

Project Reflection Paper

CS411 SU23

Team009: Drop Table Users;

1. Please list out changes in the directions of your project if the final project is different from your original proposal (based on your stage 1 proposal submission).

Compared to our initial design in stage 1, there are some changes that we made. For example, in our initial design we hoped to include some warning messages if users have a tight time window for a commute between classes. While we did some queries containing historical GPA for classes in past semesters, we originally wanted to do more analytics such as precise grade distribution of classes. Our “Plan Future Semester” page also did end up having a different UI due to the reasons stated above and also including late integration of the enrollments table. Moreover, we hoped to use more realistic datasets(UIUC schedule) but we couldn’t find a public dataset. As the schedule for summer classes are really tight, we prioritize the development of our core database and functions.

2. Discuss what you think your application achieved or failed to achieve regarding its usefulness.

Achievement:

Given our initial usefulness analysis in the project proposal, the two major usefulness are all achieved:

1. **Map Feature for Course Locations:** We integrate Bing Map into our application that enables students to find their way and travel time getting from one class to another. This functionality is achieved by user manually typing in the CRN of their choice of classes and the application would return back the route from one class to another on the map visualization as well as calculated travel time in minutes.
2. **Course Recommendation by Past GPAs:** We also achieve an advanced course search functionality in which students could check on the general educational classes with the highest GPA given in each general education group. Users can type on the general education group name and check for the best genEd classes in the given group. This would better assist students in making their choice on genEd classes.

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Failure:

However, there are also few things that doesn't work well as stated in the project proposal:

1. **Real Dataset Approval:** We are not using the real dataset from the past semester because we cannot get the approval for the dataset in such a short period of time. Rather, we are using fake data generated ourselves and try to make it as verisimilitude as the real ones. The structure of the course data in our database however, is identical to what the school offers. Because we were short on time, and retrieving info from the school's public API about courses needs authentication and is complicated, we didn't use real dataset.
2. **Limited Triggers:** We did not enforce the triggers strictly enough within our database. For the purpose of the demo, we had triggers in place to prevent students from adding more classes to their schedule when they already had more than 21 credit hours. However, for a well-developed project, it is essential to implement additional triggers for operations such as deletion or addition across all of our tables. Unfortunately, due to the time constraints of this being a summer course, we were unable to implement these comprehensive triggers. Despite this limitation, we believe that by showcasing two triggers during the demo, we were able to demonstrate our capability in this aspect.
3. **Simple Database Structure:** Regarding the database aspect, our database structure is relatively simplistic. Our primary attributes within the database consist of users and courses. Additional functionalities, such as the map, genEd requirements, and GPA calculations, have been incorporated as supplementary features. In terms of our project—a course explorer—it is important to highlight the significance of stability and the capability to efficiently manage concurrent requests.

3. Discuss if you change the schema or source of the data for your application

We used MySQL and Google Cloud Platform as our server. We didn't change the schema of our database either. However, we changed the datasets because as stated before, we cannot find public open datasets for UIUC courses, and for the purpose of testing our database and website we used auto generated fake data that have the same structure as the real dataset.

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4. Discuss what you change to your ER diagram and/or your table implementations. What are some differences between the original design and the final design? Why? What do you think is a more suitable design?

Initially we used a separate table for GPA during our stage 2 database design, but we finally included that information into the Courses table, because the GPA attribute is part of the course table. We were not so clear about how to implement the relationship User -Enrollment-> Courses, until we were inserting data we realized that we need an enrollment table. We also changed some columns in our database. For example, we added room_number(INT) to our map table because initially we forgot that, and when we actually implemented the map on UI we wanted to display the room number for the courses. Another example is we added a GPA_letter in our courses table because we want to display the letter grade rather than a double for our users to better filter information, and also it provides us a great opportunity to write a trigger that updates information. The lesson we learnt from this is that during the actual implementation sometimes we start to realize what information we really want to store in our database and display to our users. Another thing we need to pay attention to is to design an effective ER diagram that clearly shows the relationship between attributes in each table.

5. Discuss what functionalities you added or removed. Why?

We removed our initial plan to include a password reset by email function because we think that it is not the focus of this database class. Besides, we didn't have time to create the functionality that our student users can use our database to plan their genEd schedule. It is a series of CRUD with our database, but requires a lot of front end(Web development) work. However, we believe that by showing a list of ratings for different genEd courses taught by different professors, we showcase our ability to achieve such a goal.

We initially decided to have a creative map function for our students to visualize their schedule and help them plan their courses. We finished with a visual map that can show the locations of 2 courses and calculate the walking time between them. However, we didn't put warnings for people with tight schedules, and that is a good trigger to add, but we just simply didn't have enough time to develop our project, especially between the midterm and final demo, which should be half a semester for a normal class, but only 1 week for a summer class.

6. Explain how you think your advanced database programs complement your application.

We believe that the triggers and stored procedures we've implemented align well with our initial goals to achieve the desired functionalities.

Registration Maximum Credit Trigger: We design 2 triggers. The first trigger effectively limits the amount of classes users can add to their schedule, preventing excessive inputs. We achieve this by adding a constraint on 21 credits maximum. As students add classes to their schedule where the total credit exceeds 21 credits, the trigger updates students' schedule by deleting the last course selected and returning the maximum credit registration error to the screen.

Letter Grade Trigger: The other trigger improves the display of past semester course GPAs by replacing number grades with letter grades everytime there's a grade for the class, and updating the letter grade under the 'GPA_letter' attribute in the courses table. We assign each letter grade using an If statement. For example, a GPA ≥ 3.66 results in an 'A', GPA with ≥ 3.33 results in an 'A-' and etc.

Schedule Difficulty Stored Procedure: Our stored procedures offer a convenient way for student users to gauge the difficulty of their semester courses. With a stored procedure in place, our website can quickly and easily access the information, which proves particularly valuable when handling numerous users and concurrent requests.

7. Each team member should describe one technical challenge that the team encountered. This should be sufficiently detailed such that another future team could use this as helpful advice if they were to start a similar project or where to maintain your project

- Zirui Wang: One of the major challenges when we first start off the project includes group members' limited experience on front-end design using HTML and its connection to back-end using NodeJS. Besides, we had a hard time connecting our project code to the GCP's SQL database. Building an application without having knowledge of these tools was one of the difficulties.
- Ron: One challenge was setting up the Bing Maps API to interface with the website which required the shift to call these APIs in JavaScript instead of having the server code call a python function that would have required Flask and the VM would have also had to

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support Port 5000 traffic. Ultimately calling the Bing Maps API from JavaScript was better but it took a while to learn how it worked exactly.

- Sam Shi: I was in charge of developing the DB locally using MySQL workbench, and then helping my teammate to upload it on Google GCP. We encountered an issue that the local DB has different security configurations than GCP. For example, in our local database we can only have lower case letters as names for the tables. Also, when creating triggers or stored procedures there is a automatically formed commend `/*!50017 DEFINER='root'@'localhost'*/` that should be deleted because Google GCP doesn't support Definer. Also, we needed to change all the data in our database because we wanted to add new columns, but we had to turn off the safe mode of our local DB because under safe mode only changes by where clauses are supported. These are the lessons that I think everyone should know if they want to use local MySQL on GCP. Also, as the TA and Professor Abdu suggested, it is a very good practice to first develop your database locally and then deploy it on GCP, because it is much easier to do it locally and the connection to GCP is not very stable at all.
- Zonghan Yang: Our challenge also lies in writing the stored procedure to measure the difficulty of students' schedules they choose. At first our stored procedure had a bug: we would output all the enrolled students' names and display their avgGPA for all courses they took. However, we only desired the result for the name we inputted. We then spent time on the code to fix such an issue. In the end we could implement the functions we wanted.

8. Are there other things that changed comparing the final application with the original proposal?

Given the tight time schedule on this summer project, we ended up achieving a different UI design as originally planned with the application because of our limited knowledge on HTML. Besides, for application functionalities, we wanted to include the GenEd information in our database and on the website so that we can help our student users to plan their courses towards graduation, and we ended up achieving part of that goal that we can show our students ratings of different gedEd courses taught by professors. However, we ran out of time to achieve the full functionality.

9. Describe future work that you think, other than the interface, that the application can improve on.

For the future of our project, we definitely hope to use real datasets that can better help our users. Besides, as described in the previous question, we wanted to include the functionality which our users can use the website to plan for their genEd courses towards their graduation requirements. We hope to recommend for them the most suitable and easiest genEd course that they can take. Besides, we want to improve our map functionality so that we can not only support our users to search their route between 2 courses, but also show their semester schedule for a specific day and show all the routes. Other than that, we hope that we can build a login page differently for our users and admin, who are responsible for adding courses and updating information. For internet security, we want our project to have a reset password with emailing a one time token instead of changing it on our website, and we should store the password as hashed results using functions like SHA256, instead of the password itself, however that is not the main focus of this project and this database class.

10. Describe the final division of labor and how well you managed teamwork.

Initially in our project proposal we had a very detailed division of work. We ended up not strictly following it, but each of us still had a main focus of this project. For example, Ron focused on achieving the Map function and writing advanced queries, and helping Zirui, who is the team manager, worked on deploying the database on GCP, and our website full-stack development and testing using NodeJS directly from remote GCP ('root' in github repo is committed from GCP remotely). Sam worked mainly on the back end, especially testing the MySQL database locally and making sure the data, schema, triggers and stored procedures work. Zonghan helped in writing stored procedures and test cases. For the purpose of utilizing what we learnt from this class, we had everyone work on at least one trigger/stored procedure/advanced query. As a summer evening session class, we have 2 people live in the US CST while the other 2 have a 13 h timezone difference, we indeed encountered issues to find meeting times that fit for everyone. We also have people who are busy doing work for other summer classes. Besides, there are internet restrictions and location reasons that prevent some of us from having a fast, stable connection to Google GCP and services. We think that we have overcome these difficulties at last and finished this project.