# *Pathways* Mobile

## *Building a Mobile App for Students and Universities from the Ground Up*

SCALE Learning Technologies

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# I. Introduction

This document serves as a culmination of Team LD's work on the SCALE *Pathways* mobile app. The purpose of this project is to provide students with a way to create and manage their academic schedules throughout their college journey. This document will provide extensive details on the project overview, team member bios, project requirements, and specifications. Finally, this document will provide details on the status of the *Pathways* app prototype. The team will share the current progress on the prototype as well as describe what the prototype looks like.

## I.1. Project Introduction

Students choosing to pursue higher education face many difficult decisions. These include choosing the institution that best fits their needs, selecting the degree(s) they wish to pursue, and picking the individual classes that they will be taking each semester or quarter. These considerations are incredible pain points for students; it has been found that 32.9% of undergraduates are not able to complete their degree programs [1]. The factors that cause these students to drop out include attending an institution that does not match the individual's preferences, switching majors after a change of heart, and having too difficult of a course load. Students are overwhelmed by the incessant number of decisions regarding universities, degrees, and courses that they will have to make during their higher-education journey. SCALE *Pathways* will be a cross-platform mobile application that aims to address these issues. It will streamline the process of selecting a degree from an institution, tracking one's progress through time for their degree, and making adjustments to any hurdles faced. With these solutions, *Pathways* hopes to take a load off the shoulders of students around the country.

## I.2. Background and Related Work

Team LD's primary contribution to *Pathways* will be implementing the mobile version of the existing robust course planning website prototype. It is built with the motivation that choosing the correct path in higher education is a critical issue. In recent times, this issue has been further exacerbated by the pandemic in which students have experienced significant reductions in learning efficacy. This has particularly harmed students who do not have access to adequate financial and social resources. An example of these unfortunate outcomes is the situation at QC, an urban college with a socially vulnerable student population located only three miles from the epicenter of New York City's COVID-19 outbreak in 2020. The pandemic reduced the freshman retention rate by 26% and altered the graduation plans of 30% of all QC students [3].

To make it easier for students to navigate through issues such as these, there are currently numerous apps available that track one's academic schedules. One of the most popular apps in this category is Class Timetable [4]. With its minimalist design, this app allows students to enter the courses they are taking and their accompanying tasks. It can also display its information in a week view. Another similar app is Schooly [5]. It features a clean user interface with Notes, To-Do's, and different themes. Like Class Timetable, Schooly lets the user manually enter their courses and their tasks. The last app we will discuss in this space is Class Schedule Planner & Tasks [6]. This app distinguishes itself in this space with extensive voice assistant shortcuts, schedule sharing, statistics, and many schedule viewing options.

The current solutions on the market lack the ability for learning institutions, such as universities, to enhance the schedule-tracking process for students. The primary purpose of each of the above-mentioned apps is to help students track their academic schedules, and yet, they all do so in a manner that does not allow the entity creating the schedules to participate. Learning institutions like universities would be incentivized to establish this communication link as it would help attract students to their degree programs. This hole in the market is what SCALE *Pathways* Mobile hopes to fill, offering the unique advantages of being able to select standardized classes, academic schedules that are reactive to changes from both the learning institution and a student, and the ability to compare and contrast different schedules, and more.

## I.3. Project Overview

With multiple fields of study in a university, it is intimidating for students to plan an optimal course schedule throughout their years in college. SCALE *Pathways* Mobile is an application that assists current and incoming students with their scheduling based on their major. On a basic level, students will be able to input their university, major, and courses. With this information, the application will automatically generate the optimal schedule for the student throughout the university. SCALE *Pathways* Mobile offers unique advantages in comparison to its current market competitors, such as being able to select standardized classes, academic schedules that are reactive to changes from both the learning institution and a student, and the ability to compare and contrast different schedules.

This schedule created by SCALE *Pathways* Mobile will be modular. Additionally, it can be revised or regenerated based on class availability, changes to graduation requirements, and if a student needs to retake a class. The schedule will be divided into separate terms to clearly show the student which classes to sign up for. Classes will also be categorized and highlighted (i.e., UCORE, Major Class, CAPSTONE, etc.). Classes can be added in bulk via CSV (.csv) files. The schedule can be saved or reverted based on each user. Previously saved schedules can also be accessed, as well as making multiple schedules for each student.

University admins (advisors) will be able to customize different courses as they see fit. Adding details such as course codes, credit hours, descriptions, and availability. Additionally, admins will be able to generate their own pathways to graduation based on specific majors.

This project is based upon an existing web application “SCALE *Pathways*”, however, the mobile version will be built from the ground up. Using the React Mobile framework, the application will be built to support both iOS and Android devices. In previous iterations of the web application, there was an implementation of graphs to build the schedule. We will be iterating on that code and improving the functionality to fit all major requirements. A validation algorithm was also used to check and maintain course dependencies to ensure a correct schedule. We will be iterating on top of the previous version to improve handling and a possible refactor.

SCALE *Pathways* Mobile must be built to be iterated upon, different classes and majors are always being added and removed. Major requirements can change from year to year, so it is essential that the code uses precise software engineering and object-oriented principles to maintain scalability.

An optional objective that Team LD would like to include is automated functionality with university systems. Currently, universities have to manually provide their course information. It would be easier to integrate more universities into SCALE *Pathways* if we implemented a wrapper or other software solution to automate the process by which their course and university information is uploaded onto the app. This objective will be difficult to scale as different universities use different legacy APIs with their scheduling software. However, implementing this feature with WSU would be our primary objective for this year.

Another optional objective that LD would like to implement is “the ability to construct schedules that targets a specialization within a major, such as the AI/ML path for WSU’s

Computer Science B.S. Degree. This could be implemented by using tags, in which the app would create a specific course schedule for the student prioritizing courses with the corresponding tags if they wish to pursue the ML specification.

### I.4. Client and Stakeholder Identification and Preferences

Our team has identified two clients, which are students and universities. Students are clients since our app aims to help students to build their schedules using the major that they have picked. If students are using the app, Team LD can gather data with their consent and improve the app. Universities can be a client if they choose to cooperate with the team. This is because the app would require full access to a university's API in order for the app to aid the students in creating a schedule for them. The stakeholders are Tiffany, Osman, Jack, Jimmy, Christopher, Matthew, and Ernest. This project requires the team to build an app from the ground up to aid students to build a course schedule based on their major, and the university they are attending.

## II. Team Members - Bios and Project Roles

Wenda Liu is a computer science major with an interest in machine learning and web applications. Wenda has prior experience in building front and back end for web applications. Wenda has a wide range of languages he can use like C/C++, C#, Python, and HTML. Wenda is responsible for team management.

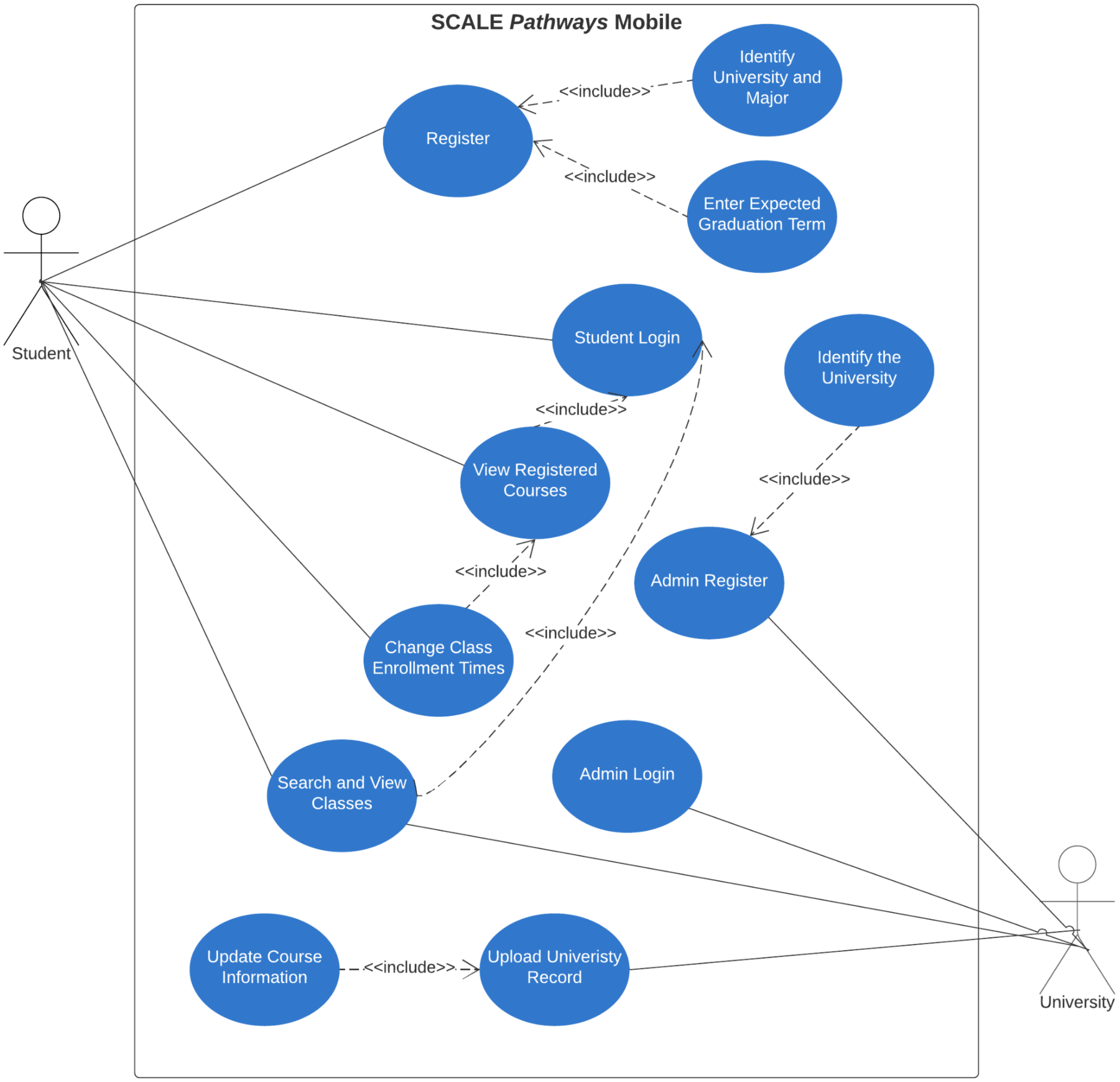
Caleb Lee is a senior computer science major that wants to go into the field of software engineering or cyber security. Caleb has experience with college-level cyber security competitions. Caleb has experience with C/C++, C#, Python, and Haskell.

Yihui Fang is a senior Computer Science student with an interest in software development. Yihui has held teaching assistant positions in Data Structure class, completed a Front-end Engineer, and participated in a deep learning-based vulnerability research program. Yihui has a good understanding of C/C++, Python, JavaScript, and Haskell.

Ganeshram Krishnamoorthy is a senior Computer Science B.S. student. Ganeshram has used JavaScript frameworks such as Ionic Framework to build native cross-platform applications for iOS and Android. Ganeshram's team utilized machine learning to rank second place in WSU's Digital Agathon 2020. Ganeshram is interested in machine learning and artificial intelligence and is proficient in C/C++, Python, and JavaScript. Ganeshram is the team leader.

# III. Project Requirements

## III.1. Use Cases



| | |
|---|---|
| Name | Course Schedule |
| Description | First, a student needs to be able to register and identify their university. Next, they should be able to view and enroll in courses. |
| Actors | Student |
| Pre-Conditions | ● The user must be logged in with a registered user account.<br>● The user must have identified their university |

| | |
|---|---|
| Flow of Events | 1. The student selects their major from the list of offered degrees at their registered university.<br>2. The website populates the course table with the template schedule for that degree.<br>3. The student clicks on the course that interest them for more information<br>4. A pop-up box will be displayed containing course details, meeting location, and time.<br>5. The student can manually push back the course they choose to next semester.<br>6. As a result, classes in the following semesters that prerequisite classes would be pushed back too<br>7. The table's credit totals for each semester are updated to reflect the change. |
| Related Requirements | ● The application must be able to populate the class table with a template schedule for every provided degree.<br>● Clicking on a class must direct the user to more information about that class.<br>● The user is able to manually move classes to the future semesters<br>● The application must be able to readjust the schedule to account for changes made by the user<br>● The class table must display the credit load for each semester |
| Post-Conditions | ● The course table must be updated with the correct courses, with no relationship conflicts. For example, students can't take a course with its prerequisite class in the same semester. |
| Exceptions | None. |

| | |
|---|---|
| Name | Invalid Class Move |
| Description | Student attempts to move a class which might affect the graduation date |
| Actors | Student |
| Pre-Conditions | ● The user must have been logged in with a registered user account.<br>● The user must have identified their university<br>● The user must select a degree and have a schedule loaded |
| Flow of Events | 1. The student attempts to move the next semester's class to the previous semester<br>2. The application realizes that there is no way for the student to take that class<br>3. The application reverts the change.<br>4. The application displays an error message informing the student that the move is not possible. |
| Related | ● The user is able to manually move classes between semesters. |

| | |
|---|---|
| Requirements | ● The application must be able to readjust the schedule to account for changes made by the user.<br>● The application must be able to recognize invalid schedule changes. |
| Post-Conditions | ● The course table is returned to the state it was in before the attempted change |
| Exceptions | None. |

| | |
|---|---|
| Name | Post and Update Course Enrollment |
| Description | A user with admin permissions for a given university uploads courses and record data for that university. |
| Actors | University Official |
| Pre-Conditions | ● The user must be logged in with a registered admin account<br>● The user account must have admin permissions to at least one university<br>The user must have already formatted their data into the desired CSV format. |
| Flow of Events | 1. The user navigates to the profile page and selects the “Admin” tab.<br>2. The user clicks the “upload university record” button, and selects their preformatted CSV file.<br>3. The application shows a message verifying the success of the operation.<br>4. The course view page is refreshed to reflect the updated courses. |
| Related Requirements | ● Allow the user to import course information from a standard file format:<br>● Provide a sample file to demonstrate the desired format<br>● Allow a university official to upload a CSV file of student academic records |
| Post-Conditions | ● The new data is entered into the database. |
| Exceptions | None. |

## III.2. Functional Requirements

### III.2.1. User information

**Gathering User Information**: the applications would require each student to use university and major information in order for the application to create and manage the student schedules.

**Source:** Primary stakeholders with SCALE originated this requirement. This requirement is necessary for the application to work.

**Priority:** priority level 0: essential and required

### III.2.2. User Authentication

**Authentication:** the application must use university specific email to authenticate the student.

**Source:** Primary stakeholders with SCALE originated this requirement. This requirement is necessary for users to access their own applications.

**Priority:** Priority level 0:essential and required

### III.2.3. Data Records

**Storing the user data:** The application will store the student data in a database and the user must be able to view and change them.

**Source:** Primary stakeholders with SCALE originated this requirement. This requirement is necessary for the application to view data.

**Priority:** Priority level 0:essential and required

## III.3. Non-Functional Requirements

### III.3.1. Easy to Use

This tool should be intuitive for its targeted demographic of college students. This is necessary for the continued use and proliferation of the SCALE *Pathways* mobile application.

### III.3.2. Reliable

The application must be free of bugs and issues that prevent the application from functioning nominally.

### III.3.3. Extensible

It must be simple for universities to integrate their APIs with SCALE *Pathways* mobile as this capability is integral to the application's functionality.

### III.3.4. Maintainable

SCALE *Pathways* mobile must be built with robust design principles so that it is simple to maintain. Without this requirement, users will encounter negative downstream effects such as slow-to-respond pages and loss of data, leading them to cease their app usage.

### III.3.5. Easy To Iterate Upon

In order to address user feedback and implement new features, SCALE *Pathways* mobile must be built in a manner that makes it easy to iterate upon.

## IV. System Evolution

Software evolution is a big factor when the team was creating the design for this project. One fundamental assumption on which our project is based is that 'Students' and 'Universities' are different actors who can complete separate actions. Another fundamental assumption is that the Student actor's functionality is dependent upon the University actor's provided information. For example, Students may only select from Universities that have registered, and only choose classes that Universities have provided. An assumption for the project's development is using a development framework that allows a single, unified code base for the iOS and Android versions of our application. Currently, a framework called React Mobile allows developers to code in a specific language and transfer that language to work on both IOS and Android. Another aspect the team needs to account for is making the project more flexible to be able to update and add new features on top of the current ones. With this, the system needs to be able to handle new attributes and be able to display the new attributes. Furthermore, the application needs to be easy to use for everyone, not just the engineers.

## V. Glossary

**API:** Application Programming Interface

**CSV:** Comma Separated Values

**UCORE**: University Common Requirements

**iOS:** iPhone Operating System

**QC:** Queens College

**AI:** Artificial Intelligence

**ML:** Machine Learning

## VI. References

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