Online Library Management System

I. Introduction

Access to academic resources and materials is required for students and lecturers to support their education. As a result, a dependable library management system is a must-have in every university and college. There, students and lecturers can browse, borrow, and manage books using their own devices, which is useful and convenient for them to keep track of their book's status, such as due date and loan charge. Not only must it provide the aforementioned essential purposes, but it must also be visually appealing and consistent in order to attract students and withstand high Internet traffic. Building such a system necessitates meticulous planning and trial-and-error due to its vast size of service.

II. Objectives

This project deals with the creation and operation of an online library, with the additions and experiments from our teammate's feature proposal. Besides basic functionalities such as book listing, issuing and returning books, sending overdue messages via emails, paying overdues, the project also introduces some features like admin management dashboard, and book reviews from past readers. However, since this is a project on a small, non-commercial scale and the time allotted to this project was limited, the final product might serve as a demonstration for essential requirements and could not be well-represented as a true library management system which could be implemented among universities and colleges.

III. Acknowledgements

We owe our gratitude to Prof. Huynh Trung Hieu, our lecturer and instructor in this Programming Exercises module. Thanks to his guidance and timely support, we can set our project's orientation and apply the software engineering ethics into our project. On this occasion, we would also like to express our sincere thanks to Truong Vinh Hoang Chau (CSE2019), a senior in the same major as us. Without his prior experience about the project, particularly in Node.js, we would not have been able to easily identify and learn about technical terms and references in the early phases, allowing us to move on to coding stages sooner than envisaged.

IV. Teamwork

Name (ID)	Tasks
Truong Vinh Hoang Chau (16076)	- Provide basic orientations, reference materials essential to start the project smoothly. - Provide some consultancy and feedback.
Vo Nguyen Minh Duy (17105)	- Majorities of UI re-decoration for Admin Pages - Admin's Add, Edit and Remove Book and/or User function - Use Case diagrams and Description Tables - Chart for Admin Dashboard
Do Dinh Dong (17000)	- Login/Register - Forgot/Reset password - Send email to users - Report writing

Tra Dang Khoa (17637)	- .Front-End:
	  - Homepage
	  - User profile
	  - Book detail (information)
	- .Back-End:
	  - Review function
	  - Update account function
	  - Help with the book management functionality
	  - Check due date middleware

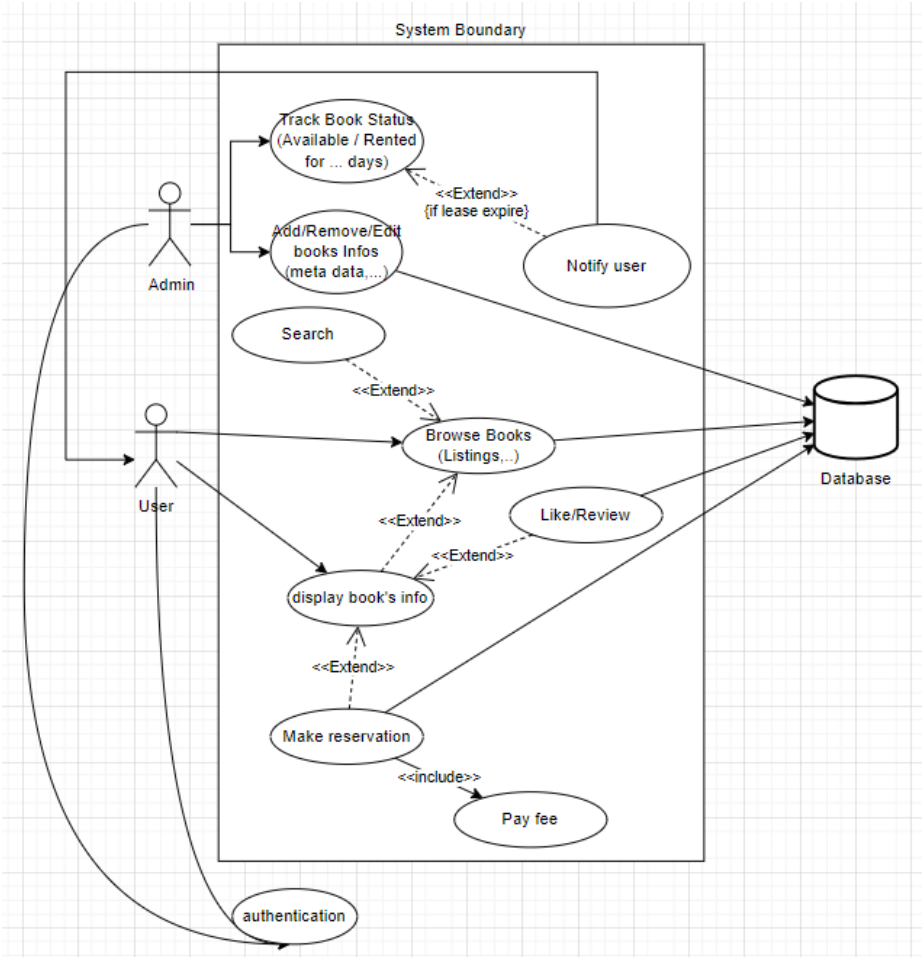
Tran Hoang Kim (17251)	- Use Case description tables - Use case diagrams - UI design: Payment pages, Search page - Payment function
Mai Trong Nhan (17565)	- Sequence diagrams - Prototype UI design - Basic functionalities for Admin pages

	- Basic functionalities for User Book Management page
Nguyen Huu Minh Quang (17452)	- Register and login for users. - Register and login for admin for testing. - Create function for the search bar on the Home page and Search page
Nguyen Thanh Son (18874)	- Design/Implement database - Added Dockerfile

V. User requirements

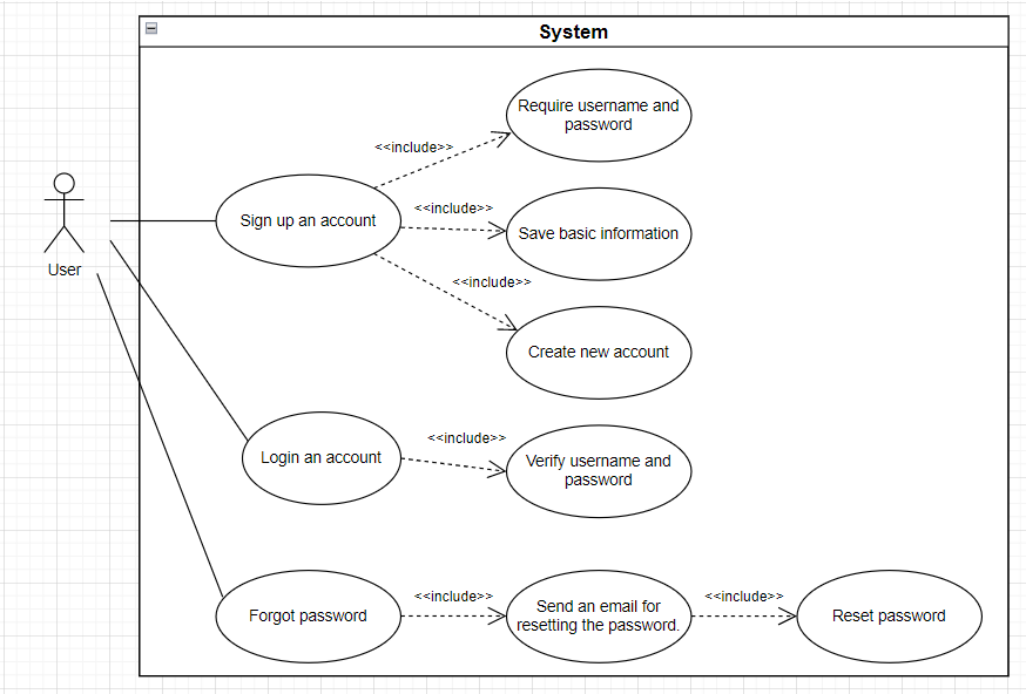
(Vo Nguyen Minh Duy - 17105, Tran Hoang Kim - 17251)

A. Overall Use case

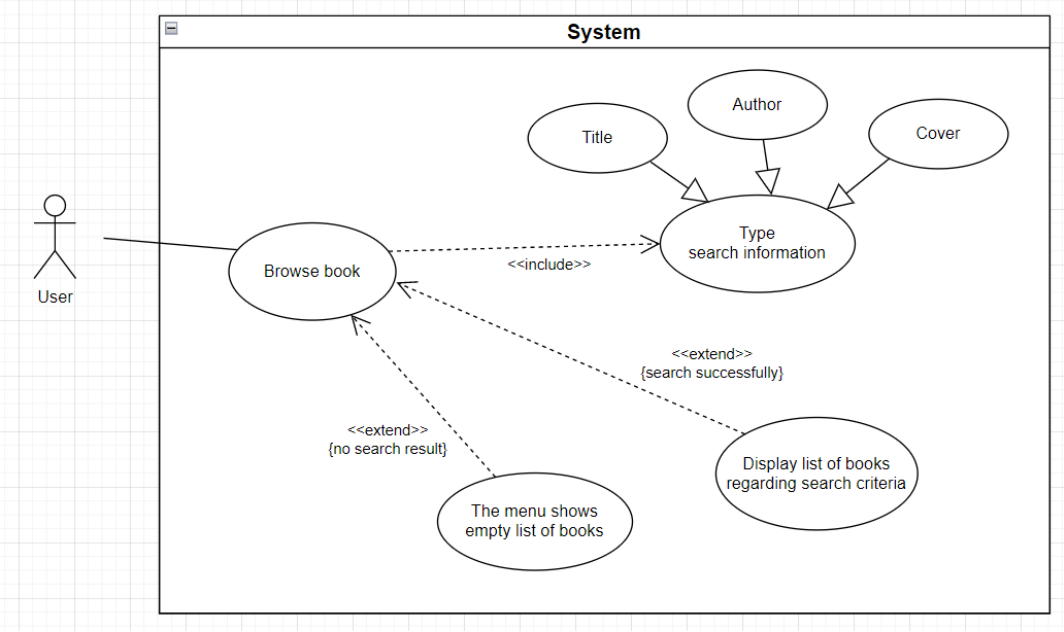


B. Use case of detail function

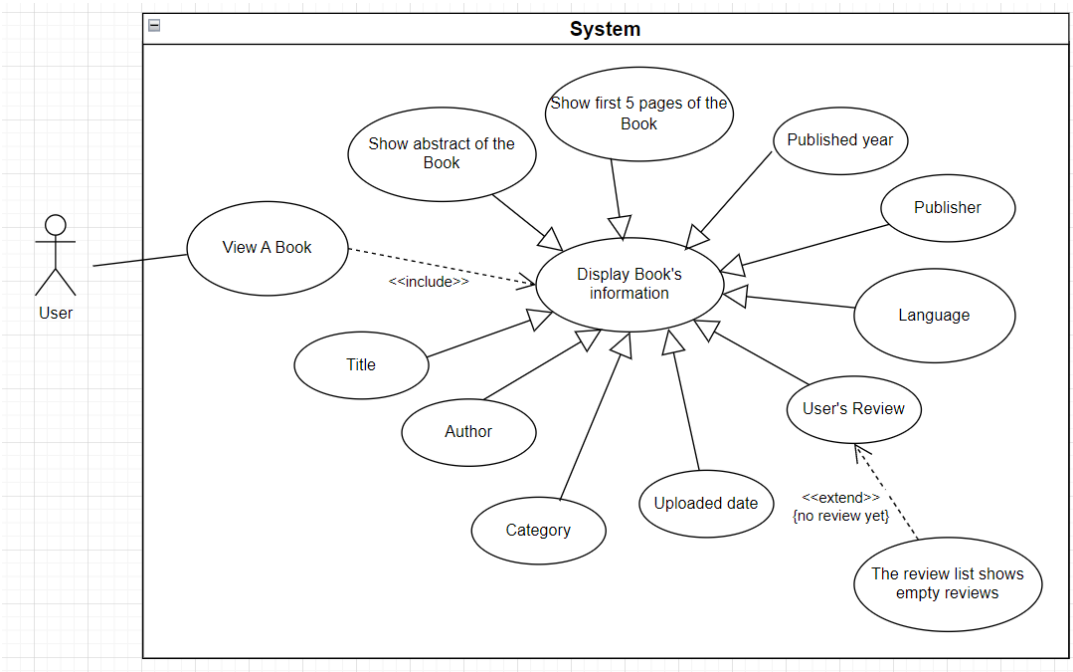
1. Login/Register



2. Book information

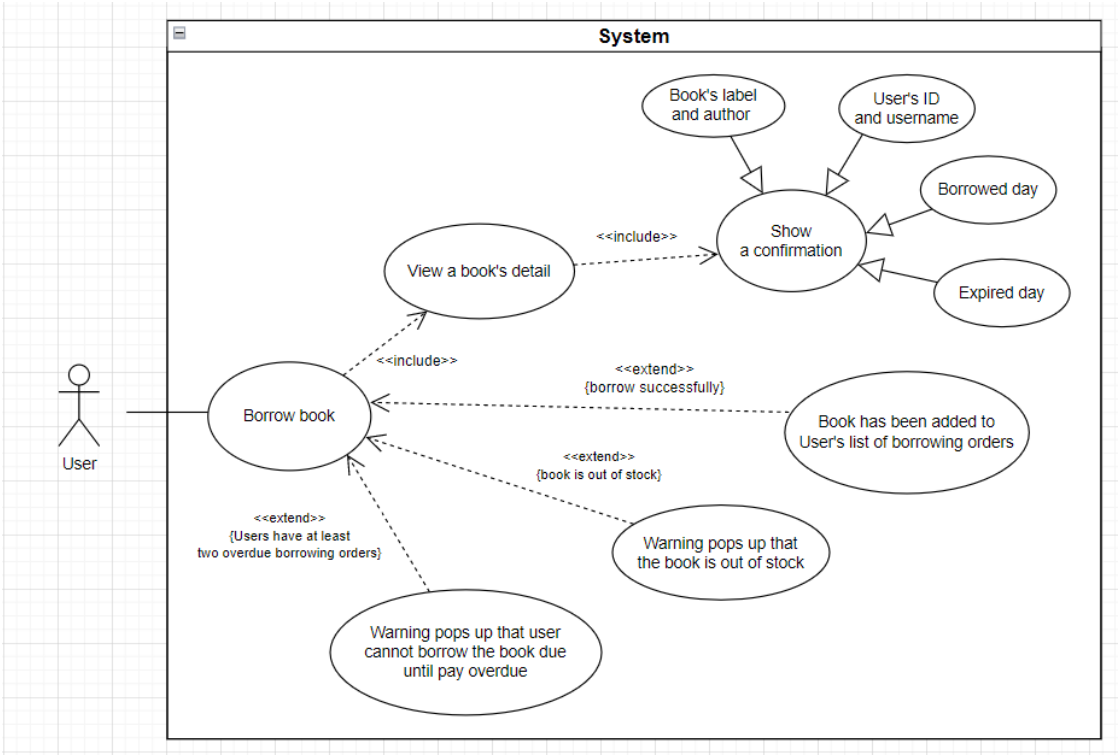


3. View a book

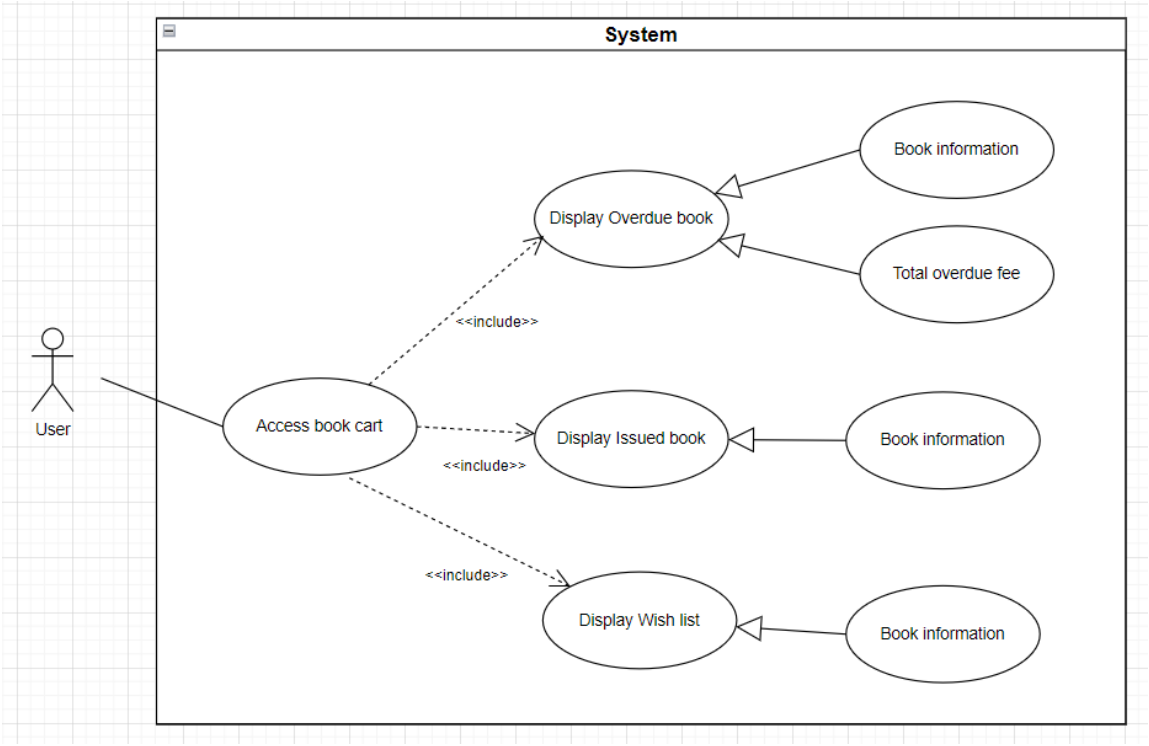


4. Borrow book

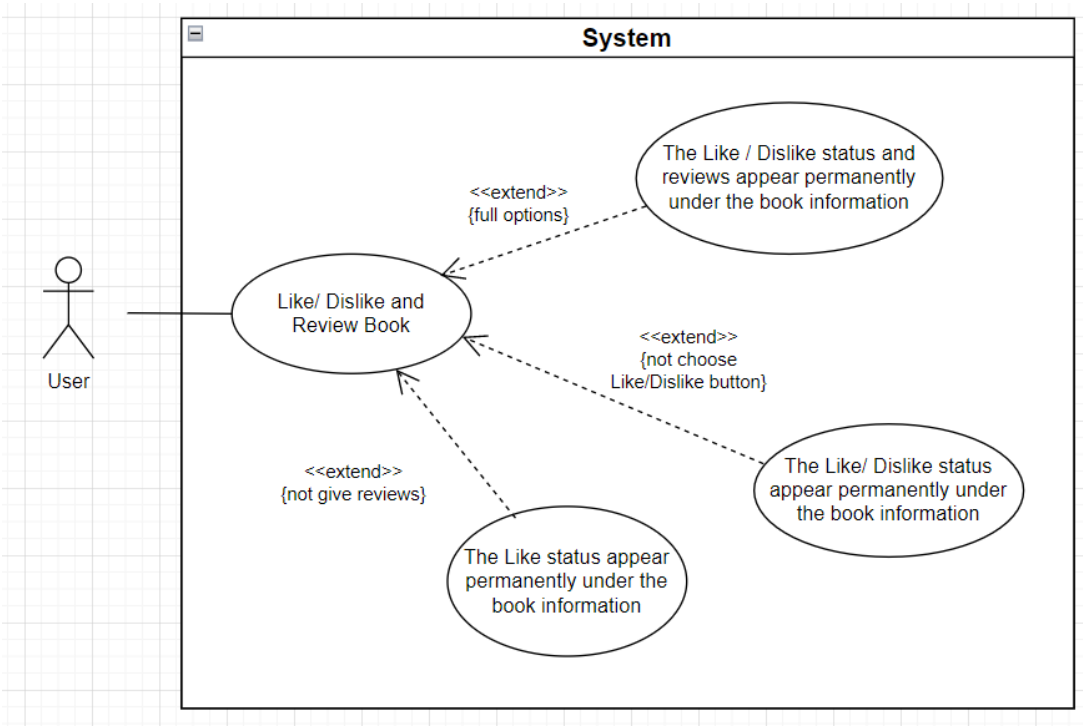
Chưa sửa



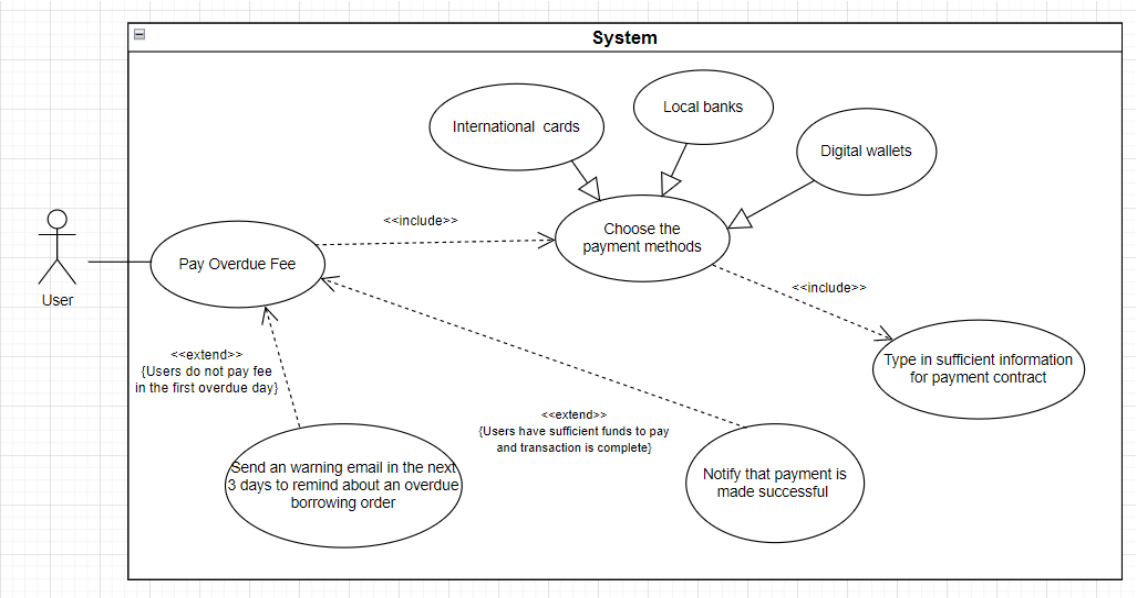
5. Book cart (book management)



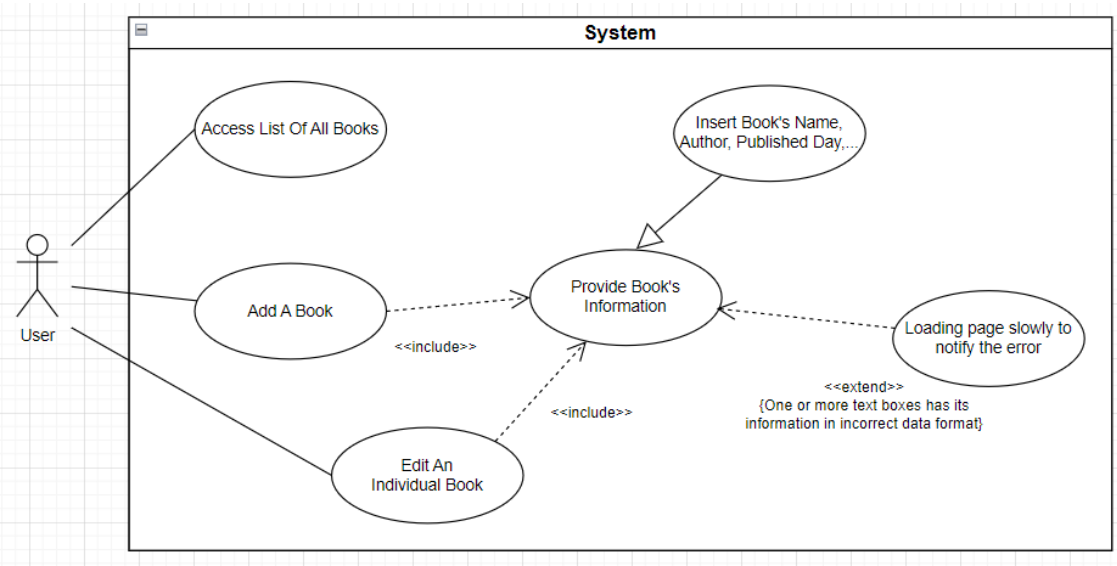
6. Like/ Dislike and Review book



7. Pay overdue



8. Add and edit book



VI. System analysis

A. Folder structure

(Nguyen Thanh Son - 18874)

Our project reference a lot from the project in the reference material provided by Mr. Chau, and has thus taken a directory structure akin to its implementation:

Code (bash):

```
$ # list all the directories in the project's git repository
$ tree --gitignore -d .
.
|-- controllers
|   `-- admin
|-- data
|-- middleware
|-- models
|-- public
|   |-- assets
|   |-- components
|   |-- css
|   |-- js
|   |-- playground_assets
|   `-- upload
`-- views
    |-- admin
    |   `-- components
    `-- layouts

16 directories
```

The main file that will called upon all the other components (index.js) lives in the project's root.The rest of the folder is rather self-explanatory: The "controllers" houses all of the controller for the web page, the "views" folder contains all the files with .ejs extension that will be rendered into html upon the user's request, all of the middlewares lives in the similarly named folder and the database blueprints for mongoose all stayed in the "models" folder. Another thing to note, as the project uses the ExpressJS framework, all of the publicly accessible resources (front-end Javascript and Cascading Style Sheet files, pictures on the website, etc.) are placed in the "public" folder, as per the default for this framework.

B. MVC Architecture

(Nguyen Thanh Son - 18874)

The MVC, or "Model-View-Controller", is one of the system architectural design patterns of modern times. It divides the moving parts of a software project into three main components:

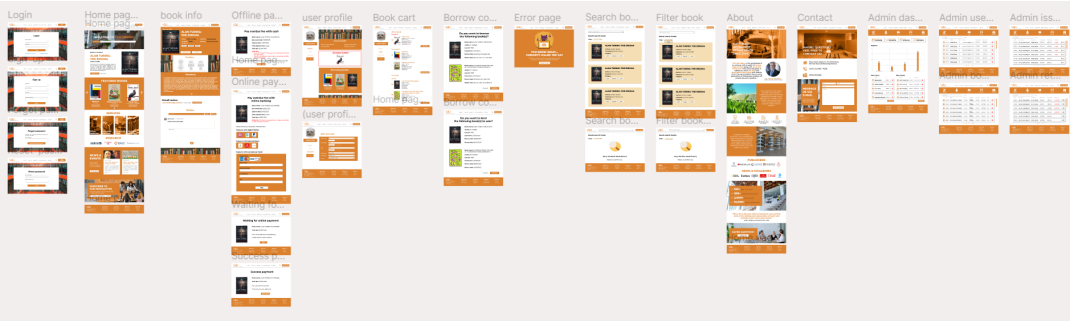
- The Controller receives incoming requests from clients, the process and directs the other two components to form corresponding responses.
- The Model manages all of the data used by the project and only interacts with the Controller.
- The View component, also communicating only with the Controller, deals with formulating data into a visual representation.

Our project takes a thin client approach of this model, commonly used in web design; in which practically all of the Model, View and Controller logic stays on the server, and the client only concerns with sending the hyperlink requests, form submissions and rendering the returning html from the server.

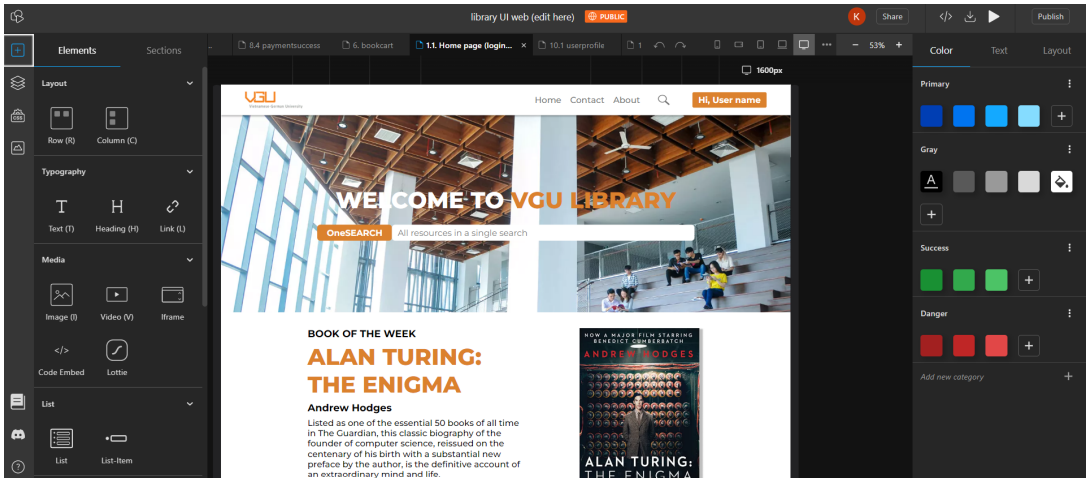
C. User Interface (UI)

(Tran Hoang Kim - 17251)

We use the Figma website to design all User Interface (UI) of the website in order to have an overview of all UI and adjust them easily before coding those.



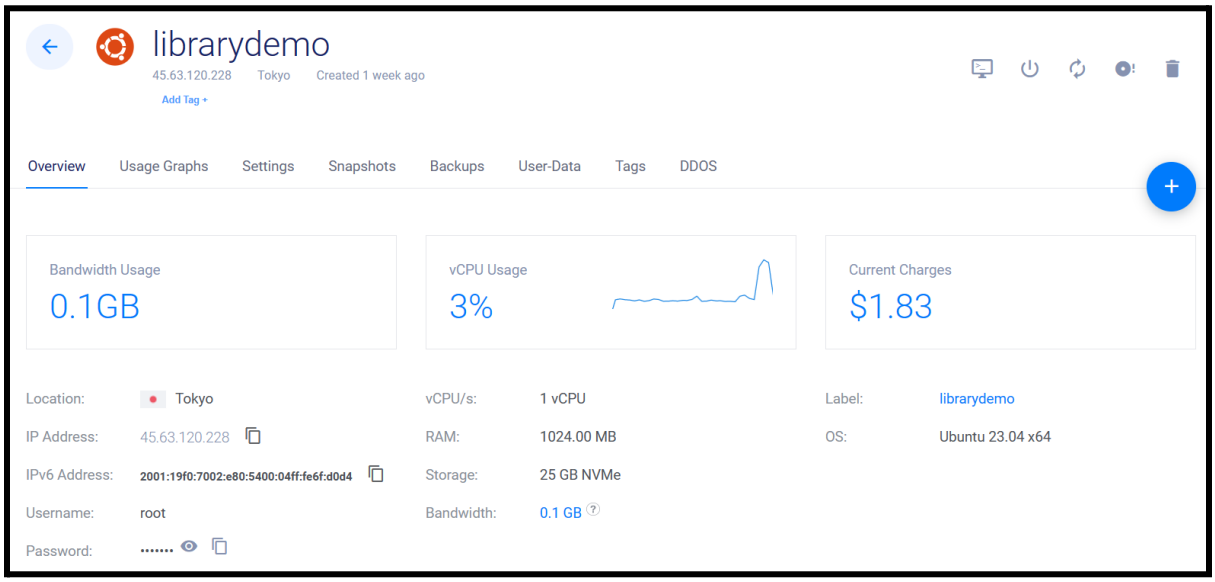
Then, we added the TeleportHQ extension in Figma to convert our designs to HTML and CSS codes. This tool can convert 80% of the origin design so that we have to adjust the pages according to the design in Figma. In the TeleportHQ website, we can drag and drop the elements (e.g. button, menu, label, text …). Almost all classes in HTML codes are so we have to change the type of classes depending on their functions in the website design.



D. Deployment Method

(Vo Nguyen Minh Duy - 17105)

In order to deploy the application to a cloud server and have it running 24/7, we use Vultr cloud service which provides us with convenient 1TB storage and 2TB bandwidth cloud server at a cheap price. After creating the account and choosing few minimal options for the cloud server, we finally settle with the following instance information:



Although Vultr provides us with an Ubuntu terminal in order to modify our instance, the server can also be accessed from the command prompt window in our laptop when applying sufficient login credentials and password.

```
C:\Users\DELL>ssh root@45.63.120.228
root@45.63.120.228's password:
Welcome to Ubuntu 23.04 (GNU/Linux 6.2.0-20-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

  System information as of Sun May 21 05:03:52 PM UTC 2023

  System load:             0.01
  Usage of /:              36.1% of 23.34GB
  Memory usage:            38%
  Swap usage:              3%
  Processes:               156
  Users logged in:         0
  IPv4 address for enp1s0: 45.63.120.228
  IPv6 address for enp1s0: 2001:19f0:7002:e80:5400:4ff:fe6f:d0d4

 * Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s
   just raised the bar for easy, resilient and secure K8s cluster deployment.

   https://ubuntu.com/engage/secure-kubernetes-at-the-edge

2 updates can be applied immediately.
To see these additional updates run: apt list --upgradable


Last login: Sun May 21 15:53:56 2023 from 171.240.177.205
```

In order to get the application running on the server, firstly the NodeJS package is installed:

- Install NVM:
  curl -o- https://raw.githubusercontent.com/nvm-sh/nvm/v0.35.3/install.sh | bash
- Install Nodesource:
  nvm install 14.4.0
- Install NodeJS:
  sudo apt-get install -y nodejs

Secondly, the procedure moves on to MongoDB installation:

- Install gnupg:
  sudo apt-get install gnupg
- Import MongoDB public GPG key:

```
curl -fsSL https://pgp.mongodb.com/server-6.0.asc | \
  sudo gpg -o /usr/share/keyrings/mongodb-server-6.0.gpg \
  --dearmor
```

+ Create list file for MongoDB
  ```
  echo "deb [ arch=amd64,arm64
  signed-by=/usr/share/keyrings/mongodb-server-6.0.gpg ]
  https://repo.mongodb.org/apt/ubuntu jammy/mongodb-org/6.0 multiverse" | sudo
  tee /etc/apt/sources.list.d/mongodb-org-6.0.list
  ```
+ Reload local package data:
  ```
  sudo apt-get update
  ```
+ Install MongoDB package:
  ```
  sudo apt-get install -y mongodb-org
  ```
+ Start MongoDB:
  ```
  sudo systemctl start mongod
  ```

After installing every package needed to run the application, the application source code from Gitlab is cloned to the directory inside the server, preferably specified. The command is shown below:

```
git clone -b temporaryMain
https://gitlab.com/galvdat/vgu_tinyprojects/pe2023/vgupe2023_team3.git
/var/apps/actual
```

Next the terminal needs to set its working directory at the folder where index.js is located. The index.js is served as application launcher and in order to specify correctly which file the command npm will run, the main terminal needs to reach index.js's root folder. The command for redirecting to the launcher's folder as well as running the application are show below:

```
cd '/var/apps/actual/online libray management'
node index.js
```

Additionally, PM2, a process manager for NodeJS applications, fully written in Shell and NodeJS, is installed in order to keep our application running stably, reloading and restarting smoothly with zero downtime. The command to install PM2 is shown below:

```
sudo npm install -g pm2
```

After installing PM2, index.js file can be binded to PM2 manager to keep the whole application permanently running. Since it requires the specific file index.js itself, the terminal needs to set its current directory to the folder containing index.js, as said above.

```
pm2 start index.js
pm2 list
```

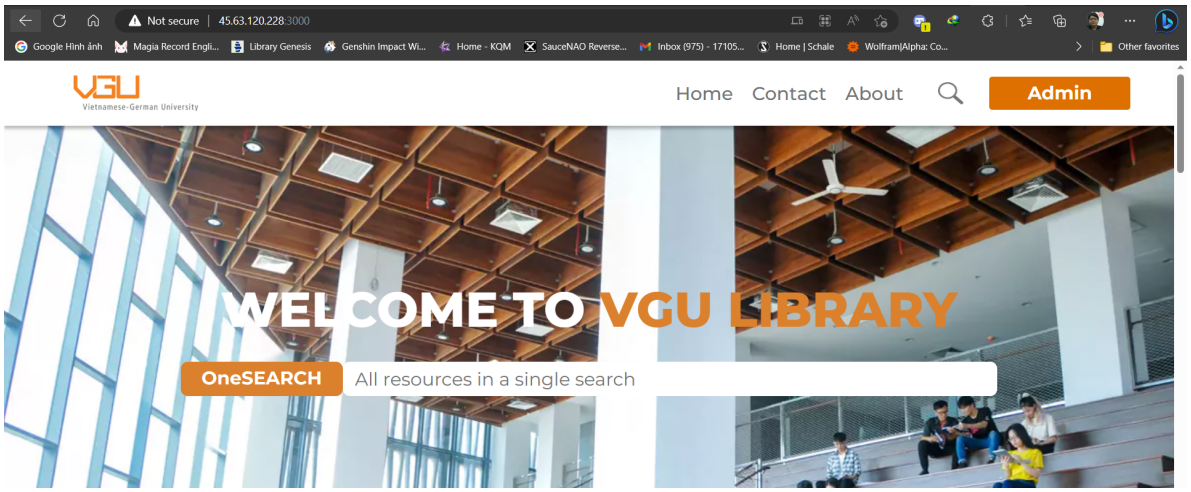
id	name	namespace	version	mode	pid	uptime	↺	status	cpu	mem	user	watching
0	index	default	1.0.0	fork	53028	107m	0	online	0%	87.9mb	root	disabled

The final step of enabling the server to accept global connections from any machine is to enable open the application port in UncomplicatedFirewall (UFW). The following commands are used to accomplish such a task.

```
sudo ufw enable
sudo ufw allow 3000
sudo ufw reset
```

Finally, any user can now access our application by entering into the address bar the following format, our cloud server's address : our application port. In this case the address will be http://45.63.120.228:3000. It does not require anything to access this link rather than the literal link itself.

Since our application does not contain any embedded data of the local MongoDB from our machine, the Admin user needs to work on initializing many Books data and Users data, if necessary. However any changes made by different users from different machines will be sent to the only one database initialized and accessed by our application.

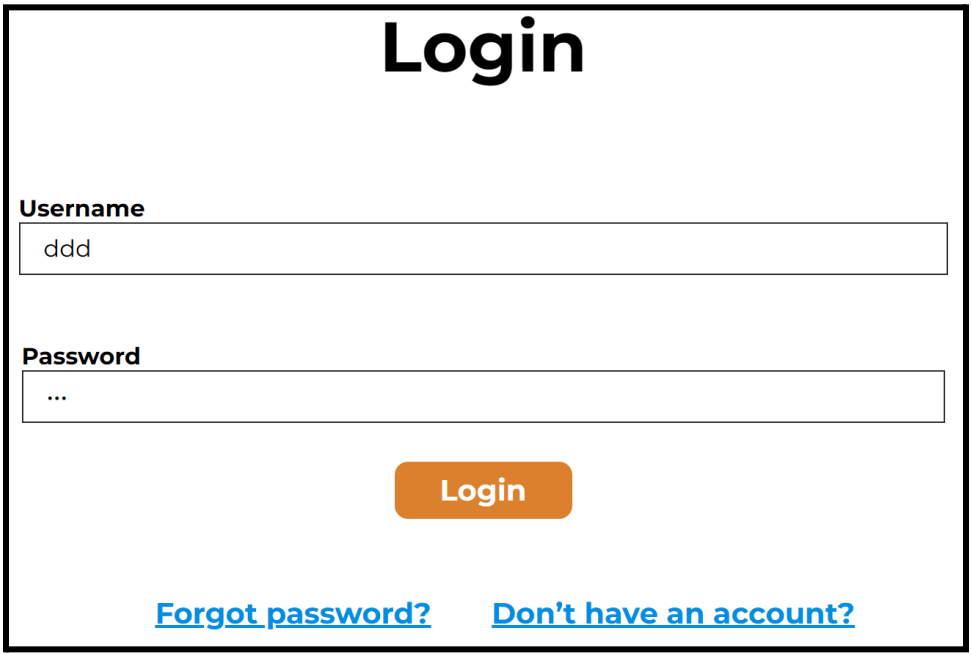


E. Login/Register

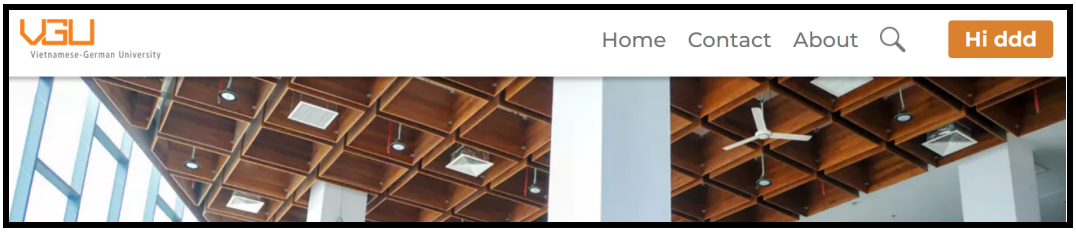
(Do Dinh Dong - 17000)

Users can login as a normal user or admin. In the Login page, after the user submits the username and password, the system will find the username and hashed

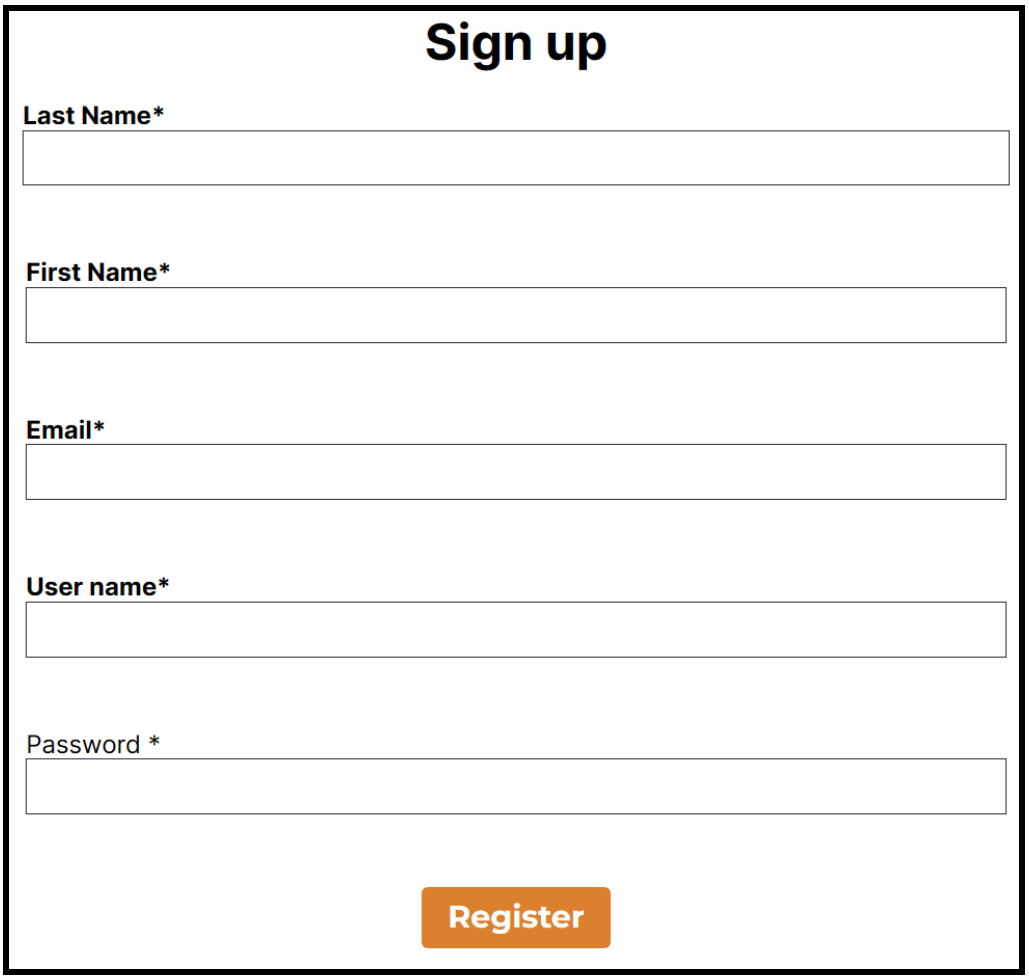
password on the database. If both are matched, the system will route to the homepage, with the username shown on the Hi <username> box.



Navigation bar after login:



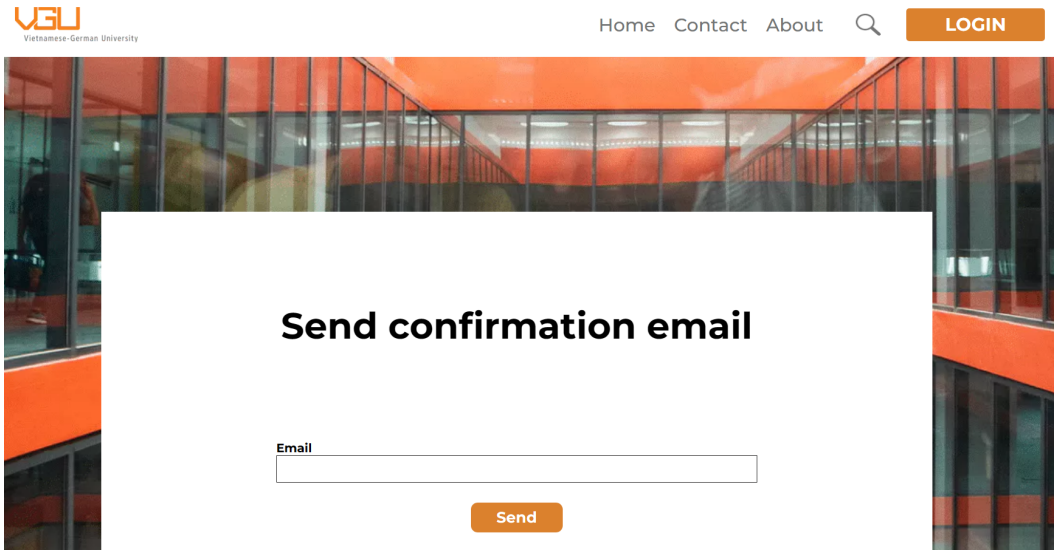
To register an account, the user goes to the Login page and clicks the "Don't have an account?" button to redirect to the Register page. The user provides their name, email address, username and password. Then, the system saves them as a new record to the database.



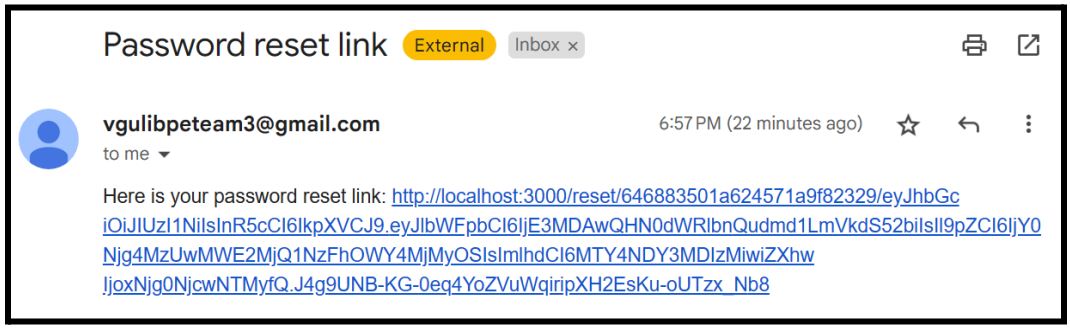
F. Reset password

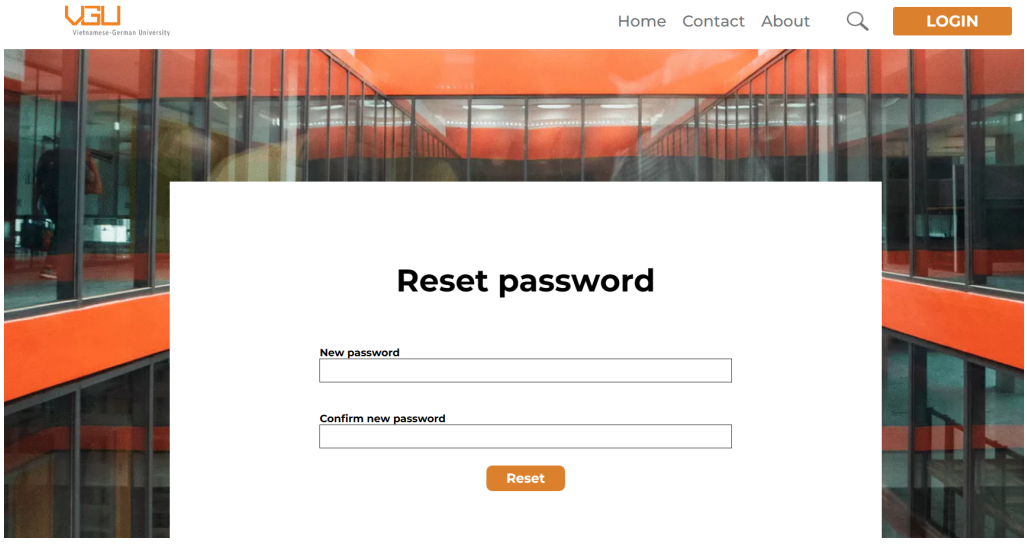
(Do Dinh Dong - 17000)

In the “Send confirmation email” page, user types in the email address. If that email exists in the database, the system sends the password reset link to the user’s email. Else, the system routes back to the send confirmation email page.



Clicking the link sent to the user's email will bring the user to the Password reset page.





G. Send email

(Do Dinh Dong - 17000)

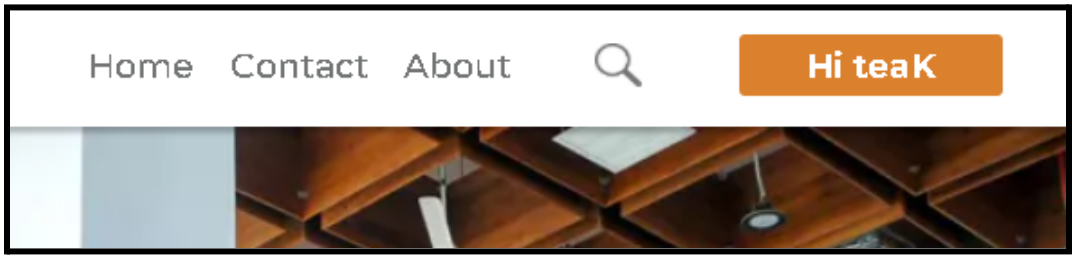
System sends email to the user to notify book overdue status or reset the password. We display the function in the *sendEmail.js* code below:

```
const nodemailer=require('nodemailer')
module.exports=async function sendEmail(recipient,subject,text){
 const transporter=nodemailer.createTransport({
  service:'gmail',
  auth:{
   user:'vgulibpeteam3@gmail.com',
   pass:'********' //hidden for security
  }
 })
 const info=await transporter.sendMail({
  from:'vgulibpeteam3@gmail.com',
  to:recipient,
  subject:subject,
  text:text
 })
 console.log('Message sent: '+info.messageId)
}
```

H. Update user account information

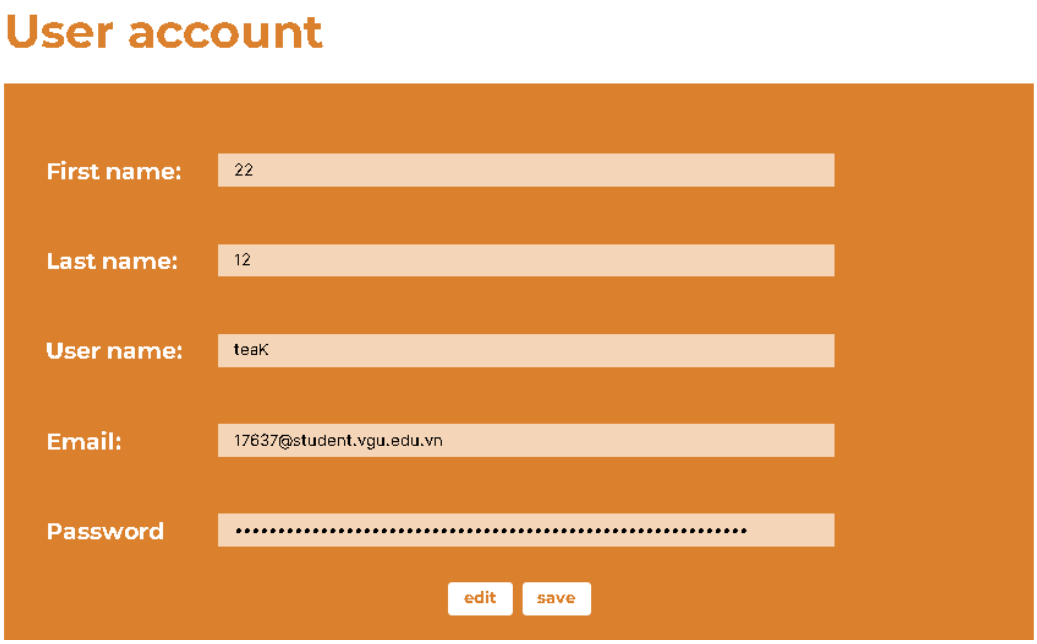
(Tra Dang Khoa - 17637)

This simple function allows the user to update their account information and profile picture. When a user logged in, they can access this function by clicking the login button (which now has turned into “Hi username” button). This will lead the user to a user profile by the route "/user_profile" in navbar.esj in the layout folder.



This will render the user profile. Users can access the account page by clicking on the "Account" on the user navigation column on the left of the page. We link the Account with route "/user_profile_setting".

When entering the account setting page. Users can now edit their general account information by clicking on the edit button. This will call the script edit.js to enable the edit.




```
function _t(id) {
```

```
    return document.getElementById(id);
}

var hey = document.querySelectorAll('input')
let btn1 = _t('startEditing');

btn1.onclick = function(){
//check the input element is readOnly or not
    console.log("sucess")
    for (let i = 0; i < hey.length; i++) {
      if( hey[i].readOnly== true) {
       hey[i].readOnly =false
       hey[i].style.backgroundColor ='#ffffff'
      } else {
       hey[i].readOnly =true
       hey[i].style.backgroundColor ='#f5d5b7'
      }
     }
}
```

After the player input the new info. They need to click the save button to submit to the database. This will call updateAccount.js.

This code makes the submit smoother without having to redirect into another route.

```
$('#change').submit(function(e){

    var formData = $('#change').serialize();
    e.preventDefault();
     $.ajax({
        url: "/users/change",
        type: 'post',
        data : formData,
        success: function(respond){
           alert(respond.text);
```

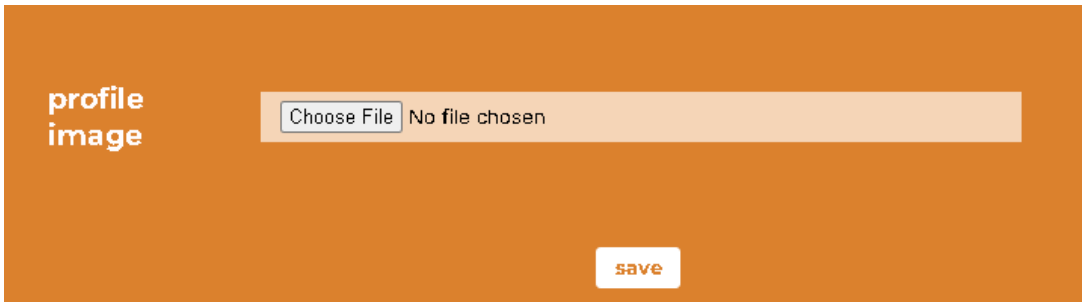
```
            console.log("hi")
        }
    });
    return false;
});
```

The "/users/change" route will lead to the updateAccount.js controller to update the database.

```
const User = require('../models/User')
const path = require('path')
module.exports = (req, res) => {

   const username = user1;
   User.findOneAndUpdate({username: username}, req.body, {upsert: true})
   .then((user)=>{
            console.log("yo");
            res.send({
               text:"sucess"
             });

   })
   .catch((error,user) =>{
      console.log(error,user)
   })

}
```

And that's all for updating general account information.

Update image function is a little bit different from update general information. Update image profile doesn't have an edit button and when clicking the save button, instead of calling the updateAccount.js script, it will simply submit the form to the route "/users/changeImage".



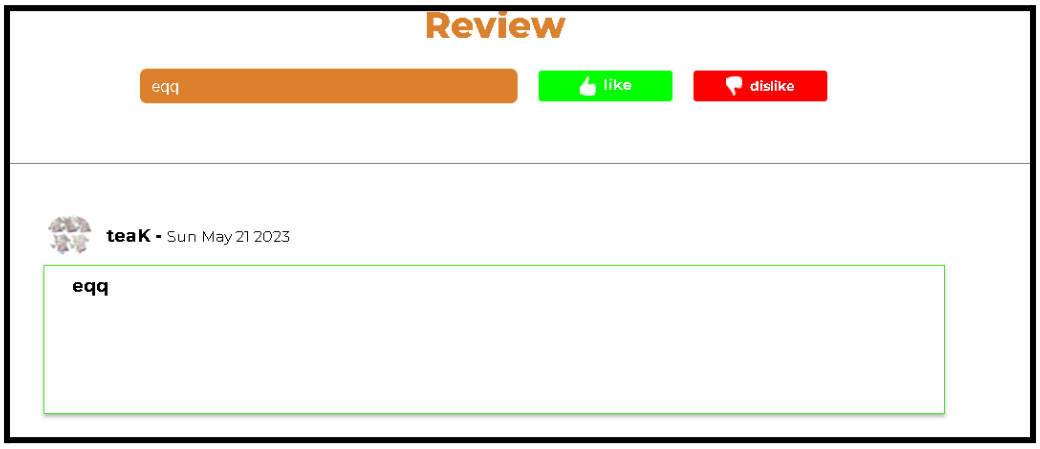
This will run an updateAccountImage.js controller to store images into route public/upload/.

```
const User = require('../models/User')
const path = require('path')
module.exports = (req, res) => {
   console.log(req.files);
   if(!req.files) console.log('Nothing');
   let { iconLink } = req.files;
   iconLink.mv(path.resolve(__dirname,'..' ,'public/upload', iconLink.name),
function (err)
   {
   const username = user1;
   User.findOneAndUpdate({username: username}, {...req.body, iconLink:
'/upload/' + iconLink.name}, {upsert: true})
   .then((user)=>{
            console.log("yo");
            res.redirect('/user_profile_setting')

   })
   .catch((error,user) =>{
      console.log(error,user)
   })
   })
}

```

I. Review book

(Tra Dang Khoa - 17637)

The book review section in the book-info page allows users to input their review to a book. In this, socket.io.js is used to enable real time updates. Meaning that users can see their submitted review right away.



First, the likeAnddislike.js script will run when clicking on dislike or like button, after the users input the review.

```
function _t(id) {
   return document.getElementById(id);
}

let input = _t('rating');
let like= _t('like');
let dislike =_t('dislike')


like.onclick = function(){
   console.log("sucess")
   input.value = "Recommended"

}
dislike.onclick = function(){
   console.log("sucess")
```

```
    input.value = 'Not Recommended'

}
```

This script will check what rating did the user choose, dislike or like then change the input rating value to corresponding user's choice. After that, doComment.js will be called to enable submitting forms without redirection.

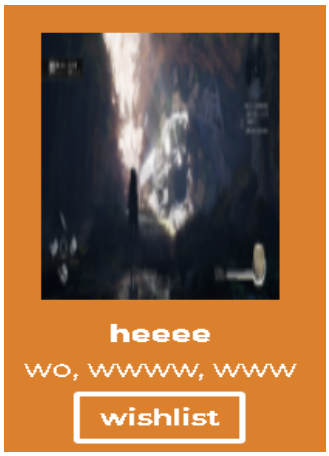
```
$('#review').submit(function(e){

  var formData = $('#review').serialize();
  var userName = document.getElementById('writtenBy.userName').value;
  var body = document.getElementById('body').value;
  var rating = document.getElementById('rating').value;
  var title = document.getElementById('title').value;
  e.preventDefault();
   $.ajax({
      url: "/users/review",
      type: 'post',
      data : formData,
      success: function(respond){
         formData._id = respond._id;
         socket.emit("new_comment", formData, userName, body, rating,
title);
         alert(respond.text);
         console.log("hi")
      }
   });
   return false;
});
```

The script will get the input data and send it to route "/users/review" to store the review content.

```
const Review = require('../models/Review')
module.exports=(req,res) =>{
   Review.create(req.body)
   .then(()=>{
      res.send({
        text:"sucessfully send"
      });
   })
}

```

J. Add wishlist

(Tra Dang Khoa - 17637)



or this


Add to wishlist function simply allows users to mark their favorite book for borrowing later on. When clicking on the wishlist button, it will submit the form into route “ /users/wishlist ” and run AddToWishlist.js.

```
const WishList = require('../models/WishList')
module.exports=(req,res) =>{
   if(loggedIn){
      console.log(req.body)
```

```
        let uid= req.body.userID;
        console.log(req.body.userID);
        let book = {
            'bookID': req.body.bookID,
            'bookName': req.body.bookName,
            'Author': [req.body.Author]
        }
        console.log(req.body.Author);
        console.log(book);
        WishList.findOneAndUpdate({'userID': uid}, {$push: {'books':
book}},{upsert:true})
        .catch((error)=> console.log(error))
        .then((book)=>{
            res.redirect('/index')
        })
    } else {
        console.log(req.body)
        res.send({
            text:"please login bro"
            });
    }
}

```

K. Book slider

(Tra Dang Khoa - 17637)

The swiper.js script is used to enable the book slider on the home page. First the swiper.js main script is imported in the script.ejs layout.

```
<script
src="https://cdn.jsdelivr.net/npm/swiper@9/swiper-bundle.min.js"></script>

```

Then import script.js

```
<script src="/js/script.js"></script>

```
After that, script.js will run when loading a page.

```
var swiper = new Swiper(".home-the-slide-content", {
   slidesPerView: 1,
   spaceBetween: 0,
   loop: true,
   centerSlide: 'true',
   fade: 'true',
   grabCursor: 'true',
   pagination: {
    el: ".swiper-pagination",
    clickable: true,
    dynamicBullets: true,
   },
   navigation: {
    nextEl: ".swiper-button-next",
    prevEl: ".swiper-button-prev",
   },

   breakpoints:{
      0: {
         slidesPerView: 1,
      },
      520: {
         slidesPerView: 2,
      },
      950: {
         slidesPerView: 3,
      },
      1600: {
       slidesPerView: 4,
      },
```

```
  },
 });
```

L. Check Due date

(Tra Dang Khoa - 17637)

This middleware will be activated before loading the homepage to check if the current date is 1 days before the due date, if yes it will send an email to the user to warn about the due date. It also checks if today is a due date, if yes then update status of that book to overdue.

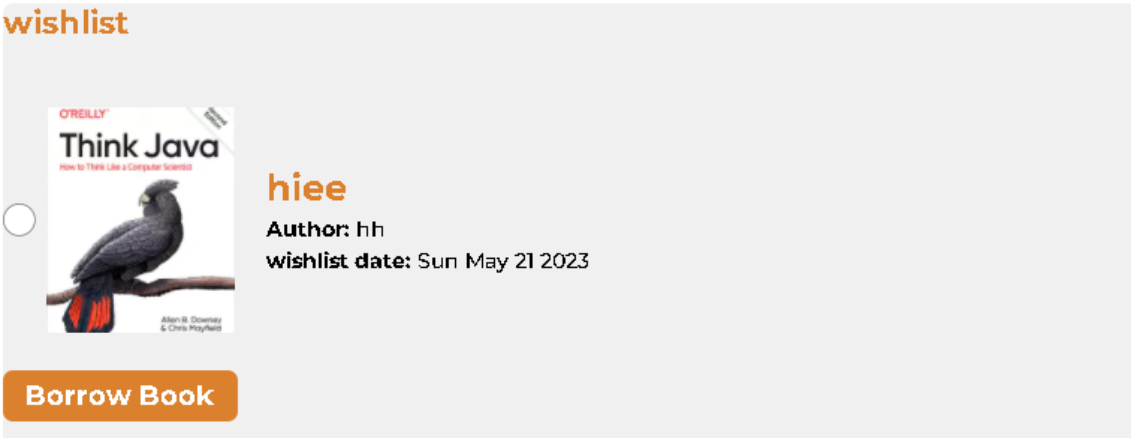
```
const Borrow = require("../models/BorrowRecord");
const Users = require("../models/User.js");

const sendEmail=require('../controllers/sendEmail')
module.exports = (req, res, next) => {
   Promise.all
   ([
      Users.find(),
      Borrow.find(),
   ])
      .then(([user, borrow]) => {
         //caculate the date
        if (user.length != 0 && borrow.length !=0) {
            var dif = []
            var due = []
            for (var i = 0; i < borrow.length; i++) {
               var now = new Date().getTime();
               dif[i] = (Math.abs(now - borrow[i].createdAt)) / (1000 * 3600 *
24);
               due[i] = (Math.abs(borrow[i].dueDate - borrow[i].createdAt)) /
(1000 * 3600 * 24);
               //  dif[i] = 0;
               //  due[i] = 0;
               console.log(dif[i])
```

```
                console.log(due[i])

                if (dif[i] != due[i] &&  due[i]- dif[i] <= 1 ){
                   console.log("one or less than one day left")
                   for (var k = 0; k < user.length; k++) {
                      if (user[k]._id.equals(borrow[i].userID) ){
                         console.log("help")
                         sendEmail(user[k].email,
                         'Password reset link', 'the book is almost due bro'
                         )
                      }

                   }
                } else if (dif[i] == due[i] ){
                   console.log("time out")
                   for (var k = 0; k < user.length; k++) {
                      if (user[k]._id.equals(borrow[i].userID) ){
                         console.log("help")
                         borrow[i].overDue = true
                         borrow[i].paymentAmount = 100;
                         borrow[i].status = "overdue";
                         borrow[i].save()
                      }
                   }
                }
             }
             next();

          })
    }

    ```
```

M. User book management

(Tra Dang Khoa - 17637)
```

Users can access book management by clicking on books.

This page has three functions: borrow in the wishlist section, return books in the book section and pay the fine for overdue books.

Borrow book:



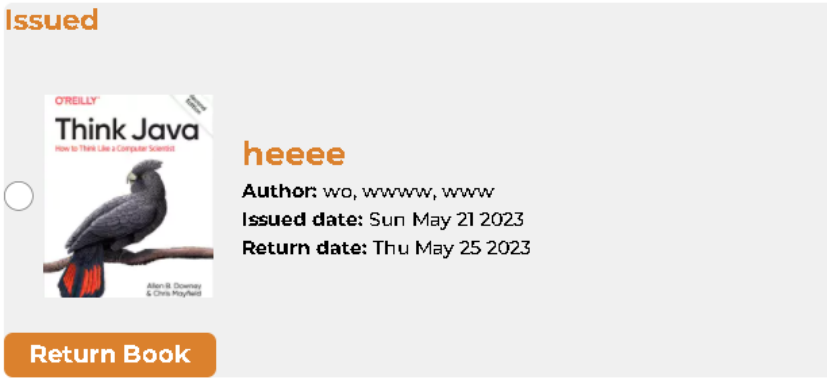
Borrow button will submit the form to "/users/borrow2" and run borrow2.js borrow2.js :

```
const Borrow = require('../models/BorrowRecord')
const WishList = require('../models/WishList')
var mongoose = require('mongoose');
module.exports=(req,res) =>{
   const id = req.session.userId;
   var objectId = new mongoose.Types.ObjectId(id);
   console.log(req.body)
   let book = {
```

```
        'bookID': req.body.bookID,
    }

    Promise.all
    ([
        Borrow.create(req.body),
        WishList.findOneAndUpdate({userID: objectId.toString()}, {$pull:
{books: book}})
    ])
    .then(()=>{
        res.redirect('/bookcart')

    })
}
```

Here, we need to combine two premade database tables, WishList and BorrowRecord to look up books based on bookID and userID. Based on userID, we can create a new entry on BorrowRecord, then find the corresponding bookID and update the entry, along with pre-defined information such as Issued Date and Return Date. A new BookRecord ID will be automatically created in MongoDB, which is necessary to perform later tasks: Return book and Paying overdue.

Return book:



Return Book function when clicking, it will submit the form to "/users/returnBook" and run the returnBook.js

```
```

```
const Borrow = require('../models/BorrowRecord')
var mongoose = require('mongoose');
module.exports= async (req,res) =>{
   var id = req.body.ID
   console.log(id)
   var objectId = new mongoose.Types.ObjectId(id);
   var user = loggedIn
   var userId = new mongoose.Types.ObjectId(user);

      // Borrow.findOneAndUpdate({bookID : objectId .toString(), userID:
userId.toString() }, {status: "returned",hasReturned: true}),
      let doc = await Borrow.findOne({bookID : objectId .toString(), userID:
userId.toString(), 'hasReturned': false })
      if(doc == null) {

         res.redirect('/404')
      };
         console.log(doc)
         doc.hasReturned = true;
         doc.status = 'returned';

         await doc.save();
         console.log("delete done")
         console.log("")

         res.redirect('/bookcart')
   // .then(()=>{

   // })
}
```

This section requires BorrowRecord entry ID to retrieve information about borrowing status. If the selected book has returned, the hasReturned attribute will change its Boolean status from “false” to “true”, which will trigger entry deletion. The page will be automatically updated once the user is redirected to their Book Management page.

Pay overdue book:

This button simply leads the user to a payment page. When clicked it will drop down two options: by Cash, by Credit card. This is done thanks to the part of the script dropdown.js.

```
const Borrow = require("../models/BorrowRecord");
const Users = require("../models/User.js");

const sendEmail=require('../controllers/sendEmail')
module.exports = (req, res, next) => {
   Promise.all
   ([
      Users.find(),
      Borrow.find(),
   ])
      .then(([user, borrow]) => {
         //caculate the date
        if (user.length != 0 && borrow.length !=0) {
            var dif = []
            var due = []
            for (var i = 0; i < borrow.length; i++) {
               var now = new Date().getTime();
               dif[i] = (Math.abs(now - borrow[i].createdAt)) / (1000 * 3600 *
24);
```

```
            due[i] = (Math.abs(borrow[i].dueDate - borrow[i].createdAt)) /
(1000 * 3600 * 24);
            //  dif[i] = 0;
            //  due[i] = 0;
            console.log(dif[i])
            console.log(due[i])

            if (dif[i] != due[i] &&  due[i]- dif[i] <= 1 ){
               console.log("one or less than one day left")
               for (var k = 0; k < user.length; k++) {
                  if (user[k]._id.equals(borrow[i].userID) ){
                     console.log("help")
                     sendEmail(user[k].email,
                     'Password reset link', 'the book is almost due bro'
                     )
                  }

               }
            } else if (dif[i] == due[i] ){
               console.log("time out")
               for (var k = 0; k < user.length; k++) {
                  if (user[k]._id.equals(borrow[i].userID) ){
                     console.log("help")
                     borrow[i].overDue = true
                     borrow[i].paymentAmount = 100;
                     borrow[i].status = "overdue";
                     borrow[i].save()
                  }
               }
            }
         }
      }
      next();

   })
}
```

```

This is the most complicated section in the User Book Management page, as mathematical conditions must be applied as a prerequisite for later functionalities. Here, the absolute values of current date and due date are calculated to obtain the date difference. If the date difference equals to 1, an email message is sent to the user's corresponding email to notify them to return the book. If the absolute value of current date equals that of due date, it means the book is overdue. Then, the server will automatically update the payment amount, and the user will select between two method options (by Cash, or by Credit Card) to redirect to Payment pages.

## N. Search book

(Nguyen Huu Minh Quang - 17452)

Search bar is required for users to look for books quickly. The below codes will show a search bar and the results shown when it receives inputs from users.

```
const express = require('express')
const app = express()
const bodyParser = require('body-parser')
const mongoose = require('mongoose')
const fileUpload = require('express-fileupload')
const expressSession = require('express-session');
const Book = require('./models/Book')
```

```
// get book for searching
app.post('/getBooks',async (req,res)=>{
    let payload = req.body.payload.trim();
    let search = await Book.find({title :{$regex : new RegExp('^'+payload+'.*','i')}}).exec();
    //Limit Search Results to 10
    search = search.slice(0,10);
    res.send({payload: search});
})
```

- The app.post('/getBooks',async (req,res)=>{...}) code creates a POST endpoint /getBooks which listens for incoming requests.
- The let payload = req.body.payload.trim(); code extracts the payload value from the request body and trims any leading or trailing whitespaces.
- The let search = await Book.find({title :{$regex : new RegExp('^'+payload+'.*','i')}}).exec(); code uses the Book model to search for books that have a title field matching the regular expression generated from the payload value. The regular expression ^ matches the beginning of the string while the .* matches any character after the payload. The i flag
```

makes the regex case-insensitive. The search is an asynchronous operation due to the await keyword.

- The search = search.slice(0,10); code limits the search result to at most 10 items.
- The res.send({payload: search}); code sends the search result in JSON format as the response to the client request.
- The /getBooks endpoint's purpose is to search for books in the database based on the provided payload value and return the matching books as a response to the client request.

After that, we need a function to send the data from the frontend, showing the results according to what they've searched.

```
<div class="search-filter-book-search-bar">
        <input
            type="text"
            placeholder="Search for book you want"
            onkeyup="sendData(this)"
            class="search-filter-book-search-bar1 input"
        />
        <a
```

```
function sendData(e){
  const searchResults = document.getElementById('searchResults')
  let match = e.value.match(/^[a-zA-Z ]*/);
  let match2 = e.value.match(/\s*/);
  if(match2[0] === e.value){
    searchResults.innerHTML = '';
    return;
  }
  if(match[0] === e.value){
    fetch('getBooks',{
    method:'POST',
    headers: {'Content-Type':'application/json'},
    body : JSON.stringify({payload: e.value})
  }).then(res => res.json()).then(data =>{
    let payload = data.payload;     // payload is an array coontaining the book's title, author and URL link
    searchResults.innerHTML = '';
    if(payload.length < 1){
      searchResults.innerHTML = '<p>Sorry. Nothing Found.</p>';
    return;
    }
  let bookTitle   = document.getElementById('bookTitle'); // get ID from bookTitle below
  let bookAuthor  = document.getElementById('bookAuthor'); // get ID from bookAuthor below
  let bookHref = document.getElementById('bookHref');      // get ID from bookHref below  (URL link of the book)
```

```
let bookTitle1  = document.getElementById('bookTitle1'); // and so on for bookTitle 1,2,3,4,5
let bookAuthor1 = document.getElementById('bookAuthor1');
let bookHref1 = document.getElementById('bookHref1');
let bookTitle2  = document.getElementById('bookTitle2');
let bookAuthor2 = document.getElementById('bookAuthor2');
let bookHref2 = document.getElementById('bookHref2');
let bookTitle3  = document.getElementById('bookTitle3');
let bookAuthor3 = document.getElementById('bookAuthor3');
let bookHref3 = document.getElementById('bookHref3');
let bookTitle4  = document.getElementById('bookTitle4');
let bookAuthor4 = document.getElementById('bookAuthor4');
let bookHref4 = document.getElementById('bookHref4');
let bookTitle5  = document.getElementById('bookTitle5');
let bookAuthor5 = document.getElementById('bookAuthor5');
let bookHref5 = document.getElementById('bookHref5');

bookTitle.innerText = payload[0].title;  // take the title from the first slot of the payload[0] array
bookAuthor.innerText = payload[0].author; // take the author from the first slot of the payload[0] array
bookHref.setAttribute('href', payload[0].url); // take the URL link from the first slot of the payload[0] array
bookTitle1.innerText = payload[1].title;
bookAuthor1.innerText = payload[1].author;
bookHref1.setAttribute('href', payload[1].url);
bookTitle2.innerText = payload[2].title;
bookAuthor2.innerText = payload[2].author;
bookHref2.setAttribute('href', payload[2].url);
bookTitle3.innerText = payload[3].title;
bookAuthor3.innerText = payload[3].author;
bookHref3.setAttribute('href', payload[3].url);
bookTitle4.innerText = payload[4].title;
bookAuthor4.innerText = payload[4].author;
bookHref4.setAttribute('href', payload[4].url);
bookTitle5.innerText = payload[5].title;
bookAuthor5.innerText = payload[5].author;
bookHref5.setAttribute('href', payload[5].url);
```

Restart Visual Studio Code to apply

```
    payload.forEach((item,index)=>{ // loop to display each book (item) information from the payload
      if(index === 0) {
        searchResults.innerHTML = `<p>${item.title}</p>`;
        document.getElementById('bookAuthor').textContent = 'Author : '+item.author;
    }

    });

  });
  return;
  }
    searchResults.innerHTML = '';

}
```

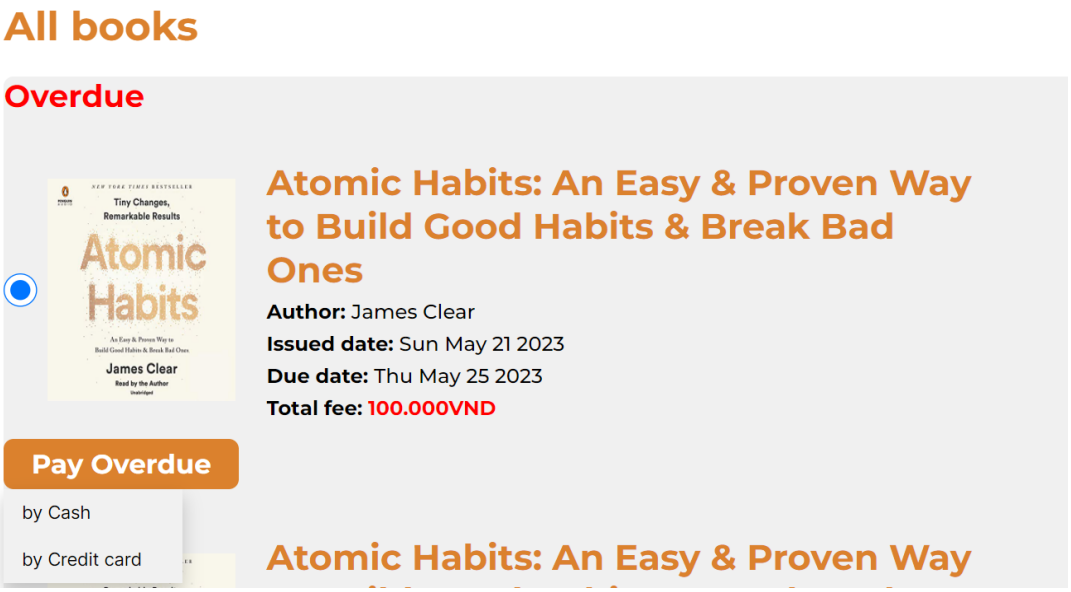
- The function sendData takes an event e as its parameter and is responsible for fetching and displaying search results based on the user's input in the search bar.
- The second and third lines use regular expressions to extract the alphabetical characters and whitespace from the user's input. The match variable captures all alphabetical characters and spaces, while match2 captures only whitespace.
- The fourth and fifth lines are conditional statements that check if the user's input is either all whitespace or only contains alphabetical characters and spaces. If either of these conditions is true, the search result element is cleared and the function returns.
- The sixth to fourteenth lines perform the main task of the function. It sends a POST request to the server with the user's input as the payload. Once a

response is received, the payload is extracted and displayed in the search result element. If there are no search results, the element displays a message saying "Sorry. Nothing Found." let payload is an array that contains the data given back from the database, which will be displayed by the loop payload.forEach(item,index).

O. Payment method

(Tran Hoang Kim - 17251)

If the time that users borrow a book is more than the days which the library allows them to borrow, users have to pay a overdue fee for that book. The payment information will be notified in the user's book cart and through email. Users need to pay the fee, otherwise they can not borrow more books. At the Overdue list in the Book cart page, there are 2 payment methods that will be dropped down when we press the Pay Overdue button. Users can choose the payment method that is suitable to them.

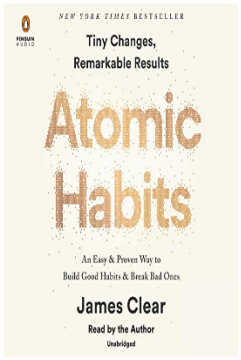


Check due date function can recognize which books are overdue. After that, the server will send a overdue notification to users through email:

```
module.exports = (req, res, next) => {
    Promise.all
    ([
        Users.find(),
        Borrow.find(),
    ])
        Complexity is 11 You must be kidding
        .then(([user, borrow]) => {
            //caculate the date
           if (user.length != 0 && borrow.length !=0) {
                var dif = []
                var due = []
                for (var i = 0; i < borrow.length; i++) {
                    var now = new Date().getTime();
                    dif[i] = (Math.abs(now - borrow[i].createdAt)) / (1000 * 3600 * 24);
                    due[i] = (Math.abs(borrow[i].dueDate - borrow[i].createdAt)) / (1000 * 3600 * 24);
                    //  dif[i] = 0;
                    //  due[i] = 0;
                    console.log(dif[i])
                    console.log(due[i])
```

```
                    if (dif[i] != due[i] &&  due[i]- dif[i] <= 1 ){
                        console.log("one or less than one day left")
                        for (var k = 0; k < user.length; k++) {
                            if (user[k]._id.equals(borrow[i].userID) ){
                                console.log("help")
                                sendEmail(user[k].email,
                                'Password reset link', 'the book is almost due bro'
                                )
                            }

                        }
                    } else if (dif[i] == due[i] ){
                        console.log("time out")
                        for (var k = 0; k < user.length; k++) {
                            if (user[k]._id.equals(borrow[i].userID) ){
                                console.log("help")
                                borrow[i].overDue = true
                                borrow[i].paymentAmount = 100;
                                borrow[i].status = "overdue";
                                borrow[i].save()
                            }
                        }
                    }
                }
            }
            next();

        })
}
```

By paying offline, users bring this confirmation and cash to the library's reception to pay their fee.



Pay overdue fee with cash

Book name: Atomic Habits: An Easy & Proven Way to Build Good Habits & Break Bad Ones

Issued date: Sun May 21 2023

Due date: Thu May 25 2023

Total fee: 100.000 VND

Attention:
- If you don't pay this fee, you aren't allowed to borrow the next book.

Please bring this conformation and cash to library's reception to pay your fee.

Return

On the other hand, users can pay online through Digital wallets, National banks and International cards. We do not have too much time to analyze and connect to the third - party for real payment so after clicking on those methods, users will move to the Waiting for payment process page.

Please choose your payment method below.

Payment with Digital Wallets

Payment with National Banks

Payment with International Cards

Name on Card

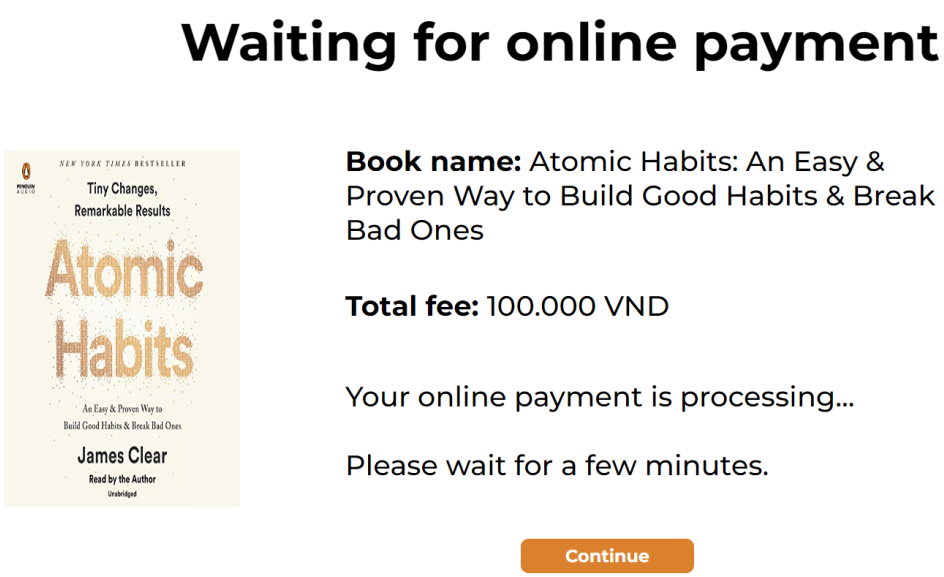
Credit card number

Exp Month/Year

CVV

Pay

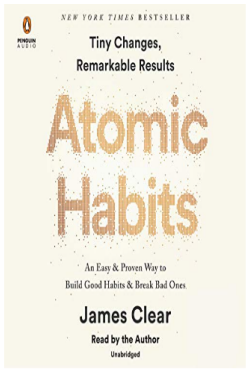
Waiting for the payment process page is displayed while users make payments on other platforms.



After clicking on the Continue button, the debt will be updated on the Databases of the website through this function in code:

```
const BorrowedBookSchema = require('../models/BorrowRecord')
module.exports=(req,res) =>{
    BorrowedBookSchema.findByIdAndUpdate(req.params.id, { paymentAmount : 0 })
    .then((remain)=>{
        console.log('Pay success')
        res.redirect('/paySuccess/' + req.params.id)
    })
}
```

Users will receive a success notification after the payment is successful. At that time, their debt had been updated to zero VND. Those are all steps for users to pay their overdue fee.



Success payment

Book name: Atomic Habits: An Easy & Proven Way to Build Good Habits & Break Bad Ones

Your debt: 0.000 VND

Your payment is success !!!

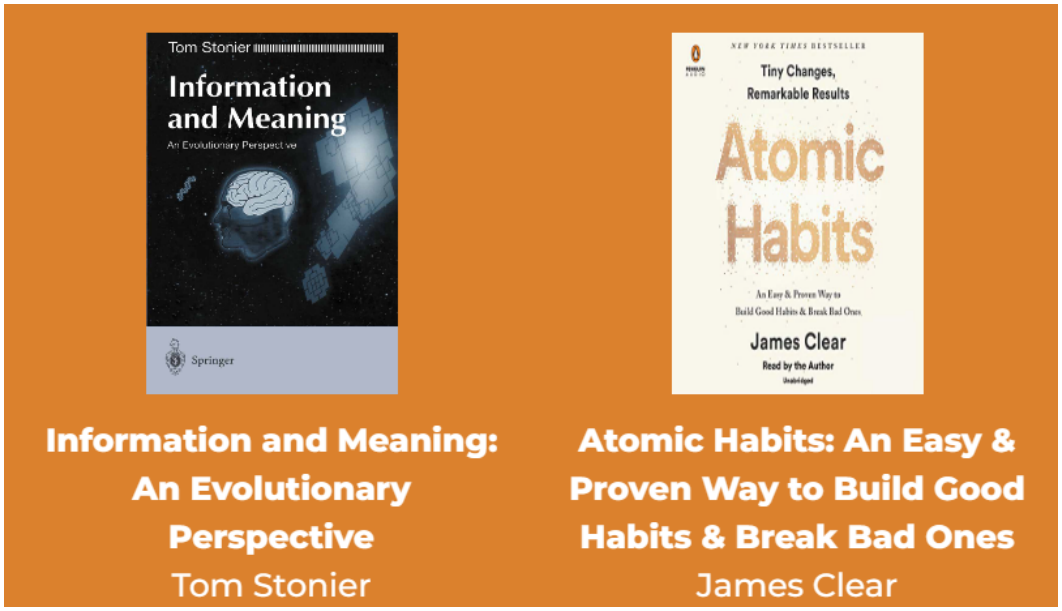
Thank you for your payment.

Return home

P. The Book Information

(Vo Nguyen Minh Duy - 17105)

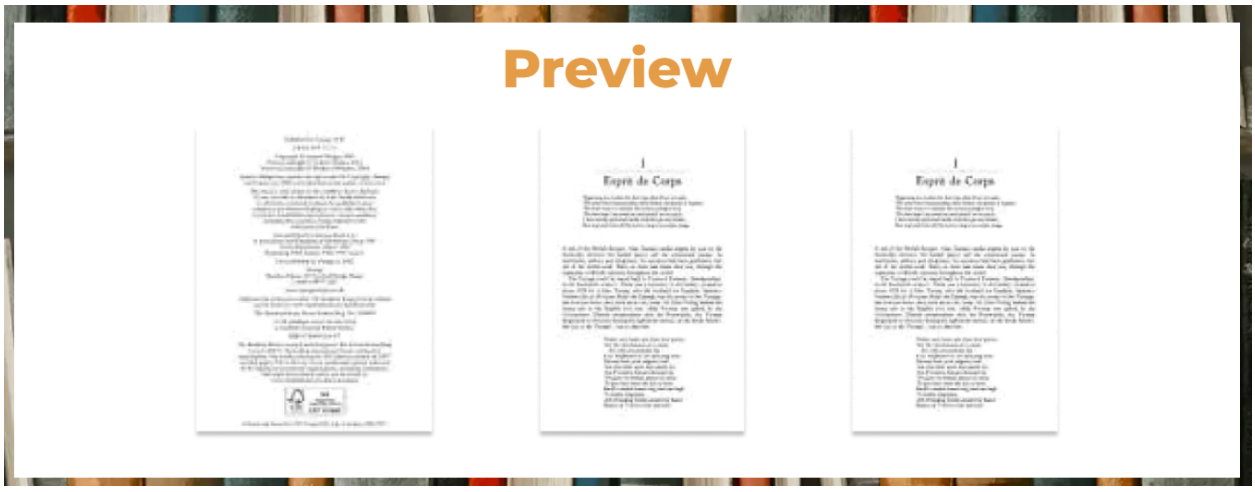
Accessible from any User user, Admin user, or unverified user, any Book in the database is embedded with title and author when displayed on the webpage. Users can access it through clicking the cover image and it will redirect to the Book information page.



On the first part of the Book Information page, the Book Cover image is shown on the left side while every Book information, such as title, authors, categories,

publisher, published year, supported language and date it was uploaded to the database. Verified User users are allowed to view and make actions with the Wishlist or Borrow button, which executes their respective operations, while Admin users and non-verified users do not view these buttons.

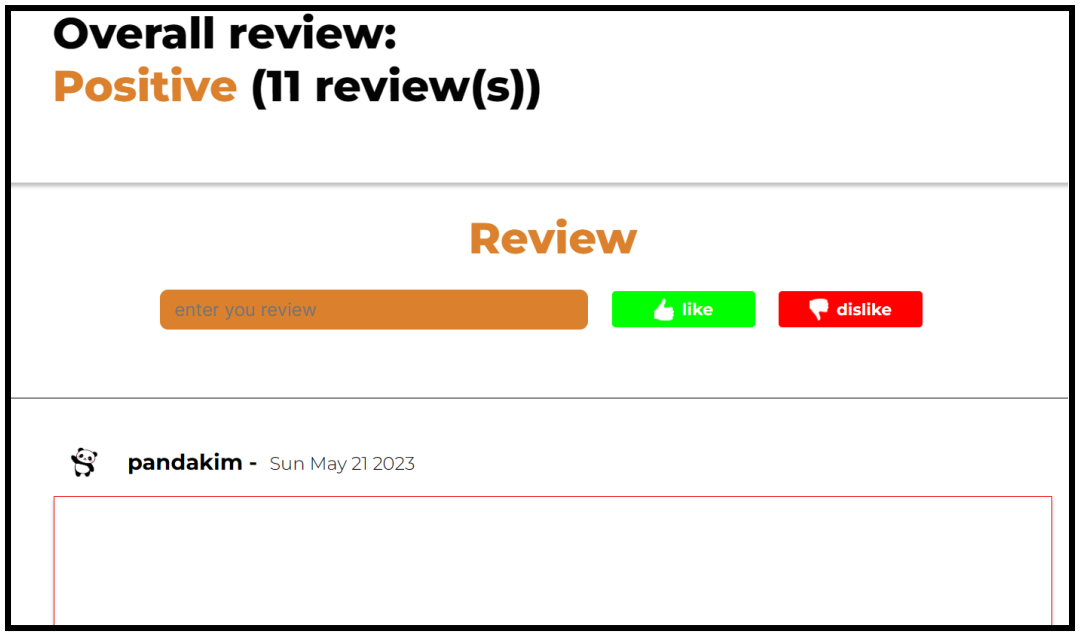
Below the information table is the preview page, allowing any users to view the first 3 pages of the featured book, along with the book's synopsis. The synopsis, labeled Summary, can be extended or retracted depending on the content.



Summary

Preamble The emergence of machine intelligence during the second half of the twentieth century is the most important development in the evolution of this planet since the origin of life two to three thousand million years ago. The emergence of machine intelligence within the matrix of human society is analogous to the emergence, three billion years ago, of complex, self-replicating molecules within the matrix of an energy-rich molecular soup - the first step in the evolution of life. The emergence of machine intelligence within a human social context has set into motion irreversible processes which will lead to an evolutionary discontinuity. Just as the emergence of "Life" represented a qualitatively different form of organisation of matter and energy, so will pure "Intelligence" represent a qualitatively different form of organisation of matter, energy and life. The emergence of machine intelligence presages the progression of the human species as we know it, into a form which, at present, we would not recognise as "human". As Forsyth and Naylor (1985) have pointed out: "Humanity has opened two Pandora's boxes at the same time, one labelled genetic engineering, the other labelled knowledge engineering. What we have let out is not entirely clear, but it is reasonable to hazard a guess that it contains the seeds of our successors".

Finally, the review section is displayed at the end of the webpage. Any user can view the review section, but only authentic User users are allowed to make the review and rate the book to be Like or Dislike, depending on their own experience. The total rating for the Book will be calculated based on number of reviews made as well as ratio between Like reviews and Dislike reviews. Each review consists of the User's username, the date the review was uploaded and the review itself.



Due to having accounted for the difference between User user and the rest of user types, the code is split so that an actual User viewing the book can be recognized and be enabled to make the review, while any visitor or Admin user is still able to view the Book without any major drawbacks.

```
Promise.all ([ Book.findById(req.params.id), Review.find({}), User.find({username : username}).limit(1)])
.then(([book, reviews, user])=>{
    //this is for when there are reviews
    var start = Date.now()
    var date = new Date(start);
    date.setDate(date.getDate() + 4);
    console.log(date)
    console.log("have it")
    var date1 = date. toISOString();
    console.log(date1)
        //if(!user) {console.log("no user");throw new Error('UwU user not logged in')}
        var id = "yes"
        console.log("have reviews")
        response.render('book-info',{
            reviews:reviews,
            book:book,
            id: id,
            date: date1,
            user: user
        });
```

Q. The Admin Page

(Vo Nguyen Minh Duy - 17105)

User account and Admin account are independent from each other. While an Admin account cannot access certain functionalities such as borrowing / wishlist-ing a book as well as making payment for a due book, Admin users can view certain statistics summarized with interesting books' information through a chart. The Admin account is majorly used to add more User accounts or Book into the database, along with modifying or removing from the library those already existing.

To prevent non-Admin users from entering the dashboard or any inner function by any means, a middleware is developed in order to check the qualification of a LoggedInAdmin global variable. This variable is initialized when a valid Admin account is logged in with its Admin unique identifier. If the variable is checked null, the user will be redirected to the Admin login page in order to log into an actual Admin account.

```
module.exports = (req, res, next) => {
    Admin.findById(req.session.userId)
    Complexity is 3 Everything is cool!
    .then((check) =>
    {
        if (!check) {
            console.log('You are not admin. Please log in as one.')
            return res.redirect('/auth/loginAdmin')
        }
            next();
        }
    )
}
```

After logging in, Admin user is redirected to the main dashboard displaying information such as Total Users and Total Books in the library, number of books currently borrowed. There also shows a chart representing comparison between books by certain criteria that can be modified internally according to Admin's preference. The page looks as follow:

Scrolling down will display 2 lists, both of which will show top 5 recently added Books or Users, respectively. The data in the table is not interactable, although Admin can use the View More button to be redirected to List of Total Books or Users in the library.

New users

PFP	Fullname	Username	ID	Joined
	Bruce Wayne	brucewayne	afb87ff	Sat May 20 2023
	Stryker Lawton	stryker0750	e78cfc6	Wed May 17 2023
	Himari Akeboshi	theHacker	88779c0	Sat May 20 2023
	Joumae Saori	saori2006	caa48b4	Fri May 19 2023

View All

New books

Title	ID	ISBN	Uploaded Date	Quantity
Foundations of Python network programming	97aca17	9781590593714	Sat May 20 2023	10
Clean Code: A Handbook of Agile Software Craftsmanship	ac6bf5b	9780132350884	Tue May 16 2023	7
JavaScript Data Structures and Algorithms: An Introduction to Understanding and Implementing Core Data Structure and Algorithm Fundamentals	049d141	9781484239872	Fri May 19 2023	9

View All

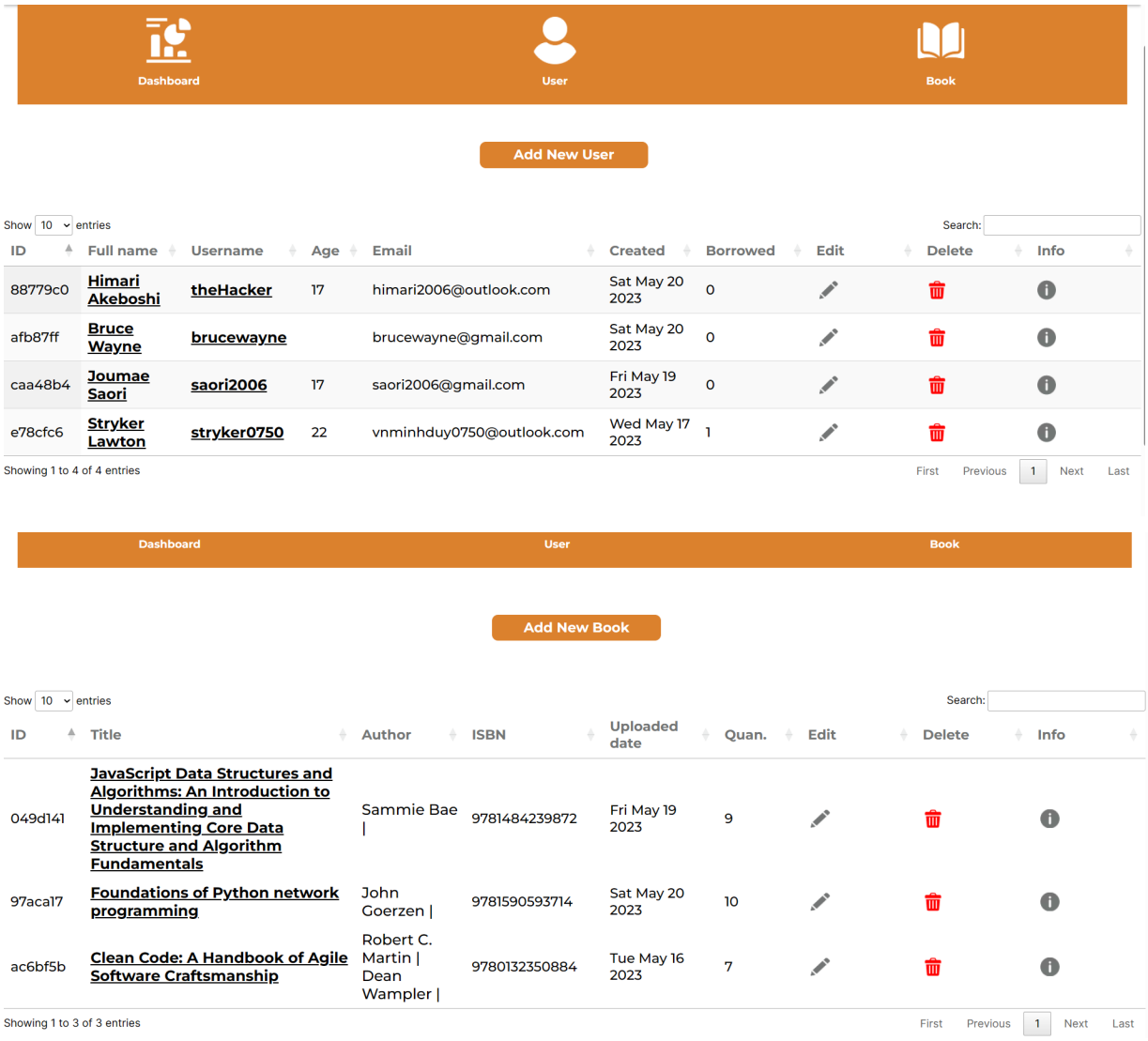
In order to display the data to the dashboard,double query calls to MongoDB to get all information about Books and Users are made at the same time. An array of objects containing specific attributes used to display on the graph is also constructed priorly so that the data can be retrieved later on and parsed onto graph drawing script.

```
module.exports = (request, response) => {
    Promise.all
    ([
        Users.find({}).sort(mysort),
        Books.find({}).sort(mysort)
    ])
    Complexity is 4 Everything is cool!
    .then ( ([usersDoc, booksDoc]) => {
        var totalBorrowed = 0;
        var chartData = [];
        var top5count = 5;
        if (booksDoc.length < 5)
        {
            top5count = booksDoc.length;
        }
        for (var i = 0; i < usersDoc.length; i++)
        {
            totalBorrowed += usersDoc[i].booksBorrowing.length;
        }
        for (var i = 0; i < top5count; i++)
        {
        chartData[i] = { title: booksDoc[i].title , copies: booksDoc[i].copiesAvailable, id: booksDoc[i]._id.toString().substring
        }
        response.render('adminDashboard', {
            usersList: usersDoc,
            booksList: booksDoc,
            totalBorrowed,
            chartData
        });
        console.log(request.session);
```

The following code snippet shows how the already combined chart data is collected and a graph is programmatically constructed from the data pack. Special configurations are hand-scripted so that hovering each bar of an element can display a different attribute associated to that element, rather than its own label. This is done on one of graph functionalities called tooltips.

```
const sample_2 = JSON.parse(document.getElementById('data-container').getAttribute('data-array'));
const tooltips = sample_2.map(obj => obj.title);
console.log(sample_2)

var myLineChart = new Chart(document.getElementById("myBarChart"), {
  type: 'bar',
  data: {
    labels: sample_2.map(row => row.id),
    datasets: [{
      label: "Copies",
      backgroundColor: "rgba(2,117,216,1)",
      borderColor: "rgba(2,117,216,1)",
      data: sample_2.map(row => row.copies),
      font:
      {
        size: 20
    }
    }
  ],
  },
  options: {
    plugins: {
      tooltip: {
        font: {
          size: 20
        },
        // Overrides the global setting
        callbacks:
        {
          title: function(context) {
            return `${tooltips[context[0].dataIndex]}`;
          }
        }
```

After the dashboard page, Admin users can press on either User or Book button on the orange navigation bar, both of which will take them to List of All Users or Books in the library, respectively. Each page also has its own Add User or Add Book used to execute said functionalities. The data table displays some interesting information, as well as 3 tools: Edit the data, Remove the data or View all details of the data. The table is heavily customized with the help of a community jQuery plugin called DataTables, which by default already greatly enhances the normal HTML table with advanced interaction features, such as its own search bar, table pagination and control over how many data can be listed at the same time.



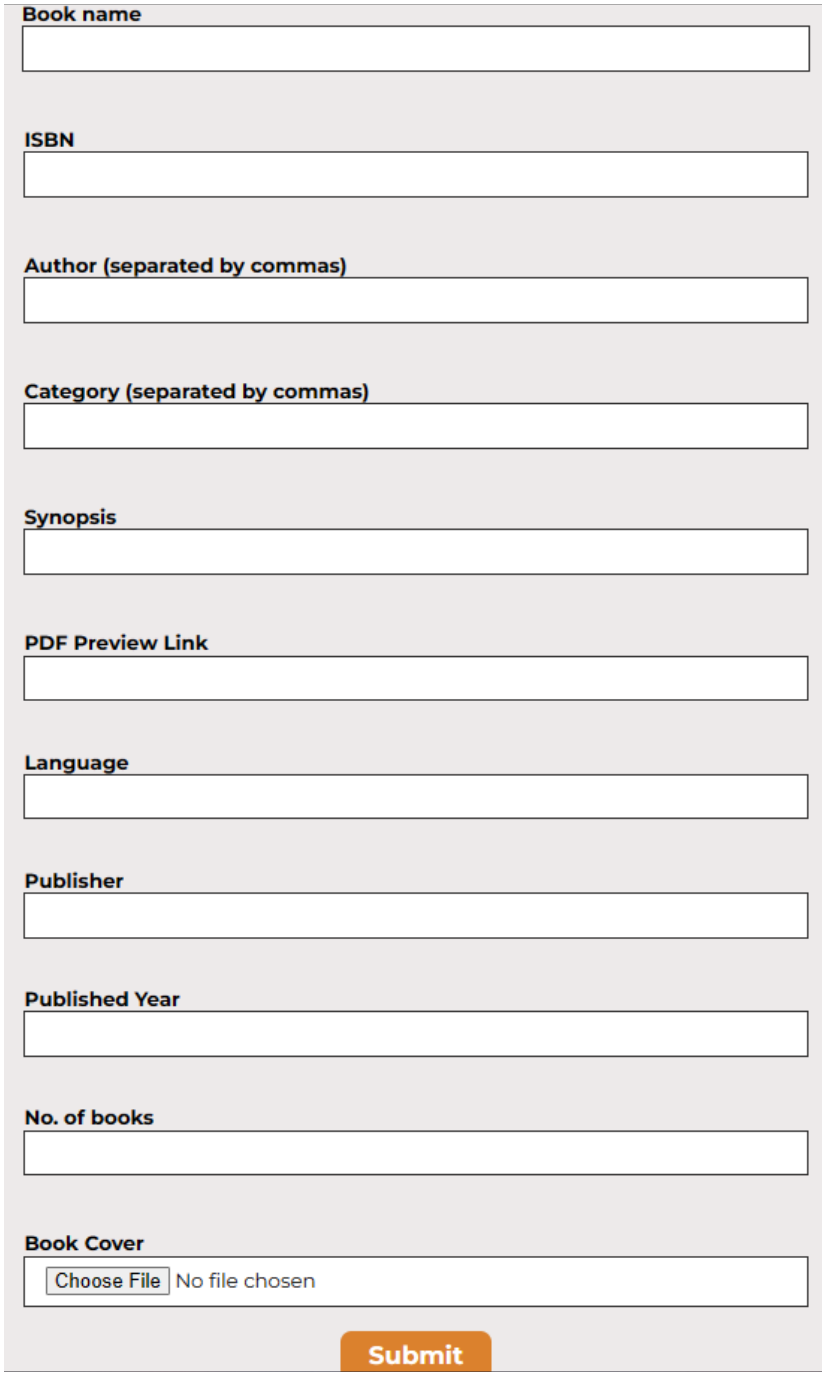
Providing the data is relatively easy, in which a simple query call to the database in order to get every Book or User and parse the result to its respective page

```
module.exports = (request, response) => {
    Books.find({})
    .then ( (books) => {
        response.render('adminBooksList', { booksList : books });
        // console.log(users);
    })
    .catch ( (error) => {
        console.log(error);        You, 2 weeks ago • Deployed fake
    })
}
```

```
module.exports = (request, response) => {
    Users.find({})
    .then ( (users) => {
        response.render('adminUsersList', { usersList : users });
    })
    .catch ( (error) => {
        console.log(error);
    })
}
```

In the scenario that the Admins want to add a book to the database collection, they can access the page through the Add Book button. A form is displayed with many sufficient fields to be inputted. Leaving any of these fields empty will result in a warning message and prevent the submission from being sent. There is also an option to display the image of the book cover, should the Admin possess the image source.

The same guidance and experience is provided should the Admins want to add a new Users to the database. There exists password fields, which will hide all characters upon being entered. The rest of the fields function similarly to Add Book functionality.



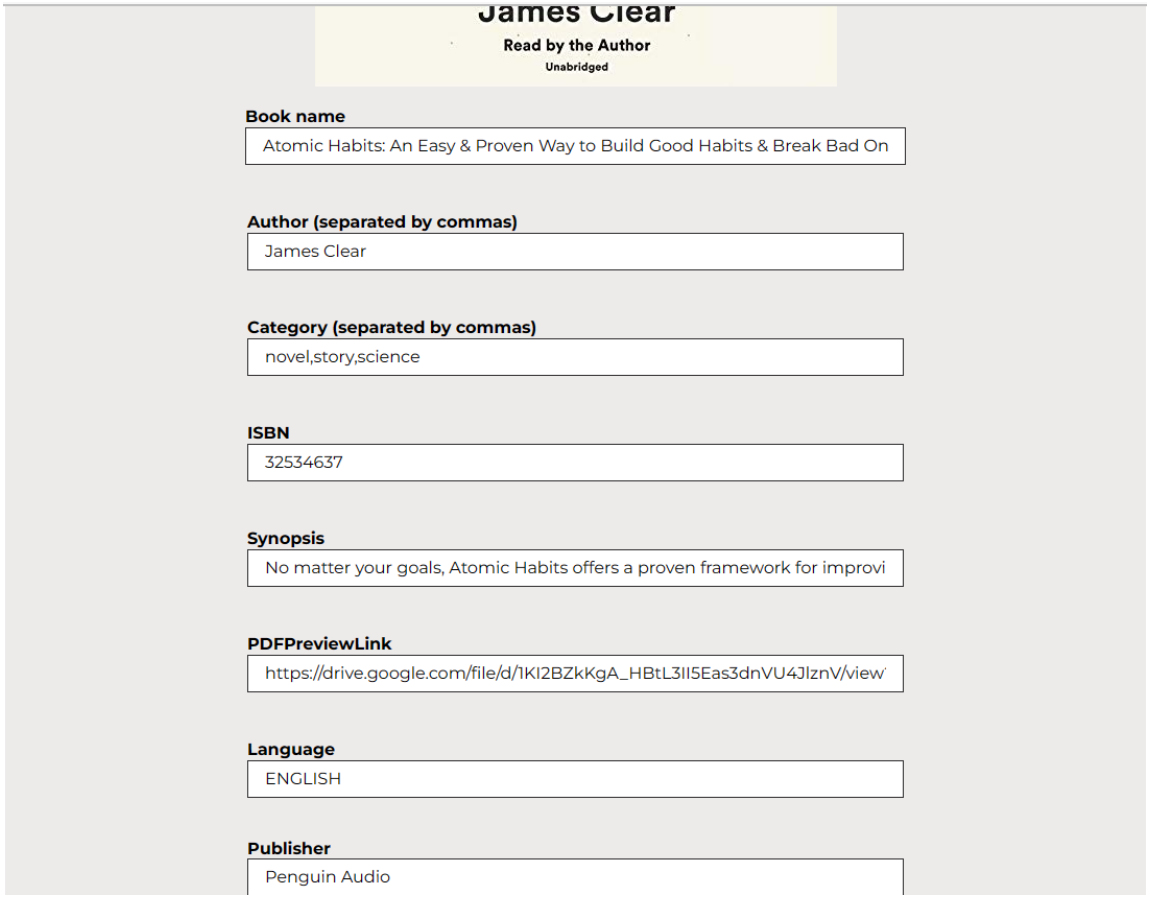
The data collecting from the page and parsing it into the database is slightly complicated. Due to some attributes being identified as an Array data type, any related string input from the form must be split by the comma and re-save the work onto the attributes of the data body. Since the form also contains an image, the middleware express-fileupload is installed on the application in order to assist with saving the image to its declared destination of the application, while its attribute saved in the database will be the directory pointed to that image.

```
module.exports = (req,res) =>
{
    req.body.author = req.body.author.split(',');
    req.body.categories = req.body.categories.split(',');
    let { coverLink } = req.files;
    Complexity is 3 Everything is cool!
    coverLink.mv(path.resolve(__dirname,'..', '..' ,'public/upload', coverLink.name), function (err)
    {
        Books.create({
            ...req.body,
            coverLink: '/upload/' + coverLink.name
        })      You, 7 hours ago • Update Add Book and Book Info
        .then ( (book) => {
            console.log(book);
            res.redirect("/adminBooksList")
        })
        .catch ( (error) => {
            console.log(error);
        })
    })
}
```

In addition to the above image saving procedure, when adding a new User into the database, the input password must be encrypted so that the text is not displayed literally, ensuring its security factor. By using middleware called Bcrypt, the input string of the password field can be encrypted by applying a hash function up to 10 times. The more it is encrypted, the harder it is decrypted.

```
UserSchema.pre('save', async function (next) {
    try {
        if (!this.isModified('password')) {
            return next();
        }
        const hashed = await bcrypt.hash(this.password, 10);
        this.password = hashed;
    } catch (err) {
        return next(err);
    }
});


Complexity is 5 Everything is cool!
UserSchema.pre('findOneAndUpdate', async function (next) {
    console.log('running midleware for findOneAndUdate')
    try {
        if (this._update.password) {
            const hashed = await bcrypt.hash(this._update.password, 10)
            this._update.password = hashed;
        }
        next();
    } catch (err) {
        return next(err);
    }
});
```

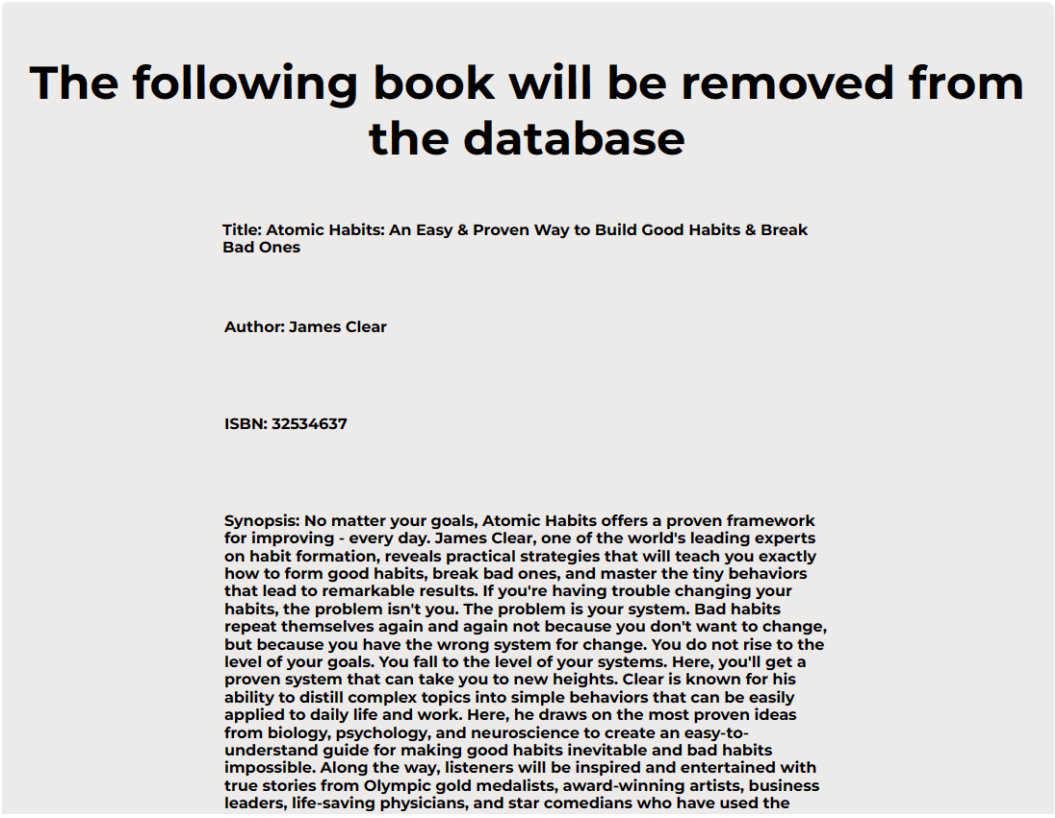
When a certain situation occurs that the Admin users are demanded to modify Book's information or User's information, they can access such functionality through the pencil icon, labeled Edit Button. Upon clicking, the User is greeted with a similar UI to the Add Book or Add User functionality, with the exception of every field filled with existing relevant data in the database. By this means, any field that does not require any modification will retain its value when an Update operation is executed with the same parameters to those of the original Book or User object. Additionally, the Admin can also view wholly expected data of the object so that they can make the change conveniently.



The coding procedure in the page's controller is similar to its counterpart of the Add Book / User controller, except that the operation we need to execute to the database now is the Update operation. Furthermore, by default the file uploading field for Book's Cover Image is left empty. Thus it demands a check whether the image file is found in a data parameter sent from the page in order to execute the Update operation with or without the addition of the image link.

```
req.body.author = req.body.author.split(',');
req.body.categories = req.body.categories.split(',');
console.log(req.files)
if (req.files)
{
    let { image } = req.files;
    Complexity is 3 Everything is cool!
    image.mv(path.resolve(__dirname,'..', '..' ,'public/upload', image.name), function (err)
    {
        Books.findByIdAndUpdate(
            req.params.id, {
            ...req.body,
            coverLink: '/upload/' + image.name
            })
        .then ( (book) => {
            res.redirect("/adminBooksList")
        })
        .catch ( (error) => {
            console.log(error);
        })
```

The last procedure to modify an existing User or Book object in the database is Delete functionality, should any of these objects be noted to be removed rather than edited. Upon clicking the Delete button, Admin users are greeted with a warning page showing every detail of the User or Book object. Final Deletion operation is executed when the Admin users press on the Confirm button.



The code for this page is relatively simple, when the Delete operation is executed by finding Book's or User's id from the webpage matching the object's unique id. Then, the whole object is deleted from the database for good and the Admin user is redirected to the List of Books or List of Users, where the objects in the respective database are updated.

```
module.exports = (req,res) =>
{
    Books.findByIdAndDelete(req.params.id)
    .then ( () => {
        res.redirect("/adminBooksList")
    })
    .catch ( (error) => {
        console.log(error);
    })
}
```

VII. Testing

All of the developments and testing were done on a variety of laptops with various hardware and software configurations. On the software side, almost all 6 of us have tested the website on the latest version of Google Chrome or Microsoft Edge (both the newer version which is based on the open-source components of Chrome as well as the older browser on the older Trident web rendering engine), on either Windows 10 or Windows 11; with one member tested using the latest version of Firefox on an Ubuntu-based Linux distribution. We found that generally, aside from some scaling issues on devices with smaller viewport, the user's hardware shouldn't be a limiting factor to experiencing our project, assuming that their web browser is reasonably up-to-date.

One of us has also tested our site on the legacy, no longer supported web browser, Internet Explorer, with dismal results. We do not encourage our end users to use our project on this browser. As mentioned multiple times in this document, the time constraint prohibited us from thoroughly testing edge cases as well as normal use cases, but we can guarantee that our users will have an experience using our project.

VIII. Result

Due to the time constraints as well as our group's inexperience at doing projects like this, the end product was delivered at a (very much) less than desired state. A not so insignificant amount of functions are only partially implemented, however we estimated that over 40 percent of our project is at a functional state.
The following use case are among those that are complete:

- Web Page navigation.
- some user-related activities:
    - register accounts, reset the password via email,
    - edit the user profiles,
    - adding books to individual wishlists,
    - marking books as "borrowing" and marking borrowing books as "returned".
- The admin Dashboard and the different overviews.
- Basic functionalities such as Add, Edit, Remove Books or Users for Admin account.
- Successful configuration and deployment of NodeJS application to the cloud server hosted by Vultr cloud service.

Even with so little progress, we can proudly say that adopting our project will substantially change the workflow of even the most efficient organization!

IX. Challenges

It is unavoidable that hurdles and challenges would arise during the project's implementation. It took us many hours to a few days to resolve these issues. Here are the four major challenges we faced while completing this project:

A. Errors and bugs

Errors and bugs were the most evident and critical challenges during this endeavor. It happened all the time during the project, from converting UI prototype designs into workable scripts to implementing different features to handle databases and user traffic. We were able to detect and correct issues quickly several times, but due to our lack of knowledge, it took us hours, if not days, to successfully troubleshoot. Some of the bugs were more complicated than they appear, while others were unusual, even among experienced programmers. Fortunately, with the

help of Dr. Huynh Trung Hieu and Truong Vinh Hoang Chau, as well as online forums like StackOverflow and GeeksforGeeks, we were able to successfully solve these issues and complete the project on time. Additionally, Tra Dang Khoa, our team leader, had always encouraged and guided everyone to debug and learn new features. We could not have finished the project on time today without his hard effort and attention to the team's progress.

B. First large - scale project

Because this was some of our members' first large - scale project, tutorials and guidance were necessary so that we could get fundamental expertise for this project. However, many of the accessible sources were inadequate and insufficient. Certain obstacles had no instructions, so we had to develop them from scratch, which severely slowed our project's progress. Truong Vinh Hoang Chau, who had prior knowledge and experience with web-based system development, informed us about this project and offered supplementary reading material at the start of the programming exercise, so our learning period was much reduced.

C. Gitlab - new platform

The transition from GitHub to GitLab was also a challenge in the early stages of the project. We were accustomed to using GitHub, so we assumed the switch to GitLab - a platform that, like GitHub, utilizes distributed source code management technology - would not be too tough. However, because the management of these two platforms is incompatible in many ways, it took us a long time to merge and pull the features from different branches. As a result, conflicting code versions and data loss occurred frequently.

D. Team's communication

Communication among team members, as well as keeping team members motivated to complete the project, is critical to the project's success. Our group includes people who have recently completed their exchange program in Germany and returned to Vietnam, thus meeting and setting future goals must begin as soon as possible. However, because the group had completed some tasks in advance around two weeks before the delegation from Germany returned, the individuals from Germany experienced considerable difficulties in catching up with the

progress and adjusting to the team's itinerary. Additionally, the communication between members is not always clear, thus leading to many errors.

X. What have we learned?

In terms of technical knowledge, we have gained numerous valuable lessons and experiences in web-based programming. We researched common web programming languages such as HTML, CSS, JavaScript, and several applications to create a rather complete web system. We additionally acquired insight knowledge about User Interface (UI) and User Experience (UX) through doing website interface design projects on Figma and Teleport. Furthermore, during the project, Truong Vinh Hoang Chau taught us about Node.js, a software system for web servers, MongoDB, a NoSQL data system that uses a JSON-like text format for management of user data and the books imported on it, and Vultr, the cloud platform through which we can publish the finished website on the Internet. His instructions were really helpful in overcoming the technical constraints that had to be met before the project.

For better management, every sprint and subtask was assigned and divided into boards (sections) in Trello - an online work management service - so that everyone would understand their tasks and rearrange their schedule better. Every Saturday evening, based on self-reports on Trello, the team organized a meeting to evaluate the progress and set up new assignments for the upcoming week. Following the project, each group member's managerial skills, including time management, work management, and communication skills, were greatly improved. This group project also provided us with excellent experience in teamwork and leadership. Despite the fact that the group was not fully formed at first due to some members having to complete their exchange program in Germany, we were able to divide responsibilities equitably among members, plan multiple meetings, and check each member's progress in each sprint to fulfill Agile workflow. Furthermore, this project gave everyone a fantastic opportunity to gain experience working in a medium-sized group (groups of 7-12 people), which is frequent in today's work environments. Everyone in the group had the same right to express themselves, come up with fresh ideas, and offer support to one another as needed.

XI. Future work

Some functionalities could not be included into the present web platform due to project time constraints. Below are some of the features we would want to introduce in the future:

- **Find a book using AI:** Next to the search icon, there will be the “Search by book cover” button. User scans the book cover by the camera, then the AI will analyze the cover and find that book.
- **Membership ranking:** In the user information page, there will be the membership rank based on books borrowed, books returned back before the due date,... Higher ranking, more discount applied when doing transactions.
- **Book delivery to and return from home:** There will be delivery people who deliver books to be borrowed and receive books to be returned to and from the customer’s home.
- **Online transaction:** Users can pay using e-wallet or bank services. Can combine with the “Book delivery” function (enable the delivery option after a successful transaction).
- **Improve wishlist button**.
- **True borrow function and read online function**: because right now, the borrow function simply adds/updates to the borrow record database . What we truly want is that when the user borrows, the read option will appear for the user to read online. But because of time constraints, we can’t apply this idea.
- **Apply featured book and newly arrived book status**.
- **Improve check due date**: because now it is just a middleware and only activated when the user used the website. So in the future we want it to check everyday and do it in real time.

XII. Conclusion

This project provides a great opportunity for our team to learn about a variety of internet resources that will help us improve our web development skills. We hope that this project, in general, and the website in particular, can contribute to the university's current library system in terms of functionality, security, and user experience. We welcome any suggestions to help us improve our product in the future.

XIII. References

1. Sach Lap Trinh Nodejs That Don Gian (2020). Retrieved 21 May 2023, from https://vntalking.com/wp-content/uploads/2020/04/sach-lap-trinh-nodejs-that-don-gian-sample.pdf
2. Mongoose v7.2.0: Getting Started. (2023). Retrieved 21 May 2023, from https://mongoosejs.com/docs/
3. Chart.js | Chart.js. (2023). Retrieved 21 May 2023, from https://www.chartjs.org/docs/latest/
4. Manual. (2023). Retrieved 21 May 2023, from https://datatables.net/manual/
5. (N.d.). Retrieved from https://www.vultr.com/
6. GeeksforGeeks | A computer science portal for geeks. (2023). Retrieved 21 May 2023, from https://www.geeksforgeeks.org/
7. Content editing - edit button in JavaScript. Retrieved from https://codepen.io/JoannaEl/pen/ZjaBvr
8. mongoose?, G., & Rehman, A. (2020). Get Top five max results based on sub document mongoose?. Retrieved 21 May 2023, from https://stackoverflow.com/questions/65195672/get-top-five-max-results-based-on-sub-document-mongoose
9. Expand a box/ div using JavaScript (2022). Retrieved 21 May 2023, from https://www.youtube.com/watch?v=Et-VKwFCYIQ&ab_channel=KhanCoding
10. How to Install Node.js on Ubuntu and Update npm to the Latest Version. (2020). Retrieved 21 May 2023, from https://www.freecodecamp.org/news/how-to-install-node-js-on-ubuntu-and-update-npm-to-the-latest-version/
11. Install MongoDB Community Edition on Ubuntu (2023). Retrieved 21 May 2023, from https://www.mongodb.com/docs/manual/tutorial/install-mongodb-on-ubuntu/
12. PM2 - Quick Start. (2023). Retrieved 21 May 2023, from https://pm2.keymetrics.io/docs/usage/quick-start/