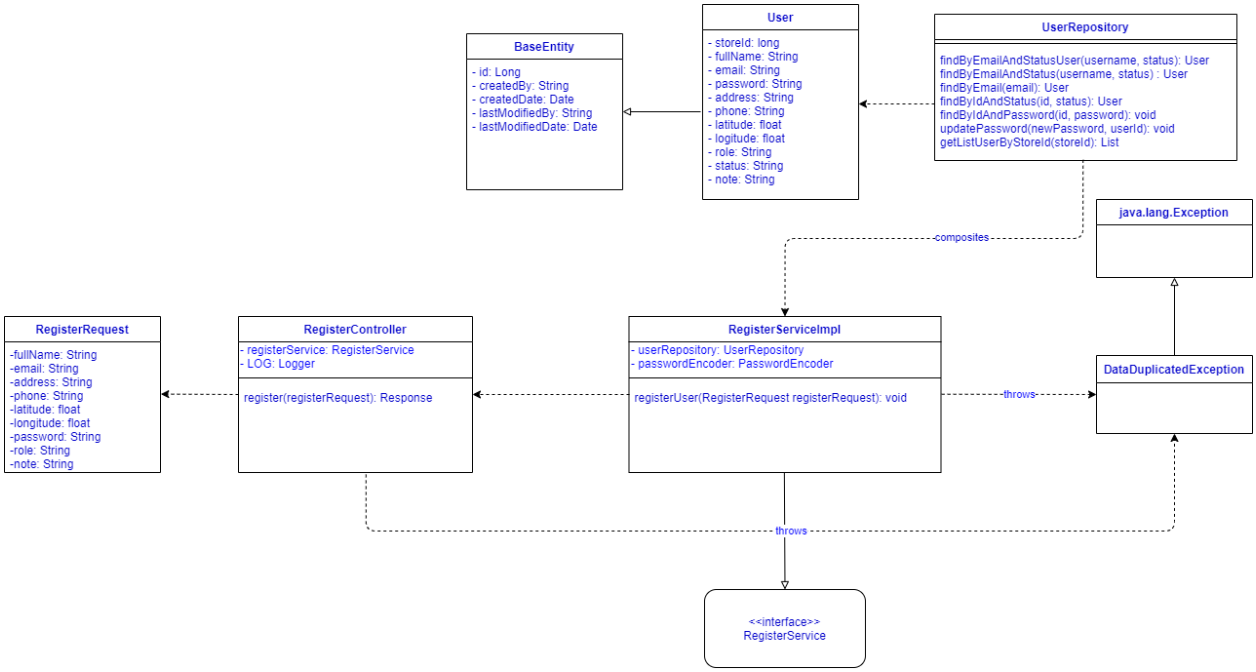
c. Design

Firgure 3.2.2: Logout Screen.

3.3 Register

a. Class Diagram

[This part presents the class diagram for the relevant feature]

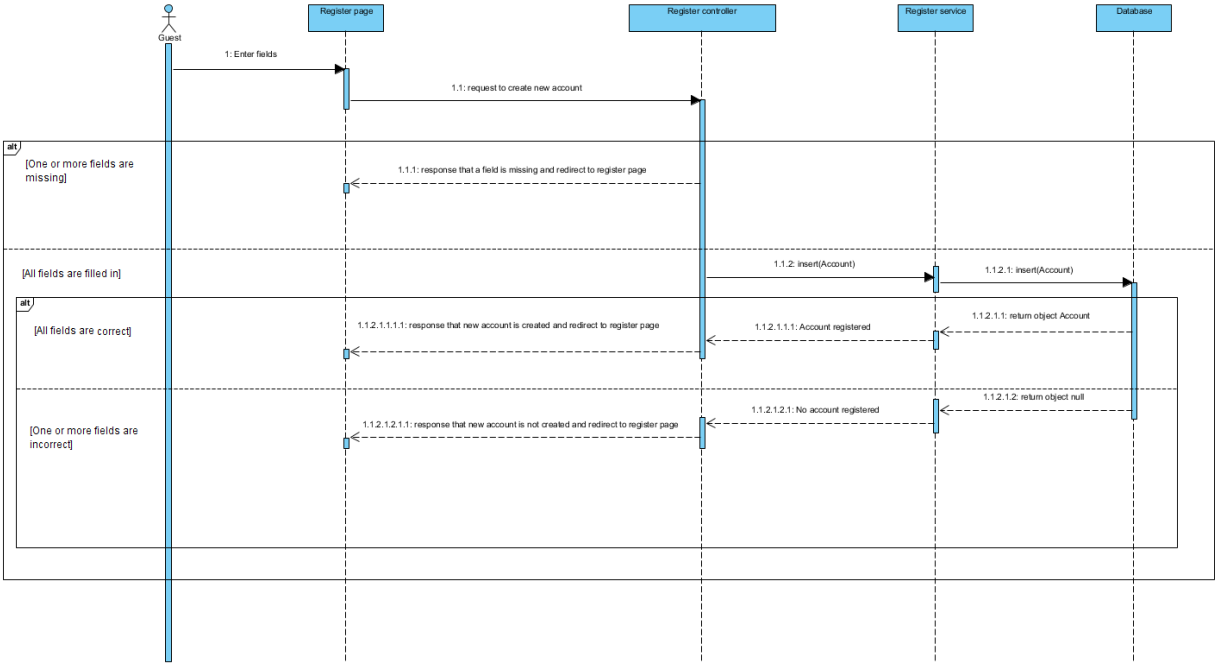


b. Class Specification

[Provide the description for each class, including both Class Attributes and Class Methods information. Those can be in the table format as below]

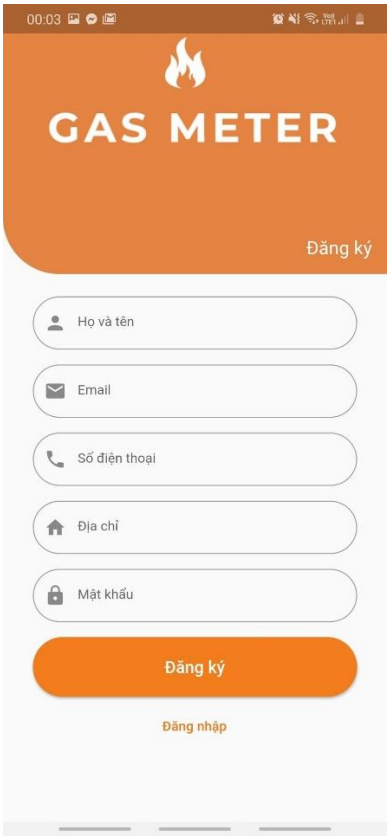
No	Class Name	Method	Description
1	BaseEntity		The default class of entity, which was inherited by many other entity class.
2	User		User class, which is related to login process.
3	UserRepository	findByEmailAndStatus(username, status): User	Method to find user by email if this user is active.
		findByEmail(email): User	Method to find user by email.
		searchUser(Strign text): List	Search user by key word.
		updatePassword (newPassword,userID): void	Method to update password of user.
		getListUserByStoreID(storeID): List	Get list user by store(User of this store).
4	RegisterServiceImpl	registerUser(RegisterRequest registerRequest)	Method to register user.
5	RegisterController	register(registerRequest): Response	Response that user is registered or not.
6	RegisterRequest		Request data from client.
8	<<interface>> RegisterService		Interface to define method of RegisterServiceImpl.

c. Sequence Diagram(s)



Firgure 3.3.1: Register Sequence Diagram.

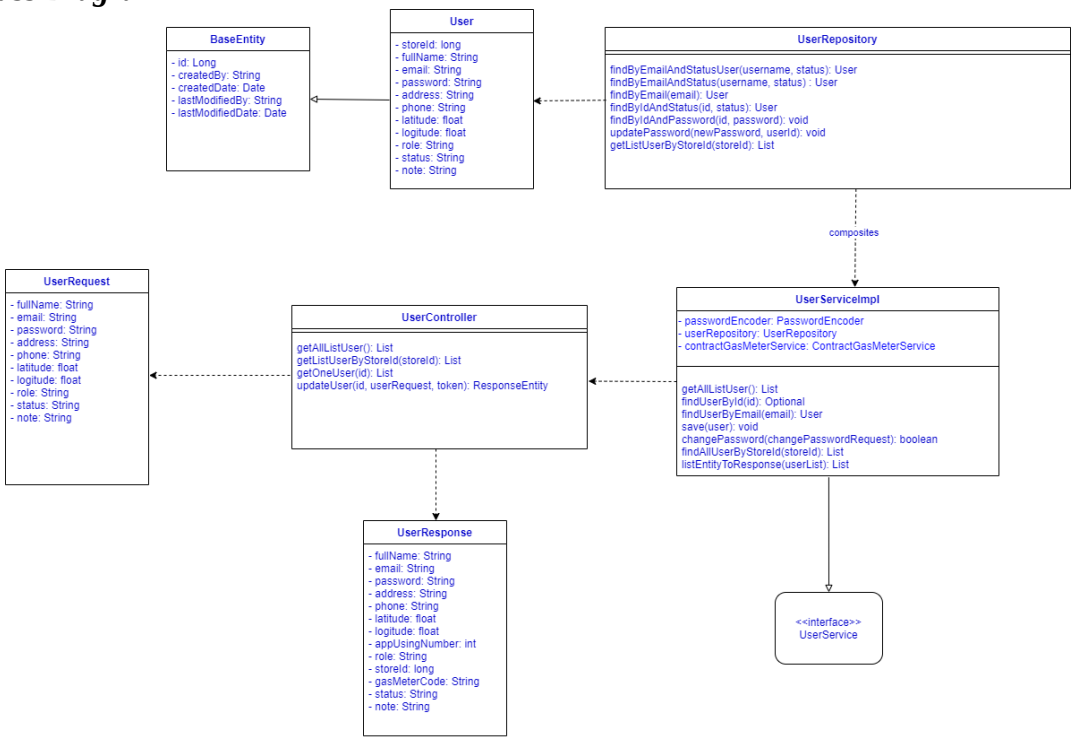
d. Design



Firgure 3.3.2: Register Screen.

3.4 Update Profile

a. Class Diagram



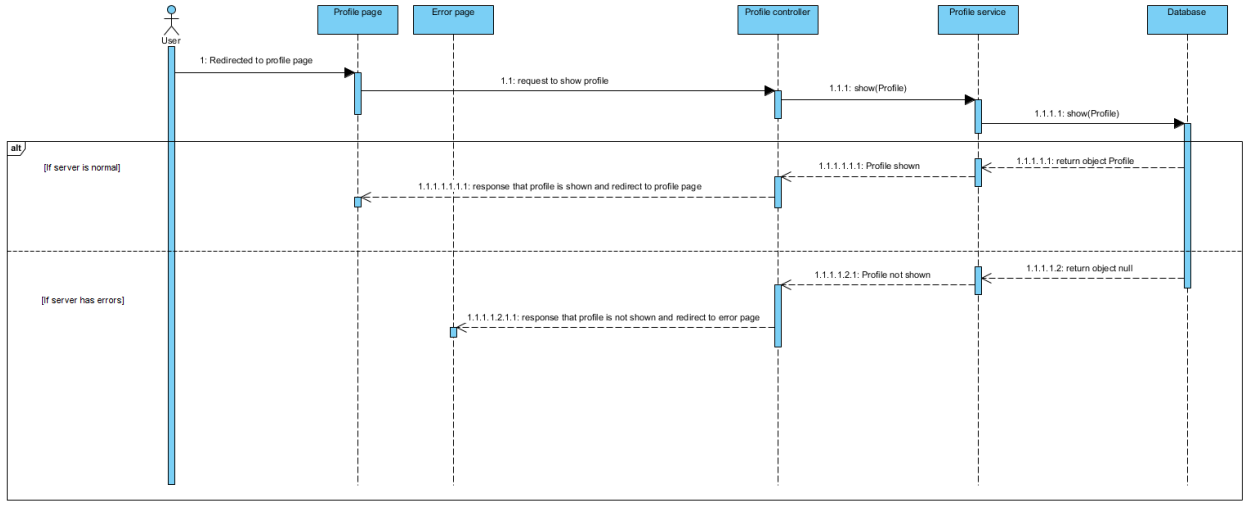
Firgure 3.9.1: Update User Class Diagram.

b. Class Specification

No	Class Name	Method	Description
1	BaseEntity		The default class of entity, which was inherited by many other entity class.
2	User		User class, which is related to update process.
3	UserRepository	findByEmailAndStatus(username, status): User	Method to find user by email if this user is active.
		findByEmail(email): User	Method to find user by email.
		searchUser(Strign text): List	Search user by key word.
		updatePassword (newPassword,userID): void	Method to update password of user.
		getListUserByStoreID(storeID): List	Get list user by store(User of this store).
		getAllListUser(): List	Get all user in system.
		findUserByID: Optional	Get user by userID.
4	UserServiceImpl	findUserByEmail(email) : User	Get user by email.

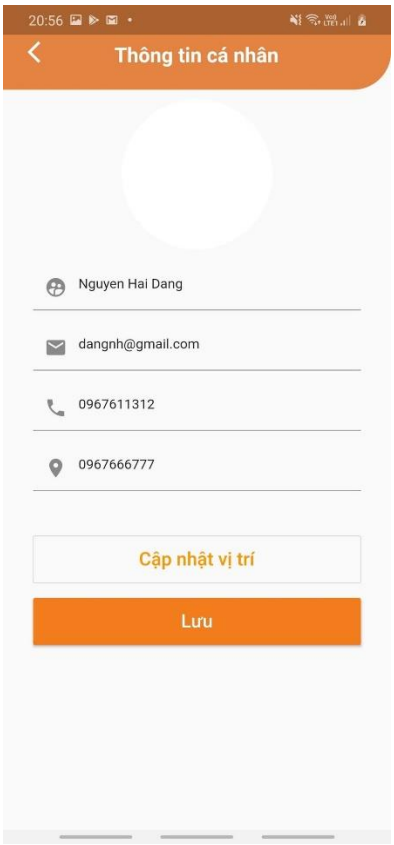
		save(user): void	Add user to database.
		changePassword(changePassrequest): boolean	Change password of user.
		findAllUserByStoreID(storeID): List	Get all user by storeID.
		listEntityToResponse(userList): List	Convert user entity to response data.
		getAllListUser():List	Get all user in system.
		getListUserByStoreID(storeID): List	Get all user by storeID.
5	UserController	getOneUser(id): List	Get one user by userID.
		updateUser(id,userRequest, token): ResponseEntity	Update datta of user.
			Request data from client .
			Response data from server.
6	<<interface>> UserService		Interface to define method of user.

c. Sequence Diagram(s)



Firgure 3.4.1: View Profile Sequence Diagram.

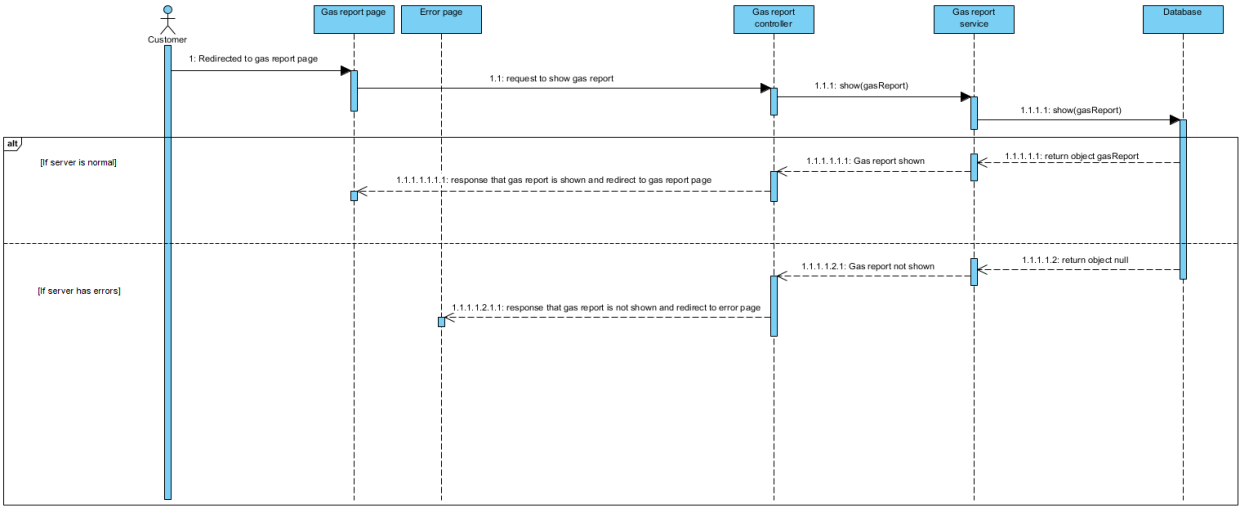
c. Design:



Firgure 3.4.2: Update Profile Screen.

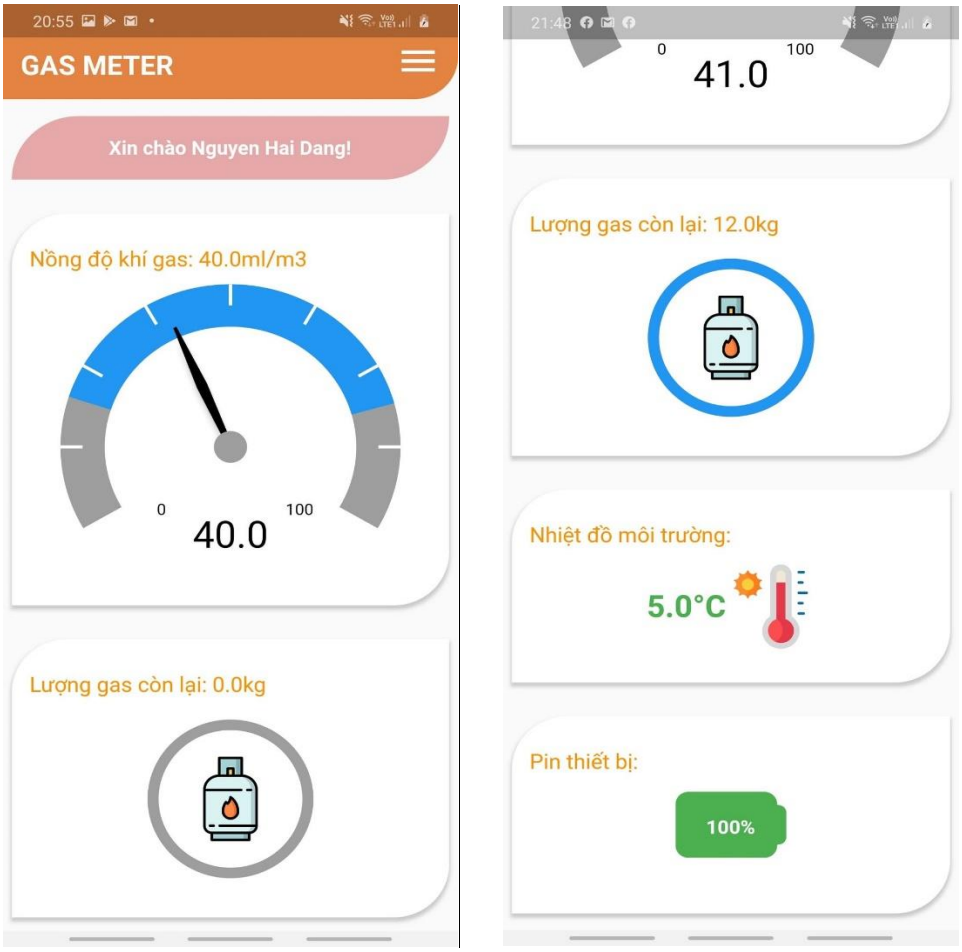
3.5 View Gas-report

a. Sequence Diagram(s)



Firgure 3.5.1: View Gas-report Sequence Diagram.

b. Design:



Firgure 3.5.2: View Gas-report Screen.

3.6 View Notification

[Provide the detailed design for the feature <Feature Name1>. It include Class Diagram, Class Specifications, and Sequence Diagram(s)]

a. Class Diagram

[This part presents the class diagram for the relevant feature]

b. Class Specification

[Provide the description for each class, including both Class Attributes and Class Methods information. Those can be in the table format as below]

b1. XYZ Class

[Provide the detailed description for the class methods]

No	Method	Description
01	<method name>	<Description of the method, including the inputs, outputs & internal method processing>

b2. ABC Class

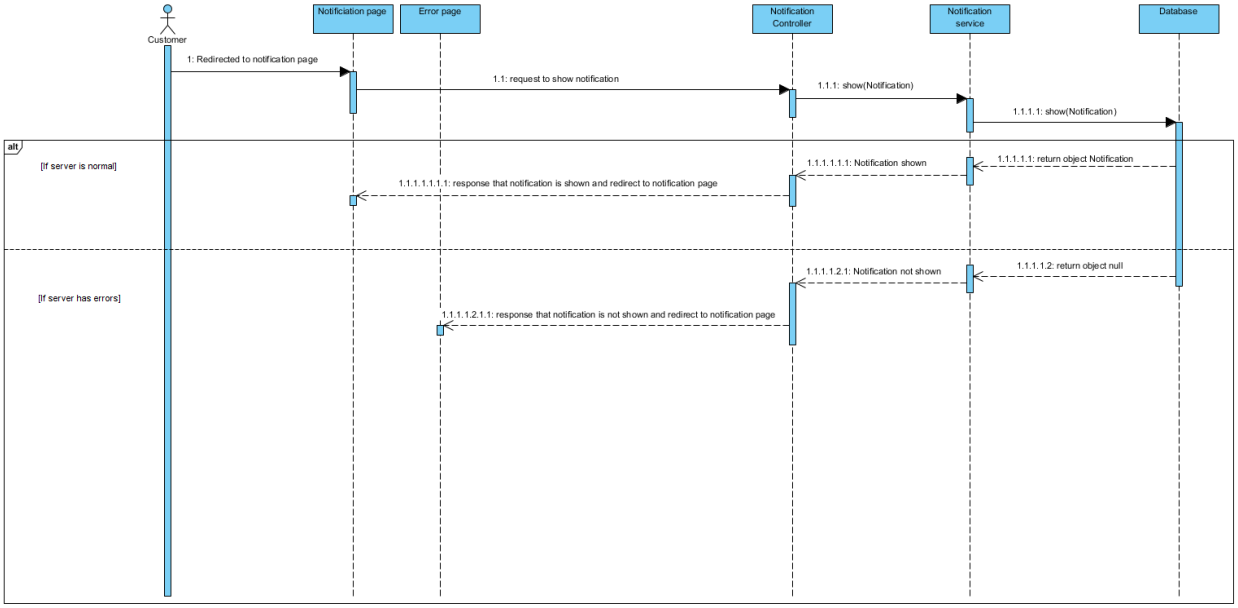
Class Methods

[Provide the detailed description for the class methods]

No	Method	Description
01	<method name>	<Description of the method, including the inputs, outputs & internal method processing>

b3. …

c. Sequence Diagram(s)



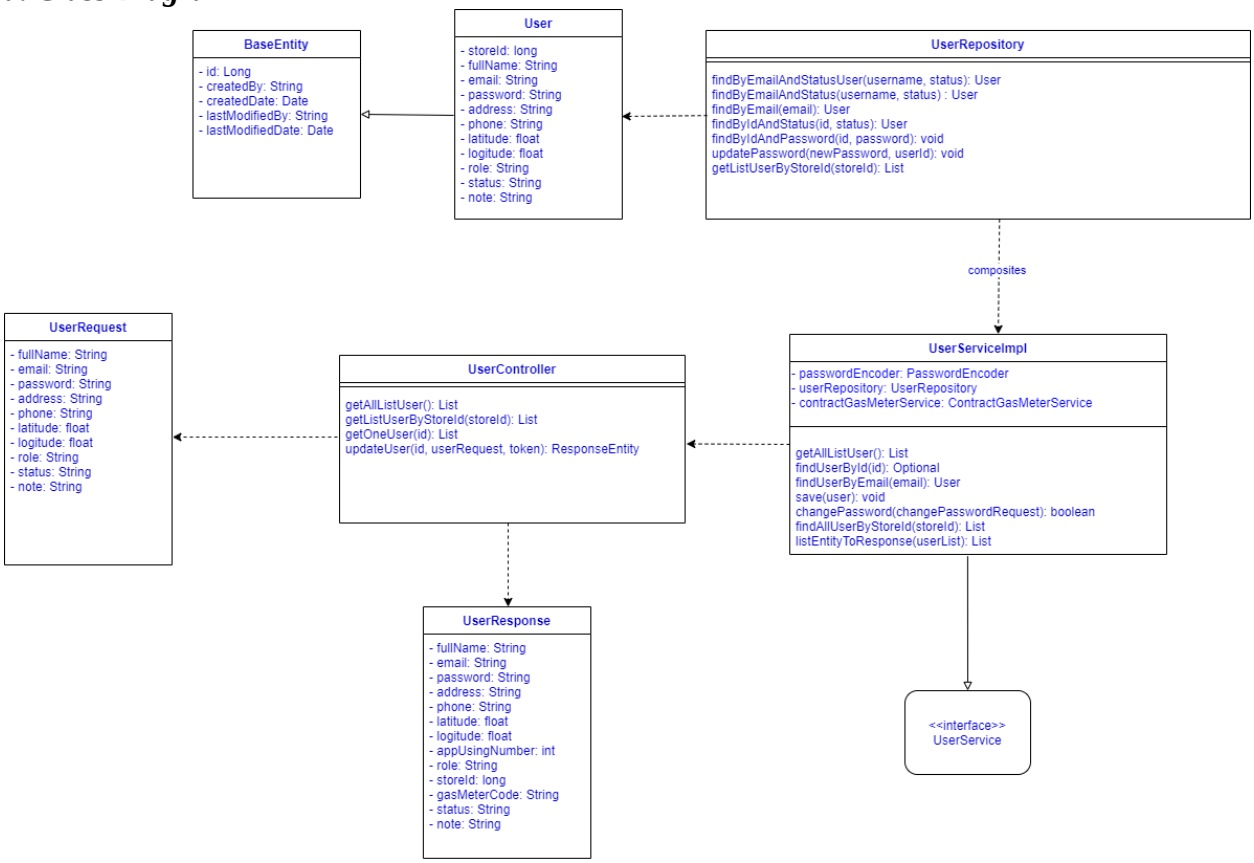
Firgure 3.6.1: View Notification Sequence Diagram.

d. Design

Firgure 3.6.2: View Notification Design.

3.7 View List - user

a. Class Diagram



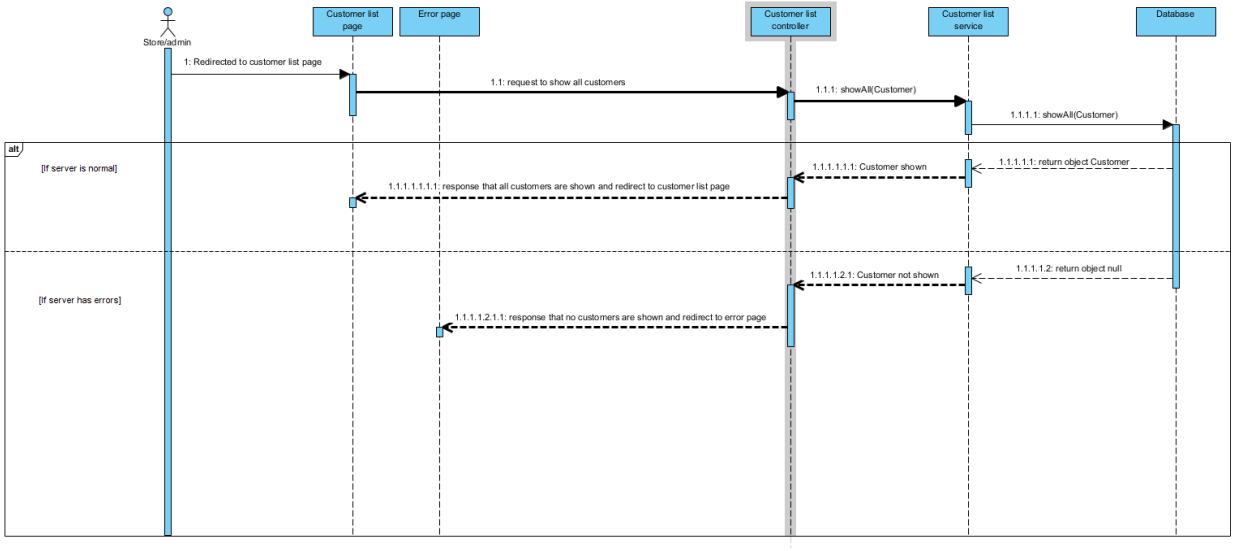
Firgure 3.7.1: View List-user Class Diagram.

b. Class Specification

No	Class Name	Method	Description
1	BaseEntity		The default class of entity, which was inherited by many other entity class.
2	User		User class, which is related to login process.
3	UserRepository	findByEmailAndStatus(username, status): User	Method to find user by email if this user is active.
		findByEmail(email): User	Method to find user by email.
		searchUser(Strign text): List	Search user by key word.
		updatePassword (newPassword,userID): void	Method to update password of user.
		getListUserByStoreID(storeID): List	Get list user by store(User of this store).
4	UserServiceImpl	getAllListUser(): List	Get all user in system.
		findUserByID: Optional	Get user by userID.
		findUserByEmail(email) : User	Get user by email.

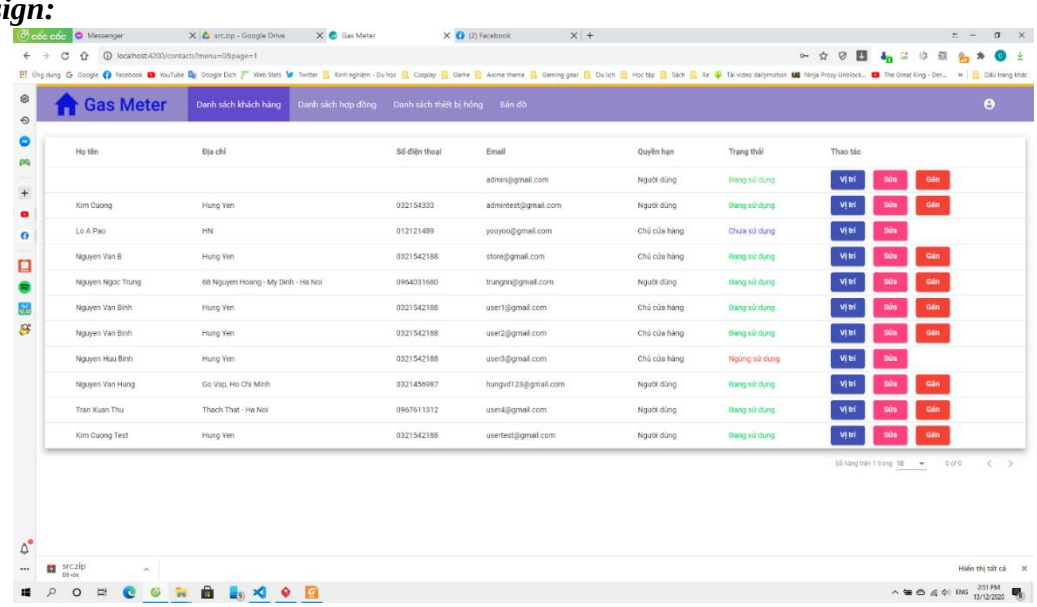
		save(user): void	Add user to database.
		changePassword(changePassrequest): boolean	Change password of user.
		findAllUserByStoreID(storeID): List	Get all user by storeID.
		listEntityToResponse(userList): List	Convert user entity to response data.
5	UserController	getAllListUser():list	Get all user in system.
		getListUserByStoreID(storeID): List	Get all user by storeID.
		getOneUser(id): List	Get one user by userID.
		updateUser(id,userRequest, token): ResponseEntity	Update datta of user.
6	UserRequest		Request data from client .
7	UserResponse		Response data from server.
8	<<interface>> UserService		Interface to define method of user.

c. Sequence Diagram(s)



Firgure 3.7.2: View List-user Sequence Diagram.

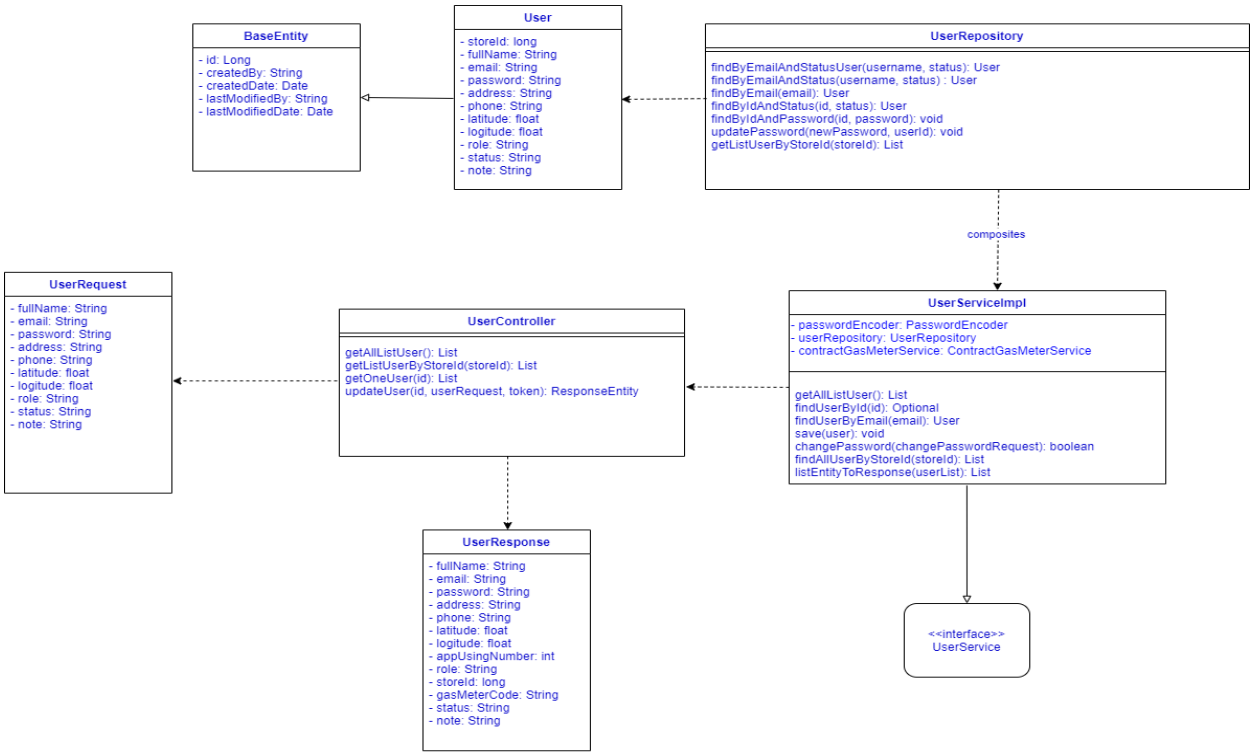
d. Design:



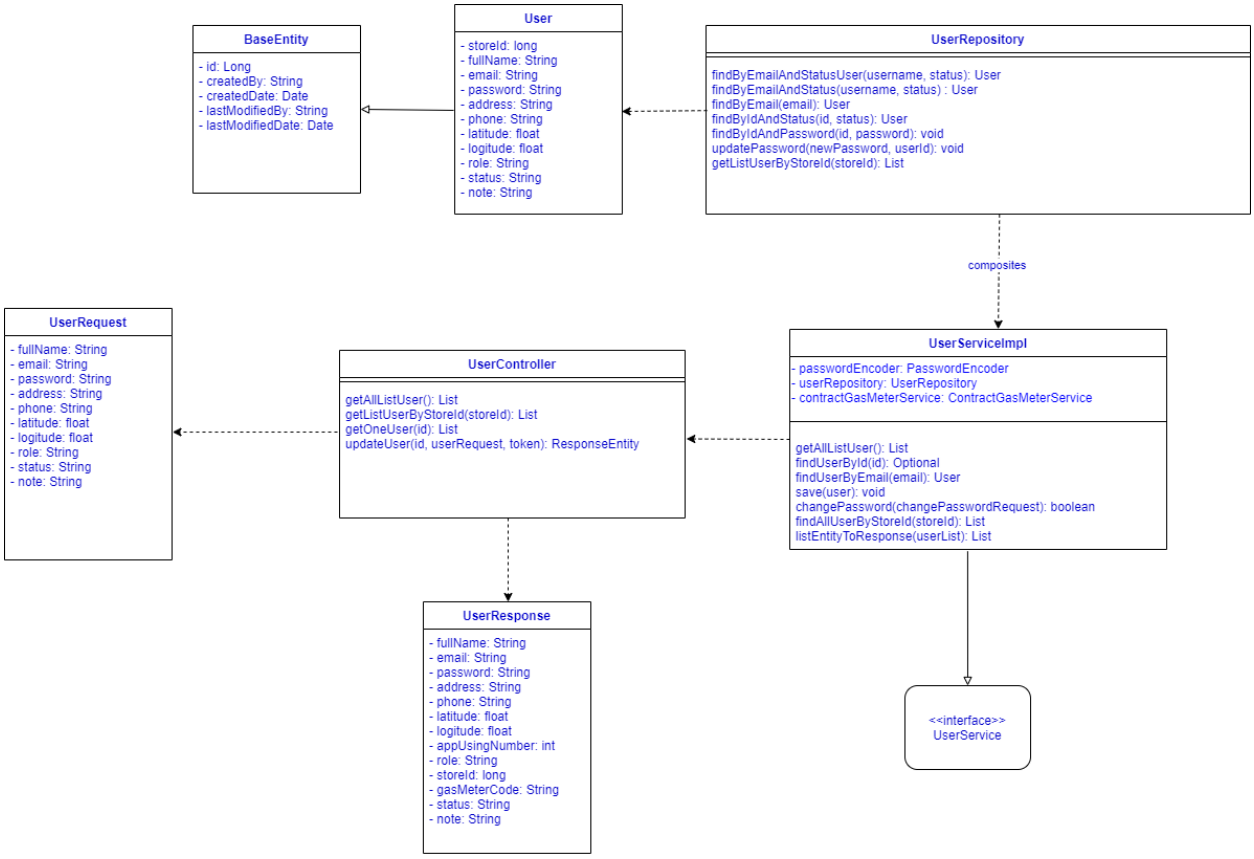
Firgure 3.7.3: View List-user Sequence Diagram.

3.8 Search User

a. Class Diagram



Firgure 3.8.1: Search User by A Class Diagram.



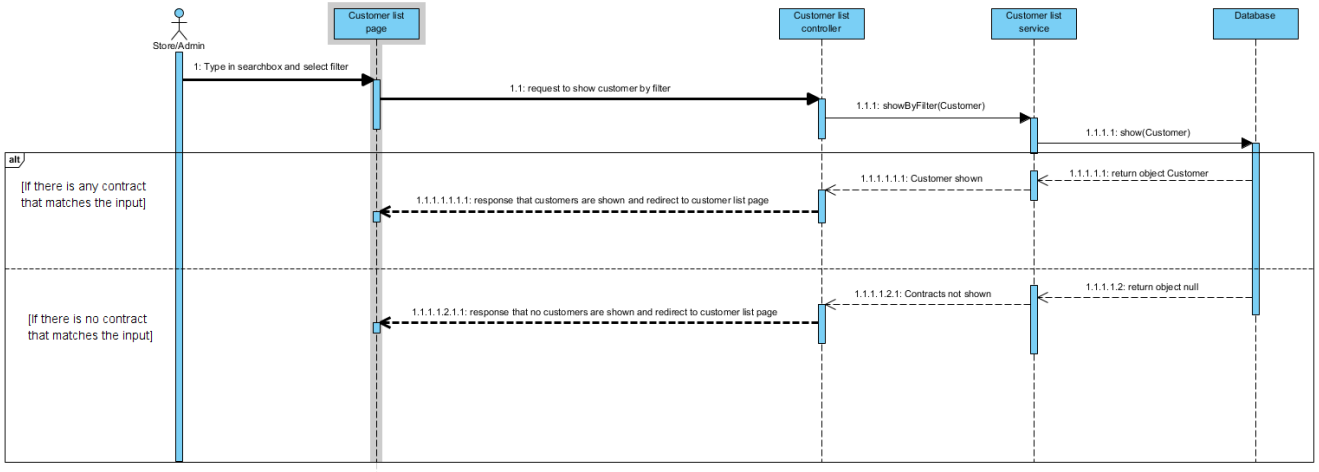
Firgure 3.8.2: Search User by storeID Class Diagram.

b. Class Specification

No	Class Name	Method	Description
1	BaseEntity		The default class of entity, which was inherited by many other entity class.
2	User		User class, which is related to search process.
3	UserRepository	findByEmailAndStatus(username, status): User	Method to find user by email if this user is active.
		findByEmail(email): User	Method to find user by email.
		searchUser(Strign text): List	Search user by key word.
		updatePassword (newPassword,userID): void	Method to update password of user.
		getListUserByStoreID(storeID): List	Get list user by store(User of this store).
4	UserServiceImpl	getAllListUser():List	Get all user in system.
		findUserByID: Optional	Get user by userID.
		findUserByEmail(email) : User	Get user by email.

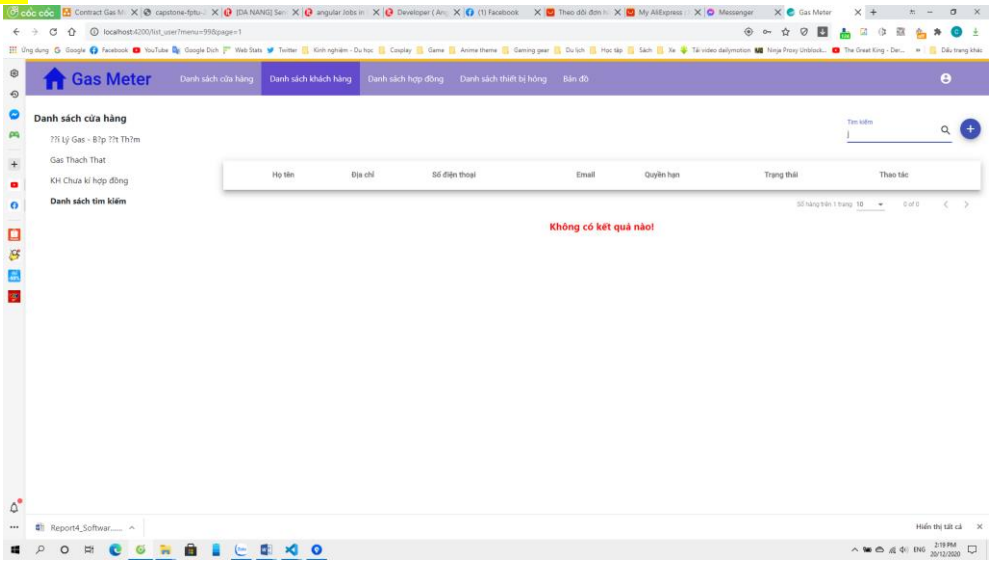
		save(user): void	Add user to database.
		changePassword(changePassrequest): boolean	Change password of user.
		findAllUserByStoreID(storeID):List	Get all user by storeID.
		listEntityToResponse(userList): List	Convert user entity to response data.
5	UserController	getAllListUser():list	Get all user in system.
		getListUserByStoreID(storeID): List	Get all user by storeID.
		getOneUser(ID): List	Get one user by userID.
		updateUser(id,userRequest, token): ResponseEntity	Update data of user.
6	UserRequest		Request data from client.
7	UserResponse		Response data from server.
8	<<interface>> UserService		Interface to define method of user.

c. Sequence Diagram(s)



Firgure 3.8.3: Search User Sequence Diagram.

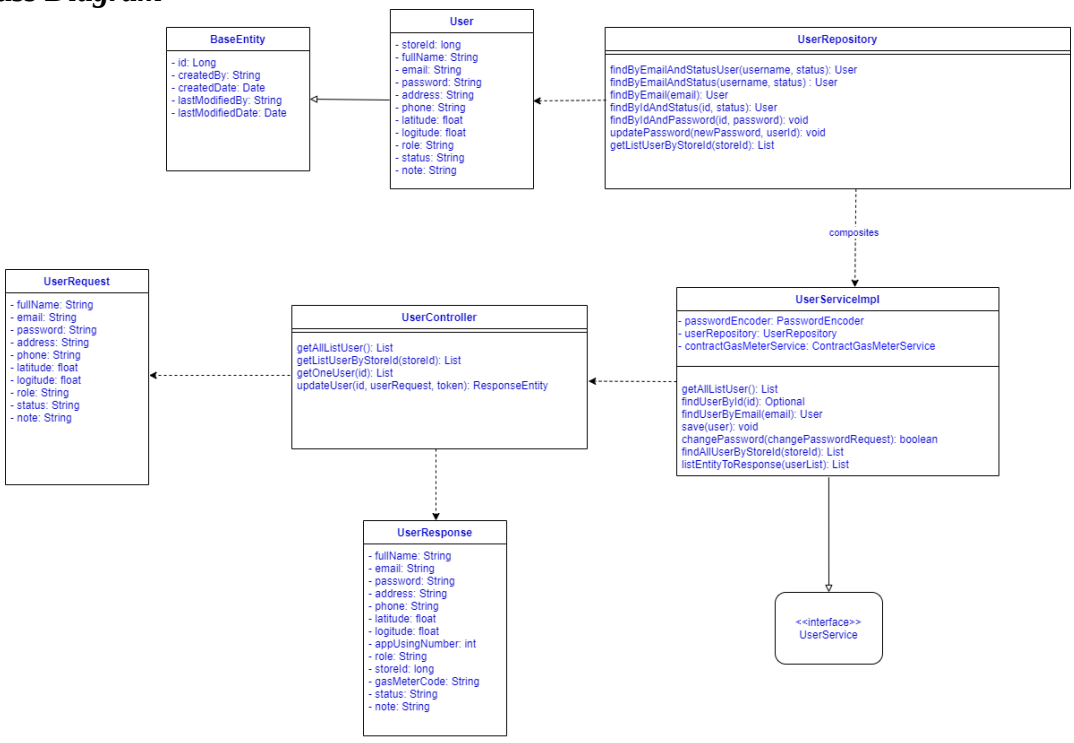
d. Design:



Firgure 3.8.4: Search User Screen.

3.9 Update User

a. Class Diagram



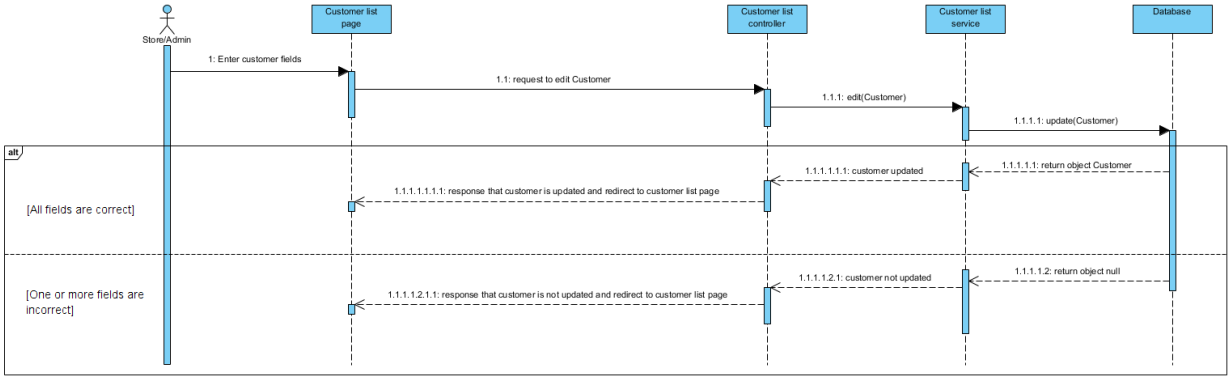
Firgure 3.9.1: Update User Class Diagram.

b. Class Specification

No	Class Name	Method	Description

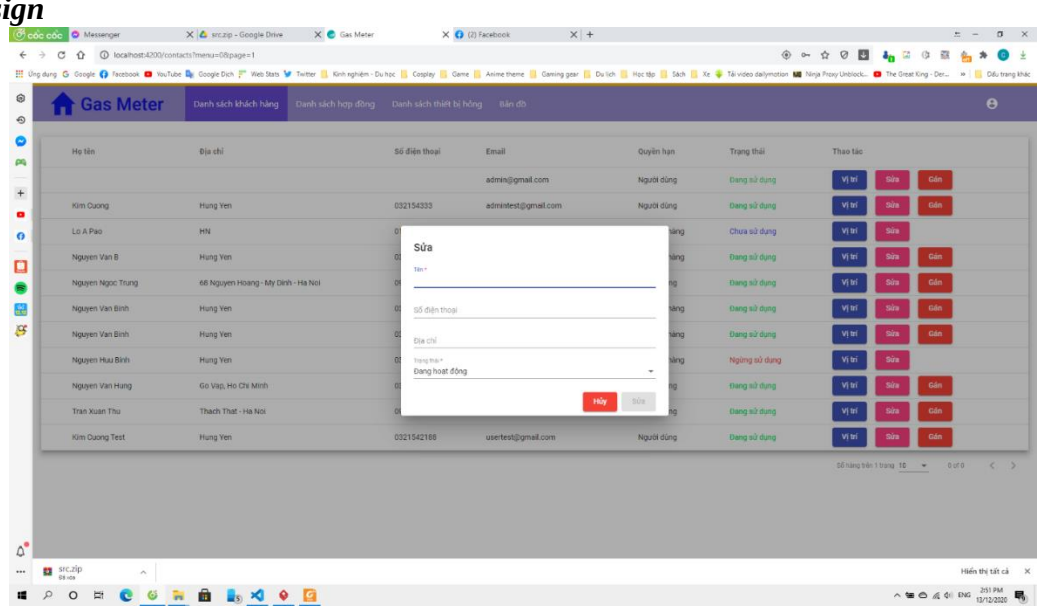
1	BaseEntity		The default class of entity, which was inherited by many other entity class.
2	User		User class, which is related to update process.
3	UserRepository	findByEmailAndStatus(username, status): User	Method to find user by email if this user is active.
		findByEmail(email): User	Method to find user by email.
		searchUser(Strign text): List	Search user by key word.
		updatePassword (newPassword,userID): void	Method to update password of user.
		getListUserByStoreID(storeID): List	Get list user by store(User of this store).
		getAllListUser(): List	Get all user in system.
		findUserByID: Optional	Get user by userID.
4	UserServiceImpl	findUserByEmail(email) : User	Get user by email.
		save(user): void	Add user to database.
		changePassword(changePassrequest): boolean	Change password of user.
		findAllUserByStoreID(storeID): List	Get all user by storeID.
		listEntityToResponse(userList): List	Convert user entity to response data.
		getAllListUser():List	Get all user in system.
		getListUserByStoreID(storeID): List	Get all user by storeID.
5	UserController	getOneUser(id): List	Get one user by userID.
		updateUser(id,userRequest, token): ResponseEntity	Update datta of user.
			Request data from client .
			Response data from server.
6	<<interface>> UserService		Interface to define method of user.

c. Sequence Diagram(s)



Firgure 3.9.2: Update User Sequence Diagram.

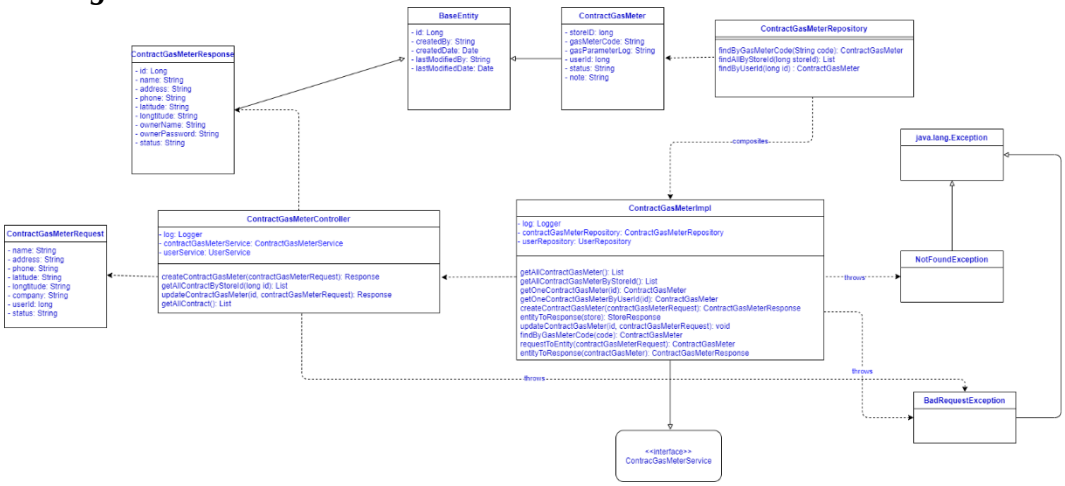
d. Design



Firgure 3.9.1: Update User Screen.

3.10 View list contract

a. Class Diagram



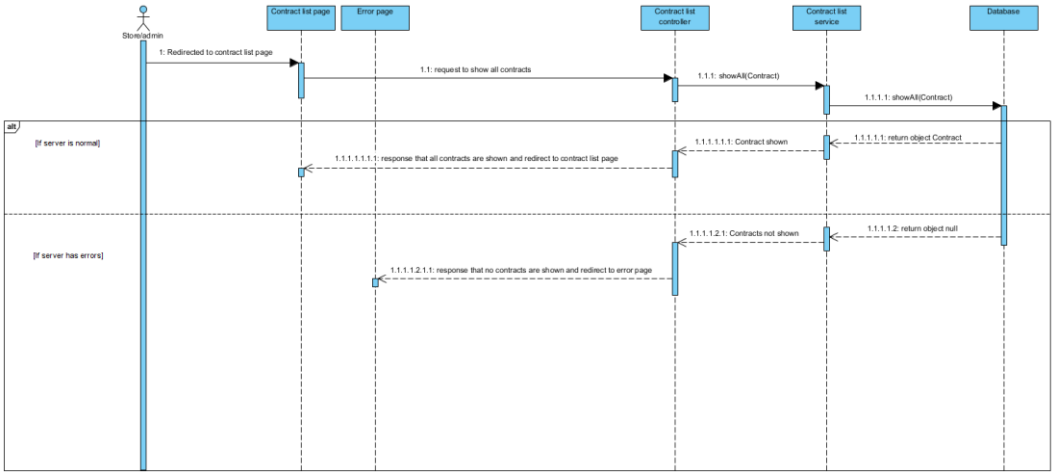
Firgure 3.10.1: View List Contract Class Diagram.

b. Class Specification

No	Class Name	Method	Description
1	BaseEntity		The default class of entity, which was inherited by many other entity class.
2	ContractGasmeterResponse		Contract response data send from server.
3	ContractGasMeter		ContractGasMeter class which is related to view contract process.
4	ContractGasMeterRepository	findByGasMeterCode(String code): ContractGasMeter	Method to find contract by gasMeterCode.
		findAllByStoreID(long storeID): List	Method to find contract by storeID.
		findByUserID (long ID): ContractGasMeter	Method to find contract by userID.
5	ContractGasMeterRequest		Contract request data from client.
6	ContractGasMeterController	createContractGasMeter(contractGasMeter Request): Response	Method to create Contract.
		getAllContractByStoreID(long id): List	Method to get list Contract by storeID.
		updateContractGasMeter(id, contractGasMeterRequest): Response	Method to update data of Contract.
		getAllContract(): List	Method to get All Contract.
7	ContractGasMeterImpl	getAllContractGasMeter(): List	Method to get All Contract from database.
		getAllContractGasMeterByStoreID(): List	Method to get list Contract by storeID from database.
		getOneContractGasMeter(id): ContractGasMeter	Method to get One Contract by id from database.
		getOneContractGasMeterByUserID(id): ContractGasMeterResponse	Method to get One Contract by userID from database.
		createContractGasMeter(contractGasMeter Request):	Method to add a new Contract to database.
		entityToResponse(ContractGasMeter): ContractGasMeterResponse	Convert entity ContractGasMeter to response data.
		updateContractGasMeter(id, contractGasMeterRequest): void	Update data of Contract from database.
		findByGasMeterCode(code): ContractGasMeter	Find Contract by gas meter code.

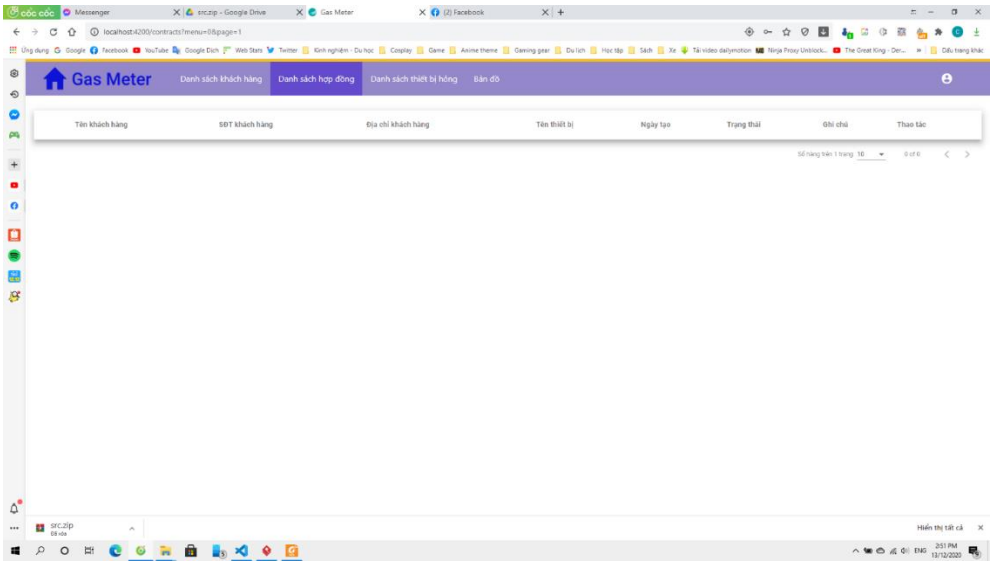
		requestToEntity(contractGasMeterRequest): ContractGasMeter	Convert request data to entity.
8	<<interface>> ContractGasmeterService		Interface to define method.
9	NotFoundException		Exception when contract not found.
10	BadRequestException		Exception when request is invalid.

c. Sequence Diagram(s)



Firgure 3.10.2: View List Contract Sequence Diagram.

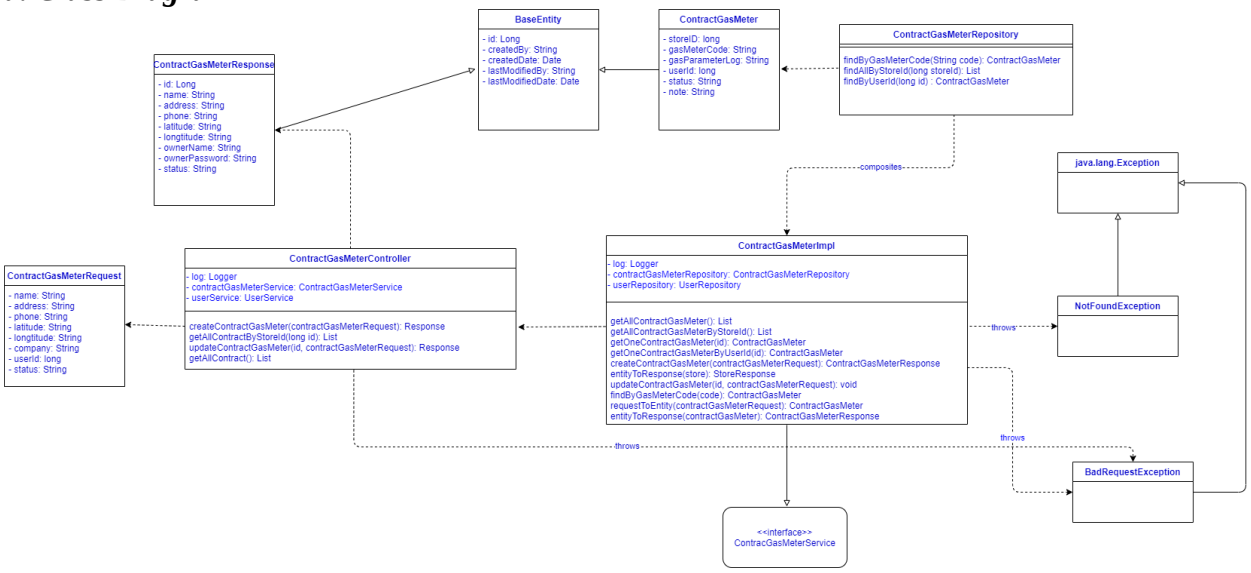
d. Design



Firgure 3.10.3: View List Contract Screen.

3.11 Create Contract

a. Class Diagram

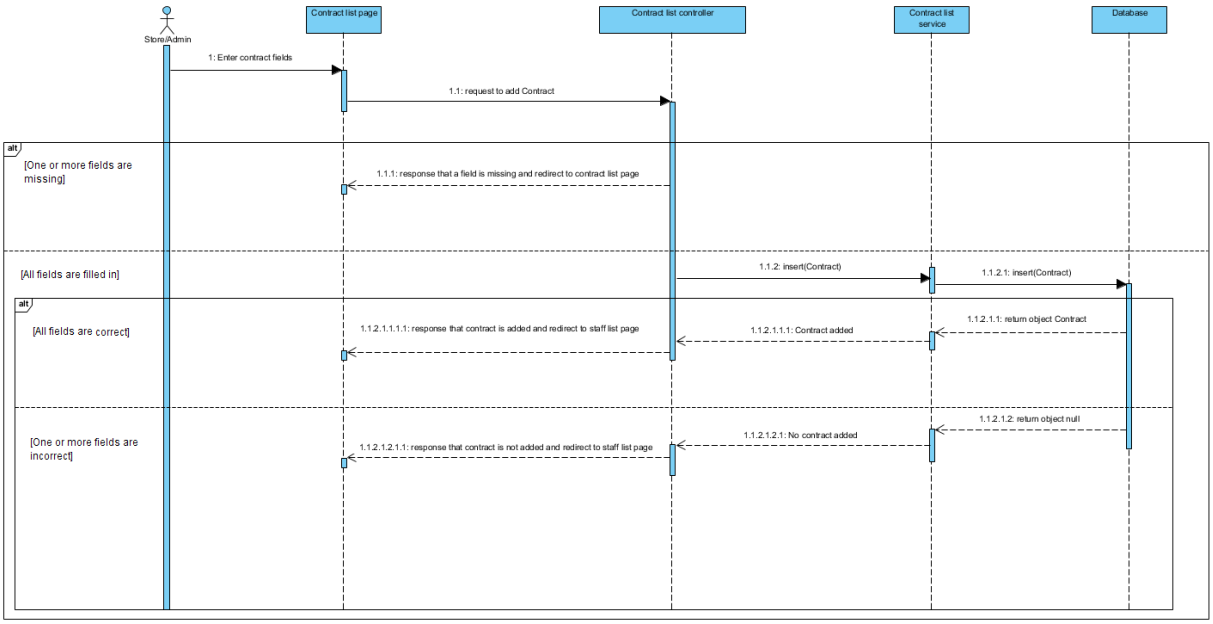


b. Class Specification

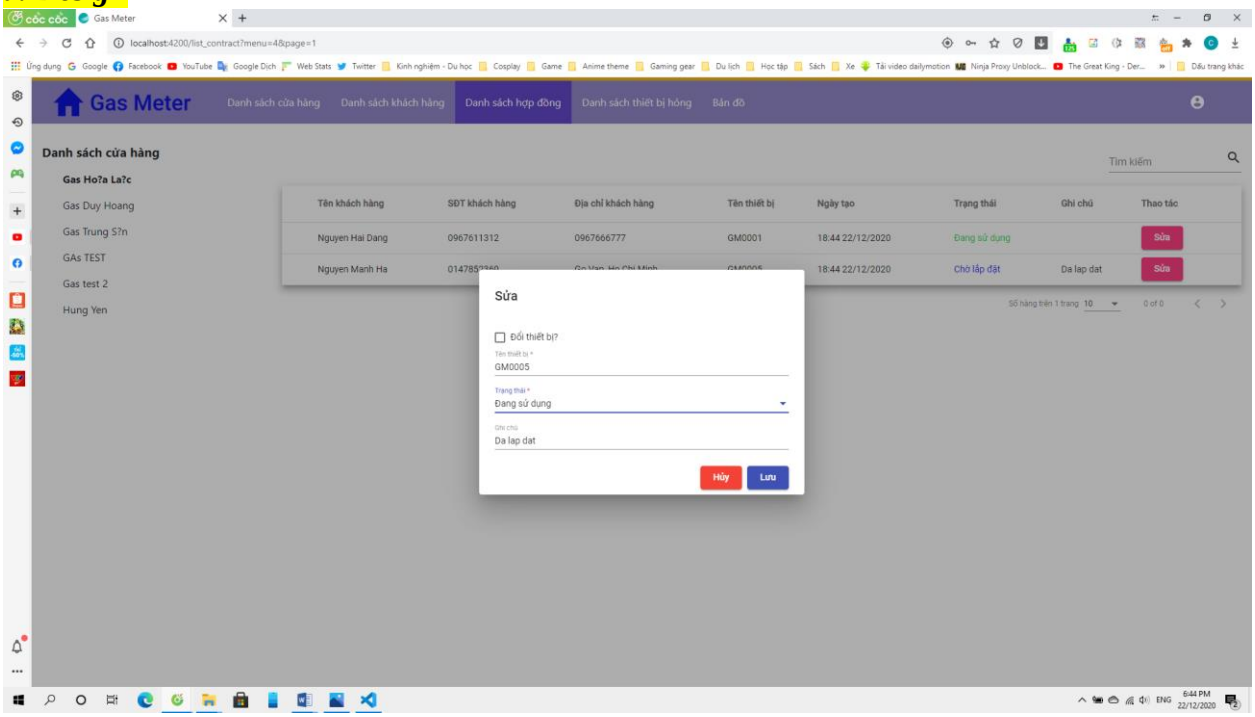
No	Class Name	Method	Description
1	BaseEntity		The default class of entity, which was inherited by many other entity class
2	ContractGasmeterResponse		Contract response data send from server
3	ContractGasMeter		ContractGasMeter class, which is related to create contract process
4	ContractGasMeterRepository	findByGasMeterCode(String code): ContractGasMeter	Method to find contract by gasMeterCode
		findAllByStoreID(long storeID): List	Method to find contract by storeID
		findByUserID(long id) : ContractGasMeter	Method to find contract by userID
5	ContractGasMeterRequest		Contract request data from client
6	ContractGasMeterController	createContractGasMeter(contractGasMeterRequest): Response	Method to create Contract
		getAllContractByStoreID(long id): List	Method to get list Contract by storeID
		updateContractGasMeter(id, contractGasMeterRequest): Response	Method to update data of Contract
		getAllContract(): List	Method to get All Contract
7	ContractGasMeterImpl	getAllContractGasMeter(): List	Method to get All Contract from database
		getAllContractGasMeterByStoreID(): List	Method to get list Contract by storeID from database

		getOneContractGasMeter(id): ContractGasMeter	Method to get One Contract by id from database
		getOneContractGasMeterByUserID(id): ContractGasMeterResponse	Method to get One Contract by userID from database
		createContractGasMeter(contractGasMeterRequest):	Method to add a new Contract to database
		entityToResponse(ContractGasMeter): ContractGasMeterResponse	Convert entity ContractGasMeter to response data
		updateContractGasMeter(id, contractGasMeterRequest): void	Update data of Contract from database
		findByGasMeterCode(code): ContractGasMeter	Find Contract by gas meter code
		requestToEntity(contractGasMeterRequest): ContractGasMeter	Convert request data to entity
8	<<interface>> ContractGasmeterService		Interface to define method
9	NotFoundException		Exception when contract not found
10	BadRequestException		Exception when request is invalid

c. Sequence Diagram(s)

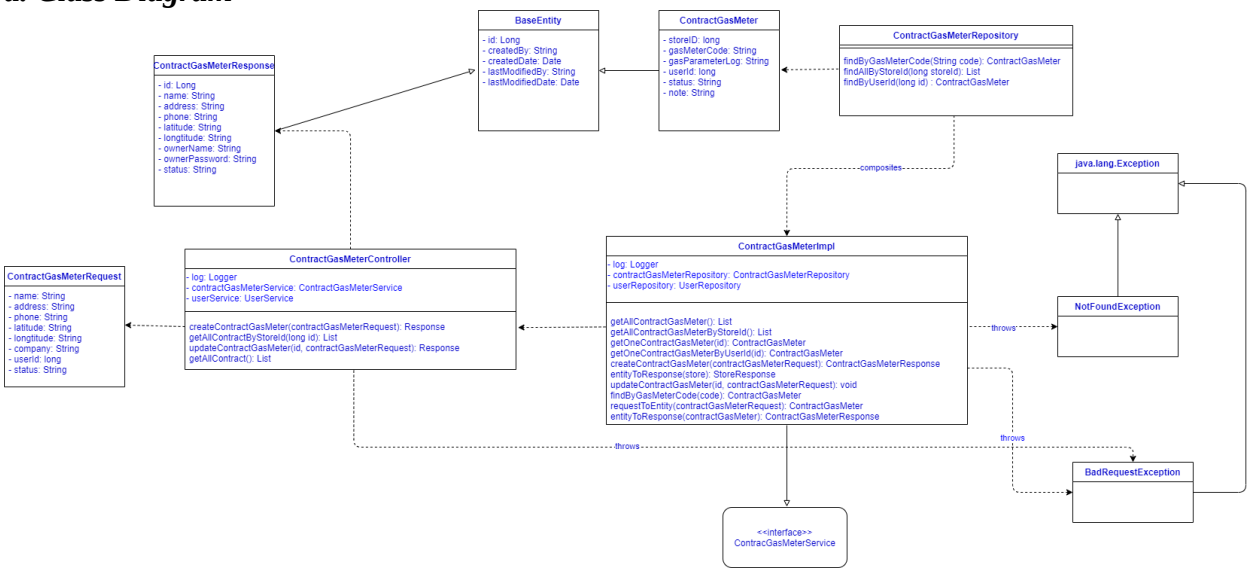


d. Design



3.14 Edit contract

a. Class Diagram



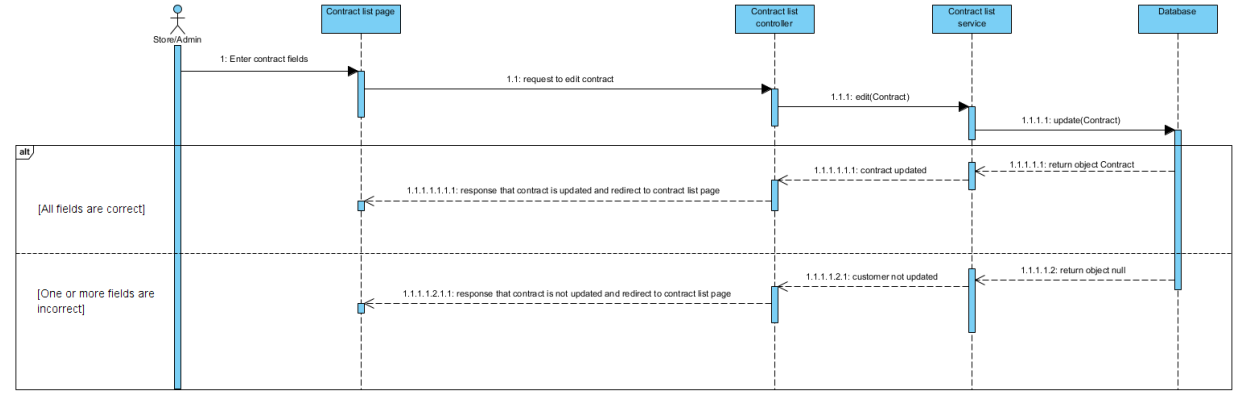
Firgure : Delete contract digram

b. Class Specification

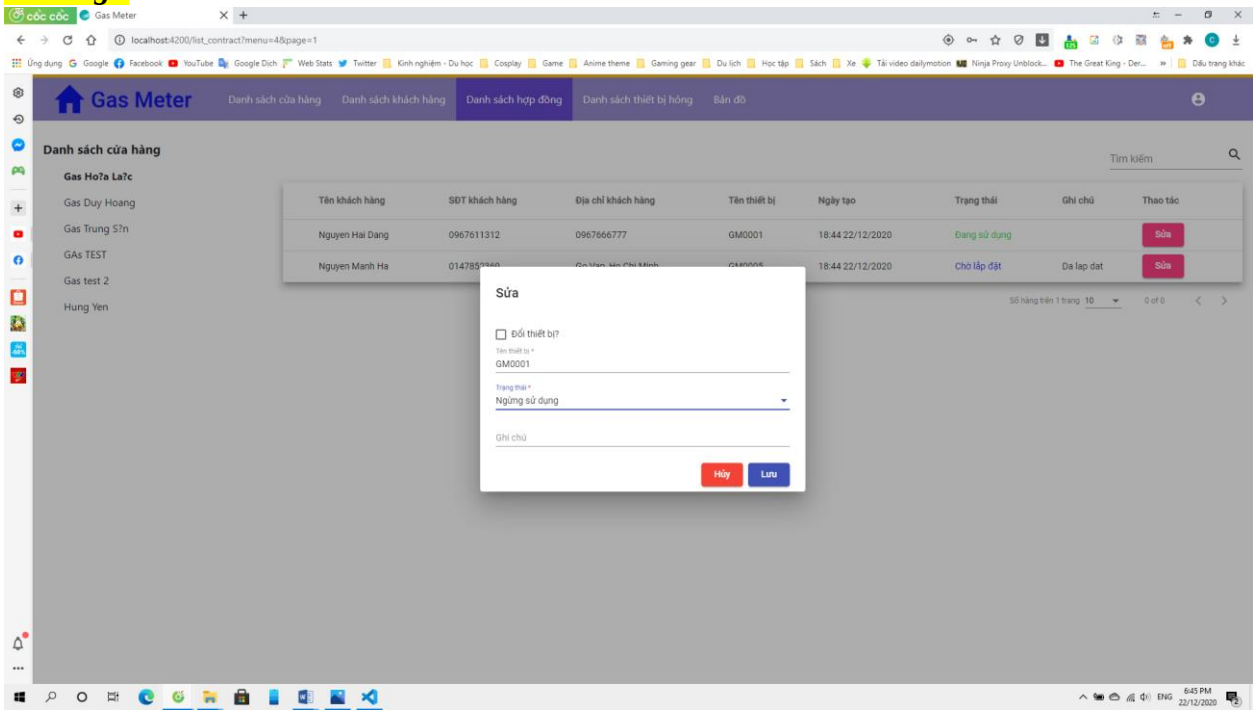
No	Class Name	Method	Description
1	BaseEntity		The default class of entity, which was inherited by many other entity class
2	ContractGasmeterResponse		Contract response data send from server

3	ContractGasMeter		ContractGasMeter class, which is related to edit contract process
4	ContractGasMeterRepository	findByGasMeterCode(String code): ContractGasMeter	Method to find contract by gasMeterCode
		findAllByStoreID(long storeID): List	Method to find contract by storeID
		findByUserID(long id) : ContractGasMeter	Method to find contract by userID
5	ContractGasMeterRequest		Contract request data from client
6	ContractGasMeterController	createContractGasMeter(contractGasMeterRequest): Response	Method to create Contract
		getAllContractByStoreID(long id): List	Method to get list Contract by storeID
		updateContractGasMeter(id, contractGasMeterRequest): Response	Method to update data of Contract
		getAllContract(): List	Method to get All Contract
7	ContractGasMeterImpl	getAllContractGasMeter(): List	Method to get All Contract from database
		getAllContractGasMeterByStoreID(): List	Method to get list Contract by storeID from database
		getOneContractGasMeter(id): ContractGasMeter	Method to get One Contract by id from database
		getOneContractGasMeterByUserID(id): ContractGasMeterResponse	Method to get One Contract by userID from database
		createContractGasMeter(contractGasMeterRequest):	Method to add a new Contract to database
		entityToResponse(ContractGasMeter): ContractGasMeterResponse	Convert entity ContractGasMeter to response data
		updateContractGasMeter(id, contractGasMeterRequest): void	Update data of Contract from database
		findByGasMeterCode(code): ContractGasMeter	Find Contract by gas meter code
		requestToEntity(contractGasMeterRequest): ContractGasMeter	Convert request data to entity
8	<<interface>> ContractGasmeterService		Interface to define method
9	NotFoundException		Exception when contract not found
10	BadRequestException		Exception when request is invalid

c. Sequence Diagram(s)



d. Design



3.16 Search contract

a. Class Diagram

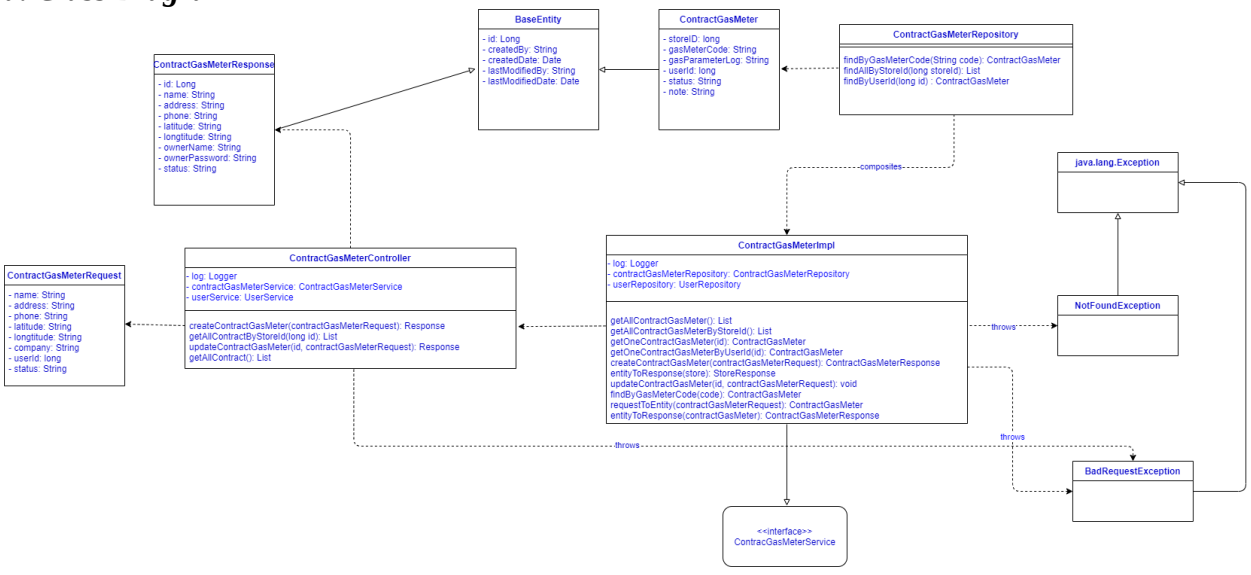


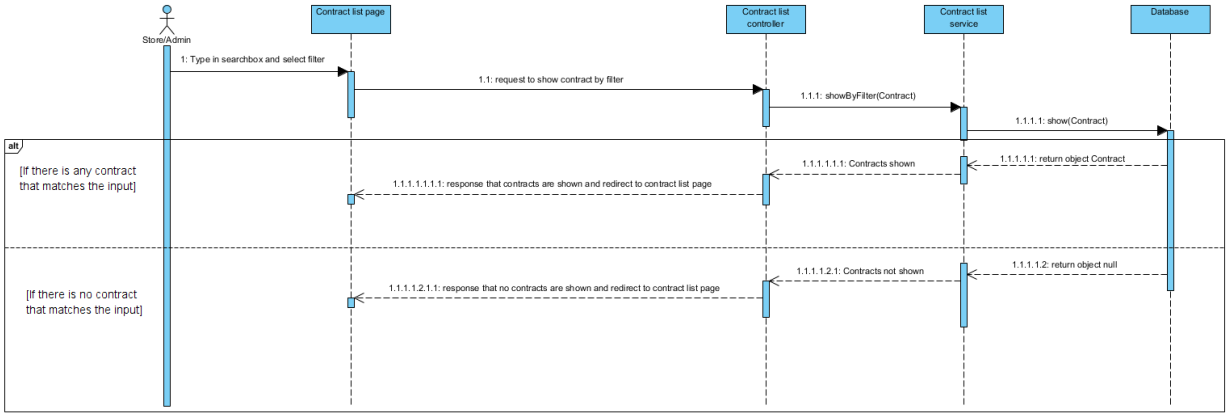
Figure : Search contract class diagram

b. Class Specification

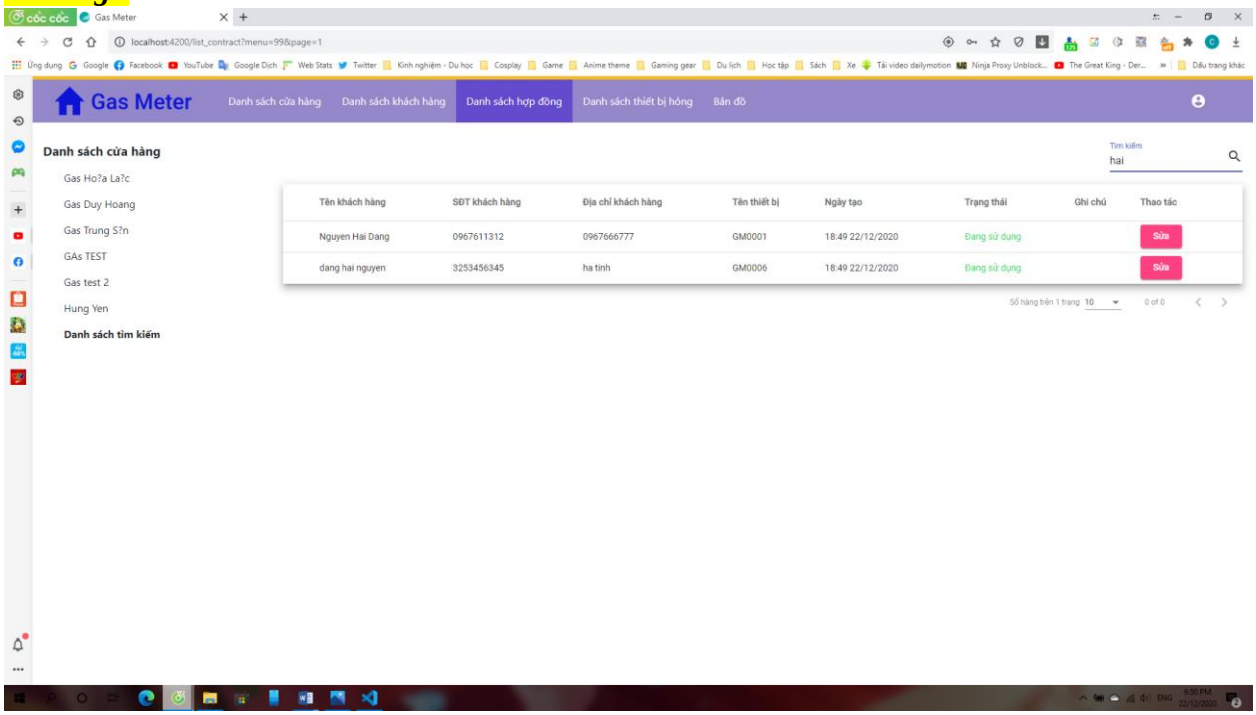
No	Class Name	Method	Description
1	BaseEntity		The default class of entity, which was inherited by many other entity class
2	ContractGasmeterResponse		Contract response data send from server
3	ContractGasMeter		ContractGasMeter class, which is related to view contract process
4	ContractGasMeterRepository	findByGasMeterCode(String code): ContractGasMeter	Method to find contract by gasMeterCode
		findAllByStoreID(long storeID): List	Method to find contract by storeID
		findByUserID(long id) : ContractGasMeter	Method to find contract by userID
5	ContractGasMeterRequest		Contract request data from client
6	ContractGasMeterController	createContractGasMeter(contractGasMeterRequest): Response	Method to create Contract
		getAllContractByStoreID(long id): List	Method to get list Contract by storeID
		updateContractGasMeter(id, contractGasMeterRequest): Response	Method to update data of Contract
		getAllContract(): List	Method to get All Contract
7	ContractGasMeterImpl	getAllContractGasMeter(): List	Method to get All Contract from database
		getAllContractGasMeterByStoreID(): List	Method to get list Contract by storeID from database
		getOneContractGasMeter(id): ContractGasMeter	Method to get One Contract by id from database
		getOneContractGasMeterByUserID(id): ContractGasMeterResponse	Method to get One Contract by userID from database
		createContractGasMeter(contractGasMeterRequest):	Method to add a new Contract to database
		entityToResponse(ContractGasMeter): ContractGasMeterResponse	Convert entity ContractGasMeter to response data
		updateContractGasMeter(id, contractGasMeterRequest): void	Update data of Contract from database
		findByGasMeterCode(code): ContractGasMeter	Find Contract by gas meter code
		requestToEntity(contractGasMeterRequest): ContractGasMeter	Convert request data to entity

8	<<interface>> ContractGasmeterService		Interface to define method
9	NotFoundException		Exception when contract not found
10	BadRequestException		Exception when request is invalid

c. Sequence Diagram(s)

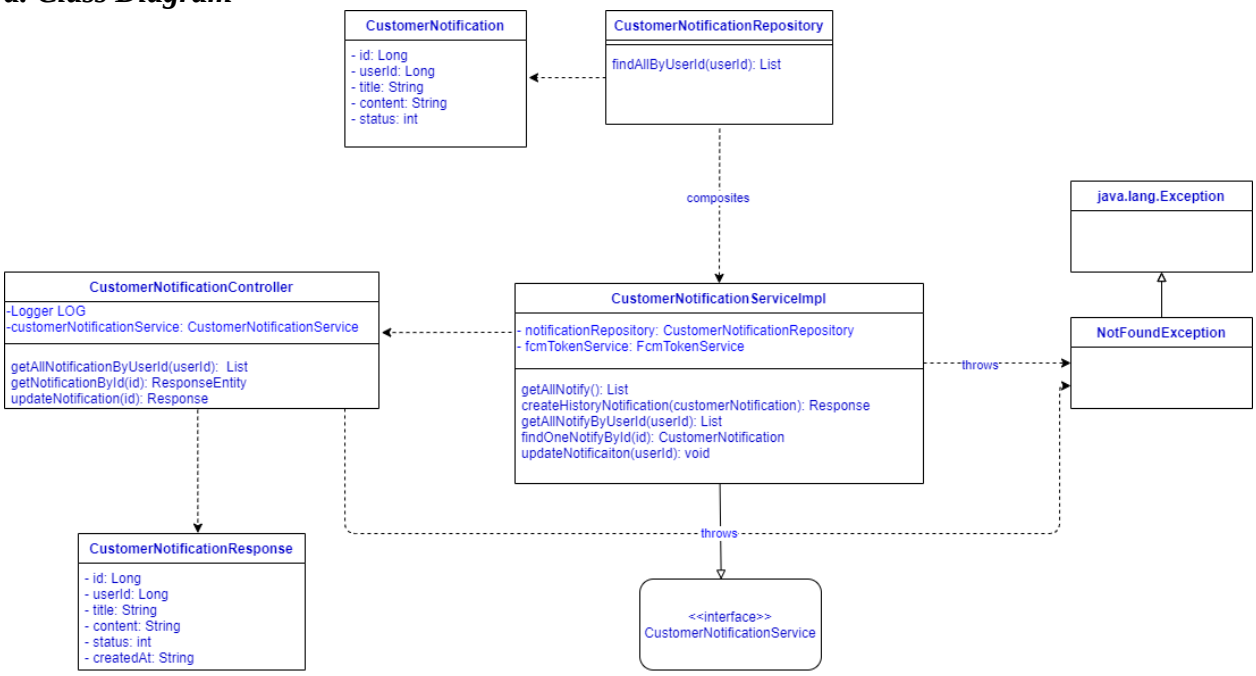


d. Design



3.17 View Notification

a. Class Diagram

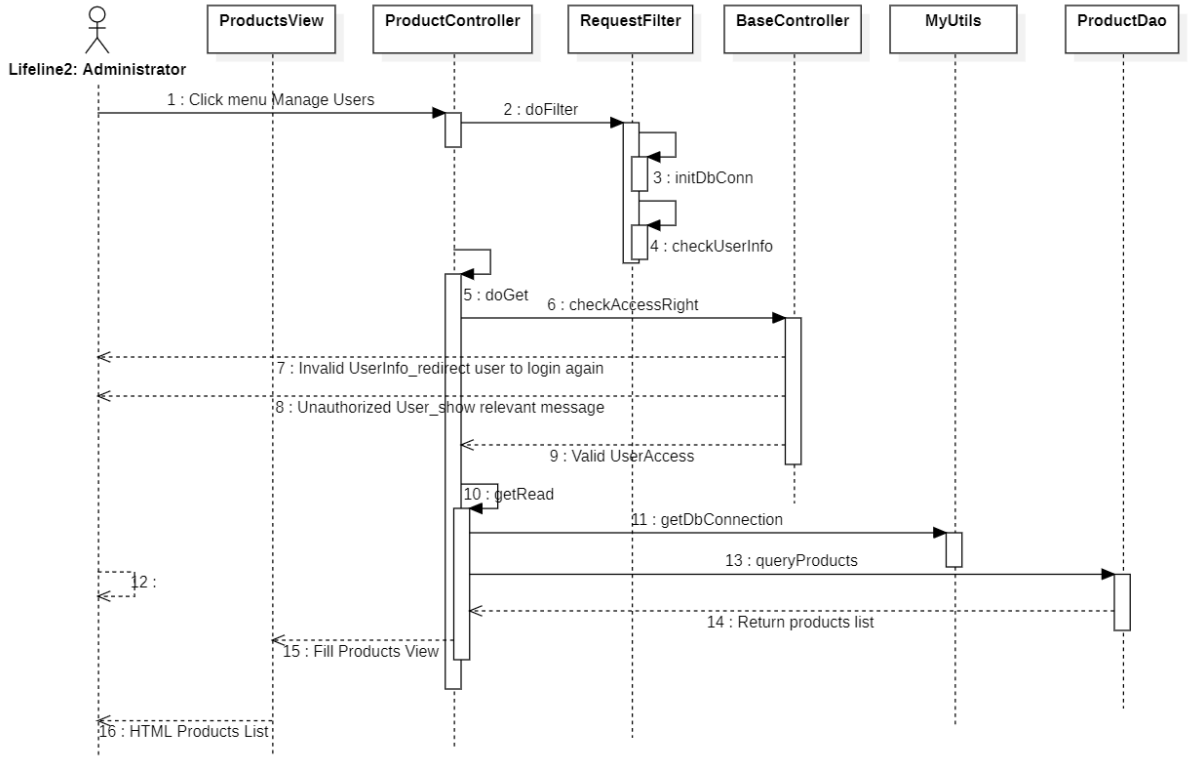


b. Class Specification

No	Class Name	Method	Description
1	CustomerNotification		CustomerNotification class which is related to view customer notifications
2	CustomerNotification Repository	findAllByUserId(userID): List	Method to find all notifications by userID

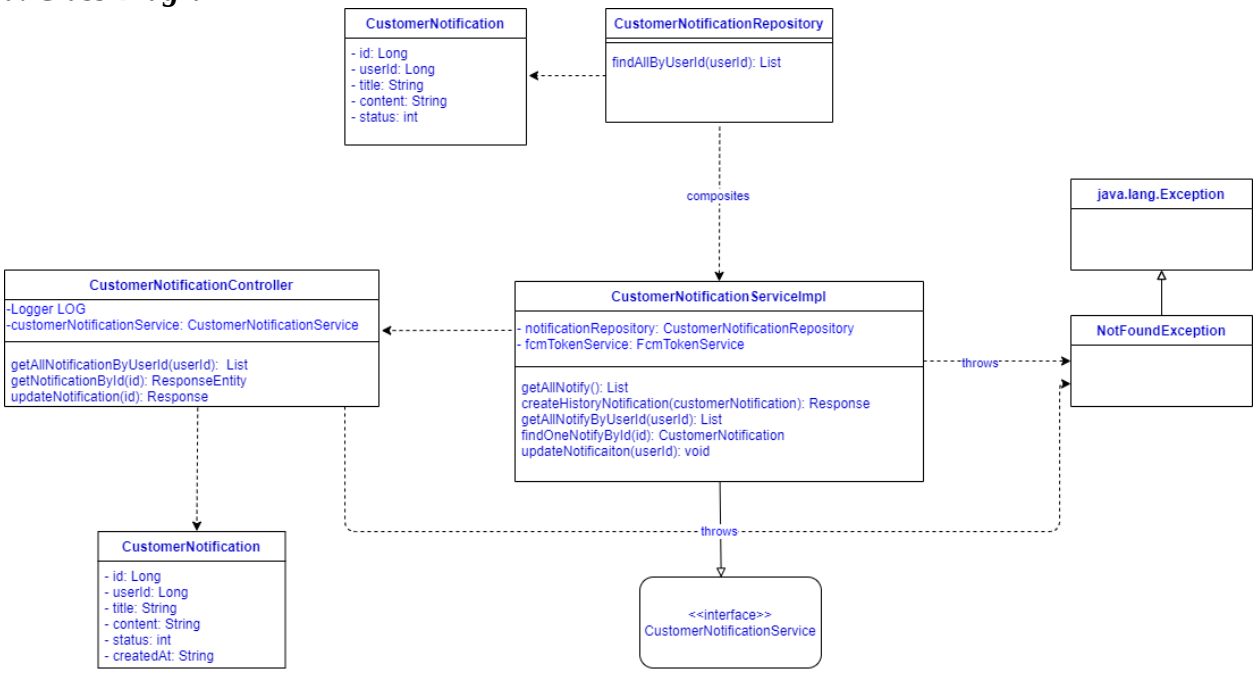
3	CustomerNotificationResponse		Response data from server
4	CustomerNotificationController	getAllNotificationByUserId(userId): List	Method to get notifications by userID.
		getNotificationById(id): ResponseEntity	Method to get notifications by id
		updateNotification(id): Response	Update notifications by id
5	CustomerNotificationServiceImpl	getAllNotify(): List	Method to get all notifications from database.
		createHistoryNotification(customerNotification): Response	Method to generate history notifications.
		getAllNotifyByUserId(userId): List	Method to get all notifications from database by userID
		findOneNotifyById(id): CustomerNotification	Method to get a notification by userID from database.
		updateNotificaiton(userId): void	Method to update notifications by userID
6	<<interface>> CustomerNotificationService		Interface to define method.
7	NotFoundException		Exception when contract not found.

c. Sequence Diagram(s)



3.18 Create Notification

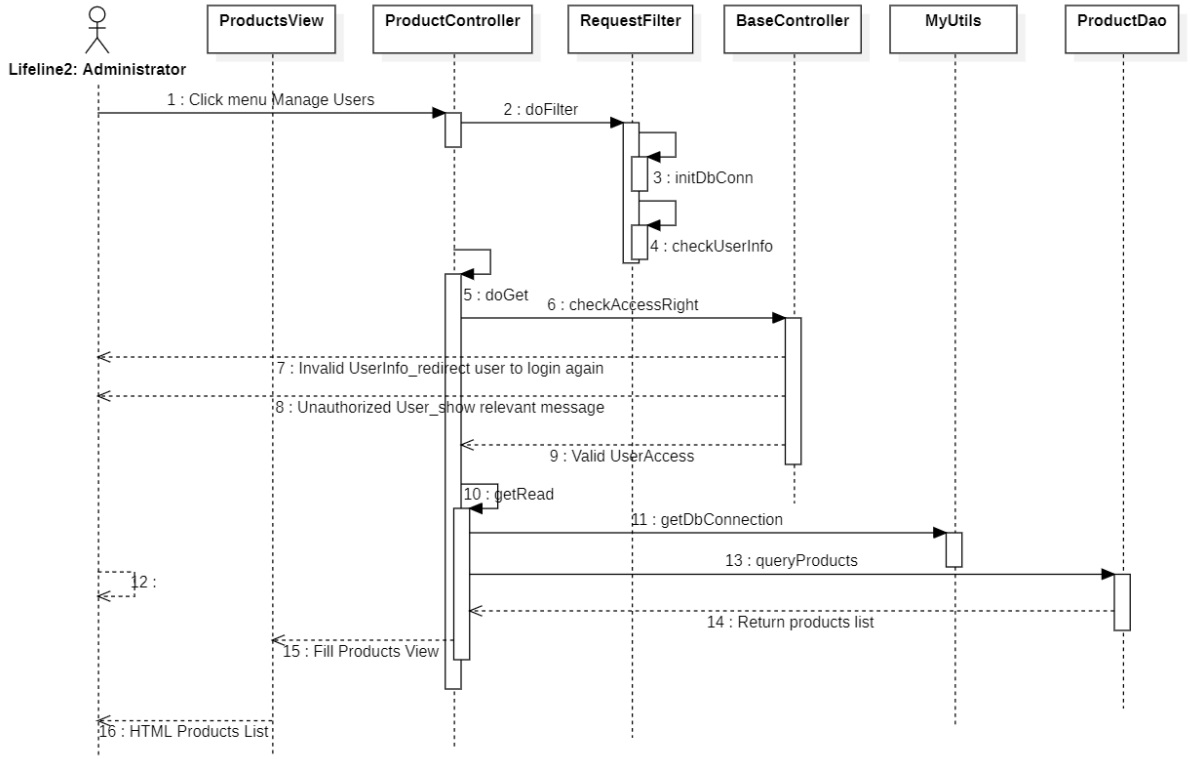
a. Class Diagram



b. Class Specification

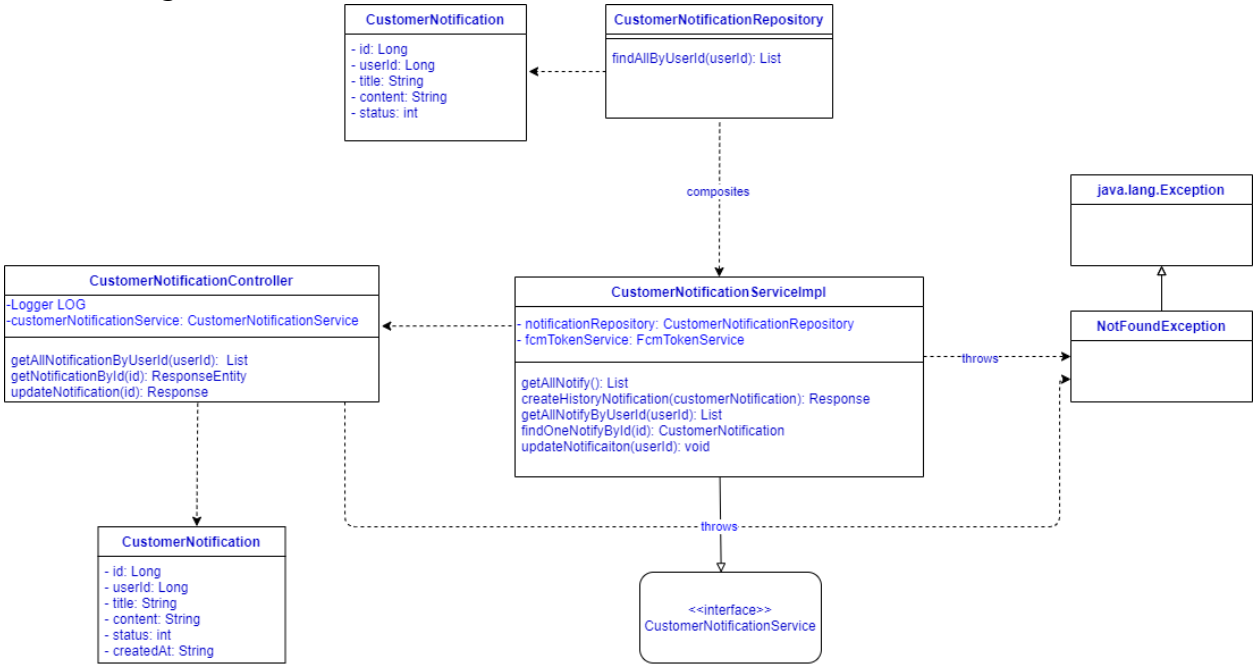
No	Class Name	Method	Description
1	CustomerNotification		CustomerNotification class which is related to view customer notifications
2	CustomerNotification Repository	findAllByUserId(userID): List	Method to find all notifications by userID
3	CustomerNotificationResponse		Response data from server
4	CustomerNotificationController	getAllNotificationByUserId(userId): List	Method to get notifications by userID.
		getNotificationById(id): ResponseEntity	Method to get notifications by id
		updateNotification(id): Response	Update notifications by id
5	CustomerNotificationServiceImpl	getAllNotify(): List	Method to get all notifications from database.
		createHistoryNotification(customerNotification): Response	Method to generate history notifications.
		getAllNotifyByUserId(userId): List	Method to get all notifications from database by userID
		findOneNotifyById(id): CustomerNotification	Method to get a notification by userID from database.
		updateNotificaiton(userId): void	Method to update notifications by userID
6	<<interface>> CustomerNotificationService		Interface to define method.
7	NotFoundException		Exception when contract not found.

c. Sequence Diagram(s)



3.19 Delete Notification

a. Class Diagram

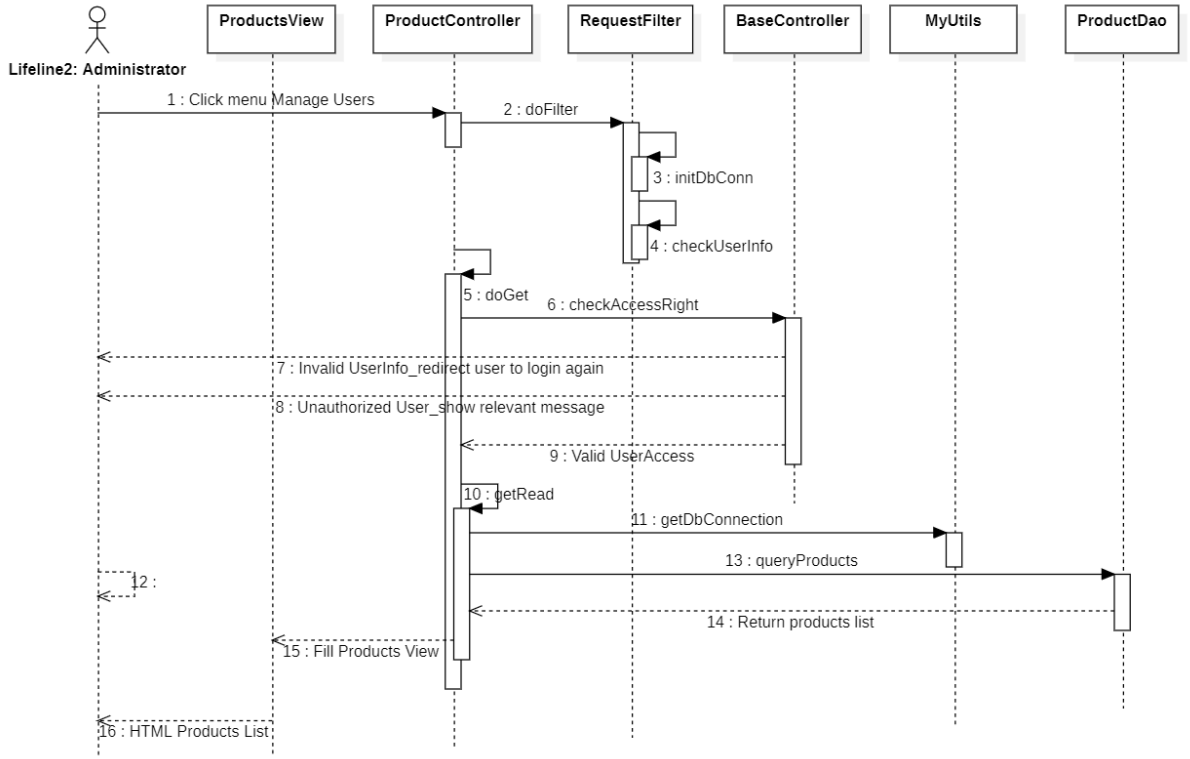


b. Class Specification

No	Class Name	Method	Description

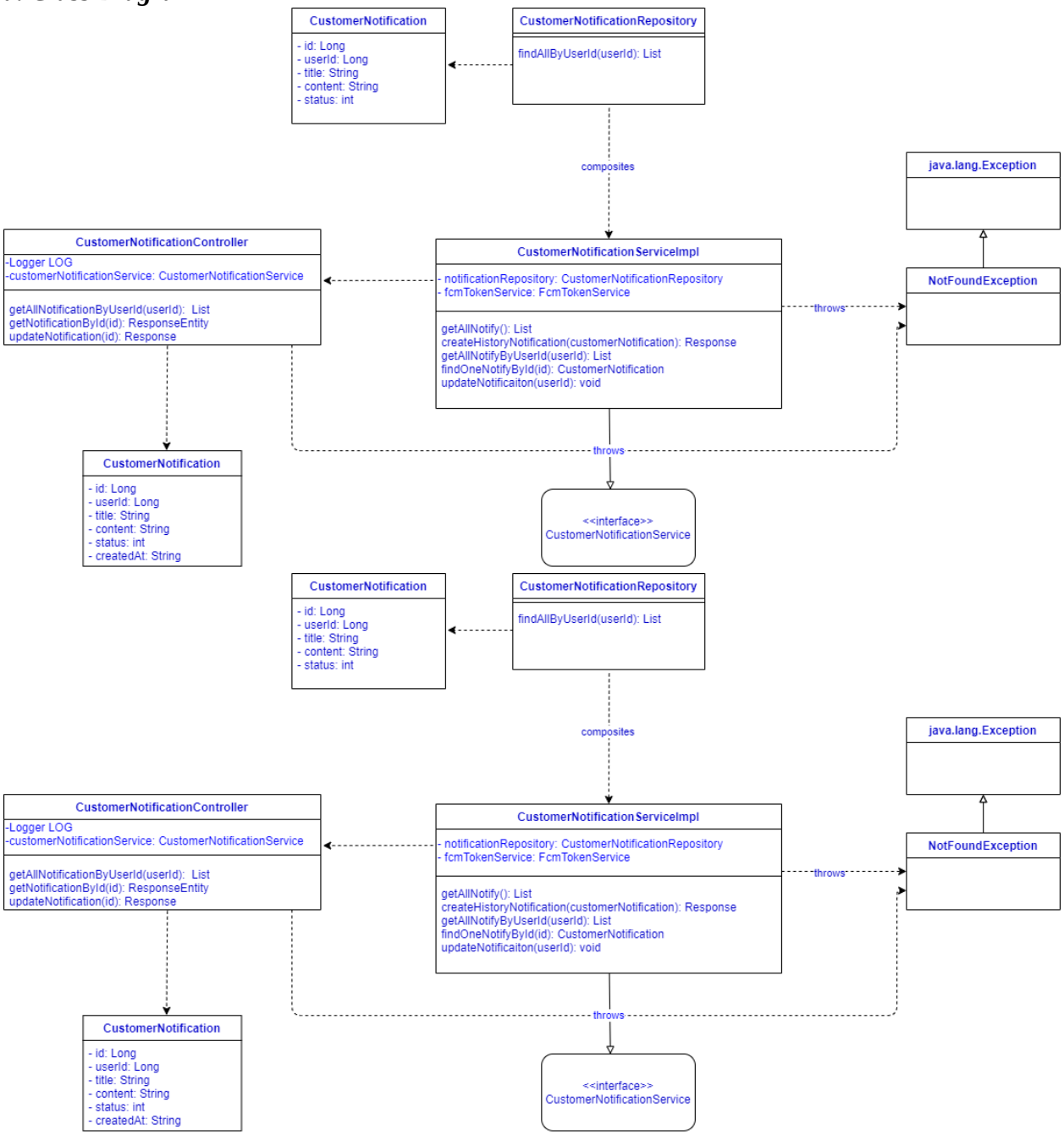
1	CustomerNotification		CustomerNotification class which is related to view customer notifications
2	CustomerNotification Repository	findAllByUserId(userID): List	Method to find all notifications by userID
3	CustomerNotificationResponse		Response data from server
4	CustomerNotificationController	getAllNotificationByUserId(userId): List	Method to get notifications by userID.
		getNotificationById(id): ResponseEntity	Method to get notifications by id
		updateNotification(id): Response	Update notifications by id
5	CustomerNotificationServiceImpl	getAllNotify(): List	Method to get all notifications from database.
		createHistoryNotification(customerNotification): Response	Method to generate history notifications.
		getAllNotifyByUserId(userId): List	Method to get all notifications from database by userID
		findOneNotifyById(id): CustomerNotification	Method to get a notification by userID from database.
		updateNotificaiton(userId): void	Method to update notifications by userID
6	<<interface>> CustomerNotificationService		Interface to define method.
7	NotFoundException		Exception when contract not found.

c. Sequence Diagram(s)



3.20 Search Notification

a. Class Diagram

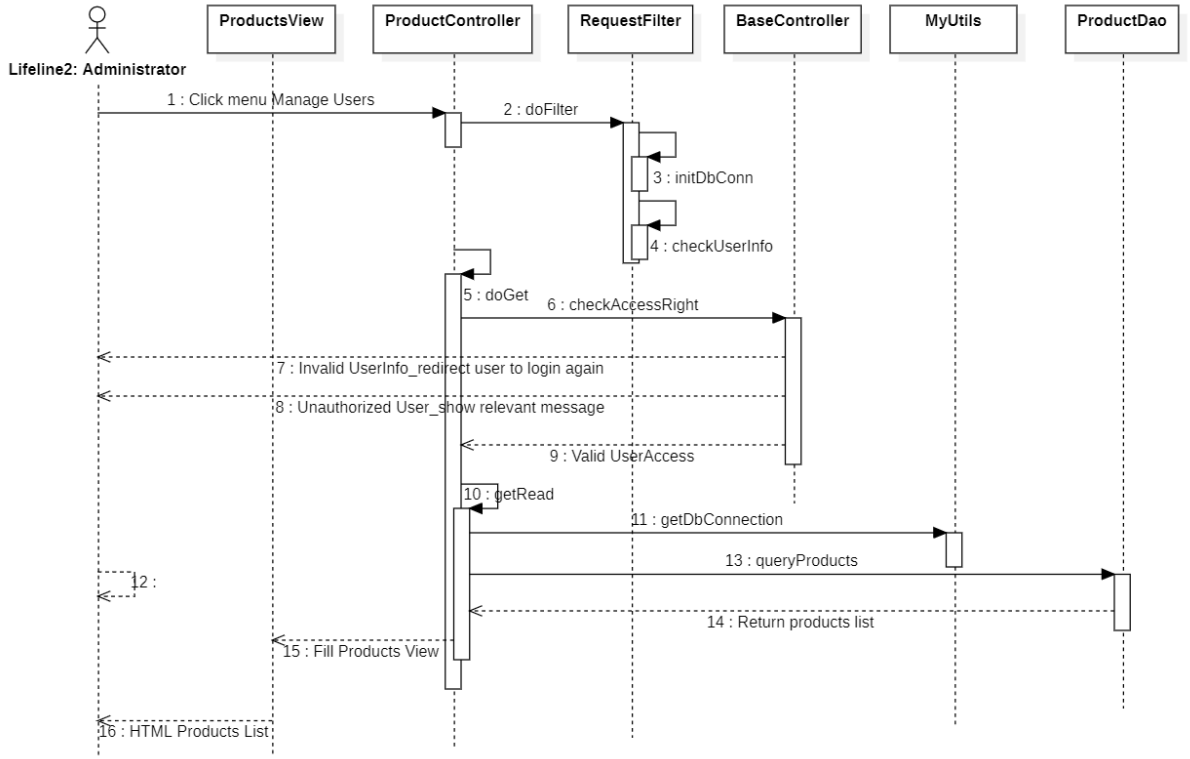


b. Class Specification

No	Class Name	Method	Description
1	CustomerNotification		CustomerNotification class which is related to view customer notifications
2	CustomerNotification Repository	findAllByUserId(userID): List	Method to find all notifications by userID
3	CustomerNotificationRes ponse		Response data from server

4	CustomerNotificationController	getAllNotificationByUserId(userId): List	Method to get notifications by userID.
		getNotificationById(id): ResponseEntity	Method to get notifications by id
		updateNotification(id): Response	Update notifications by id
5	CustomerNotificationServiceImpl	getAllNotify(): List	Method to get all notifications from database.
		createHistoryNotification(customerNotification): Response	Method to generate history notifications.
		getAllNotifyByUserId(userId): List	Method to get all notifications from database by userID
		findOneNotifyById(id): CustomerNotification	Method to get a notification by userID from database.
		updateNotificaiton(userId): void	Method to update notifications by userID
6	<<interface>> CustomerNotificationService		Interface to define method.
7	NotFoundException		Exception when contract not found.

c. Sequence Diagram(s)



3.21 View list Store

a. Class Diagram

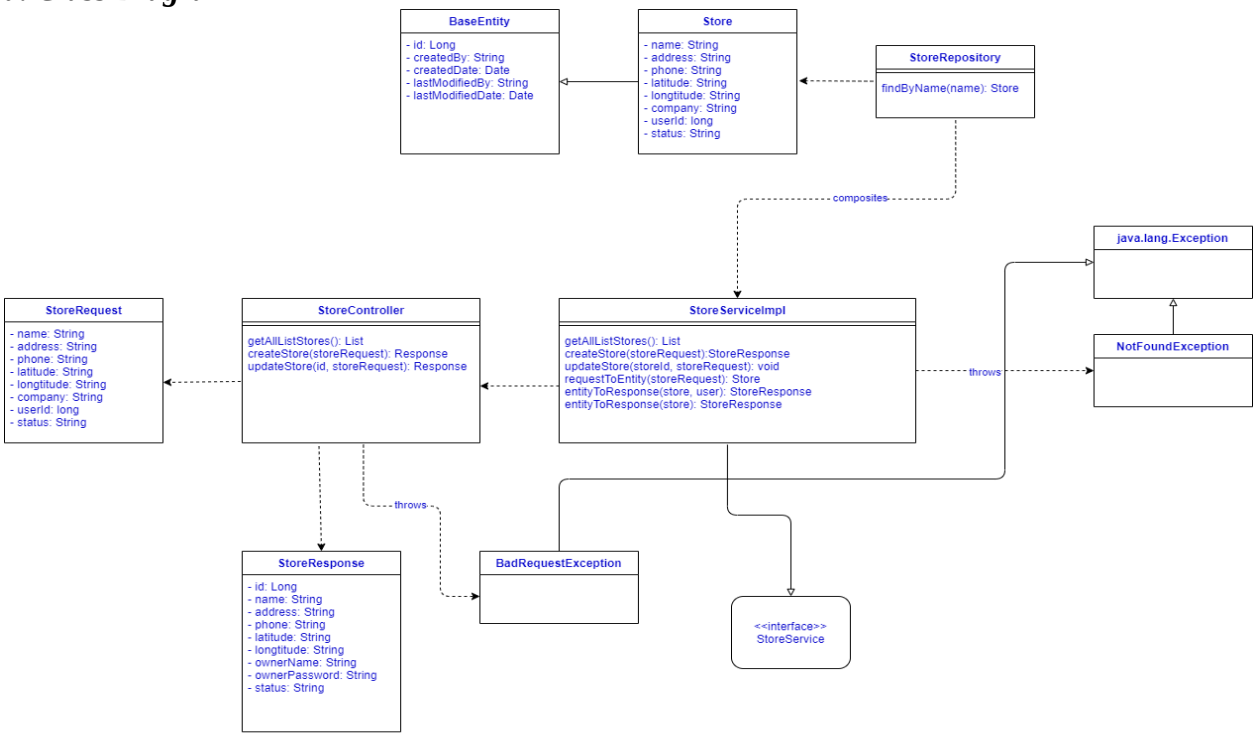


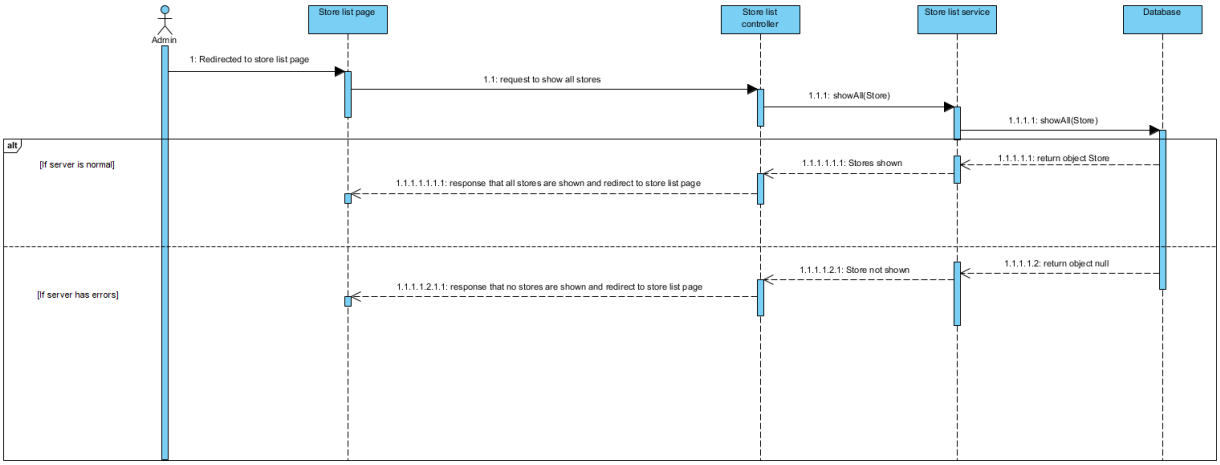
Figure : View list-store class diagram

b. Class Specification

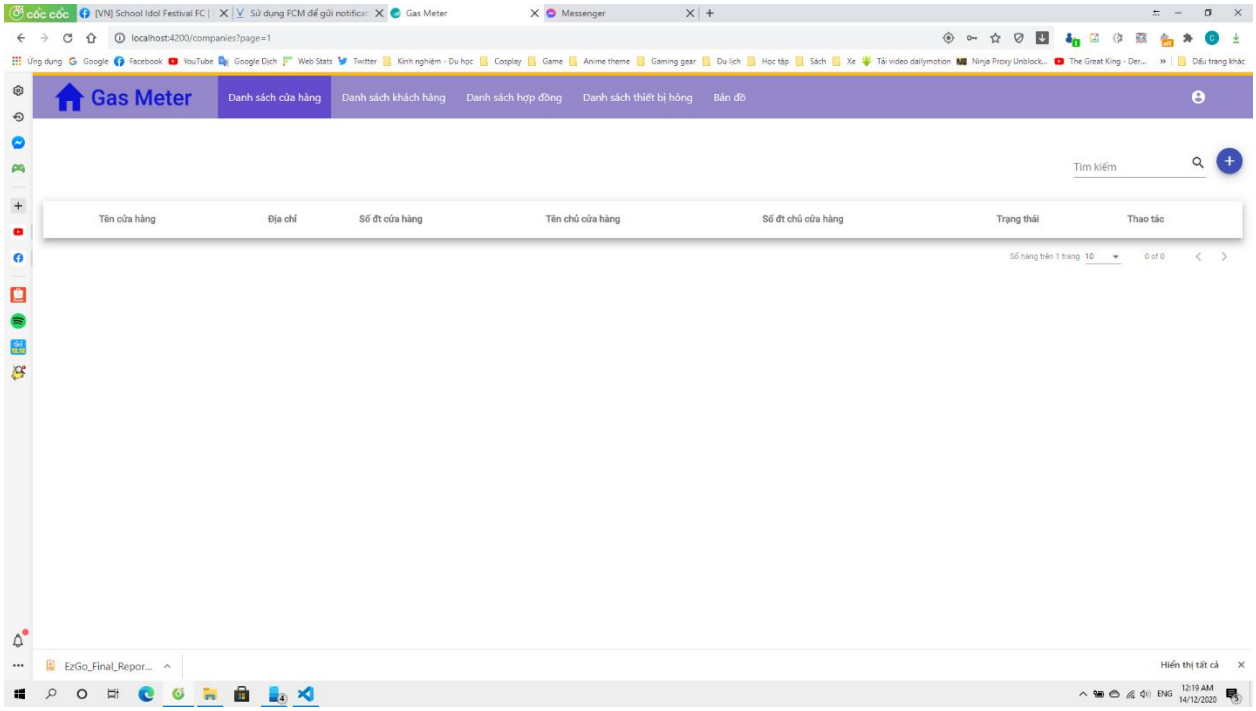
No	Class Name	Method	Description

1	BaseEntity		The default class of entity, which was inherited by many other entity class
2	Store		Store class, which is related to view Store process
3	StoreRepository		This class define method interact with database
4	StoreRequest		Request data from client
5	StoreController		to navigate when the API has called
6	StoreServiceIpml	getAllListStore():List	Function to get all store
		entityToResponse(store,user): StoreResponse	Convert Store entity to response data(attach user name and phone number)
		entityToResponse(store): StoreResponse	Convert Store entity to response data
7	StoreResponse		Response data from server
8	<<interface>> StoreService		Interface to define function
9	NotFoundException		Exception when store not found
10	BadRequestException		Exception when Request is invalid

c. Sequence Diagram(s)



d. Design



3.22 Create Store

a. Class Diagram

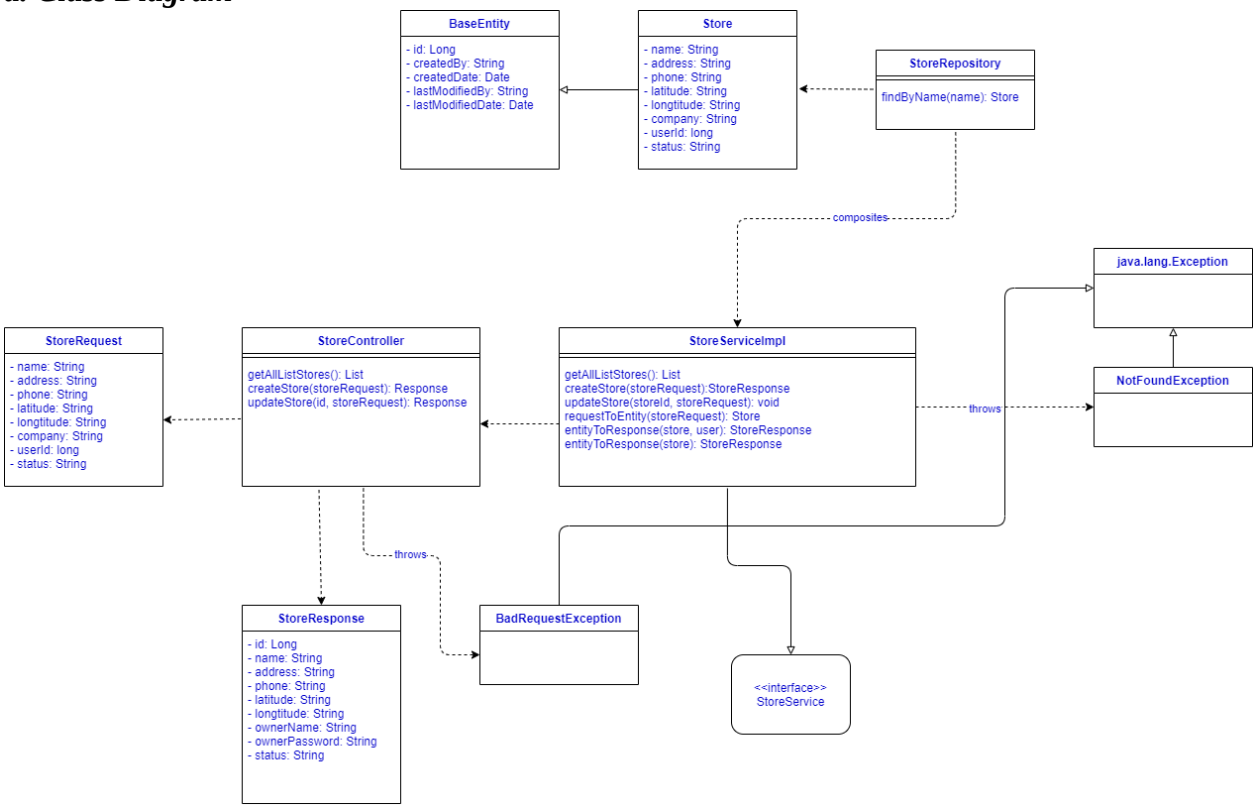


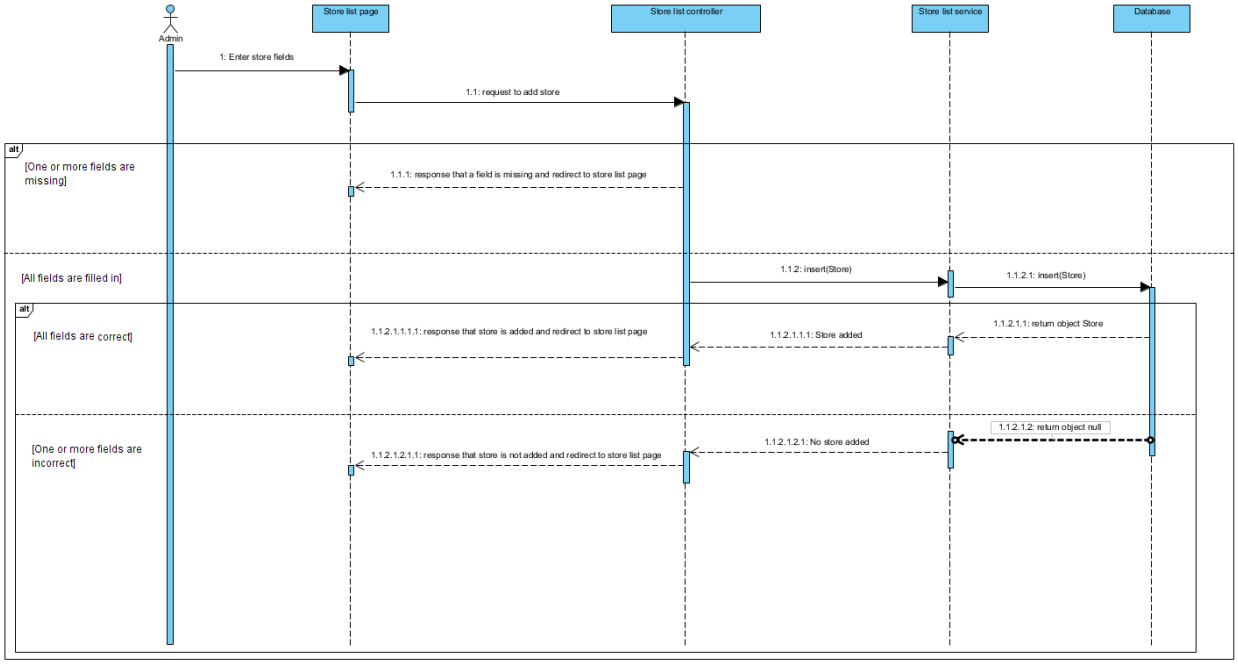
Figure : Create Store class diagram

b. Class Specification

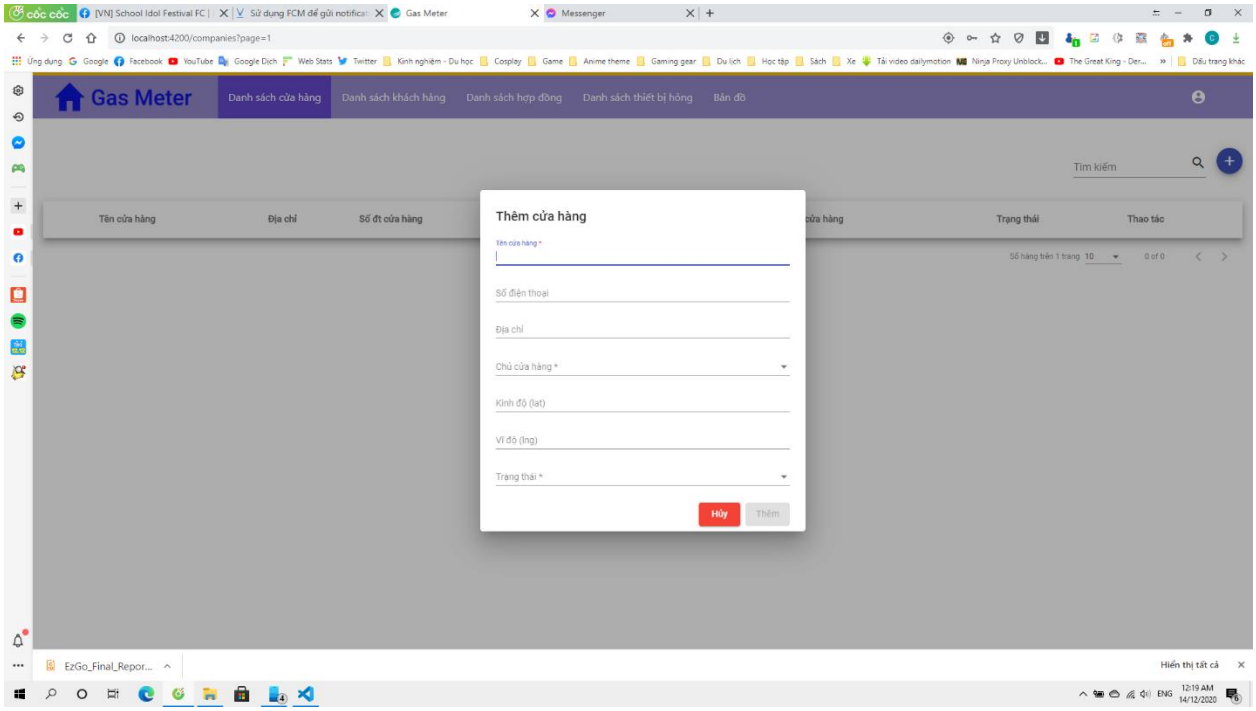
No	Class Name	Method	Description

1	BaseEntity		The default class of entity, which was inherited by many other entity class
2	Store		Store class, which is related to view Store process
3	StoreRepository		This class define method interact with database
4	StoreRequest		Request data from client
5	StoreController	createStore(storeRequest): response	to navigate when the API has called
6	StoreServiceIpml	createStore(StoreRequest): StoreResponse	Function to create new store
		requestToEntity(StoreRequest): Store	Convert request data to entity
7	StoreResponse		Response data from server
8	<<interface>> StoreService		Interface to define function
9	NotFoundException		Exception when store not found
10	BadRequestException		Exception when Request is invalid

c. Sequence Diagram(s)



d. Design:



3.23 Update Store

a. Class Diagram

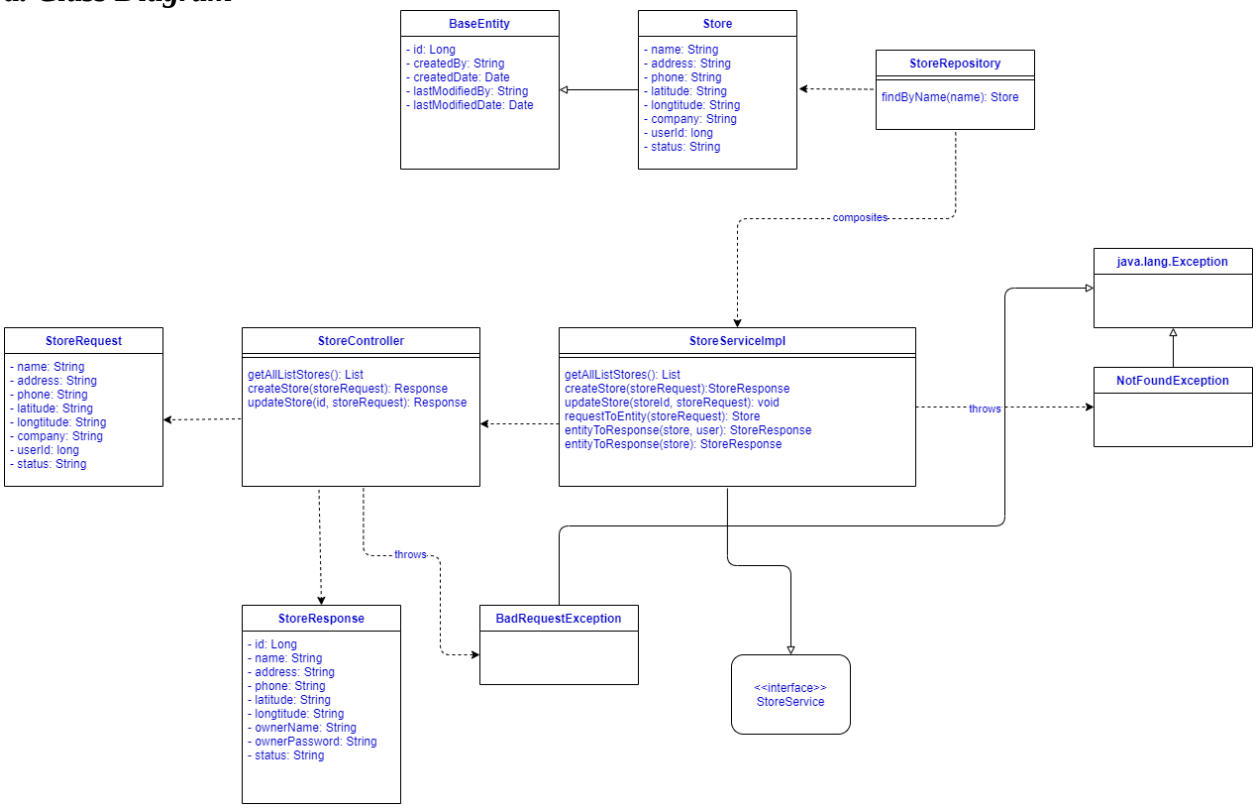
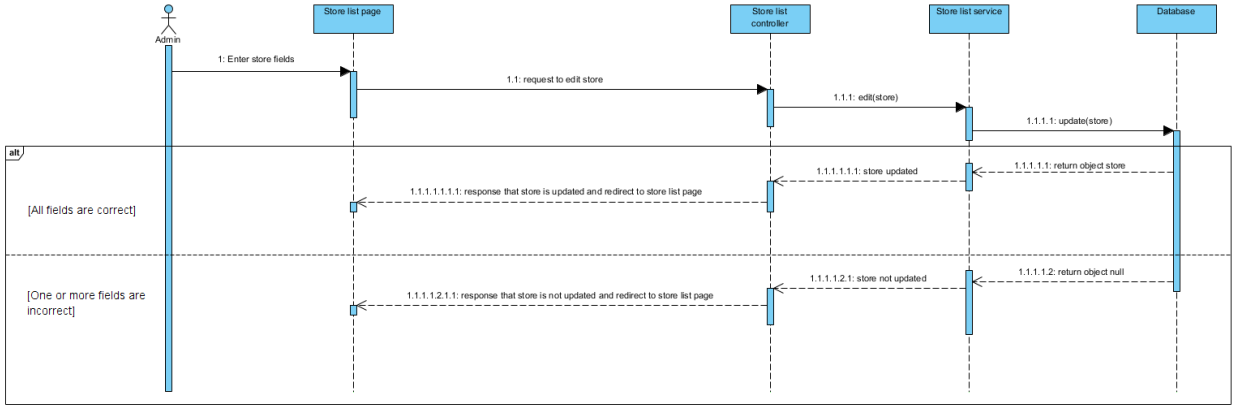


Figure : Update Store class diagram

b. Class Specification

No	Class Name	Method	Description
1	BaseEntity		The default class of entity, which was inherited by many other entity class
2	Store		Store class, which is related to view Store process
3	StoreRepository	FindByName(name): store	This class define method interact with database
4	StoreRequest	StoreController	Request data from client
5	StoreController	updateStore(id,StoreRequest): Response	to navigate when the API has called
6	StoreServiceIpml	updateStore(StoreID, StoreRequest): void	Function to update Store
		requestToEntity(StoreRequest): Store	Convert Request data to entity
7	StoreResponse		Response data from server
8	<<interface>> StoreService		Interface to define function
9	NotFoundException		Exception when store not found
10	BadRequestException		Exception when Request is invalid

c. Sequence Diagram(s)

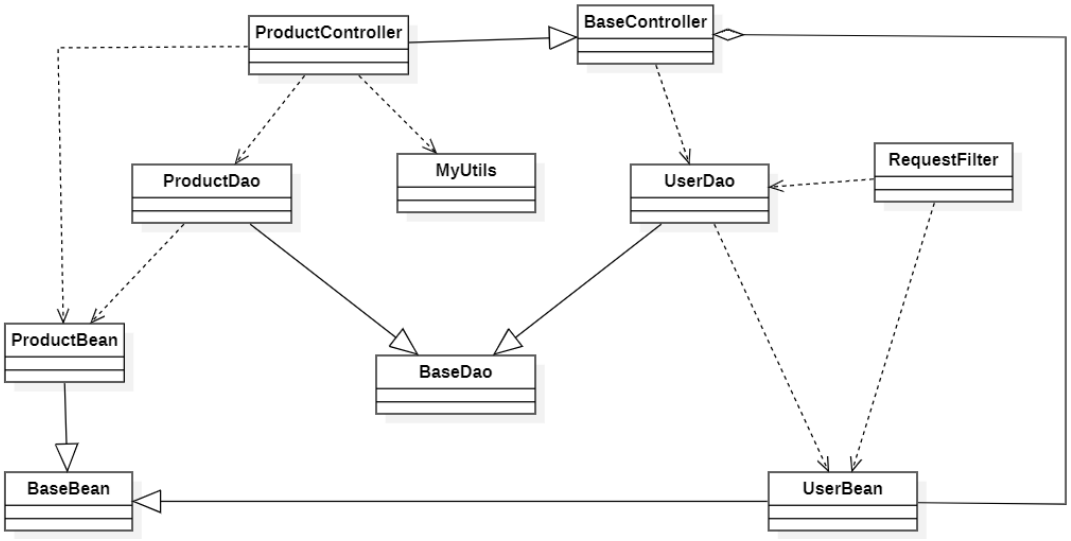


3.24 Delete Store

[Provide the detailed design for the feature <Feature Name1>. It include Class Diagram, Class Specifications, and Sequence Diagram(s)]

a. Class Diagram

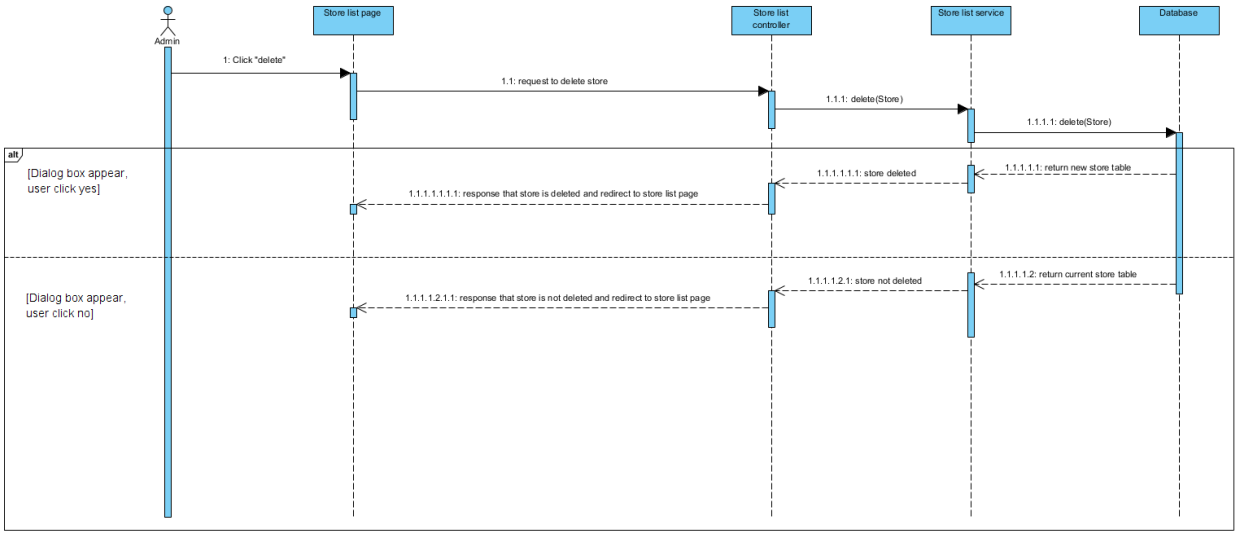
[This part presents the class diagram for the relevant feature]



b. Class Specification

No	Name	Type	Require	Max-Length	Description
1	Họ tên	Text	Yes	N/A	Display full name user
2	Địa chỉ	Text	Yes	N/A	Display address user.
3	Số điện thoại	Number	Yes	10	Display phone number of user.
4	Email	Input-text	Yes	N/A	Display address of user
5	Thao tác	Button	N/A	N/A	Button click all function of manage customer.

c. Sequence Diagram(s)



d. Design:

3.25 Search Store

[Provide the detailed design for the feature <Feature Name1>. It include Class Diagram, Class Specifications, and Sequence Diagram(s)]

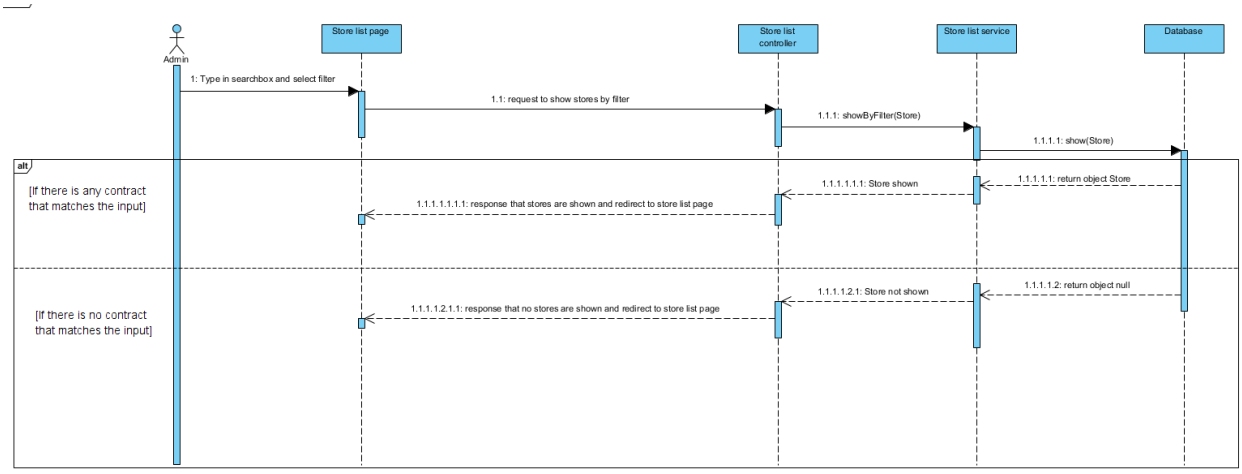
a. Class Diagram

[This part presents the class diagram for the relevant feature]

b. Class Specification

No	Name	Type	Require	Max-Length	Description
1	Họ tên	Text	Yes	N/A	Display full name user
2	Địa chỉ	Text	Yes	N/A	Display address user.
3	Số điện thoại	Number	Yes	10	Display phone number of user.
4	Email	Input-text	Yes	N/A	Display address of user
5	Thao tác	Button	N/A	N/A	Button click all function of manage customer.

c. Sequence Diagram(s)



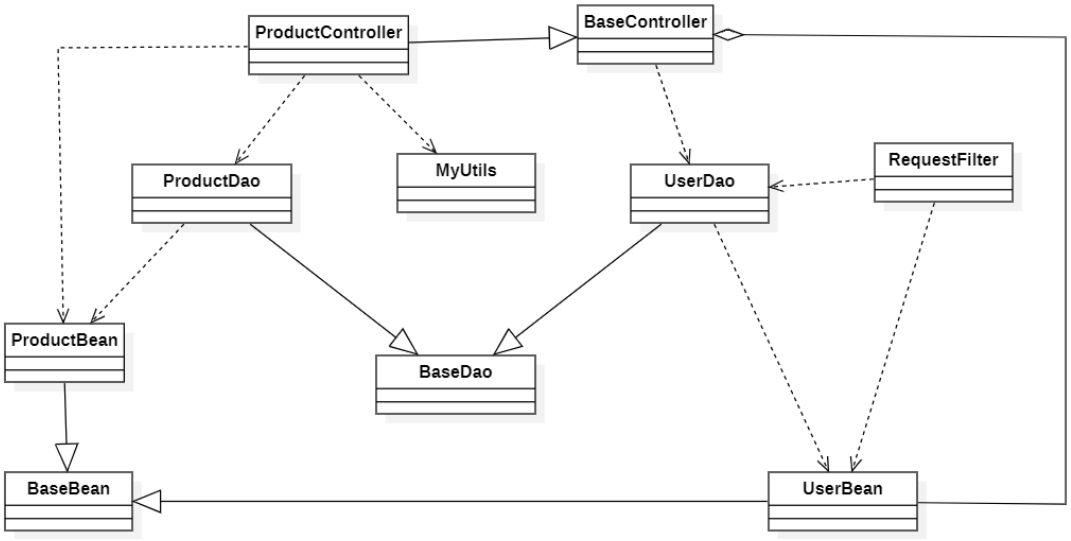
d. Design:

3.26 View Map

[Provide the detailed design for the feature <Feature Name1>. It include Class Diagram, Class Specifications, and Sequence Diagram(s)]

a. Class Diagram

[This part presents the class diagram for the relevant feature]



b. Class Specification

No	Name	Type	Require	Max-Length	Description
1	Họ tên	Text	Yes	N/A	Display full name user
2	Địa chỉ	Text	Yes	N/A	Display address user.
3	Số điện thoại	Number	Yes	10	Display phone number of user.
4	Email	Input-text	Yes	N/A	Display address of user
5	Thao tác	Button	N/A	N/A	Button click all function of manage customer.

c. Sequence Diagram(s)

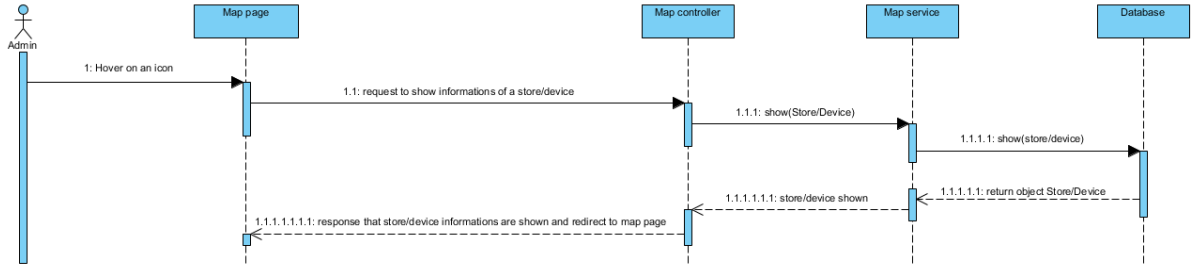


Figure: Admin sequence diagram

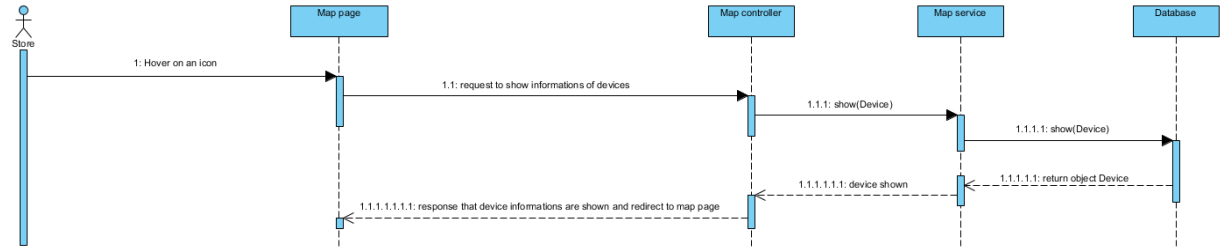


Figure: Store sequence diagram

d. Design:

4. Data & Database Design

V. Software Testing Documentation

1.Overall Description

1.1 Purpose

The primary purpose of this chapter is to detect and prevent defects which may be created by developers while developing the software and this may lead to software failures. On the other hand, another objective of this chapter is to provide information about the level of quality and to make sure that the end result meets the business and user requirements. It contains the following sections:

- Test model
- Test Plan
- Testing levels
- Testing types
- Test plan
- Test Stages
- Resources
- Test milestone
- Test Deliverables
- Test case
- Test report

2. Test Model

This project follows the V-Model process to implement testing.

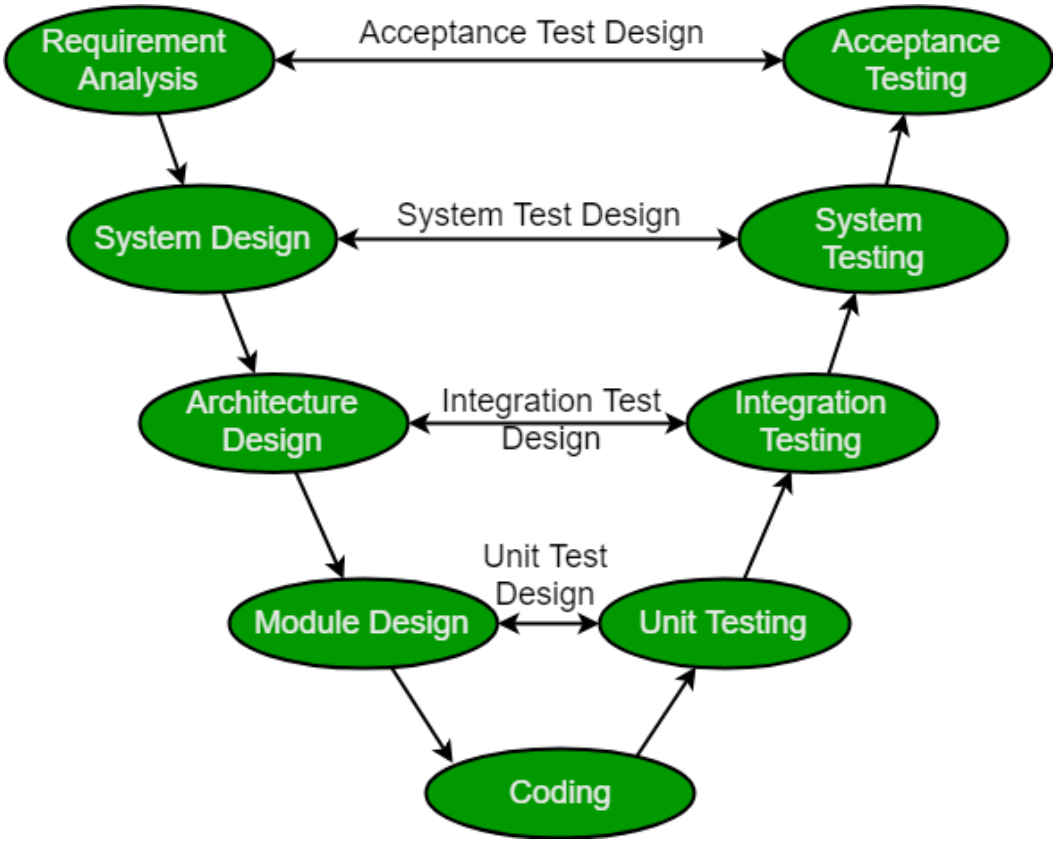


Figure 2.1: V-model process

Verification Phases	Validation Phases
User Requirement: This is the first phase in the development cycle where the product requirements are understood from the. customer's perspective. This phase involves detailed communication with the customer to understand his expectations and exact requirement. This is a very important activity and needs to be managed well, as most of the customers are not sure about what exactly they need. The acceptance test design planning is done at this stage as business requirements can be used as an input for acceptance testing	**Acceptance Testing:** Acceptance testing is associated with the business requirement analysis phase and involves testing the product in user environment. Acceptance tests uncover the compatibility issues with the other systems available in the user environment. It also discovers the non-functional issues such as load and performance defects in the actual user environment.
Software Requirement Specification: Once you have the clear and detailed product requirements, it is time to design the complete system. The system design will have the understanding and detailing the complete hardware and communication setup for the product under development. The system test plan is developed based on the system design. Doing this at an earlier stage leaves more time for the actual test execution later.	**System Testing**: System testing is directly associated with the system design phase. System tests check the entire system functionality and the communication of the system under development with external systems. Most of the software and hardware compatibility issues can be uncovered during this system test execution.

Architectural Design: Architectural specifications are understood and designed in this phase. Usually more than one technical approach is proposed and based on the technical and financial feasibility the final decision is taken. The system design is broken down further into modules taking up different functionality. This is also referred to as High Level Design (HLD). The data transfer and communication between the internal modules and with the outside world (other systems) is clearly understood and defined in this stage. With this information, integration tests can be designed and documented during this stage.	**Integration Testing:** Integration testing is associated with the architectural Designphase. Integration tests are performed to test the coexistence and communication of the internal modules within the system.
Detailed Design: In this phase, the detailed internal Designfor all the system modules is specified, referred to as Low Level Design(LLD). It is important that the Designis compatible with the other modules in the system architecture and the other external systems. The unit tests are an essential part of any development process and helps eliminate the maximum faults and errors at a very early stage. These unit tests can be Designed at this stage based on the internal module Designs.	**Unit Testing:** Unit tests Designed in the module Designphase are executed on the code during this validation phase. Unit testing is the testing at code level and helps eliminate bugs at an early stage, though all defects cannot be uncovered by unit testing.

You can reference at: https://viblo.asia/p/v-model-trong-kiem-thu-phan-mem-la-gi-tim-hieu-voi-vi-du-sdlc-stlc-Qbq5QMEL5D8

1.3 Testing Levels

About testing stage, we use four main software testing stages.

Unit Testing

During this first round of testing, the program is submitted to assessments that focus on specific units or components of the software to determine whether each one is fully functional. The main aim of this endeavor is to determine whether the application functions as Designed. In this phase, a unit can refer to a function, individual program or even a procedure, and a White-box Testing method is usually used to get the job done. One of the biggest benefits of this testing phase is that it can be run every time a

piece of code is changed, allowing issues to be resolved as quickly as possible. It's quite common for software developers to perform unit tests before delivering software to testers for formal testing.

You can reference at: https://topdev.vn/blog/unit-test-la-gi/

Integration Testing

Integration testing allows individuals the opportunity to combine all of the units within a program and test them as a group. This testing level is Designed to find interface defects between the modules/functions. This is particularly beneficial because it determines how efficiently the units are running together. Keep in mind that no matter how efficiently each unit is running, if they aren't properly integrated, it will affect the functionality of the software program. In order to run these types of tests, individuals can make use of various testing methods, but the specific method that will be used to get the job done will depend greatly on the way in which the units are defined.

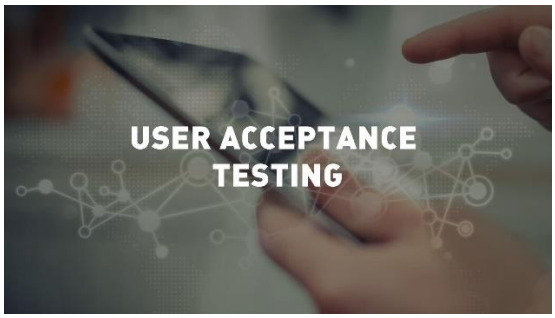
You can reference at: https://viblo.asia/p/tim-hieu-ve-kiem-thu-tich-hop-integration-testing-yMnKM94AK7P

System Testing

System testing is the first level in which the complete application is tested as a whole. The goal at this level is to evaluate whether the system has complied with all of the outlined requirements and to see that it meets Quality Standards. System testing is undertaken by independent testers who haven't played a role in developing the program. This testing is performed in an environment that closely mirrors production. System Testing is very important because it verifies that the application meets the technical, functional, and business requirements that were set by the customer.

You can reference at: https://viblo.asia/p/system-testing-kiem-thu-he-thong-aWj53pOPK6m

Acceptance Testing



The final level, Acceptance testing (or User Acceptance Testing), is conducted to determine whether the system is ready for release. During the Software development life cycle, requirements changes can sometimes be misinterpreted in a fashion that does not meet the intended needs of the users. During this final phase, the user will test the system to find out whether the application meets their business' needs. Once this process has been completed and the software has passed, the program will then be delivered to production.

You can reference at:

1.4 Testing Types

The different types of testing that will be carry out this project are:

• *Function Test*

- The target-on-test should focus on any requirements for test that can be traced directly to uses cases or business rules. The goals of these test are to verify proper data acceptance, processing and retrieval and the appropriate implementation of the business rules. This type of testing is based upon black box techniques, that are verifying the application and its internal processes by interacting with the application via the Graphical User Interface (GUI) and analyzing the output or result.

- The implementation of functional test will be passed if all functional cases in Test case document are tested and passed.

• *GUI Test*

- Graphical User Interface (GUI) Testing verifies a user's interaction with the software. The goal of GUI testing is to ensure that the GUI provides the user with the appropriate access and navigation through the functions of the target-of-test. In addition, GUI testing ensures that the objects within the GUI function as expected and conform to requirements.

- GUI test will be performed fully on all screens

- This test is targeted to cover the verification of the overall look and feel of the Gas-Meter system including initial position, color, focus, initial button, text view, edit text, screen sizes and sentences width.

• ***Acceptance test***

- The acceptance testing is a test conducted to determine if the requirements of a specification or contract are met.

- It involves alpha testing and beta testing. Alpha testing takes place at developers' sites and involves testing of the operational system by internal member, before it is released to external users. Beta testing takes place at user's sites and involves testing by a group of users who use the system at their own locations and provide feedback, before the system is release to all users.

2 Test Plan

2.1 Features to be tested

Group of function	Functions	Actor
Login	Register with email	User
	Login with email	
	Logout	
Personal information	View personal information	
	Update personal information	
View gas-meter report	View gas concentration	
	View temperature	
	View weight of gas cylinder	
View Notification	View notification	
Manage user	View list user	Admin, Store
	Add user	
	Update user	
	Search user	
	Show location of user	
Manage contract	View list contract	
	Create contract	
	Update contract	
	Search	
View list broken device	View list broken device	
View Map	View map	
Manage store	View list store	Admin
	Create store	
	Update store	
	Search store	

2.2 Features to be tested

- Out of scope features will not be tested.

- Non-functional requirements will not be tested.

2.3 Testing tool

- Google Sheet: Used to track bugs.

- Microsoft Excel: Used to manage test cases and manage bugs.

- Android Phone: Used to test features and displays.

- Android Studio: To view logs, inspect elements.

- Google Chrome: Use to view the web page, bug logging page, etc..

- Postman: To manage the list of all APIs and manually test API's result.

- Visual studio code: Use to perform unit tests.

- Mockito: Mockito is a framework that supports the creation of unit tests using mock objects (Mock or TestDouble) in an easy-to-use manner without creating "noise" from unrelated interactions.

2.4 Test Stages

Type of tests	Stage of test		
	Unit testing	Integration testing	System testing
Function test	X	X	X
GUI Test		X	X
Acceptance test			X
System test			X

2.5 Resources

a. Human Resources

ID	Resource	Responsibilities

1	Project Manager	• Responsible for Project Schedules and overall success of the project. • Review test cases and test report.
2	Test Leader	• Review test cases and test report. • Review overall quality of the project.
3	Testers	• Preforming the actual system testing • Create test plan • Create test cases • Perform tests • Write test reports • Logbugs
4	Developers	• Create and perform Unit Tests. • Fix bugs

b. Environment

In this project, the test stage is very important, and must have a certain environment. However, in this project, the effort of the team is limited, so we will use our devices to execute tests. Besides that, we focus on the function, so we will ignore the line's speech configuration speech, configuration of the server.

The following table describes the testing environment:

Type of testing	Software	Hardware
Unit test	JUnit4, Mockito	
Integration test		- Android Studio Virtual Device - Samsung Galaxy A30 OS Android 10, Ram 4GB, Rom 64GB - Samsung A6 Plus OS Android 10, Ram 3GB, Rom 32GB - Sony XZS OS Android 8.0, Ram 4GB, Rom 64GB
System test		- Android Studio Virtual Device - Samsung Galaxy A30 OS Android 10, Ram 4GB, Rom 64GB - Samsung A6 Plus OS Android 10, Ram 3GB, Rom 32GB - Sony XZS - OS Android 8.0, Ram 4GB, Rom 64GB

2.6 Test Milestones

No	Milestones	Delivery Date
1	Project Registration	14/09/2020
2	Submit: Report1_Project Introduction	28/09/2020

3	Submit: Report2_Project Management Plan	11/10/2020
4	Submit: Report3_System Requirement Specification	25/10/2020
5	Submit: Report4_Software Design Document	20/11/2020
6	Submit: Report5_Test Documentation	01/12/2020
7	Submit: Report6_Software User Guides	08/12/2020
8	Submit Final Report	23/12/2020
9	Submit all project resources	23/12/2020
10	Project defense	31/12/2020

2.7 Deliverables

Deliverables	Responsibilities	Completion Date
Test plan	Testers	29/09/2020
Test cases	Testers	03/11/2020
Test case Review	Testers + Project Manager	01/12/2020
Defect Log	All members	13/12/2020
Final Test Summary Report	All members	21/12/2020

3.Test Process Model

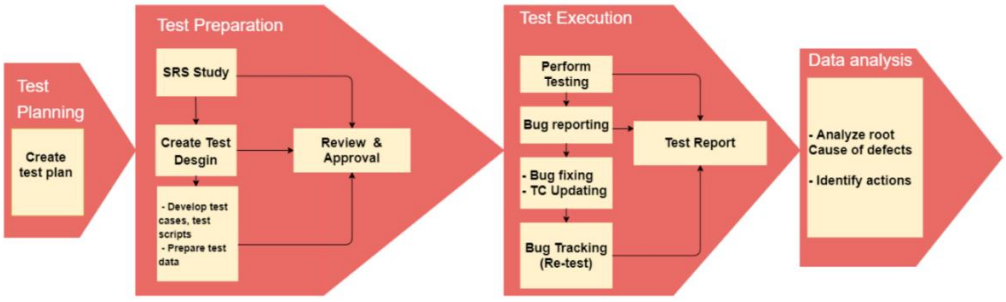


Figure: Test process model

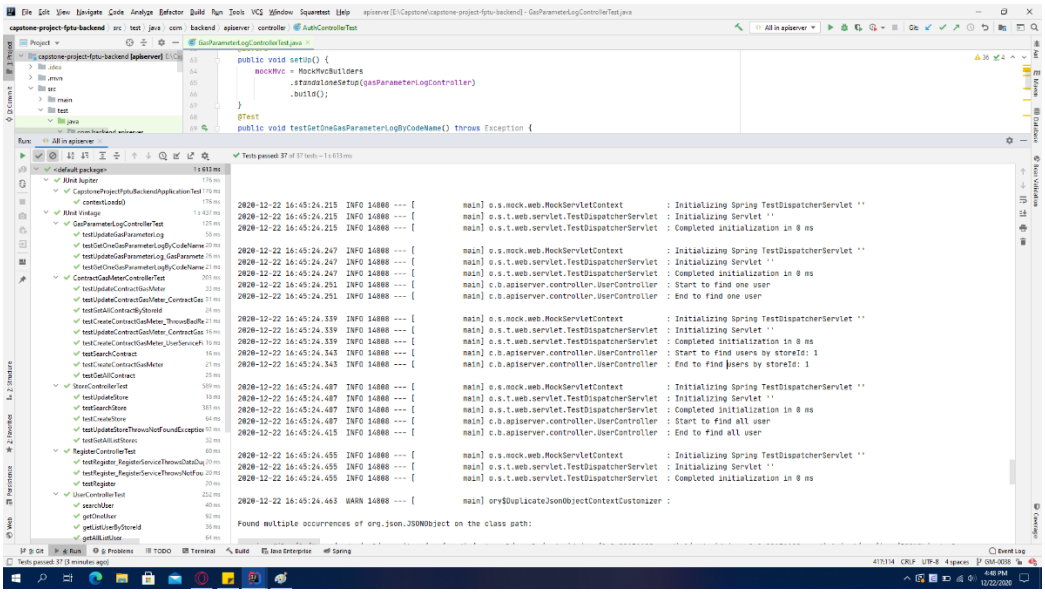
4. Test Cases

See the reference for detail of test cases

- *Unit Test Cases: Gas_Metter_ Report5_Unit Test Case.xls*
- *Other Test Cases: Gas_Metter _Report5_ Test Case.xls]*

5. Test Result

5.1 Unit test



5.2 Integration Test and System Test

Integration test and System test are done by testers to ensure that combined units work correctly and that the system functions as intended.

GUI testing is also done during this process to ensure that elements and functions load correctly, text is readable, and the website interface looks good in various browser sizes.

This is sample tests of Integration Test and System Test in Gas-Meter system:

Module Code	Register for user			
Test requirement				
Reference Document				
Pass	***Fail***	***Untested***	***N/A***	***Number of Test cases***
17	0	0	0	17

ID	**Test Case Description**	**Test Case Procedure**	**Expected Results**	**Inter-test case Dependence**
1	Test viewing login form	1. Go to login page	- Display "You have entered an invalid username or password" - Redirect to the list store page of the app. - Textbox to enter email: "Email" - Textbox to enter password: "Mật khẩu" - Button to login: "Đăng nhập"	One or more textbox must be filled
2	Check UI of SignUp form.	1. User open app 2. Click button "Đăng kí". 3. Check UI.	- Display Sign Up form. - Display the form exactly as designed: Layout is not deviated, font and color accurate Display, simplify. Required fields (Họ và tên, email, Số điện thoại, etc.) are appended "*" next to that field name. - Text box enter your name Display Text placeholder: "Họ và tên:". - Text box enter your phone number Display Text placeholder: "Số điện thoại". - Text box enter your address Display Text placeholder: "Địa chỉ". - Text box enter your password Display Text placeholder: "Mật Khẩu".	None
3	Test inputing wrong password	1. Go to login page 2. Input "dsasdas" in the password textbox	Display "You have entered an invalid username or password"	None

Figure: Integration Test

Module Code	Register for user			
Test requirement				
Reference				
Pass	*Fail*	*Untested*	*N/A*	*Number of Test cases*
8	0	0	0	8

ID	Test Case Description	Test Case Procedure	Expected Results	Inter-test case Dependence	Result
1	Test viewing login form	1. Go to login page	- Display "You have entered an invalid username or password" - Redirect to the list store page of the app. - Textbox to enter email: "Email" - Textbox to enter password: "Mật khẩu" - Button to login: "đăng nhập"	One or more textbox must be filled in	Pass
2	Check UI of SignUp form.	1. User open app 2. Click button "đăng kí". 3. Check UI.	- Display Sign Up form. - Display the form exactly as designed: Layout is not deviated, font and color accurate Display, simplify. Required fields (Họ và tên, email, Số điện thoại, etc.) are appended "*" next to that field name. - Text box enter your name Display Text placeholder: "Họ và tên:". - Text box enter your phone number Display Text placeholder: "Số điện thoại". - Text box enter your address Display Text placeholder: "Địa chỉ".	None	Pass
3	Check register when enter wrong email	1.User open app 2..User click"đăng ký"	Display "System Error!"	None	Pass
4	Check register when enter wrong email	1.User open app 2..User click"đăng ký"	Display "You have entered an invalid username or password"	Both e-mail and password textbox must be filled in	Pass

Figure: System Test

6. Test Report

6.1 Unit test

Unit Test Report			
Project_name	Gas_Meter	Creater	PhuongNH,HungVD
Project code	Gas_Meter	Reviewer/Approver	
Document Code	Gas_Meter_Report	Issue Date	

No	Function	Passed	Failed	Untested	Total Test Case
1	performAuthentication	1	0	0	1
2	getAllListUser	1	0	0	1
3	findUserById	1	0	0	1
4	findUserByEmail	1	0	0	1
5	Save(User)	1	0	0	1
6	changePassword	1	0	0	1
7	findAllUserByStoreId	1	0	0	1
8	searchAllUser	1	0	0	1
9	listEntityToResponse	1	0	0	1
10	getAllListStores	1	0	0	1

11	createStore	1	0	0	1
12	updateStore	1	0	0	1
13	searchStore	1	0	0	1
14	requestToEntity	1	0	0	1
15	getAllContractGasMeter	1	0	0	1
16	getAllContractGasMeterByStoreId	1	0	0	1
17	getOneContractGasMeter	1	0	0	1
18	getOneContractGasMeterByUserId	1	0	0	1
19	createContractGasMeter	1	0	0	1
20	updateContractGasMeter	1	0	0	1
21	findByGasMeterCode	1	0	0	1
22	getParameterLogById	1	0	0	1
23	createParameterLog	1	0	0	1
24	updateParameterLog	1	0	0	1
25	getAllNotify	1	0	0	1
26	createHistoryNotification	1	0	0	1
27	getAllNotifyByUserId	1	0	0	1
28	findOneNotifyById	1	0	0	1
29	updateNotificaiton	1	0	0	1
30	getAllFcmTokenByUserIdAndStatus	1	0	0	1
31	saveToken	1	0	0	1
32	findByToken	1	0	0	1
33	getAllListGasParameterFireBase	1	0	0	1
34	createNewSnapshotFirebase	1	0	0	1
35	updateGasParameterFireBase	1	0	0	1

36	deleteParameterFireBase	1	0	0	1
	Total	36	0	0	36

6.2 Integration Test

We have deployed all integration test cases that the system can have. In our systems, we have a total 482 test cases and all test cases are passed.

The number of integration test in phase is shown below:

Integration Test Report			
Project_name	Gas_Meter	Creater	PhuongNH,ThanhTN
Project code	Gas_Meter	Reviewer/Approver	
Document Code	Gas_Meter_Report	Issue Date	

Role	No	Function	Passed	Failed	Untested	Total Test Case
User	1	Test Login User	3	0	0	3
	2	Test Logout User	1	0	0	1
	3	Test Register user	17	0	0	17
	4	Test Update Personal Information	29	0	0	29
	5	Test View Gas_Meter Report	16	0	0	16
	6	Test View Notification	30	0	0	30
Store, Admin	7	Test store Login	3	0	0	3
	8	Test store Logout	1	0	0	0
	9	Test View list user	10	0	0	10
	10	Test create user	48	0	0	48
	11	Test update user	36	0	0	36
	12	Test search user	25	0	0	25
	13	Test view location of user store	28	0	0	28
	14	Test view list contract	10	0	0	10
	15	Test create contract	38	0	0	38
	16	Test update contract	26	0	0	26
	17	Test search contract	17	0	0	17
	18	Test view list broken	4	0	0	4
	19	Test view map	48	0	0	48
Admin	20	Test Admin Login	3	0	0	3
	21	Test Admin Logout	1	0	0	1
	22	Test View list store of Admin	10	0	0	10
	23	Test create store of Admin	38	0	0	38
	24	Test update store of Admin	26	0	0	26
	25	Test search store of Admin	14	0	0	14
		Sub Total	482			482

6.3 System Test

System Test Report			
Project_name	Gas_Meter	Creater	PhuongNH,ThanhTN
Project code	Gas_Meter	Reviewer/Approver	
Document Code	Gas_Meter_Report	Issue Date	

Role	No	Function	Passed	Failed	Untested	Total Test Case
User	1	Test Login User	3	0	0	3
	2	Test Logout User	1	0	0	1
	3	Test Register user	8	0	0	8
	4	Test Update Personal Information	14	0	0	14
	5	Test View Gas_Meter Report	8	0	0	8
	6	Test View Notification	16	0	0	16
Store, Admin	7	Test store Login	3	0	0	3
	8	Test store Logout	1	0	0	0
	9	Test View list user	5	0	0	5
	10	Test create user	24	0	0	24
	11	Test update user	18	0	0	18
	12	Test search user	13	0	0	13
	13	Test view location of user store	14	0	0	14
	14	Test view list contract	5	0	0	5
	15	Test create contract	20	0	0	20
	16	Test update contract	13	0	0	13
	17	Test search contract	9	0	0	9
	18	Test view list broken	2	0	0	2
	19	Test view map	23	0	0	23
Admin	20	Test Admin Login	3	0	0	3
	21	Test Admin Logout	1	0	0	1
	22	Test View list store of Admin	5	0	0	5
	23	Test create store of Admin	20	0	0	20
	24	Test update store of Admin	13	0	0	13
	25	Test search store of Admin	7	0	0	7
		Sub Total	249			249

6.4 User Acceptance Test

User Acceptance Test			
Project_name	Gas_Meter	Creater	PhuongNH,ThanhTN
Project code	Gas_Meter	Reviewer/Approver	
Document Code	Gas_Meter_Report	Issue Date	

Check lists				
	ID		Yes	No
General	GM-001	Every buttons have activity and working normally	Y	
	GM-002	Spelling and grammatical is correct	Y	
	GM-003	Update functionality of any record on page has confirmation	Y	
	GM-004	All mandatory fields are validated	Y	
	GM-005	All required field cannot be blank/space	Y	

	GM-006	All numeric values are properly formatted	٧	
	GM-007	Error diaLogmessages are displayed	٧	
GUI and Usability	GM-008	Screens are designed following project requirement	٧	
	GM-009	User-friendly and easy-to-use screen interface	٧	
	GM-010	All fields on page are all reasonably aligned	٧	
	GM-011	The information is arranged symmetrically with the right distance between the components.	٧	
	GM-012	The important fields and buttons are located where they are easy to see.	٧	
	GM-013	Information is displayed in the right order	٧	
	GM-014	The text easy to read. Do not use slang, acronyms, and abbreviations	٧	
	GM-015	Font size, text style and color as specified in SRS.	٧	
	GM-016	Has Copyrighted icons and images	٧	
	GM-017	The text is clear, concise, and meaningful	٧	
	GM-018	The notification in mobile displays all necessary and timely information	٧	
	GM-019	Full and detailed display of necessary parameters	٧	
	GM-020	Displays exactly position on the map	٧	
Database	GM-021	Correct data is saved in database.	٧	
	GM-022	Not null column has values	٧	
	GM-023	Fields are designed with correct data type and data length.	٧	
Performance	GM-024	Quick response display	٧	
	GM-025	Location in the map appeared almost immediately	٧	

	GM-026	Receive uninterrupted notifications	٧	
Security	GM-027	Check password security and password policy enforcement.	٧	
	GM-029	Verify old password When change password	٧	
	GM-030	Check application logout functionality.	٧	

VI. Release Package & User Guides

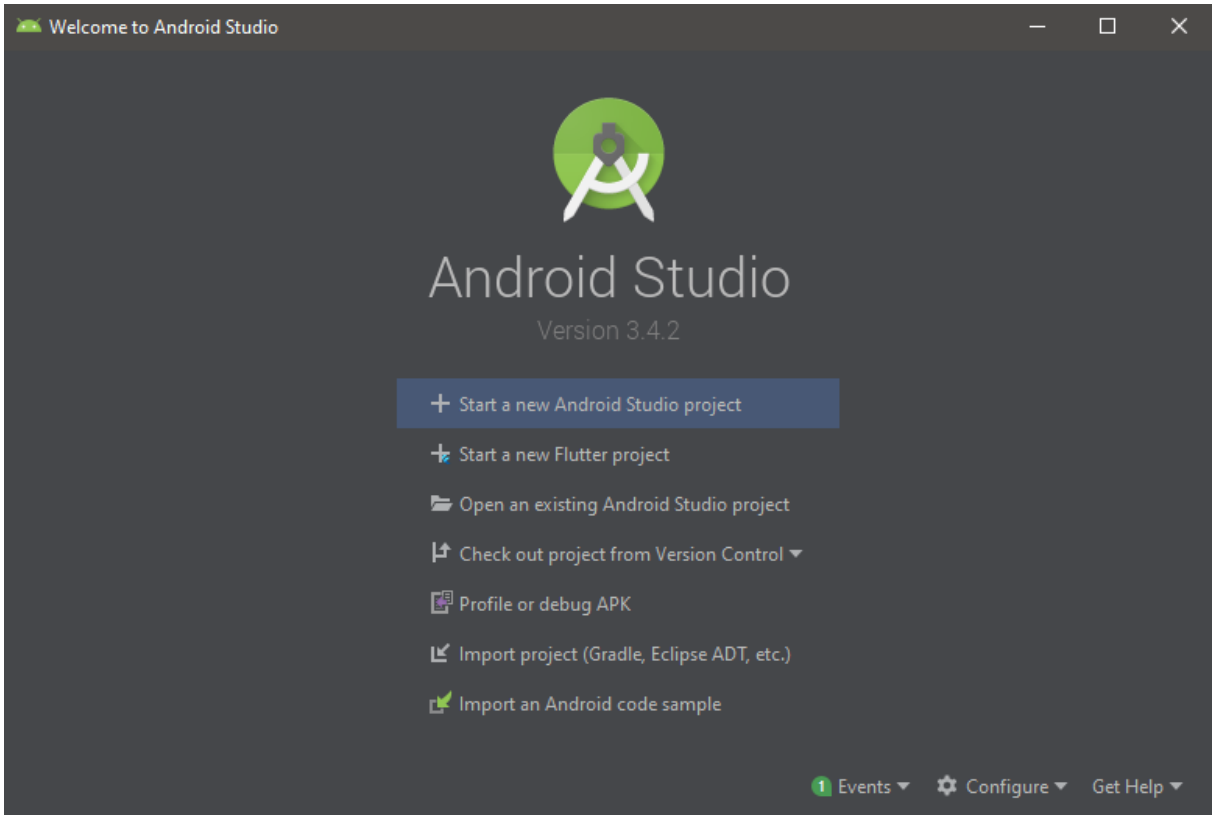
1. Installation Guides

*Note : Users need connection network to use the features in the app.

1.1 Setup Files

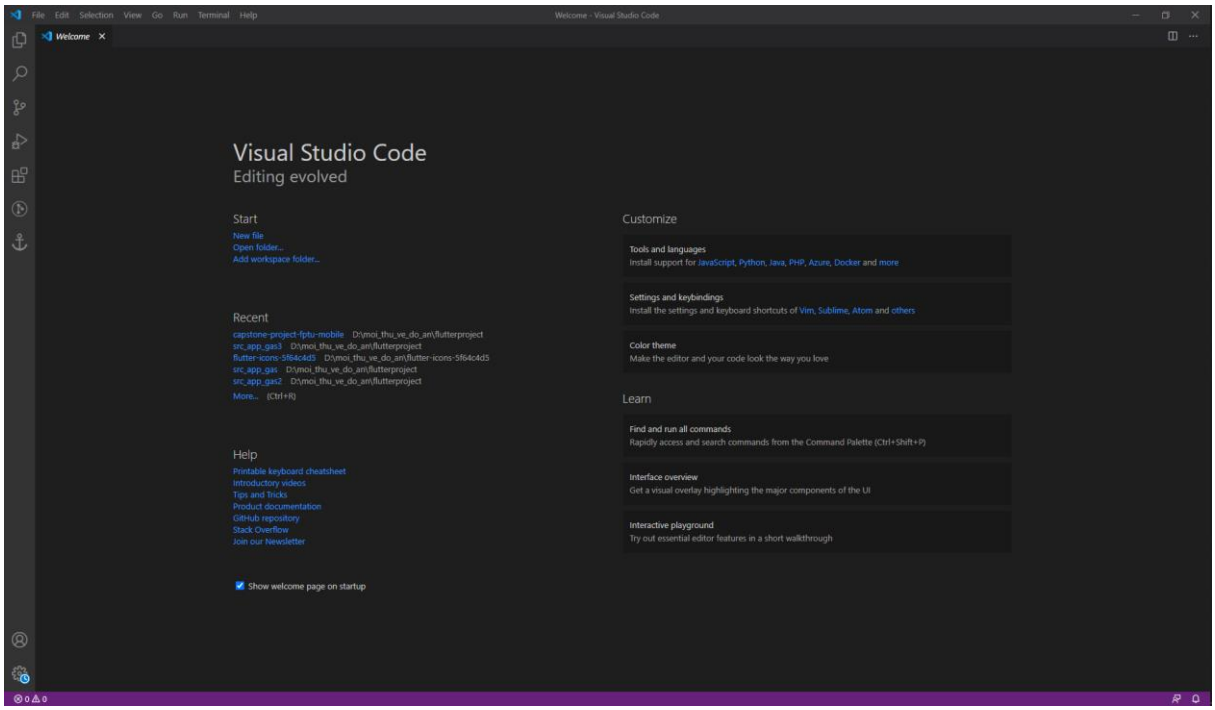
- **Android Studio**

  Dowload Android Studio from https://developer.android.com/studio, then follow the instruction to install.



- **Visual Studio Code**

  Download VSCode from https://code.visualstudio.com/download, then follow the instruction to install.



- **IntelliJ IDEA**

  Download IntelliJ IDE from https://www.jetbrains.com/idea/download/, the follow the instruction to install.

- **Flutter**

We use Flutter for developing and running GasMeter mobile application. You can go: https://flutter.dev/docs/get-started/install, then follow the instruction to install.

- **JDK 8**

Download and install JDK 8 following this link https://www.oracle.com/java/technologies/javase/javase-jdk8-downloads.html.

- **NodeJS**

Install NodeJS by following this link https://nodejs.org/en/download/. The npm will automatically be install along with NodeJS.

- **Angular 8**

Install Angular 8 by following this link https://angular.io/guide/setup-local.

- **MySQL**

Download and Install MySQL from this link: https://dev.mysql.com/downloads/workbench/

1.2 Installation Instruction

1.2.1 Mobile Application

Step 1: Clone project.

```
$ git clone https://dangnhtp@bitbucket.org/capstone-fptu-2020/capstone-project-fptu-mobile.git
```

Step 2: Go to project folder.

```
$ cd flutterproject\capstone-project-fptu-mobile
```

Step 3: Update dependencies.

```
$ flutter pub get
```

Step 4: Connect with Android Device.

Step 5: Run project in Device.

```
$ flutter run lib/main.dart
```

1.2.2 Gas_meter front-end

Step 1: Clone project.

```
$ git clone https://bitbucket.org/capstone-fptu-2020/capstone-project-fptu-frontend/src/master/-fptu-frontend/src/master/
```

Step 2: Go to project folder.

```
$ cd capstone-project-fptu-frontend
```

Step 3: Update dependencies.

```
$ npm install
```

Step 4: Connect with Android Device.

```
$ npm audit fix
```

Step 5: Run project in Device.

```
$ ng serveA
```

1.2.3 Gas_meter back-end

Step 1: Clone the project git clone

```
https://bitbucket.org/capstone-fptu-2020/capstone-project-fptu-backend/src/master/
```

Step 2: Go to the directory containing the project

```
cd /capstone-project-fptu-backend/src/master/
```

Step 3 : Create database gasmeterdb in MySQL

Step 4: Run backend

```
mvn spring-boot:run
```