Tan Tao University
School of Engineering
Course: Introduction to Database

Members

Backend
Vương Thảo Nguyên - 1902060
Lê Quang Thái - 1902097
Frontend
Nguyễn Tấn Thanh Giang - 1805015
K'Tuýts - 1902002

Instructor: Dr. Cao Tien Dung

E-LOGBOOK WEB SERVICE REPORT

Table of Contents

Introduction **3**

Project overview **4**

Overall features 4

School administrators 4

Teachers 4

Students 4

Website's design 4

Languages, Frameworks, Libraries, and Environment 5

Backend **9**

Database 9

Security 12

Deployment 17

Frontend **19**

Aims and Objectives 19

Tutorial for Graphical Interface Interactions 20

Admin 20

School 20

Teacher 31

Student 36

References **40**

Introduction

Our project focuses on building an e-logbook system for secondary and high schools in Vietnam. The expected output is a website that supports storing not only class records but also other useful information, such as timetables or users' personal information.

The idea quickly comes into action because of the contemporary situation: most schools in Vietnam are closed due to the Covid19 pandemic [Le 2021]. Thus, the demand for having an online system for storing class records also arises. But besides the current conditions, the paper version is already hard for both storing and retrieving information. Therefore, throughout the project, we want to develop a better system when compared with the traditional management method: eLogbook website application for secondary and high school.

Libraries and Frameworks used in this project include Nodejs, express js, react js and MYSQL, Bearer authentication.

Project overview

1. Overall features

The e-logbook web service is designed for logbook management by a system of several schools. Here we propose an overview of functions that will be supported in this service. In detail:

- **School administrators**
  + The school's administrator account will be created by the admin with username, password, and some basic background information. Under the role of the school administrator, they will be able to construct the system of their schools like creating courses, lessons, teacher's accounts, ...
- **Teachers**
  + The teacher's account will be created by their specific school administrator. As a teacher, users can create and manage logbooks, manage information of students, …
- **Students**
  + Account will be created by the school administrator like the teachers' account. Student users can get timetables and check logbooks.

2. Website's design

Server-Side Rendering (SSR) or Client Side Rendering (CSR)?

- **SSR**: With old server-side rendering solutions, you built a web page—with PHP for example—the server compiled everything, included the data and delivered a fully populated HTML page to the client. It was fast and effective. But… every time you navigated to another route, the server had to do the work all over again:

Get the PHP file, compile it, and deliver the HTML, with all the CSS and JS delaying the page load to a few hundred ms or even whole seconds.

- **CSR**: Server-side rendering is the most common method for displaying information onto the screen. It works by converting HTML files in the server into usable information for the browser. Whenever you visit a website, your browser makes a request to the server that contains the contents of the website [Vega 2017]. The request usually only takes a few milliseconds, but that ultimately depends on a multitude of factors:
    + Your internet speed
    + The location of the server
    + How many users are trying to access the site
    + How optimized the website is, to name a few

☐ **The team decision: CSR.**

- **Pros:**
    - Rich site interactions
    - Fast website rendering after the initial load.
    - Great for web applications.
    - Robust selection of JavaScript libraries.
- **Cons:**
    - Low SEO (Search Engine Optimization) if not implemented correctly.
    - The initial load might require more time.
    - The first load requires large space

3. Languages, Frameworks, Libraries, and Environment

- **Node.js** is the greatest tool for building real-time web applications. It provides cross-platform applications which run easily on any web. So you basically don’t

need anything extra for running up a node application ["Express/Node introduction - Learn web development | MDN", 2021]. You only need to make one.

★ **Benefits of Node.js:**

+ Great performance! Node was designed to optimize throughput and scalability in web applications and is a good solution for many common web-development problems.
+ Code is written in "plain old JavaScript", which means that less time is spent dealing with "context shift" between languages when you're writing both client-side and server-side code.
+ JavaScript is a relatively new programming language and benefits from improvements in language design when compared to other traditional web-server languages (e.g. Python, PHP, etc.).
+ The node package manager (NPM) provides access to hundreds of thousands of reusable packages. It also has best-in-class dependency resolution and can also be used to automate most of the build toolchain.
+ Node.js is portable. It is available on Microsoft Windows, macOS, Linux, Solaris, FreeBSD, OpenBSD, WebOS, and NonStop OS.
+ It has a very active third-party ecosystem and developer community, with lots of people who are willing to help.

- **Express** is the most popular *Node* web framework and is the underlying library for a number of other popular Node web frameworks. It provides mechanisms to:
  + Write handlers for requests with different HTTP verbs at different URL paths (routes).
  + Integrate with "view" rendering engines in order to generate responses by inserting data into templates.
  + Set common web application settings like the port to use for connecting, and the location of templates that are used for rendering the response.

+ Add additional request processing "middleware" at any point within the request handling pipeline.

★ **Why use Express?** Express.js supports JavaScript which is a widely used language that is very easy to learn and is also supported everywhere. With the help of Express.js, we can easily build different kinds of web applications in a short period of time. Express.js provides simple routing for requests made by clients. It also provides a middleware that is responsible for making decisions to give the correct responses for the request made by the client

- **Javascript** is a text-based programming language used both on the client-side and server-side that allows you to make web pages interactive. Where HTML and CSS are languages that give structure and style to web pages, JavaScript gives web pages interactive elements that engage a user.

★ Reason to use: Javascript was created to work in browsers, and React or Node.js also use JavaScript.

- **React** is a library for building user interfaces. React is not a framework – it's not even exclusive to the web. It's used with other libraries to render to certain environments. For instance, React Native can be used to build mobile applications.

To build for the web, developers use React in tandem with ReactDOM. React and ReactDOM is often discussed in the same spaces as — and utilized to solve the same problems as — other true web development frameworks. When we refer to React as a "framework", we're working with that colloquial understanding.

★ **Why use React?**

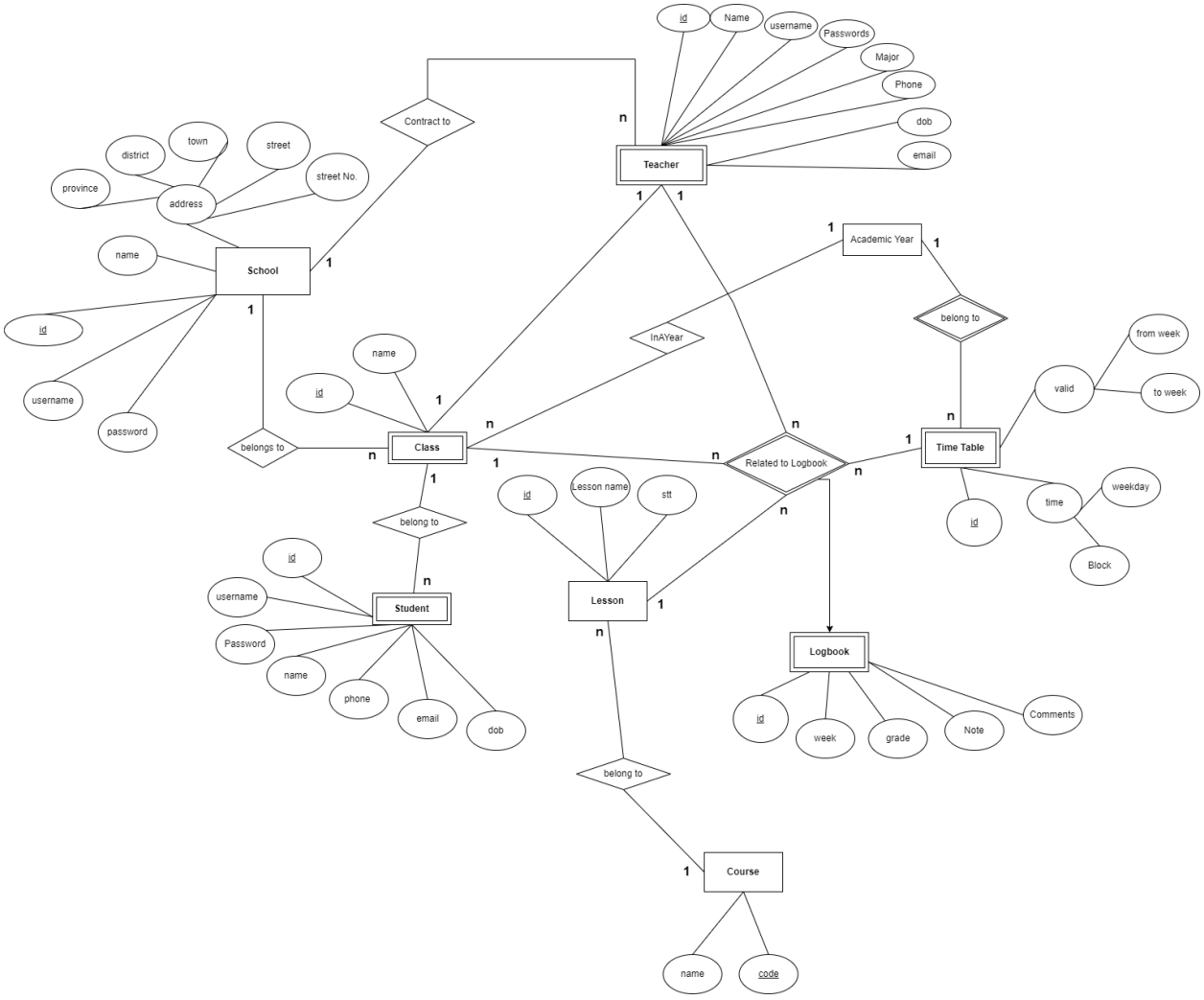
- Simplicity
- Easy to learn
- Performance

    - Testability
- **ORM:** Sequelize is a promise-based Node.js ORM for Postgres, MySQL, MariaDB, SQLite, and Microsoft SQL Server. It features solid transaction support, relations, eager and lazy loading, read replication, and more.
    ★ **Why use ORM**: Sequelize? Because our project uses MySQL to store data, it works well with ORM: Sequelize, with the help of ORM, we do not need to write raw queries → easy to read.
- **Docker** is a Linux-based, open-source containerization platform that developers use to build, run, and package applications for deployment using containers.

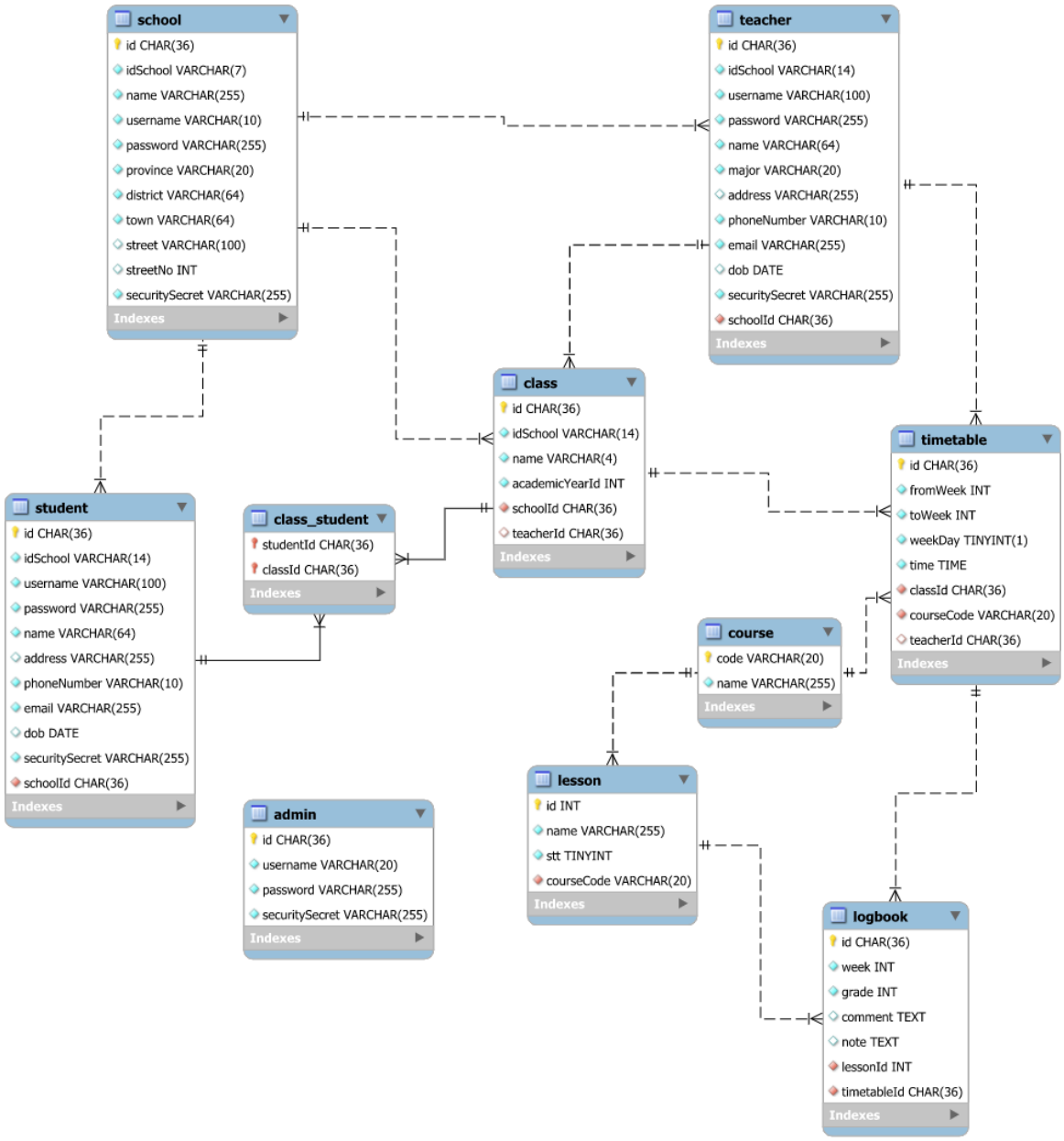
Backend

1. Database

- **Design**:
    - **ER diagram**



→ **Convert it to the MYSQL database**



The database design satisfies **the fourth normal form (4NF):**

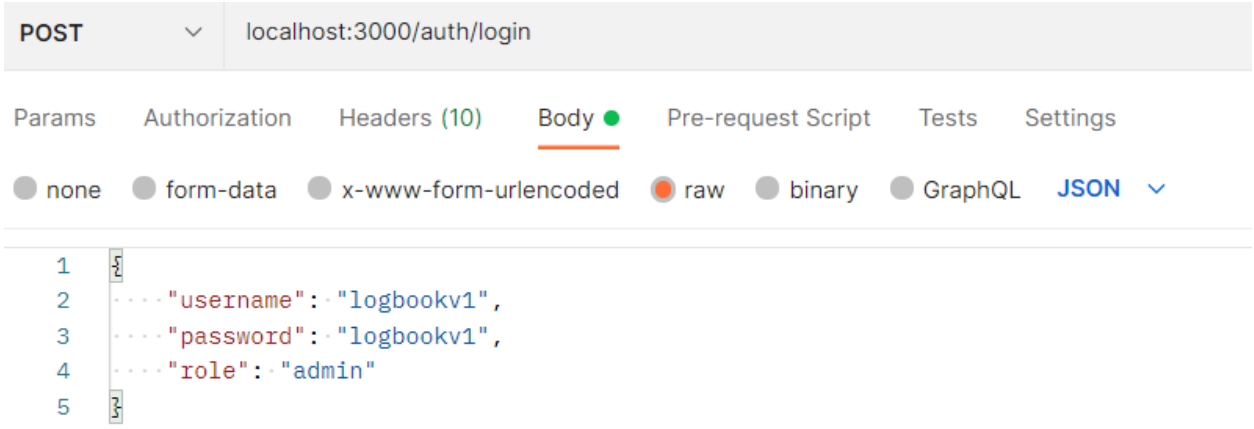
- Each column must contain an atomic value.
- A column should contain values that are of the same type.
- Each column should have a unique name.
- The order in which data is saved doesn't matter.
- No partial dependencies (2NF).
- No transitive dependencies (3NF).

- For any dependency A → B, A should be a super key (BCNF).
- No multivalued dependencies (4NF).

For the tables School, Teacher, and Student, **id, idSchool, (phone number), and username** are the candidate keys (because of its uniqueness). Choosing id to be the primary key of these tables because of its nature: It's hard to guess other primary keys even when knowing the id of some users. Although knowing one's phone number is useless for guessing the other's, the field is not secure enough. The other two fields, idSchool, and username have a pattern in them. Therefore, **the most appropriate one to use as the primary key is id - which is made of a random string consisting of 36 characters**.

Users are not stored in one place but are grouped into different tables based on their roles (admin, school, teacher, student).

- **Benefits: Specification**. Fewer rows to search on for each target user. Also, don't need to use an additional field "role" to distinguish between these different target users if we group them into just one table.
- **Drawbacks:** Users are stored separately → need to know the target user to search for the information → find a way to provide this information for every request to the server → The chosen **strategy:** sending the type of user when login, then saving this piece of information in the token so that we can know the identity of the user (the table which user belong to and the id) for every next request.
    - **Login**



- **Save the type of user in the token**

```
const sign = async (userId, role, signOption, userSecret) => {
  return jwt.sign(
    { sub: userId, role: role },
    signOption.SECRET + userSecret,
    { expiresIn: signOption.EXPIRED, }
  );
};
```

- **Use this information to find the specific table.**

```
const getUserStrategy = {
  admin: async (id) => {
    const user = await db.admin.findOne({ where: { id } });
    return user.toJSON();
  },
  school: async (id) => {
    const user = await db.school.findOne({ where: { id } });
    return user.toJSON();
  },
  teacher: async (id) => {
    const user = await db.teacher.findOne({ where: { id } });
    return user.toJSON();
  },
  student: async (id) => {
    const user = await db.student.findOne({ where: { id } });
    return user.toJSON();
  },
};
```

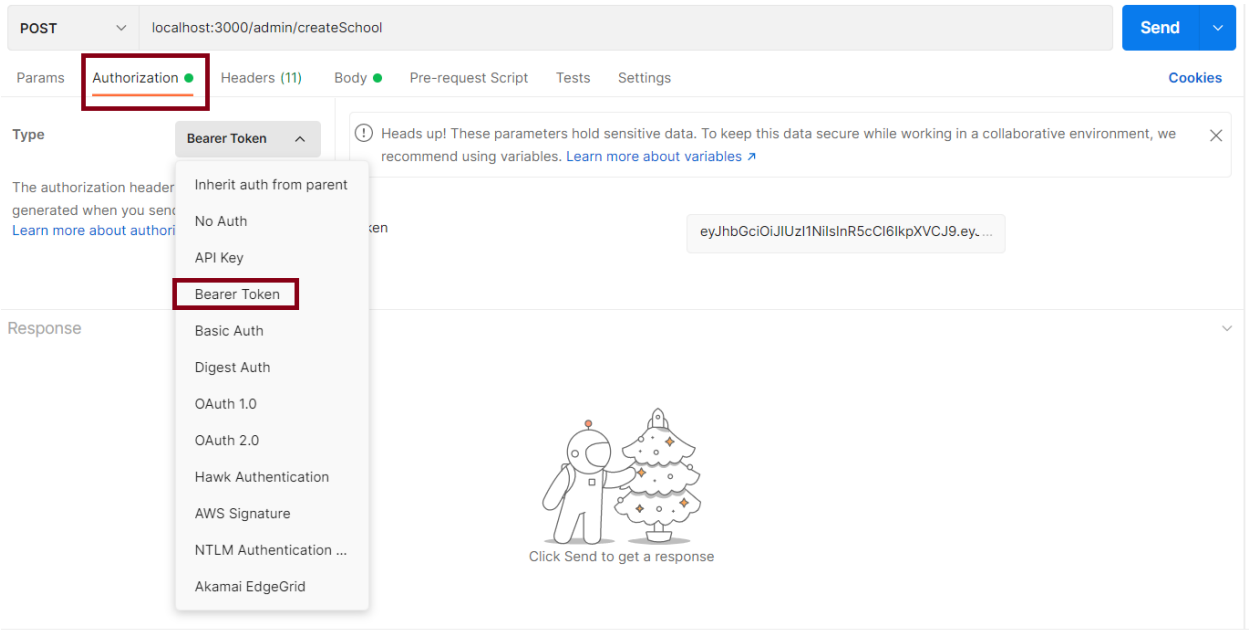
2. Security

- **Register: only store hashing password, not the original one**: even if the database system is hacked, the user's original passwords are not stolen from the database. Many surveys come to the conclusion that a lot of internet users tend to use the same or similar password for almost all of their internet accounts [Vojinovic 2021]. Therefore, once the web user loses its password on one particular website, there is a great chance that the password for other

applications of this user may also be spoiled. It is dangerous since other applications may include banking or other paid websites.

```
const salt = randomBytes(32);
teacher.password = await argon2.hash(teacher.password, {
  salt,
});
```

- **Login: secured by web token method,** specifically implemented by **HTTP Bearer authentication**. HTTP Bearer authentication method is quite commonly used in most of the websites that choose to use tokens as their security approach [Kumar 2021].



- Token is like an identity card for each user. It is an encoded string that stores some information that can be used to determine the identity of the user. That encoded string stores the id, role a secret string to verify whether it is signed by our website or not, and the expired time. After login in, it is provided and stored somewhere in the local storage in the user's devices so that he/she

doesn't need to login for every request sent to the server, for a specific period of time.

```
const sign = async (userId, role, signOption, userSecret) => {
  return jwt.sign(
    { sub: userId, role: role },
    signOption.SECRET + userSecret,
    { expiresIn: signOption.EXPIRED, }
  );
};
const signAccessToken = async (userId, role, userSecret) =>
  await sign(userId, role, config.accessToken, userSecret);

const signRefreshToken = async (userId, role, userSecret) =>
  await sign(userId, role, config.refreshToken, userSecret);
```

- signOption variable refers to either the access token or the refresh token, whose configurations are as below.

```
  accessToken: {
    SECRET: "sfsdfdsfdsfewrwerlkvasldkfjfdfddsfsad",
    EXPIRED: "5m",
  },
  refreshToken: {
    SECRET: "fsdfdsasdfdsafasdafddsafhjddfdfdddd",
    EXPIRED: "5d",
  },
```

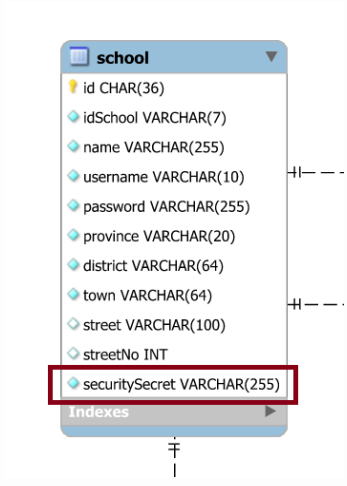
- **There are two types of tokens used in this website application**
  - **Access token**: expired every 5 minutes
  - **Refresh token**: expired every 7 days.
- Using two types of tokens is for the purpose of more security: access token is sent with a quite high frequency (for every request after login) → there is a small but possible risk that it could be stolen from hacker → setting its

validation for a short time period → even if the user loses it, there's not much time to exploit the user account.

- After the access token is expired, if users send the next request within 7 days (the validated time for refresh token), the refresh token could be used to retrieve new access and refresh token, it is done automatically by the website implementation, so that users don't need to login again to make that request. It enhances users' experience with the website: no need to login for every single call but still have some protection over the hacker from the internet. But if the web user does not send any request to the server for more than 7 days, he/she needs to login again for the next request. It also implies that if the user sends at least one request to the server a week, he/she just needs to login in once but can use the website without any disruption or further requirement.
- **Change password**: after changing the password, we need to automatically log out all the devices associated with that account. So along with the implementation of updating the user's password, we also need to provide the Log-out all device function. In other words, the task is to invalidate all the previously signed tokens, including both access and refresh ones.

→ **Chosen strategy**: create an additional field called **"securitySecret"** in all target users' tables. securitySecret consists of 32 random characters generated by the RandomByte function and it is used to verify the token. Therefore, whenever changing the password, if the securitySecret value is also changed, all the previously signed tokens will automatically be disabled because the security key in the token no longer matches the one stored in the database when we retrieve it to verify the token.

- securitySecret field



- **Sign token**

```
const sign = async (userId, role, signOption, userSecret) => {
  return jwt.sign(
    { sub: userId, role: role },
    signOption.SECRET + userSecret,
    { expiresIn: signOption.EXPIRED, }
  );
};
```

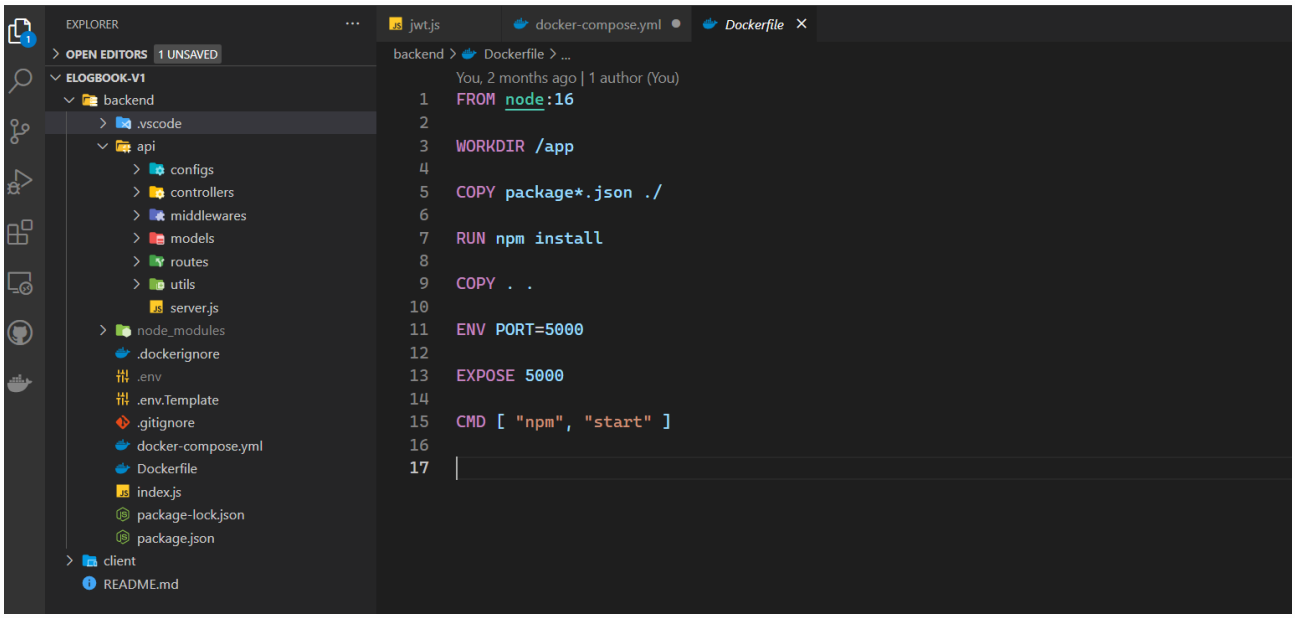
- **Verify token**

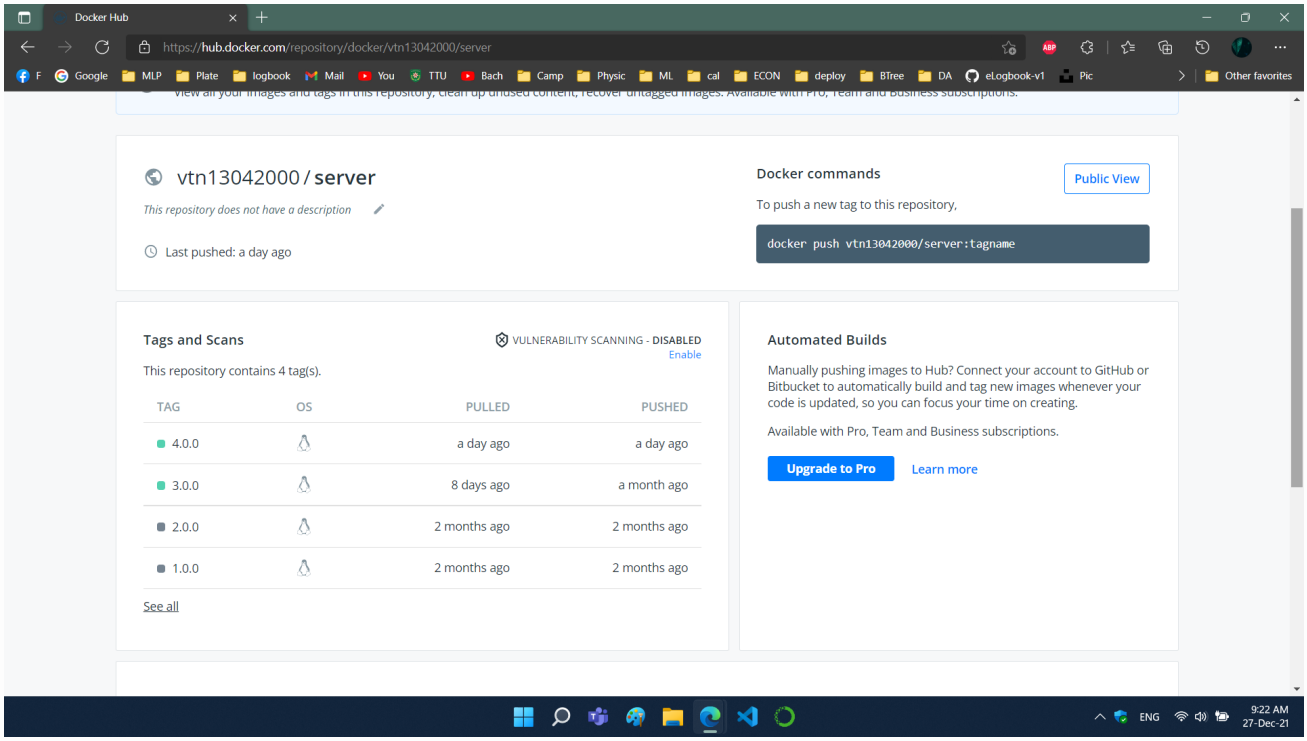
```
const verify = (token, verifyOption, userSecret) => {
  return new Promise((resolve, reject) => {
    return jwt.verify(
      token,
      verifyOption.SECRET + userSecret,
      (err, decoded) => {
        if (err) {
          resolve();
        }
        resolve(decoded);
      }
    );
  });
};
```

- userSecret variable refers to the securitySecret field stored in the database.
- verifyOption variable already explained in the database section.

3. Deployment

- Backend is deployed using Docker
    - Build the Nodejs application using the Docker file, then push it to Dockerhub.





- Using Docker compose (version 3.8) to connect The Nodejs application and the MYSQL database to form the backend.

```yaml
version: "3.8"
services:
  mysql:
    image: mysql:5.7
    hostname: mysql
    container_name: docker-logbook-mysql-4
    restart: unless-stopped
    environment:
      - MYSQL_ROOT_PASSWORD=root
      - MYSQL_USER=logbook
      - MYSQL_PASSWORD=logbook
      - MYSQL_DATABASE=logbook
    volumes:
      - db:/var/lib/mysql
    command: --character-set-server=utf8mb4 --collation-server=utf8mb4_unicode_ci
  server:
    hostname: logbookserver
    ports:
      - 3333:8000
    depends_on:
      - mysql
    image: vtn13042000/server:4.0.0
    container_name: docker-logbook-server-4
    restart: unless-stopped

    environment:
      - DB_HOST=mysql
      - DB_NAME=logbook
      - DB_USERNAME=logbook
      - DB_PASSWORD=logbook
      - DB_DIALECT=mysql
      - DB_PORT=3306
      - PORT=8000

volumes:
  db:
```

Frontend

1. Aims and Objectives

This website on the frontend side is designed to have the graphical user interface for e-logbook web service. There are several functions that were designed to serve different levels of users (super admin, school administrators, teachers, and students). The user can change their own information when it may not be precisely recorded.

In the super admin section, there is no graphical interface. It will be manipulated via API.

In the school administration section, the user can have all authority on CRUD with students, teachers, classes, and a few relationships between them which provides the information of which class that students and teachers belong to. Besides that, the courses and lessons created by the admin will be retrieved by the school administrator. Then, the timetable will be taken based on the integration of class, course, schedule, and the expiry week. Based on the timetable and respective schedules, the logbook will be constructed by the combination of timetable and specific information (teacher, lessons, comments, and notes,...).

In the teacher administration section, the user can have all authority on CRUD with logbooks as well as read some information of their own timetable.

In the student's administration, they can get the logbook information and the timetable in reading mode.

Table 1: *The levels of object's authority in Elogbook service:*

Objects/ User role	Admin	School	Teacher	Student
Course	CRUD	R	N	N
Lesson	CRUD	R	N	N
School	CRUD	N	N	N
Teacher	N	CRUD	N	R
Student	N	CRUD	N	R
Timetable	N	CRUD	R	R
Logbook	N	R	CRUD	R

Class	N	CRUD	R	R

P/s: C: Create; R: read; U: Update; D: Delete; and N: Null.

2. Tutorial for Graphical Interface Interactions

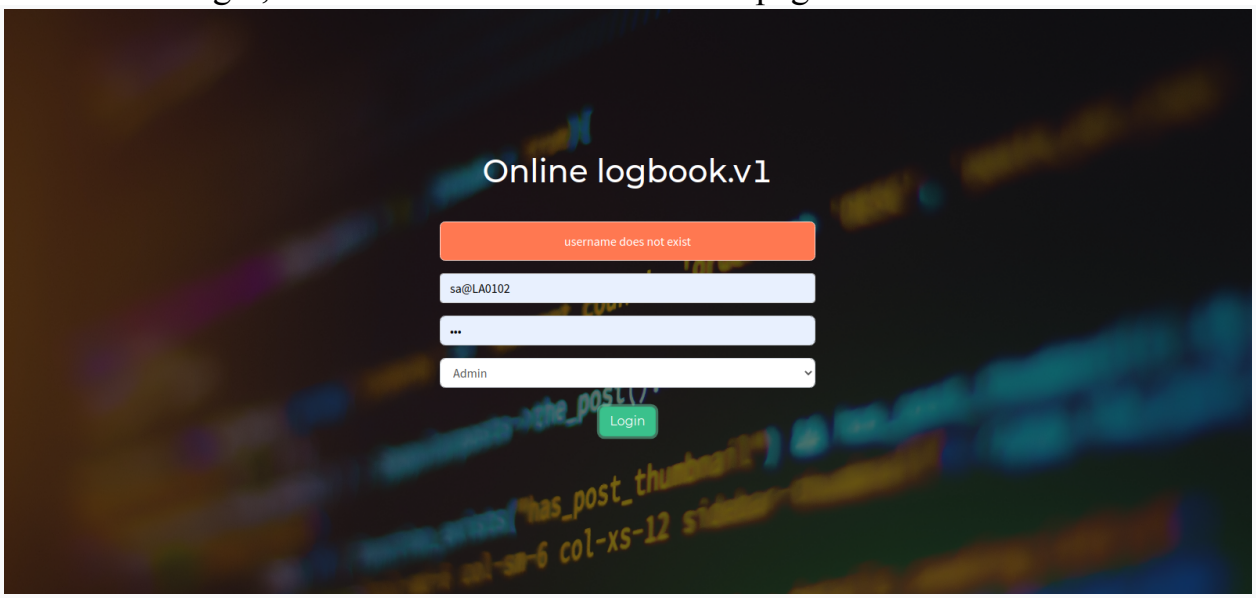
Admin

- Admin does not have an interactive web interface, but mainly through the API that will manage the courses, lessons, and the school administrator accounts.

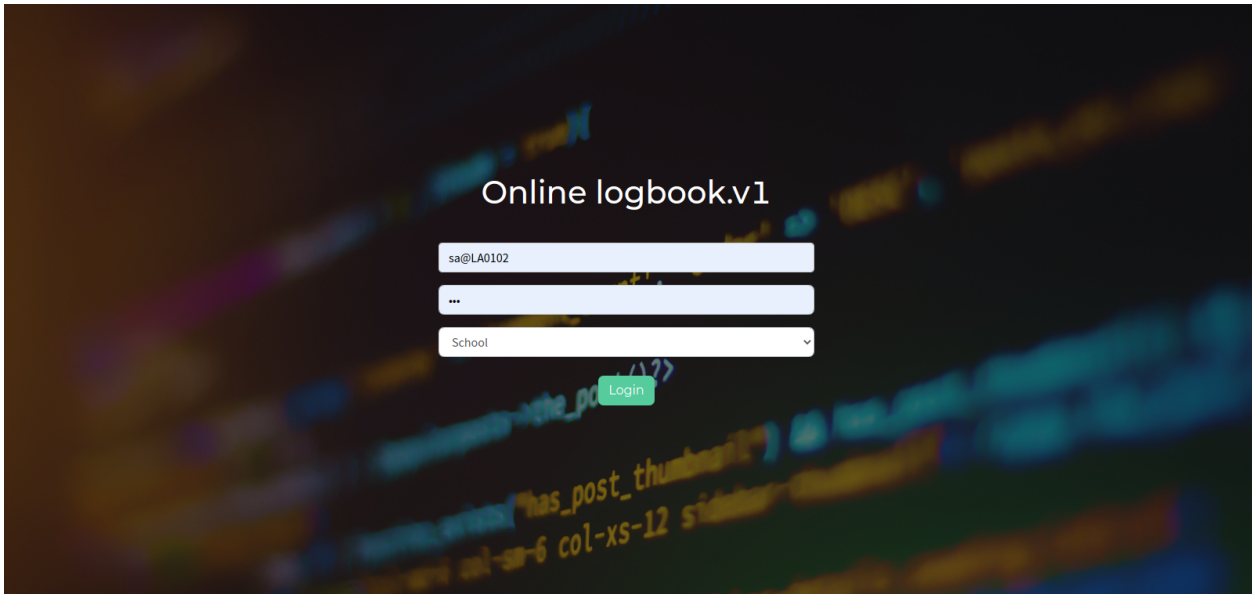
School

a) Login

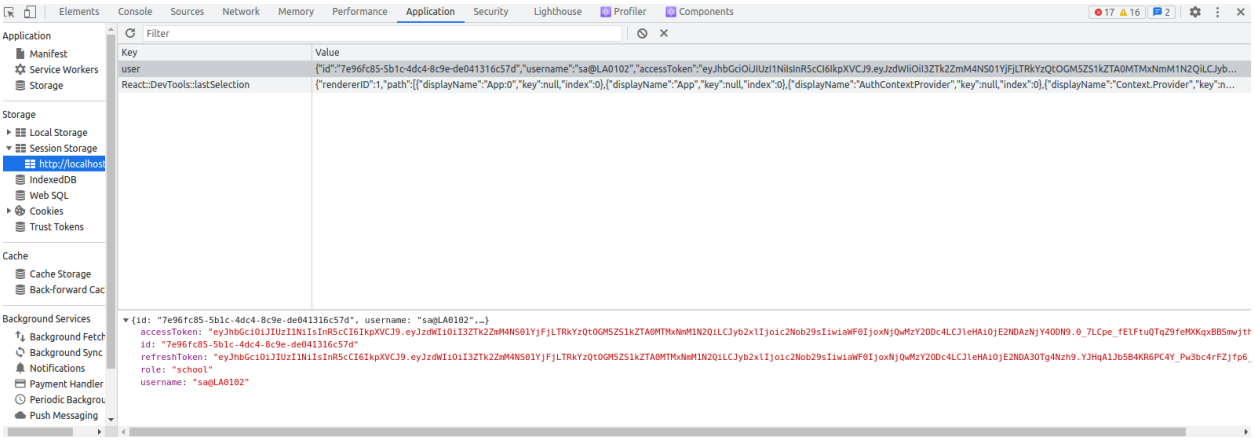
- The school account is provided by the admin.
- After login, it will be redirected to the homepage



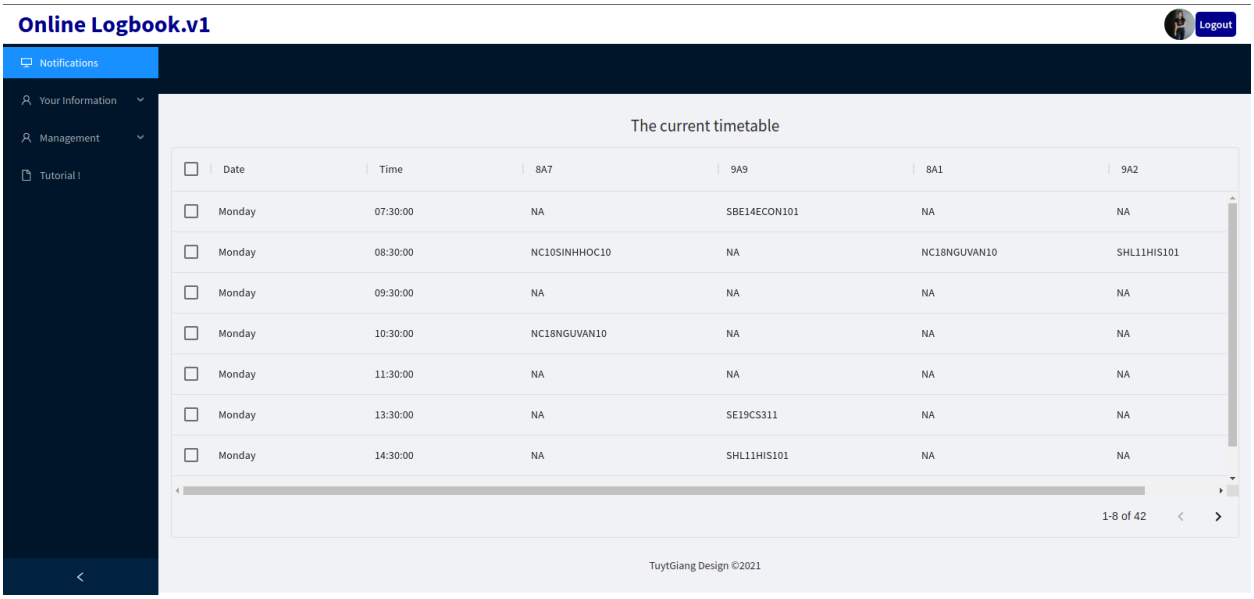
- The school account is provided by the admin.
- After login, it will be redirected to the homepage



- The access and refresh tokens will be recorded in the session storage.
- If the expired time is over, the refresh token will be sent and the new tokens.

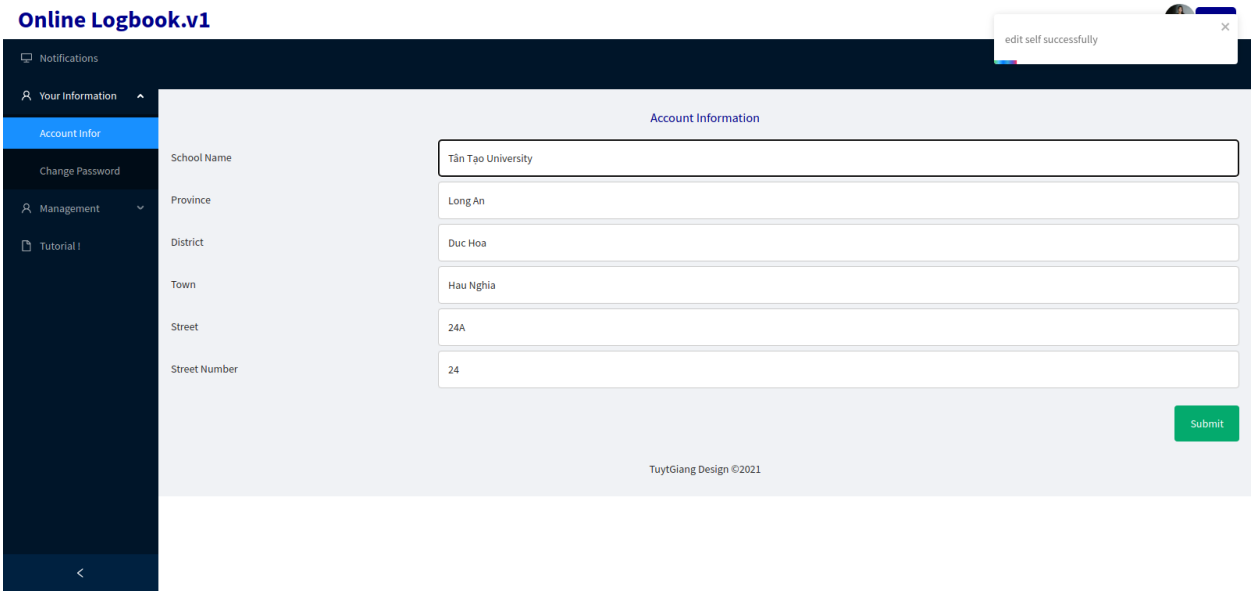


- After login, redirect to the homepage.

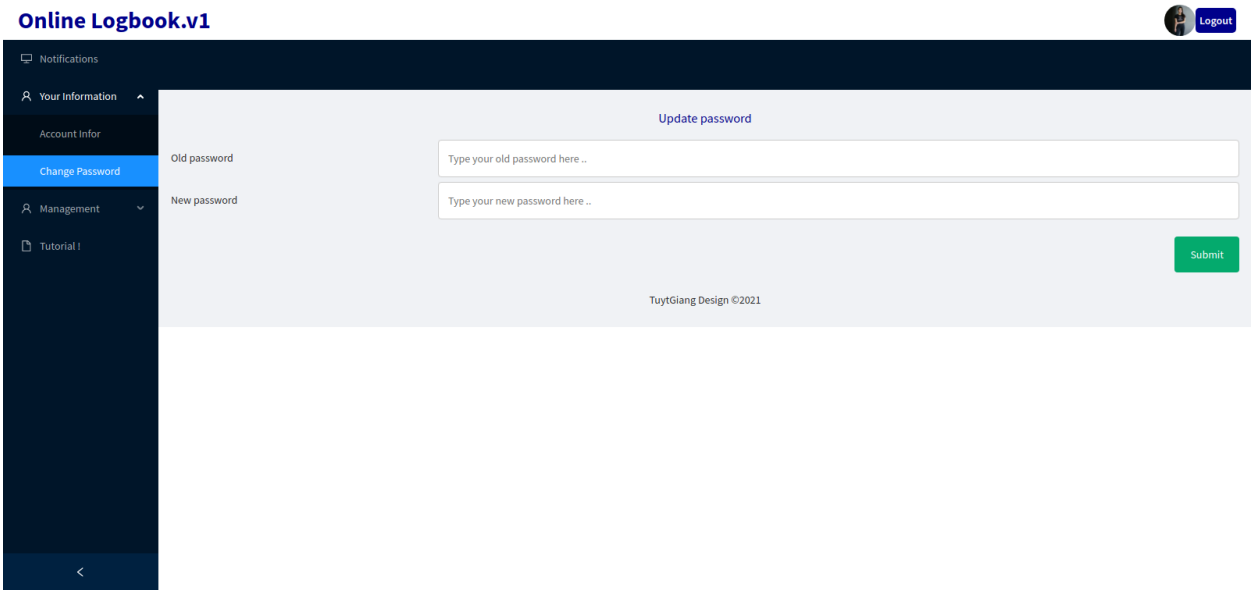


b) Account information

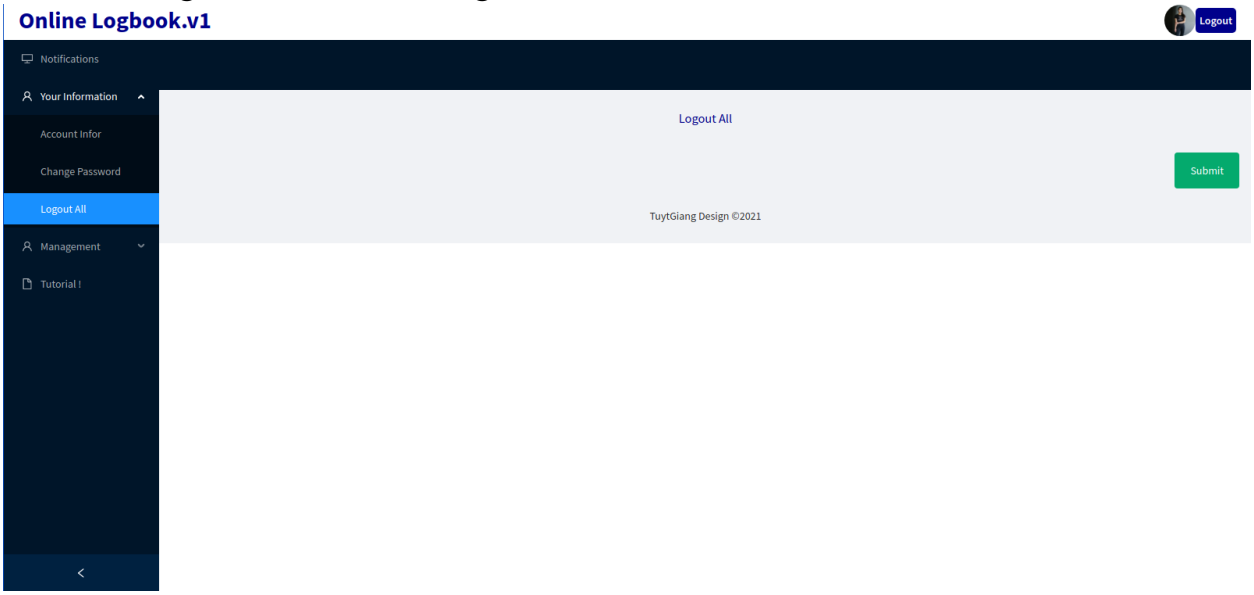
- Update information. The response from the server will be sent via the toast.



- Change password

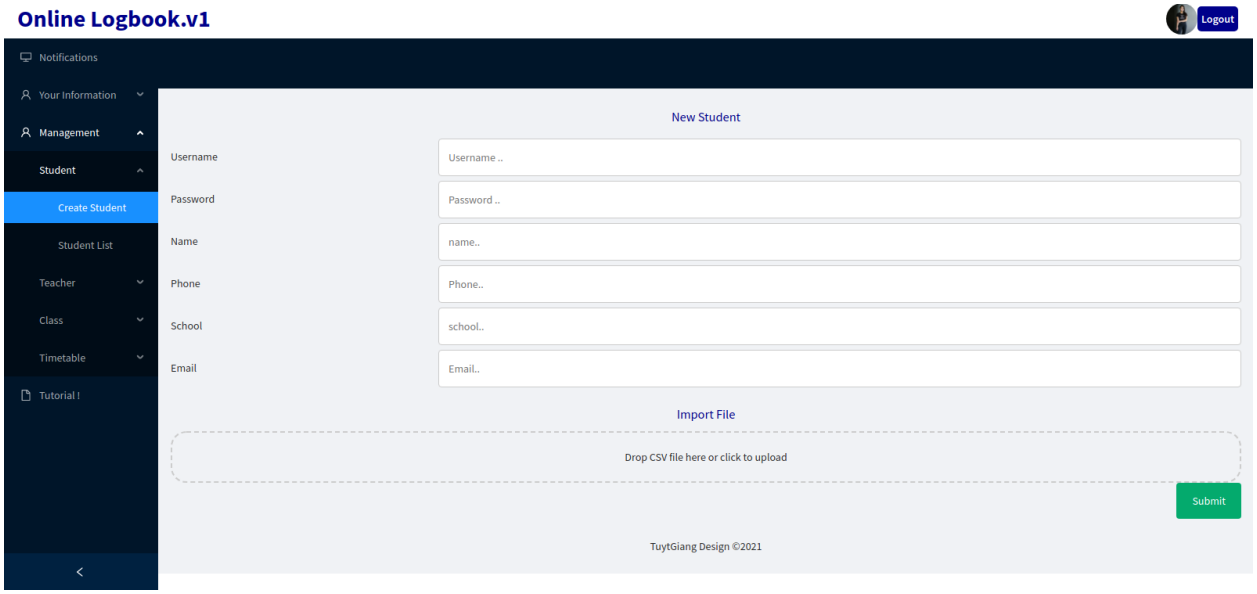


- Logout All Current Login.



c) Management

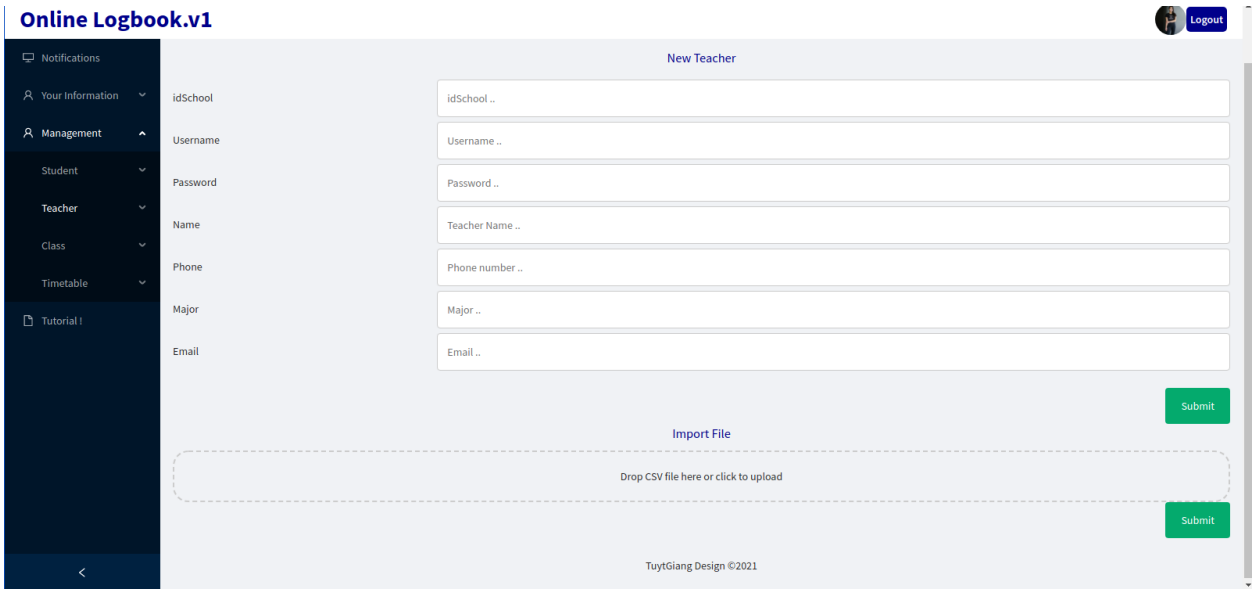
- Create Students
- Example: Add one student in case of a new student who has just come.



- Create Students
- Example: Add all students in the school using a csv file.

	A	B	C	D	E	F
1	idSchool	username	password	name	phoneNumber	email
2	LA0102-190102	nguyen.vuong.190102@LA010	vtn	Vương Thảo Nguyên	934565533	nguyen.vuong1902060@gmail.con
3	LA0102-190202	thai.le.190202@LA0102	vtn	Lê Quang Thái	934567833	thaileisme@gmail.com
4	LA0102-190203	ktuyt.190203@LA0102	vtn	K' Tuyt	934567833	ktuyt@gmail.com
5	LA0102-180204	giang.nguyen.180204@LA010	vtn	Nguyễn Tấn Thanh Giang	934567833	nguyen.giang@gmail.com
6	LA0102-190205	hoang.dao.190205@LA0102	vtn	Đào Văn Ngọc Hoàng	4409678334	hoang.dao@gmail.com
7	LA0102-190206	tuan.tran.190206@LA0102	vtn	Trần Triệu Tuấn	4409678334	tuan.tran@gmail.com

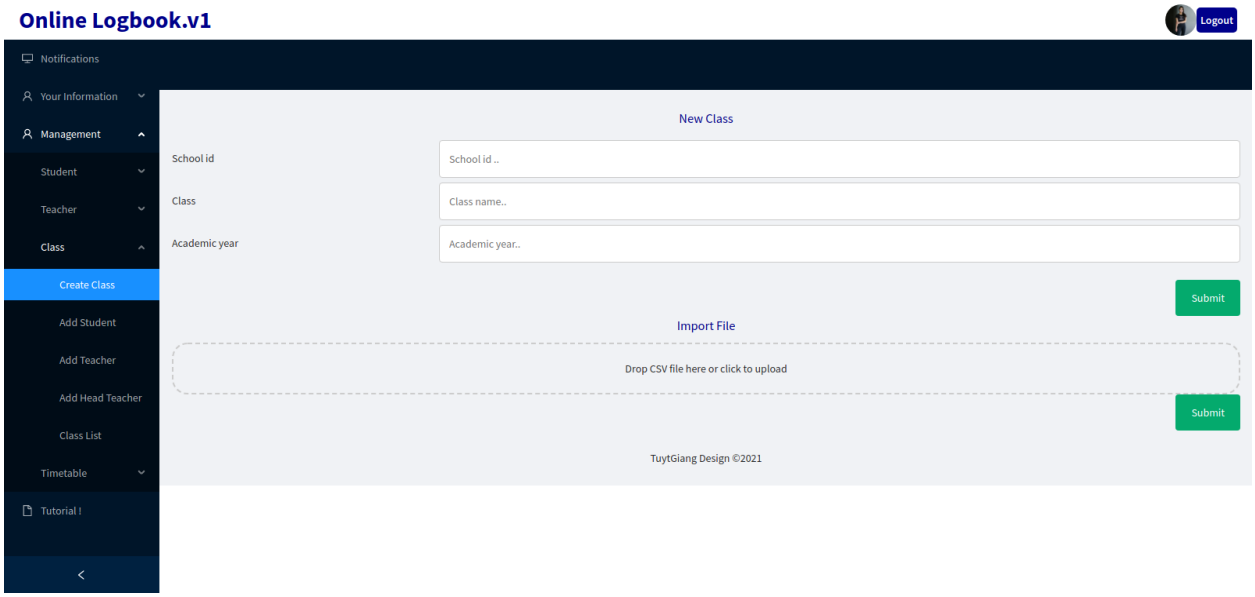
- Create Teachers
- Example: Similarly add teachers with a single form.



- Create Teachers
- Example: Similarly add teachers with a csv file.

	A	B	C	D	E	F	G
1	idSchool	username	password	name	major	phoneNumber	email
2	LA0102-T1200	dung.cao.t12001@LA0102	vtn	Cao Tiến Dũng	KHMT	987111122	dung.cao@gmail.com
3	LA0102-T1322	khanh.tran.t13220@LA0102	vtn	Trần Vũ Khanh	Toán học	934565533	khanh.tran@gmail.com
4	LA0102-T1502	hien.tran.t15022@LA0102	vtn	Trần Duy Hiến	Toán học	934567833	hien.tran@gmail.com
5	LA0102-T1922	dung.duong.t19222@LA0102	vtn	Dũng Dương	Toán	934567833	dung.duong@gmail.com
6	LA0102-T1855	fransico.roma.t18553@LA0102	vtn	Fransico Roma	Business	934567833	roma.fransico@gmail.com
7	LA0102-T1211	jonathan.lankford.t12111@LA010	vtn	Jonathan Lankford	SHL	4409678334	jonathan.lankford@gmail.com

- Create Classes
- Example: Add all classes in the school using csv file or add a single one by the form

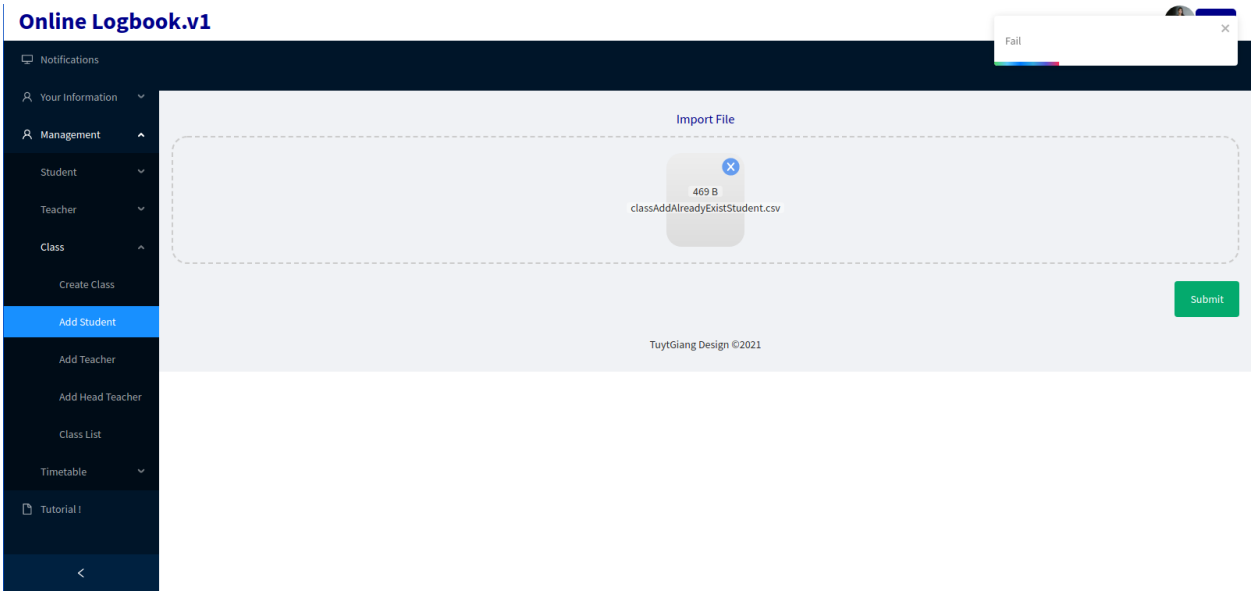


- Create Classes
- Example: Add a single class by the form

	A	B	C
1	idSchool	name	academicYearId
2	LA0102-C1900	9A9	2019
3	LA0102-C1900	9A2	2019
4	LA0102-C1900	8A7	2019
5	LA0102-C1900	8A1	2019

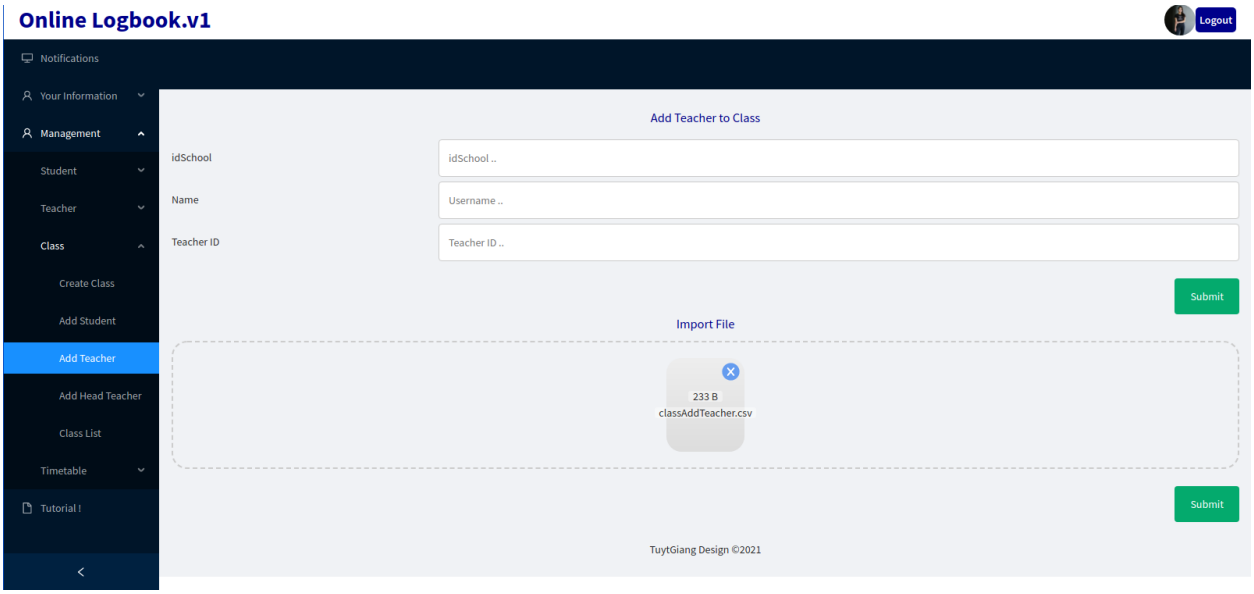
- Add students to classes
- Example: Add students to classes

	A	B	C	D
1	idSchool	class_name	Student_school_id	student_name
2	LA0102-C1900	9A9	LA0102-190102	Vương Thảo Nguyên
3	LA0102-C1900	9A9	LA0102-190202	Lê Quang Thái
4	LA0102-C1900	9A2	LA0102-190203	K'tuyt
5	LA0102-C1900	9A2	LA0102-180204	Nguyễn Tấn Thanh Giang
6	LA0102-C1900	8A7	LA0102-190205	Đào Văn Ngọc Hoàng
7	LA0102-C1900	8A7	LA0102-190206	Trần Triệu Tuấn
8	LA0102-C1900	8A1	LA0102-180207	Châu Hoài Vũ
9	LA0102-C1900	8A1	LA0102-180201	Nguyễn Đức Nam



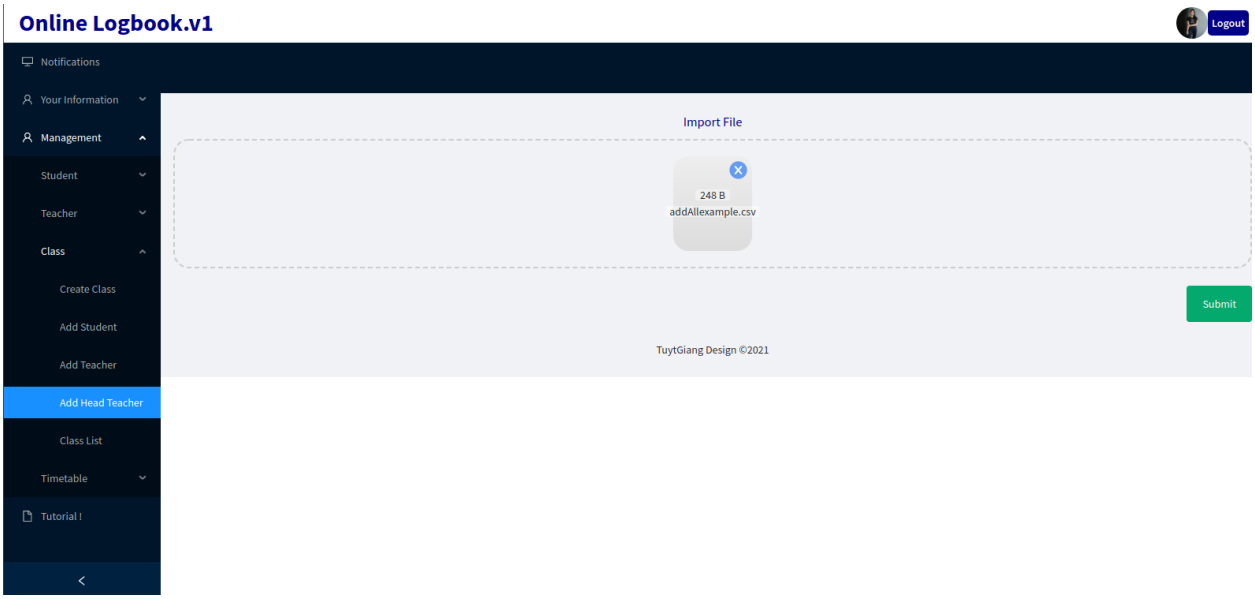
- Add teachers
- Example: Add teachers to classes

	A	B	C	D
1	idSchool	name	teacherId	teacherName
2	LA0102-C1900	9A9	LA0102-T1200	Cao Tiến Dũng
3	LA0102-C1900	8A1	LA0102-T1322	Trần Vũ Khanh
4	LA0102-C1900	9A2	LA0102-T1502	Trần Duy Hiến
5	LA0102-C1900	8A1	LA0102-T1922	Dũng Dương

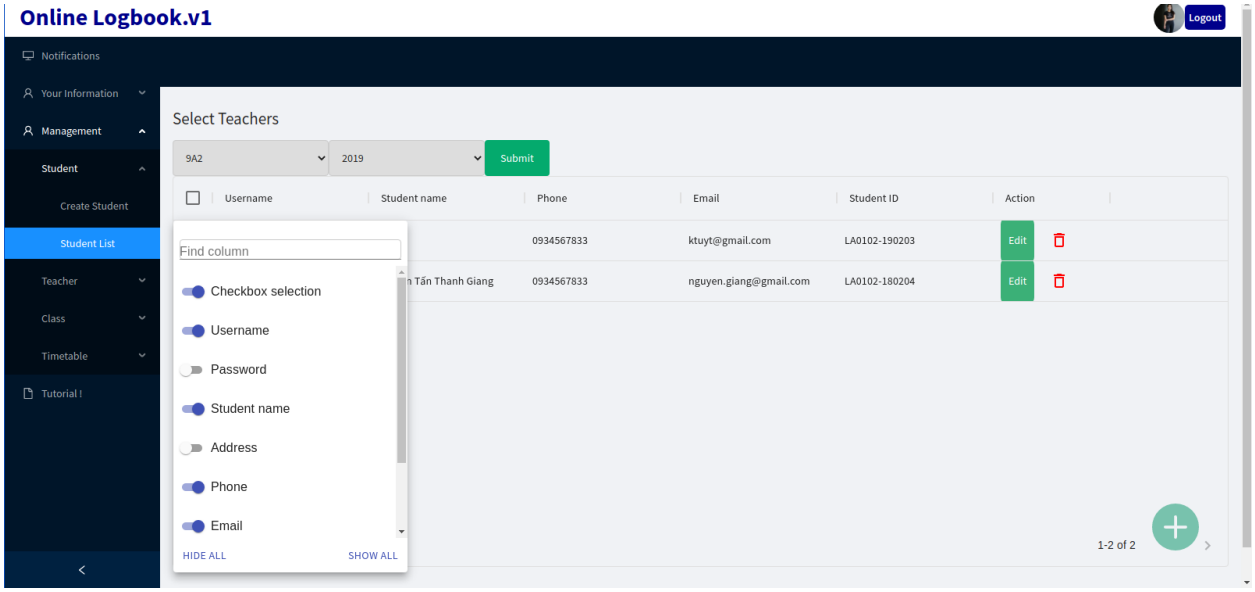


- Add headteachers.
- Example: Add all students, teachers, and classes

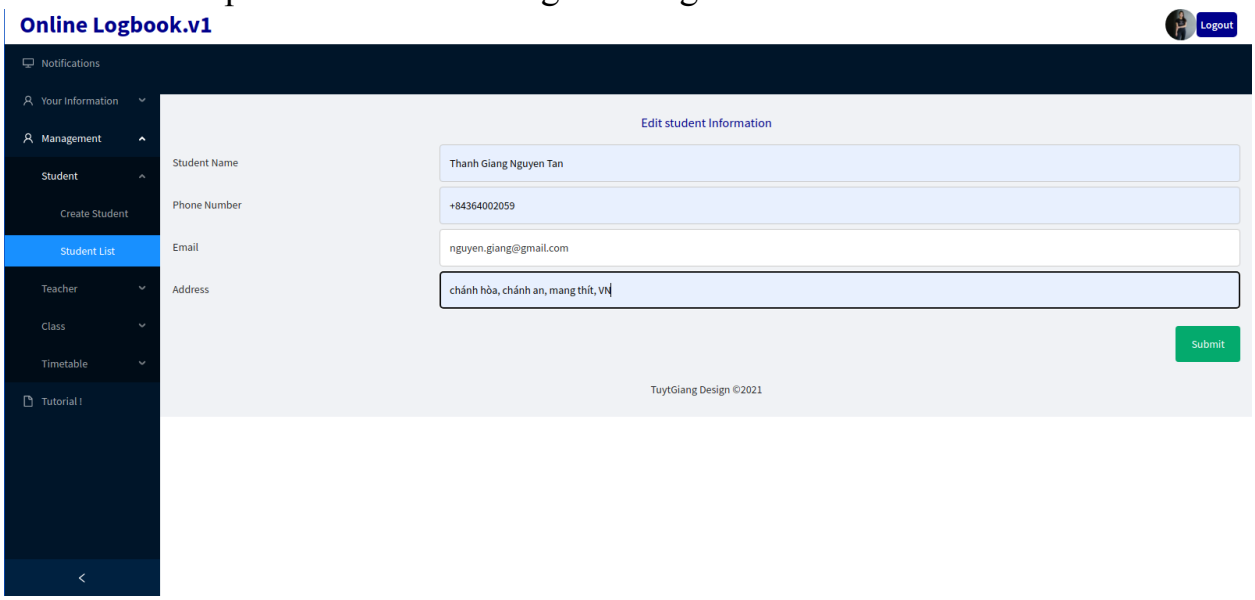
	A	B	C	D	E	F	G	H	I	J	K
1	idSchool	class_name	academicYearId	teacherId	Student_school_id	classId	username	password	name	phoneNumber	email
2	LA0102-C1800	8A8	2018	LA0102-T1502	LA0102-180207	LA0102-C1901	vu.chau.180207@LA0102	vtn	Châu Hoài Vũ	4409678334	vu.chau@gmail.com
3	LA0102-C1800	8A9	2018	LA0102-T1502	LA0102-180201	LA0102-C1901	nam.nguyen.180201@LA010	vtn	Nguyễn Đức Nam	4409678334	nam.nguyen@gmail.com



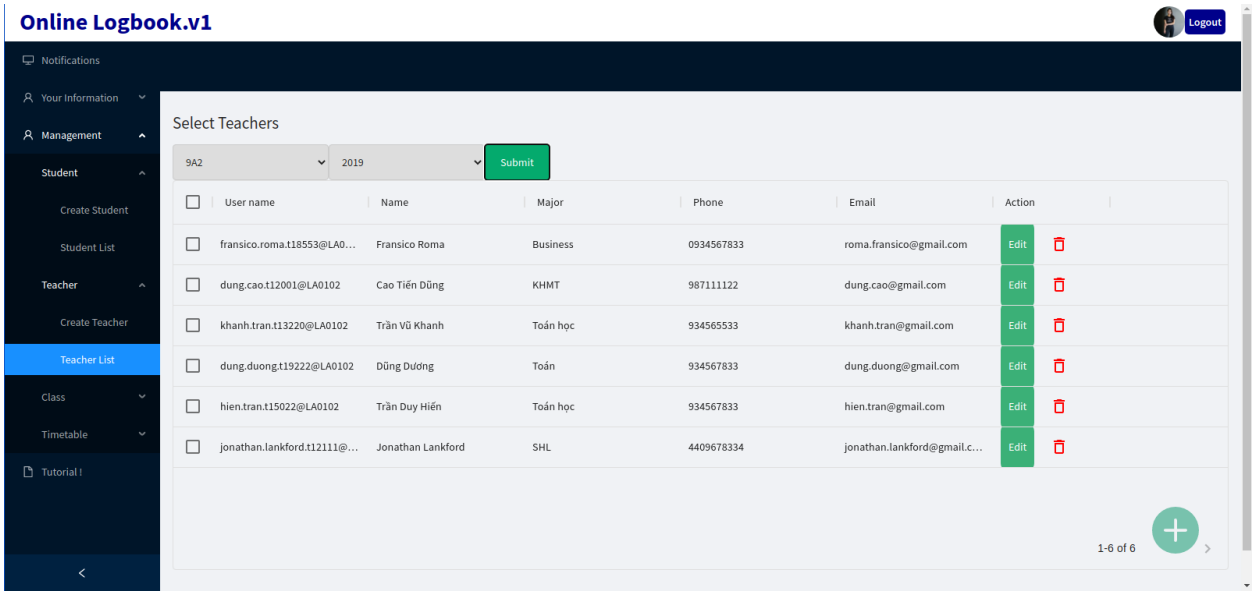
- Query and get detailed information if the typo occurred, it can be deleted or updated. Similar in case of teacher



- Query and get detail information if the typo occurred, it can be deleted or updated
- Example: Edit after clicking to Giang student

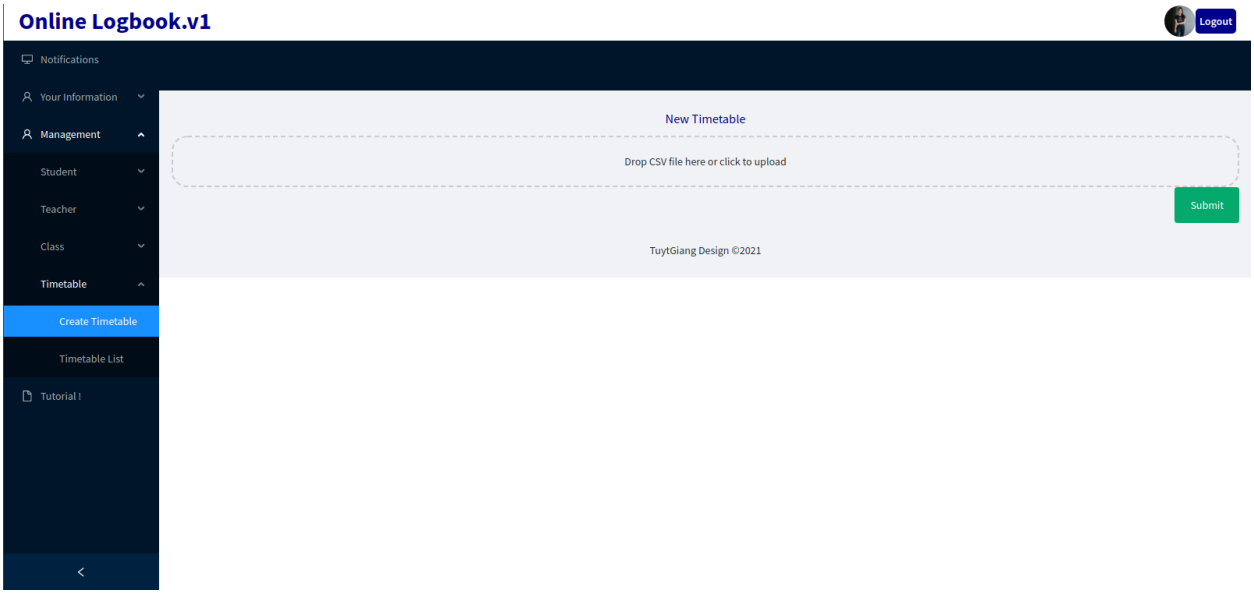


- Query and get detailed information if the typo occurred, it can be deleted or updated
- Example: Query teachers

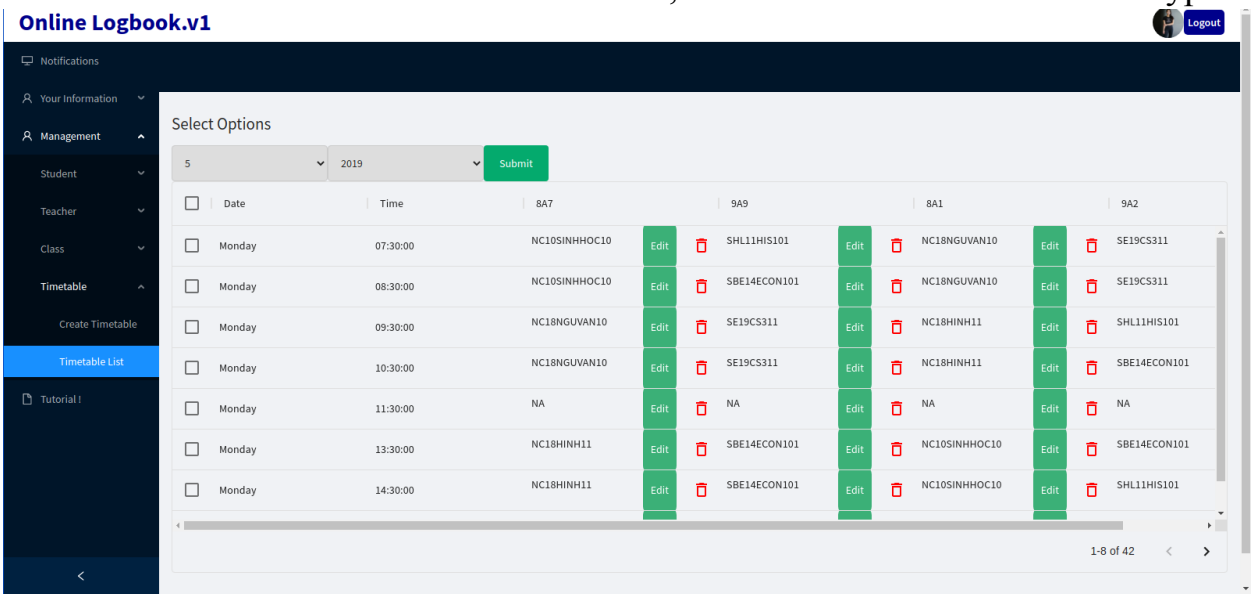


- Add timetable from csv file

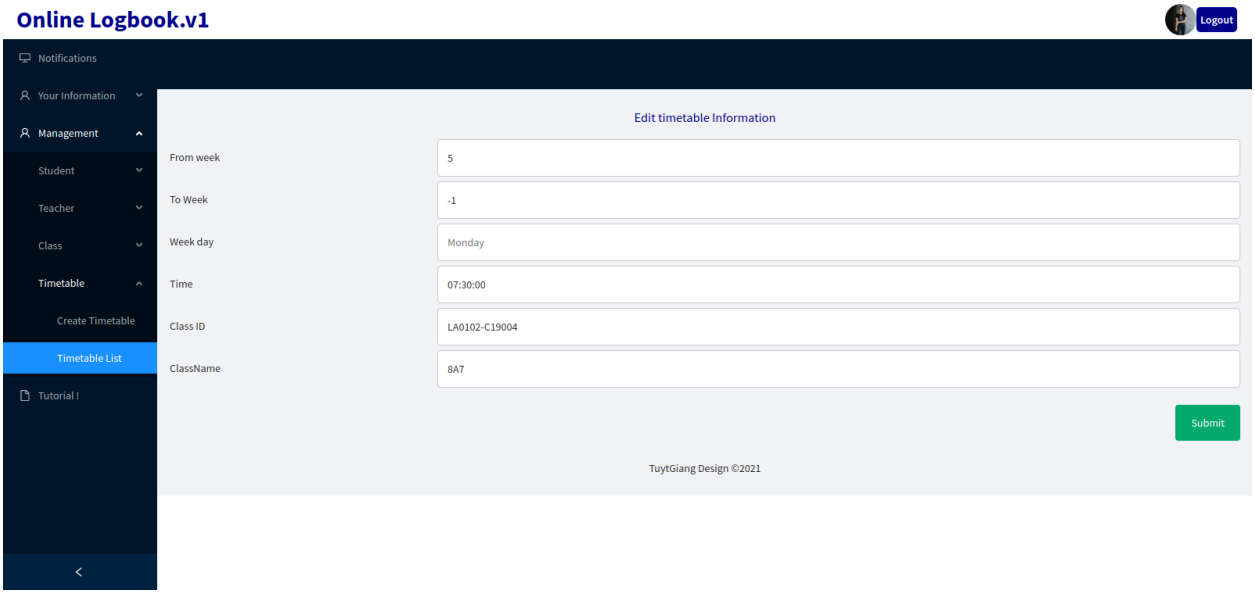
	A	B	C	D	E	F	G
1	Week	Day	Time	LA0102-C19006	LA0102-C19004	LA0102-C19005	LA0102-C19001
2	5	1	7:30	NC18NGUVAN10:LA0102-T12111	NC10SINHHOC10:LA0102-T15022	SE19CS311:LA0102-T12001	SHL11HIS101:LA0102-T12111
3	5	1	8:30	NC18NGUVAN10:LA0102-T12111	NC10SINHHOC10:LA0102-T15022	SE19CS311:LA0102-T12001	SHL11HIS101:LA0102-T12111
4	5	1	9:30	NC18HINH11:LA0102-T13220	NC18NGUVAN10:LA0102-T12111	SBE14ECON101:LA0102-T18553	SE19CS311:LA0102-T12001
5	5	1	10:30	NC18HINH11:LA0102-T13220	NC18NGUVAN10:LA0102-T12111	SBE14ECON101:LA0102-T18553	SE19CS311:LA0102-T12001
6	5	1	11:30	NA	NA	NA	NA
7	5	1	13:30	NC10SINHHOC10:LA0102-T15022	NC18HINH11:LA0102-T13220	SHL11HIS101:LA0102-T12111	SBE14ECON101:LA0102-T18553
8	5	1	14:30	NC10SINHHOC10:LA0102-T15022	NC18HINH11:LA0102-T13220	SHL11HIS101:LA0102-T12111	SBE14ECON101:LA0102-T18553
9	5	2	7:30	NA	NA	NA	NA
10	5	2	8:30	NA	NA	NA	NA
11	5	2	9:30	NA	NA	NA	NA
12	5	2	10:30	NA	NA	NA	NA
13	5	2	11:30	NA	NA	NA	NA
14	5	2	13:30	NA	NA	NA	NA
15	5	2	14:30	NA	NA	NA	NA
16	5	3	7:30	NA	NA	NA	NA
17	5	3	8:30	NA	NA	NA	NA
18	5	3	9:30	NA	NA	NA	NA
19	5	3	10:30	NA	NA	NA	NA
20	5	3	11:30	NA	NA	NA	NA
21	5	3	13:30	NA	NA	NA	NA
22	5	3	14:30	NA	NA	NA	NA
23	5	4	7:30	NA	NA	NA	NA
24	5	4	8:30	NA	NA	NA	NA
25	5	4	9:30	NA	NA	NA	NA
26	5	4	10:30	NA	NA	NA	NA
27	5	4	11:30	NA	NA	NA	NA
28	5	4	13:30	NA	NA	NA	NA
29	5	4	14:30	NA	NA	NA	NA



- Get timetables for the latest version, which can be fixed if there is a typo



- Get timetables for the latest version, which can be fixed if there is a typo

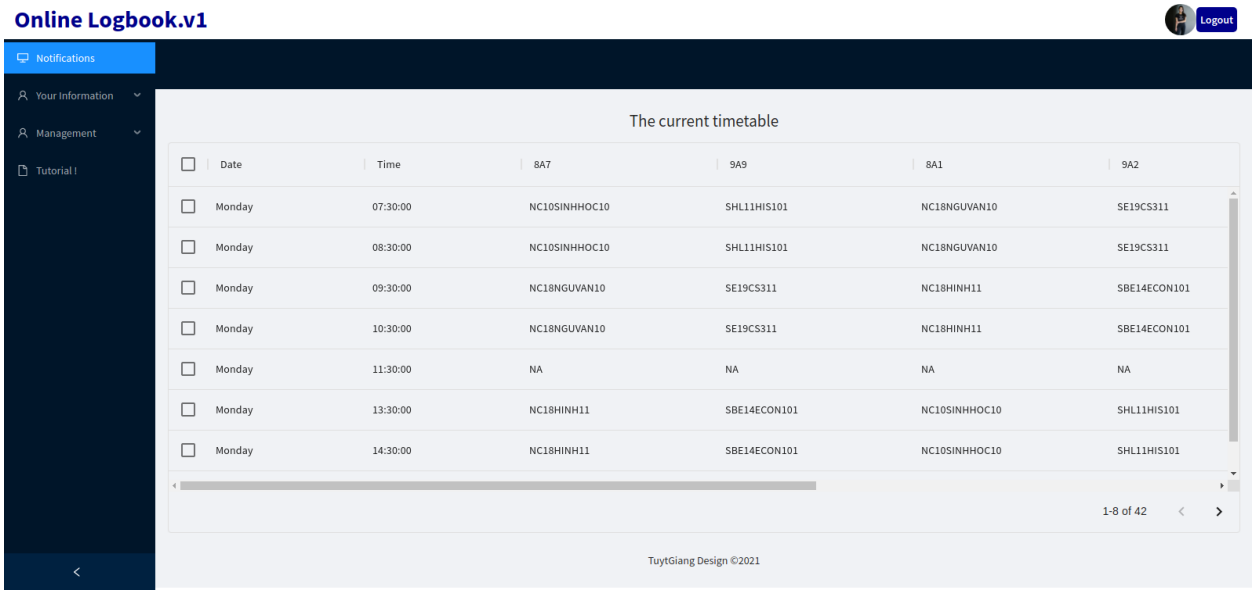


Teacher

a) Login

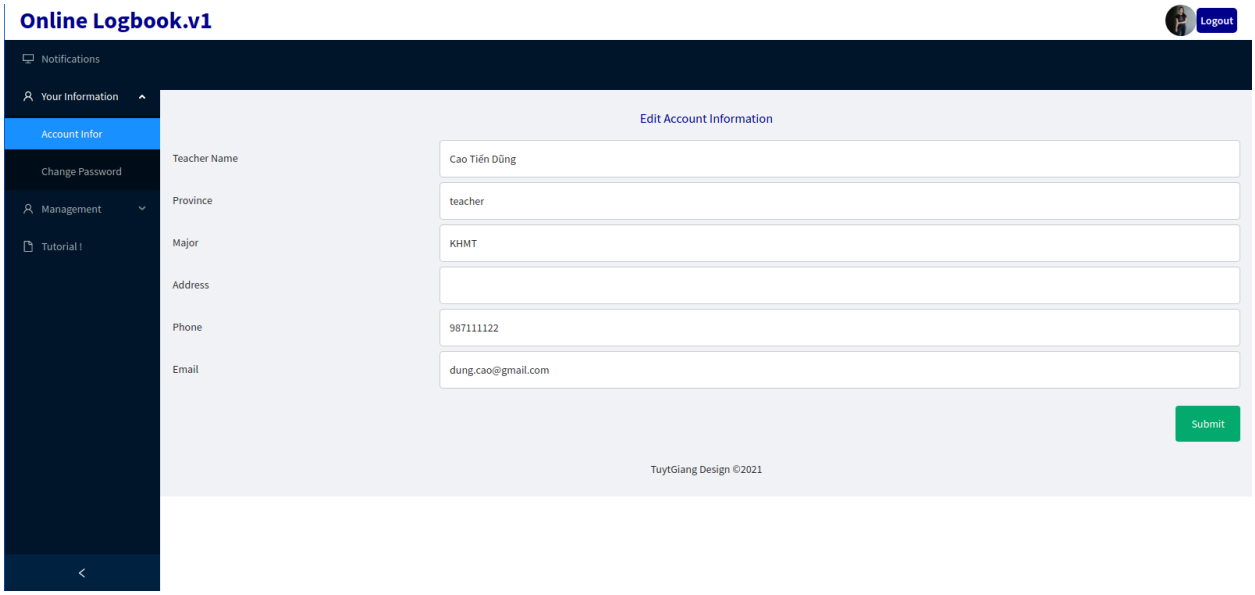
- Similar to school account in this function

- Similar to school account in this function

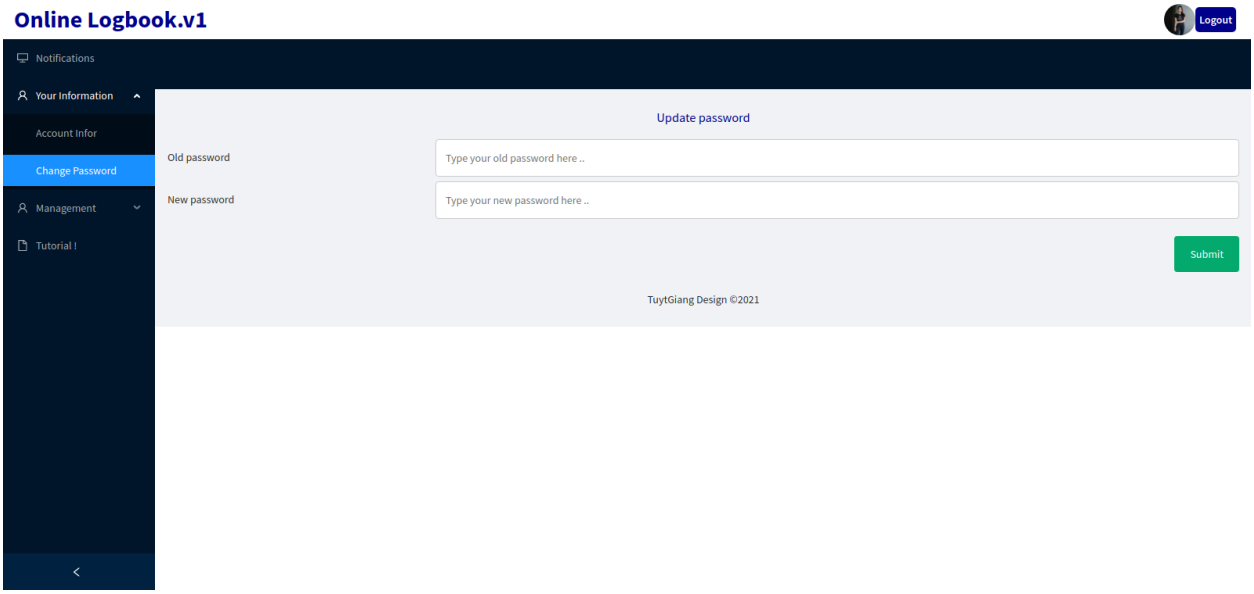


b) Account information

- Similar to school account in this function

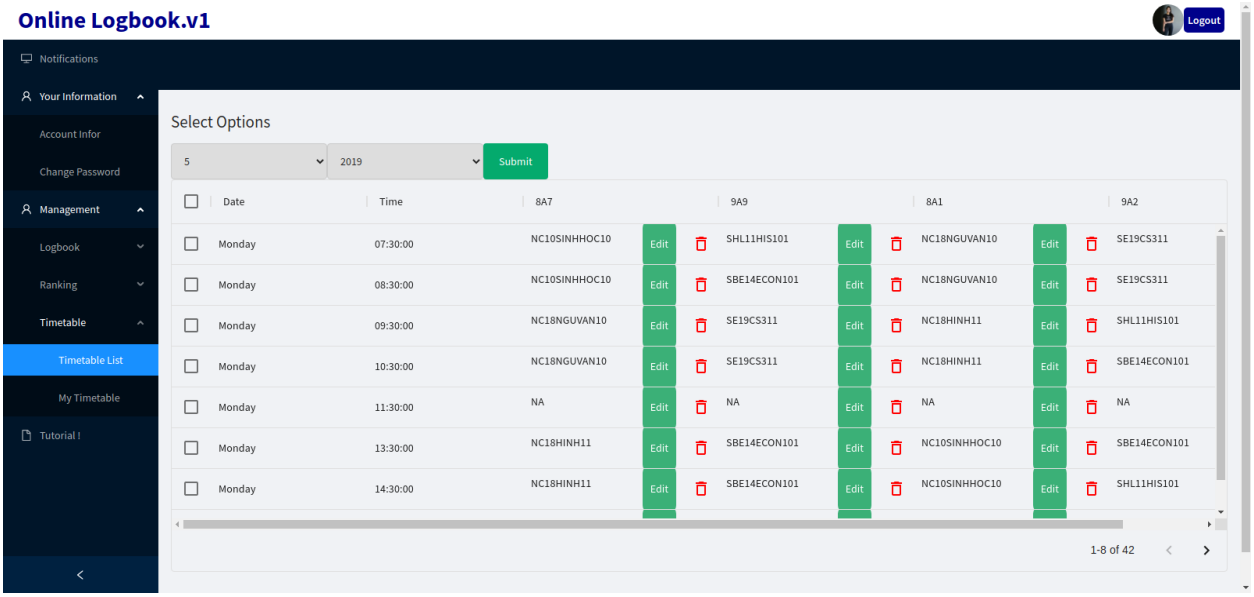


- Similar to school account in this function

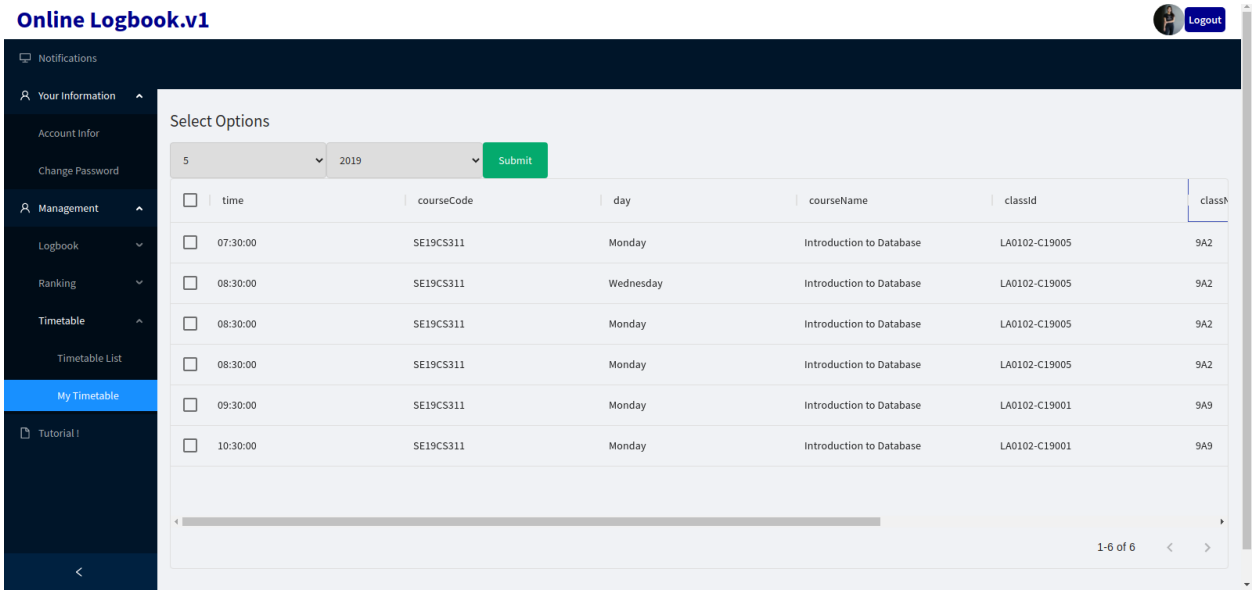


c) Management

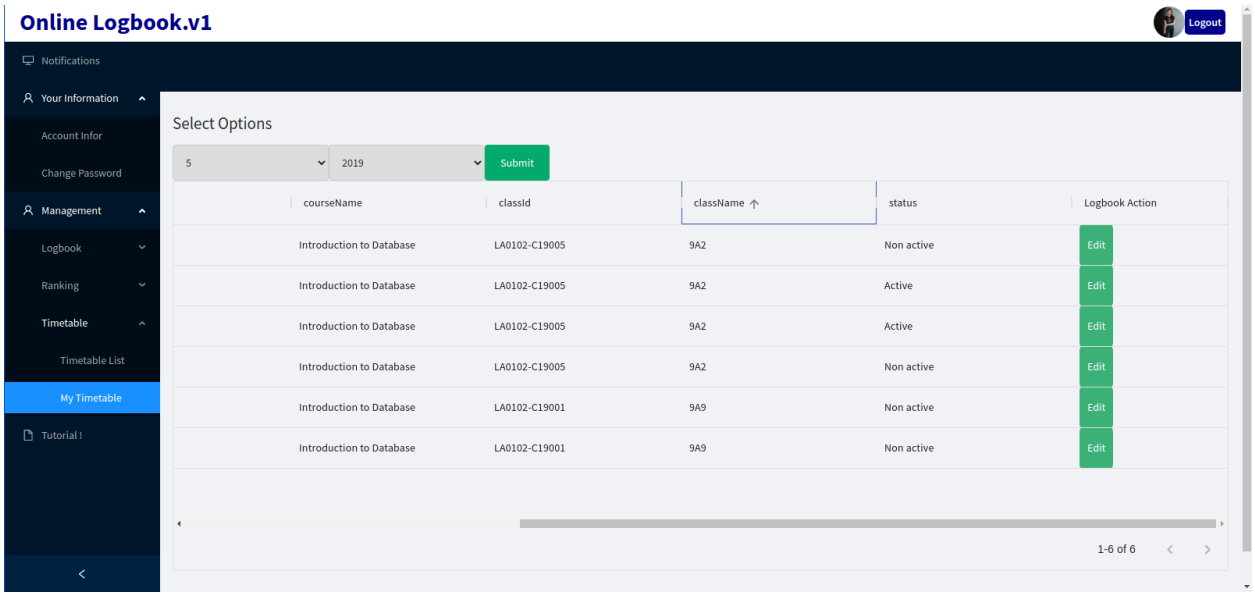
- Get timetable and teacher's timetable



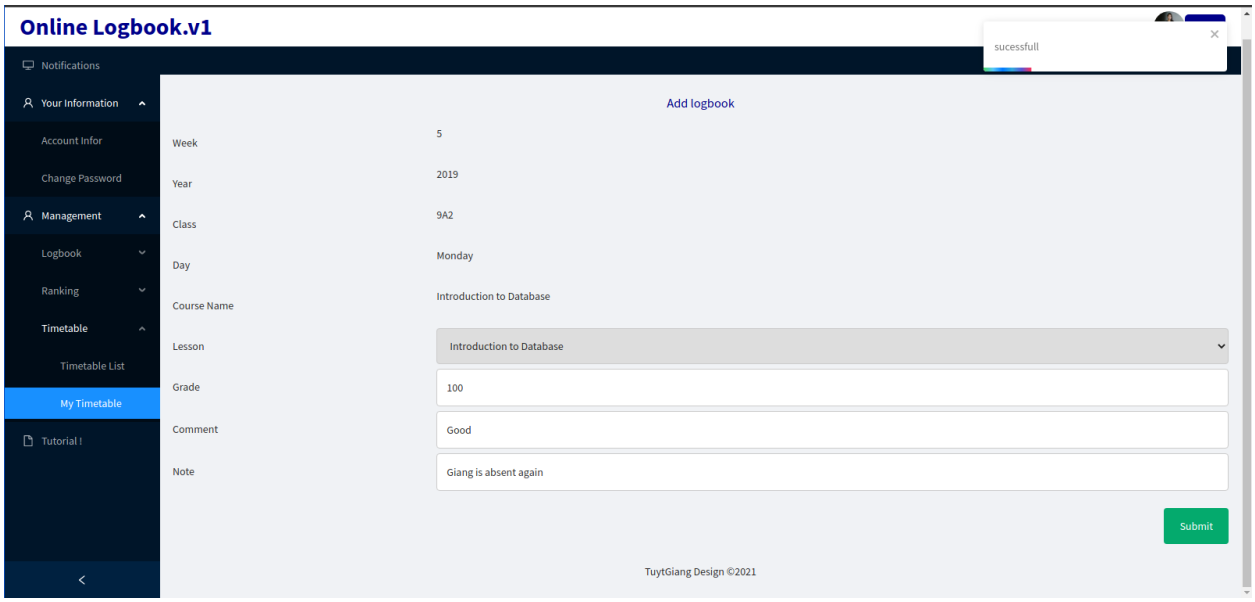
- Get timetable and teacher's timetable



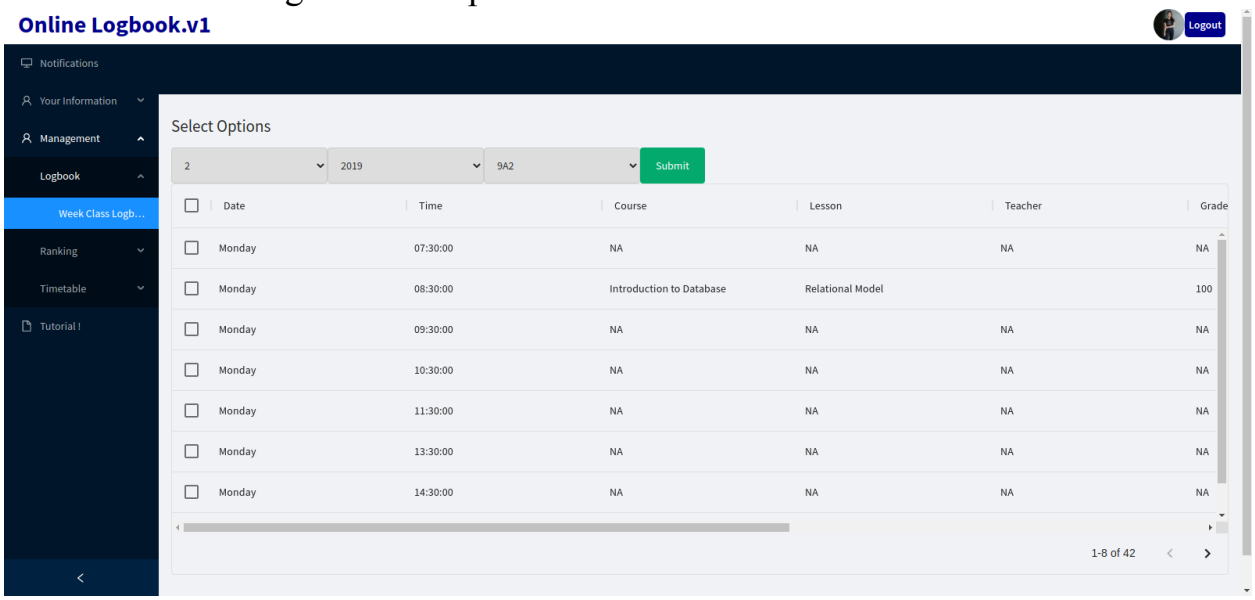
- The teacher's timetable with status value will represent whether the logbook was marked for these lessons. If not click to add



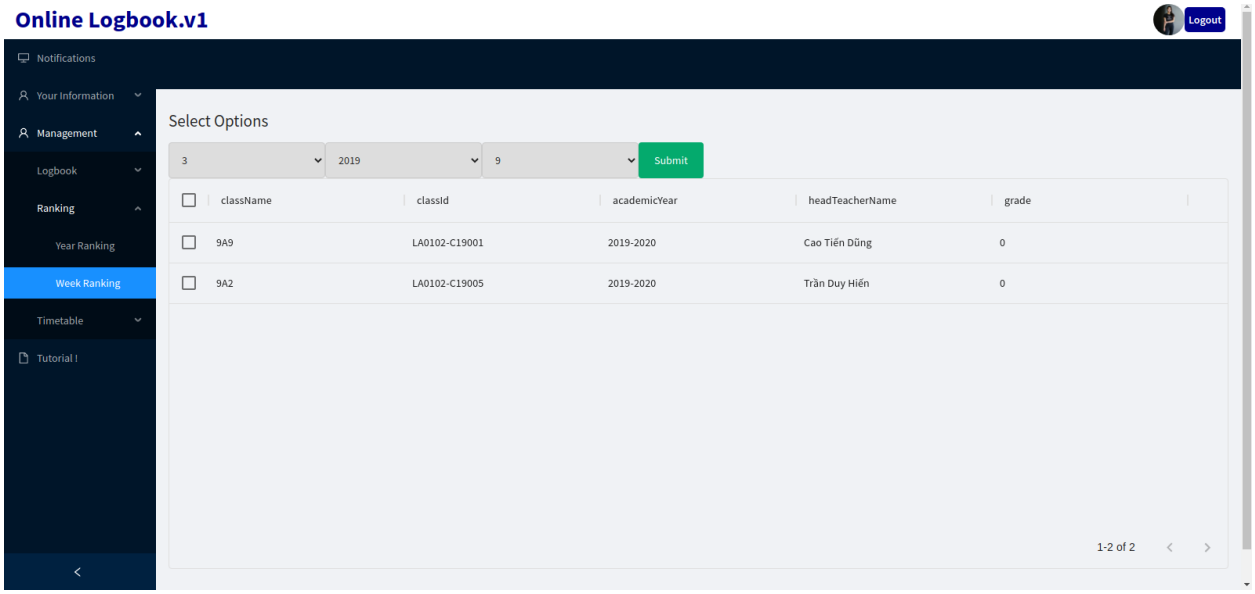
- The teacher's timetable with status value will represent whether the logbook was marked for these lessons. If not click to add



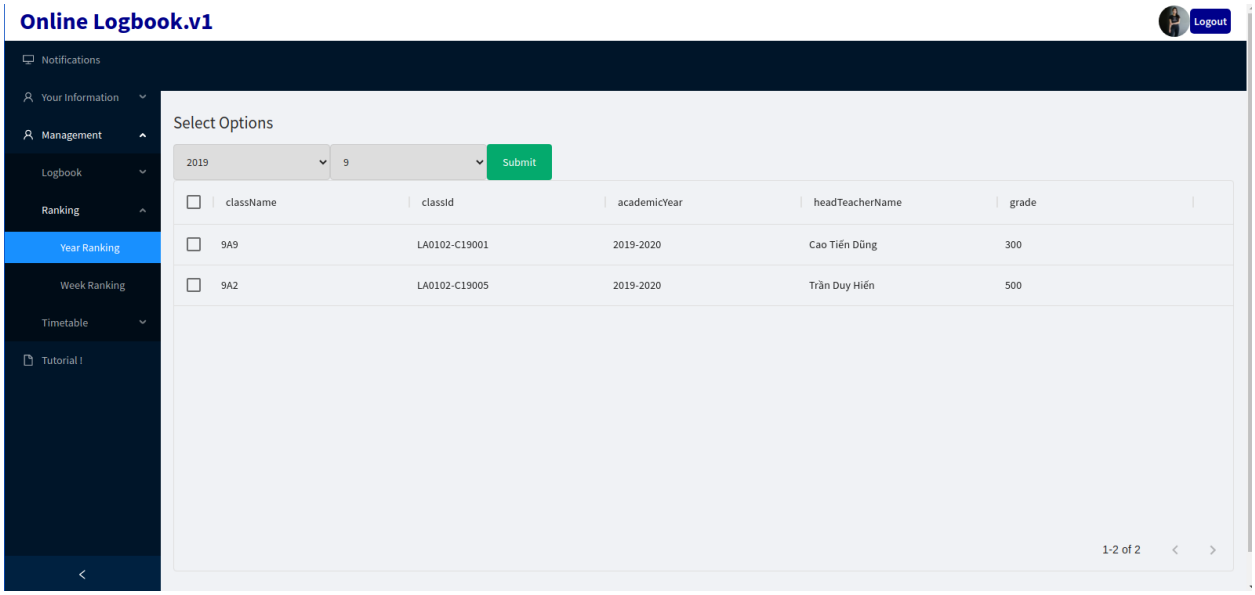
- Get the logbook of a specific week. Teachers can access different class



- Get ranking by week and year



- Get ranking by week and year

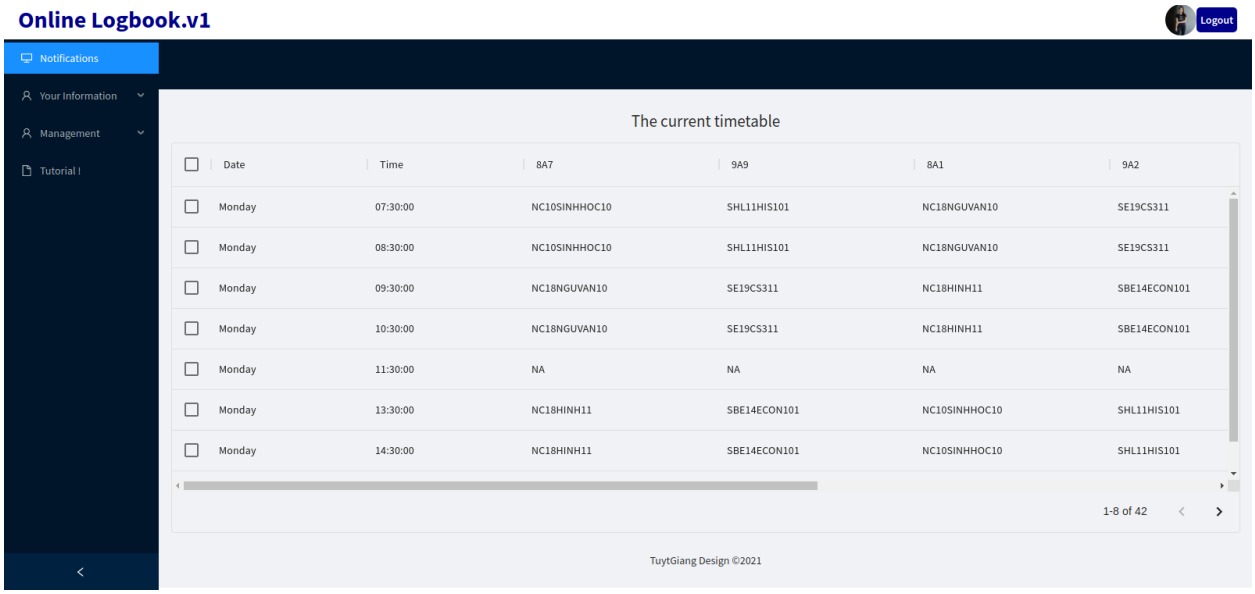


Student

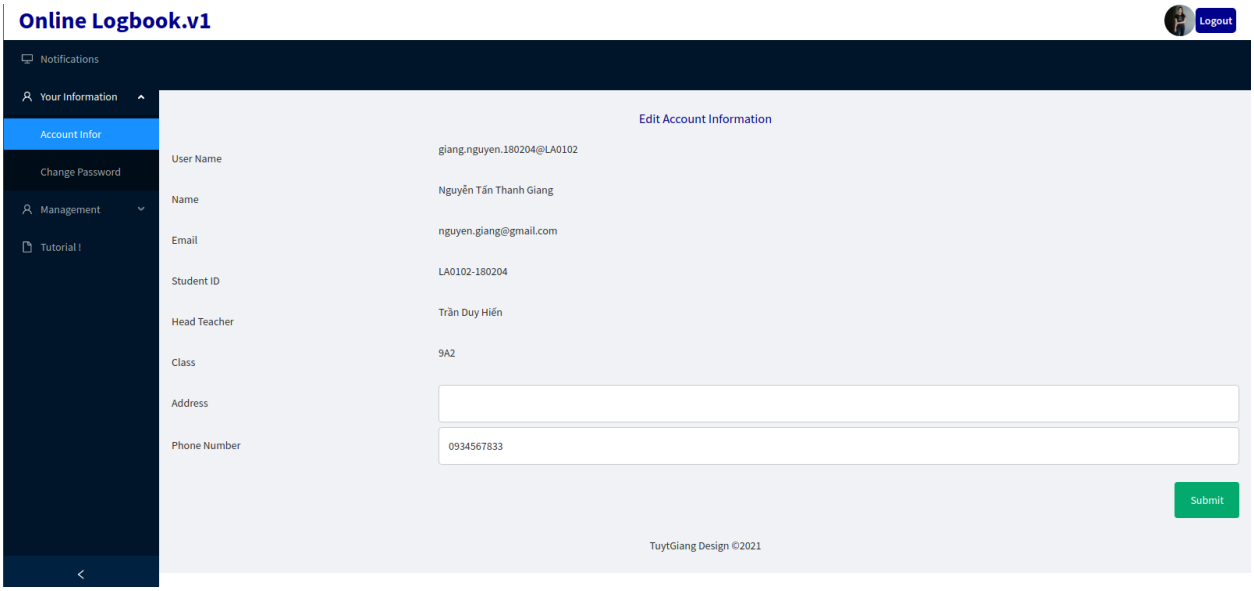
a) Login:

- Similar to teacher and school

- Similar to teacher and school

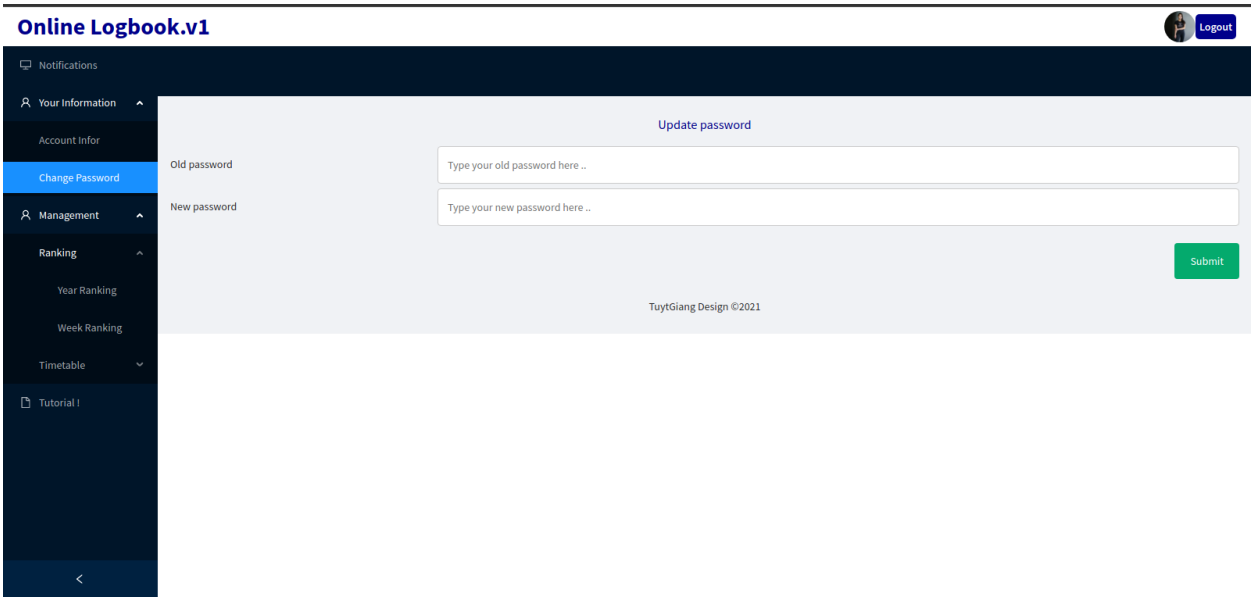


- Similar to teacher and school



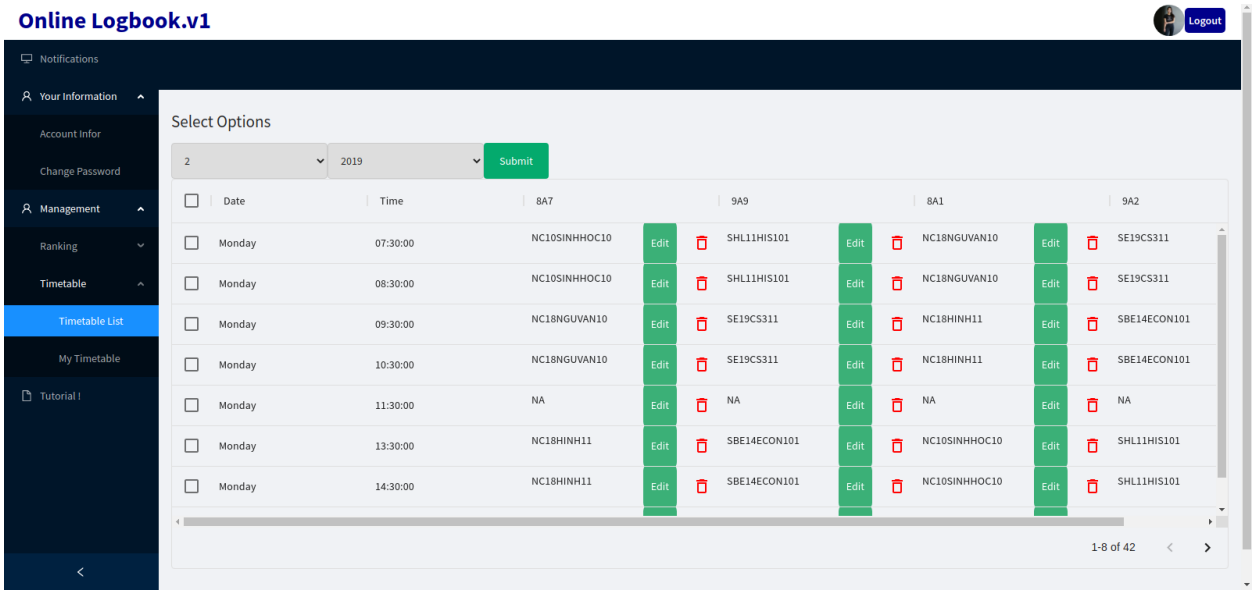
b) Account information

- Similar to teacher and school

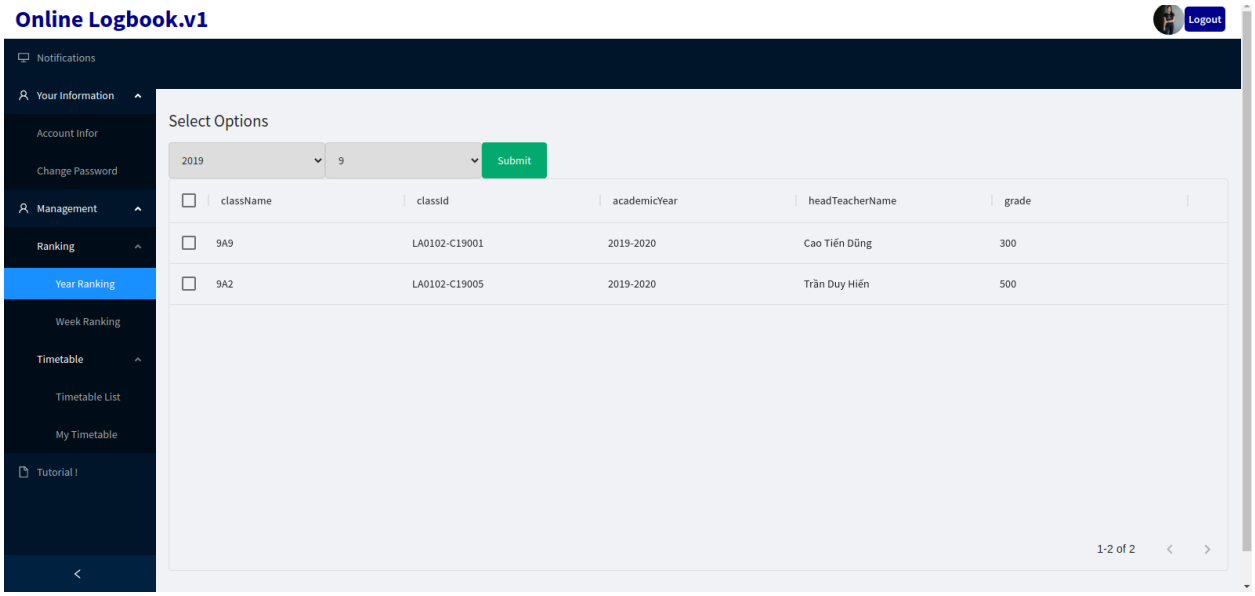


c) Management

- Similar to teacher and school



- Similar to teacher and school



References

Express/Node introduction - Learn web development | MDN. (2021). Retrieved 27 December 2021, from https://developer.mozilla.org/en-US/docs/Learn/Server-side/Express_Nodejs/Introduction.

Kumar, R., 2021. *What is Bearer token and How it works? - DevOpsSchool.com*. [online] DevOpsSchool.com. Available at: <https://www.devopsschool.com/blog/what-is-bearer-token-and-how-it-works/> [Accessed 26 December 2021].

Le, H., 2021. *Dạy học trực tuyến để ứng phó với dịch COVID-19 | Tạp chí Tuyên giáo*. [online] Tuyengiao.vn. Available at: <https://tuyengiao.vn/khoa-giao/giao-duc/day-hoc-truc-tuyen-de-ung-pho-voi-dich-covid-19-135538> [Accessed 26 December 2021].

Vega, C. (2017). Client-side vs. server-side rendering: why it's not all black and white. Retrieved 27 December 2021, from https://www.freecodecamp.org/news/what-exactly-is-client-side-rendering-and-hows-it-different-from-server-side-rendering-bd5c786b340d/

Vojinovic, I., 2021. *Save Your Data with Empowering Password Statistics | DataProt*. [online] DataProt. Available at: <https://dataprot.net/statistics/password-statistics/> [Accessed 26 December 2021].