

HO CHI MINH UNIVERSITY OF TECHNOLOGY AND EDUCATION

FACULTY FOR HIGH QUALITY TRAINING



GRADUATE THESIS

**BUILD A GRADUATE THESIS
MANAGEMENT SYSTEM
FOR FACULTY FOR HIGH QUALITY TRAINING**

STUDENT NAME:

NGUYEN DUY POON

STUDENT ID

16110186

School year:

2016 – 2020

Major:

INFORMATION TECHNOLOGY

SUPERVISOR:

M.Si LUONG VI MINH

Ho Chi Minh, December 2020

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Ho Chi Minh, December 1st 2020

MISSION OF GRADUATION THESIS

Student name	Student ID	Class
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Major: Information Technology		
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Started date: 14/09/2020	Submit date: 06/01/2021	

1. Topic name: Build a graduate thesis management system for Faculty for High Quality Trainning.
2. Content to implement the project:

Theory:

- Research about the graduate thesis process of Faculty for High Quality Trainning.
- Research about Redis, MySQL and TypeORM.
- Research about RESTful APIs, NodeJS, Typescript, NestJS framework and Postman tool.
- Research about React, NextJS and Ant Design framework.
- Research about Docker Engine, Amazon S3, Heroku, Continues integration (CI) and GitHub Actions.

3. Products

- Graduate thesis process of Faculty for High Quality Trainning.
- RESTful APIs server.
- Graduate thesis application on web platform.

HEAD OF INFORMATION TECHNOLOGY
(Name and signature)

SUPERVISOR
(Name and signature)

COMMENTARY OF SUPERVISOR

Student name: Nguyen Duy Poon

Student ID: 16110186

Major: Information Technology.

Topic name: Build a graduate thesis management system for Faculty for High Quality Trainning.

Name of supervisor: M.Si Luong Vi Minh.

COMMENTARY

1. On content of topic & workload done:

.....
.....
.....

2. Advantage:

.....
.....
.....

3. Disadvantage:

.....
.....
.....

4. Recommend for defense or not?.....

5. Rating type:

6. Mark: (By word:.....)

Ho Chi Minh, 2020

SUPERVISOR

(Name and signature)



COMMENTARY OF REVIEWER

Student name: Nguyen Duy Poon

Student ID: 16110186

Major: Information Technology.

Topic name: Build a graduate thesis management system for Faculty for High Quality Trainning.

Name of reviewer:

COMMENTARY

7. On content of topic & workload done:

.....
.....
.....

8. Advantage:

.....
.....
.....

9. Disadvantage:

.....
.....
.....

10. Recommend for defense or not?.....

11. Rating type:

12. Mark: (By word:.....)

Ho Chi Minh, 2020

REVIEWER

(Name and signature)

ASSURANCE

We assure that this project is our own implementation. We do not copy, use any material or source code of others without specifying the source. We assume responsibility for violations.

Ho Chi Minh, December 1st 2020

Nguyen Duy Poon

MANY THANKS

Success doesn't come from one person. To complete this thesis, the author would like to sincerely thanks M.Si Luong Vi Minh who has supported me during this thesis processing. The project will not complete without his comments, guides, and practices. I'm very respectful and grateful for his effort. Once again, thank you very much.

Because of limited time and knowledge with many other reasons, so there will have inevitable problems, so I hope you feel free to raise your idea with me for more complete later. We sincerely thank you.

Ho Chi Minh, December 1st 2020

Nguyen Duy Poon

SUMMARY INFORMATION BY VIETNAMESE

1. Các vấn đề nghiên cứu

- Tìm hiểu về quy trình tổ chức khóa luận của khoa Đào tạo Chất lượng cao.
- Tìm hiểu về công nghệ lưu trữ dữ liệu Redis, MySQL và công nghệ ánh xạ đối tượng quan hệ TypeORM.
- Tìm hiểu về các công nghệ để xây dựng máy chủ RESTful APIs như NodeJS, NestJS framework, Typescript giúp giải quyết rào cản về nền tảng hỗ trợ của ứng dụng công nghệ thông tin.
- Tìm hiểu về các công nghệ để xây dựng ứng dụng web hiện nay như React, NextJS framework và Ant Design framework.
- Tìm hiểu về Docker Engine, Tích hợp liên tục (CI), GitHub Actions, Amazon S3, Heroku và Postman trong việc phát triển, bảo trì và vận hành sản phẩm công nghệ thông tin.

2. Kết quả đạt được

- Quy trình tổ chức khóa luận của khoa Đào tạo Chất lượng cao.
- Máy chủ RESTfuls API.
- Hệ thống tổ chức khóa luận cho khoa Đào tạo Chất lượng cao trên nền tảng web.

SUMMARY INFORMATION BY ENGLISH

1. Research issues

- Research about the graduate thesis process of Faculty for High Quality Trainning.
- Research about storage technologies such as Redis, MySQL and Object Relational Mapping (ORM) technology TypeORM.
- Research about building RESTful APIs server technologies such as NodeJS, NestJS framework and Typescript which help solve barriers to cross-platform support of the application of information technology.
- Research about building web application technologies such as React, NextJS framework and Ant Design framework.
- Research about Docker Engine, Continues Integration (CI), GitHub Actions, Amazon S3, Heroku and Postman in development, maintenance and deploy information technology product.

2. Achieved results

- Graduate thesis process of Faculty for High Quality Trainning.
- RESTful APIs server.
- Graduate thesis application on web platform.

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CHAPTER 1. OVEWVIEW

1.1. Urgency and objectives of project

1.1.1. The urgency of project

The graduate thesis is one of the most important parts of a student's life. At some universities, it became a required condition for graduation. Besides, it also is considered that achievement or something like a memory of university time.

But the current graduate thesis process of Faculty for High Quality Training has inadequacies. The traditional process is mostly manual or semi-computerized through social networks such as Facebook. Therefore, it makes some difficult to manage, tracking and statistics. Besides, the information about the graduate thesis between attendees can be missing because don't have general communication.

With the development of information technology, every working processes are converted to computerized to optimizing resource and human force. No exceptions, the current graduate thesis process need to replace the traditional process with a computerized process to improve the above inadequacies.

As an information technology student, the author more understands than anyone else the necessity of information technology in the graduate thesis process of Faculty for High Quality Trainning. Therefore, with the agreement of Head of Infomation Technology Nguyen Dang Quang, the author choose the topic "Build a graduate thesis management system for Faculty for High Quality Training" for project of graduate thesis.

1.1.2. Project objectives

Topic "Build a graduate thesis management system for Faculty for High Quality Training" is solve the issues include:

- Understand the graduate thesis process of Faculty for High Quality Training, including attendee type (with permission), the states of a graduate thesis, the allowed behaviors of attendee with each state.
- Use the above process to build a graduate thesis management system for computerized the graduate thesis process, including student management, lecturer management, graduate thesis management (with graduate thesis state management).

1.2. Objects, scope and methods of research

1.2.1. Research objects

The research objects of this graduate thesis include two main objects:

- The current graduate thesis process of Faculty for High Quality Training.

- The technologies apply to build a graduate thesis management system on the web platform. In this object, it includes smaller research objects which are separated by the following layers:
 - + Database layer: Redis database, MySQL database, Object Relation Mapping technology TypeORM.
 - + API server layer: NodeJS platform, Typescript language, NestJS framework and RESTful APIs.
 - + Web application layer: React library, NextJS framework and Ant Design framework.
 - + Development and deploy layer: Docker Engine, Continues Integration (CI), GitHub Actions, Amazon S3, Heroku and Postman.

1.2.2. Research scope

The research scope of this thesis is limited by the current graduate thesis process of Faculty for High Quality Training with the conclusion from experimental research results from the author during this project implementation.

1.2.3. Research methods

To implement this project, the author was used the mixed research method between the theory research method the experimental result research method.

The theory research method: conclusion of the theories from related documents through sources such as e-book, lecture and instructor knowledge.

The experimental result research method: reality experience about the current graduate thesis process of Faculty for High Quality Training.

1.3. Scientific and practical meaning of the project

The content of project has scientific meaning when research and conclusion of the current graduate thesis process of Faculty for High Quality Training. Thence, state the current process inadequacies and implement for computerize the current graduate thesis process to resolve those inadequacies.

Besides, the content of the project has practical meaning when applying the knowledge was researched and information technologies to build a graduate thesis management system on the web platform. Help to solve the inadequacies and make it more convenient for the current graduate thesis process.

CHAPTER 2. THEORETICAL BASIS

2.1. The current graduate thesis process of Faculty of High Quality Training

2.1.1. Participants and roles

The current graduate thesis process of Faculty of High Quality Training has three participant types, including:

- Head of Training: This participant type has the main responsibility and full permission during the graduate thesis work. It can decide the properties of the graduate thesis such as start time, end time, finish time of each state, participants, topics, etc. Sometimes, this participant type can work as a Lecturer participant type.
- Lecturer: This participant type has many roles in the graduate thesis, including:
 - + Instructor: In this role, the lecturer can register one or more topics for the graduate thesis. When registered topics are accepted by the Head of training, the lecturer has the main responsibility in observing, following, and guide students to complete the topics which they choose. Besides, this role also has permission to evaluate the result through the thesis implement process with account for 33% of the final topic result.
 - + Reviewer: In this role, the lecturer can give a question for students who implement the topic. The scope of questions must be around the topic with the purpose survey the knowledge level of students about their topic. Head of Training can assign the Reviewer to review one topic which the Reviewer is not instructor to. In addition, the result of the reviewer can decide whether the topic should continue and account for 33% of the final topic result.
 - + Defense council member: Generally, this role and the reviewer role quite similar to the evaluation method. The main difference is the member organization and evaluation method in the council (detail in the next section).
- Student: this participant type has a mission to complete the topic which was chosen by itself with the support of the topic instructor. Student can implement a topic with your partner who also participate in the graduate thesis or only alone.

2.1.2. Phases

Normally, the graduate thesis process of Faculty of High Quality Training has 6 phases, including:

- Phase 1: Register topic for the lecturer.

- Phase 2: Register topic for the student.
- Phase 3: Semi-progress report.
- Phase 4: Review.
- Phase 5: Defense.
- Phase 6: Publish result.

2.1.2.1. Phase 1: Register topic for the lecturer

This is the first phase of the graduate thesis process and the related participant types are the Head of Training and the Lecturer. The main purpose of this phase is wants lecturers to create topics and to be an instructor for the graduate thesis. Sometimes, the topics can be continued development from topics that were implemented in Specialized essay.

In this phase, the Head of Training chooses and sends the invitation to lecturers who can give topics. After that, lecturers send topics to the Head of Training to get approval. If the Head of Training approves, topics will continue in the next phase. Otherwise, the Head of Training can send back and request the topic owner modify some information. In case the topic not suitable with criteria which are set by the Head of Training, the topic will be rejected.

2.1.2.2. Phase 2: Register topic for the student

The next phase of the graduate thesis process focuses on student participant type and lecturer participant type. The main purpose of this phase wants students can choose the topic which they will implement during the graduate thesis is processing. They can implement with their team, normally has two members, or implement only alone.

In this phase, students can contact the lecturer who is owner of the topic they want to choose for registration. If the lecturer accepts their registration, they can implement that topic and that topic can't accept any other registration. Opposite, if the lecturer rejects their registration and they still time to register, they can choose another topic for registration. Besides, the students don't need to register the topic which they implemented in the Specialized essay and continues development in the graduate thesis.

2.1.2.3. Phase 3: Semi-progress report

When the graduate thesis passed half the time, students must have a report for the Head of Training. The main purpose of this phase is the Head of Training wants to know what has done by students with their topic. Normally, the time and place of the reporting session are arranged by the Head of Training base on reality conditions and the progress of a graduate thesis.

In reporting, the students must prepare a report document for submitting and a presentation file for presentation. Content of the report document must have sections such as research scope, the amount of work done and difficulties

encountered. Besides, the report document must have the signature of the instructor. In addition, the presentation file also has content similar to the report document but it's a slightly different presentation which depends on the student and should not exceed 15 minutes.

2.1.2.4. Phase 4: Review

When students passed in the semi-progress phase, this phase is the next phase in the graduate thesis. The main purpose of this phase wants to pre-check the complete product which was implemented by the student during the graduate thesis happening. Each topic will have time, place and one reviewer which is arranged by the Head of Training.

Like a mini defense, students must prepare a complete thesis document and a presentation file for presentation. During the presentation, the reviewer can give questions about the topic to students. Besides, with a target to contribute the topic more complete before the defense, the reviewer can raise ideas or comments to help students complete their product and thesis document.

The reviewer can evaluate the result of topic. The result of reviewer has criteria similar to member of defense council (detail at table 2.1 in the next section). After the review ended, the reviewer must submit the review document to the Head of Training to complete their mission

2.1.2.5. Phase 5: Defense

This phase is the most important phase in the graduate thesis process because it determines the thesis's result. Students will presentation to the defense council which is arranged by the Head of Training.

Members of the defense council also are arranged by the Head of Training and publish before the defense phase one or two weeks. Normally, the organizational composition of a defense council includes a chairman, a topic's reviewer and a commissioner.

Normally, the defense phase has activities like the review phase. But has a little bit different about time, each topic will have 10 minutes for presentation, 15 minutes for the demo and 10 minutes for question and answer about that topic.

At the end of the defense day, students can know the result from the defense council. The result is calculated according to the formula:

$$\text{Defense result} = \frac{\text{Chairman} + \text{Reviewer} + \text{Commissioner}}{3}$$

Each member of the defense council must evaluate the topic following 7 criteria which according to the table below

Table 2.1. Table evaluate criteria of the defense council

No	Criteria	Point ladder
1	The practicality of the topic, the understanding of the research problem	10
2	The correctness and reasonableness of the research method, of the design, of the solution is stated in the thesis. The degree of perfection of the product, the degree of student work completion	40
3	Quality of the presentation	10
4	Ability to read foreign language books for reference	5
5	Ability to synthesize knowledge, write a thesis	10
6	Quality in the form of the thesis (structure, format, spelling, ...)	5
7	Quality in response to the defense council's questions	20

Students can ask questions about the result after that if they not accept that result. After that, students must submit the thesis document to their school's library. If the thesis document has problems from the defense council, students will fix them before submission.

2.1.2.6. Phase 6: Publish result

In this phase, the individuals involved (include topics instructor, topics reviewer and topics defense council) will evaluate topics and submit results to the Training department. After that, students can view results on their student profile website.

The graduate thesis result of a student includes three parts, including topic's instructor part (1), topic's reviewer part (2), topic's defense council part (3) and is calculated according to the formula

$$\text{Graduate thesis result} = \frac{(1) + (2) + (3)}{3}$$

If the graduate thesis result is greater than 5 points, the student is considered to pass. Opposite, student is considered to fail and will continue participate in the next graduate thesis.

2.2. Overview of MySQL

2.2.1. Introduction ^[1]

MySQL, the most popular Open Source SQL database management system, is developed, distributed, and supported by Oracle Corporation.



Figure 2.2.1. Logo of MySQL

2.2.2. Features^[1]

MySQL has following main features:

- Internals and Portability.
- Support many data types.
- Statements and Functions.
- Security.
- Scalability and Limits
- Connectivity.
- Localization.
- Clients and Tools

2.2.3. History^[1]

Started out with the intention of using the mSQL database system to connect to our tables using our own fast low-level (ISAM) routines. But after some testing, mSQL was not fast enough or flexible enough for needs. This resulted in a new SQL interface to our database but with almost the same API interface as mSQL. This API was designed to enable third-party code that was written for use with mSQL to be ported easily for use with MySQL.

MySQL is named after co-founder Monty Widenius's daughter, My.

The name of the MySQL Dolphin is “Sakila” which was chosen from a huge list of names suggested by users in our “Name the Dolphin” contest.

2.2.4. Advantages^[2]

MySQL is a fast, easy-to-use RDBMS being used for many small and big businesses. MySQL is becoming so popular because of many good reasons:

- MySQL is released under an open-source license. We have nothing to pay to use it.

- MySQL is a very powerful program in its own right. It handles a large subset of the functionality of the most expensive and powerful database packages.
- MySQL uses a standard form of the well-known SQL data language.
- MySQL works on many operating systems and with many languages including PHP, PERL, C, C++, JAVA, etc.
- MySQL works very quickly and works well even with large data sets.
- MySQL is very friendly to PHP, the most appreciated language for web development.
- MySQL supports large databases, up to 50 million rows or more in a table. The default file size limit for a table is 4GB, but you can increase this (if your operating system can handle it) to a theoretical limit of 8 million terabytes (TB).
- MySQL is customizable. The open-source GPL license allows programmers to modify the MySQL software to fit their own specific environments.

2.2.5. MySQL in project

This project use MySQL 5.7 (provide by JawsDB) for the main database server which storage all data of application.

2.3. Overview of Redis

2.3.1. Introduction ^[3]

Redis is an open source (BSD licensed), in-memory data structure store, used as a database, cache and message broker. Redis has built-in replication, Lua scripting, LRU eviction, transactions and different levels of on-disk persistence, and provides high availability via Redis Sentinel and automatic partitioning with Redis Cluster.



Figure 2.2. Logo of Redis

2.3.2. Features ^[3]

Redis has following main features:

- Supports data structures
- Transactions
- Pub/Sub

- Lua scripting
- Keys with a limited time-to-live
- LRU eviction of keys
- Automatic failover.

2.3.3. History ^[4]

The name Redis means REmote DIctionary Server. The Redis project began when Salvatore Sanfilippo, nicknamed antirez, the original developer of Redis, was trying to improve the scalability of his Italian startup, developing a real-time web log analyzer. After encountering significant problems in scaling some types of workloads using traditional database systems, Sanfilippo began to prototype a first proof of concept version of Redis in Tcl. Later Sanfilippo translated that prototype to the C language and implemented the first data type, the list. After a few weeks of using the project internally with success, Sanfilippo decided to open source it, announcing the project on Hacker News. The project began to get traction, more so among the Ruby community, with GitHub and Instagram being among the first companies adopting it.

Sanfilippo was hired by VMware in March, 2010.

In May, 2013, Redis was sponsored by Pivotal Software (a VMware spin-off).

In June 2015, development became sponsored by Redis Labs.

In October 2018 Redis 5.0 was released, introducing Redis Stream - a new data structure that allows storage of multiple fields and string values with an automatic, time-based sequence at a single key.

In June 2020 Salvatore Sanfilippo stepped down as Redis maintainer.

2.3.4. Advantages ^[5]

Following are certain advantages of Redis.

- Exceptionally fast – Redis is very fast and can perform about 110000 SETs per second, about 81000 GETs per second.
- Supports rich data types – Redis natively supports most of the datatypes that developers already know such as list, set, sorted set, and hashes. This makes it easy to solve a variety of problems as we know which problem can be handled better by which data type.
- Operations are atomic – All Redis operations are atomic, which ensures that if two clients concurrently access, Redis server will receive the updated value.
- Multi-utility tool – Redis is a multi-utility tool and can be used in a number of use cases such as caching, messaging-queues (Redis natively supports Publish/Subscribe), any short-lived data in your application, such as web application sessions, web page hit counts, etc.

2.3.5. Redis in project

This project use Redis Cloud 6.0.5 (provide by redislabs) as a cache server. Support to storage SQL queries from client and return the cached result for faster performance of application.

2.4. Overview of Object-relational mapping (ORM) and TypeORM

2.4.1. Object-relational mapping (ORM)^[6]

Object-relational mapping (ORM, O/RM, and O/R mapping tool) in computer science is a programming technique for converting data between incompatible type systems using object-oriented programming languages. This creates, in effect, a "virtual object database" that can be used from within the programming language. There are both free and commercial packages available that perform object-relational mapping, although some programmers opt to construct their own ORM tools.

2.4.2. TypeORM^[7]

TypeORM is an ORM that can run in NodeJS, Browser, Cordova, PhoneGap, Ionic, React Native, NativeScript, Expo, and Electron platforms and can be used with TypeScript and JavaScript (ES5, ES6, ES7, ES8). Its goal is to always support the latest JavaScript features and provide additional features that help you to develop any kind of application that uses databases - from small applications with a few tables to large scale enterprise applications with multiple databases.

TypeORM supports both Active Record and Data Mapper patterns, unlike all other JavaScript ORMs currently in existence, which means you can write high quality, loosely coupled, scalable, maintainable applications the most productive way.

TypeORM is highly influenced by other ORMs, such as Hibernate, Doctrine and Entity Framework.

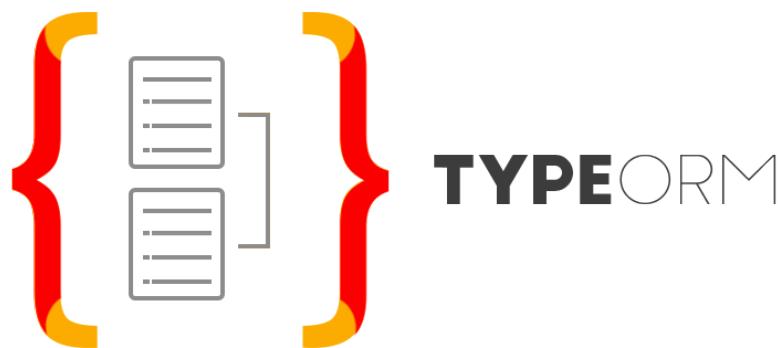


Figure 2.2. Logo of TypeORM

2.4.3. TypeORM in project

In this project, TypeORM is used to mapping data from MySQL to object type which compatible with Javascript – main programming language of project.

2.5. Overview of NodeJS

2.5.1. Introduction ^[8]

Node.js is a platform built on Chrome's JavaScript runtime for easily building fast and scalable network applications. Node.js uses an event-driven, non-blocking I/O model that makes it lightweight and efficient, perfect for data-intensive real-time applications that run across distributed devices.

Node.js is an open source, cross-platform runtime environment for developing server-side and networking applications. Node.js applications are written in JavaScript, and can be run within the Node.js runtime on OS X, Microsoft Windows, and Linux.

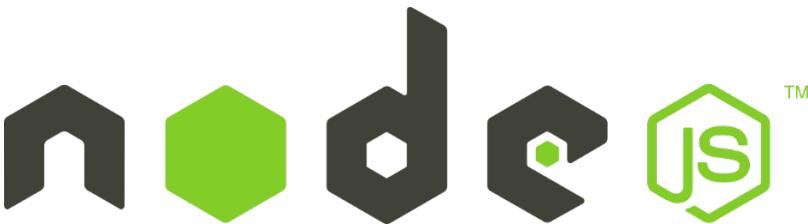


Figure 2.3. Logo of NodeJS

2.5.2. Features ^[8]

NodeJS has following main features:

- Asynchronous and Event Driven: All APIs of Node.js library is asynchronous, that is, non-blocking. It essentially means a Node.js based server never waits for an API to return data. The server moves to the next API after calling it and a notification mechanism of Events of Node.js helps the server to get a response from the previous API call.
- Very Fast: Being built on Google Chrome's V8 JavaScript Engine, Node.js library is very fast in code execution.
- Single Threaded but Highly Scalable: Node.js uses a single threaded model with event looping. Event mechanism helps the server to respond in a non-blocking way and makes the server highly scalable as opposed to traditional servers which create limited threads to handle requests. Node.js uses a single threaded program and the same program can provide service to a much larger number of requests than traditional servers like Apache HTTP Server.
- No Buffering: Node.js applications never buffer any data. These applications simply output the data in chunks.
- License: Node.js is released under the MIT license.

2.5.3. History ^[9]

Node.js was written initially by Ryan Dahl in 2009, about thirteen years after the introduction of the first server-side JavaScript environment, Netscape's LiveWire Pro Web. The initial release supported only Linux and Mac OS X. Its development and maintenance was led by Dahl and later sponsored by Joyent.

Dahl criticized the limited possibilities of the most popular web server in 2009, Apache HTTP Server, to handle a lot of concurrent connections (up to 10,000 and more) and the most common way of creating code (sequential programming), when code either blocked the entire process or implied multiple execution stacks in the case of simultaneous connections.

Dahl demonstrated the project at the inaugural European JSConf on 8 November 2009.[29][30][31] Node.js combined Google's V8 JavaScript engine, an event loop, and a low-level I/O API.

In January 2010, a package manager was introduced for the Node.js environment called npm. The package manager makes it easier for programmers to publish and share source code of Node.js packages and is designed to simplify installation, updating, and uninstallation of packages.

In June 2011, Microsoft and Joyent implemented a native Windows version of Node.js. The first Node.js build supporting Windows was released in July 2011.

In January 2012, Dahl stepped aside, promoting coworker and npm creator Isaac Schlueter to manage the project. In January 2014, Schlueter announced that Timothy J. Fontaine would lead the project.

In December 2014, Fedor Indutny started io.js, a fork of Node.js. Due to the internal conflict over Joyent's governance, io.js was created as an open governance alternative with a separate technical committee. Unlike Node.js, the authors planned to keep io.js up-to-date with the latest releases of the Google V8 JavaScript engine.

In February 2015, the intent to form a neutral Node.js Foundation was announced. By June 2015, the Node.js and io.js communities voted to work together under the Node.js Foundation.

In September 2015, Node.js v0.12 and io.js v3.3 were merged back together into Node v4.0. This merge brought V8 ES6 features into Node.js and a long-term support release cycle. As of 2016, the io.js website recommends that developers switch back to Node.js and that no further releases of io.js are planned due to the merge.

In 2019, the JS Foundation and Node.js Foundation merged to form the OpenJS Foundation.

2.5.4. NodeJS in project

Because of the scalable nature of the project, NodeJS was chosen main platform. It was used in API server and graduate thesis application.

2.6. Overview of TypeScript

2.6.1. Introduction ^[10]

By definition, “TypeScript is JavaScript for application-scale development.”

TypeScript is a strongly typed, object oriented, compiled language. It was designed by Anders Hejlsberg (designer of C#) at Microsoft. TypeScript is both a language and a set of tools. TypeScript is a typed superset of JavaScript compiled to JavaScript. In other words, TypeScript is JavaScript plus some additional features.



Figure 2.4. Logo of TypeScript

2.6.2. Features ^[10]

TypeScript has following main features:

- TypeScript is just JavaScript. TypeScript starts with JavaScript and ends with JavaScript. Typescript adopts the basic building blocks of your program from JavaScript. Hence, you only need to know JavaScript to use TypeScript. All TypeScript code is converted into its JavaScript equivalent for the purpose of execution.
- TypeScript supports other JS libraries. Compiled TypeScript can be consumed from any JavaScript code. TypeScript-generated JavaScript can reuse all of the existing JavaScript frameworks, tools, and libraries.
- JavaScript is TypeScript. This means that any valid .js file can be renamed to .ts and compiled with other TypeScript files.
- TypeScript is portable. TypeScript is portable across browsers, devices, and operating systems. It can run on any environment that JavaScript runs on. Unlike its counterparts, TypeScript doesn't need a dedicated VM or a specific runtime environment to execute.

2.6.3. History ^[11]

TypeScript was first made public in October 2012 (at version 0.8), after two years of internal development at Microsoft. Soon after the announcement, Miguel de Icaza praised the language itself, but criticized the lack of mature IDE support apart from Microsoft Visual Studio, which was not available on Linux and OS X at that time. Today there is support in other IDEs, particularly in Eclipse, via a plug-in

contributed by Palantir Technologies. Various text editors, including Emacs, Vim, Webstorm, Atom and Microsoft's own Visual Studio Code also support TypeScript.

TypeScript 0.9, released in 2013, added support for generics. TypeScript 1.0 was released at Microsoft's Build developer conference in 2014. Visual Studio 2013 Update 2 provides built-in support for TypeScript.

In July 2014, the development team announced a new TypeScript compiler, claiming 5× performance gains. Simultaneously, the source code, which was initially hosted on CodePlex, was moved to GitHub.

On 22 September 2016, TypeScript 2.0 was released; it introduced several features, including the ability for programmers to optionally prevent variables from being assigned null values, sometimes referred to as the billion-dollar mistake.

TypeScript 3.0 was released on 30 July 2018, bringing many language additions like tuples in rest parameters and spread expressions, rest parameters with tuple types, generic rest parameters and so on.

TypeScript 4.0 was released on 20th, August 2020. While 4.0 did not introduce any breaking changes, it added language features such as Custom JSX Factories and Variadic Tuple Types.

2.6.4. TypeScript in project

All of source in this project is programed by TypeScript and compiled to Javascript for product. TypeScript help programer decrease bugs which root cause is data type or data structure.

2.7. Overview of NestJS

2.7.1. Introduction [12]

Nest (NestJS) is a framework for building efficient, scalable Node.js server-side applications. It uses progressive JavaScript, is built with and fully supports TypeScript (yet still enables developers to code in pure JavaScript) and combines elements of OOP (Object Oriented Programming), FP (Functional Programming), and FRP (Functional Reactive Programming).

Under the hood, Nest makes use of robust HTTP Server frameworks like Express (the default) and optionally can be configured to use Fastify as well.

Nest provides a level of abstraction above these common Node.js frameworks (Express/Fastify), but also exposes their APIs directly to the developer. This gives developers the freedom to use the myriad of third-party modules which are available for the underlying platform.



Figure 2.5. Logo of NestJS

2.7.2. Features ^[12]

NestJS has following main features:

- Extensible: Gives the true flexibility by allowing use of any other libraries thanks to modular architecture.
- Versatile: An adaptable ecosystem that is a fully-fledged backbone for all kinds of server-side applications.
- Progressive: Takes advantage of latest JavaScript features, bringing design patterns and mature solutions to node.js world.

2.7.3. NestJS in project

This project use NestJS framework to build API server. Therefore, it can be scalable in the future.

2.8. Overview of React

2.8.1. Introduction ^[13]

React is a library for building composable user interfaces. It encourages the creation of reusable UI components, which present data that changes over time. Lots of people use React as the V in MVC. React abstracts away the DOM from you, offering a simpler programming model and better performance. React can also render on the server using Node, and it can power native apps using React Native. React implements one-way reactive data flow, which reduces the boilerplate and is easier to reason about than traditional data binding.

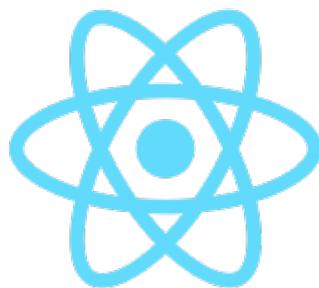


Figure 2.6. Logo of React

2.8.2. Features ^[13]

React has following main features:

- JSX – JSX is JavaScript syntax extension. It isn't necessary to use JSX in React development, but it is recommended. Besides, React can apply TypeScript with file extension TSX.
- Components – React is all about components. You need to think of everything as a component. This will help you maintain the code when working on larger scale projects.
- Unidirectional data flow and Flux – React implements one-way data flow which makes it easy to reason about your app. Flux is a pattern that helps keeping your data unidirectional.
- License – React is licensed under the Facebook Inc. Documentation is licensed under CC BY 4.0.

2.8.3. Advantages ^[13]

- Uses virtual DOM which is a JavaScript object. This will improve apps performance, since JavaScript virtual DOM is faster than the regular DOM.
- Can be used on client and server side as well as with other frameworks.
- Component and data patterns improve readability, which helps to maintain larger apps.

2.8.4. History ^[14]

React was created by Jordan Walke, a software engineer at Facebook, who released an early prototype of React called "FaxJS". He was influenced by XHP, an HTML component library for PHP. It was first deployed on Facebook's News Feed in 2011 and later on Instagram in 2012. It was open source at JSConf US in May 2013.

React Native, which enables native Android, iOS, and UWP development with React, was announced at Facebook's React Conf in February 2015 and open-sourced in March 2015.

On April 18, 2017, Facebook announced React Fiber, a new core algorithm of React library for building user interfaces. React Fiber was to become the foundation of any future improvements and feature development of the React library.

On September 26, 2017, React 16.0 was released to the public.

On February 16, 2019, React 16.8 was released to the public. The release introduced React Hooks.

On August 10, 2020, the React team announced the first release candidate for React v17.0, notable as the first major release without major changes to the React developer-facing API.

2.8.5. React in project

This project using React (includes React hooks) to build the front-end of the graduate thesis application. Therefore, the application becomes easy to maintain and develop for developers. Besides, React helps end-user experiences better by dynamically rewriting the current web page with new data from the webserver, instead of the default method of the browser loading entire new pages.

2.9. Overview of NextJS

2.9.1. Introduction ^[15]

NextJS is the React framework. It helps the developer solve some problems which often occur when using React to build a web application, including:

Code has to be bundled using a bundler like webpack and transformed using a compiler like Babel.

production needs optimizations such as code splitting.

Statically pre-render some pages for performance and SEO and use server-side rendering or client-side rendering.

Write some server-side code to connect your React app to your data store.



Figure 2.7. Logo of NextJS

2.9.2. Features ^[16]

NextJS has following main features:

- Hot Code Reloading: Next.js reloads the page when it detects any change saved to disk.
- Automatic Routing: Any URL is mapped to the filesystem, to files put in the pages folder, and you don't need any configuration (you have customization options of course).
- Single File Components: Using styled-jsx, completely integrated as built by the same team, it's trivial to add styles scoped to the component.
- Server Rendering: We can render React components on the server-side, before sending the HTML to the client.
- Ecosystem Compatibility: Next.js plays well with the rest of the JavaScript, Node, and React ecosystem.
- Automatic Code Splitting: Pages are rendered with just the libraries and JavaScript that they need, no more. Instead of generating one single JavaScript file containing all the app code, the app is broken up automatically by Next.js in several different resources.
- Prefetching: The Link component, used to link together different pages, supports a prefetch prop which automatically prefetches page resources (including code missing due to code splitting) in the background.
- Dynamic Components: We can import JavaScript modules and React Components dynamically.
- Static Exports: Using the next export command, Next.js allows you to export a fully static site from your app.
- TypeScript Support: Next.js is written in TypeScript and as such comes with excellent TypeScript support.

2.9.3. NextJS in project

This project uses NextJS combined with React to build the graduation thesis application. With NextJS features, this application easier to maintain and develop in the future. Besides, its assurance the performance of this application with SSG and SSR mechanism.

2.10. Overview of Ant Design (for React)

2.10.1. Introduction ^[17]

Ant Design is an enterprise-class UI design language and React UI library. It contains a set of high quality components and demos for building rich, interactive user interfaces.



Figure 2.8. Logo of Ant Design

2.10.2. Features ^[17]

Ant Design has following main features:

- Enterprise-class UI designed for web applications.
- A set of high-quality React components out of the box.
- Written in TypeScript with predictable static types.
- The whole package of design resources and development tools.
- Internationalization support for dozens of languages.
- Powerful theme customization in every detail.

2.10.3. Ant Design in project

The graduate thesis application use Ant Design to main UI design.

2.11. Other technologies and libraries

2.11.1. Docker Engine ^[18]

Docker is a set of the platform as a service (PaaS) product that use OS-level virtualization to deliver software in packages called containers. Containers are isolated from one another and bundle their own software, libraries and configuration files; they can communicate with each other through well-defined channels. All containers are run by a single operating system kernel and therefore use fewer resources than virtual machines.

The service has both free and premium tiers. The software that hosts the containers is called Docker Engine. It was first started in 2013 and is developed by Docker, Inc.

In this project, the author uses Docker to create a developed environment such as MySQL database and Redis.



Figure 2.9. Logo of Docker

2.11.2. Continues Integration (CI)^[19] and GitHub Actions^[20]

Continuous Integration (CI) is a development practice where developers integrate code into a shared repository frequently, preferably several times a day. Each integration can then be verified by an automated build and automated tests. While automated testing is not strictly part of CI it is typically implied.

One of the key benefits of integrating regularly is that we can detect errors quickly and locate them more easily. As each change introduced is typically small, pinpointing the specific change that introduced a defect can be done quickly.

In recent years CI has become a best practice for software development and is guided by a set of key principles. Among them is a revision control, build automation and automated testing.

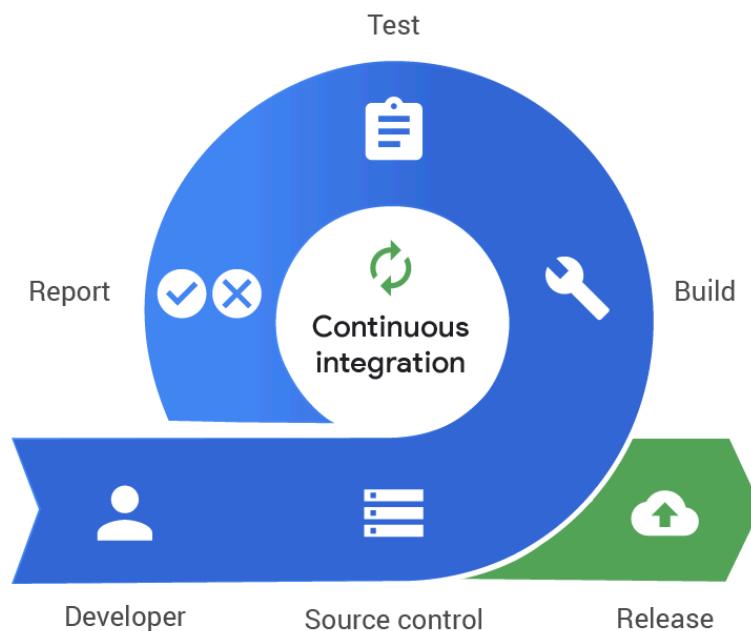


Figure 2.10. Continuous Integration life cycle

GitHub Actions is a feature of GitHub and be integrated in our repository on GitHub. We can automate, customize, and execute our software development workflows right in our repository with GitHub Actions. We can discover, create, and

share actions to perform any job you'd like, including CI/CD, and combine actions in a completely customized workflow.

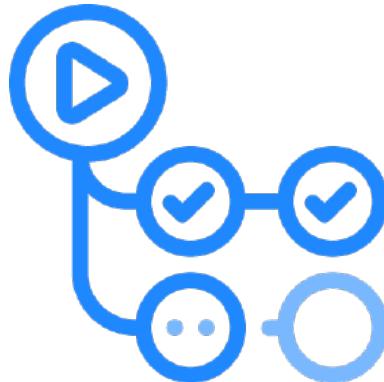


Figure 2.11. Logo of GitHub Actions

This project use GitHub Actions to checking two jobs:

- Lint job for assurance of the source convention.
- Build job for assurance new change of source can build to a product without bugs or problems.

2.11.3. Amazon S3^[21]

Amazon Simple Storage Service (Amazon S3) is an object storage service that offers industry-leading scalability, data availability, security, and performance. This means customers of all sizes and industries can use it to store and protect any amount of data for a range of use cases, such as data lakes, websites, mobile applications, backup and restore, archive, enterprise applications, IoT devices, and big data analytics. Amazon S3 provides easy-to-use management features so you can organize your data and configure finely tuned access controls to meet your specific business, organizational, and compliance requirements. Amazon S3 is designed for 99.99999999% (11 9's) of durability, and stores data for millions of applications for companies all around the world.

To assurance user's data, this project uses Amazon S3 to store files that are uploaded from users.

2.11.4. Heroku^[22]

Heroku is a platform as a service based on a managed container system, with integrated data services and a powerful ecosystem, for deploying and running modern apps. The Heroku developer experience is an app-centric approach for software delivery, integrated with today's most popular developer tools and workflows.

Heroku runs your apps inside dynos — smart containers on a reliable, fully managed runtime environment. Developers deploy their code written in Node, Ruby, Java, PHP, Python, Go, Scala, or Clojure to a build system which produces an app

that's ready for execution. The system and language stacks are monitored, patched, and upgraded, so it's always ready and up to date. The runtime keeps apps running without any manual intervention.

Heroku runs your app in lightweight, isolated Linux containers called "dynos." The platform offers different dyno types to help you get the best results for your type of app. With free version, heroku provided any services includes:

- 550-1,000 dyno hours per month.
- Deploy with Git and Docker.
- Custom domains.
- Container orchestration.
- Automatic OS patching.

This project uses Heroku as a main platform to deploy review and production including API server and the graduate thesis application. Besides, this project also uses add-ons of Heroku such as JawsDB MySQL (for database service) and Redis Cloud (for cache service) to support the operation.



Figure 2.12. Logo of Heroku

2.11.1. Postman^[23]

Postman is a collaboration platform for API development. Postman's features simplify each step of building an API and streamline collaboration so you can create better APIs faster.

Postman has main features:

- + API Client: Quickly and easily send REST, SOAP, and GraphQL requests directly within Postman.
- + Automated Testing: Automate manual tests and integrate them into your CI/CD pipeline to ensure that any code changes won't break the API in production.
- + Design & Mock: Communicate the expected behavior of an API by simulating endpoints and their responses without having to set up a backend server.
- + Documentation: Generate and publish beautiful, machine-readable documentation to make your API easier to consume.

- + Monitors: Stay up to date on the health of your API by checking performance and response times at scheduled intervals.
- + Workspaces: Provide a shared context for building and consuming APIs and collaborate in real-time with built-in version control.

This project uses Postman to develop and testing the API server.



Figure 2.13. Logo of Postman

CHAPTER 3. REQUIREMENT MODELING

3.1. Define usecase

3.1.1. Actor

Table 3.1. Actor

No	Use case	Admin Actor	Lecturer Actor	Student Actor	Guest Actor
1	Login				x
2	Logout	x	x	x	
3	Change avatar	x	x	x	
4	Manage lecturers	x			
5	Manage students	x			
6	Manage theses	x			
7	Manage defense councils	x			
8	Manage topics		x		
9	Process topic approval request	x	x		
10	Process topic register request		x	x	
11	Comment in topic phase	x	x	x	
12	Upload report file			x	
13	Upload result file		x		
14	View thesis result	x	x	x	
15	Edit thesis result		x		
16	Edit semi-progress report information	x			
17	Edit semi-progress report result	x			
18	Edit review information	x			
19	Edit review result		x		

20	Manage defense information	x			
21	View lecturer detail	x	x	x	
22	View student detail	x	x	x	
23	View theses	x	x	x	
24	View thesis	x	x	x	
25	Search thesis	x	x	x	
26	View topics	x	x	x	
27	View topic	x	x	x	
28	Search topic	x	x	x	

3.1.2. Use case

Table 3.2. Use case

No	Use case		Use case ID
1	Login		UC_1
2	Logout		UC_2
3	Change avatar		UC_3
4	Manage lecturers		UC_4
4.1	Create lecturer		UC_4.1
	Edit lecturer		UC_4.2
	Delete lecturer		UC_4.3
	Search lecturer		UC_4.4
	View lecturers		UC_4.5
5	Manage students		UC_5
5.1	Create student		UC_5.1
	Edit student		UC_5.2
	Delete student		UC_5.3
	Search student		UC_5.4
	View students		UC_5.5
6	Manage theses		UC_6
6.1	Create thesis		UC_6.1
	Edit thesis		UC_6.2
	Delete thesis		UC_6.3

	6.4	Active thesis	UC_6.4
	6.5	Inactive thesis	UC_6.5
7	Manage defense councils		UC_7
	7.1	View defense councils	UC_7.1
	7.2	Search defense council	UC_7.2
	7.3	Create defense council	UC_7.3
	7.4	Edit defense council	UC_7.4
	7.5	Delete defense council	UC_7.5
8	Manage topics		UC_8
	8.1	Create topic	UC_8.1
	8.2	Edit topic	UC_8.2
	8.3	Delete topic	UC_8.3
	8.4	Cancel topic	UC_8.4
	8.5	Open register	UC_8.5
	8.6	Close register	UC_8.6
9	Process topic approval request		UC_9
	9.1	Send approval request	UC_9.1
	9.2	Withdraw approval request	UC_9.2
	9.3	Accept approval request	UC_9.3
	9.4	Reject approval request	UC_9.4
	9.5	Sendback approval request	UC_9.5
10	Process topic register request		UC_10
	10.1	Send topic register request	UC_10.1
	10.2	Accept topic register request	UC_10.2
	10.3	Reject topic register request	UC_10.3
11	Comment in topic phase		UC_11
12	Upload report file		UC_12
13	Upload result file		UC_13
14	View thesis result		UC_14
15	Edit thesis result		UC_15
16	Edit semi-progress report information		UC_16
17	Edit semi-progress report result		UC_17
18	Edit review information		UC_18
19	Edit review result		UC_19
20	Edit defense information		UC_20

Chapter 3. Requirement modeling

21	View lecturer detail	UC_21
22	View student detail	UC_22
23	View theses	UC_23
24	View thesis	UC_24
25	Search thesis	UC_25
26	View topics	UC_26
27	View topic	UC_27
28	Search topic	UC_28

3.2. Use case diagram

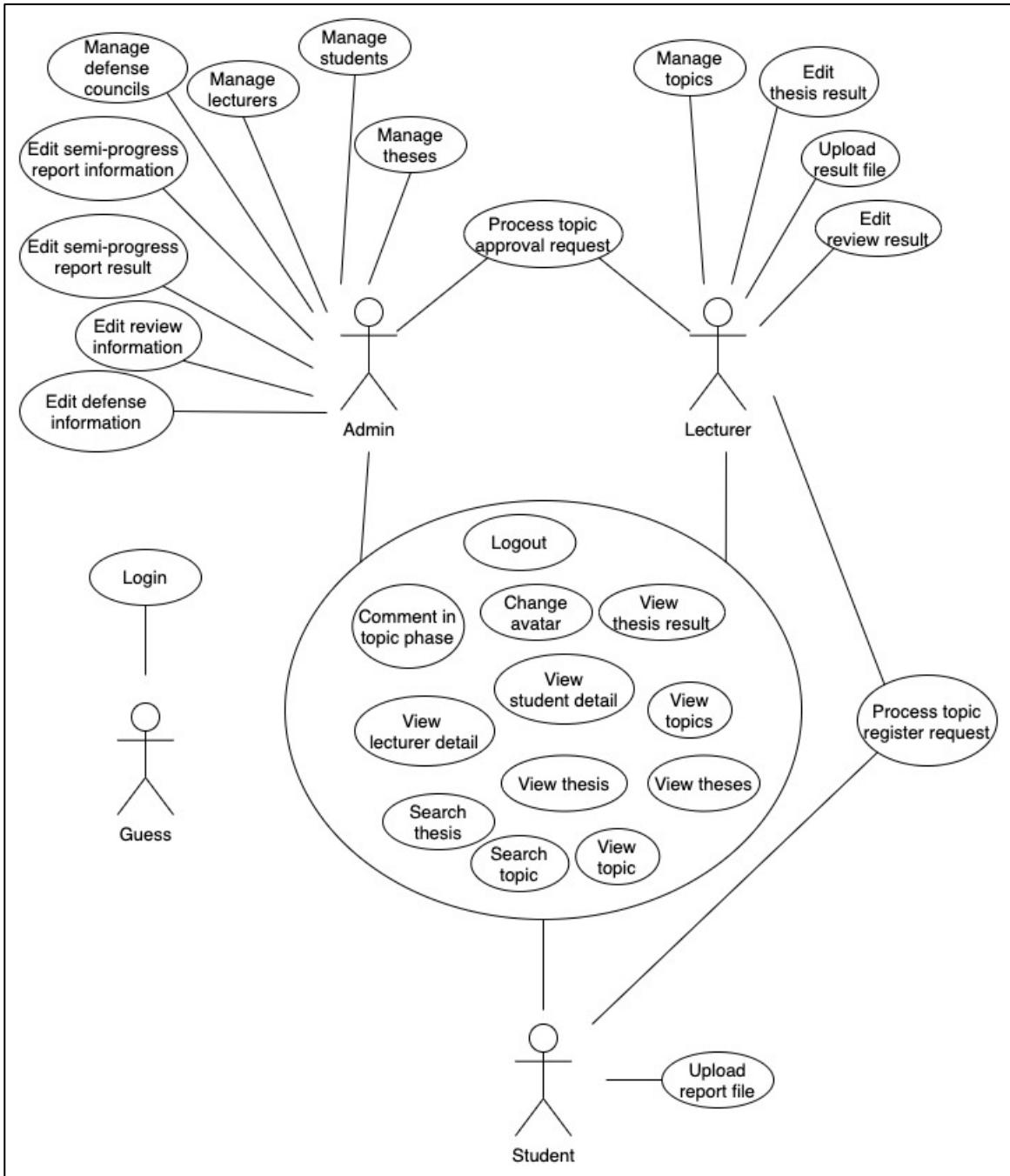


Figure 3.1. Use case diagram

3.3. Use case specification

3.3.1. Manage lecturers

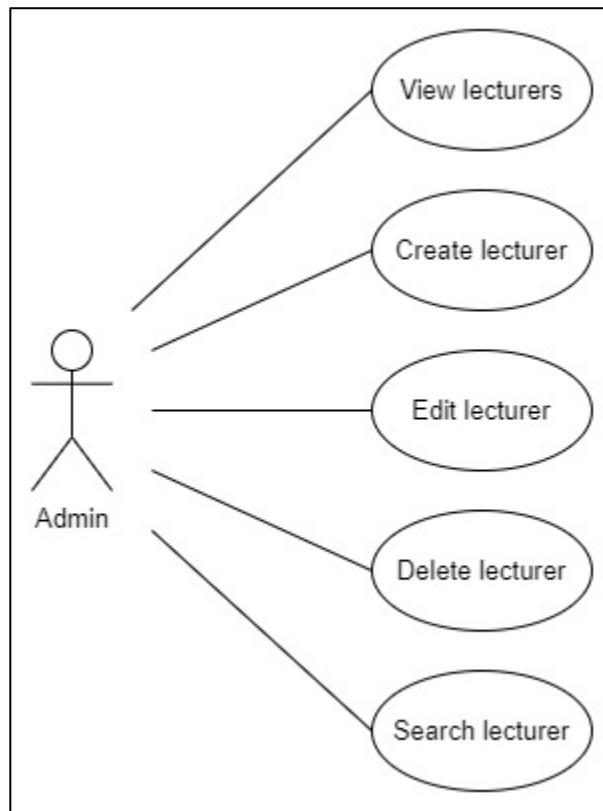


Figure 3.2. Use case manage lecturers

3.3.1.1. *View lecturers*

Table 3.3. Specific view lecturers

Use Case ID	UC_4.1
Name	View lecturers
Goal	Allow admin views all lecturers in system
Actors	Admin
Pre-conditions	Logged in as admin
Main flow	(1) On the dashboard page, select “Quản lý giảng viên”
Exception	N/a
Open Issues	N/a

3.3.1.2. *Create lecturer*

Table 3.4. Specific create lecturer

Use Case ID	UC_4.2
Name	Create lecturer
Goal	Allow admin create a lecturer
Actors	Admin
Pre-conditions	Logged in as admin
Main flow	<p>(1) On the “Quản lý giảng viên” page.</p> <p>(2) Click plus button.</p> <p>(3) Input new lecturer information.</p> <p>(4) Click “Xác nhận”.</p>
Exception	<ul style="list-style-type: none"> - If require fields do not have value, click “Xác nhận” will occur error. - If input value invalid, click “Xác nhận” will occur error.
Open Issues	N/a

3.3.1.3. Edit lecturer

Table 3.5. Specific edit lecturer

Use Case ID	UC_4.3
Name	Edit lecturer
Goal	Allow admin edit a lecturer
Actors	Admin
Pre-conditions	Logged in as admin
Main flow	<p>(1) On the “Chi tiết giảng viên” page.</p> <p>(2) Click pen button.</p> <p>(3) Input new lecturer information</p> <p>(4) Click “Xác nhận”</p>
Exception	<ul style="list-style-type: none"> - If require fields do not have value, click “Xác nhận” will throw error.

	- If input value invalid, click “Xác nhận” will throw error.
Open Issues	N/a

3.3.1.4. Delete lecturer

Table 3.6. Specific delete lecturer

Use Case ID	UC_4.4
Name	Delete lecturer
Goal	Allow admin delete a lecturer
Actors	Admin
Pre-conditions	Logged in as admin
Main flow	<p>(1) On the “Chi tiết giảng viên” page.</p> <p>(2) Click remove button.</p> <p>(3) Click “Xác nhận”</p>
Exception	If lecturer does not exist, click “Xác nhận” will occur error.
Open Issues	N/a

3.3.1.5. Search lecturer

Table 3.7. Specific search lecturer

Use Case ID	UC_4.5
Name	Search lecturer
Goal	Allow admin search one or many lecturers
Actors	Admin
Pre-conditions	Logged in as admin
Main flow	<p>(1) On the “Quản lý giảng viên” page.</p> <p>(2) Input keyword into search bar.</p> <p>(3) Click glass button.</p>

Exception	N/a
Open Issues	N/a

3.3.2. Manage students

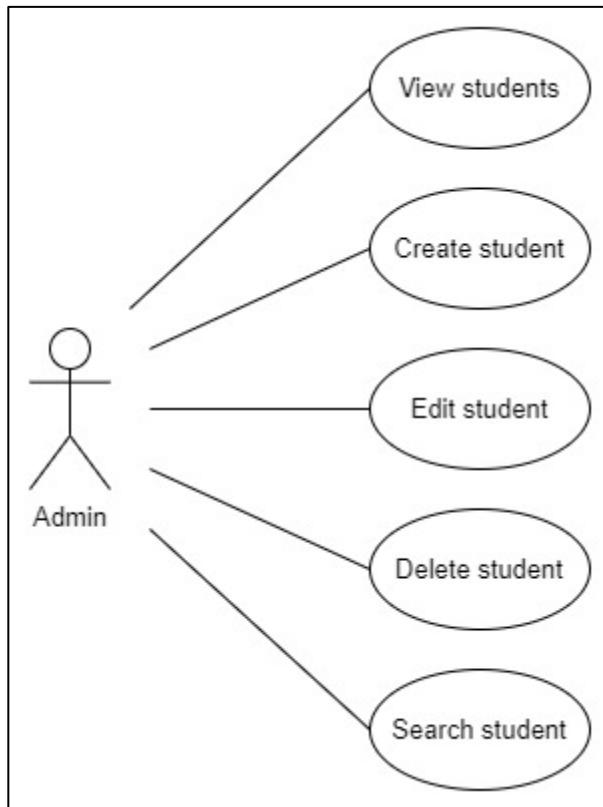


Figure 3.3. Use case manage students

3.3.2.1. View students

Table 3.8. Specific view students

Use Case ID	UC_5.1
Name	View students
Goal	Allow admin views all students in system
Actors	Admin
Pre-conditions	Logged in as admin

Main flow	(1) On the dashboard page, select “Quản lý sinh viên”
Exception	N/a
Open Issues	N/a

3.3.2.2. Create student

Table 3.9. Specific create student

Use Case ID	UC_5.2
Name	Create student
Goal	Allow admin create a student
Actors	Admin
Pre-conditions	Logged in as admin
Main flow	<p>(1) On the “Quản lý sinh viên” page.</p> <p>(2) Click plus button.</p> <p>(3) Input new student information.</p> <p>(4) Click “Xác nhận”.</p>
Exception	<ul style="list-style-type: none"> - If require fields do not have value, click “Xác nhận” will occur error. - If input value invalid, click “Xác nhận” will occur error.
Open Issues	N/a

3.3.2.3. Edit student

Table 3.10. Specific edit student

Use Case ID	UC_5.3
Name	Edit student
Goal	Allow admin edit a student
Actors	Admin

Pre-conditions	Logged in as admin
Main flow	<p>(1) On the “Chi tiết sinh viên” page.</p> <p>(2) Click pen button.</p> <p>(3) Input new student information</p> <p>(4) Click “Xác nhận”</p>
Exception	<ul style="list-style-type: none"> - If require fields do not have value, click “Xác nhận” will throw error. - If input value invalid, click “Xác nhận” will throw error.
Open Issues	N/a

3.3.2.4. Delete student

Table 3.11. Specific delete student

Use Case ID	UC_5.4
Name	Delete student
Goal	Allow admin delete a student
Actors	Admin
Pre-conditions	Logged in as admin
Main flow	<p>(1) On the “Chi tiết sinh viên” page.</p> <p>(2) Click remove button.</p> <p>(3) Click “Xác nhận”</p>
Exception	If student does not exist, click “Xác nhận” will occur error.
Open Issues	N/a

3.3.2.5. Search student

Table 3.12. Specific search student

Use Case ID	UC_5.5
Name	Search student

Goal	Allow admin search one or many students
Actors	Admin
Pre-conditions	Logged in as admin
Main flow	<p>(1) On the “Quản lý sinh viên” page.</p> <p>(2) Input keyword into search bar.</p> <p>(3) Click glass button.</p>
Exception	N/a
Open Issues	N/a

3.3.3. Manage theses

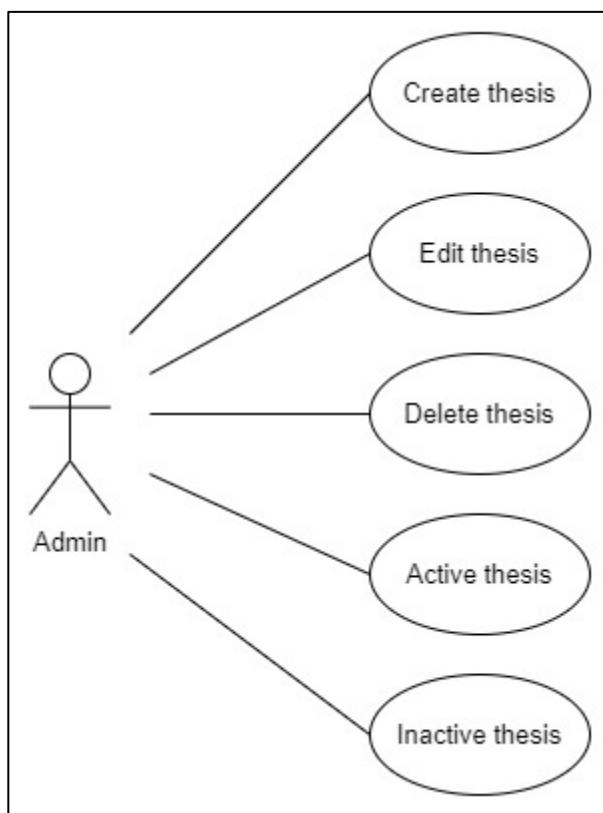


Figure 3.4. Use case manage theses

3.3.3.1. Create thesis

Table 3.13. Specific create thesis

Use Case ID	UC_6.1
Name	Create thesis
Goal	Allow admin create a thesis
Actors	Admin
Pre-conditions	Logged in as admin
Main flow	<p>(1) On the dashboard page, select “Khóa luận”.</p> <p>(2) Click plus button.</p> <p>(3) Input new thesis information.</p> <p>(4) Click “Xác nhận”.</p>
Exception	<ul style="list-style-type: none"> - If require fields do not have value, click “Xác nhận” will occur error. - If input value invalid, click “Xác nhận” will occur error.
Open Issues	N/a

3.3.3.2. Edit thesis

Table 3.14. Specific edit thesis

Use Case ID	UC_6.2
Name	Edit thesis
Goal	Allow admin edit a thesis
Actors	Admin
Pre-conditions	Logged in as admin
Main flow	<p>(1) On the “Chi tiết khóa luận” page.</p> <p>(2) Click “Sửa khóa luận” button.</p> <p>(3) Input new thesis information</p> <p>(4) Click “Xác nhận”</p>

Exception	<ul style="list-style-type: none"> - If require fields do not have value, click “Xác nhận” will throw error. - If input value invalid, click “Xác nhận” will throw error. - If target thesis has status is “Đang hoạt động”, click “Xác nhận” will throw error.
Open Issues	N/a

3.3.3.3. Delete thesis

Table 3.15. Specific delete thesis

Use Case ID	UC_6.3
Name	Delete thesis
Goal	Allow admin delete a thesis
Actors	Admin
Pre-conditions	Logged in as admin
Main flow	<p>(1) On the “Chi tiết khóa luận” page.</p> <p>(2) Click “Xóa khóa luận” button.</p> <p>(3) Click “Xác nhận”</p>
Exception	<ul style="list-style-type: none"> - If thesis does not exist, click “Xác nhận” will occur error. - If target thesis has status is “Đang hoạt động”, click “Xác nhận” will throw error.
Open Issues	N/a

3.3.3.4. Active thesis

Table 3.16. Specific active thesis

Use Case ID	UC_6.4
Name	Active thesis
Goal	Allow admin active a thesis

Actors	Admin
Pre-conditions	Logged in as admin
Main flow	<p>(1) On the “Chi tiết khóa luận” page.</p> <p>(2) Click “Kích hoạt” button.</p> <p>(3) Click “Xác nhận” button.</p>
Exception	If thesis does not exist, click “Xác nhận” will throw error.
Open Issues	N/a

3.3.3.5. Inactive thesis

Table 3.17. Specific inactive thesis

Use Case ID	UC_6.5
Name	Inactive thesis
Goal	Allow admin inactive a thesis
Actors	Admin
Pre-conditions	Logged in as admin
Main flow	<p>(1) On the “Chi tiết khóa luận” page.</p> <p>(2) Click “Ngưng kích hoạt” button.</p> <p>(3) Click “Xác nhận” button.</p>
Exception	If thesis does not exist, click “Xác nhận” will throw error.
Open Issues	N/a

3.3.4. Manage defense councils

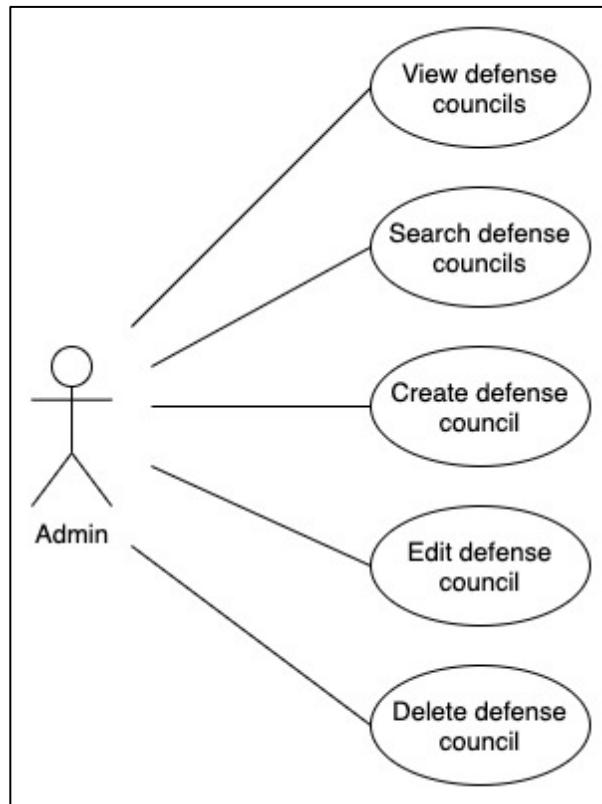


Figure 3.5. Use case manage defense councils

3.3.4.1. *View defense councils*

Table 3.18. Specific view defense councils

Use Case ID	UC_7.1
Name	View defense councils
Goal	Allow admin views all defense councils in system
Actors	Admin
Pre-conditions	<ul style="list-style-type: none"> - Logged in as admin. - Current phase of target thesis is defense phase.
Main flow	<p>(1) On the “Chi tiết khóa luận” page.</p> <p>(2) Click “Hội đồng bảo vệ” tab.</p>
Exception	N/a
Open Issues	N/a

3.3.4.2. *Create defense council*

Table 3.19. Specific create defense council

Use Case ID	UC_7.2
Name	Create defense council
Goal	Allow admin create a defense council
Actors	Admin
Pre-conditions	<ul style="list-style-type: none"> - Logged in as admin. - Current phase of target thesis is defense phase. - Status of target thesis is active.
Main flow	<p>(1) On the “Hội đồng bảo vệ” tab.</p> <p>(2) Click plus button.</p> <p>(3) Input new defense council information.</p> <p>(4) Click “Xác nhận”.</p>
Exception	<ul style="list-style-type: none"> - If require fields do not have value, click “Xác nhận” will occur error. - If input value invalid, click “Xác nhận” will occur error. - If thesis phases invalid, click “Xác nhận” will occur error.
Open Issues	N/a

3.3.4.3. *Edit defense council*

Table 3.20. Specific edit defense council

Use Case ID	UC_7.3
Name	Edit student
Goal	Allow admin edit a defense council
Actors	Admin
Pre-conditions	<ul style="list-style-type: none"> - Logged in as admin.

	<ul style="list-style-type: none"> - Current phase of target thesis is defense phase. - Status of target thesis is active.
Main flow	<p>(1) On the “Hội đồng bảo vệ” tab.</p> <p>(2) Click pen button.</p> <p>(3) Input new defense council information</p> <p>(4) Click “Xác nhận”</p>
Exception	<ul style="list-style-type: none"> - If require fields do not have value, click “Xác nhận” will throw error. - If input value invalid, click “Xác nhận” will throw error. - If thesis phases invalid, click “Xác nhận” will occur error.
Open Issues	N/a

3.3.4.4. Delete defense council

Table 3.21. Specific delete defense council

Use Case ID	UC_7.4
Name	Delete student
Goal	Allow admin delete a defense council
Actors	Admin
Pre-conditions	<ul style="list-style-type: none"> - Logged in as admin. - Current phase of target thesis is defense phase. - Status of target thesis is active.
Main flow	<p>(1) On the “Hội đồng bảo vệ” tab.</p> <p>(2) Click remove button.</p> <p>(3) Click “Xác nhận”</p>
Exception	<ul style="list-style-type: none"> - If defense council does not exist, click “Xác nhận” will occur error. - If thesis phases invalid, click “Xác nhận” will occur error.

Open Issues	N/a
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3.3.4.5. *Search defense council*

Table 3.22. Specific search defense council

Use Case ID	UC_7.5
Name	Search defense council
Goal	Allow admin search one or many defense councils
Actors	Admin
Pre-conditions	Logged in as admin.
Main flow	<p>(1) On the “Hội đồng bảo vệ” tab.</p> <p>(2) Input keyword into search bar.</p> <p>(3) Click glass button.</p>
Exception	N/a
Open Issues	N/a

3.3.5. Manage topics

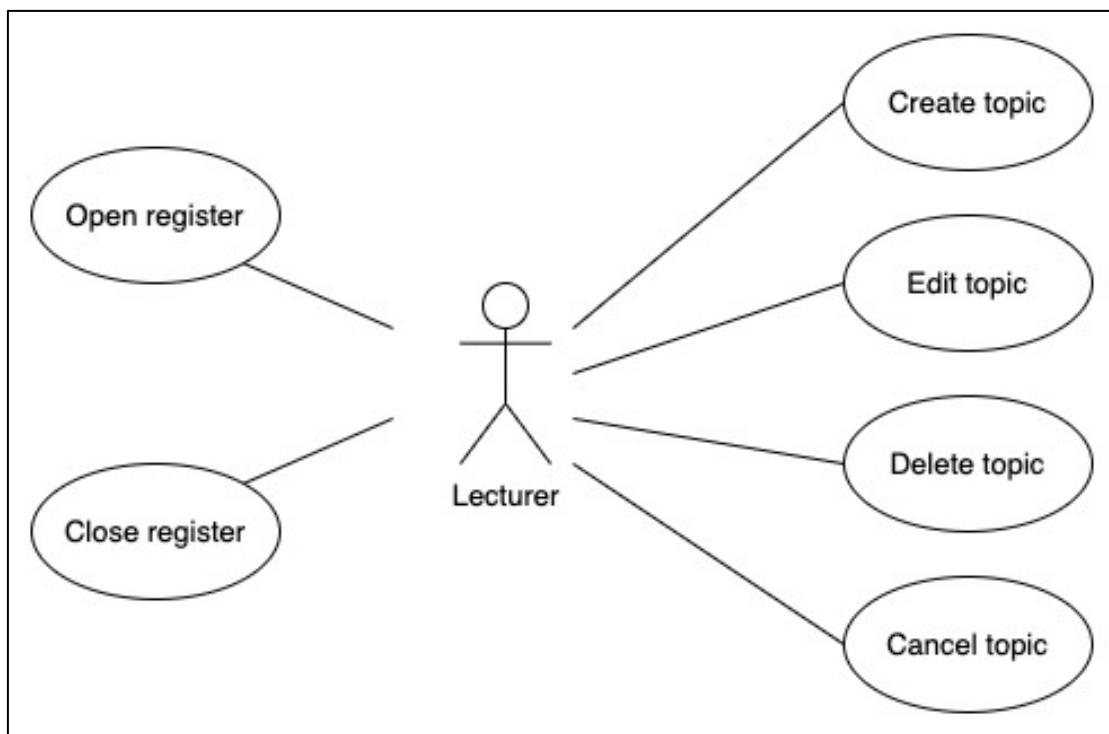


Figure 3.6. Use case manage topics

3.3.5.1. *Create topic*

Table 3.23. Specific create topic

Use Case ID	UC_8.1
Name	Create topic
Goal	Allow lecturer create a topic
Actors	Lecturer
Pre-conditions	<ul style="list-style-type: none"> - Logged in as lecturer. - Be an attendee of target thesis. - Current phase of target thesis is Topic register for lecturer. - Status of target thesis is active.
Main flow	<ol style="list-style-type: none"> (1) On the “Danh sách đề tài” tab. (2) Click “Tạo đề tài” button. (3) Input new topic information. (4) Click “Xác nhận”.

Exception	<ul style="list-style-type: none"> - If require fields do not have value, click “Xác nhận” will occur error. - If input value invalid, click “Xác nhận” will occur error. - If thesis phases invalid, click “Xác nhận” will occur error.
Open Issues	N/a

3.3.5.2. Edit topic

Table 3.24. Specific edit topic

Use Case ID	UC_8.2
Name	Edit topic
Goal	Allow lecturer edit a topic
Actors	Lecturer
Pre-conditions	<ul style="list-style-type: none"> - Logged in as lecturer. - Be an attendee of target thesis. - Current phase of target thesis is Topic register for lecturer. - State of target topic is “Mới” or “Thu hồi” or “Trả lại”. - Status of target thesis is active.
Main flow	<p>(1) On the “Danh sách đề tài” tab.</p> <p>(2) Click “Sửa đề tài” button.</p> <p>(3) Input new topic information.</p> <p>(4) Click “Xác nhận”.</p>
Exception	<ul style="list-style-type: none"> If require fields do not have value, click “Xác nhận” will occur error. - If input value invalid, click “Xác nhận” will occur error. - If thesis phases invalid, click “Xác nhận” will occur error.
Open Issues	N/a

3.3.5.3. Delete topic

Table 3.25. Specific delete topic

Use Case ID	UC_8.3
Name	Delete topic
Goal	Allow lecturer delete a topic
Actors	Lecturer
Pre-conditions	<ul style="list-style-type: none"> - Logged in as lecturer. - Be an attendee of target thesis. - Current phase of target thesis is Topic register for lecturer. - State of target topic is “Mới” or “Thu hồi” or “Trả lại”. - Status of target thesis is active.
Main flow	<p>(1) On the “Chi tiết đề tài” page.</p> <p>(2) Click “Xóa đề tài” button.</p> <p>(3) Click “Xác nhận”</p>
Exception	If topic does not exist, click “Xác nhận” will occur error.
Open Issues	N/a

3.3.5.4. Cancel topic

Table 3.26. Specific cancel topic

Use Case ID	UC_8.4
Name	Cancel topic
Goal	Allow lecturer cancel a topic
Actors	Lecturer
Pre-conditions	<ul style="list-style-type: none"> - Logged in as lecturer. - Be an attendee of target thesis. - Current phase of target thesis is Topic register for lecturer.

	<ul style="list-style-type: none"> - State of target topic is “Mới” or “Thu hồi” or “Trả lại”. - Status of target thesis is active.
Main flow	<p>(1) On the “Chi tiết đề tài” page.</p> <p>(2) Click “Thông tin phê duyệt” tab.</p> <p>(3) Click “Hủy bỏ” button.</p> <p>(4) Click “Xác nhận” button.</p>
Exception	<ul style="list-style-type: none"> - If topic does not exist, click “Xác nhận” will occur error. - If status of topic invalid, click “Xác nhận” will occur error.
Open Issues	N/a

3.3.5.5. Open register

Table 3.27. Specific open register

Use Case ID	UC_8.5
Name	Open register
Goal	Allow lecturer open register topic
Actors	Lecturer
Pre-conditions	<ul style="list-style-type: none"> - Logged in as lecturer. - Be an attendee of target thesis. - Current phase of target thesis is Topic register for student. - State of target topic is “Chấp nhận”. - Status of target thesis is active.
Main flow	<p>(1) On the “Chi tiết đề tài” page.</p> <p>(2) Click “Mở đăng ký” button.</p> <p>(3) Click “Xác nhận” button.</p>
Exception	<ul style="list-style-type: none"> - If topic does not exist, click “Xác nhận” will occur error. - If status of topic invalid, click “Xác nhận” will occur error.

Open Issues	N/a
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3.3.5.6. Close register

Table 3.28. Specific close register

Use Case ID	UC_8.6
Name	Close register
Goal	Allow lecturer close register topic
Actors	Lecturer
Pre-conditions	<ul style="list-style-type: none"> - Logged in as lecturer. - Be an attendee of target thesis. - Current phase of target thesis is Topic register for student. - State of target topic is “Chấp nhận”. - Status of target thesis is active.
Main flow	<p>(1) On the “Chi tiết đề tài” page.</p> <p>(2) Click “Đóng đăng ký” button.</p> <p>(3) Click “Xác nhận” button.</p>
Exception	<ul style="list-style-type: none"> - If topic does not exist, click “Xác nhận” will occur error. - If status of topic invalid, click “Xác nhận” will occur error.
Open Issues	N/a

3.3.6. Process topic approval request

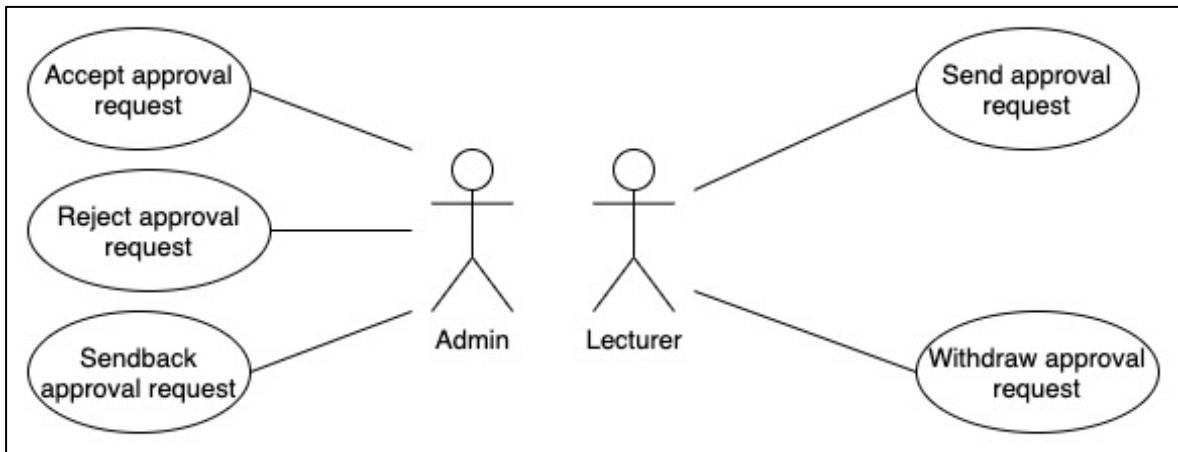


Figure 3.7. Use case process topic approval request

3.3.6.1. *Send approval request*

Table 3.29. Specific send approval request

Use Case ID	UC_9.1
Name	Send approval request
Goal	Allow lecturer send approval request to admin
Actors	Lecturer
Pre-conditions	<ul style="list-style-type: none"> - Logged in as lecturer. - Be an attendee of target thesis. - Current phase of target thesis is Topic register for lecturer. - Status of target thesis is active. - Target topic has owner by actor. - State of target topic is “Mới” or “Thu hồi” or “Trả lại”.
Main flow	<ol style="list-style-type: none"> (1) On the “Thông tin phê duyệt” tab. (2) Click “Yêu cầu phê duyệt” button. (3) Click “Xác nhận”.
Exception	If thesis phases invalid, click “Xác nhận” will occur error.
Open Issues	N/a

3.3.6.2. Withdraw approval request

Table 3.30. Specific withdraw approval request

Use Case ID	UC_9.2
Name	Withdraw approval request
Goal	Allow lecturer withdraw approval request
Actors	Lecturer
Pre-conditions	<ul style="list-style-type: none"> - Logged in as lecturer. - Be an attendee of target thesis. - Current phase of target thesis is Topic register for lecturer. - Status of target thesis is active. - Target topic has owner by actor. - State of target topic is “Đang được phê duyệt”.
Main flow	<p>(1) On the “Thông tin phê duyệt” tab.</p> <p>(2) Click “Thu hồi” button.</p> <p>(3) Click “Xác nhận”.</p>
Exception	If thesis phases invalid, click “Xác nhận” will occur error.
Open Issues	N/a

3.3.6.3. Accept approval request

Table 3.31. Specific accept approval request

Use Case ID	UC_9.3
Name	Accept approval request
Goal	Allow admin accept approval request of lecturer
Actors	Admin
Pre-conditions	<ul style="list-style-type: none"> - Logged in as admin. - Current phase of target thesis is Topic register for lecturer.

	<ul style="list-style-type: none"> - Status of target thesis is active. - State of target topic is “Đang được phê duyệt”.
Main flow	<p>(1) On the “Thông tin phê duyệt” tab.</p> <p>(2) Click “Chấp nhận” button.</p> <p>(3) Click “Xác nhận”.</p>
Exception	If thesis phases invalid, click “Xác nhận” will occur error.
Open Issues	N/a

3.3.6.4. Reject approval request

Table 3.32. Specific reject approval request

Use Case ID	UC_9.4
Name	Reject approval request
Goal	Allow admin reject approval request of lecturer
Actors	Admin
Pre-conditions	<ul style="list-style-type: none"> - Logged in as admin. - Current phase of target thesis is Topic register for lecturer. - Status of target thesis is active. - State of target topic is “Đang được phê duyệt”.
Main flow	<p>(1) On the “Thông tin phê duyệt” tab.</p> <p>(2) Click “Từ chối” button.</p> <p>(3) Click “Xác nhận”.</p>
Exception	If thesis phases invalid, click “Xác nhận” will occur error.
Open Issues	N/a

3.3.6.5. Sendback approval request

Table 3.33. Specific sendback approval request

Use Case ID	UC_9.5
Name	Sendback approval request
Goal	Allow admin sendback approval request of lecturer
Actors	Admin
Pre-conditions	<ul style="list-style-type: none"> - Logged in as admin. - Current phase of target thesis is Topic register for lecturer. - Status of target thesis is active. - State of target topic is “Đang được phê duyệt”.
Main flow	<p>(1) On the “Thông tin phê duyệt” tab.</p> <p>(2) Click “Trả lại” button.</p> <p>(3) Click “Xác nhận”.</p>
Exception	If thesis phases invalid, click “Xác nhận” will occur error.
Open Issues	N/a

3.3.7. Process topic register request

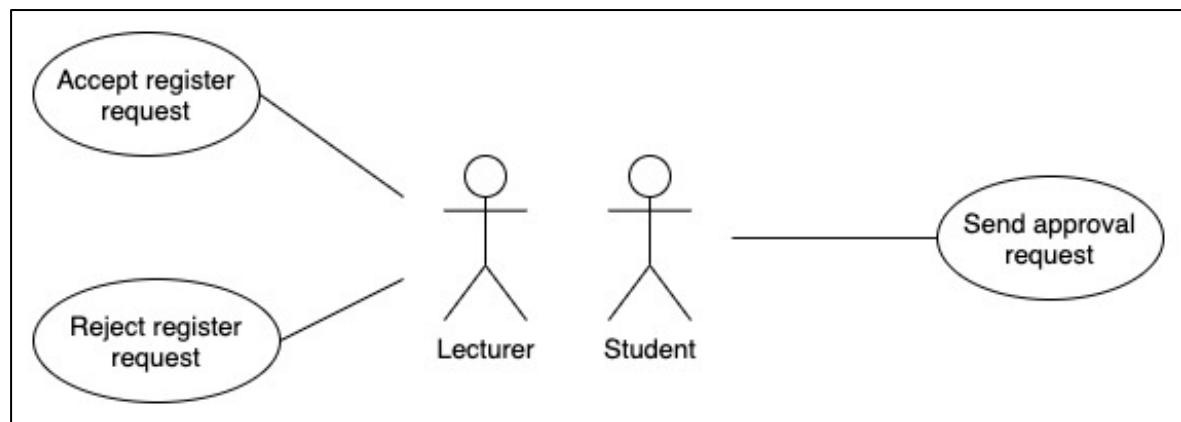


Figure 3.8. Use case process topic register request

3.3.7.1. Send register request

Table 3.34. Specific send register request

Use Case ID	UC_10.1
Name	Send register request
Goal	Allow student send register request to lecturer
Actors	Student
Pre-conditions	<ul style="list-style-type: none"> - Logged in as student. - Be an attendee of target thesis. - Current phase of target thesis is Topic register for student. - Status of target thesis is active. - Status of target topic is “Mở đăng ký”. - Actor have not registered any topic.
Main flow	<p>(1) On the “Danh sách sinh viên đăng ký đề tài” tab.</p> <p>(2) Click “Đăng ký đề tài” button.</p> <p>(3) Click “Xác nhận”.</p>
Exception	If thesis phases invalid, click “Xác nhận” will occur error.
Open Issues	N/a

3.3.7.2. Accept register request

Table 3.35. Specific accept register request

Use Case ID	UC_10.2
Name	Accept register request
Goal	Allow lecturer accept register request of student
Actors	Lecturer
Pre-conditions	<ul style="list-style-type: none"> - Logged in as lecturer. - Be an attendee of target thesis. - Current phase of target thesis is Topic register for student.

	<ul style="list-style-type: none"> - Status of target thesis is active. - Status of target topic is “Mở đăng ký”. - Target topic is owner by actor.
Main flow	<p>(1) On the “Danh sách sinh viên đăng ký đề tài” tab.</p> <p>(2) Click accept icon button.</p> <p>(3) Click “Xác nhận”.</p>
Exception	<ul style="list-style-type: none"> - If thesis phases invalid, click “Xác nhận” will occur error. - If current registered student amount equal or greater than maximum student amount, click “Xác nhận” will occur error.
Open Issues	N/a

3.3.7.3. Reject register request

Table 3.36. Specific reject register request

Use Case ID	UC_10.3
Name	Reject register request
Goal	Allow lecturer reject register request of student
Actors	Lecturer
Pre-conditions	<ul style="list-style-type: none"> - Logged in as lecturer. - Be an attendee of target thesis. - Current phase of target thesis is Topic register for student. - Status of target thesis is active. - Status of target topic is “Mở đăng ký”. - Target topic is owner by actor.
Main flow	<p>(1) On the “Danh sách sinh viên đăng ký đề tài” tab.</p> <p>(2) Click remove icon button.</p> <p>(3) Click “Xác nhận”.</p>
Exception	If thesis phases invalid, click “Xác nhận” will occur error.

Open Issues	N/a
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3.3.8. Edit review information

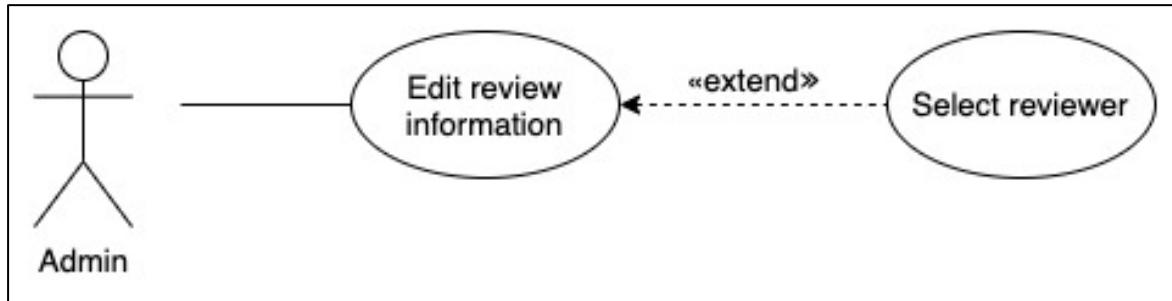


Figure 3.9. Use case edit review information

Table 3.37. Specific edit review information

Use Case ID	UC_18
Name	Edit review information
Goal	Allow admin edit review information
Actors	Admin
Pre-conditions	<ul style="list-style-type: none"> - Logged in as admin. - Current phase of target thesis is review phase. - Status of target thesis is active.
Main flow	<ol style="list-style-type: none"> (1) On the “Phản biện” tab. (2) Click “Chỉnh sửa” button. (3) Input new review information. (4) Click “Xác nhận”.
Exception	<ul style="list-style-type: none"> - If thesis phases invalid, click “Xác nhận” will occur error. - If input value invalid, click “Xác nhận” will occur error.
Open Issues	N/a

3.3.9. Edit defense information

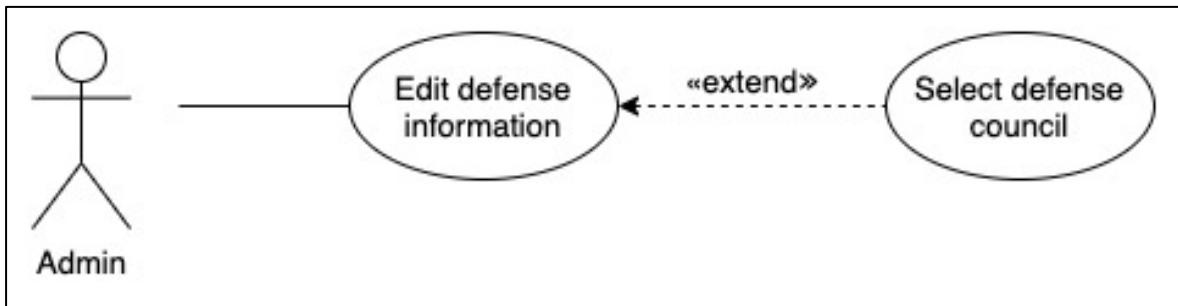


Figure 3.10. Use case edit defense information

Table 3.38. Specific edit defense information

Use Case ID	UC_20
Name	Edit review information
Goal	Allow admin edit defense information
Actors	Admin
Pre-conditions	<ul style="list-style-type: none"> - Logged in as admin. - Current phase of target thesis is defense phase. - Status of target thesis is active.
Main flow	<ol style="list-style-type: none"> (1) On the “Bảo vệ” tab. (2) Click “Chỉnh sửa” button. (3) Input new defense information. (4) Click “Xác nhận”.
Exception	<ul style="list-style-type: none"> - If thesis phases invalid, click “Xác nhận” will occur error. - If input value invalid, click “Xác nhận” will occur error.
Open Issues	N/a

CHAPTER 4. SOFTWARE DESIGN

4.1. System design

4.1.1. Workflow

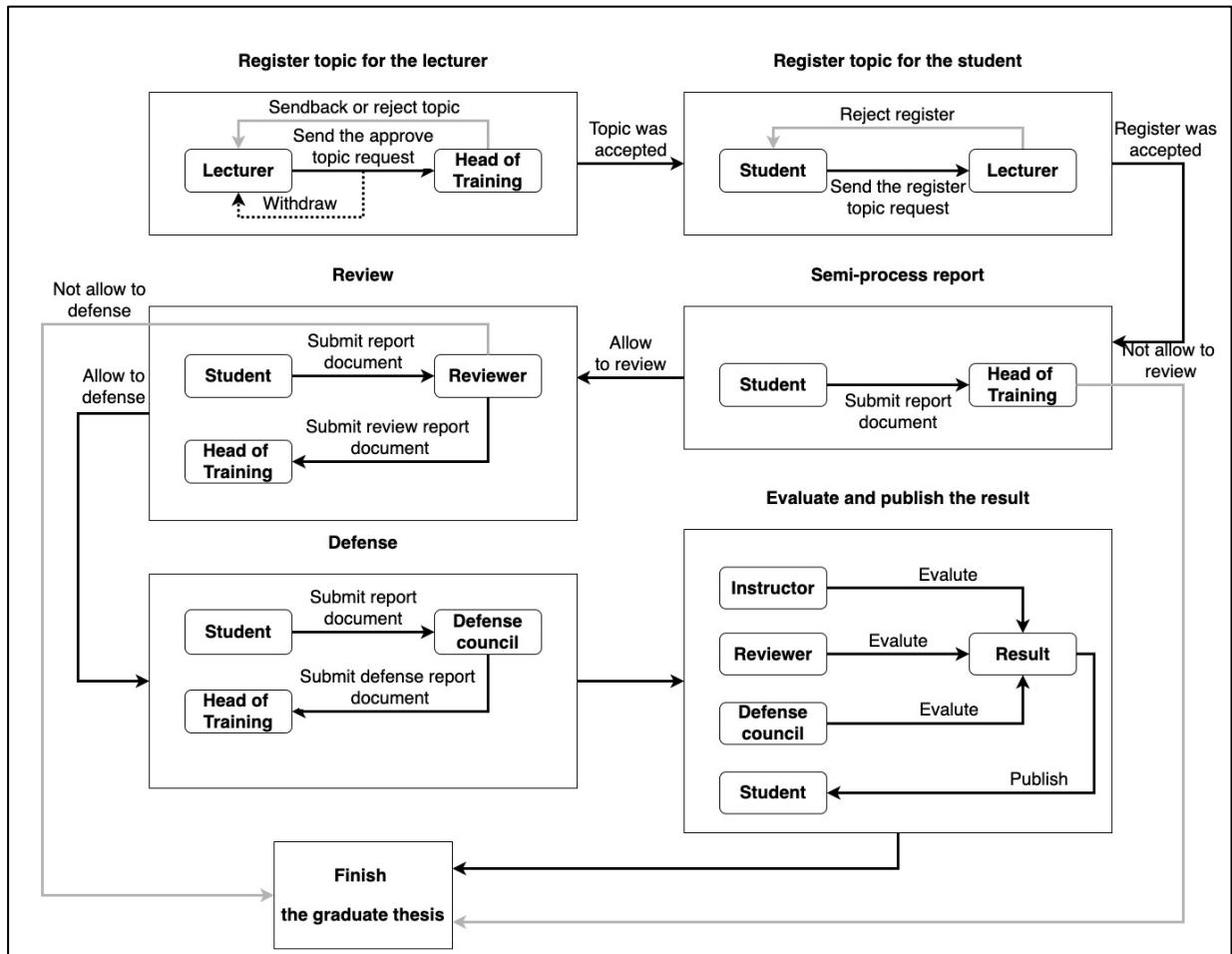


Figure 4.1. Workflow about graduate thesis

4.2. Database design

4.2.1. Database diagram

Reference to Appendix 1

4.2.2. Description for each table

Table 4.1. Description for user table

Purpose: Storage user information
--

No	Column	Type	Key	Allow Null	Description
1	id	int(11)	PK		Unique key, auto increment
2	username	varchar(50)			
3	firstname	varchar(50)		✓	
4	lastname	varchar(50)		✓	
5	gender	tinyint(4)		✓	
6	email	varchar(100)		✓	
7	address	varchar(100)		✓	
8	phone	char(10)		✓	
9	status	tinyint(4)			1 – Inactive 2 – Active Default: 2
10	is_admin	tinyint(4)			1 – False 2 – True Default: 1
11	user_type	tinyint(4)			1 – Student 2 – Lecturer
12	password	varchar(40)			Hashed by SHA1 algorithm
13	deleted_at	datetime(6)		✓	Delete datetime
14	created_at	datetime(6)		✓	Create datetime
15	updated_at	datetime(6)		✓	Updated datetime

Table 4.2. Description for user_refresh_token table

Purpose: Storage refresh token of user					
No	Column	Type	Key	Allow Null	Description
1	id	int(11)	PK		Unique key, auto increment
2	userId	varchar(50)	FK		Map to id of user table
3	browser	varchar(50)		✓	Browser name

4	version	varchar(50)		✓	Browser version
5	platform	varchar(50)		✓	Platform of client
6	os	varchar(50)		✓	Operation system of client
7	refreshToken	varchar(255)		✓	Refresh token
8	source	varchar(255)		✓	User-agent header
9	deleted_at	datetime(6)		✓	Delete datetime
10	created_at	datetime(6)		✓	Create datetime
11	updated_at	datetime(6)		✓	Updated datetime

Table 4.3. Description for lecturer table

Purpose: Storage lecturer information					
No	Column	Type	Key	Allow Null	Description
1	id	int(11)	PK FK		- Unique key, auto increment. - Map to id of user table
2	lecturer_id	varchar(4)		✓	ID of lecturer
3	position	varchar(255)		✓	
4	level	varchar(255)		✓	
5	deleted_at	datetime(6)		✓	Delete datetime
6	created_at	datetime(6)		✓	Create datetime
7	updated_at	datetime(6)		✓	Updated datetime

Table 4.4. Description for student table

Purpose: Storage student information					
No	Column	Type	Key	Allow Null	Description
1	id	int(11)	PK FK		- Unique key, auto increment. - Map to id of user table

2	student_id	char(8)		✓	ID of student
3	school_year	varchar(10)		✓	
4	student_class	varchar(20)		✓	
5	is_graduate	tinyint(4)			1 – False 2 – True Default: 1
6	deleted_at	datetime(6)		✓	Delete datetime
7	created_at	datetime(6)		✓	Create datetime
8	updated_at	datetime(6)		✓	Updated datetime

Table 4.5. Description for thesis table

Purpose: Storage thesis information					
No	Column	Type	Key	Allow Null	Description
1	id	int(11)	PK FK		-Unique key, auto increment. - Map to id of user table
2	subject	varchar(100)			
3	creator_id	int(11)	FK		Map to id of lecturer table
4	start_time	datetime			
5	end_time	datetime			
6	state	tinyint(4)			
7	lecturer_topic_register	datetime			
8	student_topic_register	datetime			
9	progress_report	datetime			
10	review	datetime			
11	defense	datetime			
12	status	tinyint(4)			1 – Inactive

					2 – Active Default: 1
13	deleted_at	datetime(6)		✓	Delete datetime
14	created_at	datetime(6)		✓	Create datetime
15	updated_at	datetime(6)		✓	Updated datetime

Table 4.6. Description for thesis_lecturer table

Purpose: Storage lecturer type participant information					
No	Column	Type	Key	Allow Null	Description
1	thesis_id	int(11)	PK FK		Map to id of thesis table
2	lecturer_id	int(11)	PK FK		Map to id of lecturer table
3	deleted_at	datetime(6)		✓	Delete datetime
4	created_at	datetime(6)		✓	Create datetime
5	updated_at	datetime(6)		✓	Updated datetime

Table 4.7. Description for thesis_student table

Purpose: Storage student type participant information					
No	Column	Type	Key	Allow Null	Description
1	thesis_id	int(11)	PK FK		Map to id of thesis table
2	student_id	int(11)	PK FK		Map to id of student table
3	deleted_at	datetime(6)		✓	Delete datetime
4	created_at	datetime(6)		✓	Create datetime
5	updated_at	datetime(6)		✓	Updated datetime

Table 4.8. Description for topic table

Purpose: Storage topic information					
No	Column	Type	Key	Allow Null	Description
1	id	int(11)	PK		Unique key, auto increment.
2	subject	text			
3	creator_id	int(11)	FK		Map to id of lecturer table
4	description	text			
5	status	tinyint(4)			
6	approver_id	int(11)	FK		Map to id of lecturer table
7	thesis_id	int(11)	FK		Map to id of thesis table
8	max_student	tinyint(4)			Default: 2
9	current_student	tinyint(4)			Default: 0
10	register_status	tinyint(4)			1 – Close 2 – Open Default: 1
11	deleted_at	datetime(6)		✓	Delete datetime
12	created_at	datetime(6)		✓	Create datetime
13	updated_at	datetime(6)		✓	Updated datetime

Table 4.9. Description for topic_state table

Purpose: Storage state action of topic					
No	Column	Type	Key	Allow Null	Description
1	id	int(11)	PK		Unique key, auto increment.
2	topic_id	int(11)	FK		Map to id of topic table
3	processor_id	int(11)	FK		Map to id of lecturer table
4	note	text		✓	

5	action	tinyint(4)			1 – New 2 – Approved 3 – Rejected 4 – Sendback 5 – Withdraw 6 – Send request 7 – Canceled Default: 1
6	deleted_at	datetime(6)		✓	Delete datetime
7	created_at	datetime(6)		✓	Create datetime
8	updated_at	datetime(6)		✓	Updated datetime

Table 4.10. Description for topic_student table

Purpose: Storage students who register topic					
No	Column	Type	Key	Allow Null	Description
1	id	int(11)	PK		Unique key, auto increment.
2	topic_id	int(11)	FK		Map to id of topic table
3	student_id	int(11)	FK		Map to id of student table
4	status	tinyint(4)			1 – Pending 2 – Approved 3 – Rejected Default: 1
5	deleted_at	datetime(6)		✓	Delete datetime
6	created_at	datetime(6)		✓	Create datetime
7	updated_at	datetime(6)		✓	Updated datetime

Table 4.11. Description for progress_report table

Purpose: Storage semi-progress report information					
--	--	--	--	--	--

No	Column	Type	Key	Allow Null	Description
1	id	int(11)	PK		Unique key, auto increment.
2	time	datetime			
3	place	varchar(100)			
4	result	tinyint(4)			1 – Not decided 2 – Passed 3 – Failed Default: 1
5	note	text		✓	
6	deleted_at	datetime(6)		✓	Delete datetime
7	created_at	datetime(6)		✓	Create datetime
8	updated_at	datetime(6)		✓	Updated datetime

Table 4.12. Description for review table

Purpose: Storage review information					
No	Column	Type	Key	Allow Null	Description
1	id	int(11)	PK		Unique key, auto increment.
2	time	datetime			
3	place	varchar(100)			
4	result	tinyint(4)			1 – Not decided 2 – Passed 3 – Failed Default: 1
5	note	text		✓	
6	reviewer_id	int(11)	FK		Map to id of lecturer table
7	reviewer_comment	text		✓	

8	deleted_at	datetime(6)		✓	Delete datetime
9	created_at	datetime(6)		✓	Create datetime
10	updated_at	datetime(6)		✓	Updated datetime

Table 4.13. Description for council table

Purpose: Storage council information					
No	Column	Type	Key	Allow Null	Description
1	id	int(11)	PK		Unique key, auto increment.
2	name	varchar(100)			
3	thesis_id	int(11)	FK		Map to id of thesis table
4	chairman_id	int(11)	FK		Map to id of lecturer table
5	instructor_id	int(11)	FK		Map to id of lecturer table
6	commissioner_id	int(11)	FK		Map to id of lecturer table
8	deleted_at	datetime(6)		✓	Delete datetime
9	created_at	datetime(6)		✓	Create datetime
10	updated_at	datetime(6)		✓	Updated datetime

Table 4.14. Description for defense table

Purpose: Storage defense information					
No	Column	Type	Key	Allow Null	Description
1	id	int(11)	PK		Unique key, auto increment.
2	time	datetime			

3	place	varchar(100)			
4	note	text		✓	
5	council_id	int(11)	FK		Map to id of council table
6	deleted_at	datetime(6)		✓	Delete datetime
7	created_at	datetime(6)		✓	Create datetime
8	updated_at	datetime(6)		✓	Updated datetime

Table 4.15. Description for result table

Purpose: Storage result information					
No	Column	Type	Key	Allow Null	Description
1	id	int(11)	PK		Unique key, auto increment.
2	topic_id	int(11)	FK		Map to id of topic table
3	student_id	int(11)	FK		Map to id of student table
4	creator_id	int(11)	FK		Map to id of lecturer table
5	note	text		✓	
6	type	tinyint(4)			1 – Instructor 2 – Review 3 – Defense
7	point	json			{ title: string, rate: number, value: null number }
8	status	tinyint(4)			1 – Lock 2 – Unlock Default: 1
9	deleted_at	datetime(6)		✓	Delete datetime

10	created_at	datetime(6)		✓	Create datetime
11	updated_at	datetime(6)		✓	Updated datetime

Table 4.16. Description for comment table

Purpose: Storage comment information					
No	Column	Type	Key	Allow Null	Description
1	id	int(11)	PK		Unique key, auto increment.
2	topic_id	int(11)	FK		Map to id of topic table
4	creator_id	int(11)	FK		Map to id of user table
5	content	text			
6	mode	tinyint(4)			1 – Private 2 – Public Default: 2
7	module	tinyint(4)			1 – Semi-progress report 2 – Review 3 – Defense
8	deleted_at	datetime(6)		✓	Delete datetime
9	created_at	datetime(6)		✓	Create datetime
10	updated_at	datetime(6)		✓	Updated datetime

Table 4.17. Description for migrations table

Purpose: Storage migrations log					
No	Column	Type	Key	Allow Null	Description
1	id	int(11)	PK		Unique key, auto increment.
2	timestamp	bigint(20)			
3	name	varchar(255)			

4.3. Interface design

4.3.1. Screen flow

Reference to Appendix 2

4.3.2. Specification of the screens

This section only describes the specification of the main screens of the graduation thesis application. Therefore, some screens describe in the screen flow of section 4.4.1 will be not described.

4.3.2.1. Thesis list screen

a. Thesis list screen

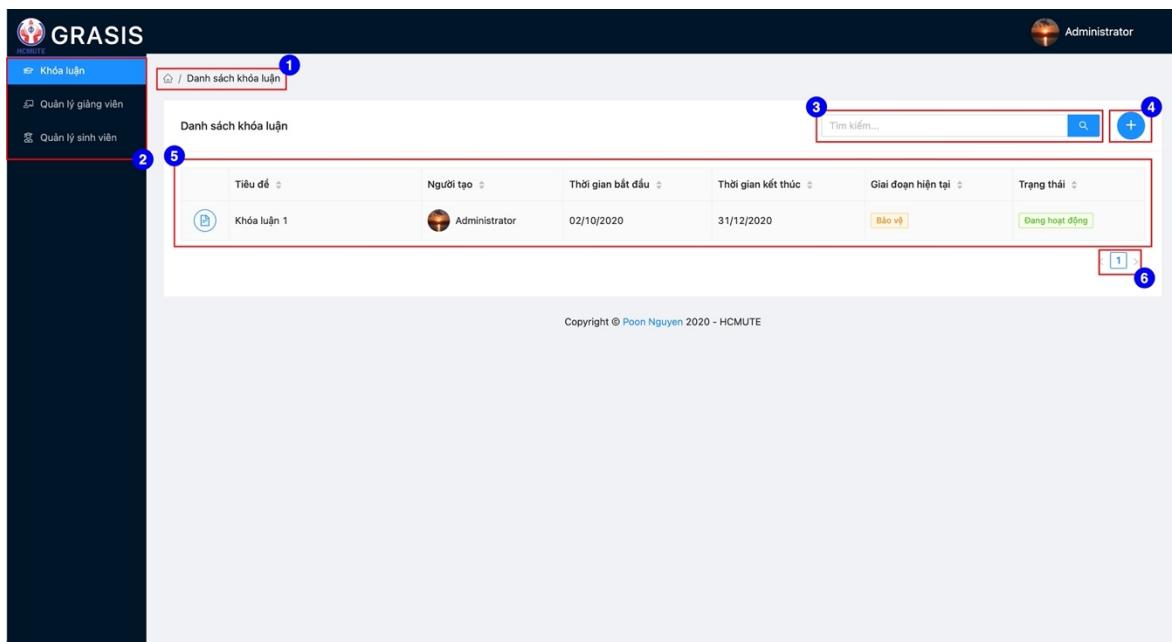


Figure 4.2. Thesis list screen

Table 4.18. Thesis list screen specification

Item	Descriptions	Operations
Item-1	Page breadcrumbs	When the user clicks on Item-1, the user will be redirected to corresponding page.
Item-2	Navigation bar	When the user clicks on Item-2, the user will be redirected to corresponding page.

Item-3	Search bar	When the user input keyword and clicks glass icon, search result will be displayed on Item-5.
Item-4	Add thesis button	When the user clicks on Item-4, the user will be redirected to “Tạo khóa luận” page.
Item-5	Pagination button	When the user clicks on Item-5, the thesis list will be displayed on Item-4 by page number.

b. Create thesis screen

The screenshot shows the 'Create thesis' screen with several input fields and dropdown menus, each annotated with a blue circle containing a number from 1 to 26. The fields include:

- 1: Tiêu đề (Title) input field with placeholder "Vui lòng nhập tiêu đề!" (Please enter the title!).
- 2: Ngày bắt đầu (Start date) and Ngày kết thúc (End date) input fields with placeholder "Vui lòng nhập thời gian diễn ra!" (Please enter the duration!).
- 3: Chọn thời điểm (Select time) input field with placeholder "Vui lòng nhập hạn chót giảng viên đăng ký để tài!" (Please enter the deadline for teachers to register!).
- 4: Chọn thời điểm (Select time) input field with placeholder "Vui lòng nhập hạn chốt sinh viên đăng ký để tài!" (Please enter the deadline for students to register!).
- 5: Chọn thời điểm (Select time) input field with placeholder "Vui lòng nhập hạn chốt báo cáo tiến độ!" (Please enter the deadline for progress reports!).
- 6: Chọn thời điểm (Select time) input field with placeholder "Vui lòng nhập hạn chốt phản biện!" (Please enter the deadline for defense!).
- 7: Chọn thời điểm (Select time) input field with placeholder "Vui lòng nhập hạn chốt bảo vệ!" (Please enter the deadline for defense!).
- 8: Giảng viên hướng dẫn (Supervisor) dropdown menu showing "v 1/7 mục" (1/7 items) with 1 item selected.
- 9: A small circular icon next to the dropdown menu.
- 10: List of supervisors: null Administrator, Nguyễn Văn F (0001), Nguyễn Thị G (0002) (selected), Nguyễn Văn H (0003), Nguyễn Thị I (0004), Nguyễn Văn J (0005).
- 11: Thêm (Add) button.
- 12: Tim ở đây (Search here) input field with placeholder "Tim ở đây" and a magnifying glass icon.
- 13: List of search results: Nguyễn Văn C, Nguyễn Thị B.
- 14: A small circular icon next to the search results.
- 15: Tim kiếm theo (Search by) dropdown menu: Tên giảng viên (Selected), Mã giảng viên.
- 16: Sinh viên thực hiện (Student involved) dropdown menu showing "v 1/4 mục" (1/4 items) with 1 item selected.
- 17: A small circular icon next to the dropdown menu.
- 18: List of students: Nguyễn Văn A (16110001), Nguyễn Thị B (16110001) (selected), Nguyễn Thị D (16110001), Nguyễn Văn E (16110001).
- 19: Thêm (Add) button.
- 20: Tim ở đây (Search here) input field with placeholder "Tim ở đây" and a magnifying glass icon.
- 21: List of search results: Nguyễn Văn C (16110001).
- 22: A small circular icon next to the search results.
- 23: Tim kiếm theo (Search by) dropdown menu: Tên sinh viên (Selected), Niên khóa, Mã sinh viên, Lớp.
- 24: Xác nhận (Confirm) button.
- 25: Hủy (Cancel) button.

Figure 4.3. Create thesis screen

Table 4.19. Create thesis screen specification

Item	Descriptions	Operations
Item-1	Subject	
Item-2	Duration time	When the user clicks on Item-2, selecting data dialog will display.
Item-3	Deadline of register topic for lecturer time	When the user clicks on Item-3, selecting data dialog will display.
Item-4	Deadline of register topic for student time	When the user clicks on Item-4, selecting data dialog will display.
Item-5	Deadline of semi-progress report time	When the user clicks on Item-5, selecting data dialog will display.
Item-6	Deadline of review time	When the user clicks on Item-6, selecting data dialog will display.
Item-7	Deadline of defense time	When the user clicks on Item-7, selecting data dialog will display.
Item-8	Select all lecturers in Item-10	When the user clicks on Item-8, all lecturers items in Item-10 will be selected.
Item-9	Suggestion lecturer search bar	When the user inputs keyword on Item-9, search result will display at Item-10
Item-10	Suggestion lecturer search result	
Item-11	Add lecturer button	When the user clicks on Item-11, selected lecturers at Item-10 will move to Item-13
Item-12	Selected lecturer search bar	When the user inputs keyword on Item-12, search result will display at Item-13
Item-13	Selected lecturers	
Item-14	Remove selected lecturer button	When the user clicks on Item-14, target lecture will move to Item-10

Item-15	Criteria for suggestion lecturer search	
Item-16	Select all students in Item-18	When the user clicks on Item-16, all students in Item-10 will be selected.
Item-17	Suggestion student search bar	
Item-18	Suggestion student search result	
Item-19	Add student button	When the user clicks on Item-19, selected students at Item-18 will move to Item-21
Item-20	Selected student search bar	When the user inputs keyword on Item-20, search result will display at Item-18
Item-21	Selected students	
Item-22	Remove selected student button	When the user clicks on Item-22, target student will move to Item-18
Item-23	Criteria for suggestion student search	
Item-24	Submit button	When the user clicks on Item-24, success notification will display and redirect to thesis list screen
Item-25	Cancel button	When the user clicks on Item-24, redirect to thesis list screen
Item-26	Validation error message	When the user inputs invalid or empty value, Item-26 will display.

4.3.2.2. Thesis detail screen

a. Thesis detail tab

Chapter 4. Software design

Chi tiết khóa luận				
1	<input type="radio"/> Thông tin về khóa luận	<input type="radio"/> Danh sách giảng viên hướng dẫn	<input type="radio"/> Danh sách sinh viên thực hiện	<input type="radio"/> Danh sách đề tài
2	<input type="radio"/> Sửa khóa luận	<input type="radio"/> Xóa khóa luận	<input type="radio"/> Ngưng kích hoạt	
3				
4				
5				
6				
7				
8				
9				
Tiêu đề		Khóa luận 1	Người tạo	Administrator
Thời gian bắt đầu		02/10/2020	Thời gian kết thúc	31/12/2020
Hạn chót giảng viên đăng ký đề tài		19/11/2020	Hạn chót sinh viên đăng ký đề tài	01/12/2020
Hạn chót báo cáo tiến độ		02/12/2020	Hạn chót phản biện	03/12/2020
Hạn chót bảo vệ		31/12/2020 (Còn 16 ngày) *		
Giai đoạn hiện tại		<input type="radio"/> Bảo vệ	Trạng thái	<input type="radio"/> Đang hoạt động
Ngày tạo		27/11/2020	Ngày cập nhật	13/12/2020 (2 ngày trước)

Chi tiết khóa luận				
<input type="radio"/> Thông tin về khóa luận	<input type="radio"/> Danh sách giảng viên hướng dẫn	<input type="radio"/> Danh sách sinh viên thực hiện	<input type="radio"/> Danh sách đề tài	<input type="radio"/> Danh sách hội đồng
<input type="radio"/> Sửa khóa luận	<input type="radio"/> Xóa khóa luận	<input checked="" type="radio"/> Kích hoạt		
10				
Tiêu đề		Khóa luận 1	Người tạo	Administrator
Thời gian bắt đầu		02/10/2020	Thời gian kết thúc	31/12/2020
Hạn chót giảng viên đăng ký đề tài		19/11/2020	Hạn chót sinh viên đăng ký đề tài	01/12/2020
Hạn chót báo cáo tiến độ		02/12/2020	Hạn chót phản biện	03/12/2020
Hạn chót bảo vệ		31/12/2020 (Còn 16 ngày) *		
Giai đoạn hiện tại		<input type="radio"/> Bảo vệ	Trạng thái	<input type="radio"/> Đang hoạt động
Ngày tạo		27/11/2020	Ngày cập nhật	13/12/2020 (2 ngày trước)

Figure 4.4. Thesis detail screen

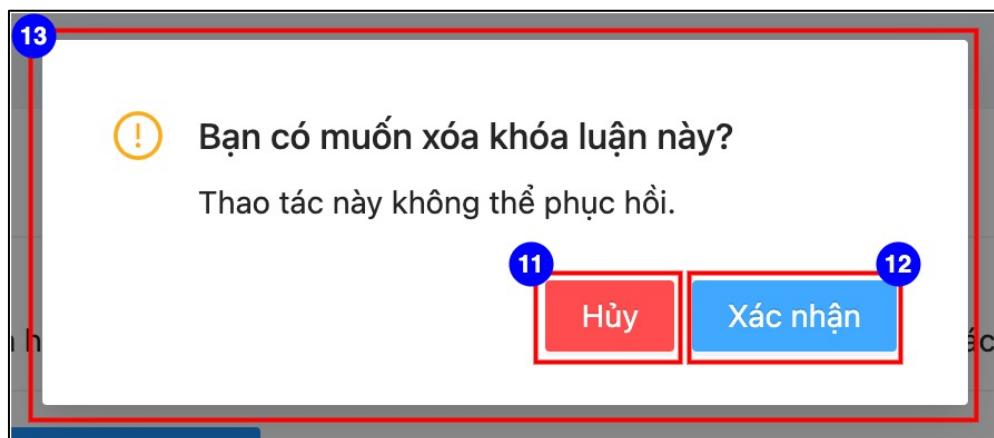


Figure 4.5. Delete thesis confirm dialog

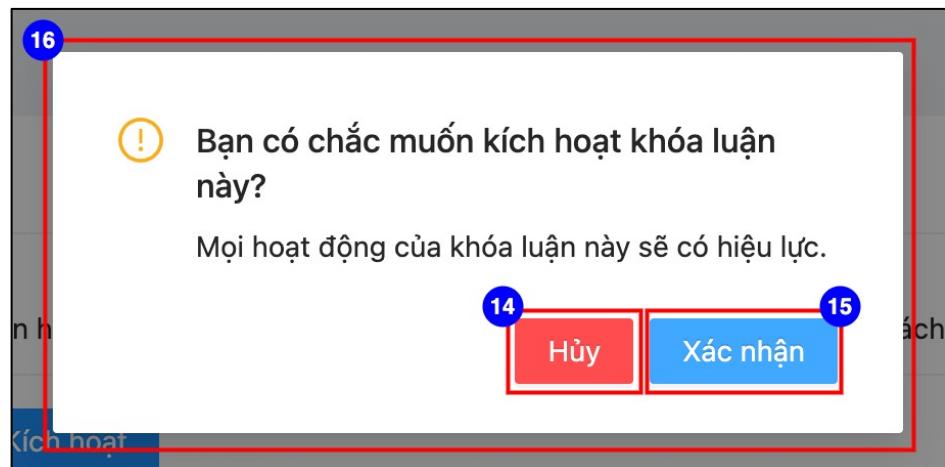


Figure 4.6. Active thesis confirm dialog

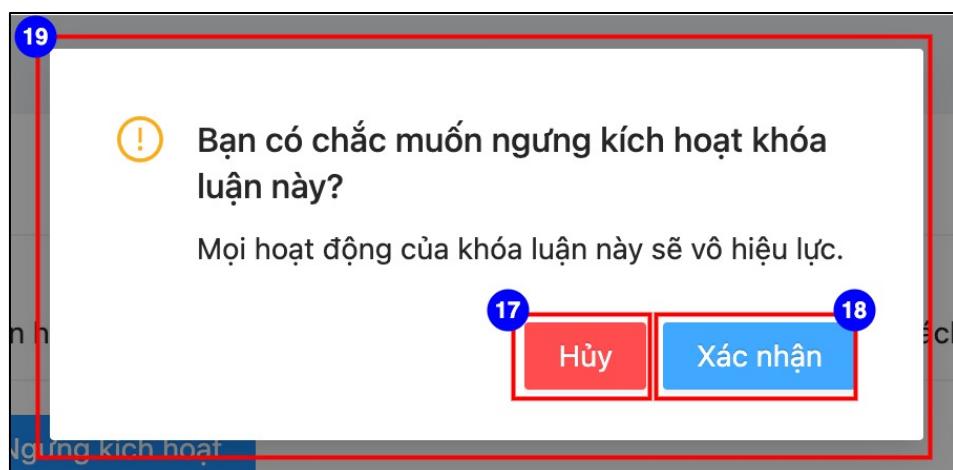


Figure 4.7. Inactive thesis confirm dialog

Table 4.20. Thesis list tabscreen specification

Item	Descriptions	Operations
Item-1	Thesis detail tab	When the user clicks on Item-1, the thesis detail tab will be displayed.
Item-2	Instructor list tab	When the user clicks on Item-2, the instructor list tab will be displayed.
Item-3	Student list tab	When the user clicks on Item-3, the student list tab will be displayed.

Item-4	Topic list tab	When the user clicks on Item-4, the topic list tab will be displayed.
Item-5	Council list tab	<ul style="list-style-type: none"> - When the user clicks on Item-5, the council list tab will be displayed. - When current phase of target thesis isn't defense, Item-5 not displayed.
Item-6	Edit thesis button	<ul style="list-style-type: none"> - When the target thesis has status is “Đang hoạt động”, Item-6 will not display. - When the user clicks on Item-6, the user will be redirected to edit thesis screen.
Item-7	Delete thesis button	<ul style="list-style-type: none"> - When the target thesis has status is “Đang hoạt động”, Item-7 will not display. - When the user clicks on Item-7, the Item-13 will display.
Item-8	Inactive thesis button	When the user clicks on Item-7, the Item-19 will display.
Item-9	Thesis detail information	
Item-10	Active thesis button	When the user clicks on Item-10, the Item-16 will display.
Item-11	Cancel delete button	When the user clicks on Item-11, the Item-13 will close.
Item-12	Submit delete button	When the user clicks on Item-12, the target thesis will be deleted and redirect the user to thesis list screen.
Item-13	Delete thesis confirm dialog	
Item-14	Cancel active button	When the user clicks on Item-14, the Item-16 will close.

Item-15	Submit active button	When the user clicks on Item-15, the target thesis is activated, and the Item-16 will close.
Item-16	Active thesis confirm dialog	
Item-17	Cancel inactive button	When the user clicks on Item-17, the Item-19 will close.
Item-18	Submit inactive button	When the user clicks on Item-18, the target thesis is inactivated, and the Item-19 will close.
Item-19	Inactive thesis confirm dialog	

b. Instructor list tab

The screenshot shows a table of instructor data with the following columns: Họ và tên đệm (Last Name), Tên (First Name), Giới tính (Gender), and Mã giảng viên (Staff ID). The data is as follows:

Họ và tên đệm	Tên	Giới tính	Mã giảng viên
NULL	Administrator	NULL	NULL
Nguyễn Văn	F	Nam	0001
Nguyễn Thị	G	Nữ	0002
Nguyễn Văn	H	Nam	0003
Nguyễn Thị	I	Nữ	0004
Nguyễn Văn	J	Nam	0005

Annotations:

- Annotation 1: A red box highlights the search bar labeled "Tim kiem...".
- Annotation 2: A red box highlights the first six rows of the table.
- Annotation 3: A red box highlights the page navigation buttons at the bottom right.
- Annotation 4: A blue circle highlights the "Danh sách giảng viên hướng dẫn" tab in the top navigation bar.

Figure 4.8. Instructor list tab

Table 4.21. Instructor list tabscreen specification

Item	Descriptions	Operations

Item-1	Search bar	When the user input keyword and clicks glass icon, search result will be displayed on Item-4.
Item-2	Detail instructor button	When the user clicks on Item-2, the user will be redirected to corresponding detail instructor page.
Item-3	Pagination button	When the user clicks on Item-3, the lecturer list will be displayed on Item-4 by page number.
Item-4	Instructor list	

c. Student list tab

Họ và tên đệm	Tên	Giới tính	Mã sinh viên	Niên khóa	Lớp	Kết quả
Nguyễn Văn	A	Nam	16110001	2016	16110CL3	NULL
Nguyễn Thị	B	Nữ	16110001	2016	16110CL3	NULL
Nguyễn Văn	C	Nam	16110001	2016	16110CL3	NULL
Nguyễn Thị	D	Nữ	16110001	2016	16110CL3	NULL
Nguyễn Văn	E	Nam	16110001	2016	16110CL3	NULL

Figure 4.9. Student list tab

Table 4.22. Student list tabscreen specification

Item	Descriptions	Operations
Item-1	Search bar	When the user input keyword and clicks glass icon, search result will be displayed on Item-4.

Item-2	Detail student button	When the user clicks on Item-2, the user will be redirected to corresponding detail student page.
Item-3	Pagination button	When the user clicks on Item-3, the student list will be displayed on Item-4 by page number.
Item-4	Instructor list	

d. Topic list tab

The screenshot shows a table titled 'Chi tiết khóa luận' (Topic details) with the following columns: Tiêu đề (Title), Giảng viên hướng dẫn (Instructor), Còn trống (Available slots), Số lượng sinh viên thực hiện (Number of students), Trạng thái đăng ký (Registration status), Ngày tạo (Created date), and Trạng thái phê duyệt (Approval status). The table contains the following data:

Tiêu đề	Giảng viên hướng dẫn	Còn trống	Số lượng sinh viên thực hiện	Trạng thái đăng ký	Ngày tạo	Trạng thái phê duyệt
Đề tài 1	Nguyễn Văn F (0001)	2	2	Đóng đăng ký	27/11/2020	Hủy bỏ
Đề tài 2	Nguyễn Thị G (0002)	2	2	Đóng đăng ký	27/11/2020	Hủy bỏ
Đề tài 3	Nguyễn Văn H (0003)	2	2	Đóng đăng ký	27/11/2020	Hủy bỏ
Đề tài 4	Nguyễn Thị I (0004)	2	2	Đóng đăng ký	27/11/2020	Hủy bỏ
Đề tài 5	Nguyễn Văn J (0005)	2	2	Đóng đăng ký	27/11/2020	Hủy bỏ
Đề tài 2	Administrator	2	2	Đóng đăng ký	18/11/2020	Hủy bỏ
Đề tài 3	Administrator	1	1	Đóng đăng ký	18/11/2020	Hủy bỏ
Topic 1	Administrator	1	2	Đóng đăng ký	13/12/2020	Chấp nhận

Annotations with numbers 1 through 4 highlight specific elements: 1 points to the search bar; 2 points to the first row of the table; 3 points to the bottom right corner of the table; 4 points to the 'Danh sách đề tài' tab at the top.

Figure 4.10. Topic list tab

Figure 4.11. Create topic drawer

Table 4.23. Topic list tab specification

Item	Descriptions	Operations
Item-1	Search bar	When the user input keyword and clicks glass icon, search result will be displayed on Item-4.
Item-2	Detail topic button	When the user clicks on Item-2, the user will be redirected to corresponding detail topic page.
Item-3	Pagination button	When the user clicks on Item-3, the topic list will be displayed on Item-4 by page number.
Item-4	Instructor list	
Item-5	Subject input field	
Item-6	Validation error message	When the user input invalid value or empty value on Item-5, Item-6 will display.
Item-7	Description input field	

Item-8	Maximum student	- Minimum value is 1. - Maximum value is 2
Item-9	Submit button	When the user clicks on Item-9, the create topic drawer will disappear.
Item-10	Cancel button	When the user clicks on Item-10, the create topic drawer will disappear.

e. Council list tab

The screenshot shows a table of council entries. Each entry includes columns for Name, Chairman, Instructor, Vice-chairman, Creation Time, and Last Update. To the right of each entry are three icons: a blue edit icon, a red delete icon, and a blue trash icon. A red box highlights the first four columns of the table. A red box also highlights the bottom right corner of the table area. Numbered circles 1 through 6 are overlaid on the interface: 1 is on the 'Create Council' button, 2 is on the search bar, 3 is on the edit icon, 4 is on the delete icon, 5 is on the trash icon, and 6 is on the 'Council List' tab itself.

Figure 4.12. Council list tab

The screenshot shows the 'Create council' dialog box. It contains fields for Name, Chairman, Instructor, Vice-chairman, and Vice-chairwoman. Below these fields are two buttons: 'Xác nhận' (Confirm) and 'Hủy' (Cancel). A red box highlights the entire dialog box. Numbered circles 7 through 13 are overlaid: 7 is on the dialog title, 8 is on the 'Name' field, 9 is on the 'Chairman' field, 10 is on the 'Confirm' button, 11 is on the 'Cancel' button, 12 is on the 'Vice-chairwoman' dropdown list, and 13 is on the 'Vice-chairwoman' dropdown list itself.

Figure 4.13. Create council

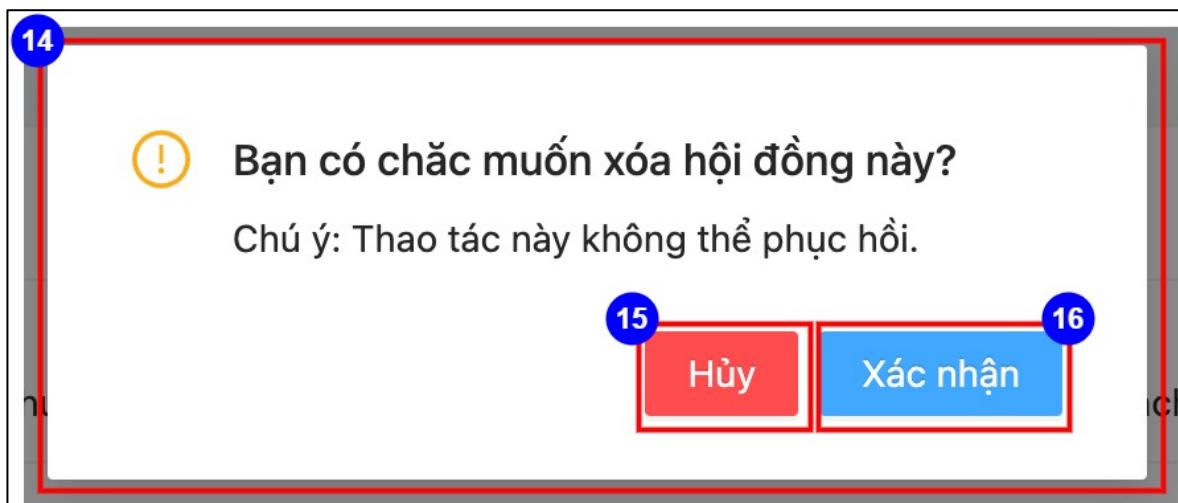


Figure 4.14. Delete council confirm dialog

Table 4.24. Council list tab specification

Item	Descriptions	Operations
Item-1	Create council button	When the user clicks on Item-1, Item-7 will display.
Item-2	Search council bar	When the user input keyword and clicks glass icon, search result will be displayed on Item-6.
Item-3	Edit council button	When the user clicks on Item-2, edit council drawer will display with UI similar Item-7.
Item-4	Delete council button	When the user clicks on Item-4, Item-14 will display.
Item-5	Pagination button	When the user clicks on Item-5, the thesis list will be displayed on Item-6 by page number.
Item-6	Council list	
Item-7	Create council drawer	

Item-8	Council information input fields	When the user inputs invalid value or empty value, Item-9 will display
Item-9	Validation error message	
Item-10	Submit button	When the user clicks on Item-10, Item-7 will disappear, and success notification will display.
Item-11	Cancel button	When the user clicks on Item-10, Item-7 will disappear.
Item-12	Chairman input field	When the user inputs value, Item-13 will display.
Item-13	Suggestion list	When the user clicks on Item-13, target value will be displayed at Item-12 and Item-13 will disappear.
Item-14	Delete council confirm dialog	
Item-15	Cancel delete confirm	When the user clicks on Item-15, Item-14 will disappear.
Item-16	Submit delete confirm	When the user clicks on Item-16, Item-14 will disappear, and success notification will display.

4.3.2.3. *Topic detail screen*

a. Topic detail tab

Chapter 4. Software design

Chi tiết đề tài

① Thông tin đề tài ② Thông tin phê duyệt

1 Sửa đề tài 2 Xóa đề tài

Tiêu đề	Topic 1
Giảng viên hướng dẫn	Nguyễn Văn F (0001)
Số lượng sinh viên thực hiện	2
Số lượng sinh viên được chấp nhận	0
Trạng thái đăng ký	<button>Đóng đăng ký</button>
Mô tả	XXXX

Chi tiết đề tài

① Thông tin đề tài ② Thông tin phê duyệt ③ Danh sách sinh viên đăng ký đề tài

4 Mở đăng ký

Tiêu đề	Topic 2
Giảng viên hướng dẫn	Nguyễn Văn F (0001)
Số lượng sinh viên thực hiện	2
Số lượng sinh viên được chấp nhận	0
Trạng thái đăng ký	<button>Đóng đăng ký</button>
Mô tả	XXXX

Chi tiết đề tài

① Thông tin đề tài ② Thông tin phê duyệt ③ Danh sách sinh viên đăng ký đề tài

5 Đóng đăng ký

Tiêu đề	Topic 2
Giảng viên hướng dẫn	Nguyễn Văn F (0001)
Số lượng sinh viên thực hiện	2
Số lượng sinh viên được chấp nhận	0
Trạng thái đăng ký	<button>Mở đăng ký</button>
Mô tả	XXXX

Figure 4.15. Detail topic tab



Figure 4.16. Change resiter status of topic confirm dialog

Table 4.25. Topic detail tab specification

Item	Descriptions	Operations
Item-1	Edit topic button	When the user input keyword and clicks glass icon, search result will be displayed on Item-4.
Item-2	Delete topic button	When the user input keyword and clicks glass icon, search result will be displayed on Item-4.

Item-3	Detail topic information	
Item-4	Open register button	<ul style="list-style-type: none"> - When target topic has state is “Chấp nhận” and status is “Đóng đăng ký”. - When the user clicks on Item-4, the Item-14 will display.
Item-5	Close register button	<ul style="list-style-type: none"> - When target topic has state is “Chấp nhận” and status is “Mở đăng ký”. - When the user clicks on Item-5, the council list will be displayed on Item-6 by page number.
Item-6	Close register confirm dialog	
Item-7	Cancel close register button	When the user clicks on Item-7, Item-6 will disappear.
Item-8	Submit close register button	When the user clicks on Item-8, Item-6 will disappear, and success notification will display.
Item-9	Open register confirm dialog	
Item-10	Cancel open register button	When the user clicks on Item-10, Item-9 will disappear.
Item-11	Submit open register button	When the user clicks on Item-11, Item-9 will disappear, and success notification will display.

b. Approval information tab

Chapter 4. Software design

Chi tiết đề tài

① Thông tin đề tài ② Thông tin phê duyệt

Người phê duyệt: Administrator

Trạng thái phê duyệt: Mới

Lịch sử:

+ Mới

Nguyễn Văn F (0001) 13:37:06, 15/12/2020 (2 giờ trước)
[Hệ thống] Khởi tạo đề tài.

3

Ghi chú...

4

5 Yêu cầu phê duyệt

6 Hủy bỏ

1

2

Chi tiết đề tài

① Thông tin đề tài ② Thông tin phê duyệt

Người phê duyệt: Administrator

Trạng thái phê duyệt: Đang được phê duyệt

Lịch sử:

+ Mới

Nguyễn Văn F (0001) 13:37:06, 15/12/2020 (2 giờ trước)
[Hệ thống] Khởi tạo đề tài.

Đang được phê duyệt

Nguyễn Văn F (0001) 16:00:23, 15/12/2020 (vài giây trước)
XXX

Ghi chú...

7 Chấp nhận

8 Trả lại

9 Từ chối

The screenshot shows a software interface titled "Chi tiết đề tài" (Detail of the topic). At the top, there are two tabs: "Thông tin đề tài" (Topic information) and "Thông tin phê duyệt" (Approval information), with the latter being active. Below the tabs, it says "Người phê duyệt: Administrator". The status is "Trạng thái phê duyệt: Đang được phê duyệt" (Approval status: Being reviewed). A section titled "Lịch sử:" (History) shows a list of reviews:

- Mới (New): Nguyễn Văn F (0001) 13:37:06, 15/12/2020 (2 giờ trước) [Hệ thống] Khởi tạo đề tài.
- Đang được phê duyệt (Being reviewed): Nguyễn Văn F (0001) 16:00:23, 15/12/2020 (vài giây trước) XXX

Below the history is a note input field with placeholder text "Ghi chú...". At the bottom left is a red button labeled "10" with the text "Thu hồi" (Revert).

Figure 4.17. Approval information tab

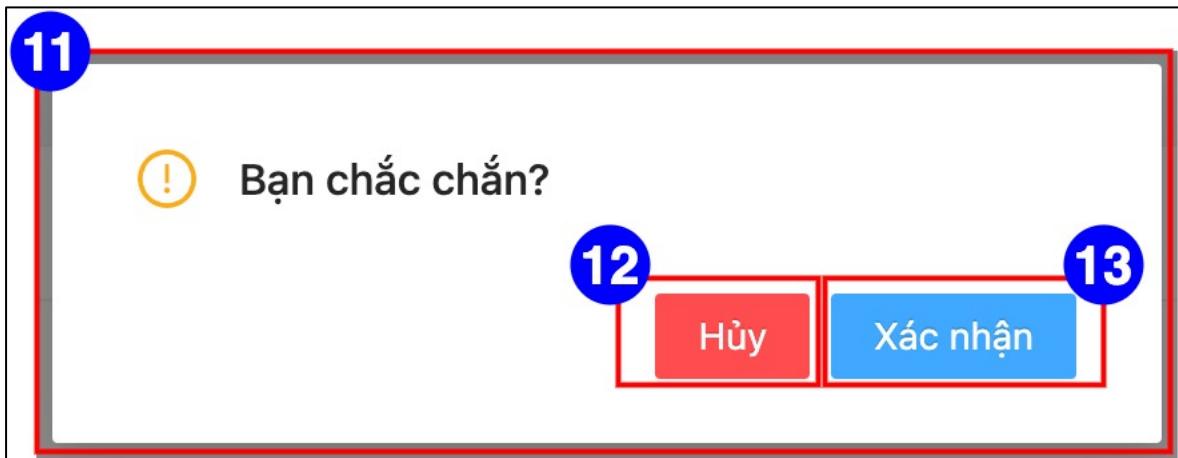


Figure 4.18. Confirm action dialog

Table 4.26. Approval information tab specification

Item	Descriptions	Operations
Item-1	Approver information	

Item-2	Approval status	
Item-3	Approval history	
Item-4	Action note input field	
Item-5	Send approval request button	<ul style="list-style-type: none"> - When the approval status of target topic is “Mới” hoặc “Trả lại” hoặc “Thu hồi”, Item-5 will display. - When the user clicks on Item-5, Item-3 will be updated, and Item-2 will change to “Đang được phê duyệt”.
Item-6	Cancel	<ul style="list-style-type: none"> - When the approval status of target topic is “Mới” hoặc “Trả lại” hoặc “Thu hồi”, Item-6 will display. - When the user clicks on Item-6, Item-3 will be updated, and Item-2 will change to “Hủy bỏ”.
Item-7	Accept button	<ul style="list-style-type: none"> - When the approval status of target topic is “Đang được phê duyệt”, Item-7 will display. - When the user clicks on Item-7, Item-3 will be updated, and Item-2 will change to “Chấp nhận”.
Item-8	Sendback button	<ul style="list-style-type: none"> - When the approval status of target topic is “Đang được phê duyệt”, Item-8 will display. - When the user clicks on Item-8, Item-3 will be updated, and Item-2 will change to “Trả lại”.
Item-9	Reject button	<ul style="list-style-type: none"> - When the approval status of target topic is “Đang được phê duyệt”, Item-9 will display.

		<ul style="list-style-type: none"> - When the user clicks on Item-9, Item-3 will be updated, and Item-2 will change to “Từ chối”.
Item-10	Withdraw button	<ul style="list-style-type: none"> - When the approval status of target topic is “Đang được phê duyệt”, Item-10 will display. - When the user clicks on Item-10, Item-3 will be updated, and Item-2 will change to “Thu hồi”.
Item-11	Confirm action dialog	
Item-12	Cancel confirm button	When the user clicks on Item-12, Item-11 will disappear.
Item-13	Submit confirm button	When the user clicks on Item-13, Item-11 will disappear and success notification will display.

c. Register list tab

Figure 4.19. Register list tab



Figure 4.20. Register confirm dialog

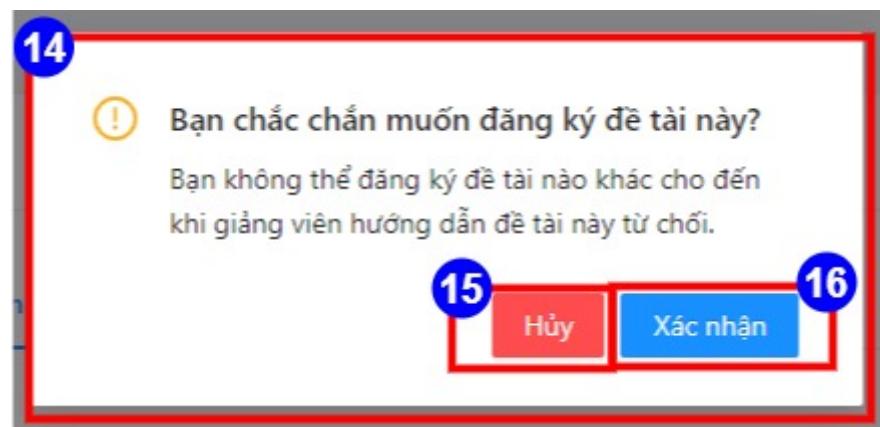


Figure 4.21. Register confirm dialog

Table 4.27. Register list tab specification

Item	Descriptions	Operations

Item-1	Register list tab button	<ul style="list-style-type: none"> - When the phase of target thesis is register for student and the status of target topic is “Chấp nhận”, Item-1 will display. - When the user clicks on Item-1, register list tab will display.
Item-2	Register button	<ul style="list-style-type: none"> - When login user is student and target topic has register status is open, Item-2 will display. - When the user clicks on Item-2, Item-14 will display.
Item-3	Topic register statistics	
Item-4	Register list	
Item-5	Accept register button	<ul style="list-style-type: none"> - When login user is owner of target topic, Item-5 will display. - When the user clicks on Item-5, Item-8 will display.
Item-6	Reject register button	<ul style="list-style-type: none"> - When login user is owner of target topic, Item-6 will display. - When the user clicks on Item-6, Item-11 will display.
Item-7	Pagination button	When the user clicks on Item-7, the register list will be displayed on Item-4 by page number.
Item-8	Accept confirm dialog	
Item-9	Cancel accept confirm	When the user clicks on Item-9, Item-8 will disappear.
Item-10	Submit accept confirm	When the user clicks on Item-10, Item-8 will disappear, and success notification will display.
Item-11	Reject confirm dialog	

Item-12	Cancel reject confirm	When the user clicks on Item-12, Item-11 will disappear.
Item-13	Submit reject confirm	When the user clicks on Item-13, Item-11 will disappear, and success notification will display.
Item-14	Register confirm dialog	
Item-15	Cancel register confirm	When the user clicks on Item-15, Item-14 will disappear.
Item-16	Submit register confirm	When the user clicks on Item-16, Item-14 will disappear, and success notification will display.

d. Semi-progress report tab

The screenshot shows a user interface for a 'Semi-progress report' tab. The main area is titled 'Chi tiết đề tài' (Details of the topic). It includes sections for 'Thông tin đề tài' (Topic information), 'Thông tin phê duyệt' (Approval information), and 'Danh sách sinh viên đăng ký đề tài' (List of students registered for the topic). A red box highlights the 'Báo cáo tiến độ' (Progress report) button. Below this are buttons for 'Chỉnh sửa' (Edit), 'Cho phép phản biện' (Allow defense), and 'Dừng phát triển' (Stop development).

The 'Sinh viên báo cáo' (Reporter student) section lists 'Nguyễn Thị B (16110001)' and 'Nguyễn Văn C (16110001)'. The 'Thời gian' (Time) is listed as 23:59:00, 17/12/2020. The 'Địa điểm' (Location) is XXXXXX. The 'Ngày tạo' (Creation date) is 18:20:32, 15/12/2020. The 'Ngày cập nhật' (Last update date) is 18:20:32, 15/12/2020 (3 giờ trước). The 'Ghi chú' (Note) field contains XXXXXX. The 'Kết quả' (Result) field shows 'Chưa có' (Not yet) with a trash can icon.

The 'Tài liệu báo cáo' (Report document) section shows a small document icon and the word 'Trống' (Empty).

To the right, there is a 'Nhập bình luận tại đây...' (Enter comment here) input field with a placeholder. Below it is a 'Công khai' (Public) dropdown and a 'Xác nhận' (Confirm) button. A red box highlights the 'Nhập bình luận tại đây...' input field. A red line connects this input field to a list of comments. The comments are as follows:

- Administrator 20:56:25, 15/12/2020 (với giây trước): Comment 2
- Administrator 20:56:21, 15/12/2020 (với giây trước): Comment 1

A red box highlights the 'Comment 1' entry. A blue box highlights the 'Xác nhận' (Confirm) button. A red line connects the 'Xác nhận' button to a navigation bar at the bottom right with arrows and a page number.

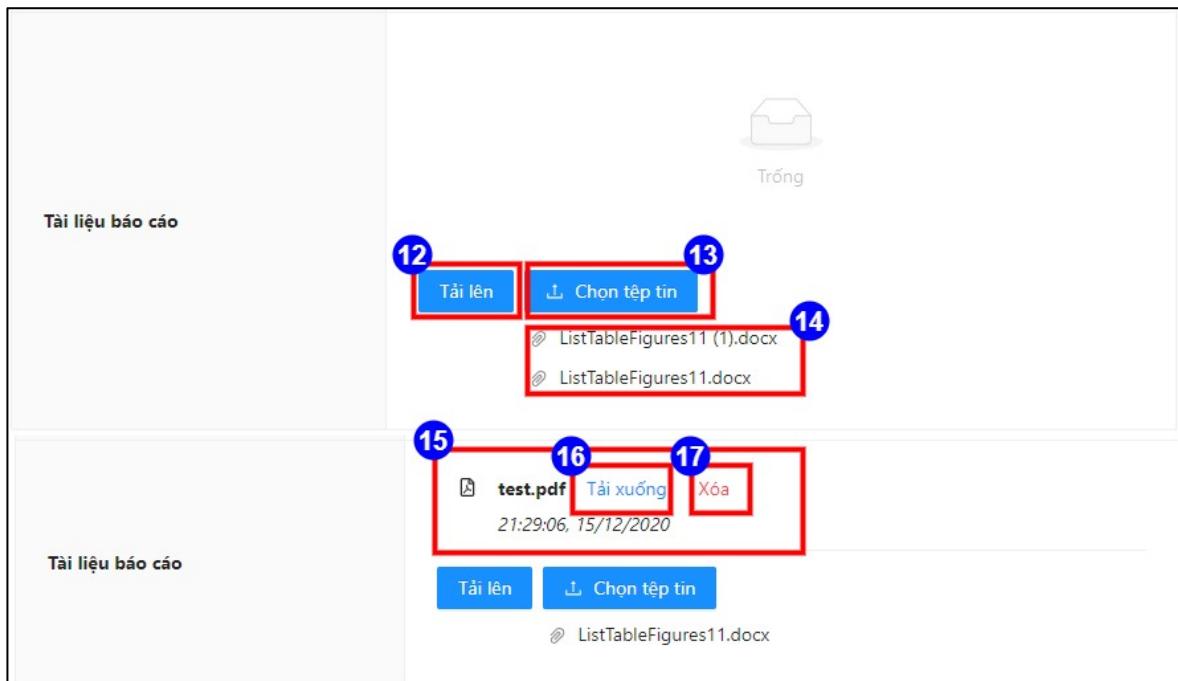


Figure 4.22. Semi-progress report tab

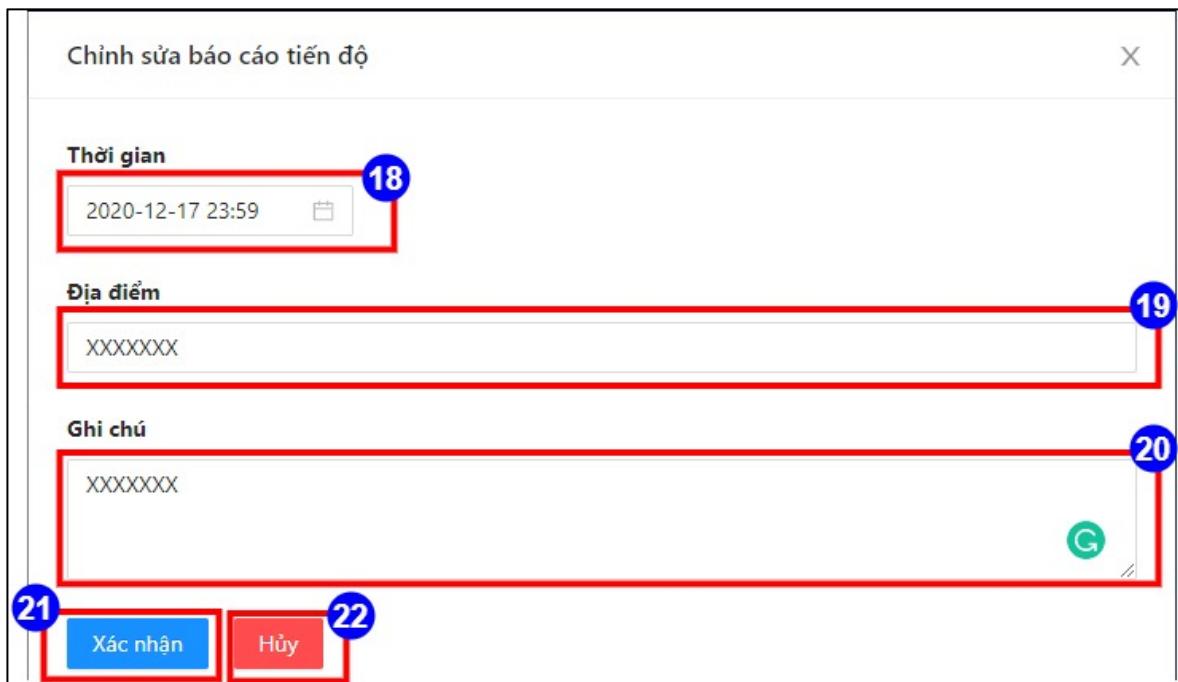


Figure 4.23. Edit semi-progress information drawer

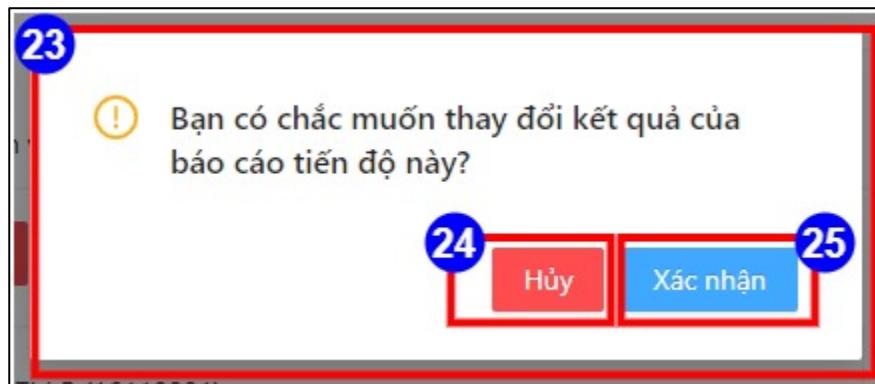


Figure 4.24. Change result confirm dialog



Figure 4.25. Delete comment confirm dialog



Figure 4.26. Delete document report confirm dialog

Table 4.28. Semi-progress report tab specification

Item	Descriptions	Operations

Item-1	Semi-progress report tab button	<ul style="list-style-type: none"> - When the phase of target thesis is semi-progress report and the status of target topic is “Chấp nhận”, Item-1 will display. - When the user clicks on Item-1, semi-progress report tab will display.
Item-2	Edit semi-progress report information button	<ul style="list-style-type: none"> - When login user is admin and the current phase of target topic is semi-progress report, Item-2 will display. - When target semi-progress report has result, Item-2 will not display. - When the user clicks on Item-2, the edit semi-progress information drawer will display.
Item-3	Semi-progress detail information	When target semi-progress report has result, Item-3 will not display.
Item-4	Accept review button	<ul style="list-style-type: none"> - When target semi-progress report has result, Item-4 will not display. - When the user clicks on Item-4, Item-20 will display
Item-5	Reject review button	When the user clicks on Item-5, Item-20 will display.
Item-6	Comment input field	
Item-7	Comment types selector	<ul style="list-style-type: none"> - When loggin user is student, Item-7 not display. - When the user clicks on Item-7, a comment types will display, including: <ul style="list-style-type: none"> + Private type + Public type
Item-8	Post comment button	When the user clicks on Item-8, Item-6 will empty, and Item-9 will be updated.

Item-9	Comment list	
Item-10	Delete comment button	When the user clicks on Item-10, Item-26 will display.
Item-11	Comment pagination button	When the user clicks on Item-11, the comment list will be displayed on Item-9 by page number.
Item-12	Submit upload	When the user clicks on Item-12, Item-14 disappear.
Item-13	Select upload file button	When the user clicks on Item-13, file upload dialog will display.
Item-14	Upload file list	
Item-15	Uploaded file list	
Item-16	Download uploaded file button	When the user clicks on Item-16, file will be downloaded.
Item-17	Delete uploaded file button	<ul style="list-style-type: none"> - When loggin user is student, Item-17 will display. - When the user clicks on Item-17, Item-29 will display.
Item-18	Datetime input field	When the user clicks on Item-18, datetime dialog will display.
Item-19	Place input field	
Item-20	Note input field	
Item-21	Submit edit button	When the user clicks on Item-21, drawer will close, and success notification will display.
Item-22	Cancel edit button	When the user clicks on Item-22, drawer will close.
Item-23	Change result confirm dialog	

Item-24	Cancel change result confirm dialog	When the user clicks on Item-24, Item-23 will disappear.
Item-25	Submit change result confirm dialog	When the user clicks on Item-25, Item-23 will disappear, and success notification will display.
Item-26	Delete comment confirm dialog	
Item-27	Delete comment confirm dialog	When the user clicks on Item-27, Item-26 will disappear.
Item-28	Submit delete comment confirm dialog	When the user clicks on Item-28, Item-26 will disappear, and success notification will display.
Item-29	Delete uploaded file confirm dialog	
Item-30	Delete uploaded file confirm dialog	When the user clicks on Item-30, Item-27 will disappear.
Item-31	Submit delete uploaded file confirm dialog	When the user clicks on Item-31, Item-27 will disappear, and success notification will display.

e. Review tab

In this section, items which similar items on above sections will not have specification.

Chapter 4. Software design

Chi tiết đề tài

1 Phản biện

2 Chính sửa

3 Thay đổi kết quả

4 Nhập bình luận tại đây...

Công khai Xác nhận

Sinh viên báo cáo

Nguyễn Thị B (16110001)
Nguyễn Văn C (16110001)

Thời gian

00:00:00, 06/12/2020

Địa điểm

XXXXXXX

Ngày tạo

21:58:03, 15/12/2020

Ngày cập nhật

21:58:03, 15/12/2020 (36 phút trước)

Ghi chú

XXXXXXX

Giảng viên phản biện

Administrator

Nhận xét của giảng viên phản biện

NULL

Kết quả

Chưa có

Tài liệu phản biện

Tài liệu báo cáo

Tải lên Chọn tệp tin

Tài liệu phản biện

Trống

Tài liệu phản biện

Tải lên Chọn tệp tin

5 Tải lên

6 Chọn tệp tin

7 ListTableFigures11 (1).docx
ListTableFigures11.docx

8 test.pdf

9 Tài xuống

10 Xóa

21:29:06, 15/12/2020

Tài liệu phản biện

Tải lên Chọn tệp tin

8 ListTableFigures11.docx

The screenshot displays the 'Review' tab of a software application. At the top, there's a navigation bar with links for 'Thông tin đề tài', 'Thông tin phê duyệt', 'Danh sách sinh viên đăng ký đề tài', 'Báo cáo tiến độ', and 'Phản biện'. The 'Phản biện' link is highlighted with a red box and a blue circle containing the number 1. Below the navigation bar, there are two buttons: 'Chỉnh sửa' (highlighted with a red box and blue circle 2) and 'Thay đổi kết quả' (highlighted with a red box and blue circle 3). A large red box encloses the main content area, which includes fields for 'Sinh viên báo cáo' (with two entries), 'Thời gian', 'Địa điểm', 'Ngày tạo', 'Ngày cập nhật', 'Ghi chú', 'Giảng viên phản biện' (Administrator), 'Nhận xét của giảng viên phản biện' (NULL), and 'Kết quả' (Chưa có). There are also sections for 'Tài liệu phản biện' and 'Tài liệu báo cáo' with upload buttons ('Tải lên') and selection buttons ('Chọn tệp tin'). The bottom section shows a list of uploaded files: 'ListTableFigures11 (1).docx' and 'ListTableFigures11.docx' (highlighted with a red box and blue circles 5, 6, and 7). Below this is a file named 'test.pdf' with download ('Tài xuống') and delete ('Xóa') buttons, timestamped '21:29:06, 15/12/2020' (highlighted with a red box and blue circles 8, 9, and 10). The entire interface is in Vietnamese.

Figure 4.27. Review tab

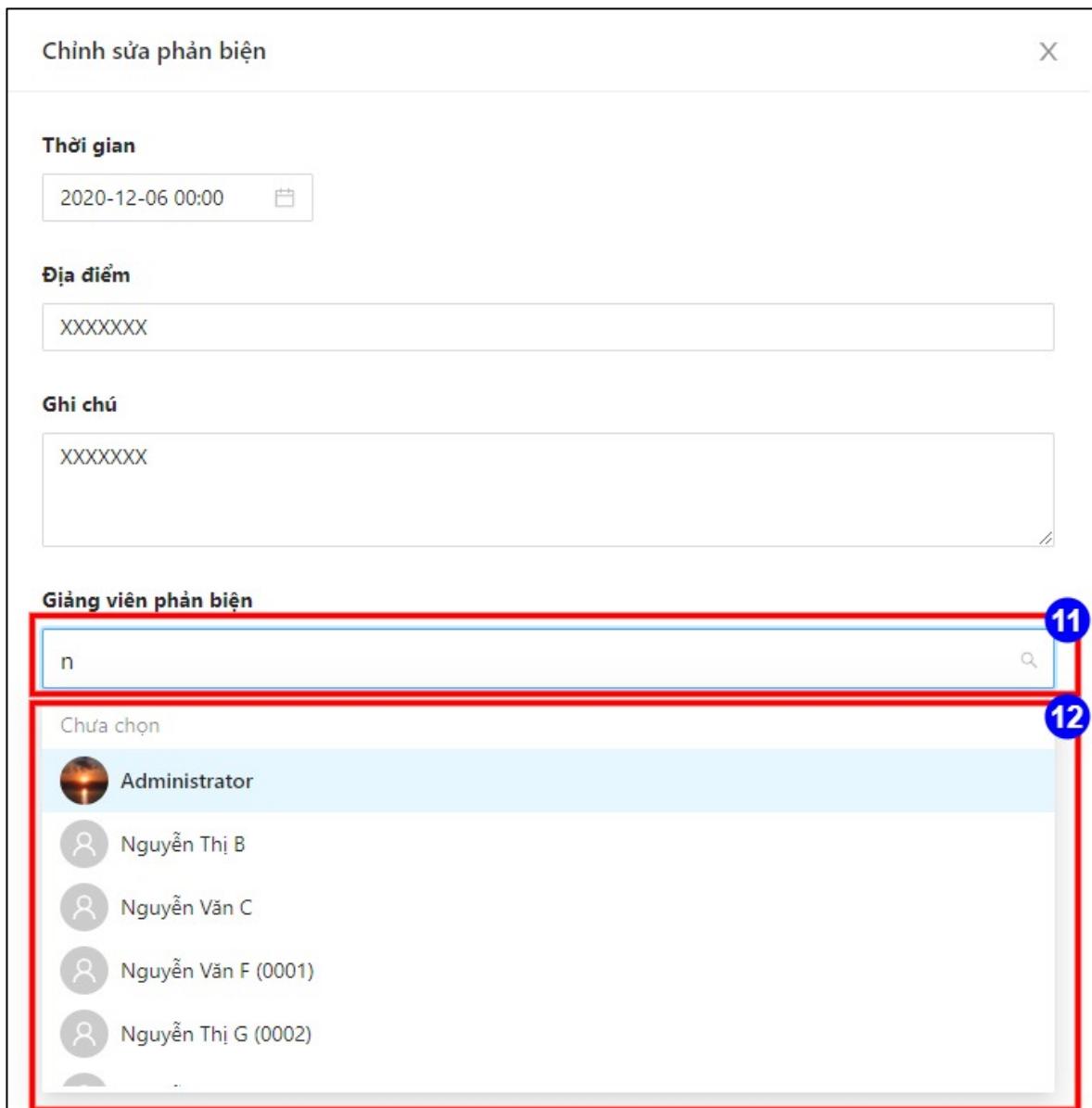


Figure 4.28. Edit review drawer

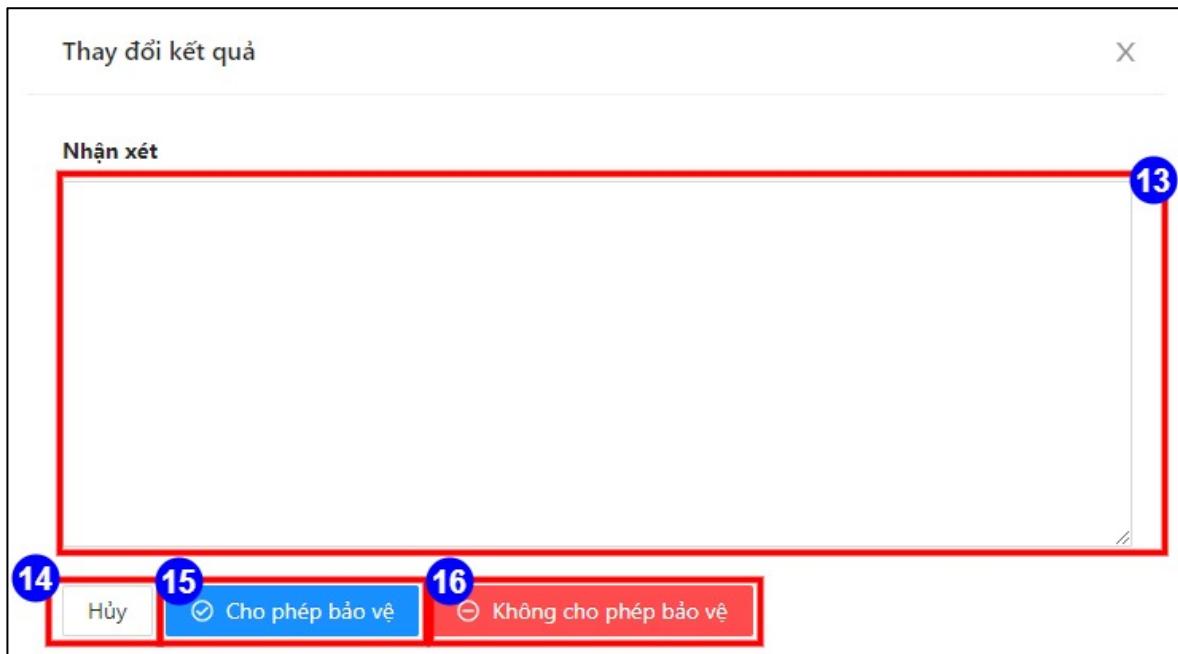


Figure 4.29. Change result confirm drawer

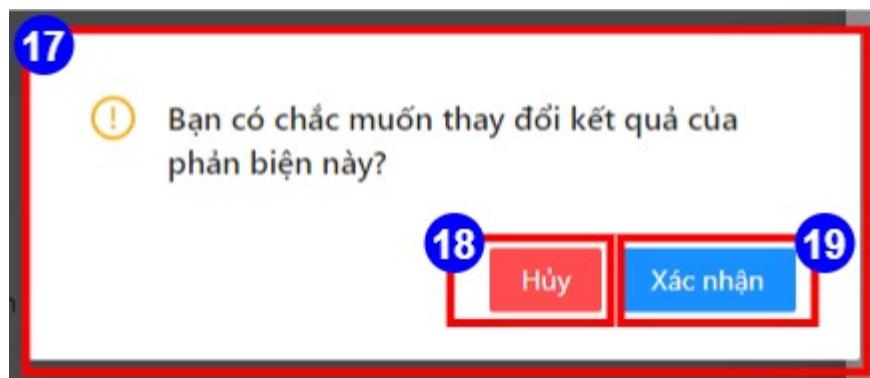


Figure 4.30. Change result confirm dialog

Table 4.29. Review tab specification

Item	Descriptions	Operations
Item-1	Review tab button	<ul style="list-style-type: none"> - When the phase of target thesis is review and the status of target topic is “Chấp nhận”, Item-1 will display. - When the user clicks on Item-1, review tab will display.

Item-2	Edit review information button	<ul style="list-style-type: none"> - When login user is admin and the current phase of target topic is review, Item-2 will display. - When target review has result, Item-2 will not display. - When the user clicks on Item-2, the edit review information drawer will display.
Item-3	Change result button	When the user clicks on Item-3, the change result drawer will display.
Item-4	Review detail information	
Item-5	Submit upload	<ul style="list-style-type: none"> - When loggin user is reviewer, Item-5 will display. - When the user clicks on Item-12, Item-14 disappear.
Item-6	Select upload file button	<ul style="list-style-type: none"> - When loggin user is reviewer, Item-5 will display. - When the user clicks on Item-13, file upload dialog will display.
Item-7	Upload file list	
Item-8	Uploaded file list	
Item-9	Download uploaded file button	When the user clicks on Item-16, file will be downloaded.
Item-10	Delete comment button	<ul style="list-style-type: none"> - When loggin user is reviewer, Item-5 will display. - When the user clicks on Item-10, the delete confirm dialog will display.
Item-11	Reviewer input field	When the user inputs value, Item-12 will display.

Item-12	Suggest reviewers	When the user clicks on Item-12, Item-12 disappear, and value display on Item-11.
Item-13	Comment of reviewer input field	
Item-14	Cancel change result	When the user clicks on Item-14, the drawer will disappear.
Item-15	Allow defense button	When the user clicks on Item-15, Item-17 will display
Item-16	Disallow defense button	When the user clicks on Item-15, Item-18 will display.
Item-17	Change result confirm dialog	
Item-18	Cancel change result confirm dialog	When the user clicks on Item-18, Item-17 will disappear.
Item-19	Submit change result confirm dialog	When the user clicks on Item-19, Item-17 will disappear, and success notification will display.

f. Defense tab

In this section, items which similar items on above sections will not have specification.

Chapter 4. Software design

Chi tiết đề tài

1 Thông tin đề tài 2 Thông tin phê duyệt 3 Danh sách sinh viên đăng ký đề tài 4 Báo cáo tiến độ 5 Phản biện 6 Bảo vệ Bảo vệ

Chỉnh sửa

Sinh viên báo cáo	Nguyễn Thị B (16110001) Nguyễn Văn C (16110001)
Thời gian	00:00:00, 06/12/2020
Địa điểm	XXXXXX
Ngày tạo	23:12:51, 15/12/2020
Ngày cập nhật	23:12:51, 15/12/2020 (11 giờ trước)
Ghi chú	XXXXXXXX
Hội đồng bảo vệ	Tên hội đồng: Hội đồng 1 Chủ tịch hội đồng: Administrator Giảng viên hướng dẫn: Nguyễn Văn F (0001) Ủy viên: Nguyễn Văn C
Tài liệu bảo vệ	<input type="button" value="Tải lên"/> <input type="button" value="Chọn tệp tin"/> Trống
Tài liệu báo cáo	<input type="button" value="Tải lên"/> <input type="button" value="Chọn tệp tin"/> Trống

Nhập bình luận tại đây...

Figure 4.31. Defense tab

Chỉnh sửa bảo vệ

Thời gian

2020-12-06 00:00

Địa điểm

XXXXXX

Ghi chú

XXXXXXX

Hội đồng bảo vệ

h

Chưa chọn

Hội đồng 1

Figure 4.32. Edit defense drawer

Table 4.30. Defense tab specification

Item	Descriptions	Operations
Item-1	Defense tab button	<ul style="list-style-type: none"> - When the phase of target thesis is defense and the status of target topic is “Chấp nhận”, Item-1 will display. - When the user clicks on Item-1, defense tab will display.
Item-2	Edit defense information button	<ul style="list-style-type: none"> - When login user is admin and the current phase of target topic is defense, Item-2 will display.

		- When the user clicks on Item-2, the edit defense information drawer will display.
Item-3	Review detail information	
Item-4	Defense council input field	When the user input value on Item-4, Item-5 will display.
Item-5	Suggest defense councils	When the user clicks on Item-5, Item-5 disappear, and value display on Item-4.

g. Result tab

In this section, items which similar items on above sections will not have specification.

Chapter 4. Software design

The screenshot shows a software application window with a title bar "Giảng viên phản biện" and a user icon "Administrator". Below the title bar, there is a red number "0". In the top right corner, there is a blue circular icon with the number "5" and a red rectangular button with the text "Chỉnh sửa". The main area contains a table with the following data:

Người chấm	Administrator	Ti lệ	Số điểm																								
Ghi chú	NULL																										
Ngày tạo	10:54:11, 16/12/2020	Ngày cập nhật	10:54:11, 16/12/2020 (3 phút trước)																								
Điểm	<table border="1"><thead><tr><th>Tiêu chí</th><th>Ti lệ</th><th>Số điểm</th></tr></thead><tbody><tr><td>Tính thực tiễn của đề tài, sự hiểu biết về vấn đề nghiên cứu</td><td>10%</td><td>NULL</td></tr><tr><td>Tính đúng đắn và hợp lý của phương pháp nghiên cứu, của thiết kế, của giải pháp được nêu ra trong luận văn. Mức độ hoàn thiện của sản phẩm, mức độ hoàn thành công việc của sinh viên</td><td>40%</td><td>NULL</td></tr><tr><td>Chất lượng của bài thuyết trình</td><td>10%</td><td>NULL</td></tr><tr><td>Khả năng đọc sách ngoại ngữ tham khảo</td><td>5%</td><td>NULL</td></tr><tr><td>Khả năng tổng hợp kiến thức, viết luận văn</td><td>10%</td><td>NULL</td></tr><tr><td>Chất lượng về hình thức của luận văn (Cấu trúc, định dạng, chính tả, ...)</td><td>5%</td><td>NULL</td></tr><tr><td>Chất lượng trả lời các câu hỏi của hội đồng</td><td>20%</td><td>NULL</td></tr></tbody></table>	Tiêu chí	Ti lệ	Số điểm	Tính thực tiễn của đề tài, sự hiểu biết về vấn đề nghiên cứu	10%	NULL	Tính đúng đắn và hợp lý của phương pháp nghiên cứu, của thiết kế, của giải pháp được nêu ra trong luận văn. Mức độ hoàn thiện của sản phẩm, mức độ hoàn thành công việc của sinh viên	40%	NULL	Chất lượng của bài thuyết trình	10%	NULL	Khả năng đọc sách ngoại ngữ tham khảo	5%	NULL	Khả năng tổng hợp kiến thức, viết luận văn	10%	NULL	Chất lượng về hình thức của luận văn (Cấu trúc, định dạng, chính tả, ...)	5%	NULL	Chất lượng trả lời các câu hỏi của hội đồng	20%	NULL		
Tiêu chí	Ti lệ	Số điểm																									
Tính thực tiễn của đề tài, sự hiểu biết về vấn đề nghiên cứu	10%	NULL																									
Tính đúng đắn và hợp lý của phương pháp nghiên cứu, của thiết kế, của giải pháp được nêu ra trong luận văn. Mức độ hoàn thiện của sản phẩm, mức độ hoàn thành công việc của sinh viên	40%	NULL																									
Chất lượng của bài thuyết trình	10%	NULL																									
Khả năng đọc sách ngoại ngữ tham khảo	5%	NULL																									
Khả năng tổng hợp kiến thức, viết luận văn	10%	NULL																									
Chất lượng về hình thức của luận văn (Cấu trúc, định dạng, chính tả, ...)	5%	NULL																									
Chất lượng trả lời các câu hỏi của hội đồng	20%	NULL																									

Figure 4.33. Result tab

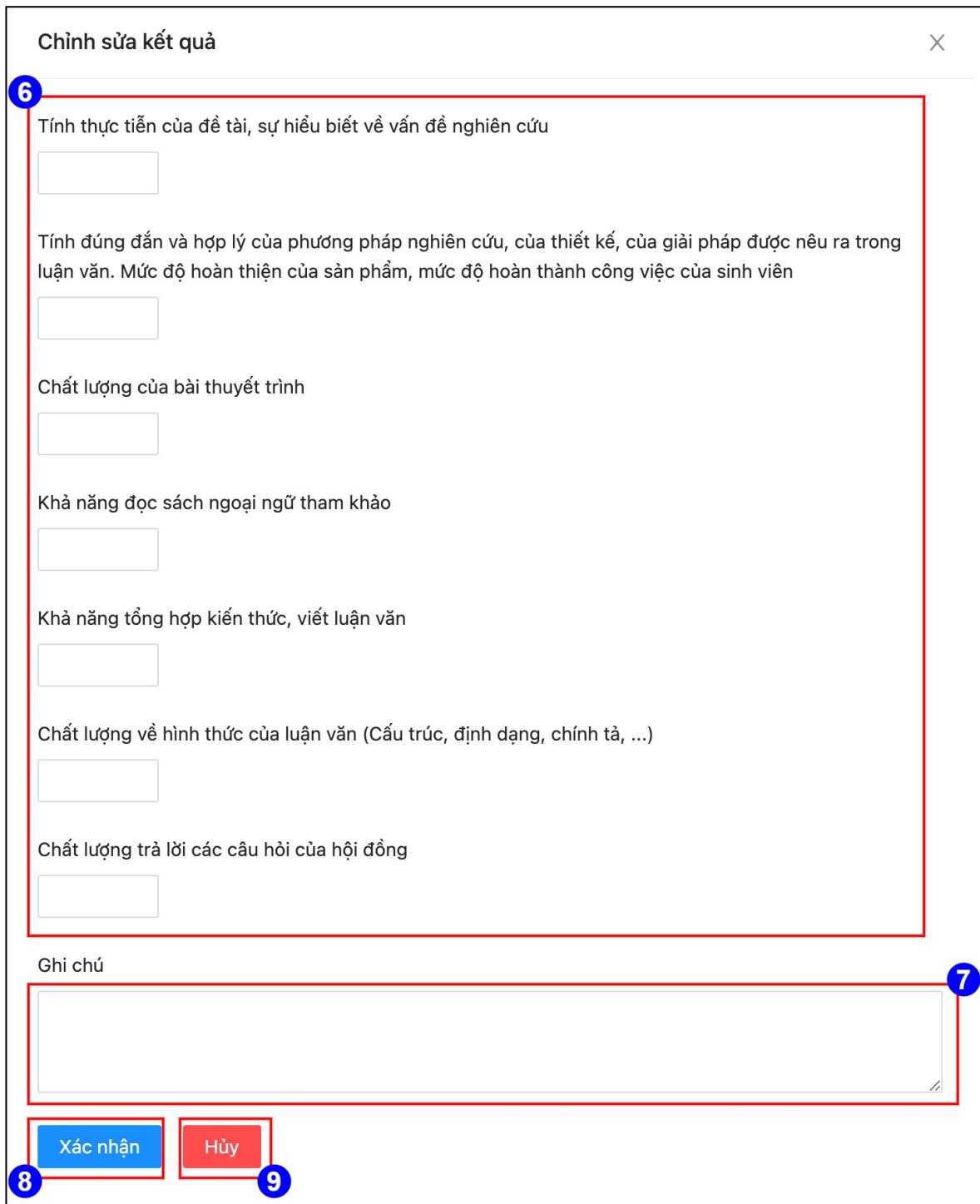


Figure 4.34. Edit result drawer

Table 4.31. Result tab specification

Item	Descriptions	Operations

Item-1	Result tab button	<ul style="list-style-type: none"> - When the phase of target thesis is publish result and the status of target topic is “Chấp nhận”, Item-1 will display. - When the user clicks on Item-1, result tab will display.
Item-2	Student list	When the user clicks on Item-2, Item-3 will update by target student.
Item-3	Result list	When the user clicks on Item-3, Item-4 will display by target result.
Item-4	Result detail information	When loggin user is not owner of result, specify result will have “NULL” value (except summary result).
Item-5	Edit result button	<ul style="list-style-type: none"> - When loggin user is not owner of result, Item-5 will not display. - When the user clicks on Item-5, the edit result drawer will display.
Item-6	The field enters the results according to each criterion	
Item-7	Note input field	
Item-8	Submit edit result button	When the user clicks on Item-8, drawer will disappear, and success notification will display.
Item-9	Cancel edit result button	When the user clicks on Item-9, drawer will disappear.

CHAPTER 5. INSTALLATION AND TESTING

5.1. Installation

Download source code from: <https://github.com/doonpy/grasis>

5.1.1. Production environment

5.1.1.1. Libraries and software need

Table 5.1. Libraries and software need to be installed in production

No	Library/Software	Download Url
1	NodeJS 14.x or later (include Yarn and NPM)	https://nodejs.org
2	MySQL Community Server 5.7	https://downloads.mysql.com/archives/community/
3	Redis 6.0.9 or later	https://redis.io

5.1.1.2. Step by step to deploy

- Step 1: Create database with name “grasis” in MySQL Community Server.
- Step 2: Open file **api/config/production.env** and config following params:
 - + JAWSDB_URL: Database connection string.
 - + REDISCLOUD_URL: Redis connection string.
 - + AWS_REGION: AWS region (default us-east-1).
 - + AWS_ACCESS_KEY_ID: AWS access key for AWS S3 service.
 - + AWS_SECRET_ACCESS_KEY: AWS secret access key for AWS S3 service.
 - + AWS_BUCKET_NAME: Bucket name of AWS S3 service.
- Step 3: Open file **web/.env.production** and config following params:

- + NEXT_PUBLIC_API_SERVER: API sever address.
- Step 4: Run shell script file **deploy/production.sh** to deploy.

5.1.2. Development environment

5.1.2.1. Libraries and software need

Table 5.2. Libraries and software need to be installed in development

No	Library/Software	Download Url
1	NodeJS 14.x or later (include Yarn and NPM)	https://nodejs.org
2	MySQL Community Server 5.7	https://downloads.mysql.com/archives/community/
3	Redis 6.0.9 or later	https://redis.io
4	NestJS CLI package	https://docs.nestjs.com/cli/overview
5	NextJS CLI package	https://nextjs.org/docs/api-reference/cli

5.1.2.2. Step by step to configuration

- Step 1: Create database with name “grasis” in MySQL Community Server.
- Step 2: Open file **api/config/local.env** and config following params:
 - + JAWSDB_URL: Database connection string.
 - + REDISCLOUD_URL: Redis connection string.
- Step 3: Open file **web/.env.production** and config following params:
 - + NEXT_PUBLIC_API_SERVER: API sever address.

5.1.2.3. Command cheatsheet

Table 5.3. List of command for install and run projects

No	Command	Description

Chapter 5. Installation and testing

1	yarn run install	Install dependencies.
2	yarn run build	Build source code to production code.
3	yarn --cwd api start:dev	Start API sever for development
4	yarn --cwd api start:prod	Start API server for production (require build command before).
5	yarn --cwd web start:dev	Start web application for development
6	yarn --cwd web start:prod	Start web application for production (require build command before).

5.2. Testing

5.2.1. Thesis

5.2.1.1. Function create thesis

Table 5.4. Test case function create thesis

Test Case Description	Create thesis – Positive test case	Test Priority	High
Pre-Requisite	- Valid thesis information. - Users has lecturer type. - Users has student type.	Post-Requisite	NA

Test Execution Steps:

No	Action	Inputs	Expected Output	Test Result	Test Comments
1	Login to system	The correct username and password	Return to the account screen	Passed	
2	Click add thesis button		Redirect to the create thesis screen	Passed	
3	Input thesis information	The correct thesis information	Not display validation error messages	Passed	

4	Click “Xác nhận” button		Thesis was created and redirect to thesis detail screen.	Passed	
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5.2.1.1. Function active thesis

Table 5.5. Test case function active thesis

Test Case Description	Active thesis – Positive test case	Test Priority	High
Pre-Requisite	Thesis has status is inactive	Post-Requisite	NA

Test Execution Steps:

No	Action	Inputs	Expected Output	Test Result	Test Comments
1	Login to system	The correct username and password	Return to the account screen	Passed	
2	Click on thesis detail button		Redirect to the thesis detail screen	Passed	
3	Click on “Kích hoạt” button		Confirm dialog display	Passed	
4	Click “Xác nhận” button		Thesis was activated and confirm dialog disappear.	Passed	

5.2.2. Topic

5.2.2.1. Function create topic

Table 5.6. Test case function create topic

Test Case Description	Create topic – Positive test case		Test Priority	High
Pre-Requisite	Valid topic information		Post-Requisite	NA
Test Execution Steps:				
No	Action	Inputs	Expected Output	Test Result
1	Login to system	The correct username and password	Return to the account screen	Passed
2	Click on thesis detail button		Redirect to the create thesis screen	Passed
3	Click on topic list tab		Topic list tab display	Passed
4	Click “Tạo đề tài” button		Create topic drawer display	Passed
5	Input topic information	The correct topic information	Not display validation error messages	Passed

6	Click “Xác nhận” button		Topic was created and redirect to topic detail screen	Passed	
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5.2.2.2. Function approval topic

Table 5.7. Test case function approval topic

Test Case Description	Approval topic – Positive test case		Test Priority	High
Pre-Requisite	Topic has status is “Mới”		Post-Requisite	NA
Test Execution Steps:				
No	Action	Inputs	Expected Output	Test Result
1	Login to system	The correct username and password	Return to the account screen	Passed
2	Click on thesis detail button		Redirect to the thesis detail screen	Passed
3	Click on topic list tab		Topic list tab display	Passed
4	Click on topic detail button		Redirect to the topic detail screen	Passed

5	Click on approval tab		Approval tab display	Passed	
6	Click “Yêu cầu phê duyệt” button		Confirm dialog display	Passed	
7	Click “Xác nhận” button		Confirm dialog disappear and status of target topic change to “Đang được phê duyệt”		

5.2.2.1. Function upload report document

Table 5.8. Test case function upload report document

Test Case Description	Upload report document – Positive test case	Test Priority	High
Pre-Requisite	<ul style="list-style-type: none"> - Thesis has current phase is semi-progress report. - Topic has status is “Chấp nhận” and has at least one student doing it. - Semi-progress report of target topic has result is “Chưa có”. - A file has extension is .doc or .pdf 	Post-Requisite	NA
Test Execution Steps:			

No	Action	Inputs	Expected Output	Test Result	Test Comments
1	Login to system	The correct username and password	Return to the account screen	Passed	
2	Click on thesis detail button		Redirect to the thesis detail screen	Passed	
3	Click on topic list tab		Topic list tab display	Passed	
4	Click on topic detail button		Redirect to the topic detail screen	Passed	
5	Click on semi-progress report tab		Semi-progress report tab display	Passed	
6	Click “Chọn tệp tin” button		File selector display	Passed	
7	Select file which is prepared		Selected file display in selected file list	Passed	
8	Click “Tải lên” button		Selected file was uploaded and success notification display	Passed	

CHAPTER 6. CONCLUSIONS AND DEVELOPMENT STRATEGY

6.1. Results

The author researched and concluded the current graduate thesis process of the Faculty of High Quality Training. From that, understood and stated current inadequacies and building an information technology system to solve these.

Beside that, the author gets knowledge about the communication, authentication, and authorization process between API server and web application through REST APIs and JWT token.

Through building the server API, the author gains knowledge of database design, REST APIs, authentication, and authorization mechanisms. In addition, the author also understands the NestJS knowledge to build a stable API server with high scalability and good load balancing. In addition, for the server API to have high response speed, understanding and using Redis as a database caching has contributed significantly.

Moreover, the author also understands the knowledge of NextJS and applies it to build graduation thesis organization application on web platform. Application is based on the concept of SPA - Single Page Application makes the user experience better because it has limited the need to reload the page. With the support of the Static Generation Rendering (SGR) rendering engine, the responsiveness and performance of the application are always of good quality in any infrastructure condition. In addition, the application uses the Ant Design design library, a library commonly used in real-world websites. Since then, the interface of the application is friendly, easy to use and more eye-catching, but it takes less time to design and can be reused many times.

Finally, this project also gives me the knowledge of continuous integration (CI) and its use in project development. CI makes the development process faster and more stable. The change of source will affect the currently operating product, so applying CI in the development process helps early and timely detection of risks and errors that may occur when the product is put into operation. From there, it helps to save costs and manpower in software development.

6.3. Restrictions

- Web application UX is still limited, making it inconvenient for users.
- Not yet supported on mobile devices.
- The source code is not optimized, and the processing logic is complicated.

6.4. Development strategy

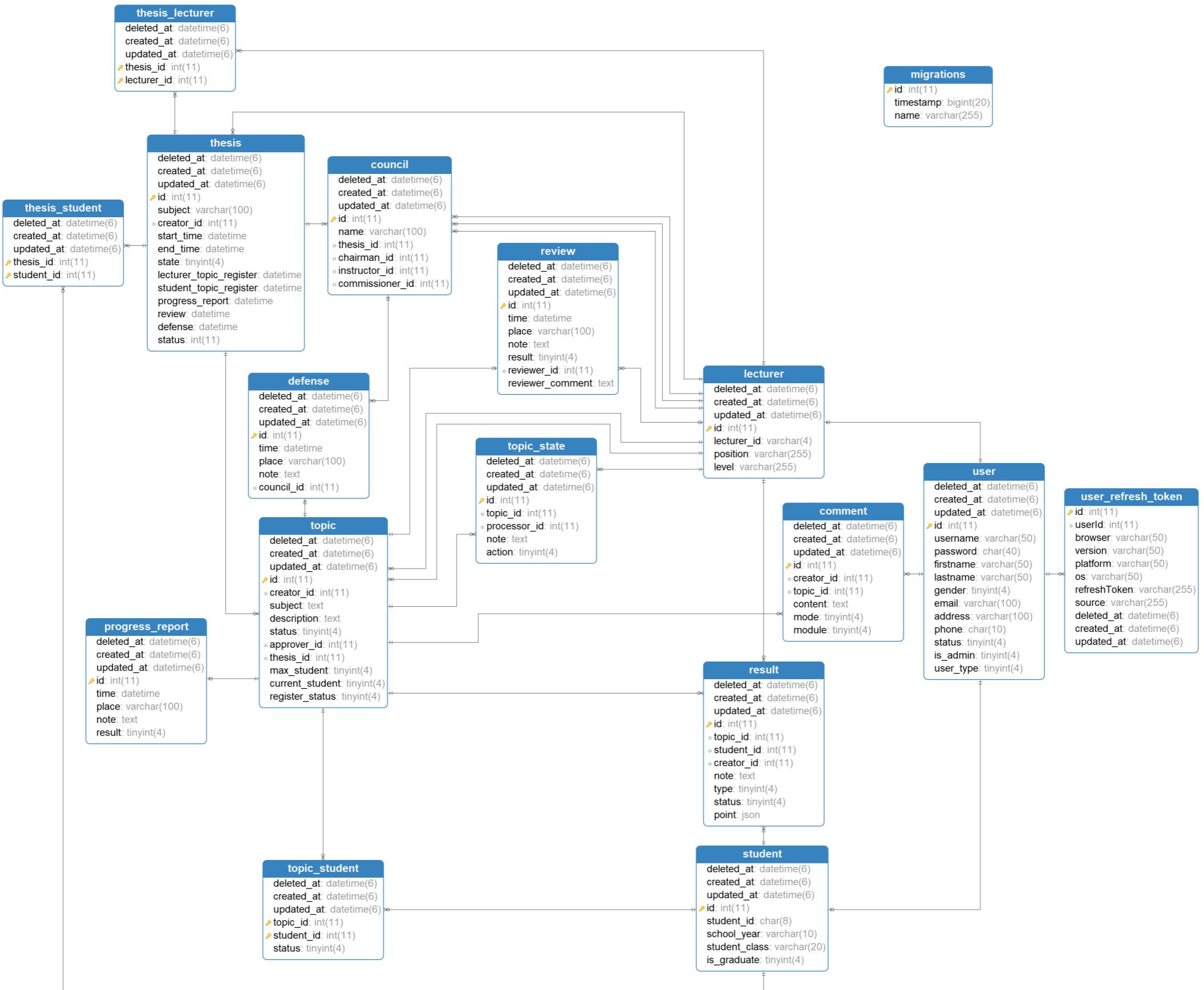
- Support on mobile devices.
- Improve UI/UX of web application.
- Implement new features such as notification, progress tracking between instructor and student, system settings, personal settings, import and export data, ...
- Link to university database for easy management and synchronization.

REFERENCES

- [1] MySQL. (2020). Overview of the MySQL Database Management System. Retrieved from: <https://dev.mysql.com/doc/refman/8.0/en/what-is.html> [Accessed 07 Dec. 2020].
- [2] Tutorialspoint. (2020). MySQL – Introduction. Retrieved from: <https://www.tutorialspoint.com/mysql/mysql-introduction.htm> [Accessed 07 Dec. 2020].
- [3] Redis. (2020). Introduction to Redis. Retrieved from: <https://redis.io/topics/introduction> [Accessed 07 Dec. 2020].
- [4] Wikipedia. (2020). Redis – History section. Retrieved from: <https://en.wikipedia.org/wiki/Redis#History> [Accessed 07 Dec. 2020].
- [5] Tutorialspoint. (2020). Redis – Overview. Retrieved from: https://www.tutorialspoint.com/redis/redis_overview.htm [Accessed 07 Dec. 2020].
- [6] Wikipedia. (2020). Object – relational mapping. Retrieved from: https://en.wikipedia.org/wiki/Object-relational_mapping [Accessed 07 Dec. 2020].
- [7] TypeORM. (2020). TypeORM - Amazing ORM for TypeScript and JavaScript (ES7, ES6, ES5). Supports MySQL, PostgreSQL, MariaDB, SQLite, MS SQL Server, Oracle, WebSQL databases. Works in NodeJS, Browser, Ionic, Cordova and Electron platforms. Retrieved from: <https://typeorm.io> [Accessed 07 Dec. 2020].
- [8] Tutorialspoint. (2020). Node.js - Introduction. Retrieved from: https://www.tutorialspoint.com/nodejs/nodejs_introduction.htm [Accessed 08 Dec. 2020].
- [9] Wikipedia. (2020). NodeJS – History section. Retrieved from: <https://en.wikipedia.org/wiki/Node.js#History> [Accessed 08 Dec. 2020].
- [10] Tutorialspoint. (2020). TypeScript - Overview. Retrieved from: https://www.tutorialspoint.com/typescript/typescript_overview.htm [Accessed 08 Dec. 2020].
- [11] Wikipedia. (2020). TypeScript – History section. Retrieved from: <https://en.wikipedia.org/wiki/TypeScript#History> [Accessed 08 Dec. 2020].
- [12] NestJS. (2020). Documentation | NestJS - A progressive Node.js framework. Retrieved from: <https://docs.nestjs.com> [Accessed 08 Dec. 2020].
- [13] Tutorialspoint. (2020). ReactJS - Overview. Retrieved from: https://www.tutorialspoint.com/reactjs/reactjs_overview.htm [Accessed 08 Dec. 2020].

- [14] Wikipedia. (2020). React – History section. Retrieved from: [https://en.wikipedia.org/wiki/React_\(web_framework\)#History](https://en.wikipedia.org/wiki/React_(web_framework)#History) [Accessed 08 Dec. 2020].
- [15] NextJS. (2020). Create a Next.js App | Learn Next.js. Retrieved from: <https://nextjs.org/learn/basics/create-nextjs-app> [Accessed 10 Dec. 2020].
- [16] Flavio Copes. (2019). The Next.js Handbook. Retrieved from: <https://www.freecodecamp.org/news/the-next-js-handbook> [Accessed 10 Dec. 2020].
- [17] Ant Design. (2020). Ant Design of React. Retrieved from: <https://ant.design/docs/react/introduce> [Accessed 10 Dec. 2020].
- [18] Wikipedia. (2020). Docker (software). Retrieved from: [https://en.wikipedia.org/wiki/Docker_\(software\)](https://en.wikipedia.org/wiki/Docker_(software)) [Accessed 12 Dec. 2020].
- [19] CodeShip. (2020). Continuous Integration Essentials. Retrieved from: <https://codeship.com/continuous-integration-essentials> [Accessed 12 Dec. 2020].
- [20] GitHub. (2020). Product – GitHub Actions. Retrieved from: <https://docs.github.com/en/free-pro-team@latest/actions> [Accessed 12 Dec. 2020].
- [21] AWS. (2020). Amazon S3. Retrieved from: <https://aws.amazon.com/s3> [Accessed 12 Dec. 2020].
- [22] Heroku. (2020). The Heroku Platform. Retrieved from: [Accessed 12 Dec. 2020].
- [23] Postman. (2020). Postman | The Collaboration Platform for API Development. Retrieved from: <https://www.postman.com> [Accessed 12 Dec. 2020].

APPENDIX 1: DATABASE DIAGRAM



APPENDIX 2: SCREEN FLOW

