NATIONAL UNIVERSITY OF SINGAPORE

SCHOOL OF COMPUTING

BT3103 Application Systems Development for Business Analytics

Team Halcyon

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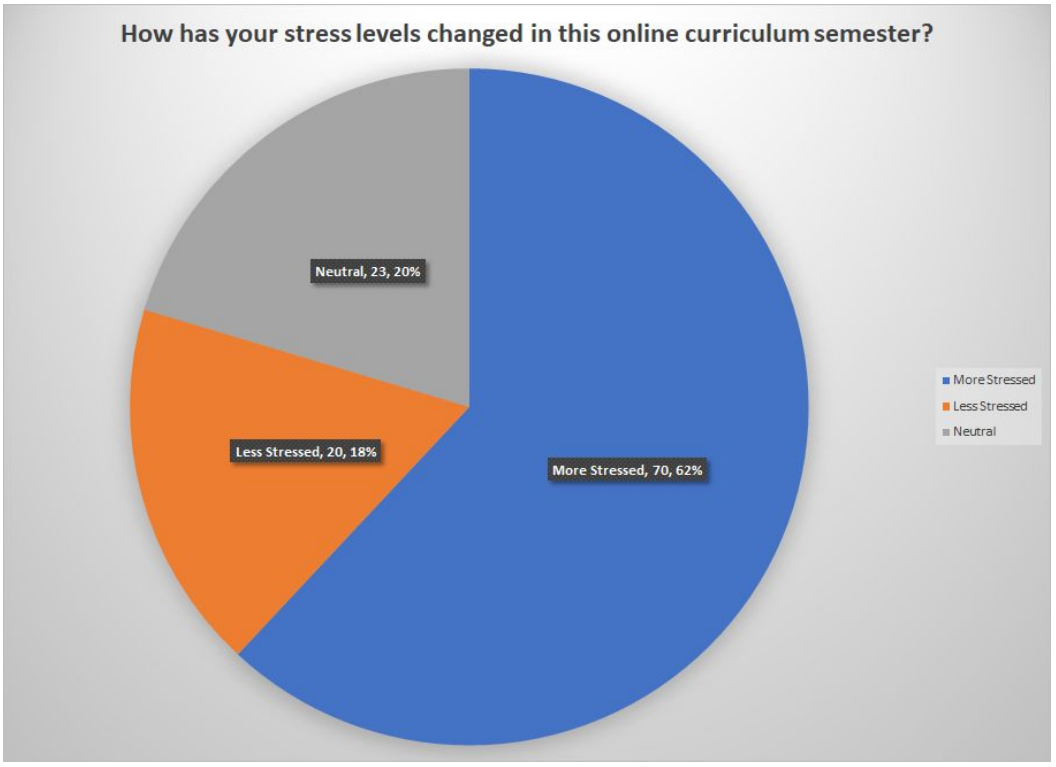
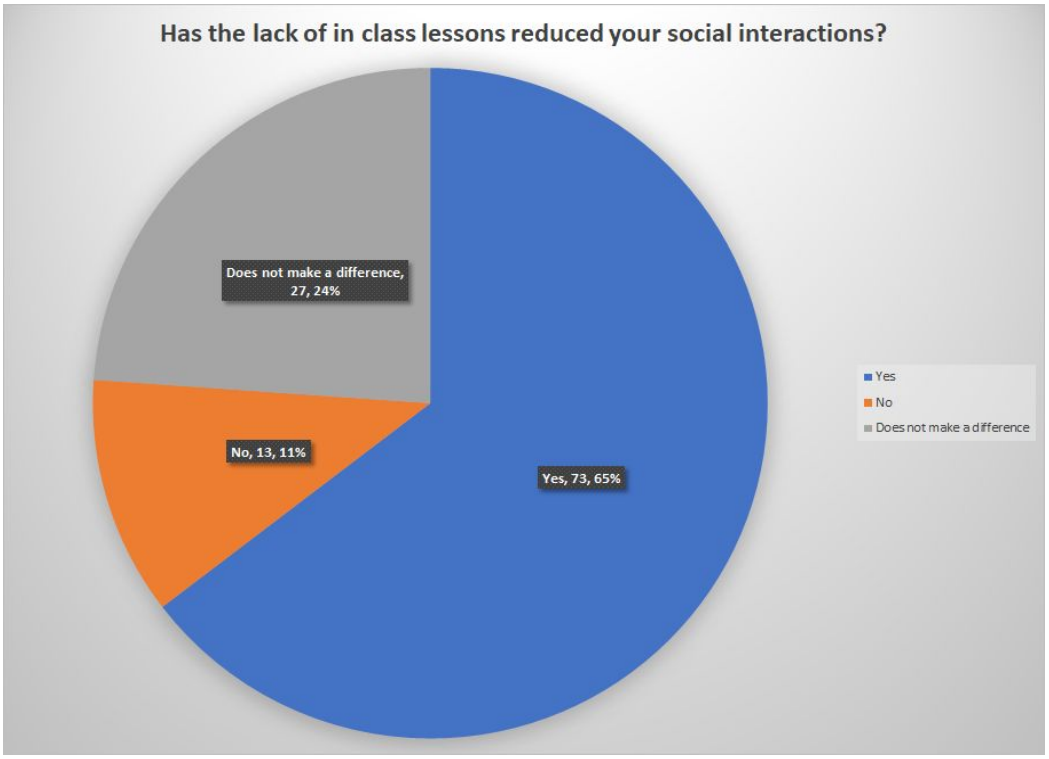
Problem Definition

Amidst the COVID-19 Pandemic, most faculties have opted to conduct online lessons. A consequence of E-learning would be the lack of interaction between students. This would in turn cause them to feel lost and helpless during the semester. Another issue would be the lack of work life balance as students need not travel to campus anymore. This would result in longer periods of studying which can cause greater stress and accumulation of fatigue among students.

After surveying 113 NUS students from varying faculties (School of Computing, Faculty of Social Sciences, Faculty of Science, Faculty of Engineering, NUS Business School), we found that 62% of the respondents indicated that their stress levels have increased during this semester where majority of the lessons have been conducted online.



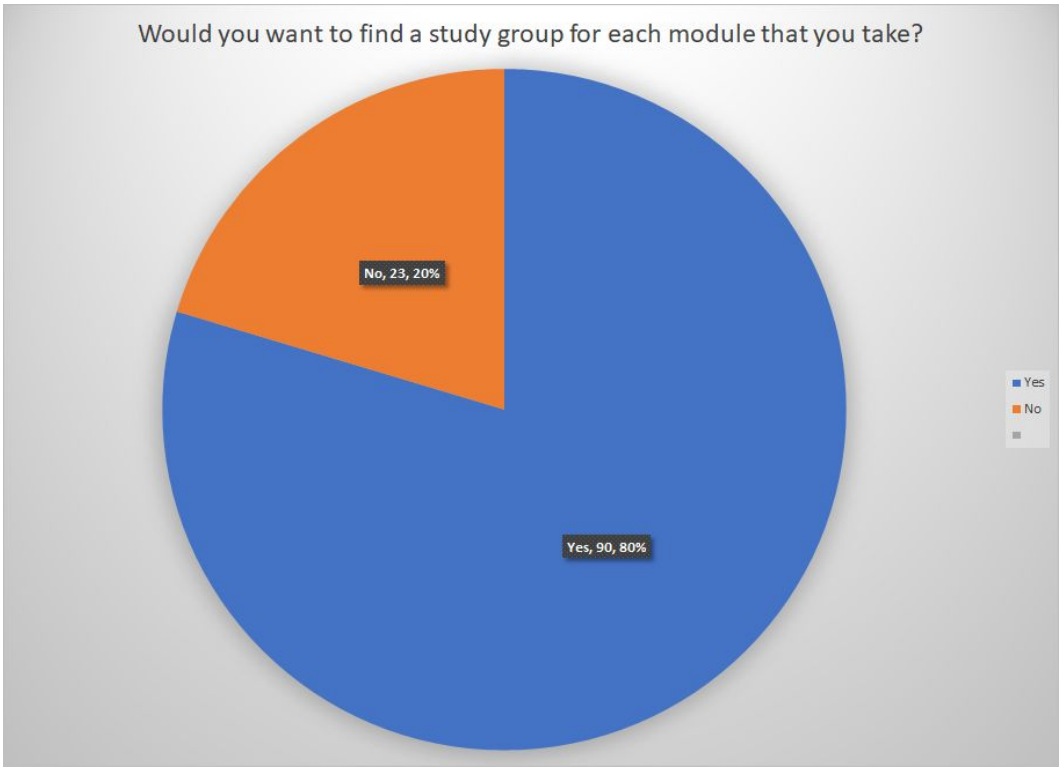
Another question asked was if the lack of in class lessons reduced their social interactions. 65% of the respondents replied that the lack of physical lessons have reduced their social interactions.



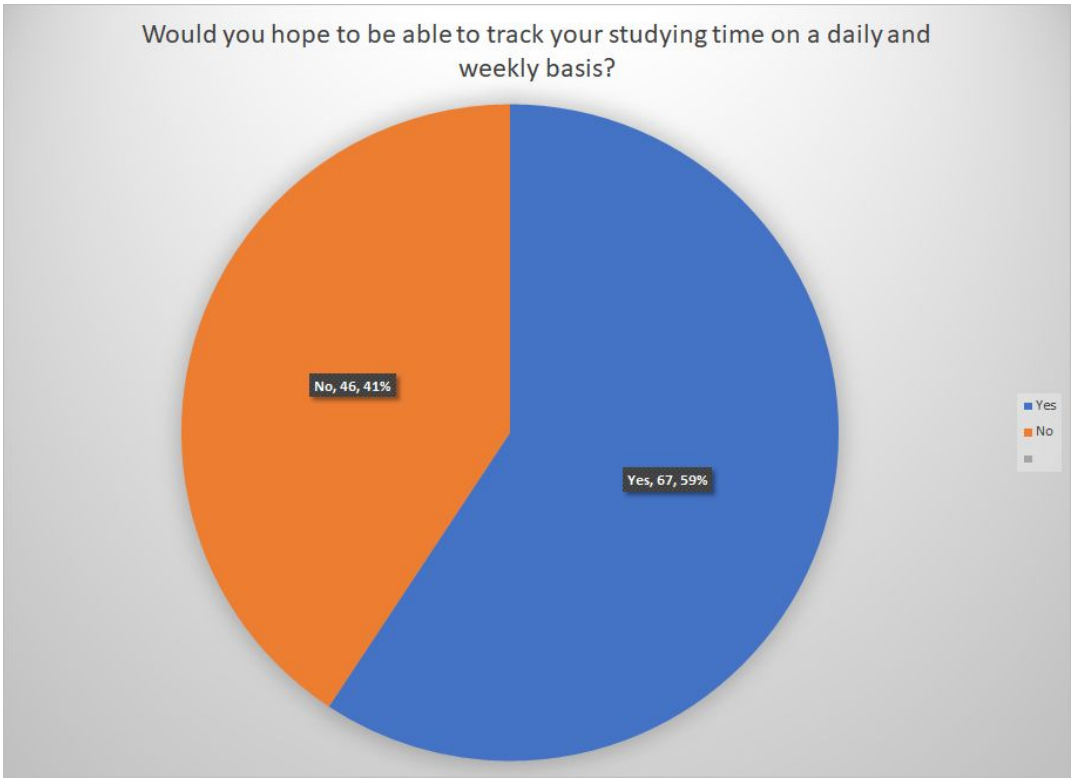
Proposed Solution

In order to craft our solutions to the problems shared by our respondents, we further asked a few more questions to seek more understanding and knowledge on the problem.

When asked, “Would you want to find a study group for each module that you take?”, approximately 80% of the respondents indicated that they are interested in doing so.



When asked, “Would you hope to be able to track your studying time on a daily and weekly basis?”, close to 59% of the students indicated that they would want to manage their studying time.



SCRUM Execution

Roles & responsibilities identified within the team

Product Owner - Terence

- Owns the product backlog
- Drives the success of Halcyon
- Has the vision for how Halcyon should progress
- Prioritises and accepts work
- Consistent backlog grooming by constantly reviewing items on the backlog and checking that the priorities at the top of the backlog are ready for delivery
- Ensuring that the product backlog is visible and transparent, such that the Scrum Team will identify what to work on next.

Scrum Master - Hazel

- Ensures that the scrum team are fully aware of the goals, scope and product domain
- Provide techniques and relevant tools to manage product backlog more efficiently
- Helps the scrum team to be self-organized
- Assist in removing obstacles in the process in order to create a high-value product
- Communicates any issues to the product owner and seeks to resolves any impediments

Scrum Team - Mitchell and Zhi Han

- Self-organized and disciplined, cross-functional team
- Performs self-allocation of work within the team
- Makes our own commitments
- Ensures consistency in work ethic and work methods
- Takes responsibility for quality and commitment

Product Backlog (User Stories)

1. As a year 1 student, I felt very lost and did not have many friends to talk to at the start of school. It was challenging to do things alone. I wish there was a way to meet other people from my course.
2. As a year 4 student in Science, I was stressed out knowing that this semester was to be conducted online. Ever since the pandemic started, I have developed anxiety for the future as well as for my studies.
3. As a law student, this semester's workload has been especially heavy, I wish that there was a way to keep track of my assignments easily.
4. As a year 2 computing student, I find it hard to develop a work life balance ever since the online semester started. I sit in front of my computer and code for up to 16 hours a day.
5. As an arts student I enjoy discussing different topics with my peers as it introduces me to new viewpoints and opinions. I prefer to do this in a more casual setting and I feel that the Luminus forums are too highly regulated.
6. As a year 1 student, I wish that there was a system that could remind me of various lectures and tutorials that were coming up.

7. The aesthetics of a website is important to me, a nice looking website will encourage me to use it. If the website does not look appealing, I would not be interested in opening it up and using it often.
8. When I heard of Halcyon, I felt that it was a good idea to help manage the different needs that we students have.
9. I initially felt that Halcyon was quite similar to LumiNUS but after learning more about it I realized that it had a more human touch and I would be excited to use it.
10. As someone who seldom uses Luminus, I'm actually interested in personalizing Halcyon to suit my needs.
11. As a student who is struggling in my academics now, apart from receiving assistance from the Professor and Teaching Assistants, I would hope that I could do my work with a group of students and seek help when needed.

Sprints

1. Setting up of user login and registration pages as well as backend (2 weeks)
2. Frontend works for the various functions in the website (2 weeks)
3. Connecting the frontend functions to the backend (3 weeks)
4. Final touch ups (2 weeks)

Scrum ceremony

- Daily scrum meeting
    - 10am for 15 minutes a day
    - What have you done?
    - Did you face any issues?
    - What can you accomplish today?
- Sprint planning meeting
- Sprint review meeting
- Sprint retrospective

Start of Sprint 2: Frontend works for the various functions in the website
Sprint Backlog 1. [Finding study groups for every module] As a year 1 student, I felt very lost and did not have many friends to talk to at the start of school. It was challenging to do things alone. I wish there was a way to meet other people from my course. 2. [Mental health and wellbeing page] As a year 4 student in Science, I was stressed out knowing that this semester was to be conducted online. Ever since the pandemic started, I have developed anxiety for the future as well as for my studies. 3. [Home page with alerts function] As a law student, this semester's workload has been especially heavy, I wish that there was a way to keep track of my assignments easily.

4. [Study progress management with pomodoro timer] As a year 2 computing student, I find it hard to develop a work life balance ever since the online semester started. I sit in front of my computer and code for up to 16 hours a day.
5. [Finding study groups for every module] As an arts student I enjoy discussing different topics with my peers as it introduces me to new viewpoints and opinions. I prefer to do this in a more casual setting and I feel that the Luminus forums are too highly regulated.
6. [Calendar and alerts function] As a year 1 student, I wish that there was a system that could remind me of various lectures and tutorials that were coming up.

To Do List	**Tasks Completed from the previous sprint**
Home page to include alerts functionality	Splash page
Study groups page	User login pages
Study progress management page	
Mental health and wellbeing page	

Sprint 2 Review:

Survey Results

1. 60% would want to be able to manage their work life balance using the study progress management page
2. 95% would like to use the application to keep track of their assignments
3. 70% would like to join a study group and meet new friends using this application

Sprint Retrospective:

What went well:

- Positive team environment, encouraging each other on
- Great team dynamics, could understand each other well
- Prompt with deadlines and requirements demanded
- Scrum Team committed with minimal errors and provided clear and substantial explanation
- Pull requests were submitted before merging to master branch so that other members can check and verify

What did not go well:

- Unsuccessful in splitting the job scopes for various members as multiple jobs were interlinked
- Not very skilled in using GitHub
- Merge conflicts when working on the same files and features

- Merge conflicts when working on the same branch - Not fully committed to daily standups - Unable to meet up often due to difference in timetables - COVID-19 making it difficult to have physical meetup due to health and personal concerns - Slight unequal distribution of workload - Lack of proper communication which resulted in the same work being done twice - Occasional delayed deadlines met where commits were late - Pull Requests not accessed properly and committed though there were errors
How we can improve: - Allocate workload and job scopes more efficiently and effectively - Do more personal research and understanding of GitHub to improve our usability of GitHub - Ensure that at one point of time, only 1 member is working on one feature - Ensure that we work off one branch when editing and pushing codes - Scrum Master can seek to enforce daily stand ups and ensure that they are effective and time-efficient - Push for commits to be on time and the flow of work to be on track - Allow CI/CD to perform full checks on every single Pull Request before merging into the master branch and main codes

Challenges faced and resolutions

Frontend

- Image Display
    - During the import of images for the designing of the website, some images were not imported correctly and it resulted in them bugging out in the application, displayed as a non-image output instead.
    - In order to resolve this, we re-imported the images and fixed the links to the image, and deployed it to re test and it worked this time.

Backend

- Manipulating user data in child components runs the risk of violating the one-way data flow principle, which can lead to unexpected behaviour.
- We worked around this carefully by setting up a firebase listener in a parent component which is responsible for passing the latest data as props to all child components.
- All child components that modified data were only allowed to do so by modifying the database directly.
- This way, all changes made to the user data are always detected by the listener in the parent component and propagated to all child components, ensuring consistency across the app.

- We ran into infinite loop issues that did not present a problem in our local copy but caused the published copy of the website to hang. Later, we realised that this was because we were modifying the state in our render, which causes the renderer to re-render, resulting in an infinite loop. This was fixed by re-coding all our logic “reactively”.

Firebase

- We initially wanted to store all of NUS module data on firebase, but ran into upload quotas for the free plan.
- This was addressed by using the NUSMods’ REST API to query for required data on demand rather than supplying it from our own database.
- Furthermore, after our mass upload failed, we had to wait for a cool down time before the quota was refreshed and we could add new entries into the database. Subsequently, we kept hitting the quota again and again as each cool down period only gave us a small amount of additional uploads. This affected our debugging process as we had to work on the code without access to firebase.

Vue Project Structure

Login and Registration Page

Scenario 1: User does not have an account

If the user does not have an account it will prompt them to enter a valid username and password. Subsequently, when the user finishes the registration they will automatically be logged in.

Scenario 2: User has an account

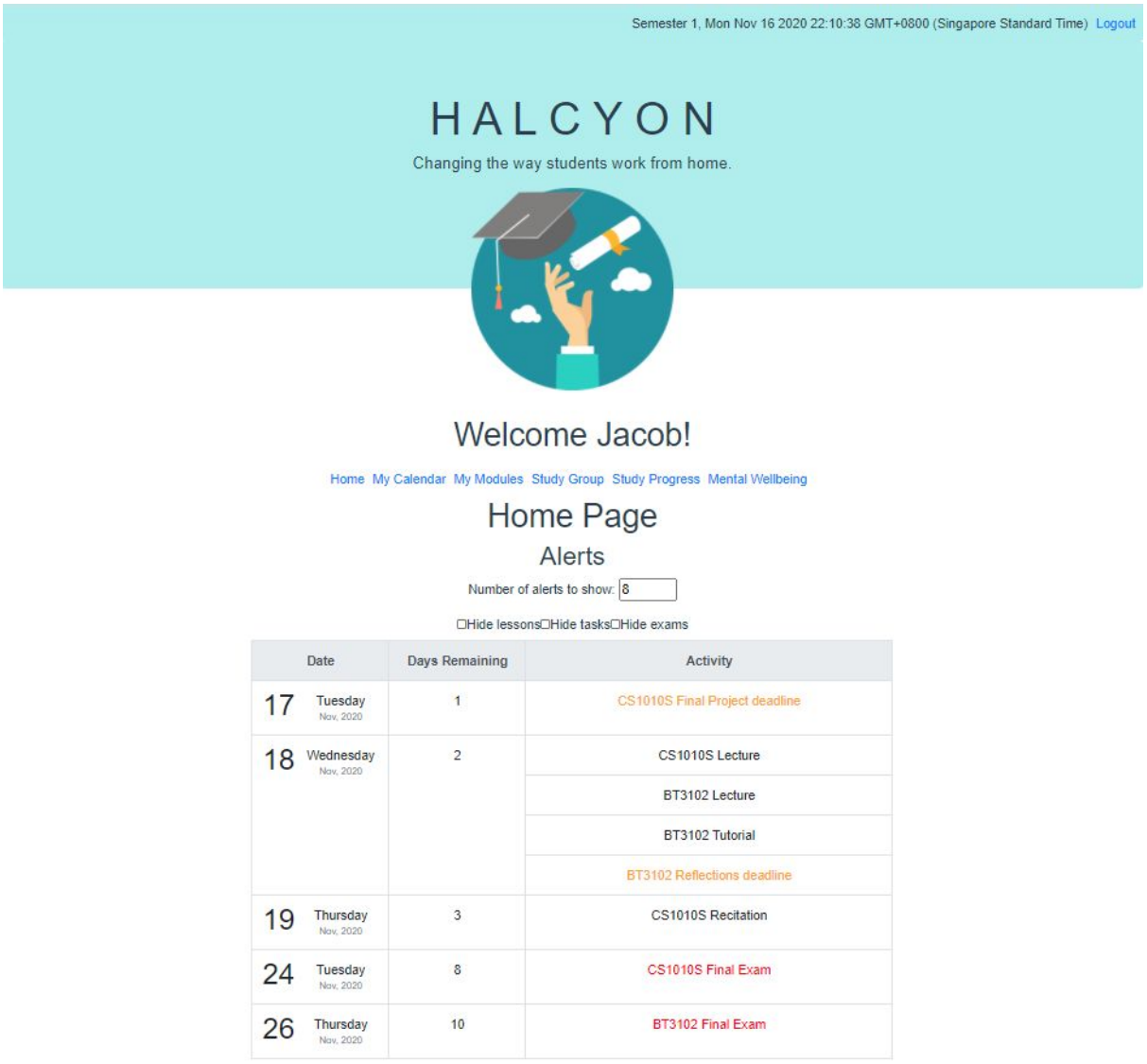
When there is a username and password that is linked to the backend, the user will be directed to their personalized home page. The modules, study groups and study progress data will be retrieved from the backend.

Features of our Web Application

Persistent User Data

All content in the following pages are rendered dynamically using user data that is persisted on firebase firestore. Upon a successful login, user data is retrieved in a container component (User.vue) before being processed and passed down to its child components, the pages described below. A firebase listener is also set up to propagate any live changes in the database to all child components. This ensures that all pages always render content using the latest snapshot of user data.

Home Page



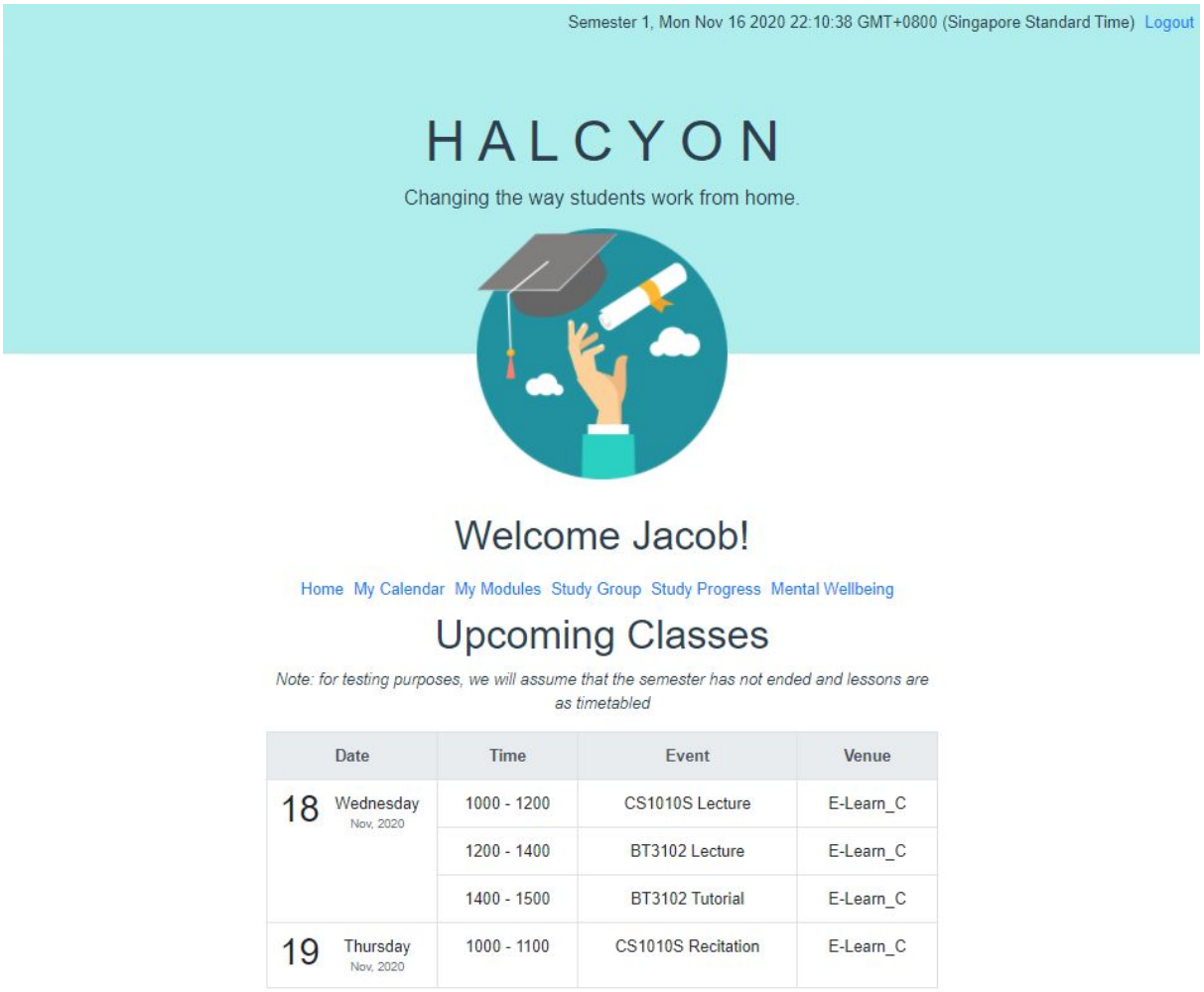
The Home Page contains a summary of alerts for users notifying them of upcoming task deadlines, lessons and exams. It displays the number of days remaining till each activity from the current date.

In the home page, different types of events (lessons, tasks, and exams) are coloured a different colour (black, yellow, and red) respectively for improved readability. Activity on the same date are also grouped together with merged cells in the date and days remaining columns.

How the alerts are displayed is also customizable, allowing the user to hide their lessons, tasks or exams, and choose how many alerts to display. This way, they can more easily filter out the noise and focus on what really matters to them.

This page hence provides a quick and easy way to view key information quickly.

My Calendar



Showcases the lectures and tutorials the student has for the week.

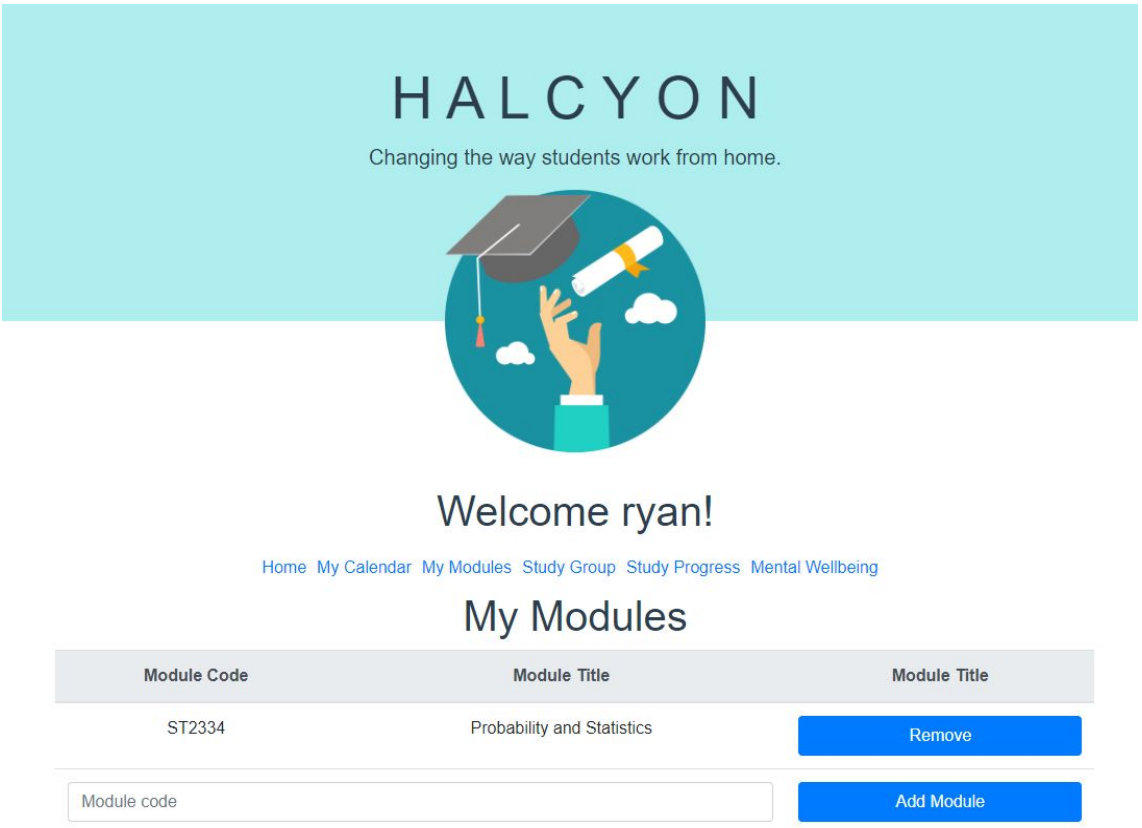
When the student inputs their modules into the application in the My Modules page, it will draw from the Registrar Office's module database through the NUSMods API to gather relevant information on what classes the student has for the upcoming week.

This will result in the module's lectures and tutorials to be shown in the Calendar page as well.

For demonstration purposes, we have assumed that the semester has not ended yet, so that lesson details can continue to be shown.

Lessons on the same date are also grouped together with merged cells in the date columns.

My Modules

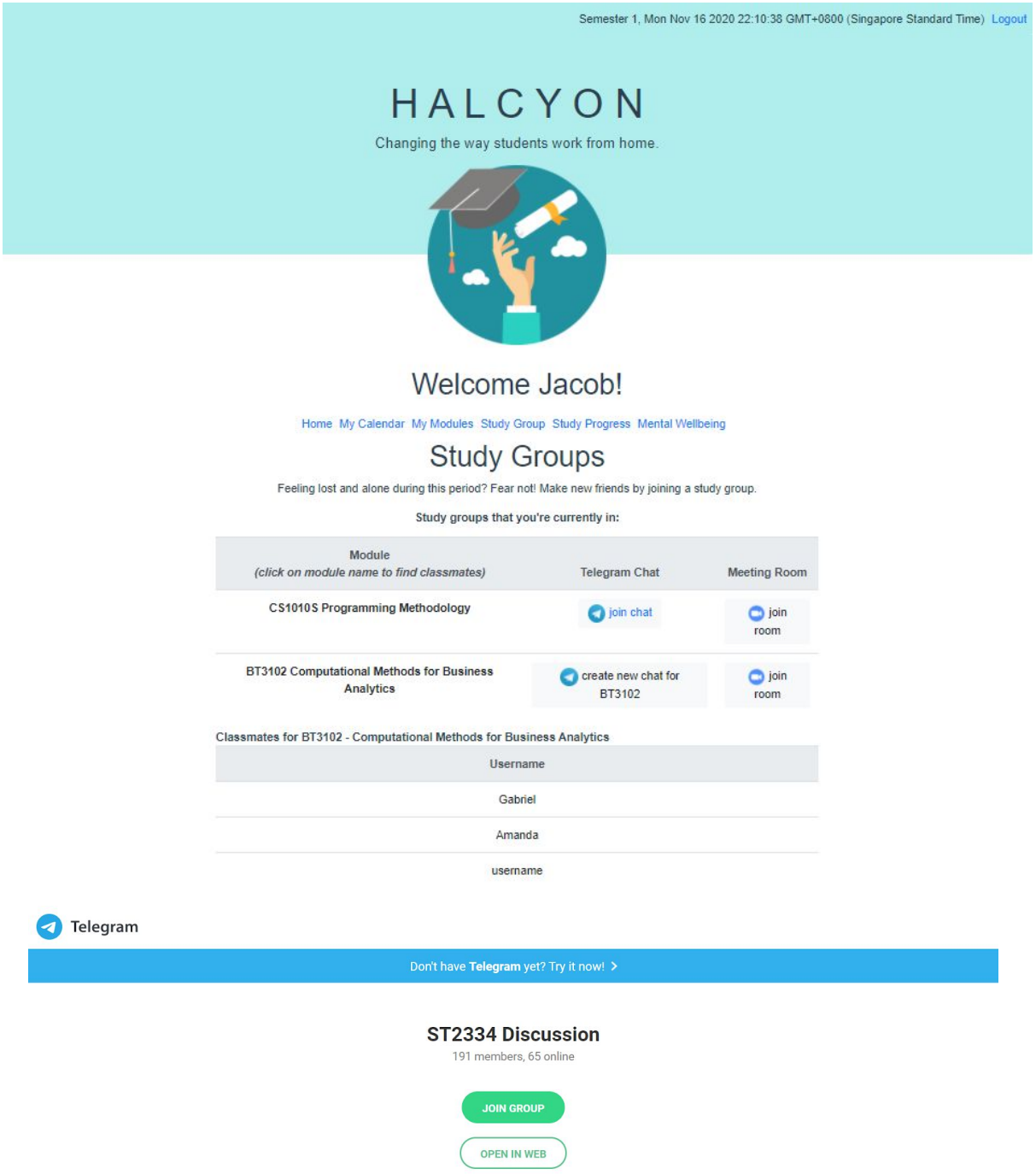


The My Modules feature allows students to add the modules that they are taking in the semester to the application. User input is used to query the NUSMods REST API for module data.

The module data is then associated with the user in firebase and propagated through all the other website functions.

As exam data is drawn from module data stored in a firebase document associated with each user, removal of a module from the user will remove all module associated data from the user including exam data. However, as the user might still want to work on unfinished tasks associated to the module, we have implemented tasks to remain even after the module has been removed.

Study Group



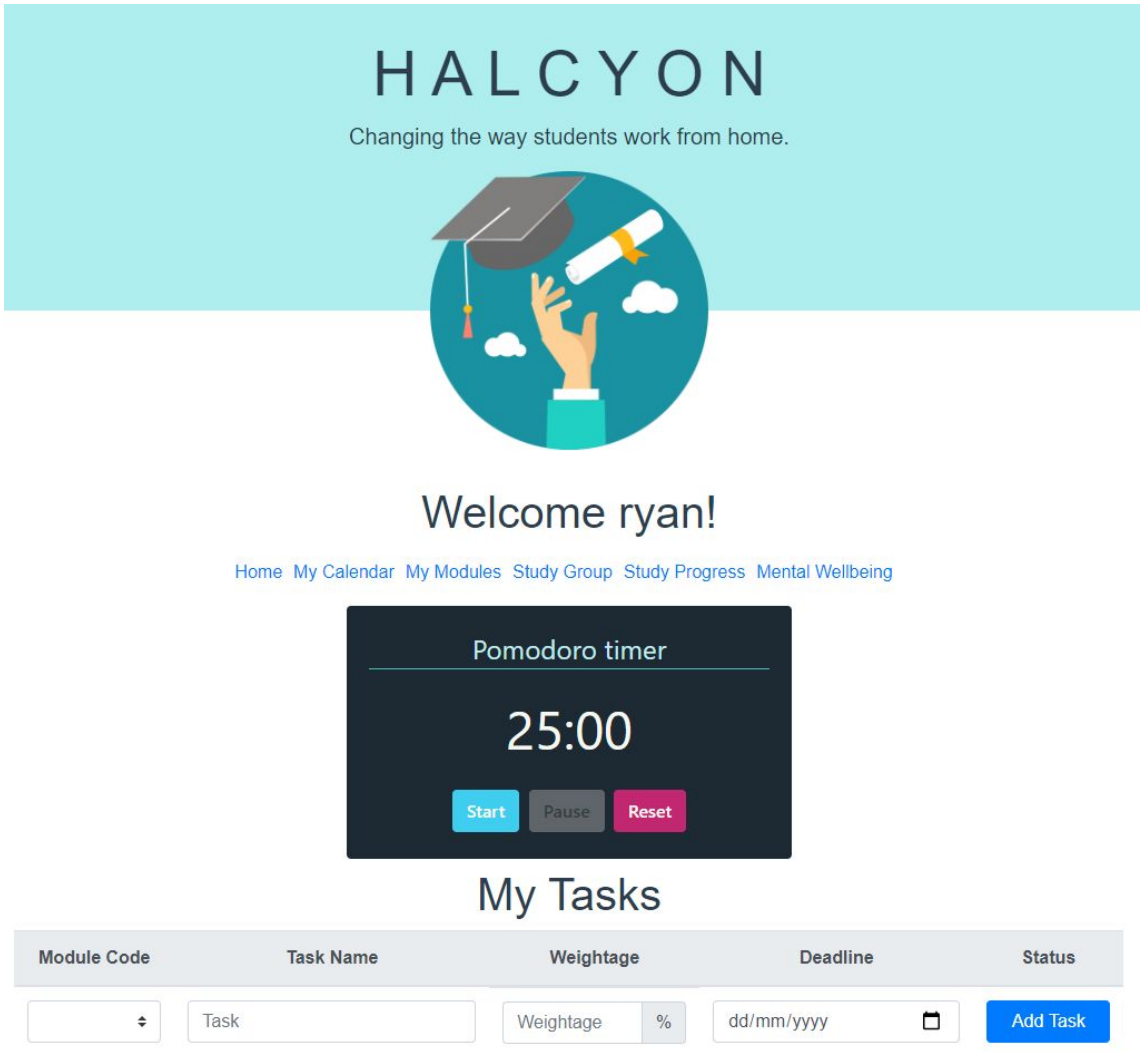
Find Classmates: By clicking on the module title, users can find friends taking similar courses with them. This information is retrieved from firebase.

Telegram chat integration: They can then chat and learn from one another via telegram. They are able to create a telegram group using a telegram bot if the chat group for the modules do not already exist. Otherwise, the link will lead the user to an existing telegram group.

Zoom study room integration: The zoom links have been created for each individual module study group and they can access unique zoom rooms for their study group usage. These zoom study rooms for each module have no duration restrictions, to facilitate unlimited duration study sessions

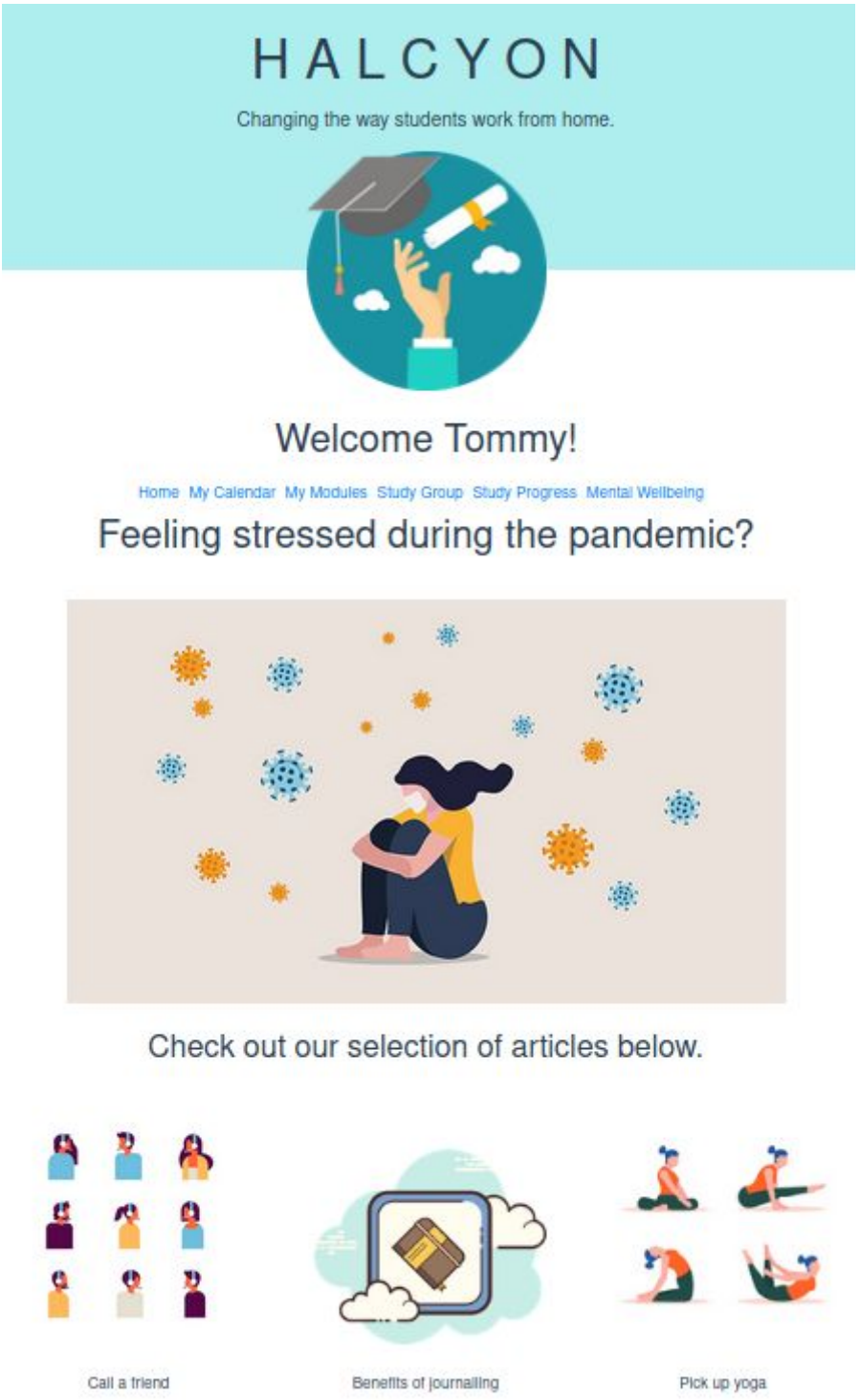
between classmates, which will be especially useful during the COVID-19 season where students no longer get to meet their friends in person.
Students in the same study group will be able to access the same zoom room by navigating to the Study Group page in their Halcyon account and clicking on the zoom link associated to the respective study group.

Study Progress



This page aims to help the student keep track of the time spent on studying. This is done through a Pomodoro timer where a suggested duration of per study session is 25 minutes before taking a short break and starting another study session. This will help them in managing the proportion of the time they spend on a certain module, and total time spent on studying as a whole, such that they can create a more optimal work-life balance, helping them to manage their stress levels as well.

Mental Wellbeing



The page will include links to websites with tips and interesting articles for students to read and destress during this pandemic period. Students can click or tap on the different photos which will open up a browser, surfing the link for an article that is related to mental wellness. Providing them some useful tips on how to destress and improve their mental wellness can go a long way in helping them throughout the semester and generate cumulative benefits for the students.

GitHub URL

Our GitHub URL for our project is as follows:
https://github.com/terenceneo/Halcyon/tree/master/student_portal

Deployed Application Link

Our deployed application link is as follows:
https://bt3103-halcyon.web.app/

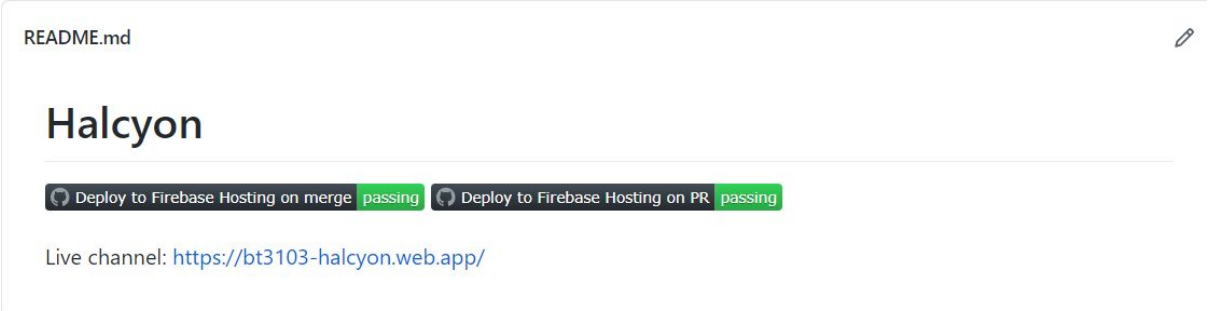
Firebase Details

Our firebase project is found at:
https://console.firebase.google.com/u/0/project/bt3103-halcyon/overview
The email accounts specified on Luminus have been granted Viewer access to the Project.

Additional Functionality/Feature

Continuous Integration and Continuous Delivery

Continuous Integration and Continuous Delivery (CI/CD) was implemented for our project using github actions. The aim of this was to seamlessly handle redeployment where frequent code changes were being merged into the main branch, allowing team members to work better in parallel. The nature of the Github action used for our CI/CD encouraged group members to build and merge code in feature branches, which were then conveniently deployed once merged into the master branch.



Our CI/CD process consisted of 2 github actions for pull requests (PRs) and merges to master. After sending a pull request (PR) to the master branch, a CI/CD github action helps run tests on its deployability and deploys the PR to a preview channel to allow reviewers to easily test the changes before merging the PR. Similarly, upon a successful review and merge to the master branch, another CI/CD github action similarly tests its deployability before deploying it to the live channel. Status

badges for each of these actions were also set up on the project's README so that team members were always aware of the project's deployment status.

CI and CD helps us to deliver our code changes more frequently and reliably. This helps to ensure the correctness and quality of our codes. It establishes a consistent and automated way to create and run tests on applications.

Integration with NUS Registrar Office Module Database through NUSMods API

The NUSMods API was added into our project to allow users (Students) to add modules into the application following an accurate API database. NUSMods API contains the data used to render the NUSMods website. It consists of data on modules offered by NUS and their timetables, along with the locations where the classes are held.

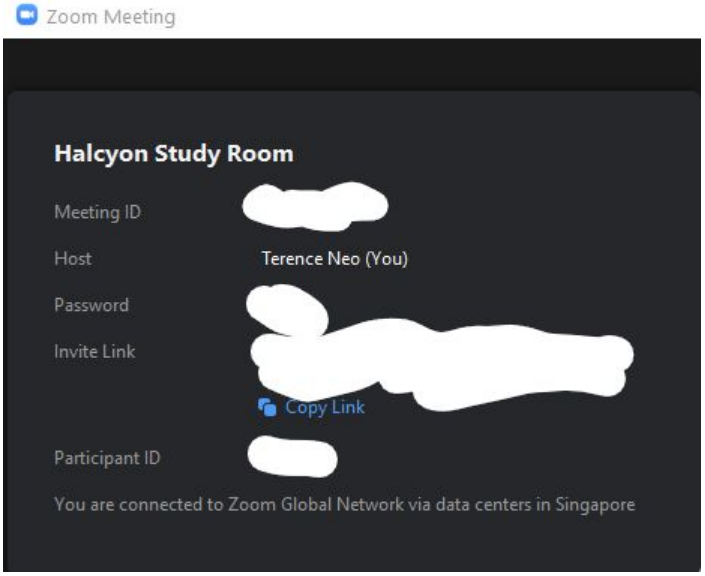
Integration with Telegram and Zoom

Nusmodchat integration for telegram channels: Users can chat and learn from one another via telegram. They are able to create a telegram group using a telegram bot if the chat group for the modules do not already exist. Otherwise, the link will lead the user to an existing telegram group.

Through the telegram chat integration, the user will be able to interact with his coursemates in an informal setting, something remote learning has made difficult.

Telegram group links and bot are integrated with nusmodchat (https://modchat.nuscomputing.com/).

Zoom study room integration: The zoom links have been created for each individual study group and they can access unique zoom rooms for their study group usage.



Possible Extensions

LumiNUS integration

In this virtual learning environment COVID-19 has created, we expect lessons, task submissions, and exams to be online. Most of these are already online, with links placed in LumiNUS. With native integration with LumiNUS we will be able to make our website more comprehensive, linking each lesson, task, and exam to the lesson zoom URL, task/exam information/ submission page.

However, we are unable to do this currently, as LumiNUS integration requires a certain level of user rights that we do not have access to.

References

- NUSMods API for accessing NUS Registrar Office's module database: https://api.nusmods.com/v2/
- Nusmodchat for retrieving telegram links for existing module telegram chat groups https://modchat.nuscomputing.com/