SOFE 3700U: Data Management Systems

Final Report

Supervised By: Dr. Khalid A. Hafeez

Project Title: University DBMS

GitHub Link: https://github.com/abdulbhutta/SOFE3700U-Final-Project.git

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Introduction

For this project we created a university database, for the purposes of anyone within the system to be able to access and view the information specific to their individual roles. This includes both the students and members of staff such as professors. Ever since the emergence of the covid 19 pandemic which caused a stop to all in person activities, new educational software that can maintain University and course specific information for both students and instructors to view, was suddenly a necessity. We used the current educational software for our University (Canvas) as inspiration for this database.

The database in the perspective of the professors helps them with a few things. They can view their own profile, the classes they are teaching, and classes they have taught in previous semesters/years. In terms of student information, they can edit and view overall student grades, as well as access other student information such as their IDs, their grades for each assignment, their submissions, and their records.

From the students' perspective, they can view their student ID, the courses they are enrolled in and the grades they currently have in each course (based on how many assignments the professors and TAs have marked). With the courses they are enrolled in, they can view the course name, their individual grade as well as the class average, for the current semester. Additionally, they are also able to set notifications on or off and can add or drop classes for their current semester.

The reason why having a university database is so important is for ease of access and organization for both students and professors, especially amidst the covid era. This university database system allows everyone involved to be able to access their information in a streamlined and orderly fashion, removing stress and complications from the process, so professors can fully focus on teaching and students can experience a rich learning environment with no distractions.

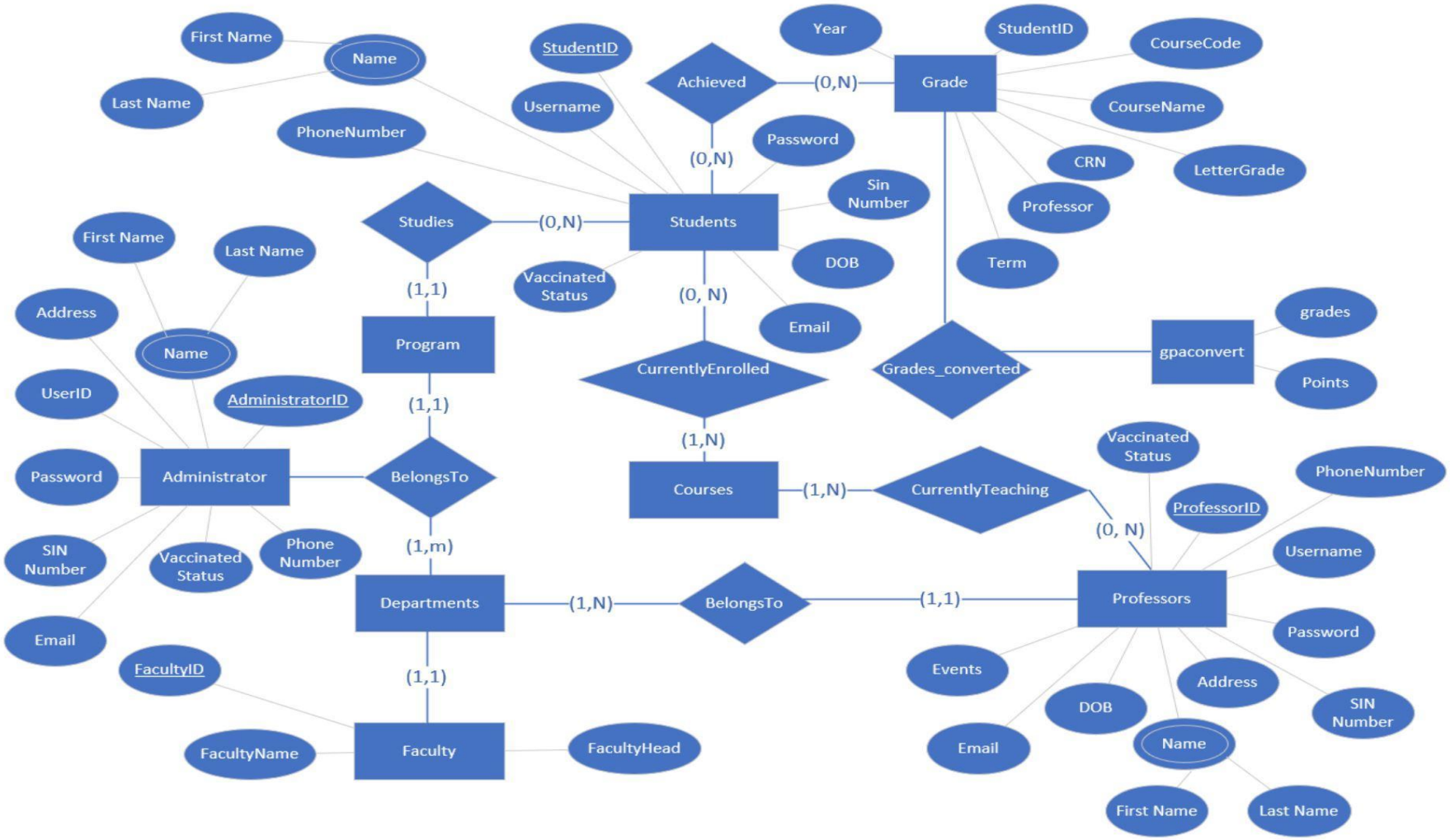
Background and Motivation

As a student at Ontario Tech University, we use the student portal every day to access our classes. One of the biggest issues our group faced was the user interface and how it was not easily accessible. There were many different links you had to visit to access what was needed. We wanted to create an application that was different from all the other university DBMS's but wanted to make it user friendly and easily accessible with one or two clicks to access what was needed. If you wish to access your portal, then all the information you need will be in that portal and do not need to leave to access other features. During our research, we used Ontario Tech University's MyCampus and Carleton University's Carleton 360 to get an idea of where to start. These references can be found below in the reference section.

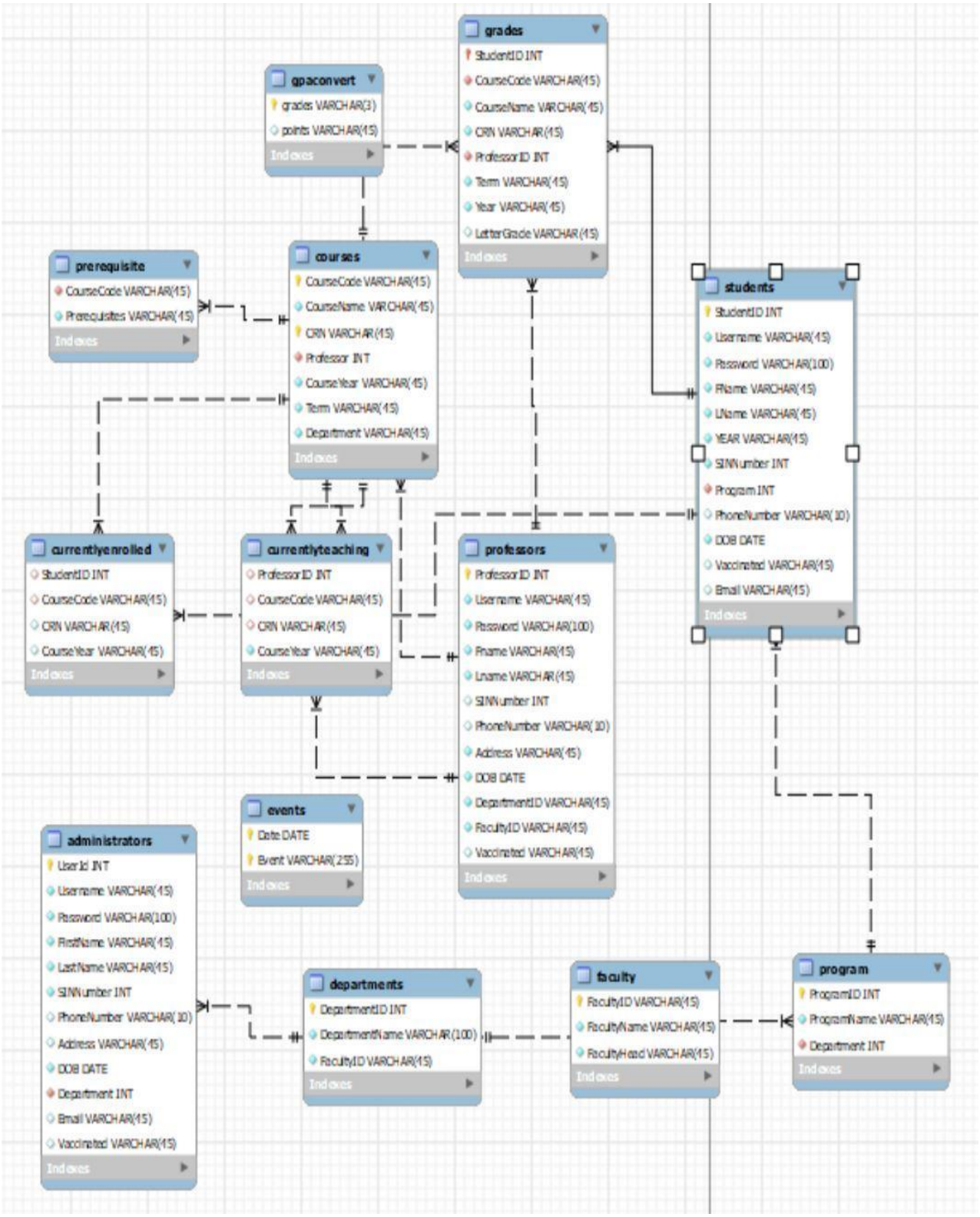
In our application it is assumed the user that will be using our application is already registered in the database, and only then they will be able to access the portals. There are three users that can access this application which are professors, students, and administrators. In our project the administrators are the users in the registrar office as they will be able to add/remove students/courses/professors from the database. In the system's home page (Appendix B), the user will choose the best portal that fits them. The user will be prompted to login and if they enter the correct information, they will be taken to the homepage of their portal. From this portal, the users will be able to access all the information they would need.

System Design

ER Diagram



Database Schema



Observations and Analysis

In this project we had difficulty approaching phase 2 as we did not have much experience with databases or web programming. Our team initially had trouble applying complex queries with different techniques. As we started implementing our applications and getting hands-on experience with PHP/Databases, we had to rework a few of the views we initially created for phase 2. As we were progressing in our project, we realized we never added anything related to one of the biggest impacts in the world, the covid 19 pandemic and the vaccination situation. Due to this fact, we designed and implemented new views that were useful in our application and the users that were using the DBMS. The views you will find in our application are listed below:

1. Vaccination Status
2. Unvaccinated Status
3. View Profile (Professor/Registrar)
4. View classes being taught by professor
5. Professor to contact any other professor that is in the same faculty
6. Professor grades given to students in a certain course
7. Search any users in the database (students, administrators, and professors)
8. View all student records based on year
9. View all courses registered at the university by year/term
10. Total Students at the University

These views have potential business use cases in our application. The reason we chose these views are because they are helpful in everyday use in a university environment depending on which user you are. The mandatory views, 1-5, are explained below along with the queries executed in our application. All of the views that are implemented and executed in our application can be seen in Appendix A (views).

View 1: To obtain information about students that are enrolled in a specific professor's class
The use case for this query is to help professors find all the students that are currently enrolled in the course. This helps the professor access a user-friendly list with all the student's information and can reach out to them if need be.

-> *Computes a join of at least three tables*

```
SELECT students.StudentID, students.FName, students.LName, currentlyenrolled.CRN
FROM currentlyenrolled
        INNER JOIN students ON students.StudentID=currentlyenrolled.StudentID
        INNER JOIN courses ON currentlyenrolled.CourseCode=courses.CourseCode
        WHERE currentlyenrolled.CourseCode = '".$course."' AND currentlyenrolled.CourseYear =
'".$year."' AND
        courses.Professor = '".$profID."' AND courses.Term =  '".$semester."';
```

View 2: Obtain the department name for the professor
This view will allow the user to view the professor's department name rather than the department ID. In the table for the professor, it stores the department ID and not the name. As the user would prefer to view the name and not the department ID where then they would have to go see which department they belonged to.
-> Uses nested queries with the ANY or ALL operator and uses a GROUP BY clause

```
SELECT DepartmentName
FROM departments
WHERE DepartmentID IN (
        SELECT DepartmentID
        FROM professors
        WHERE Department LIKE ");
GROUP BY DepartmentName
```

View 3: Average GPA of a course in that "year" and "term"
This helps the professor view the course average and how the students are doing. From this they may perform a bell curve if needed for the semester or view the past grades to compare the grades to the current term and perform any necessary tasks based of the GPA.

-> A correlated nested query

```
SELECT *
FROM gpa As A
WHERE GPA > (
    SELECT avg(GPA)
    FROM gpa
    WHERE A.CourseCode = CourseCode AND A.Year = Year AND A.Term = Term)
```

View 4: View information about student and what program they are enrolled in

This lets the university/registrar office view information about the student as well as what program they are enrolled in. It combines the student and the program information table.

-> Uses a FULL JOIN
- NOTE* MYSQL does not implement FULL JOIN and the work around for a full join was to create a union for left and right join.

```
SELECT StudentID, FName, LName, Year, program.ProgramName
FROM students
LEFT JOIN program ON students.Program = program.ProgramID
UNION
SELECT StudentID, FName, LName, Year, program.ProgramName
FROM students
RIGHT JOIN program ON students.Program = program.ProgramID
```

View 5: View all Professors that are in Department of Electrical, Computer, and Software Engineering

This view helps the professors reach out to any other professors that work in the same department. It will let them see the professors name and phone number so they are able to reach out for any concerns/reasons they may have.

-> Uses nested queries with any of the set operations UNION, EXCEPT, or INTERSECT

```
SELECT Fname,Lname,PhoneNumber
FROM professors
WHERE DepartmentID = (SELECT DepartmentID FROM departments
        WHERE DepartmentName = 'Department of Electrical, Computer, and Software Engineering')
UNION
  SELECT Fname,Lname,PhoneNumber
  FROM administrator
  WHERE Department= (SELECT DepartmentID FROM departments
  WHERE DepartmentName = 'Department of Electrical, Computer, and Software Engineering')
```

Potential Views and Future Implementation

There are many views that we have been working on which have not been implemented. Due to time constraints and the scope of this course, we were not able to add these views and some features that we have been working on. These include removing a student from the university, the student portal and adding/removing professors/courses. One of our regrets was not being able to finish and implement all the functionality of the student portal. We started construction and designing the functionality of the portal which can be seen in Appendix C. Our group met the requirements for our project and were satisfied with the result, but we think we will be working on this after submitting it to gain valuable experience which can be used for future endeavors.

Challenges

There were a few challenges we faced during this project. One of the challenges our team faced was during the design/implementation phase. Since we had to work around several different schedules, it was hard to communicate and set meetings which led us to approach this problem in a divide and conquer strategy. We divided the project into small problems and assigned them based on the strengths of everyone in the team. The main issue occurred when we tried to implement all problems together into one application, which led to extensive debugging and tracing of code. This will be one of the major lessons we will consider with future projects.

One of the key challenges that we had faced as a group was figuring out how complex the database should be. When we were in our initial phase of designing the database, we investigated real world educational database systems such as MyCampus or Canvas. We noticed that they were highly complex, holding a lot of information and were capable of doing a lot of tasks that facilitate managing the university. When designing our database, we needed to not only think about what were the relevant or core aspects that are required for a functional university database but also think about what is possible within our given timeframe and resource constraint. This included figuring out what information, tables, and views were relevant and essential for a university database system. When creating the database architecture, we needed to figure out what information was necessary to have, as well as what information

can be obtained or derived from another table or view. Even now, while we're entering the final phase of this project, when we created the web pages for this database, there were a couple of tables and columns that went unused as they were unnecessary. Finally, the biggest key challenge of them all was relearning the technologies and tools that we used to design the web pages. All of us in our group have not done web design in quite a while so a good portion of our time was spent relearning the tools that we have used.

Web Service implementation

One of the requirements for our database was implementing a web service. To achieve this, we utilized the Google Calendar API to update and create an academic schedule for members of the University to have access to. However, due to time constraints, we were only able to implement the academic schedule for professors to view. We achieved this by creating a request for all the dates and event titles, from a Google Calendar that holds key dates for the University (e.g., Last day to submit an online application for graduation). The information pulled from the Google Calendar is then converted into a JSON file and then stored into the database. When the "view academic schedule" is opened, it will read the events table from the database and output the information to the user. Events in the calendar are shown in Appendix F.

Conclusion

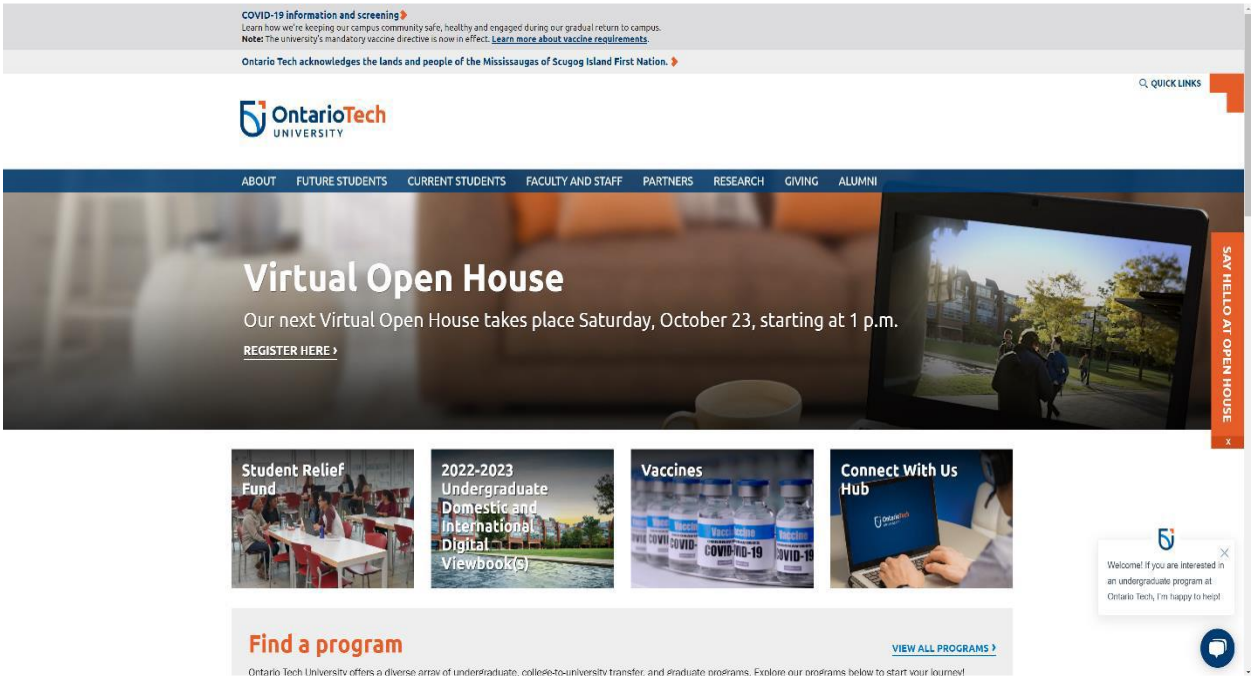
In conclusion, our group chose to develop a university database management system, for professors and students looking for a highly functional, and user-friendly experience. We were inspired by many of the software we Ontario Tech students use day-to-day, such as Canvas and myCampus. And since the onset of the COVID-19 crisis, almost all universities were forced to augment these online systems further to better cater to students and staff. But instead of being reliant on multiple different systems, we wanted a way to combine the functionalities of everything into one easy-to-use system. This is what drove our development process.

During phase 2 of our project, we constructed physical models to overview our system design before getting into the programming aspect. We drafted relational schemas and ER diagrams, as well as sampled data and views using MySQL Workbench. This is where we practiced what we learnt from the SOFE3700U course, before translating it over to our project.

To sum up our code, we implemented our system using several different web programming languages such as HTML, CSS, JavaScript and PHP, and constructed our relational database using MySQL. We also used external APIs such as the Google Calendar API to add key dates and deadline features to our system.

Furthermore, we chose to build this system to account for 3 different kinds of users: students, professors, and administrative/service staff. Each of these 3 different perspectives of our system would require different login-pages, homepages, permissions, and functionality according to the needs for each role. But due to time constraints and limited resources and experience, we couldn't delve too deep into later development phases or deploy our system.

References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Learn how we're keeping our campus community safe, healthy and engaged during our gradual return to campus.
Note: The university's mandatory vaccine directive is now in effect. Learn more about vaccine requirements.
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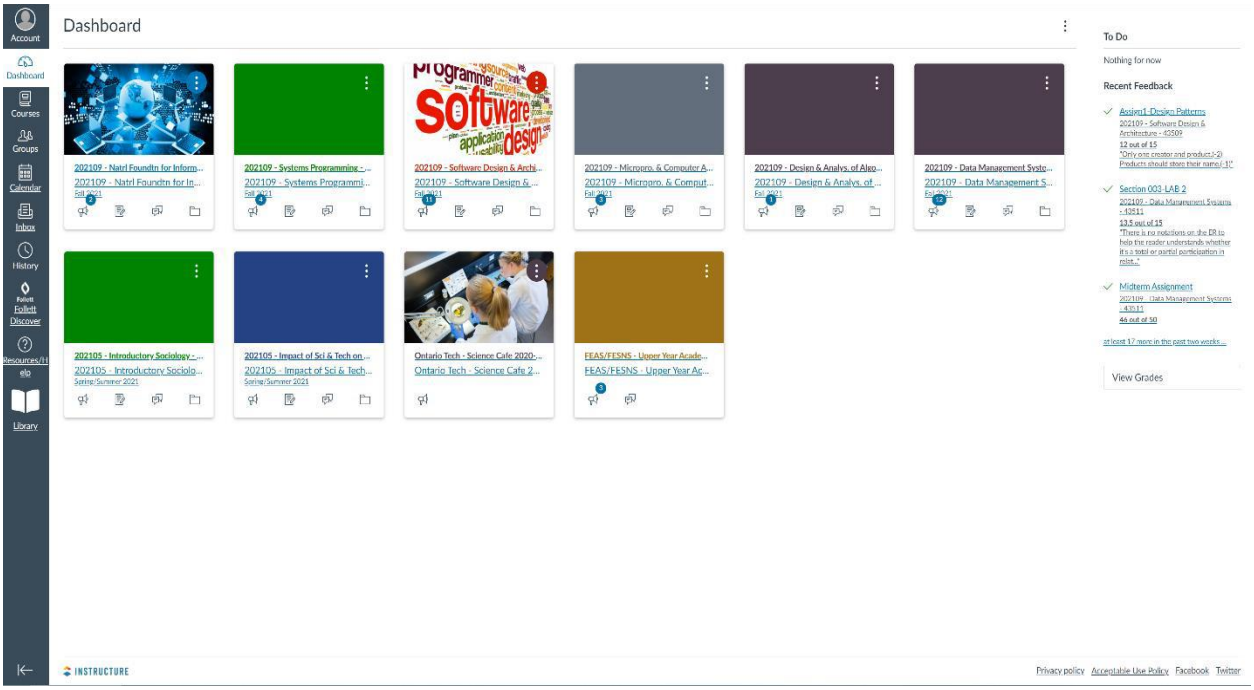
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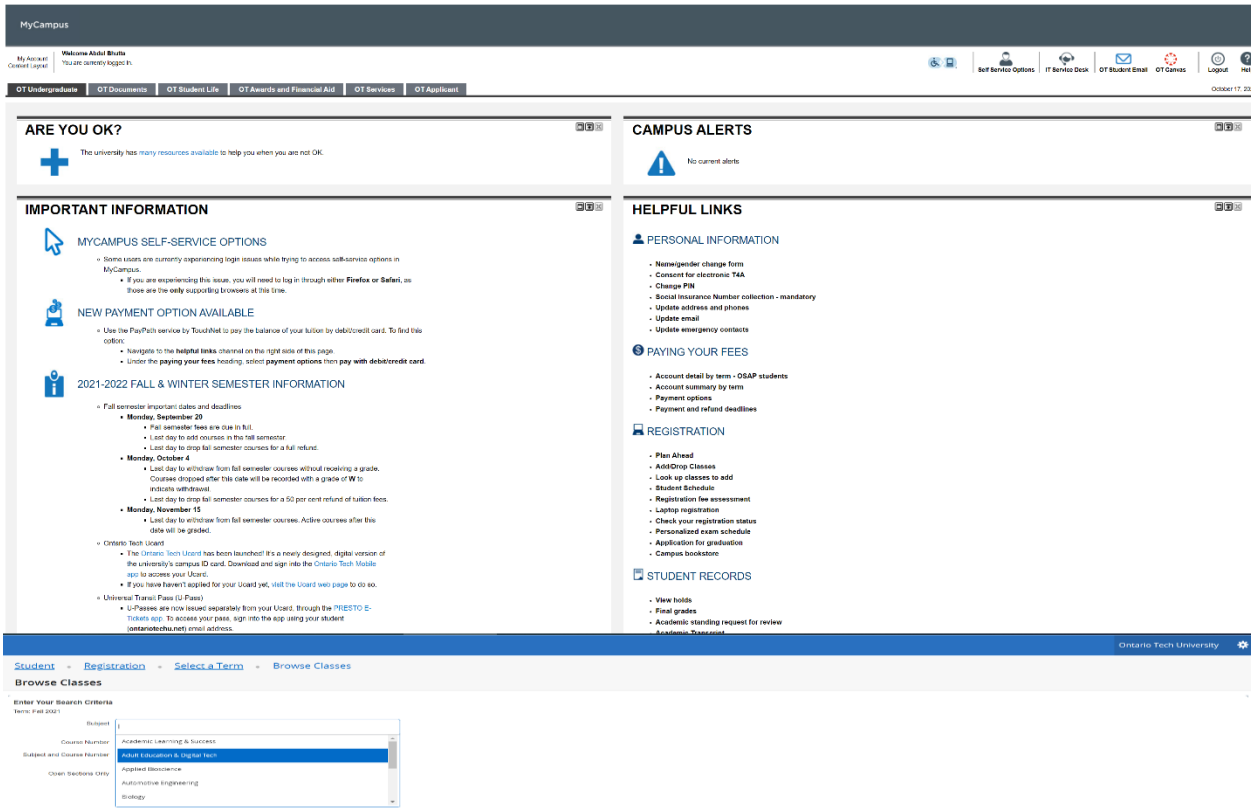
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REGISTRATION
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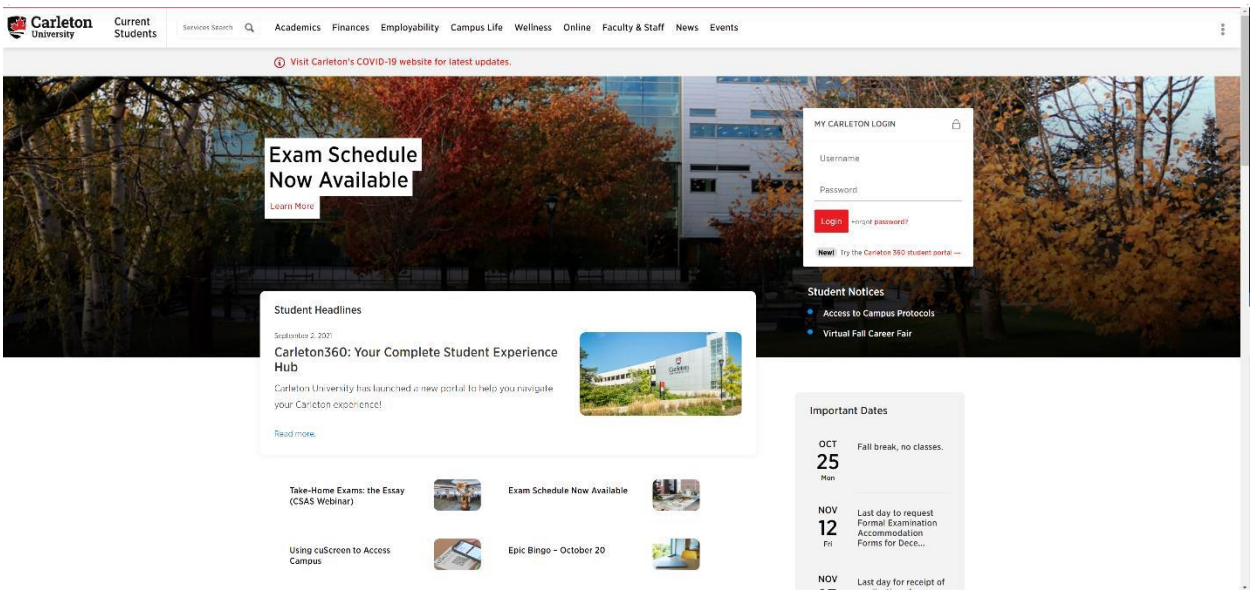
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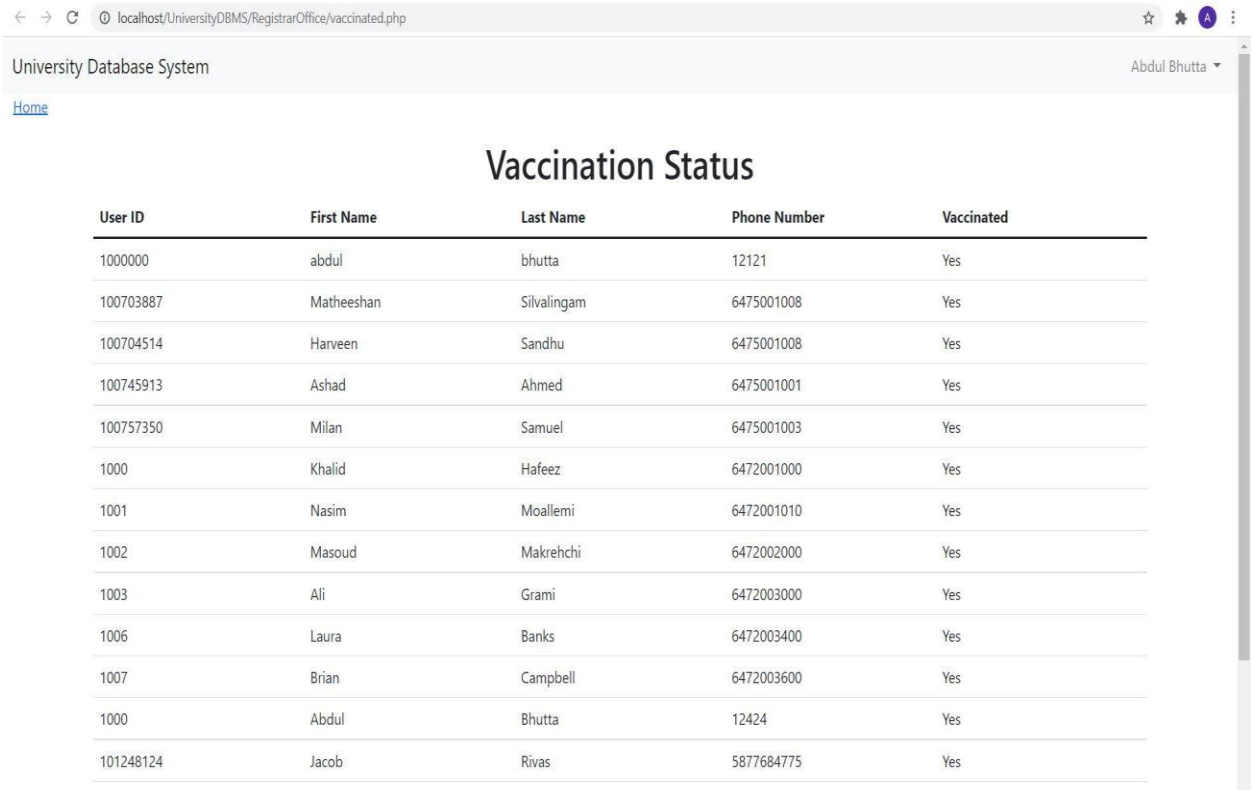
Student Headlines
Carleton360: Your Complete Student Experience Hub
Important Dates
Fall break, no classes.

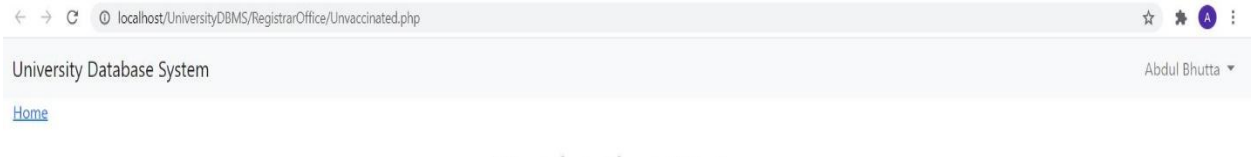
Appendix A. Views

A1. Vaccination Status



Vaccination Status

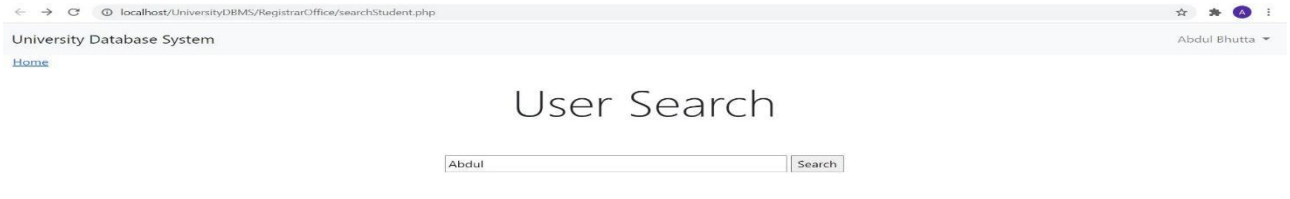
User ID	First Name	Last Name	Phone Number	Vaccinated
1000000	abdul	bhutta	12121	Yes
100703887	Matheeshan	Silvalingam	6475001008	Yes
100704514	Harveen	Sandhu	6475001008	Yes
100745913	Ashad	Ahmed	6475001001	Yes
100757350	Milan	Samuel	6475001003	Yes
1000	Khalid	Hafeez	6472001000	Yes
1001	Nasim	Moallemi	6472001010	Yes
1002	Masoud	Makrehchi	6472002000	Yes
1003	Ali	Grami	6472003000	Yes
1006	Laura	Banks	6472003400	Yes
1007	Brian	Campbell	6472003600	Yes
1000	Abdul	Bhutta	12424	Yes
101248124	Jacob	Rivas	5877684775	Yes

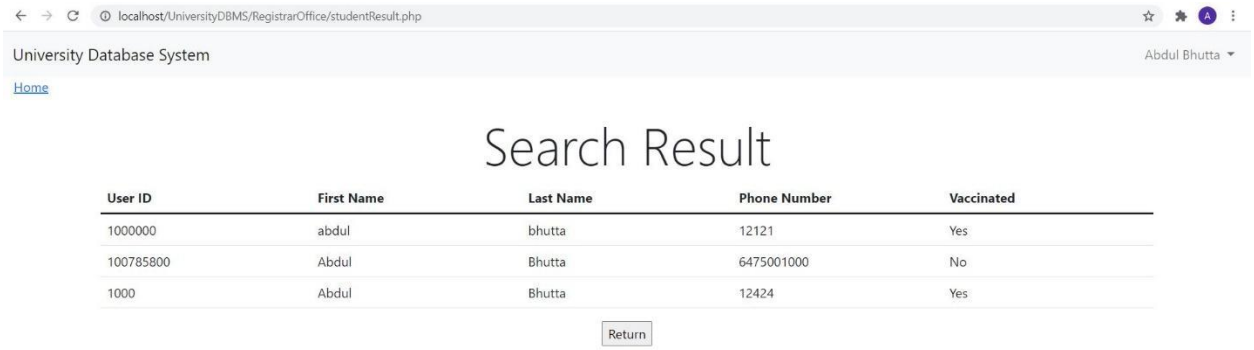


Vaccination Status

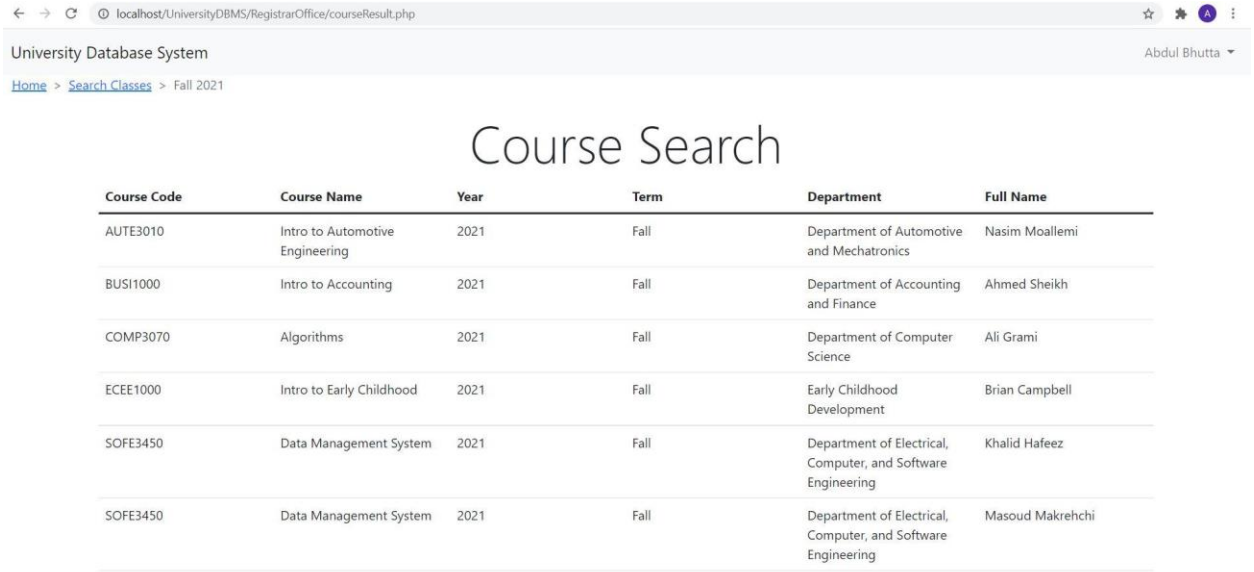
User ID	First Name	Last Name	Phone Number	Vaccinated
100785800	Abdul	Bhutta	6475001000	No
100785802	Usman	Bhutta	6475001000	No
1004	Ahmed	Sheikh	6472003100	No
1005	Ahmed	Sheikh	6472003200	No
107426958	Claudia	Keenan	2893001534	No

A2. User Search

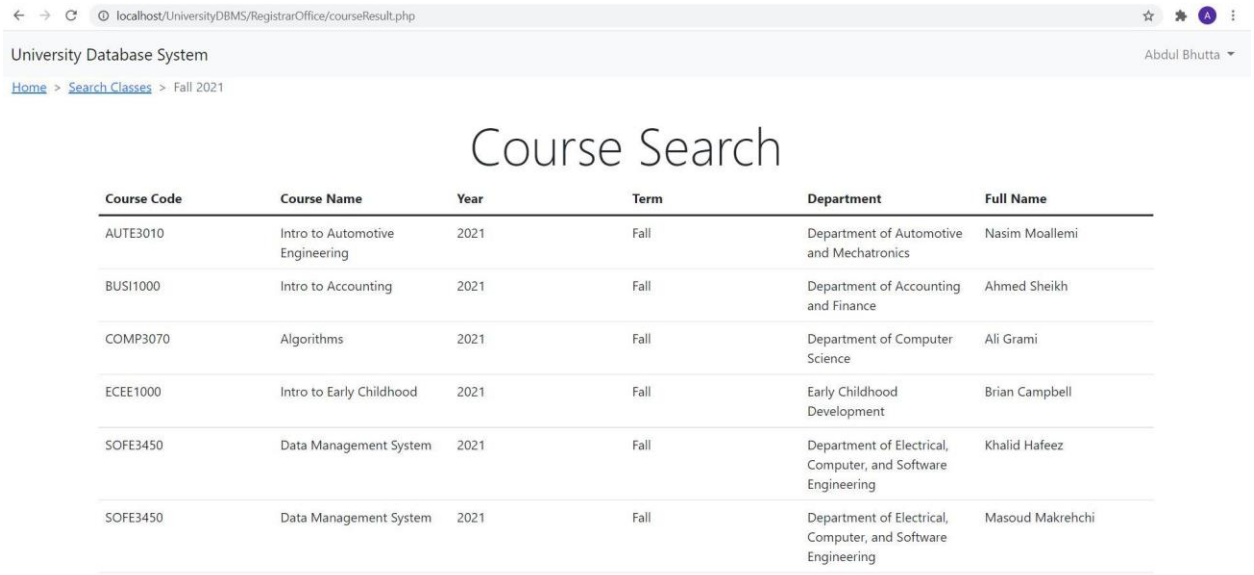




A3. Course Search by Year/Term

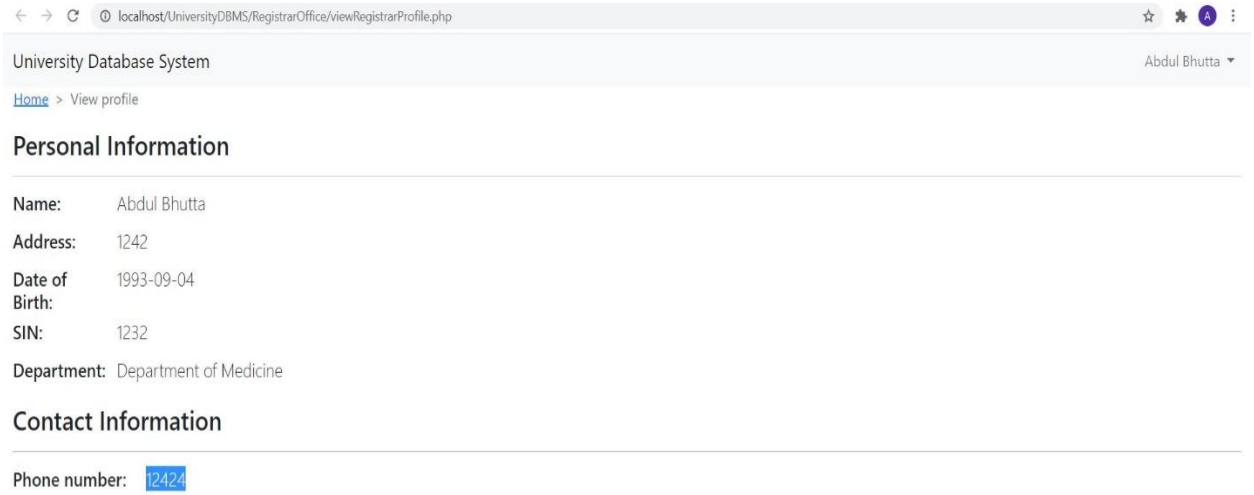


Course Code	Course Name	Year	Term	Department	Full Name
AUTE3010	Intro to Automotive Engineering	2021	Fall	Department of Automotive and Mechatronics	Nasim Moallemi
BUSI1000	Intro to Accounting	2021	Fall	Department of Accounting and Finance	Ahmed Sheikh
COMP3070	Algorithms	2021	Fall	Department of Computer Science	Ali Grami
ECEE1000	Intro to Early Childhood	2021	Fall	Early Childhood Development	Brian Campbell
SOFE3450	Data Management System	2021	Fall	Department of Electrical, Computer, and Software Engineering	Khalid Hafeez
SOFE3450	Data Management System	2021	Fall	Department of Electrical, Computer, and Software Engineering	Masoud Makrehchi

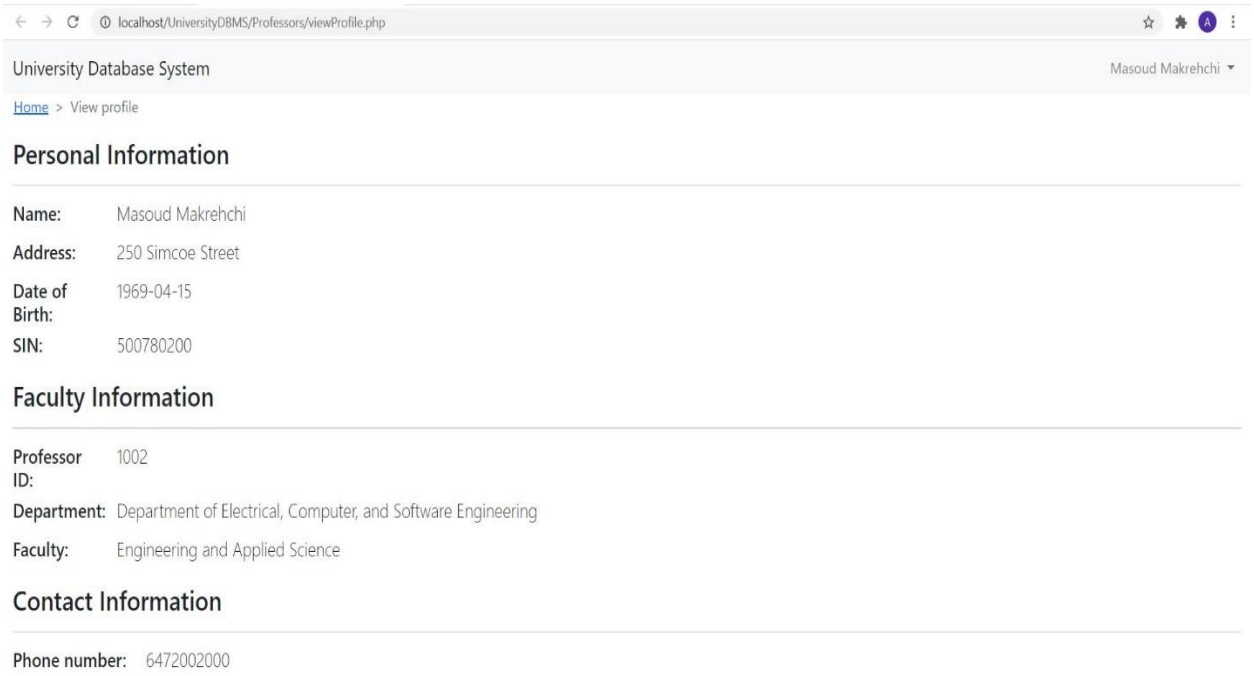


Course Code	Course Name	Year	Term	Department	Full Name
AUTE3010	Intro to Automotive Engineering	2021	Fall	Department of Automotive and Mechatronics	Nasim Moallemi
BUSI1000	Intro to Accounting	2021	Fall	Department of Accounting and Finance	Ahmed Sheikh
COMP3070	Algorithms	2021	Fall	Department of Computer Science	Ali Grami
ECEE1000	Intro to Early Childhood	2021	Fall	Early Childhood Development	Brian Campbell
SOFE3450	Data Management System	2021	Fall	Department of Electrical, Computer, and Software Engineering	Khalid Hafeez
SOFE3450	Data Management System	2021	Fall	Department of Electrical, Computer, and Software Engineering	Masoud Makrehchi

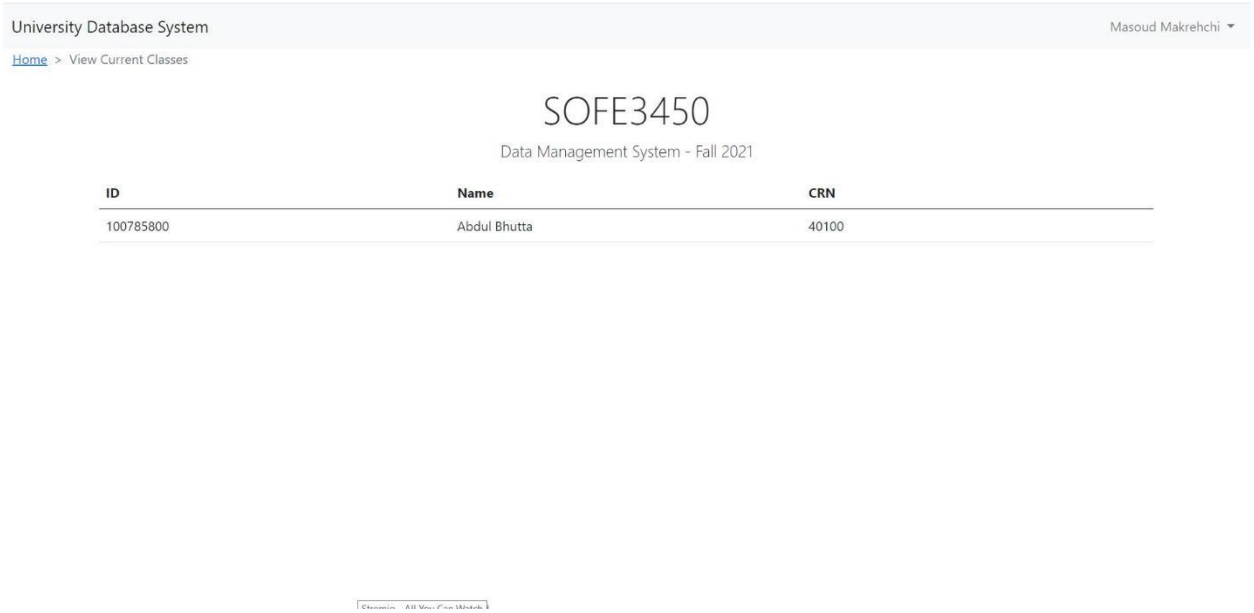
A4. Personal Pages (Administrator/Registrar)



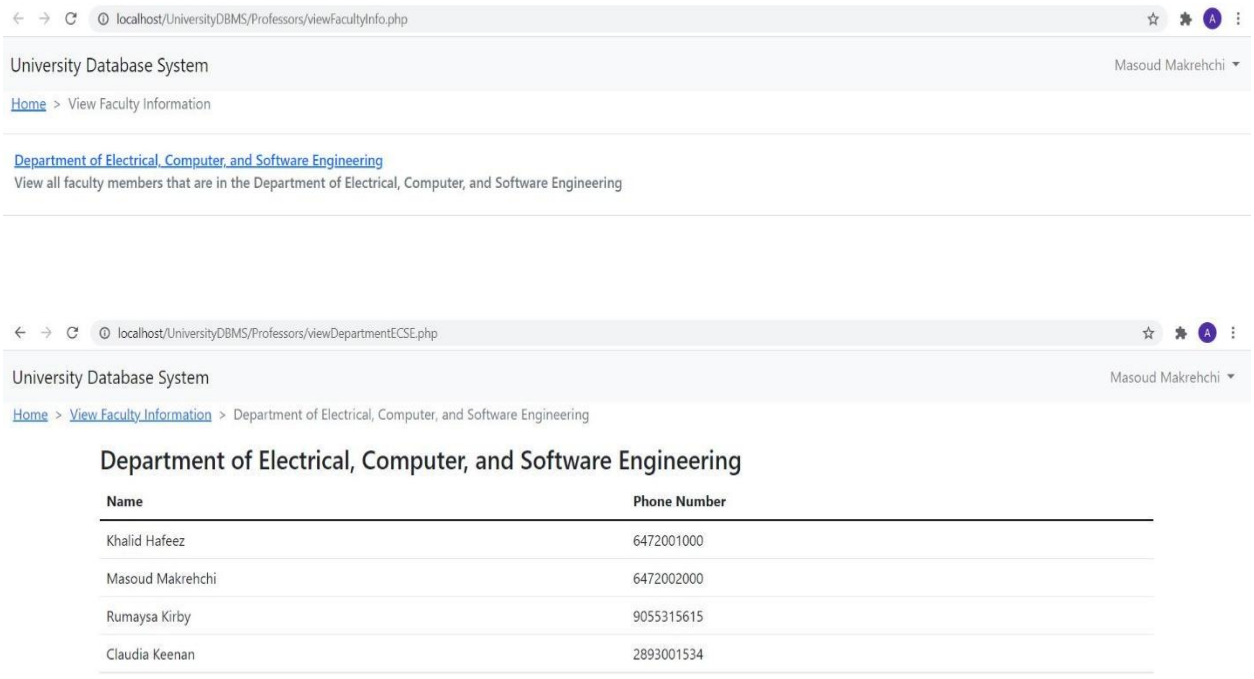
A5. Personal Pages (Professor)



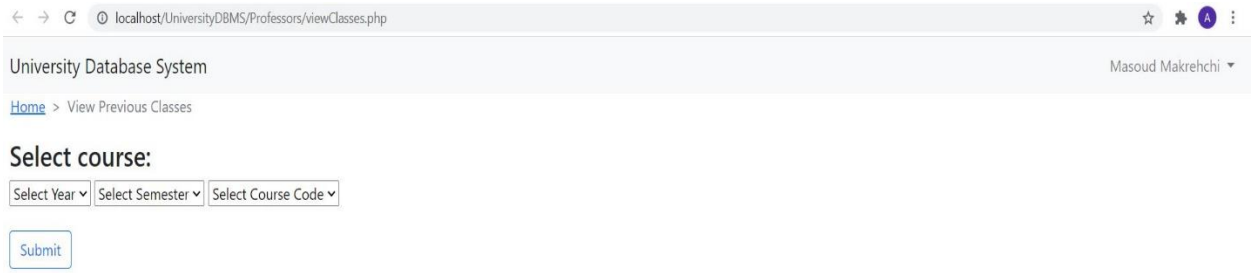
A5. Current classes taught by professor

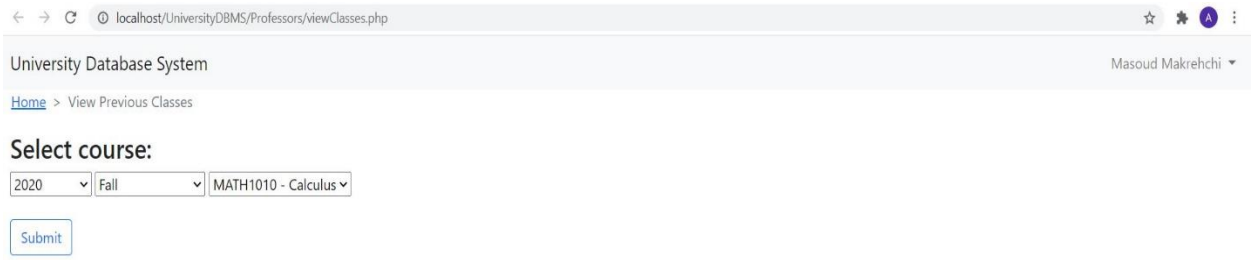


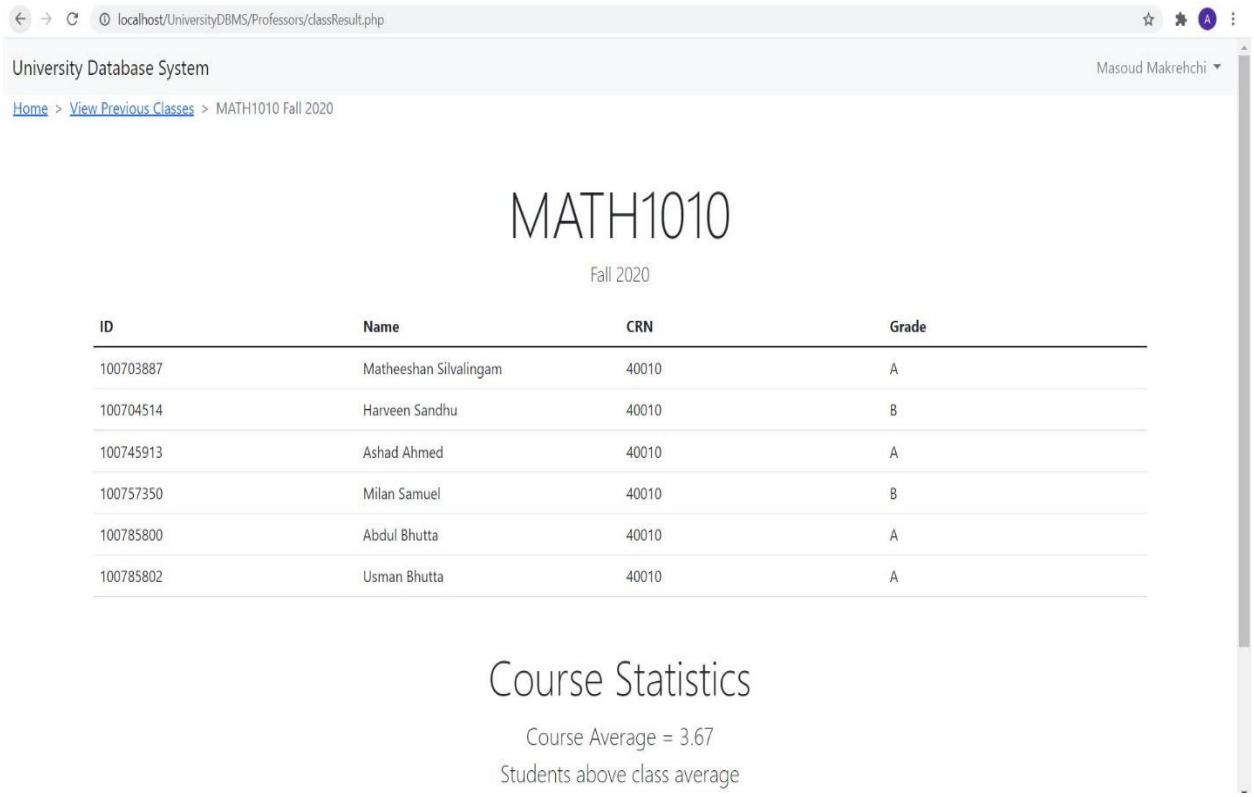
A6. View Professor Faculty Information



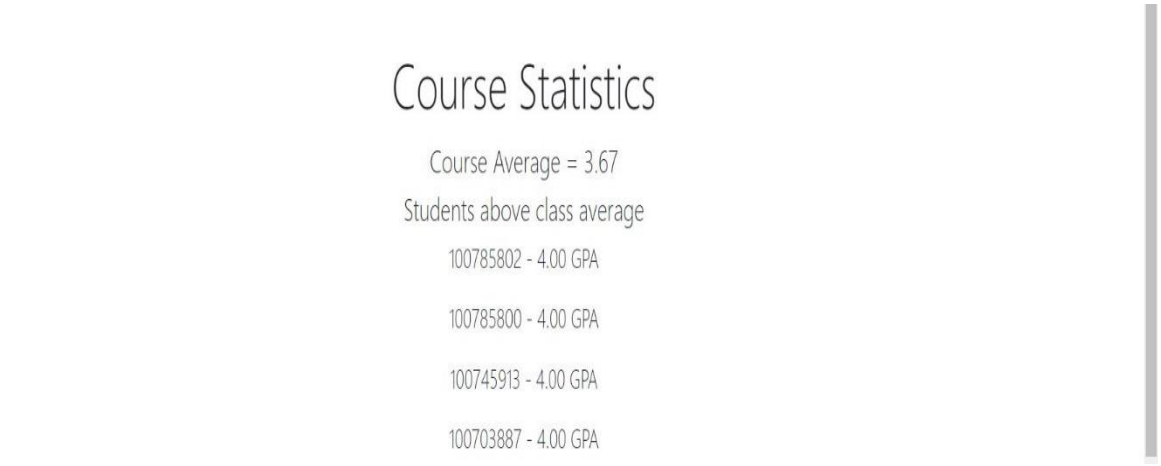
A7. View previous grades given to students by professor



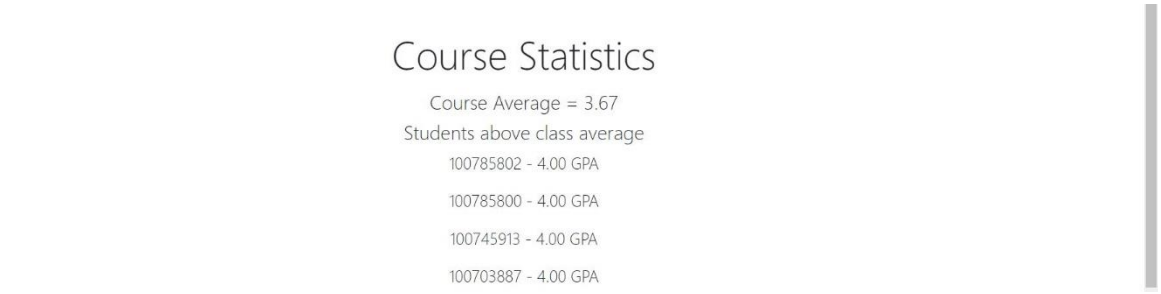




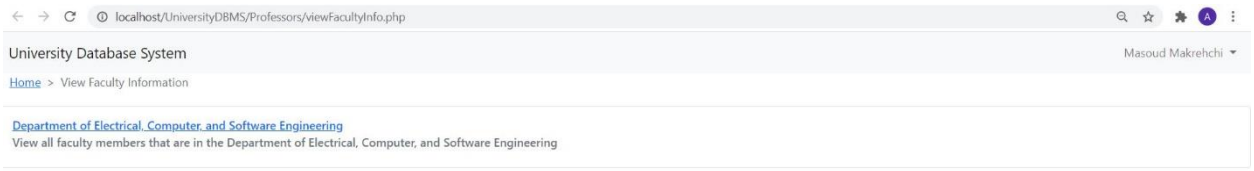
A8. Calculate GPA for the course

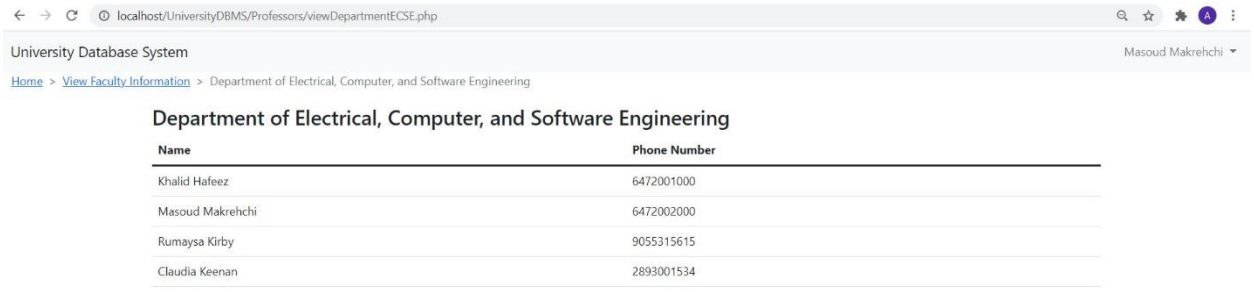


A9. Display the students above class average

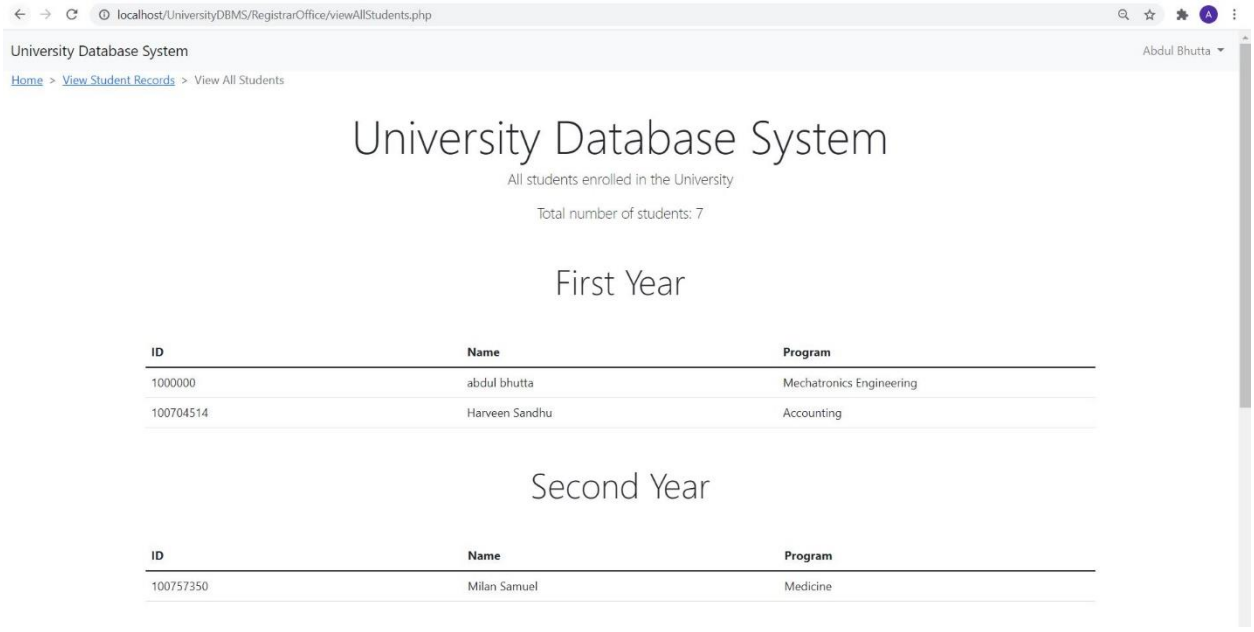


A10. All members in the same faculty as the professor





A11. View all Students based on year status (Shows total students as well)



Second Year

ID	Name	Program
100757350	Milan Samuel	Medicine

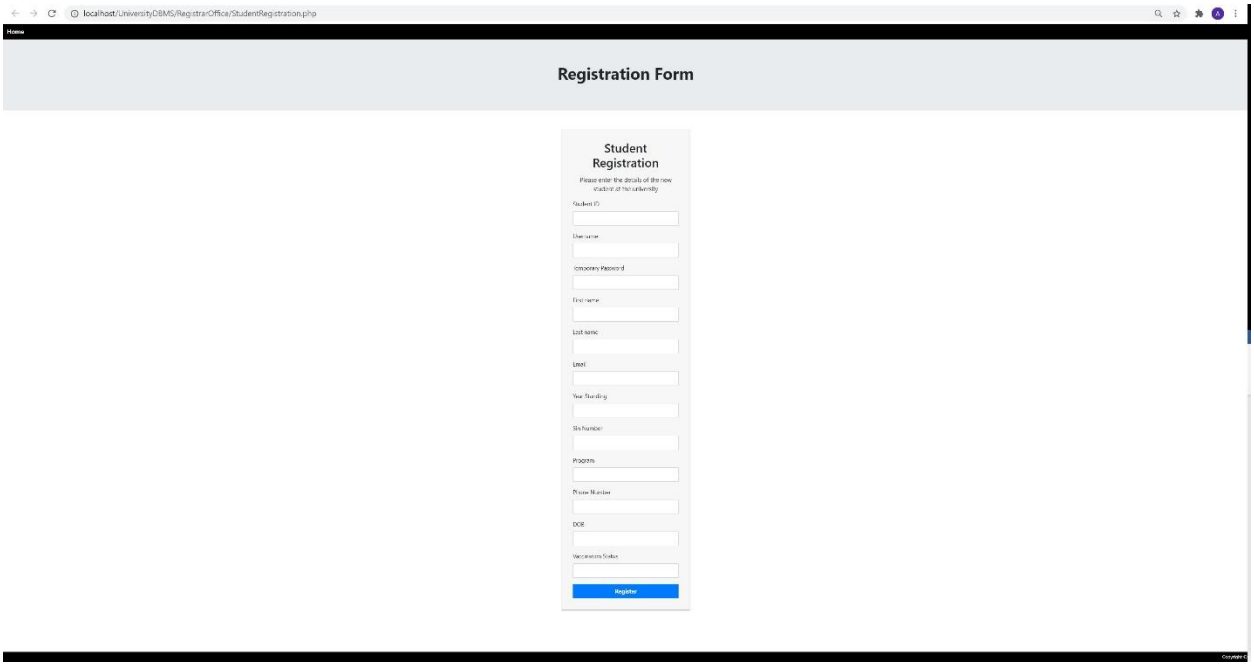
Third Year

ID	Name	Program
100745913	Ashad Ahmed	Mechatronics Engineering
100785800	Abdul Bhutta	Software Engineering

Fourth Year

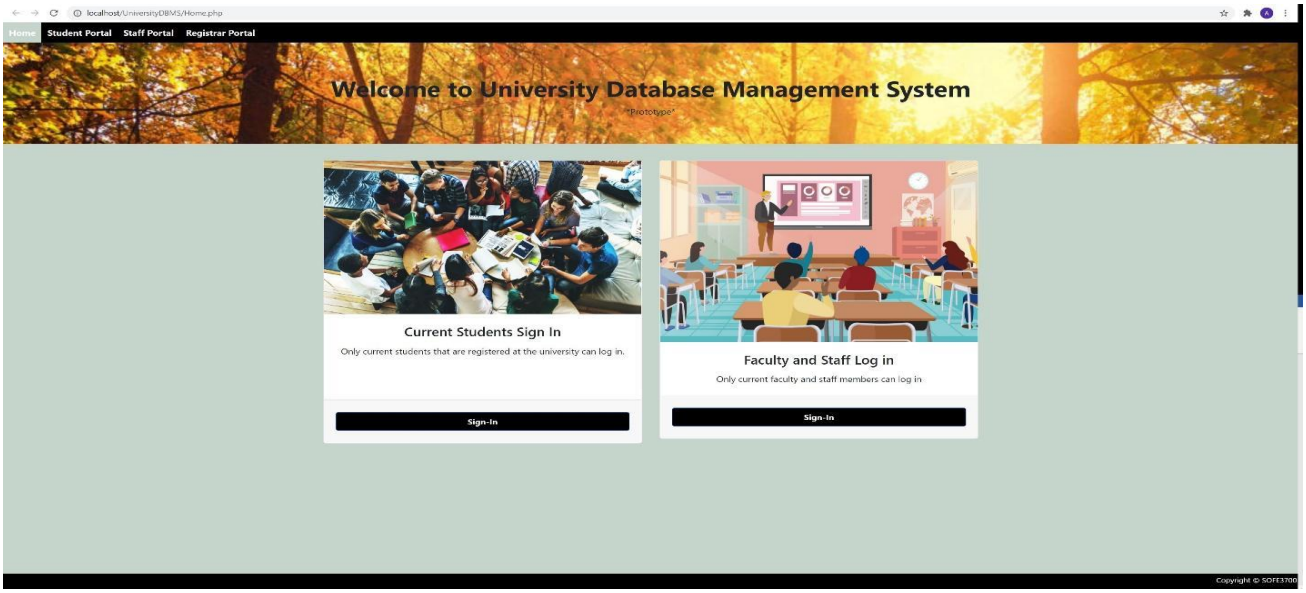
ID	Name	Program
100703887	Matheeshan Silvalingam	Mechanical Engineering
100785802	Usman Bhutta	Software Engineering

A12. Add Student and Print status update

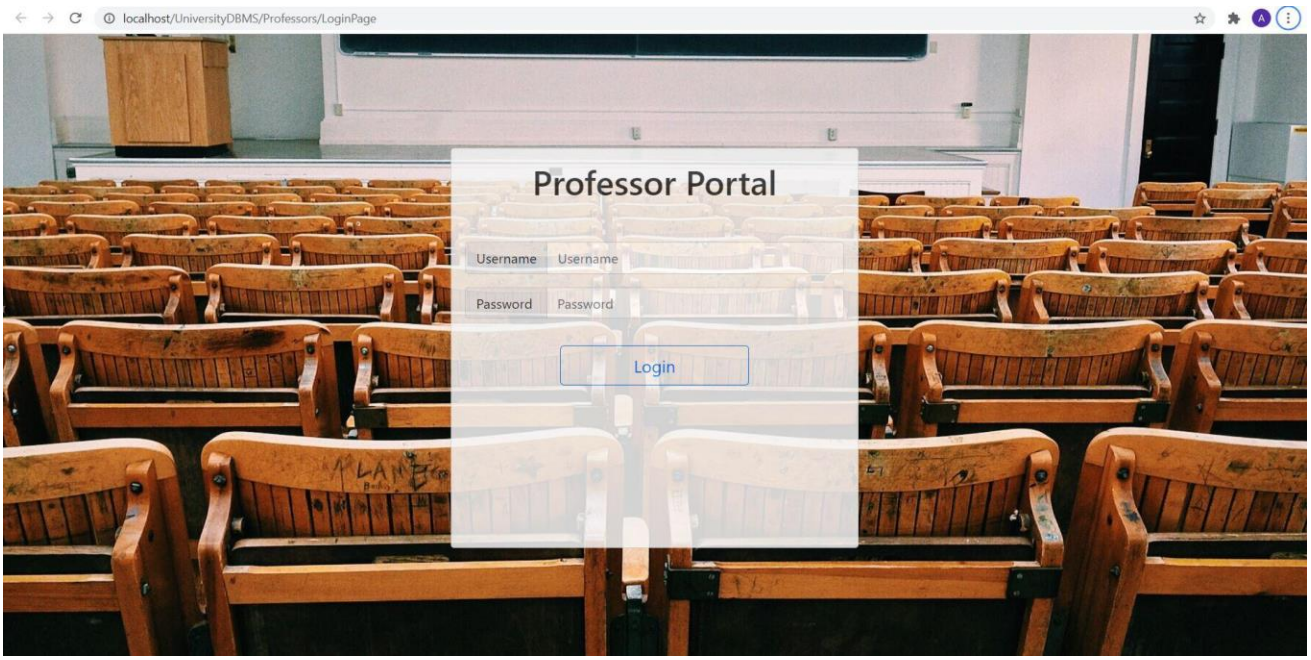


Appendix B. Home Page and Login

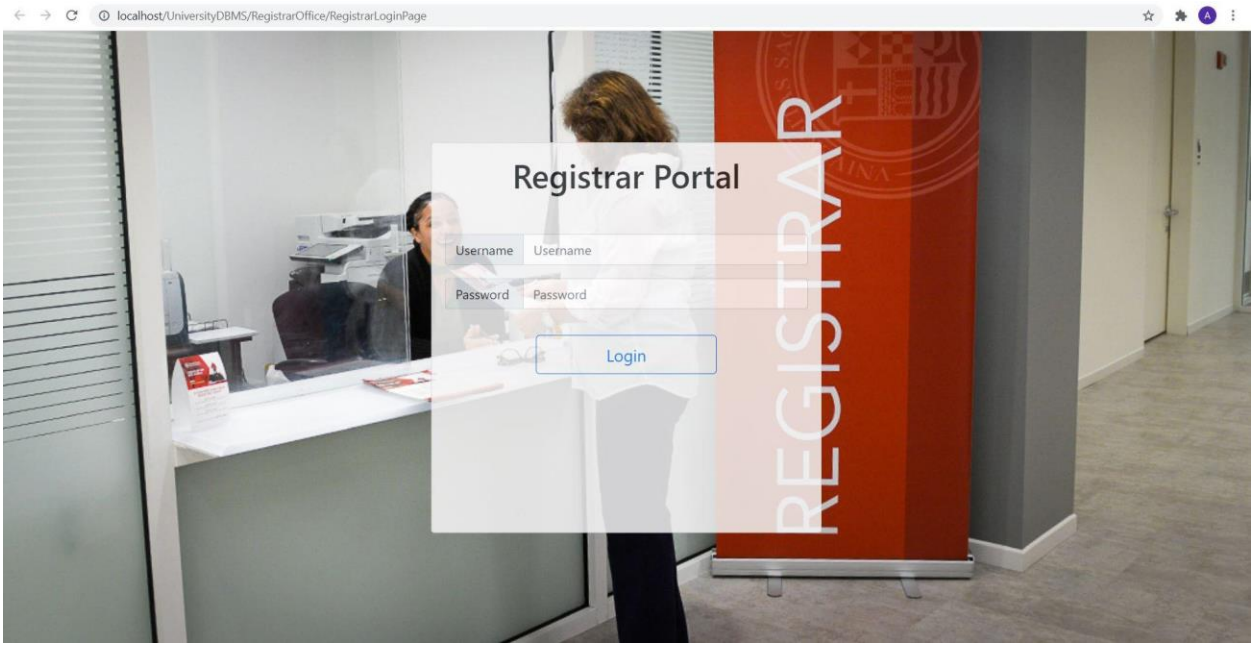
B1. Home Page



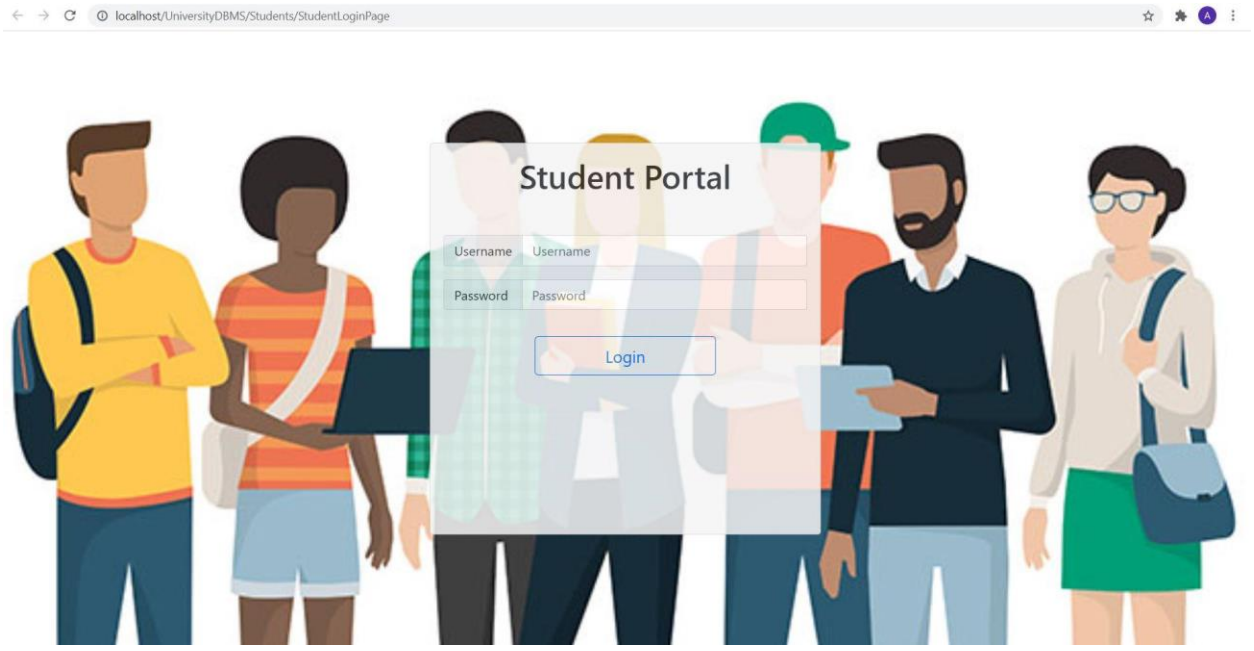
B2. Professor Portal



B3. Registrar Portal



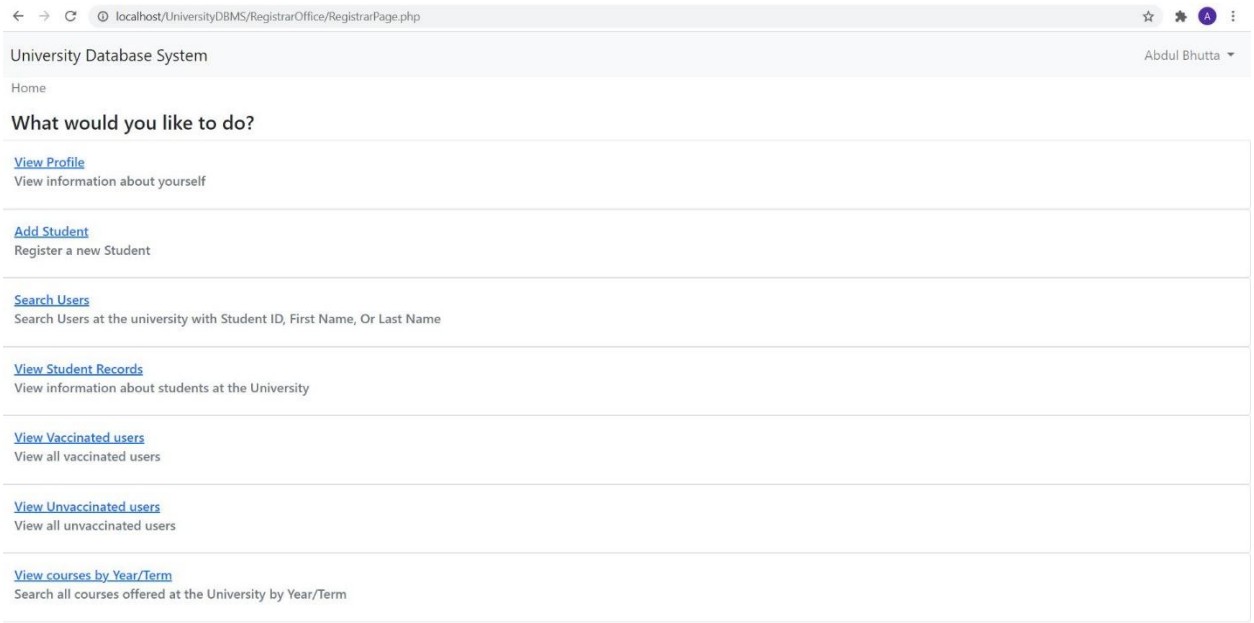
B4. Student Portal



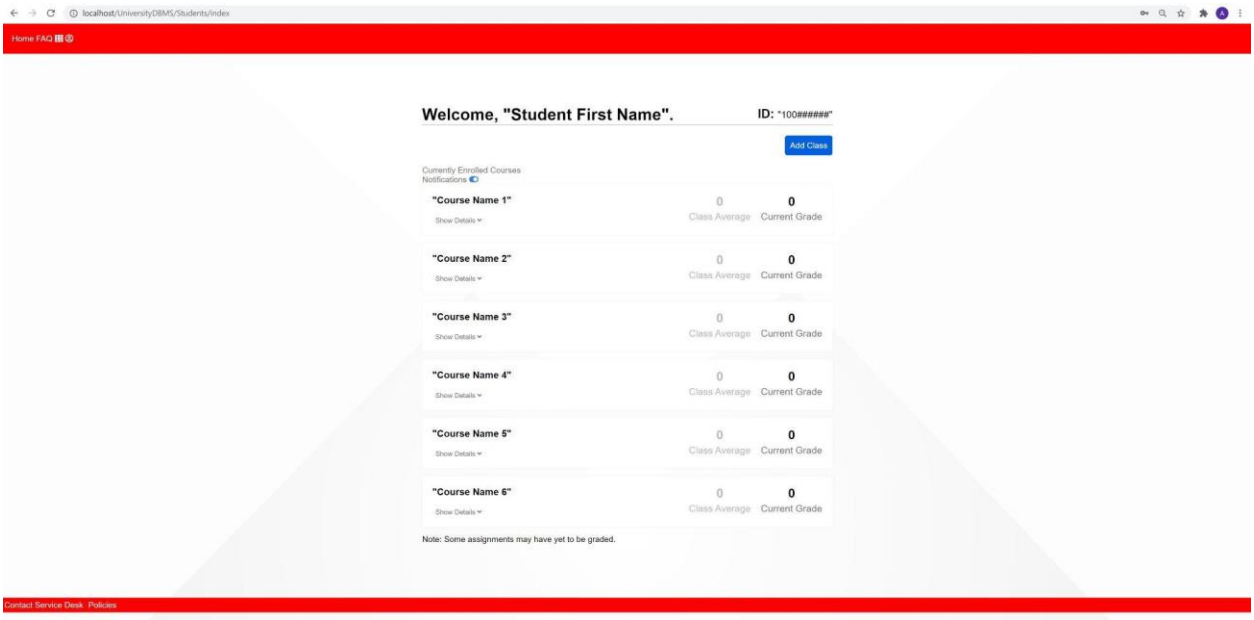
Appendix C. User Homepage

C1. Professors Homepage

C2. Administrator Homepage (Registrar Office)



C3. Student Homepage



Appendix D. GitHUB Link

Please use this link to access the application: https://github.com/abdulbhutta/SOFE3700U-Final-Project.git

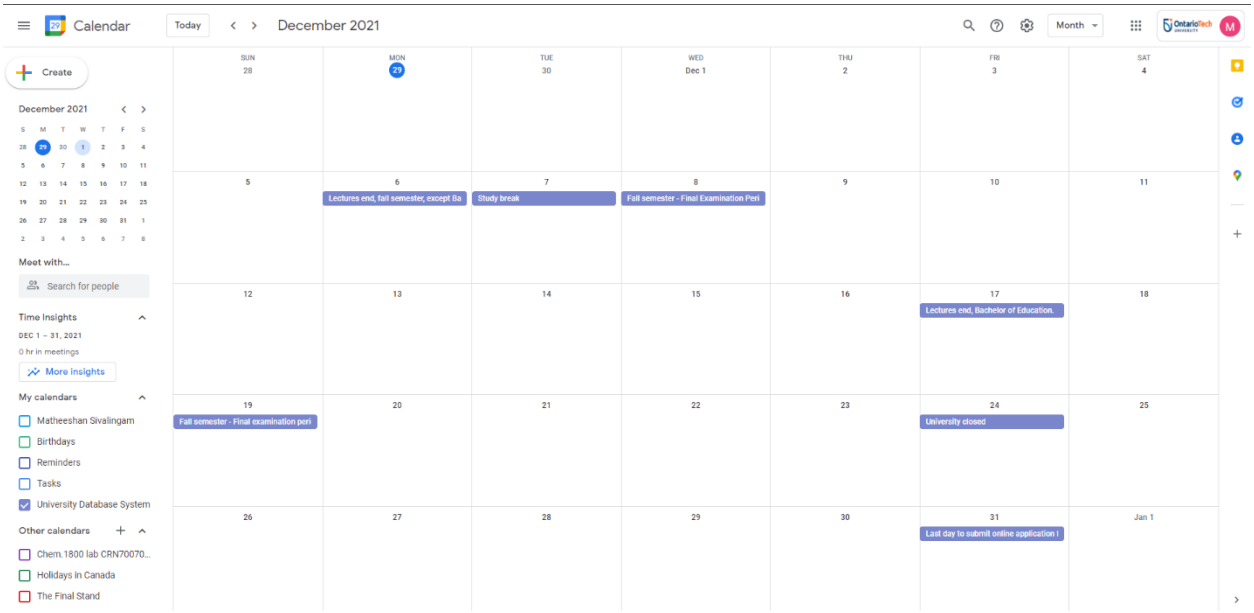
Appendix E. Contribution

	Home Page	Registrar Page	Professor Page	Student Page	Database
Abdul Bhutta	3	3	3	3	3
Matheeshan Sivalingam	3	3	3	3	3
Harveen Sandhu	2	2	3	3	3
Milan Saju Samuel	2	2	2	3	3
Ashad Ahmed	2	2	2	3	3

Appendix F: Web Service

Please use this to link to add to your calendar:

https://calendar.google.com/calendar/u/1?cid=Y19uMmgydjI1ZWZ1ODAzc2hrNXBzMzF2bmNiZ0Bncm91cC5jYWxlbmRhci5nb29nbGUuY29t


Calendar
Today
December 2021
Month
Create
December 2021
Meet with...
Search for people
Time Insights
DEC 1 – 31, 2021
0 hr in meetings
More insights
My calendars
Matheeshan Sivalingam
Birthdays
Reminders
Tasks
University Database System
Other calendars
Chem.1800 lab CRN70070...
Holidays in Canada
The Final Stand
SUN
MON
TUE
WED
THU
FRI
SAT
28
29
30
Dec 1
2
3
4
5
6
Lectures end, fall semester, except Ba
7
Study break
8
Fall semester - Final Examination Peri
9
10
11
12
13
14
15
16
17
Lectures end, Bachelor of Education.
18
19
Fall semester - Final examination peri
20
21
22
23
24
University closed
25
26
27
28
29
30
31
Last day to submit online application f
Jan 1