Course Scheduling Platform

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Abstract

An important aspect of a college student's academic career is their schedule, and in what order they take core classes versus electives. However, a lot of time is spent trying to create schedules each semester, not to mention the enrollment hardships that come with popular classes. My service intends to utilize AWS services with database values of computer science course information to help UVA students plan their schedule for their undergraduate career. Based on my own experience in taking core and elective courses, I have found that taking certain computer science courses in the same semester resulted in an overwhelming workload, and that other courses result in the opposite effect. Current services available for students to use such as Lou's List and VAGrades allow users to look at past grades per class. I will propose a solution which provides a different service by recommending a schedule path to pursue. My service will utilize user preferences such as workload distribution to determine the best schedule.

Purpose

As previously stated, my personal college experience consisted of certain semesters that combined multiple core major classes which when combined resulted in an overwhelming workload. In retrospect, I would not have structured my course path this way and would have preferred to spread out my harder classes over different semesters in order to facilitate a more manageable workload for each semester.

A nationwide survey found that 48.4% of college students say that they do not have enough time to do their course work, and that 87% of students believe that better time management would help them get better grades ("College students struggle," n.d.). In 2017,

Deloitte published an article analyzing the steps that colleges and universities can take to support the dramatically changing profile of incoming students more effectively (Fishman, Ludgate, Tutak, 2017). One of the measures discussed was structured pathways, stating that students are more likely to graduate on time when they have a clear academic plan upon matriculation. The purpose of this proposed tool is to generate a foundation for students to conduct self-sufficient research with. By having access to information related to the manageability of workloads, students should find that they have enough time to do course work for classes they researched before enrolling in.

Related Work

One of the structured pathways cited in by Fishman, Ludgate, and Tutak was the University of Hawaii's STAR Guides Pathways System, which dramatically increased graduation rates. This registration system prescribes courses to students each semester in order to fulfill degree requirements in a timely manner (STAR - Guided Pathways to Graduation, n.d.). However, it also still grants students the freedom to enroll in the courses of their choosing.

UVA students have access to SIS, Lou's List, VAGrades, and theCourseForum as resources to use in order to create schedules. SIS is the platform that students use to enroll in courses and create their schedules, and it contains personal information about what requirements are still left for each student. Additionally, it also contains information about courses, such as prerequisites and section information. Lou's List scrapes this course data and presents it in a more interactive and user-friendly format, in addition to keeping data for both present and previous semesters.

Both VAGrades and theCourseForum offer grading information about classes that are offered. VAGrades provides specific grade counts for each section, while theCourseForum shows percentages based on the instructor. theCourseForum also allows its users to leave ratings and reviews, in order to express positive or negative sentiments about specific instructors or classes.

The proposed tool intends to consolidate the functions of all the tools outside of SIS in order to produce a platform so that students do not need to know about differing resources, but also in order to provide the new functionality of prescribed suggested courses, which gives students an idea of what to research.

Tool Architecture

The initial architectural design for implementation involves utilizing two Amazon Web Services to host the tool. These services are: Amazon Relational Database Service (RDS) and AWS Elastic Beanstalk. RDS will be used to set up a cloud database. This database will store information about degree requirements, such as what classes are required and existing prerequisites. It will also store grade data for each course, which will be obtained through Freedom of Information Act (FOIA) requests made to UVA, similar to VAGrades. Elastic Beanstalk will be used to leverage and maintain a Django application which will serve as the tool, by integrating the RDS database instance.

Figure 1. Illustration of Architecture Interaction

Data Privacy

The Virginia FOIA permits citizens of the Commonwealth access to the public records of public bodies, public officials, and public employees (FOIA, n.d.). UVA also complies with the Family Educational Rights and Privacy Act (FERPA). UVA's FERPA compliant policy protects students' education records and directory information. Education records include academic records, which only include direct transcripts of a student. The removal of all student identity association to a grade achieved in a particular section of a course means that the data being shared is not a transcript, nor does it contain any student directory information. By only recording the quantity of grades achieved in a particular section, no FERPA policies are being broken.

Because data is stored in Amazon RDS, databases are encrypted using keys managed with the AWS Key Management Service. The key management service allows for the creation and management of cryptographic keys in order to control use across the whole platform (Key Management Service, n.d.) The use of hardware security modules that have been validated under the Federal Information Processing Standard (140-2), in addition to the access to logs makes it easier to manage the database security. Data at rest is also encrypted on numerous levels and backups using the industry standard AES-256 encryption algorithm (Amazon RDS Security & Compliance, n.d.).

Figure 2. Visualization of RDS encryption, taken from https://aws.amazon.com/rds/features/security/.

Hosting the application on AWS Elastic Beanstalk also allows for shared responsibility of security in the cloud, as AWS is then responsible for protecting the infrastructure being used to provide services. The recommended practices to ensure proper shared responsibility includes using multi-factor authentication for the AWS account, using Transport Layer Security to communicate with AWS resources, in addition to using AWS encryption and setting up user activity logging (EBS services).

Authentication

Users will be able to sign up for an account, in addition to recording completed classes to match against the scheduling tool. The encryption of the database at numerous levels in addition to the utilization of centralized cryptographic key management will enable the storage and processing of encrypted email/password authentication. Also storing which accounts have been validated through email will ensure the authentication of university student users.

The user policies provided by AWS Elastic Beanstalk allow for the assignment of full access or read-only access to all managed resources, making it easy to manage data roles for fully authenticated administrators or users.

Interface

Similar to how Lou's List consolidates data from SIS for public use, the Django application will scrape data from Lou's List through a python script to obtain enrollment and waitlist data for the sections of courses, lectures, and labs of the current semester. This data will be stored in the RDS database. The user-accessible interface will contain a page with a list of the departments, which users can click on to navigate to the course that they wish to get enrollment information about for the current semester, in addition to grade history.

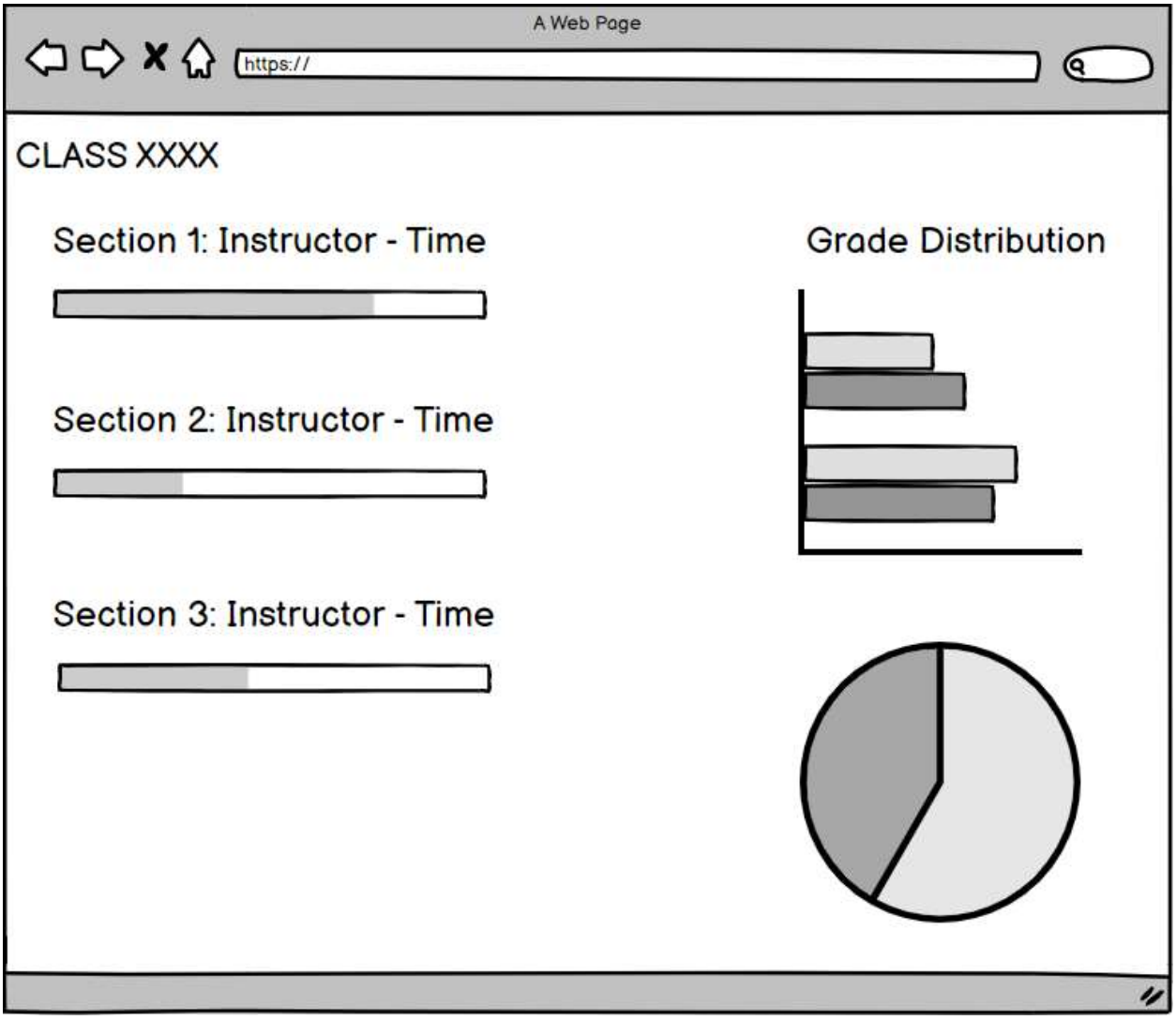

Figure 3. Mockup of possible UI for viewing course/section information.

The part of the application that will propose the suggested schedule will take in user preferences about classes that they must take that semester. The assigned workload value of a course will be determined through an analysis of the grade statistics for each course. Based on the user's self-recorded class history and the degree requirements stored in the database instance, the application will choose courses to suggest based on sections available and the calculated perceived workload. Users will then be able to look at these suggested courses, in order to view both enrollment information and grade history.

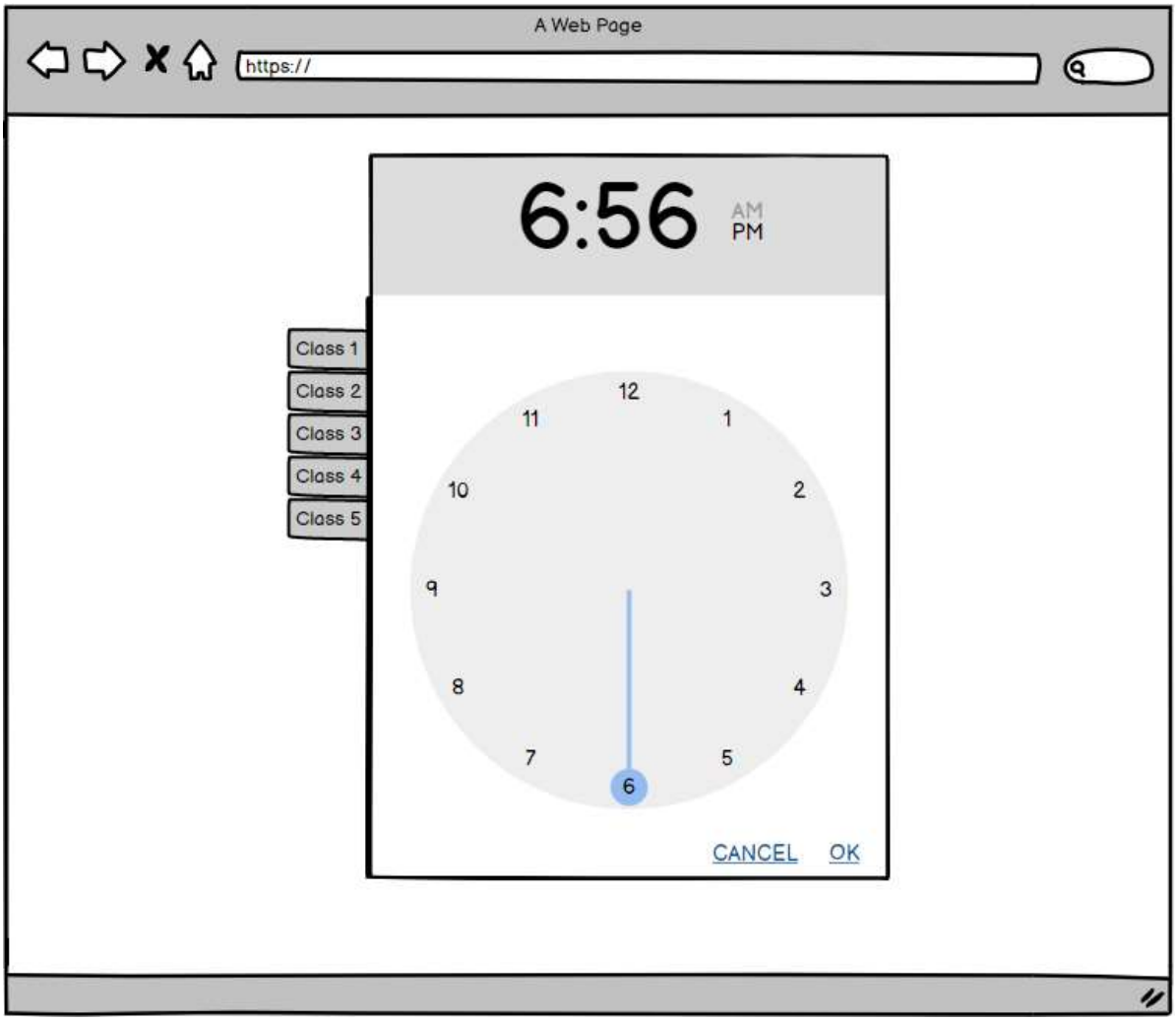

Figure 4. Mockup of possible UI for viewing suggested courses

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