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Knight Foundation School of Computing and Information Sciences*

Software Engineering Focus

Final Deliverable

Project Title: Gamification of LMS App on Facebook
Ver. 7.0

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Abstract

This document presents the information necessary to gain a good understanding of Gamification of a Learning Management System app with a Facebook Authentication Service. It is an application that is designed to provide anyone, specifically individuals in underprivileged countries, access to an educational learning management system similar to Canvas at little to no data cost. Since this product has been developed throughout previous semesters, this document describes the contributions that our group has made within the Spring 2021 semester in detail, including, but not limited to, UML diagrams, System design, and Agile Ceremonies.

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INTRODUCTION

Over time, the whole world has undergone a digital revolution where vast sums of knowledge can be accessed and learned right through the palm of our hands with the use of computers, mobile devices, etc. However, many people who live in underdeveloped countries don't have the ease or ability to access this information freely due to their limitations of Internet data. Facebook has managed to resolve this problem in which their application can be accessed for free with no data charges. Therefore, this application has been developed to serve as a learning management system in which users can access it through Facebook and enroll into their courses of interest at no cost. This application also utilizes gamification in order to provide positive feedback loops for learning the content within each course through putting people into groups and having to complete modules together in order to advance through the course, utilizing a progress tree to display progress for the individual as well as their group and the whole class and an announcement/discussion post system.

Current System

A Learning Management System Application that uses the Facebook Platform for users to easily access, progress, communicate, and enroll in the educational courses of their choice.

Purpose of New System

Contributions:

Alex Lopez - Acted as the team lead for this semester, helped organized the repository and google drive. Mainly focused on building the progress tree design in the frontend and hooked it up to DB using existing backend code. Also tested AWS migration through EC2 to lay groundwork for hosting web app on FIU servers. Also focused on fixing a couple of bugs in the frontend.

Luis Rosa - Worked on the progress tree implementation at the beginning with Alex and Miguel. Started the frontend work, the first implementation of the progress tree. Worked on migrating the project from Heroku to AWS EC2 instances.

Miguel Cortes - Worked on the progress tree implementation throughout the semester along with Alex and Luis, helping design the tree in the frontend, link progress dynamically, as well as implementing markers for course and group progress tracking.

Francisco Mazzei - Installed all of the necessary components for a working development

environment. Analyzed the process for using AWS to deploy the project and had attempts at populating the database on MySQL for the sake of functionality. Took the time to understand the client and server side frameworks to be able to use them effectively along with Typescript and other dependencies utilized for the product.

Taylor Martinez - Set up the project onto my own system to be able to view and work through the already established application and used YouTube to learn SQL(MySQL), AWS, Angular and TypeScript to be able to prepare for next semester when my team takes over the project.

Cody Jimenez - Set up the project onto my own system to be able to view and work through the already established application and used LinkedIn learning/YouTube to learn SQL(MySQL), AWS and Angular to be able to prepare for next semester when my team takes over the project.

Daniel Riquelme Rebollar - Installed and tested the project on my own environment and reviewed its components in order to acquire the necessary knowledge through video tutorials, such as Angular, NodeJS with Express, MySQL, JavaScript, and AWS. All these was done to successfully take over the project the next term.

Enrique Aylagas - Analyzed, installed and tested the project on my own environment, and reviewed its components in order to acquire the necessary knowledge through video tutorials, such as Angular, NodeJS with Express, MySQL, JavaScript, and AWS. All these was done to successfully take over the project the next term.

USER STORIES

The following section provides the detailed user stories that were implemented in this iteration of the Gamification of an LMS App project. These user stories served as the basis for the implementation of the project's features. This section also shows the user stories that are to be considered for future development.

Implemented User Stories

User Story #	1
Assigned to	All team members.
User Story	As a developer, I want to be able to understand the project proposal and wishlist, as well as what has already been done by past teams so that I understand the project I am working on.
Acceptance Criteria	Review the submitted documents from last semester, watch the videos, and Meet with the PO to discuss project with team and discuss goals for this semester.

User Story #	2
Assigned to	All Team Members
User Story	As a developer, I want access to the GitHub repositories and documentation needed to communicate with my team members so that my team and I are informed on the progress of each team member.
Acceptance Criteria	All members gain access to the GitHub repositories

User Story #	3
Assigned to	All Team Members
User Story	As a developer, I want to become familiar with the project stack: Angular, NodeJS, MySQL, etc. To accomplish this, go through some tutorials online. This is so that I am able to work on this project for this semester..
Acceptance Criteria	All team members use LinkedIn learning and other resources to start learning the project stack.

User Story #	4
Assigned to	All Team Members
User Story	4 - As a developer, I want to begin to view/review the repository frontend/backend code on GitHub so that I may gain/regain my understanding of the project layout. (3 hours)
Acceptance Criteria	All members git clones the projects into their local computer and start looking over the backend and frontend structure: discuss code structure.

User Story #	5
Assigned to	All team members
User Story	As a developer, I want to be able to run the project locally through reviewing the project Installation Guide so that I can test my

	changes to the app before posting them on GitHub.
Acceptance Criteria	Set up the project fully to run the backend API and Angular Frontend, login into FB with proper FB app developers set up, and push the code to Heroku apps to see if they work there.

User Story #	6
Assigned to	Everyone
User Story	As a developer, I want to share the previous code of the last team with our current team through either giving them access to the zip
Acceptance Criteria	The team lead gives access to the previous semester GitHub repositories and everyone else in the team views and/or pulls the code repositories.

User Story #	7
Assigned to	All members
User Story	As a developer, I want to review how to properly use GitHub for managing the project repositories so that I can efficiently add new changes to my branch, effectively make pull requests and revert to a previous commit in any branch if needed.
Acceptance Criteria	Spend a bit of time to go over online resources to review GitHub functionality.

User Story #	8
Assigned to	Alex Lopez, Miguel Cortés, Luis Rosa
User Story	As a developer, I want to conduct research into progress tree implementations in Angular through online resources and examples so that we can have a solid foundation for our implementation in the LMS app
Acceptance Criteria	Find enough online resources about creating progress bars(vertical and horizontal) to use a base to build our progress tree implementation

User Story #	9
Assigned to	Alex Lopez, Miguel Cortés, Luis Rosa
User Story	As a developer, I want to create an initial progress tree implementation that is able to track the progress of students individually in their modules, in groups, and the class progress as a whole.
Acceptance Criteria	Create a progress tree with a good looking design that integrates some progress tracking through currently existing Backend API routes for the course point column at the student-courses table.

User Story #	11
Assigned to	Alex Lopez
User Story	As a developer, I want to resolve connectivity issues the frontend Heroku app is having with

	the database, not allowing the app to pull the course list and more from the database.
Acceptance Criteria	Have Heroku Web app pull properly from DB to get the list of courses and login the user properly.

User Story #	12
Assigned to	All members
User Story	As a developer, I want to continue to review/learn more about the project stack (JavaScript/Typescript, MySQL, HTML/CSS) and frameworks(Angular, Node.js) (as I am working on the project so that I improve and apply it to the current project.
Acceptance Criteria	Use online resources Youtube to find and watch introduction videos for Angular/nodeJS, as well as utilize LinkedIn Learning to take video courses on Web development stack. Also, use these resources as a reference throughout the semester.

User Story #	13
Assigned to	All members
User Story	As a developer, I want to review and write proper documentation throughout our development of the application so that other developers can understand my work and understand the functionality of each code component of the app.
Acceptance Criteria	Write documentation on additions to the code base, as well as add any lacking documentation in the project so that each

	component and function is explained.
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User Story #	14
Assigned to	All members
User Story	As a developer, I want to resolve the bug where module content does not have its latest status when it refreshes the page so that the application can work accordingly.(20 hours)
Acceptance Criteria	Find the bug regarding module content, identify the issue in code, and fix it.

User Story #	15
Assigned to	Enrique Aylagas,Cody Jimenez, Taylor Martinez, Francisco Mazzei, Daniel Riquelme
User Story	As an incoming developer, I want to familiarize myself and review the code of the project frontend and backend so that I get a better understanding of the code structure of the project.
Acceptance Criteria	Each Capstone 1 student manage to spend a few hours looking at the code in Frontend and Backend, then asks a a question or two about the structure of the project or about anything specific.

User Story #	16
Assigned to	Alex Lopez, Miguel Cortes
User Story	As a developer, I want to finish and finalize progress tree implementation this sprint: figure out the final design, how we implement

	it in the frontend, and how to connect it to the DB through the backend.
Acceptance Criteria	Get a working progress tree that fits the specifications of the PO in terms of design, then actually get the points of course to be hooked into overall course progress, and see about how to implement module progress to hook into module progress bars.

User Story #	17
Assigned to	Luis Rosa, Francisco Mazzei
User Story	As a developer, I want to explore hosting the app on AWS online so that we can migrate the application from Heroku as a stepping stone towards launching the web app fully for FIU.
Acceptance Criteria	Do research on AWS platforms for web hosting, experiment and find documentation on options and see which ones can be viably set up.

User Story #	18
Assigned to	Alex Lopez, Miguel Cortes
User Story	As a developer, I want to create markers on the module progress bars that show/represent group and class progress
Acceptance Criteria	Create markers that actually overlay over module progress bars using templated found online, have them properly moving across the module bars themselves. Also

User Story #	19
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Assigned to	Alex Lopez, Miguel Cortés, Luis Rosa
User Story	As a developer, I want to fix a bug where groups are not being displayed or not working properly for courses.
Acceptance Criteria	Find the source of the bug of why groups won't display, fix it, and test to see if any more group-related bugs and if so, try to fix those as well.

User Story #	20
Assigned to	Alex Lopez, Luis Rosa
User Story	As a developer, I want to finish our AWS hosting migration for the web application so that we can eventually host the web app at FIU servers. Work together to get the EC2 instances working fully and fix the bugs regarding the project dependencies that have been hindering our progress.
Acceptance Criteria	Work together to get proper set up for running backend and frontend EC2 instances with a connected AWS RDS Database connected to DB, have it running on instances and is accessible from public IP4 address and test it.

User Story #	22
Assigned to	Alex Lopez, Luis Rosa, Miguel Cortes.
User Story	As a capstone 2 student, I want to get the documentation done by the end of the sprint: Individual Posters, Videos(introduction/Demo), Powerpoint

	presentation, and final Documentation submitted to canvas/Pathable.
Acceptance Criteria	Work on documentation needed to be submit to pathable/google form before April 12th 5pm: have intro and demo videos done and published to Youtube, have individual Posters basically done, have a working draft of Final Document, Have slides finished and ready to use for Presentation on Presentation day.

User Story #	23
Assigned to	Enrique Aylagas, Cody Jimenez, Taylor Martinez, Francisco Mazzei, Daniel Riquelme
User Story	As a capstone 1 student, I want to make my group poster as required for submission before the end of this sprint and submit to Canvas/Pathable.
Acceptance Criteria	Work together to make a complete poster that shows off our contributions to the project.

Pending User Stories

User Story #	10
Assigned to	All members
User Story	As a developer, I want modules that are empty to not show as complete or award points to the student.
Acceptance Criteria	Try to fix bug in frontend code for modules and test it by creating empty modules, then switching over to student role.

User Story #	21
Assigned to	Alex Lopez, Miguel Cortés, Luis Rosa
User Story	As a developer, I want to link the module progress and group/class markers dynamically to the progress bars(Maybe won't get if done before end of semester but at least make some progress with it if possible).
Acceptance Criteria	Have module progress and other related DB tables set up properly to assign points to complete for each module that student must complete in their courses, and have it accessible through Backend API to update module progress bars.

PROJECT PLAN

This section describes the planning that went into the realization of this project. This project incorporated the agile development techniques and as such required the sprints to be planned. These sprint planning meetings are detailed in the section. This section also describes the components, both software and hardware, chosen for this project.

Hardware and Software Resources

The following is a list of all hardware and software resources that were used in this project:

- Backed was implemented as a NodeJS w/ Express API app, which was utilized to connect the progress tree to the Database for tracking course/module progress.
- Database was implemented using MySQL. Accessed and modified tables efficiently using MySQL Workbench (6.3.10)
- The Front-End was implemented using the Angular 9. Angular CLI for generating services/components/modules/etc. The MVC Architecture is used with Angular.
- The DevOps used were Heroku, GitHub, and AWS.
 - Heroku is a free PaaS used to deploy the code to run using Heroku web servers and create a MySQL Server DB (Clear DB) to connect to our app. We linked our GitHub repositories with Heroku to continuously deploy the application.
 - AWS is the platform we started migrating to in order to make use of FIU Linux servers. We used EC2 instances using ubuntu 18.04 virtual machines to construct the backend API and Frontend web app, and Amazon RDS to construct a MySQL database to connect to those apps. Full web hosting on this has not been completed, but we provided the foundation necessary to complete it in the next iteration.

Sprints Plan

Sprint 1

Date: 1/18/2021

Start time: 8:30 pm

End time: 9:00 pm

User Stories:

- 1 - As a developer, I want to be able to understand the project proposal and wish list, as well as what has already been done by past teams so that I understand the project I am working on. (6 hours)
- 2 - As a developer, I want access to the GitHub repositories and documentation needed to communicate with my team members so that my team and I are informed on the progress of each team member. (1 hour)
- 3 - As a developer, I want to become familiar with the project stack: Angular, NodeJS, MySQL, etc. To accomplish this, go through some tutorials online. This is so that I am able to work on this project for this semester. (30 hours)
- 4 - As a developer, I want to begin to view/review the repository frontend/backend code on GitHub so that I may gain/regain my understanding of the project layout. (3 hours)
- 5 - As a developer, I want to be able to run the project locally through reviewing the project Installation Guide so that I can test my changes to the app before posting them on GitHub. (6 hours)
- 6 - As a developer, I want to share the previous code of the last team with our current team through either giving them access to the zip or (0.5 hours)

Assignment of user stories:

- Alex Lopez
 - User Story 1, 2 ,3 ,4 ,5, 6
- Luis Rosa
 - All user stories
- Miguel Cortes
 - All user stories
- Francisco Mazzei
 - All user stories

- Taylor Ann Martinez
 - All User Stories
- Daniel Riquelme Rebollar
 - All user stories
- Cody Daniel Jimenez
 - All user stories
- Enrique Aylagas
 - All user stories

Sprint 2

Date: 2/1/2021

Start time: 4:15 pm

End time: 4:45 pm

User Stories:

- 3 - As a developer, I want to become familiar with the project stack: Angular, NodeJS, MySQL, etc. To accomplish this, go through some tutorials online. This is so that I am able to work on this project for this semester. (15 hours)
- 5 - As a developer, I want to be able to run the project locally through reviewing the project Installation Guide so that I can test my changes to the app before posting them on GitHub. (3 hours).
- 7 - As a developer, I want to review how to properly use GitHub for managing the project repositories so that I can efficiently add new changes to my branch, effectively make pull requests and revert to a previous commit in any branch if needed. (2 hours)
- 8 - As a developer, I want to conduct research into progress tree implementations in Angular through online resources and examples so that we can have a solid foundation for our implementation in the LMS app (20 hours).
- 9 - As a developer, I want to create an initial progress tree implementation that is able to track the progress of students individually in their modules, in groups, and the class progress as a whole. (35 hours)
- 10 - As a developer, I want modules that are empty to not show as complete or award points to the student. (5 hours)

Assignment of user stories:

- Alex Lopez
 - All user stories.
- Luis Rosa
 - All User stories
- Miguel Cortes
 - All user stories
- Francisco Mazzei
 - All user stories
- Taylor Ann Martinez
 - User stories 3,5,7
- Daniel Riquelme Rebollar
 - User stories 3,5,7
- Cody Daniel Jimenez
 - User stories 3,5,7
- Enrique Aylagas
 - User stories 3,5,7

Sprint 3**Date: 2/15/2021**

Start time: 4:15 pm

End time: 4:45 pm

User Story:

- 9 - As a developer, I want to create an initial progress tree implementation that is able to track the progress of students individually in their modules, in groups, and the class progress as a whole. (35 hours)
- 10 - As a developer, I want modules that are empty to not show as complete or award points to the student. (5 hours)
- 11 - As a developer, I want to resolve connectivity issues the frontend Heroku app is having with the database, not allowing the app to pull the course list and more from the database. (5 hours)
- 12 - As a developer, I want to continue to review/learn more about the project stack(Javascript/Typescript, MySQL,HTML/CSS) and frameworks(Angular, Node.js) (as I am working on the project so that I improve and apply it to the current project.(100 hours (20 hours this sprint).

- 13 - As a developer, I want to review and write proper documentation throughout our development of the application so that other developers can understand my work and understand the functionality of each code component of the app.(20 (5 hours this sprint))
- 14 - As a developer, I want to resolve the bug where module content does not have its latest status when it refreshes the page so that the application can work accordingly.(20 hours)
- 15 - As an incoming developer, I want to familiarize myself and review the code of the project frontend and backend so that I get a better understanding of the code structure of the project. (5 hours).

Assignment of user stories:

- Alex Lopez
 - User Story 9, 10, 11, 12, 13, 14.
- Luis Rosa
 - User Story 9, 10, 11, 12, 13, 14.
- Miguel Cortes
 - User Story 9, 10, 11, 12, 13, 14.
- Francisco Mazzei
 - User Story 10, 11, 12, 13, 14, 15
- Taylor Ann Martinez
 - User Story 10, 11, 12, 13, 14, 15
- Daniel Riquelme Rebollar
 - User Story 10, 11, 12, 13, 14, 15
- Cody Daniel Jimenez
 - User Story 10, 11, 12, 13, 14, 15
- Enrique Aylagas
 - User Story 10, 11, 12, 13, 14, 15

Sprint 4

Date: 3/1/2021

Start time: 4:15 pm

End time: 4:45 pm

User Stories:

- 10 - As a developer, I want modules that are empty to not show as complete or award points to the student. (5 hours)
- 12 - As a developer, I want to continue to review/learn more about the project stack(Javascript/Typescript, MySQL,HTML/CSS) and frameworks(Angular, Node.js) (as I am working on the project so that I improve and apply it to the current project.(80 hours (20 hours this sprint).
- 13 - As a developer, I want to review and write proper documentation throughout our development of the application so that other developers can understand my work and understand the functionality of each code component of the app.(15 (5 hours this sprint))
- 14 - As a developer, I want to resolve the bug where module content does not have its latest status when it refreshes the page so that the application can work accordingly.(20 hours)
- 15 - As an incoming developer, I want to familiarize myself and review the code of the project frontend and backend so that I get a better understanding of the code structure of the project. (5 hours).
- 16 - As a developer, I want to finish and finalize progress tree implementation this sprint: figure out the final design, how we implement it in the frontend, and how to connect it to the DB through the backend. (20 hours)
- 17 - As a developer, I want to explore hosting the app on AWS online so that we can migrate the application from Heroku as a stepping stone towards launching the web app fully for FIU.(15 hours).

Assignment of user stories:

- Alex Lopez
 - User Story 10, 12, 14, 16
- Luis Rosa
 - User Story 10, 12,16, 17,
- Miguel Cortes
 - User Story 10, 12, 13, 14, 16
- Francisco Mazzei
 - User Story 12, 13, 17
- Taylor Ann Martinez
 - User Story 12, 13, 15

- Daniel Riquelme Rebollar
 - User Story 12, 13
- Cody Daniel Jimenez
 - User Story 12, 13
- Enrique Aylagas
 - User Story 12, 13

Sprint 5

Date: 3/16/2021

Start time: 5:15 pm

End time: 5:45 pm

User Stories:

- 12 - As a developer, I want to continue to review/learn more about the project stack (JavaScript/Typescript, MySQL, HTML/CSS) and frameworks(Angular, Node.js) (as I am working on the project so that I improve and apply it to the current project.(60 hours (20 hours this sprint)).
- 13 - As a developer, I want to review and write proper documentation throughout our development of the application so that other developers can understand my work and understand the functionality of each code component of the app.(15 (7.5 hours this sprint))
- 16 - As a developer, I want to finish and finalize progress tree implementation this sprint: figure out the final design, how we implement it in the frontend, and how to connect it to the DB through the backend. (10 hours).
- 17 - As a developer, I want to explore hosting the app on AWS online so that we can migrate the application from Heroku as a stepping stone towards launching the web app fully for FIU.(7.5 hours).
- 18 - As a developer, I want to create markers on the module progress bars that show/represent group and class progress(5 hours).
- 19 - As a developer, I want to fix a bug where groups are not being displayed or not working properly for courses. (13.5 hours).

The team members indicated their willingness to work on the following user stories.

- Alex Lopez
 - Priority list: User Story 12,16, 18, 19
- Luis Rosa

- User Story 12, 16, 17, 19
- Miguel Cortes
 - User Story 12, 16, 18, 19
- Francisco Mazzei
 - User Story 12, 13
- Taylor Ann Martinez
 - User Story 12, 13,
- Daniel Riquelme Rebollar
 - User Story 12, 13
- Cody Daniel Jimenez
 - User Story 12, 13
- Enrique Aylagas
 - User Story 12, 13

Sprint 6

Date: 3/31/2021

Start time: 4:10 pm

End time: 4:25 pm

The product owner chose the following user stories to be done during the next sprint:

- 12 - As a developer, I want to finish reviewing/learning about the project stack (JavaScript/Typescript, MySQL, HTML/CSS) and frameworks (Angular, Node.js). (15 hours)
- 13 - As a developer, I want to review and write proper documentation throughout our development of the application so that other developers can understand my work and understand the functionality of each code component of the app. (5 hours)
- 19 - As a developer, I want to fix a bug where groups are not being displayed or not working properly for courses. (5 hours).
- 20 - As a developer, I want to finish our AWS hosting migration for the web application so that we can eventually host the web app at FIU servers. Work together to get the EC2

instances working fully and fix the bugs regarding the project dependencies that have been hindering our progress. (10 hours)

- 21 - As a developer, I want to link the module progress and group/class markers dynamically to the progress bars(Maybe won't get if done before end of semester but at least make some progress with it if possible). (10 hours)

- 22 - As a capstone 2 student, I want to get the documentation done by the end of the sprint: Individual Posters, Videos(introduction/Demo), Powerpoint presentation, and final Documentation.(25 hours)

- 23 - As a capstone 1 student, I want to make my group poster as required for submission before the end of this sprint.(15 hours).

The team members indicated their willingness to work on the following user stories.

- Alex Lopez
 - Priority list: User Story 12,19, 20, 21, 22,
- Luis Rosa
 - User Story 20, 21, 22
- Miguel Cortes
 - User Story 12, 19, 21, 22,
- Francisco Mazzei
 - User Story 12, 13, 23
- Taylor Ann Martinez
 - User Story 12, 13, 23
- Daniel Riquelme Rebollar
 - User Story 12, 13, 23
- Cody Daniel Jimenez
 - User Story 12, 13, 23
- Enrique Aylagas
 - User Story 12, 13, 23

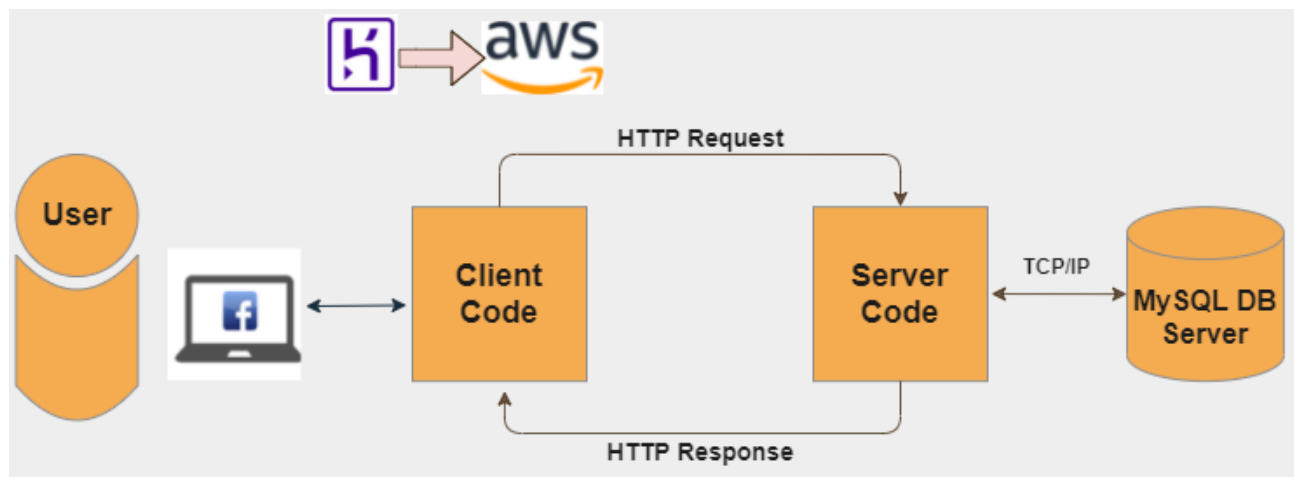
SYSTEM DESIGN

This section contains information on the design decisions that went into this project. The architecture patterns are outlined and explained. The entire system is shown in a package diagram and the subsystems are explained. Finally, the design patterns used in the project are discussed.

Architectural Patterns

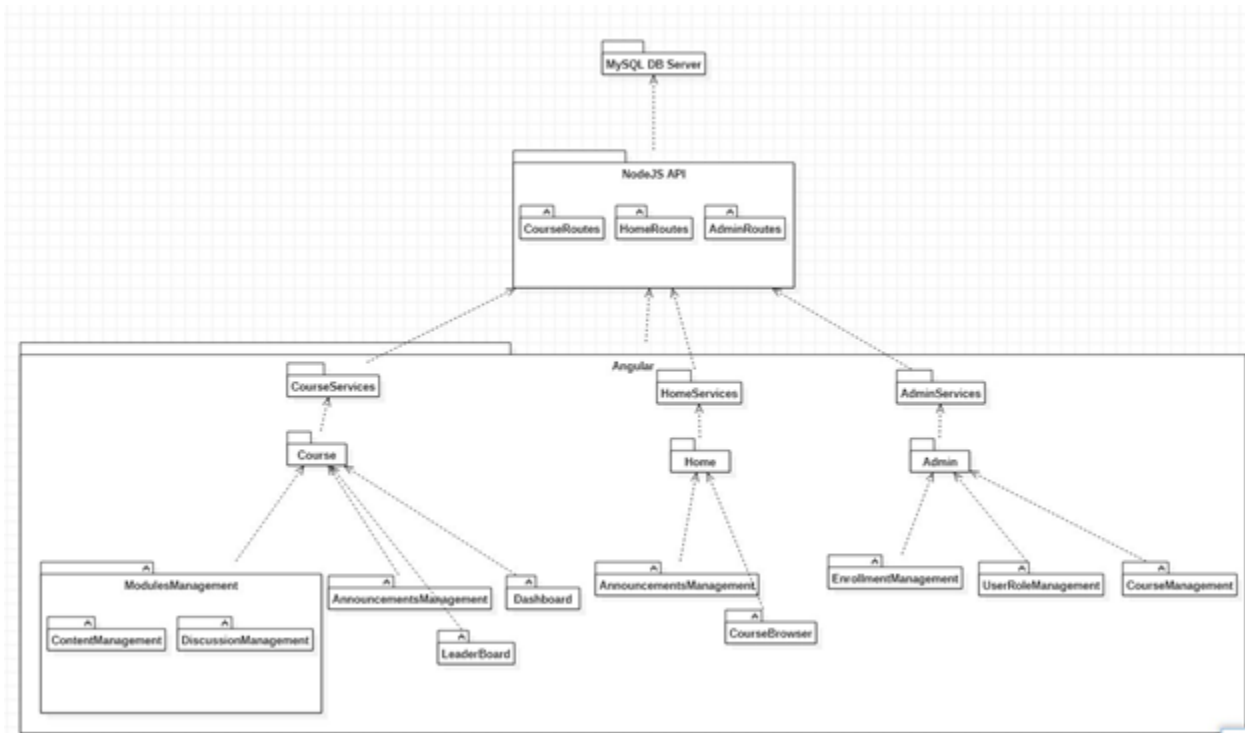
The three tier architecture pattern was used for the project. It consists of a presentation layer (Front-end), an application layer (Back-end), and a data layer (DBMS) [1]. The three tiers/layers communicate via API calls from one layer to another. For our project, Angular (Front-end) makes HTTP requests to our RESTful NodeJS/Express Back-end API, which also makes API calls to our MySQL DB Server.

The following diagram depicts the communication between the three tiers; client (front-end), server (back-end), and MySQL DB server.



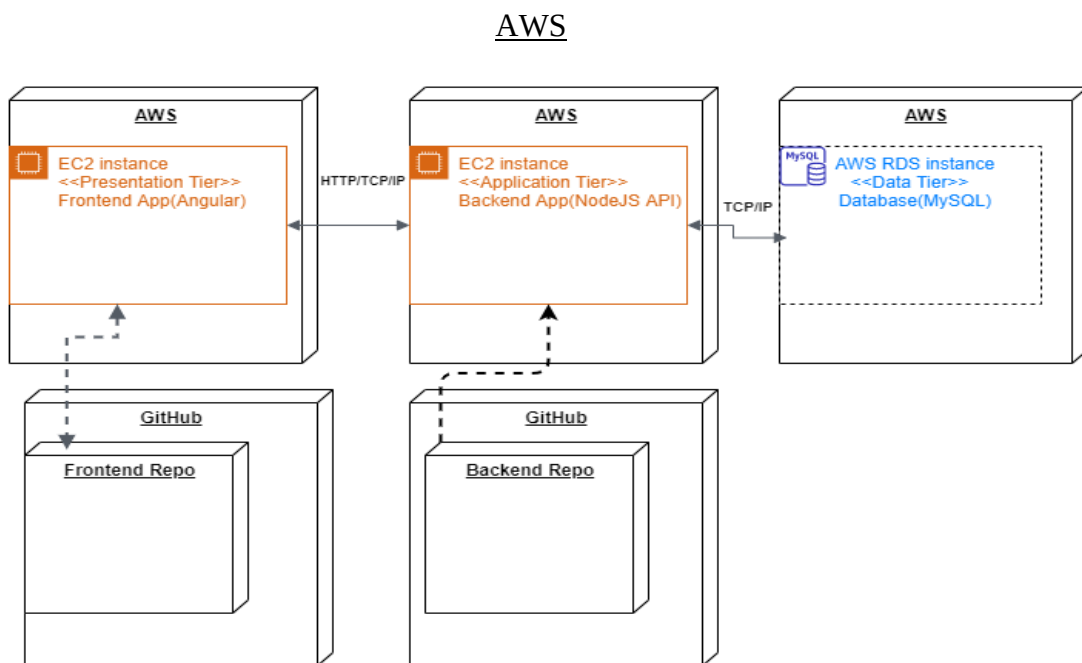
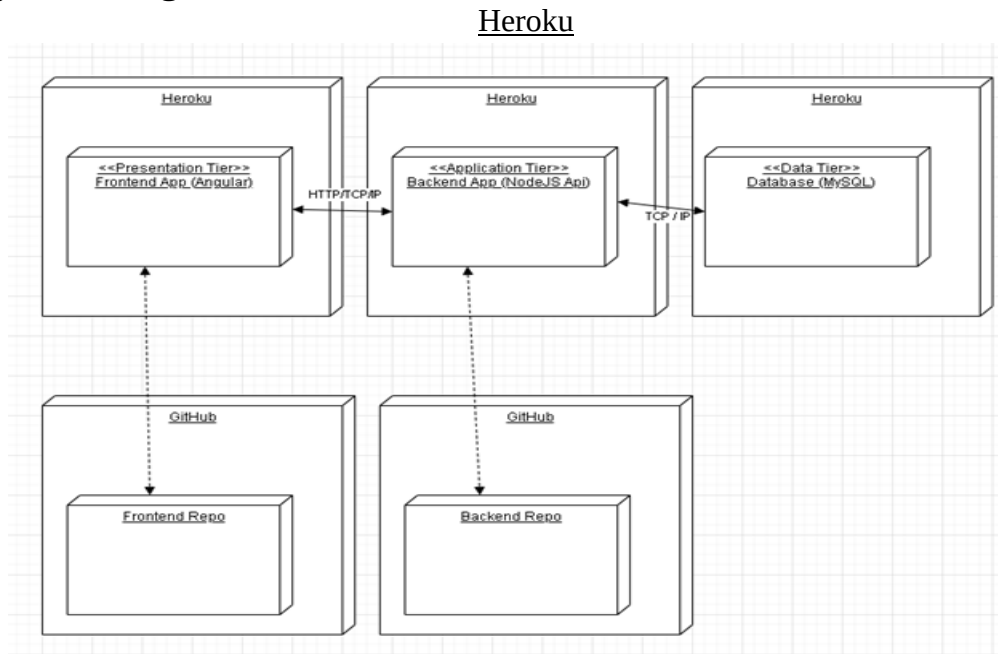
System and Subsystem Decomposition

The following diagram illustrates our three-tier architecture's system and subsystem decomposition.



As described in the diagram, the subsystems inside the Angular package named Course, have more subsystems that subsequently depend on them. Modules Management, for example, contains Course Management and Discussion Management, which depend on Modules Management which in turn depends on Course. The Course thereafter depends on Course Services to make API calls to the NodeJS API Back-end Package. Then, the NodeJS API makes API calls to the MySQL DB Server package to retrieve the necessary data. To clarify, the packages and subsystems form a dependency tree.

Deployment Diagram



Design Patterns

The main design pattern used in our front-end is the Observer design pattern. Observers are used in Service classes to fetch data, which is then sent to the back-end. The observer's objects are subscribed to, which will let the controller know when the observer sent data to the back-end and got a response. This basically allows for our controllers to make asynchronous calls back to the back-end NodeJS API.

Another design used in our front-end is the dependency injection design pattern. It is utilized on our Angular components to inject services and their methods for our components to use. This allows for the Injector to instantiate necessary object for our client component to use through an interface. Although we only use it for method calls from the Injector, it allows for future development to have a more loosely coupled code base.

SYSTEM VALIDATION

Testing originally began locally. Error checking was done through IDE and browser console output in order to debug and improve features. Once the live deployment of the application was stable, testing on the responsiveness and cohesion of all the new and improved components was done. Furthermore, testing for mobile development was done by checking for any layout bugs on mobile devices of all sizes and generations. This allowed us to verify functionality and accessibility for first-time users of any role and using any device.

GLOSSARY

Angular: Front-end web framework

NodeJS: Back-end RESTful framework.

Express: NodeJS middleware (easy RESTful API development).

Heroku: Platform as a service (hosting): Current Host

Amazon Web Services: Platform as a service (hosting): Migration from Heroku (incomplete)

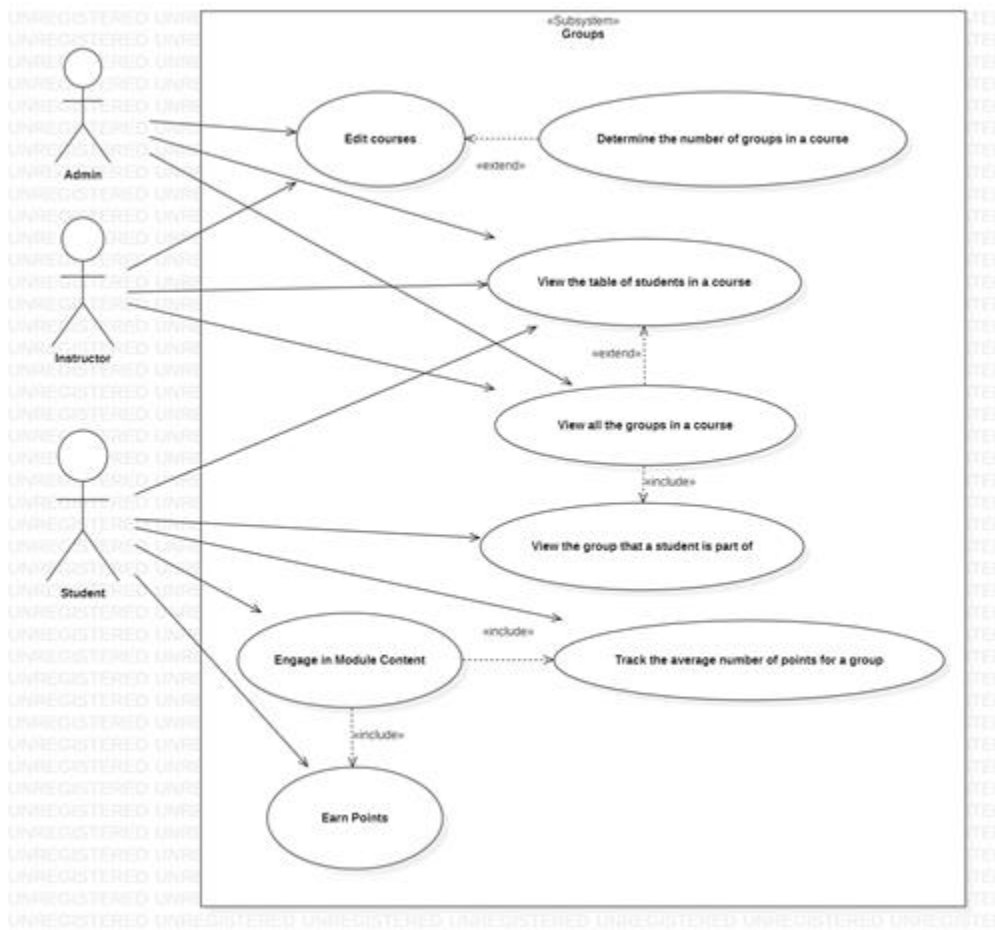
GitHub: Git repository online.

APPENDIX

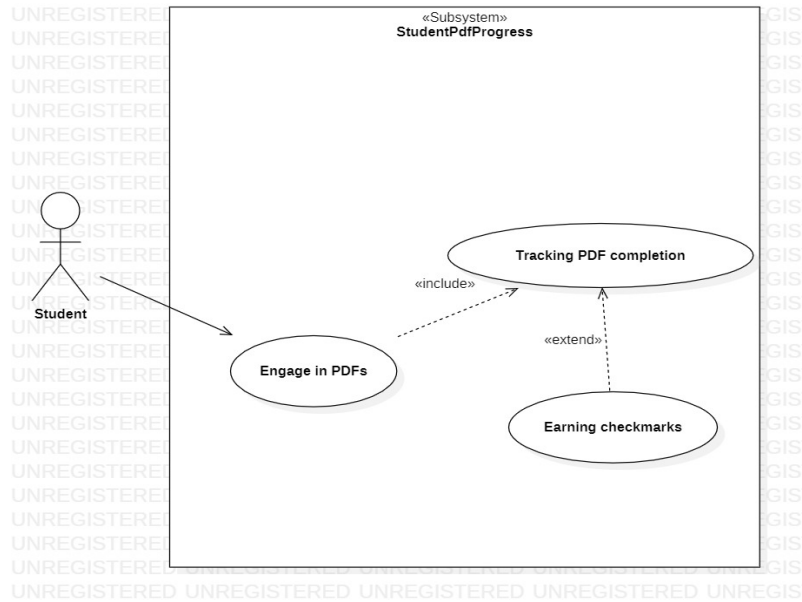
Appendix A - UML Diagrams

Use Case Diagrams

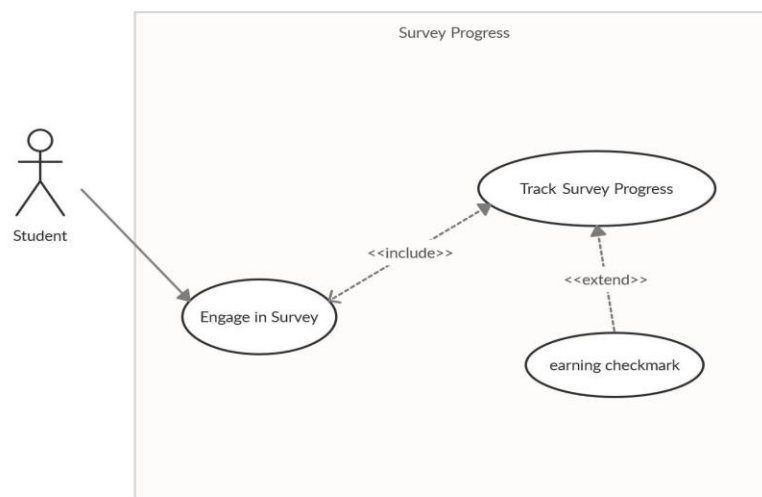
By Alex Lopez
Groups



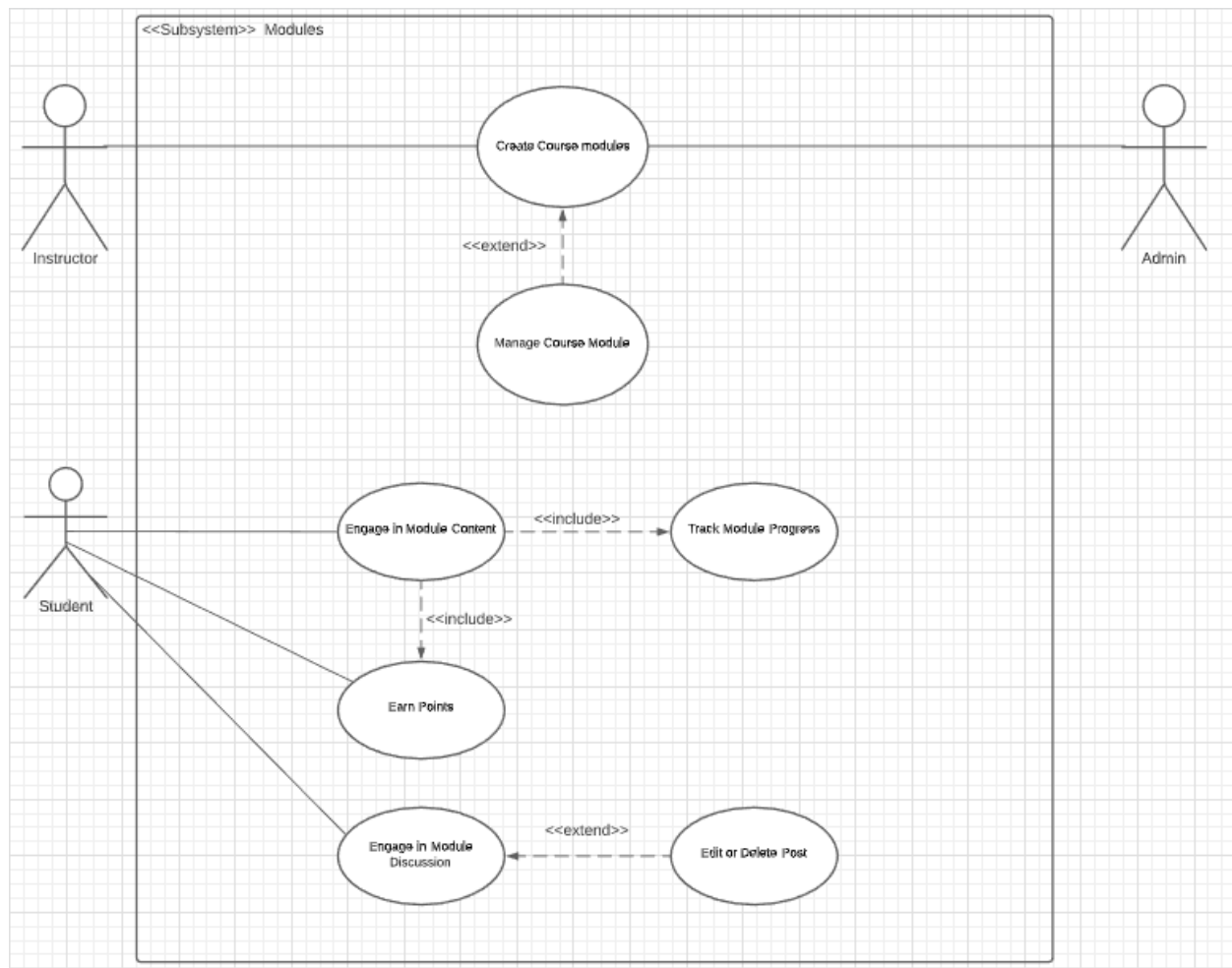
By
Luis Rosa
StudentPDFProgress



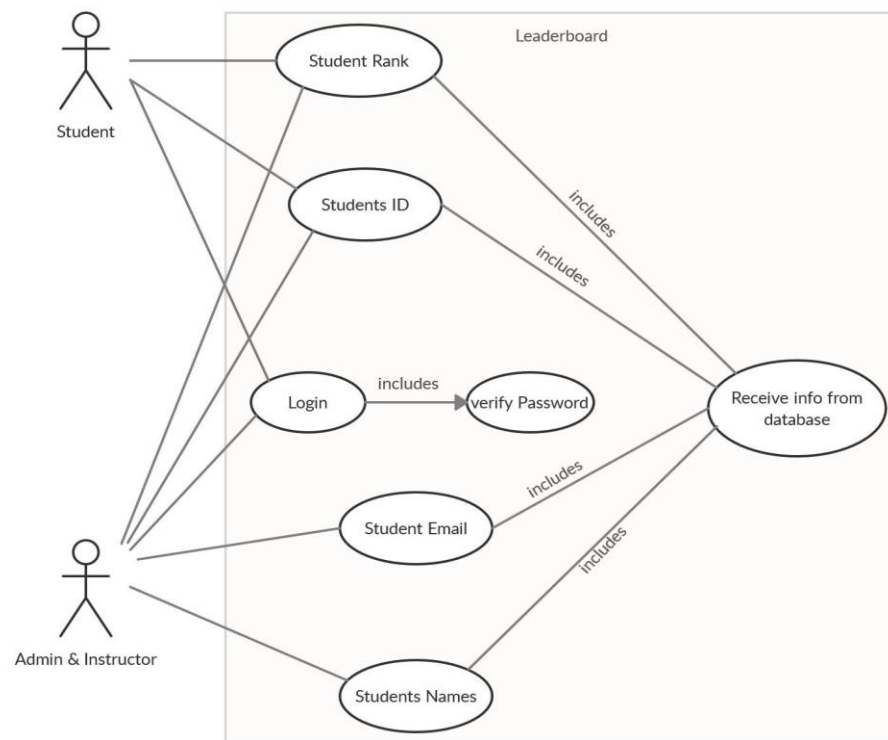
By Luis Rosa
StudentSurveyProgress



By Miguel Cortes
Modules



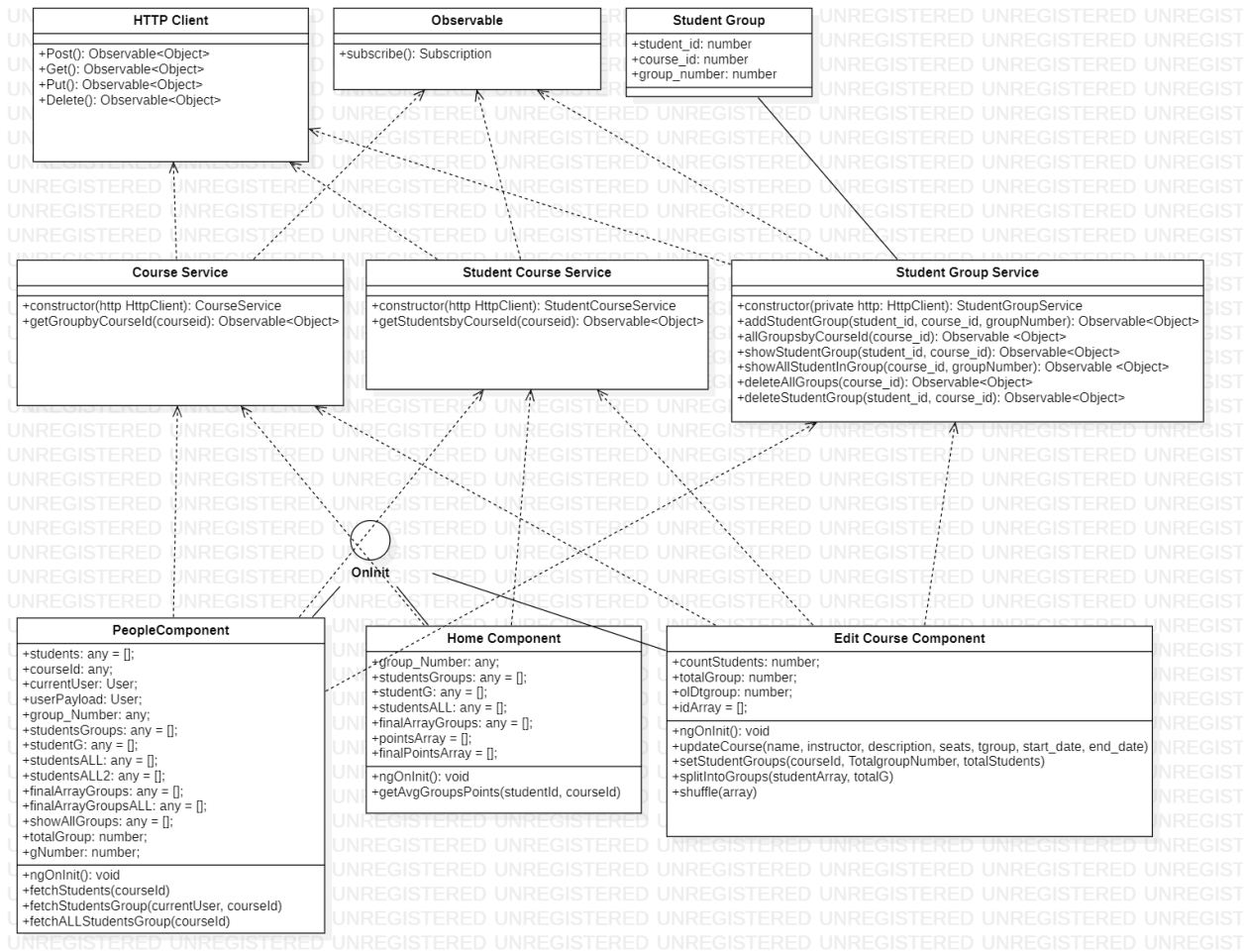
By Miguel Cortes
Leaderboard



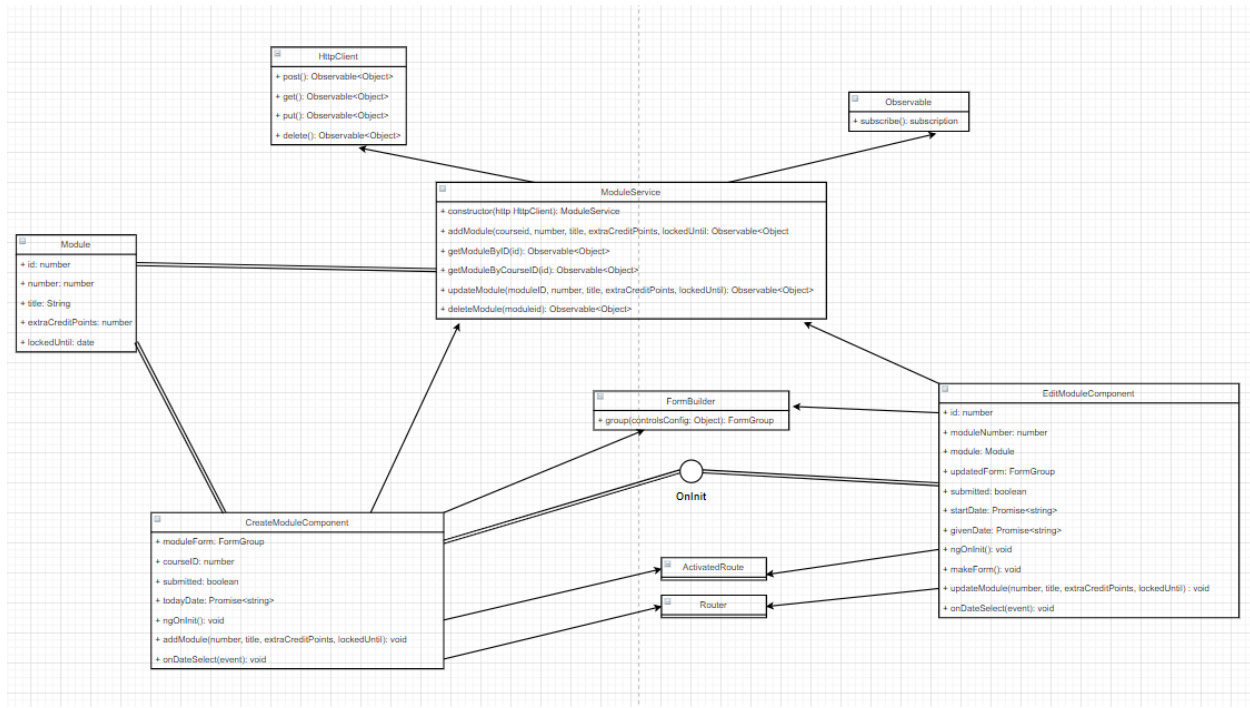
Class Diagrams

By Alex Lopez

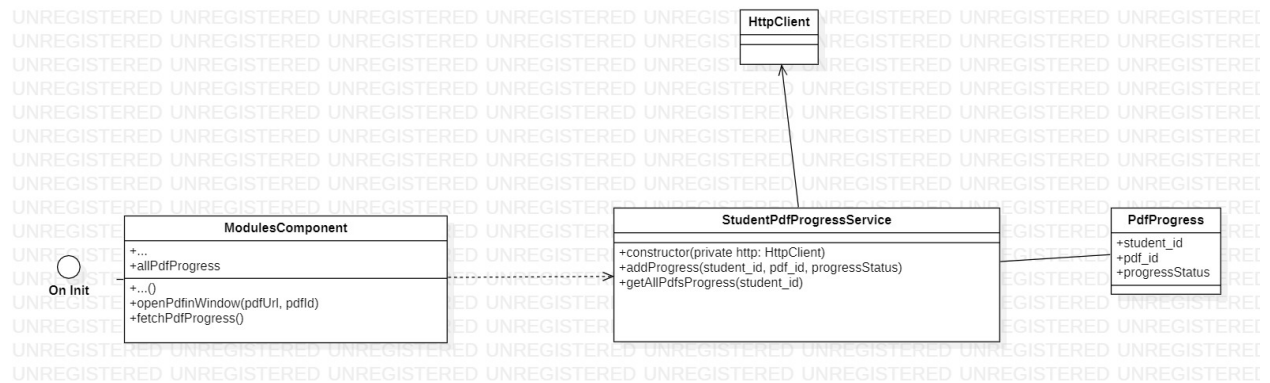
Groups



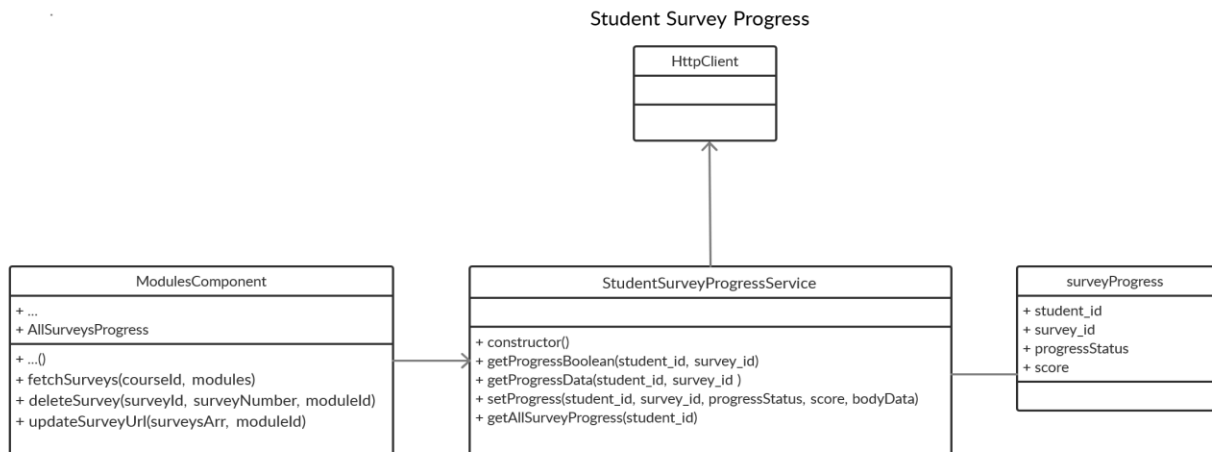
By Miguel Cortes
ModuleManagement



By Luis Rosa
StudentPDFProgress

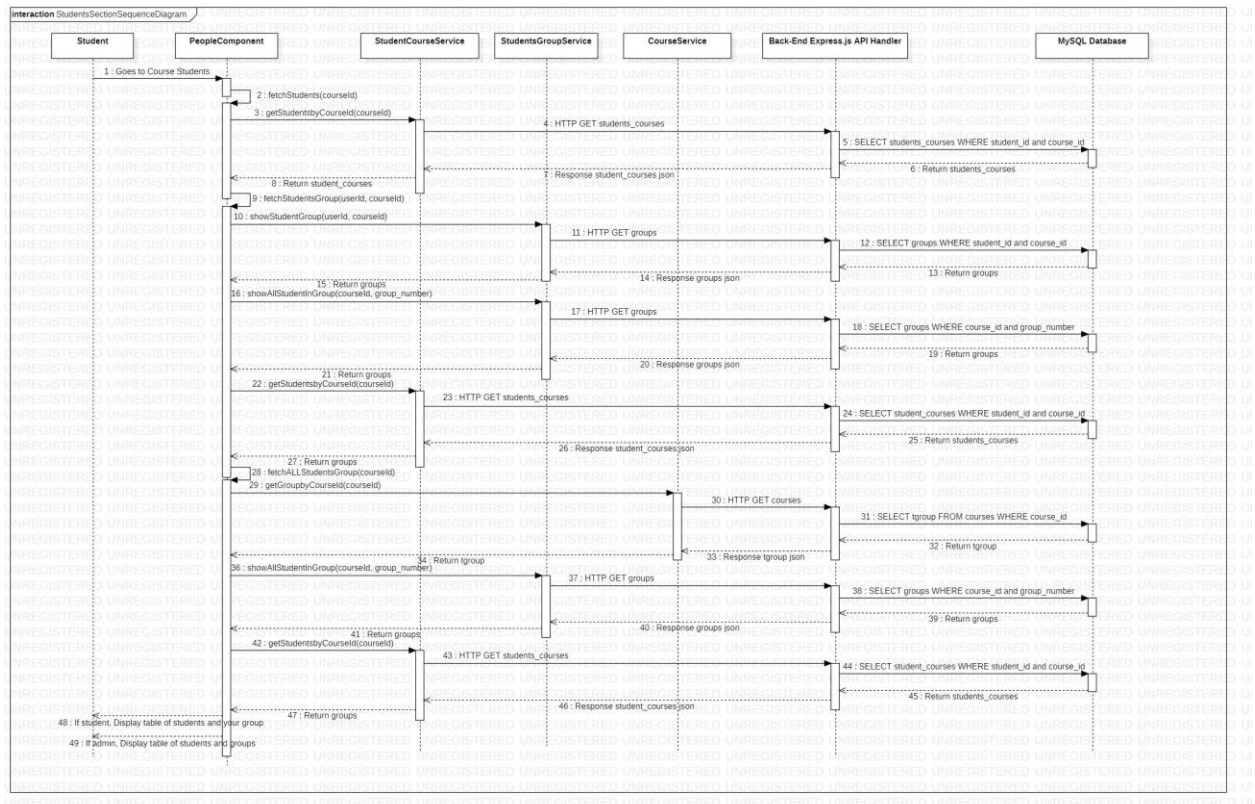


By Luis Rosa
StudentSurveyProgress



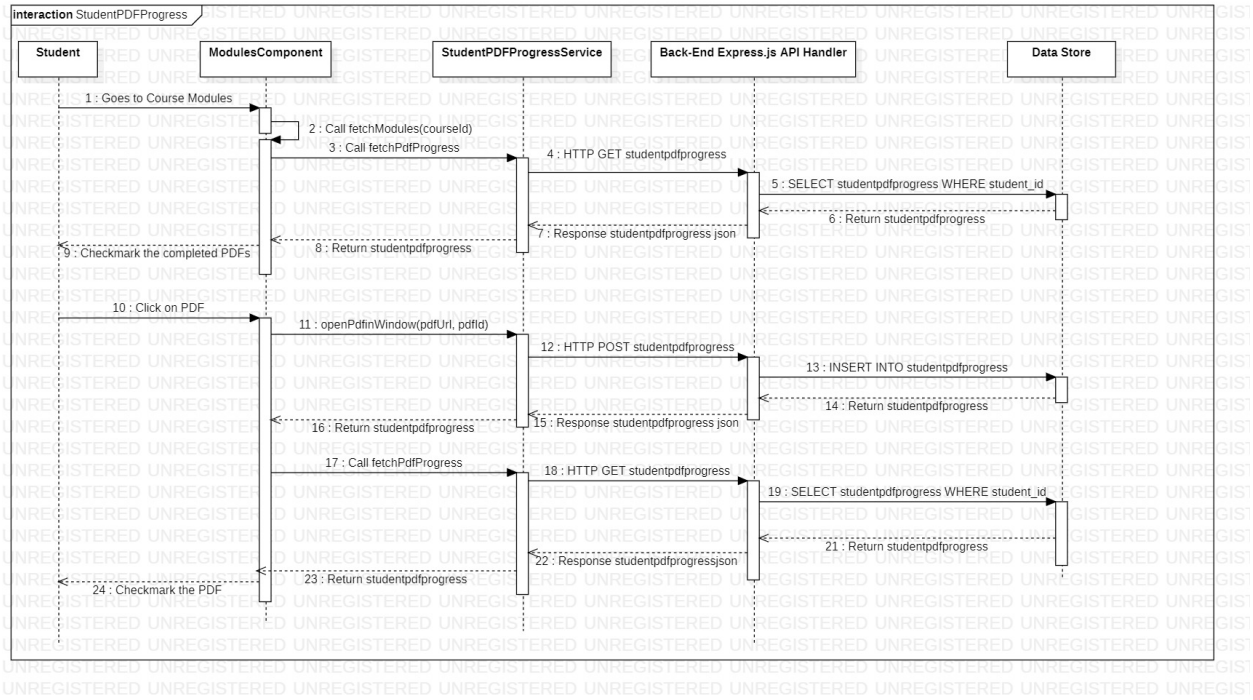
Sequence Diagrams

By Alex Lopez
StudentsSection

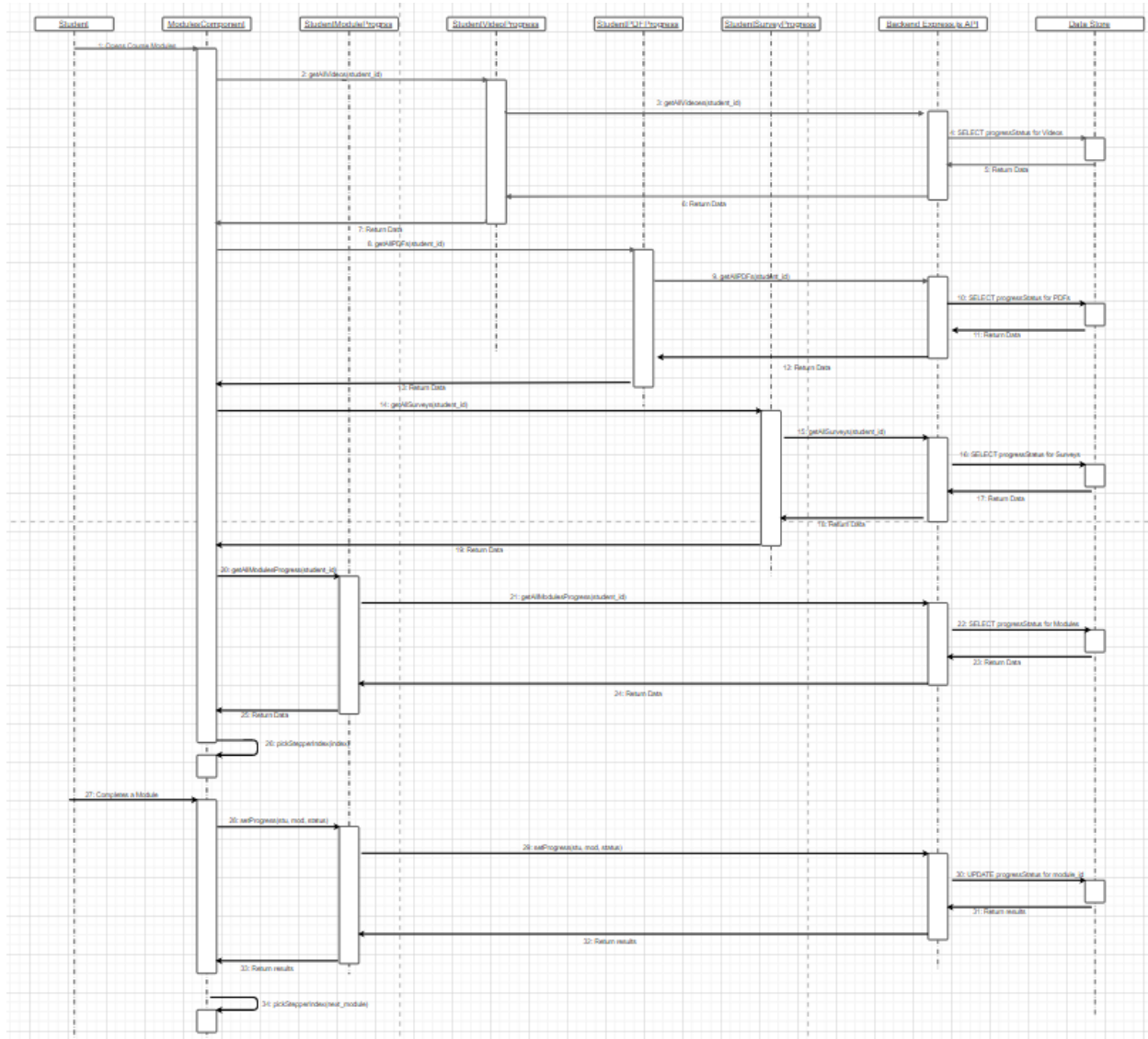


By Luis Rosa

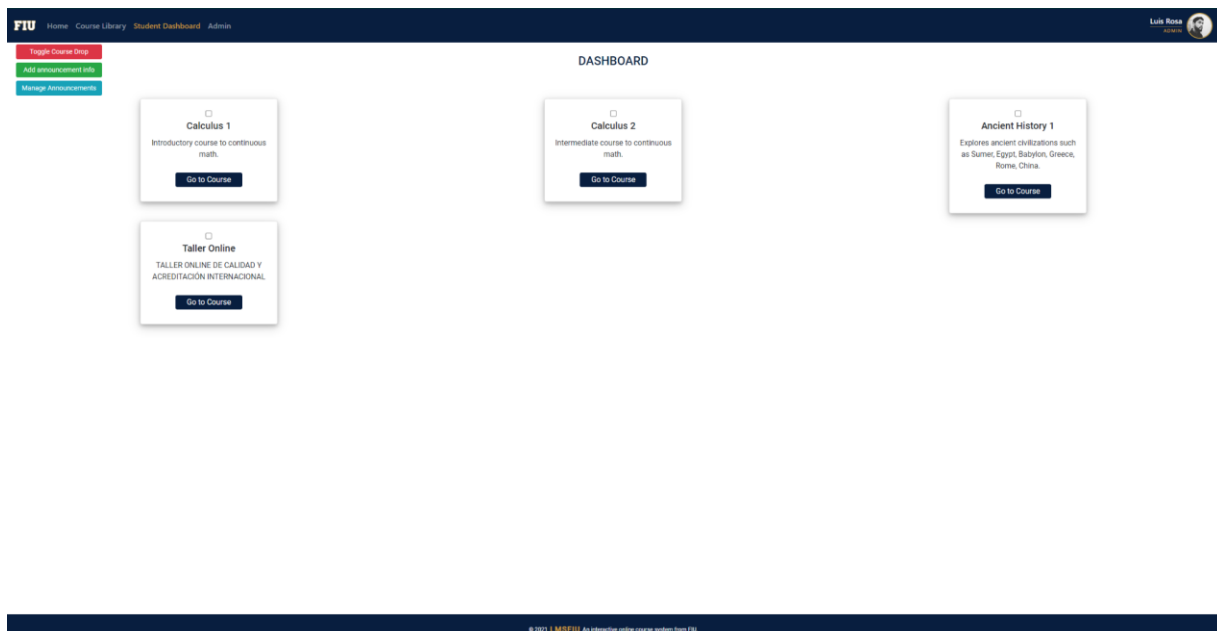
StudentPDFProgress



By Miguel Cortes
Modules Progress



Appendix B - User Interface Design



FIU

Home Course Library Student Dashboard Admin

Luis RosaADMIN

Edit

Calculus 1

Welcome to the course.

This course is math based and continues higher math education.

[Go to Modules](#)

Progress Tree

Module	Progress
Module 5	0%
Module 4	0%
Module 3	0%
Module 2	0%
Module 1	20%

© 2021 LMSFIU An interactive online course system from FIU.

FIU

Home Course Library Student Dashboard Admin

Luis RosaADMIN

STUDENTS

ALL GROUPS

Name	Group - 1
Luisania Brito	
Healthcare M Americas Flu	
Suyin Lopez	
Fran Mazzei	
Luis Rosa	
James Watson	

Name	Group - 2
Nick Arv	
Ashe Doe	
John Doe	
Lmsstudent Lms	

FIU [Home](#) [Course Library](#) [Student Dashboard](#) [Admin](#)

Luis Rosa
ADMIN

⋮

LEADERBOARD

ID	Name	Email	Points
1294	Suyin Lopez	94suyin@gmail.com	210
18	Nick Arv	narev001@fiu.edu	52
1	John Doe	mail@mail.edu	50
1304	Luis Rosa	luisrosa98@hotmail.com	50
22	James Watson	jwats057@fiu.edu	40
1272	Healthcare M Americas Fiu	crimahs@gmail.com	20
1282	Luisania Brito	princesita_luisania@hotmail.com	10
3	Ashe Doe	mail3@mail.edu	0
852	Lms Instructor	lmsfiuinstructor@gmail.com	0
1232	Lmsstudent Lms	lmsfiustudent@gmail.com	0
1324	Fran Mazzei	fmazz010@fiu.edu	0

Class average: 39

FIU [Home](#) [Course Library](#) [Student Dashboard](#) [Admin](#)

Luis Rosa
ADMIN

⋮

CLICK ON THE GAME TO PLAY!



Score:

Your High Score:1

Course's High Score:26

Leaderboard

FIU
[Home](#)
[Course Library](#)
[Student Dashboard](#)
[Admin](#)

Luis Rosa
ADMIN

COURSE MANAGER
 Create New Course

ID	NAME	SEATS	START_DATE	END_DATE	ACTIONS
22	Ancient History 1	26	2/12/2020	4/23/2020	Edit Delete Pending
1	Calculus 1	48	5/31/2020	6/30/2020	Edit Delete Pending
2	Calculus 2	41	1/4/2020	4/22/2020	Edit Delete Pending
152	Course1	60	4/8/2020	4/28/2020	Edit Delete Pending
162	Taller Online	495	4/10/2020	9/23/2020	Edit Delete Pending

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FIU
[Home](#)
[Course Library](#)
[Student Dashboard](#)
[Admin](#)

Luis Rosa
ADMIN

USER MANAGER

ID	EMAIL	NAME	ROLE	ACTIONS
1282	princesita_luisania@hotmail.com	Luisania Brito	admin	Make Student Make Instructor Make Admin Delete
1272	crimahs@gmail.com	Healthcare M Americas Flui	admin	Make Student Make Instructor Make Admin Delete
1232	lmsfiustudent@gmail.com	Lmsstudent Lms	admin	Make Student Make Instructor Make Admin Delete
18	narev001@fiu.edu	Nick Arv	admin	Make Student Make Instructor Make Admin Delete
22	jwats057@fiu.edu	James Watson	admin	Make Student Make Instructor Make Admin Delete

Previous 1 2 3 4 Next

FIU [Home](#) [Course Library](#) [Student Dashboard](#) [Admin](#)

Luis Rosa
ADMIN

COURSES

Search for course

ID	NAME	DESCRIPTION	SEATS	START_DATE	END_DATE	ENROLLMENT
22	Ancient History 1	Explores ancient civilizations such as Sumer, Egypt, Babylon, Greece, Rome, China.	26	2/12/2020	4/23/2020	Enrolled
1	Calculus 1	Introductory course to continuous math.	48	5/31/2020	6/30/2020	Enrolled
2	Calculus 2	Intermediate course to continuous math.	41	1/4/2020	4/22/2020	Enrolled
152	Course1	Des	60	4/8/2020	4/28/2020	Pending
162	Taller Online	TALLER ONLINE DE CALIDAD Y ACREDITACIÓN INTERNACIONAL	495	4/10/2020	9/23/2020	Enrolled
132	test2	test2	43	3/12/2020	4/23/2020	Pending
142	test3	test3	33	3/30/2020	4/23/2020	<button>Enroll</button>
172	test4	test4	0	4/5/2020	4/10/2020	Full

[Previous](#) [1](#) [2](#) [Next](#)

Choose number of courses per page to display

5

Submit

Appendix C - Sprint Review Reports

Sprint 1

Date: Friday, January 29, 2021

Start time: 6:15 PM

End time: 6:30 PM

Approved

- User Story 1: As a developer, I want to be able to understand the project proposal and wishlist, as well as what has already been done by past teams so that I understand the project I am working on. (6 hours)
- User Story 2: As a developer, I want access to the GitHub repositories and documentation needed to communicate with my team members so that my team and I are informed on the progress of each team member. (1 hour)
- User Story 4: As a developer, I want to begin to view/review the repository frontend/backend code on GitHub so that I may gain/regain my understanding of the project layout. (3 hours)
- User Story 6: As a developer, I want to share the previous code of the last team with our current team through either giving them access to the zip or (0.5 hours)

Rejected

- None

Sprint 2**Date: Friday, February 12, 2021****Start time: 6:15 PM****End time: 6:30 PM****Approved**

- 3 - As a developer, I want to become familiar with the project stack: Angular, NodeJS, MySQL, etc. To accomplish this, go through some tutorials online. This is so that I am able to work on this project for this semester. (15 hours)
- 5 - As a developer, I want to be able to run the project locally through reviewing the project Installation Guide so that I can test my changes to the app before posting them on GitHub. (3 hours).
- 7 - As a developer, I want to review how to properly use GitHub for managing the project repositories so that I can efficiently add new changes to my branch, effectively make pull requests and revert to a previous commit in any branch if needed. (2 hours)
- 8 - As a developer, I want to conduct research into progress tree implementations in Angular through online resources and examples so that we can have a solid foundation for our implementation in the LMS app (20 hours).

Rejected

- 9 - As a developer, I want to create an initial progress tree implementation that is able to track the progress of students individually in their modules, in groups, and the class progress as a whole. (35 hours)
- 10 - As a developer, I want modules that are empty to not show as complete or award points to the student. (5 hours)

Sprint 3**Date: Sunday, March 14th, 2021****Start time: 4:00 PM****End time: 4:15 PM****Approved**

- 9 - As a developer, I want to create an initial progress tree implementation that is able to track the progress of students individually in their modules, in groups, and the class progress as a whole. (35 hours)
- 15 - As an incoming developer, I want to familiarize myself and review the code of the project frontend and backend so that I get a better understanding of the code structure of the project. (5 hours).

Rejected

- 10 - As a developer, I want modules that are empty to not show as complete or award points to the student. (5 hours)
- 9 - As a developer, I want to create an initial progress tree implementation that is able to track the progress of students individually in their modules, in groups, and the class progress as a whole. (35 hours).
- 11 - As a developer, I want to resolve connectivity issues the frontend Heroku app is having with the database, not allowing the app to pull the course list and more from the database. (5 hours)
- 12 - As a developer, I want to continue to review/learn more about the project stack(Javascript/Typescript, MySQL,HTML/CSS) and frameworks(Angular, Node.js) (as I am working on the project so that I improve and apply it to the current project.(100 hours (20 hours this sprint).
- 13 - As a developer, I want to review and write proper documentation throughout our development of the application so that other developers can understand my work and understand the functionality of each code component of the app.(20 (5 hours this sprint))
- 14 - As a developer, I want to resolve the bug where module content does not have its latest status when it refreshes the page so that the application can work accordingly.(20 hours)

Sprint 4**Date: Sunday, March 14, 2021****Start time: 4:15 PM****End time: 4:30 PM****Approved**

- 9 - As a developer, I want to create an initial progress tree implementation that is able to track the progress of students individually in their modules, in groups, and the class progress as a whole. (35 hours)
- 15 - As an incoming developer, I want to familiarize myself and review the code of the project frontend and backend so that I get a better understanding of the code structure of the project. (5 hours).

Rejected

- 10 - As a developer, I want modules that are empty to not show as complete or award points to the student. (5 hours)
- 12 - As a developer, I want to continue to review/learn more about the project stack(JavaScript/Typescript, MySQL, HTML/CSS) and frameworks(Angular, Node.js) (as I am working on the project so that I improve and apply it to the current project.(60 hours (20 hours this sprint).
- 13 - As a developer, I want to review and write proper documentation throughout our development of the application so that other developers can understand my work and understand the functionality of each code component of the app.(20 (5 hours this sprint))
- 14 - As a developer, I want to resolve the bug where module content does not have its latest status when it refreshes the page so that the application can work accordingly.(20 hours).
- 16 - As a developer, I want to finish and finalize progress tree implementation this sprint: figure out the final design, how we implement it in the frontend, and how to connect it to the DB through the backend. (10 hours).
- 17 - As a developer, I want to explore hosting the app on AWS online so that we can migrate the application from Heroku as a stepping stone towards launching the web app fully for FIU.(15 hours).

Sprint 5**Date: Sunday, March 28, 2021****Start time: 4:15 PM****End time: 4:30 PM****Approved**

- 12 - As a developer, I want to continue to review/learn more about the project stack(Javascript/Typescript, MySQL,HTML/CSS) and frameworks(Angular, Node.js) (as I am working on the project so that I improve and apply it to the current project.(40 hours (20 hours this sprint). (cut down to 20 hours, next sprint will be last for reviewing stack)
- 13 - As a developer, I want to review and write proper documentation throughout our development of the application so that other developers can understand my work and understand the functionality of each code component of the app.(10 (5 hours this sprint))(Cut from 20 to 10 since next sprint will be last sprint with progress on project)
- 15 - As an incoming developer, I want to familiarize myself and review the code of the project frontend and backend so that I get a better understanding of the code structure of the project. (5 hours).
- 16 - As a developer, I want to finish and finalize progress tree implementation this sprint: figure out the final design, how we implement it in the frontend, and how to connect it to the DB through the backend. (10 hours).
- 17 - As a developer, I want to explore hosting the app on AWS online so that we can migrate the application from Heroku as a stepping stone towards launching the web app fully for FIU.(15 hours).
- 18 - As a developer, I want to create markers on the module progress bars, as well as implement individual module progress tracking and link it to the progress tree.(2.5 hours).

Rejected

- 10 - As a developer, I want modules that are empty to not show as complete or award points to the student. (5 hours)
- 14 - As a developer, I want to resolve the bug where module content does not have its latest status when it refreshes the page so that the application can work accordingly.(20 hours)

Sprint 6**Date: Sunday, April 11th, 2021****Start time: 4:15 PM****End time: 4:30 PM****Approved**

- 12 - As a developer, I want to finish reviewing/learning about the project stack(Javascript/Typescript, MySQL,HTML/CSS) and frameworks(Angular, Node.js).(15 hours)
- 13 - As a developer, I want to review and write proper documentation throughout our development of the application so that other developers can understand my work and understand the functionality of each code component of the app.(5 hours).
- 19 - As a developer, I want to fix a bug where groups are not being displayed or not working properly for courses. (5 hours).
- 20 - As a developer, I want to finish our AWS hosting migration for the web application so that we can eventually host the web app at FIU servers. Work together to get the EC2 instances working fully and fix the bugs regarding the project dependencies that have been hindering our progress. (4 hours).
- 22 - As a capstone 2 student, I want to get the documentation done by the end of the sprint: Individual Posters, Videos(installation/Demo), Powerpoint presentation, and final Documentation submitted to canvas/Pathable.(25 hours)
- 23 - As a capstone 1 student, I want to make my group poster as required for submission before the end of this sprint and submit to Canvas/Pathable.(15 hours)
- 11 - As a developer, I want to resolve connectivity issues the frontend Heroku app is having with the database, not allowing the app to pull the course list and more from the database. (5 hours).

Rejected

- None

**Appendix D - User Guide, Installation/Maintenance Document,
Shortcomings/Wishlist Document**



Gamification of a LMS App(v7) – User Manual

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1 Introduction

In this section, a detailed user manual is provided for different possible actors in the system. There are three main actors within the FB LMS, admin, instructor, and student. This document will go over a full guide about using the application for all human roles (users) of the app.



Figure 1. FIU LMS V5 Home Page

2 Usage for Role: Admin

Administrative accounts are mainly used to create courses, add instructors, manage all course announcements, and approve student enrollment requests. Keep in mind that an admin may also manage the course content as well if allowed to by instructor or if it is needed.

COURSES
Search for course

search course here....

ID	NAME	DESCRIPTION	SEATS	START_DATE	END_DATE	ENROLLMENT
22	Ancient History 1	Explores ancient civilizations such as Sumner, Egypt, Babylon, Greece, Rome, China.	26	2/12/2020	4/23/2020	Enroll
1	Calculus 1	Introductory course to continuous math.	49	5/31/2020	6/30/2020	Pending
2	Calculus 2	Intermediate course to continuous math.	41	1/4/2020	4/22/2020	Enroll
152	Course1	Des	60	4/8/2020	4/28/2020	Enroll
162	Taller Online	TALLER ONLINE DE CALIDAD Y ACREDITACIÓN INTERNACIONAL	495	4/10/2020	9/23/2020	Enroll
132	test2	test2	43	3/12/2020	4/23/2020	Enroll
142	test3	test3	33	3/30/2020	4/23/2020	Enroll
172	test4	test4	0	4/5/2020	4/10/2020	Full

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Choose number of courses per page to display

5

Figure 2. Student Dashboard, but from Admin's point of view. As it's shown they have the option to create / manage courses

2.1 Managing Courses



COURSE MANAGER					
Create New Course					
ID	NAME	SEATS	START_DATE	END_DATE	ACTIONS
22	Ancient History 1	26	2/12/2020	4/23/2020	Edit Delete Pending
1	Calculus 1	49	5/31/2020	6/30/2020	Edit Delete Pending
2	Calculus 2	41	1/4/2020	4/22/2020	Edit Delete Pending
152	Course1	60	4/8/2020	4/28/2020	Edit Delete Pending
162	Taller Online	495	4/10/2020	9/23/2020	Edit Delete Pending

Previous 1 2 Next

Figure 3. Course Manager View for Admins shown, where they can accept enrollment for any student signing up for enrollment, edit the course, or create a new course

2.2 Managing Users on Application

USER MANAGER				
ID	EMAIL	NAME	ROLE	ACTIONS
1282	princesita_luisania@hotmail.com	Luisania Brito	admin	Make Student Make Instructor Make Admin Delete
1272	crimahs@gmail.com	Healthcare M Americas Fiu	admin	Make Student Make Instructor Make Admin Delete
1232	lmsfiustudent@gmail.com	Lmsstudent Lms	admin	Make Student Make Instructor Make Admin Delete
18	narev001@fiu.edu	Nick Arv	admin	Make Student Make Instructor Make Admin Delete

Figure 4. User Manager View for Admins shown, in where they could change all of the application users' roles or remove their accounts.

2.3 Add/Edit Courses

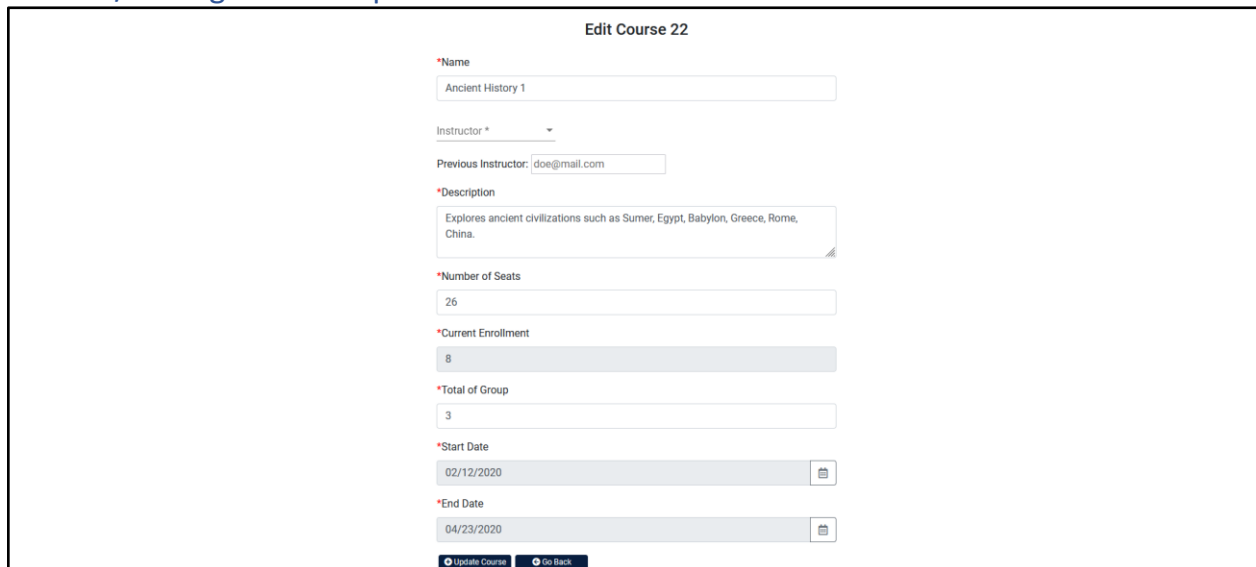
The screenshot shows the 'Create New Course' form in the LMS app. The form is titled 'Create New Course' and is located in the center of the page. It contains several input fields and buttons. The fields are: 'Name' (with the value 'Introduction to AI'), 'Instructor *' (with the value 'mail2@mail.edu'), 'Description' (with the value 'Introductory course to Artificial Intelligence: Going from Search algorithms to Neural Networks.'), 'Number of Seats' (with the value '50'), 'Total of Group' (with the value '0'), 'Start Date' (with the value '04/27/2021'), and 'End Date' (with the value '07/27/2021'). There are two buttons at the bottom: 'Create Course' and 'Go Back'.

Figure 5. Create New Course form displayed. All Fields are mandatory :
Name, Instructor, Description, Number of Seats, Number of Groups, Start and End Date

The screenshot shows the 'Edit Course 22' form in the LMS app. The form is titled 'Edit Course 22' and is located in the center of the page. It contains several input fields and buttons. The fields are: 'Name' (with the value 'Ancient History 1'), 'Instructor *' (with a dropdown arrow), 'Previous Instructor:' (with the value 'doe@mail.com'), 'Description' (with the value 'Explores ancient civilizations such as Sumer, Egypt, Babylon, Greece, Rome, China.'), 'Number of Seats' (with the value '26'), 'Current Enrollment' (with the value '8'), 'Total of Group' (with the value '3'), 'Start Date' (with the value '02/12/2020'), and 'End Date' (with the value '04/23/2020'). There are two buttons at the bottom: 'Update Course' and 'Go Back'.

Figure 6. Edit Course form, enables the admins to edit the course details, start & end dates, changing the instructor, changing the number of groups, etc.

2.4 Add/Manage Course Specific Announcements

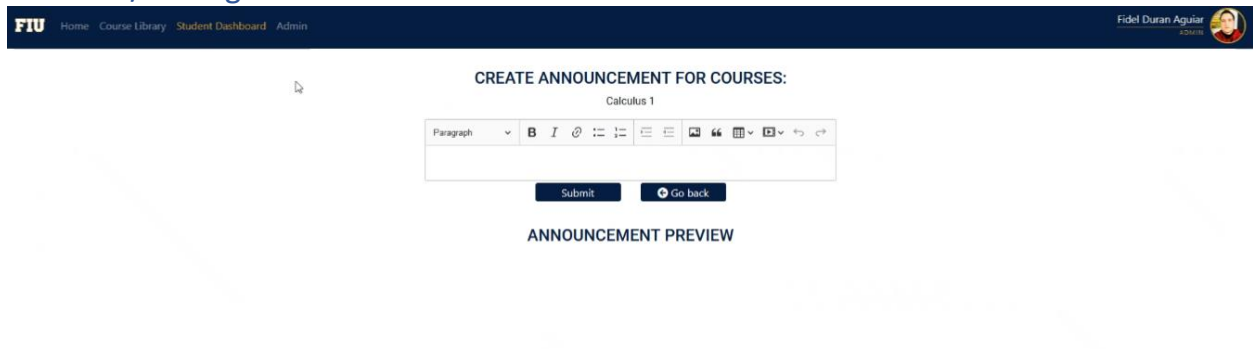


The screenshot shows the 'Edit Course 22' form. It includes the following fields and controls:

- *Name:** A text input field containing 'Ancient History 1'.
- Instructor *:** A dropdown menu.
- Previous Instructor:** A text input field containing 'doe@mail.com'.
- *Description:** A text area containing 'Explores ancient civilizations such as Sumer, Egypt, Babylon, Greece, Rome, China.'
- *Number of Seats:** A text input field containing '26'.
- *Current Enrollment:** A text input field containing '8'.
- *Total of Group:** A text input field containing '3'.
- *Start Date:** A date picker showing '02/12/2020'.
- *End Date:** A date picker showing '04/23/2020'.
- Buttons:** At the bottom, there are two buttons: 'Update Course' and 'Go Back'.

Figure 7. Student Dashboard, but from Admin's point of view. As shown, only they have the option to create / manage course specific announcements.

2.5 Add/Manage Global Announcements



The screenshot shows the 'CREATE ANNOUNCEMENT FOR COURSES' form. It includes the following elements:

- Header:** A dark blue header bar with the FIU logo and navigation links: Home, Course Library, Student Dashboard, Admin. On the right, it says 'Fidel Duran Aguilar' with a profile picture.
- Title:** 'CREATE ANNOUNCEMENT FOR COURSES:'
- Course:** 'Calculus 1'.
- Form:** A rich text editor with a toolbar containing icons for Paragraph, Bold, Italic, Underline, Link, Unlink, Bulleted List, Numbered List, Indent, Outdent, Image, Video, and others. Below the editor is a 'Submit' button and a 'Go back' button.
- Section:** 'ANNOUNCEMENT PREVIEW'.

Figure 8. Home Page from admin's point of view, showing create announcement, as well as edit, delete for current global announcements, only visible to admins.

3 Usage for Role: Instructor

Furthermore, the instructor's role is mainly interacting with the system by managing course's contents, as well as defining completion points for each module within the course, sending and receiving messages to/from students & other instructors (if any) in the course.

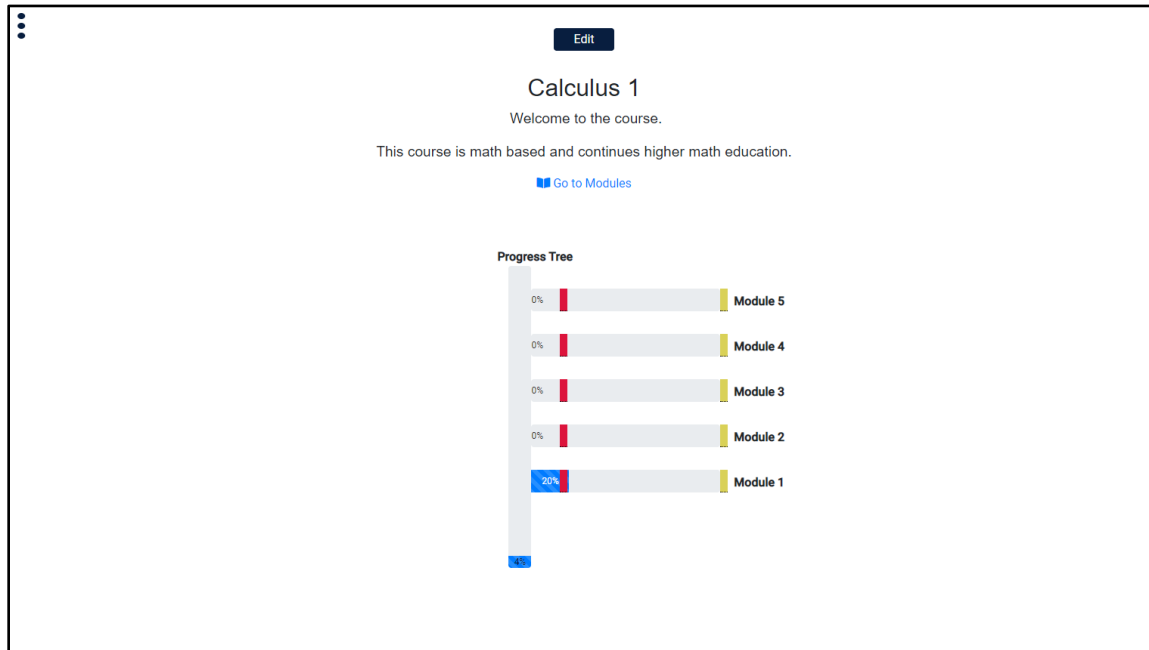


Figure 9. Course homepage from an instructor's point of view.(difference is the edit button)

3.1 Add/Manage Course Modules & Their Content

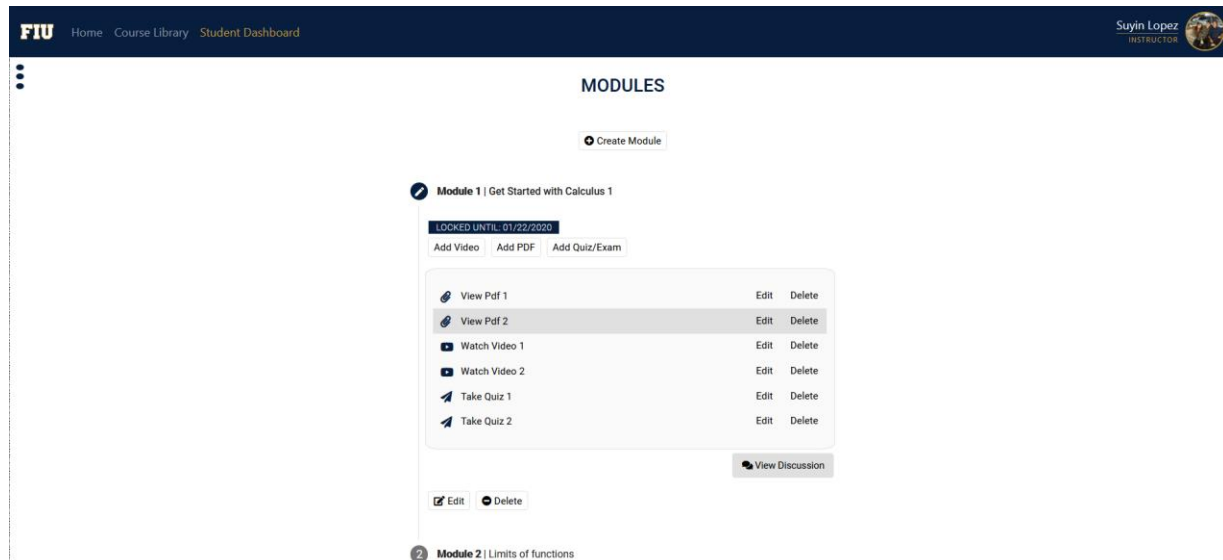


Figure 10. Course modules page from instructors' point of view. As shown instructors would be able to create, edit, or delete modules as well as the content inside each.(also they can't make progress in module)

3.2 View groups

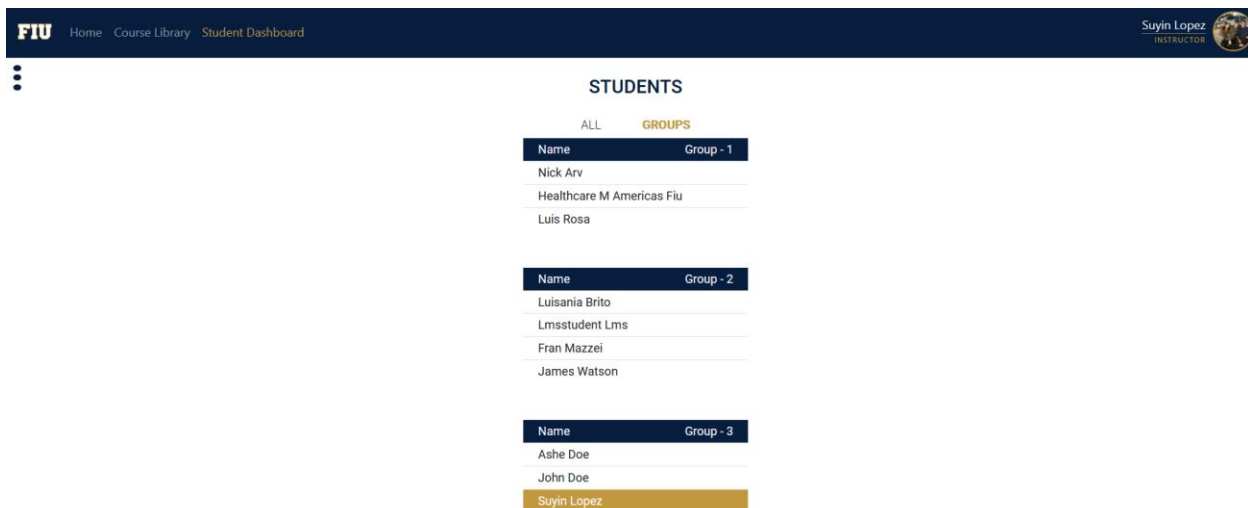


Figure 11. View the groups students are in.

3.3 Leaderboard

FIU Home Course Library Student Dashboard				Suyin Lopez INSTRUCTOR
LEADERBOARD				
ID	Name	Email	Points	
1294	Suyin Lopez	94suyin@gmail.com	210	
18	Nick Arv	narev001@fiu.edu	52	
1	John Doe	mail@mail.edu	50	
1304	Luis Rosa	luisrosa98@hotmail.com	50	
22	James Watson	jwats057@fiu.edu	40	
1272	Healthcare M Americas Fiu	crimahs@gmail.com	20	
1282	Luisania Brito	princesita_luisania@hotmail.com	10	
3	Ashe Doe	mail3@mail.edu	0	
2	Jane Doe	mail2@mail.edu	0	
1232	Lmsstudent Lms	lmsfiustudent@gmail.com	0	
1324	Fran Mazzei	fmazz010@fiu.edu	0	
Class average: 39				

Figure 12. View the Leaderboard for all students and their info

3.4 Send Message to Students & Other Instructors

FIU

HomeCourse LibraryStudent Dashboard

Suyin Lopez
INSTRUCTOR

ANNOUNCEMENTS

Create

John Doe

Wednesday, Apr 01, 2020 - 7:40 AM

Welcome to the LMS-FIU Website

Login into your Facebook account and take courses

...

Nick Arv

Tuesday, Mar 31, 2020 - 5:21 PM

Welcome to calculus!

John Doe

Friday, Mar 27, 2020 - 2:16 PM

Welcome to the calculus course series!!

John Doe

Wednesday, Mar 25, 2020 - 6:39 PM

Enjoy learning the higher math course!

Figure 13. Announcements view from instructors' point of view. It contains their message/chat history with other students/instructors within the course, as well as course specific announcements sent by admins

3.5 Create App Compatible Qualtrics Surveys (Quiz)*

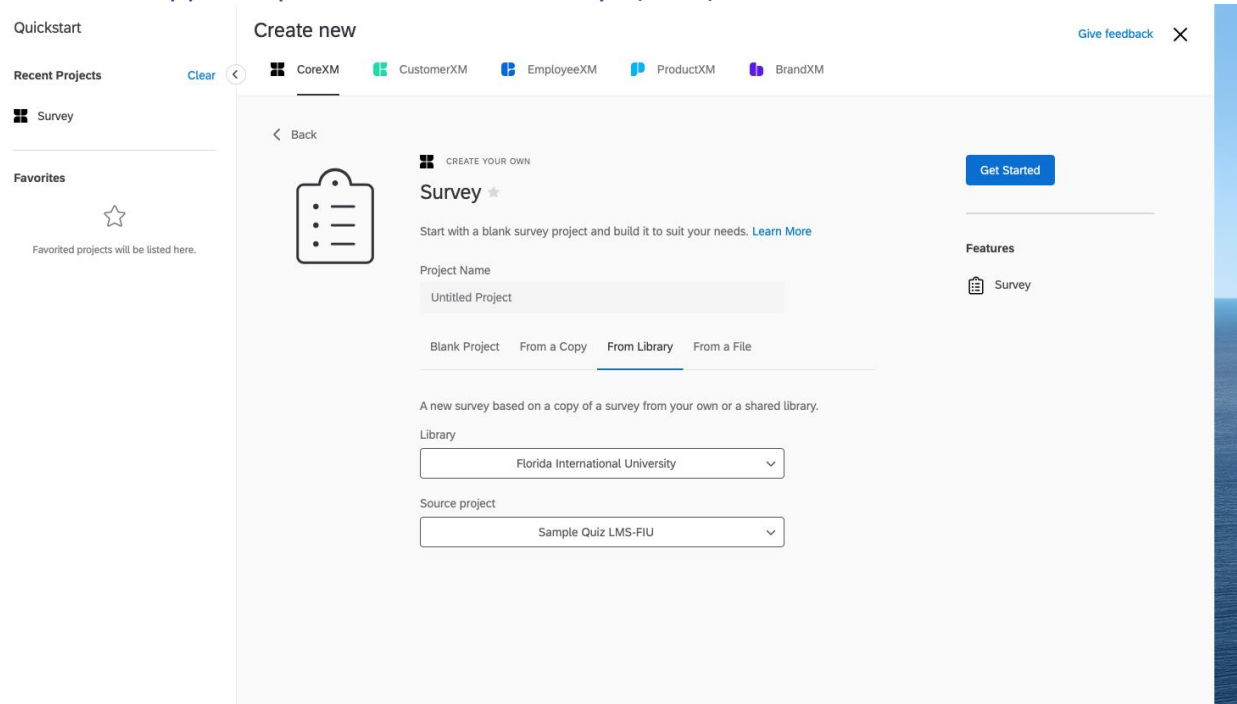


Figure 14. Qualtrics used as a 3rd party service, in order to create surveys/quizzes compatible with the application. Please note that the survey structure must be able to receive & send data back to the application. For ease of use by instructors, make sure to create surveys on fiu.qualtrics.com. Then when creating a quiz choose 'From Library' option instead of a blank project and after choosing Florida International University's library, select 'Sample Quiz LMS-FIU' from 'LMS-FIU (*)' Category.

4 Usage for Role: Student

Finally, students do not have managing power within the system, their role within the system is to browse and study the course content, send & receive messages to/from their instructor, as well as other students in the same course.

4.1 Enroll in a Course

FIU Home Course Library Student Dashboard Suyin Lopez STUDENT

COURSES
Search for course

search course here...

ID	NAME	DESCRIPTION	SEATS	START_DATE	END_DATE	ENROLLMENT
22	Ancient History 1	Explores ancient civilizations such as Sumer, Egypt, Babylon, Greece, Rome, China.	26	2/12/2020	4/23/2020	Enroll
1	Calculus 1	Introductory course to continuous math.	48	5/30/2020	6/29/2020	Enrolled
2	Calculus 2	Intermediate course to continuous math.	41	1/4/2020	4/22/2020	Enrolled
152	Course1	Des	59	4/8/2020	4/28/2020	Enrolled
162	Taller Online	TALLER ONLINE DE CALIDAD Y ACREDITACIÓN INTERNACIONAL	494	4/10/2020	9/23/2020	Enrolled
132	test2	test2	43	3/12/2020	4/23/2020	Enroll

Previous 1 2 Next

Choose number of courses per page to display

6

Figure 15. Course Library page shown from student's perspective, where they can enroll, and see all their course enrollments status. Note that after they request to enroll an admin must approve their request in order for them to be fully enrolled in that specific course.

4.2 Send Message to Students & Instructor(s)

FIU Home Course Library Student Dashboard Admin Fidel Duran Aguilar ADMIN

CREATE MESSAGE

From: Fidel Duran Aguilar

To:

Type message...

Figure 16. Send message page from student's point of view, where they can send and receive messages from and to other students as well as instructors in the course.

4.3 Game

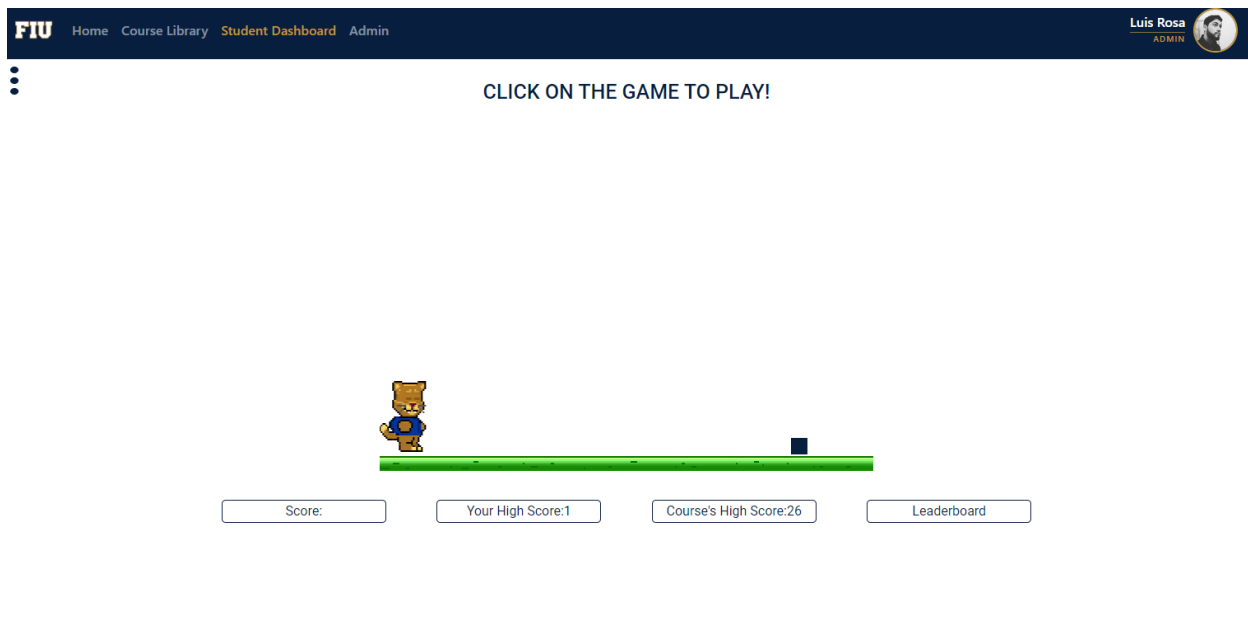


Figure 17. Panther game

Installation Guide

Installation/Maintenance guide:

1. Development Environment

- Windows 10 (Licenses can be obtained from Azure Student with FIU account), or macOS 10.10+.
- Visual Studio Code (<https://code.visualstudio.com/>).
- For Windows: PuTTY for accessing Linux Virtual Machines for AWS EC2 instances (<https://www.putty.org/>)
- GitHub Account: (<https://github.com/>)
- Git/ Git Bash: To push local changes onto GitHub Repositories (<https://git-scm.com/downloads>)

- MySQL Workbench (Version 6.3.10 preferred for use to support the older queries) (<https://downloads.mysql.com/archives/workbench/>)
 - Node.js LTS (<https://nodejs.org/en/>)
 - npm (should come with Node.js LTS)
 - Angular CLI (Global requirement) (\$ npm install -g @angular/cli)
 - Heroku Account to use Heroku web services:<https://www.heroku.com/>
 - Generate SSL key and certificate for Heroku and replace the current ones in your local version of the project. (ssl folder in both repos.This is for generating the self-signed certificate necessary for Heroku to produce their certified ssl certificate) (<https://devcenter.heroku.com/articles/ssl-certificate-self>).
 - Create new AWS account to set up AWS web hosting(Migrate from Heroku to AWS to launch app using FIU linux servers): (<https://aws.amazon.com/>)
2. Access to Project Source Code
 - A zip file containing the source code will be provided
 - Extract the Project folder into the development environment
 3. Get Project Dependencies
 - In both, the back-end and front-end root folders, run '*npm install*'
 4. Git Hub Repositories:
 - Create three GitHub repositories for the project:
 - One for the Database Folder(The SQL queries to create and load the initial DB tables).
 - One for the Backend Folder(Backend API app with NodeJS/Express)
 - One for the Frontend Folder(Running Website with Angular Framework)
 5. Heroku App Access
 - Create two new apps with Heroku with your heroku account, and tie them to your backend/frontend repositories, respectively (<https://www.heroku.com/>)
 - In the backend app, install the “ClearDB MySQL” add-on
 - In both apps, create a “web” dyno with command “*npm start*”
 - In the source code file '*environment.prod.ts*', update the frontend / API URLs with your frontend and backend Heroku app urls, respectively.
 - In both your frontend and backend, run this command as follows:
 - In Backend:heroku git:remote -a <Heroku_backend_AppName>
 - In Frontend; heroku git:remote -a <Heroku_frontend_AppName>
 6. Heroku Database Setup and Access

- Install MySQL Workbench (Version 6.3.10)
(<https://www.mysql.com/products/workbench/>)
- Connect to your ClearDB database: (<https://devcenter.heroku.com/articles/cleardb>)
 - Navigate to your backend in git bash and run this command:
heroku config | grep CLEARDB_DATABASE_URL. It should print a link to your database in this format:
mysql://username:password@hostname/database_name?reconnect=true
 - Copy the MySQL link and paste it into a file in your backend in VS Code called Database.txt. If it doesn't exist, create it and paste the link into it.
 - In MySQL workbench, add a new connection to your DB by pressing the plus icon in the home page next to MySQL Connections.
 - Name your DB in the connection name at the top, then in the tabs go to Connection -> Parameters, then fill out the information using your mysql link you generated.
mysql://username:password@hostname/database_name?reconnect=true
 - Once everything is filled, press test connection. If successful, you should see an icon page below MySQL connections.
- Import the *Dump.sql* file and other sql files from the DB repo. Run all of its queries starting with the Dump, then Views and Procedures.
- Update your backend code as following:
 - Navigate to the backend in VS Code and go to app -> config -> db.config.js
 - Using your MySQL link, update the values HOST, USER(username), PASSWORD, and DB(database name) with that in your own MySQL link:
mysql://username:password@hostname/database_name?reconnect=true

7. AWS Setup

- EC2 tutorial
 - Using your created AWS account, go to EC2 under their services, then go to launch an instance for frontend and backend(Use Ubuntu AMI): Use this to help set up instances: [How to Deploy a Node.js Application On AWS EC2 Server](#)(make sure to create a unique key pair for each instance and that you save it on your computer).

- Next, set up your PuTTY(if using windows) and use key pair to ssh into each of your VM EC2 instances setup: [Connect to your Linux instance from Windows using PuTTY - Amazon Elastic Compute Cloud](#)
 - Now connect to your machines using your key pairs and clone git repo on front end and backend separately, then install all dependencies via terminal using `sudo npm install`.
 - Install node into Backend/Frontend command: `curl -fsSL https://deb.nodesource.com/setup_15.x | sudo -E bash - sudo apt-get install -y nodejs`
 - Install Angular on Frontend instance globally: `sudo npm install -g @angular/cli` if you get an error saying that CLI is higher than 9.0.7 then you can uninstall it without the -g and install again without the -g since it would only do to for the local directory.
 - Now, install Production Manager 2 globally on backend instance using `sudo npm install pm2 -g`, then run backend using `sudo pm2 start server.js`. This will keep backend running in background when leaving VM. Use `sudo pm2 startup` to have server automatically run when VM server reboots.
 - Now try to run frontend instance using ng serve: `sudo ng serve --host 0.0.0.0`
 - if ng serve does not automatically start to run and instead shows an editor then we need to do the following: `sudo apt purge ng-common ng-latin` , `sudo npm install -g @angular/cli`
 - now try ng serve again: if you get: **FATAL ERROR: MarkCompactCollector**, then run this: `export NODE_OPTIONS=--max-old-space-size=1024`
 - If that does not work and it says that it ran out of memory, You must use a higher tier VM instance with at least 2 GB of memory. Set up frontend repo with that instance, then should run `sudo ng serve --host 0.0.0.0` and test app using public ip4 address and append:8080 to URL link.
- AWS RDS for MySQL tutorial:
 - on AWS go to services -> RDS (relational database) -> create database -> MySQL 5.7.33 select free tier
 - once database finishes setup make sure to modify the database so it is publicly accessible

- add database to security group in backend EC2 instance:
<https://stackoverflow.com/questions/16488135/unable-to-connect-mysql-workbench-to-rds-instance>
- Use this to connect to workbench:
<https://aws.amazon.com/premiumsupport/knowledge-center/connect-rds-mysql-workbench/>
 1. In MySQL workbench, add a new connection to your DB by pressing the plus icon in the home page next to MySQL Connections.
 2. Name your DB in the connection name at the top, then in the tabs go to Connection -> Parameters, then fill out the information using your mysql link you generated. The host name is the string within the sql link going from the @ to a /, the username is the first string after the mysql://, and the password is the second string after the username after the colon (:).
`mysql://username:password@hostname/database_name?reconnect=true`
 3. Once everything is filled, press test connection. If successful, you should see an icon page below MySQL connections.
- Run the queries on AWS database to load the initial tables for use in the Inno DB section.
- Update your backend code as following:
 1. Navigate to the backend in VS Code and go to app -> config -> db.config.js
 2. Using your MySQL link, update the values HOST, USER(username), PASSWORD, and DB(database name) with that in your own MySQL link:
`mysql://username:password@hostname/database_name?reconnect=true`
- Links for finishing AWS Migration for next iteration:
 - Link to create SSL certificate for AWS:
https://aws.amazon.com/elasticloadbalancing/?did=ft_card&trk=ft_card&elb-whats-new.sort-by=item.additionalFields.postDateTime&elb-whats-new.sort-order=desc&whats-new-cards-elb.sort-by=item.additionalFields.postDateTime&whats-new-cards-elb.sort-order=desc

- Link for Docker with AWS:
<https://docs.aws.amazon.com/AmazonECS/latest/developerguide/docker-basics.html>

8. Facebook App Access

- Set up a Facebook app at (<https://developers.facebook.com>)
- In settings > basic, your App Domains should include:
- Heroku:
 - (yourHerokuFrontendAppName).herokuapp.com
 - (yourHerokuBackendAppName).herokuapp.com

AWS:

- IP4 address for AWS backend EC2 instance
- IP4 address for AWS frontend EC2 instance

For both:

- localhost (for local development environment)
- At the bottom of settings, click “add platform” > “Page Tab” > enter (yourHerokuFrontendURL) in “Secure Page Tab URL”
- Note: Your Facebook does not need to add the “Facebook Login” product. Login functionality is done through npm packages on the client-side app.
- Copy the ‘APP ID’ and replace the old one in *app.component.ts* (frontend repo)

9. Run Project

- Frontend: Before running either for development or production, the http listener must be configured correctly. See the comments at the bottom of the server.js file and just comment out the listener you are not using.

Development: ng serve

Production: Runs on Heroku/AWS

- Backend:

Development: npm run dev
Production: Runs on Heroku/AWS

10. Resources:

- LinkedIn Learning Web development:
<https://www.linkedin.com/learning/paths/become-a-full-stack-web-developer?u=42567804>
- Other Links:
 - <https://blog.thoughttram.io/angular/2017/02/21/using-zones-in-angular-for-better-performance.html>
 - <https://basarat.gitbook.io/typescript/future-javascript/promise>
 - <https://ultimatecourses.com/blog/angular-ngif-async-pipe>
 - <https://www.tutorialrepublic.com/twitter-bootstrap-tutorial/bootstrap-progress-bars.php>
 - <https://ng-bootstrap.GitHub.io/#/components/progressbar/examples#height>
 - <https://ng-bootstrap.GitHub.io/#/components/tooltip/api>
 - <https://itnext.io/the-magic-of-rxjs-sharing-operators-and-their-differences-3a03d699d255>

Wishlist for LMS App on Facebook Version 8.0

Priority Features:

1. Finish implementation of Module Progress in DB and Backend to hook up into Module progress bars in Progress Tree. Essentially, Have a Module Progress table that includes the module id, student id, completion status, and Number of Points earned. Also add a procedure in DB to calculate the maximum score that can be earned in the module.
2. Finish Migration from Heroku to AWS: Have the code running properly and working with the current setup(May need higher tier VM with at least 2 GB of memory to run), then find a way to create new certified SSL certificate to make website secure, and add Web Domain, use Docker for the AWS instances, etc.
3. Fix module content system so that it actually updates the points of a student (in module and course) when they complete an item.
4. Implement an achievement system throughout the site where students can competitively earn points as they progress through the course.
5. Notification system for new announcements/messages.
6. Add extra abilities for instructors on website:
 - Create announcements

- Edit the Course Content(Home page details and Module content)
 - Delete the Course when Students complete the course(When Course ends)
 - Delete module from course, which wipes out the content and the progress of all students who worked on that module.
7. Improve the existing game featured on Website(Dinosaur game but with Roary Sprite):
- Randomize obstacles appearance
 - Improve Physics and Playability with improved sprites/stylings.
8. The leaderboard table for the game has to be organized by rank (in other words, points or it would be based on the implementation of the achievement system)

Secondary Features (implement if time permitting):

1. Update/Upgrade the dependencies of the Project for Angular Frontend App to avoid the website having deprecated features. This will require re-doing a bunch of the code in the Frontend to deal with new dependencies or try to use other libraries. Only do this and prioritize this for the web app can't run on Heroku/AWS due to deprecated dependencies that no longer exist or work.
2. Improve the overall score system for modules and its contents.
3. Ability to save new lines in messages sent. This would allow messages to have some formatting.
4. Add pages for announcements/messages after a certain amount or ask to load messages after a certain amount.
5. Improve discussions page for modules. This includes improving the UI and allowing for formatted content and images.
6. Dynamic color for progress bars on quizzes to change their styling relative to the values they are displaying.
7. Explore if the Facebook Messenger component could be a better option to use when it comes to announcements and messaging.
8. Qualtrics Account, make it easier to pull information on grading the quizzes, or Use Qualtrics API to create Quizzes for the Website instead of creating Qualtrics Link to a created survey on a FIU.
9. Implement a cookie consent for the application in the Facebook for Developers page(Currently using fake generated links to run Live on Web app).
10. Implement a link that lets users delete their data for the Facebook Authentication system

REFERENCES

- [1] <https://www.jinfony.com/resources/bi-defined/3-tier-architecture-complete-overview/>
- [2] https://en.wikipedia.org/wiki/Observer_pattern
- [3] https://en.wikipedia.org/wiki/Dependency_injection