GradMap

“Your Roadmap to Graduation Success”

Team Ruby

CS-410 Fall 2025

Team Bio


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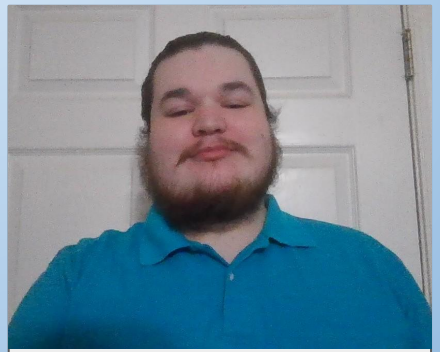

Matthew Haydon - Designing Lead

The Background

- **Why is this domain important?**

  Students can often have an issue with not being able to register for the classes they need wich can delay graduation and increase costs.
- **What are the current misconceptions or gaps?**

  Current tools like DegreeWorks do not really work well with handling personal time conflicts.
- **Define key terms.**

  Conflict-free scheduling: Ensuring no overlapping courses within a plan

  Constraints blocks: Reserved personal or work time where classes cannot be scheduled.
- **Who is struggling?**

  Students and advisors spend hours trying to align students schedules.
- **Why are existing options insufficient?**

  Current options are outdated, confusing, and do not combine degree rules with current course data due to the lack of the good use of scribing which is how you code program requirements that the system can logically understand.
- **Show the cost of inaction.**

  If this problem is ignored students can waste time, spend more money, take longer to graduate, or even drop out.

The Problem

Problem statement: Our project addresses the challenges of students facing graduation delays due to issues with overlapping class schedules with personal commitments, lack of real-time registration integrations, and limited advisor support tools.

Who is Affected:

- Students cannot register for required classes, can face delay by not being able to complete the necessary credits to graduate, stress, and extra tuition cost.
- Advisors spend hours manually checking prerequisites and student time conflicts.
- As a result of insufficient class registration systems, universities can have lower graduation rates due to people being not being able to complete classes. And advisers spend more time trying to look for accommodation for student schedules.

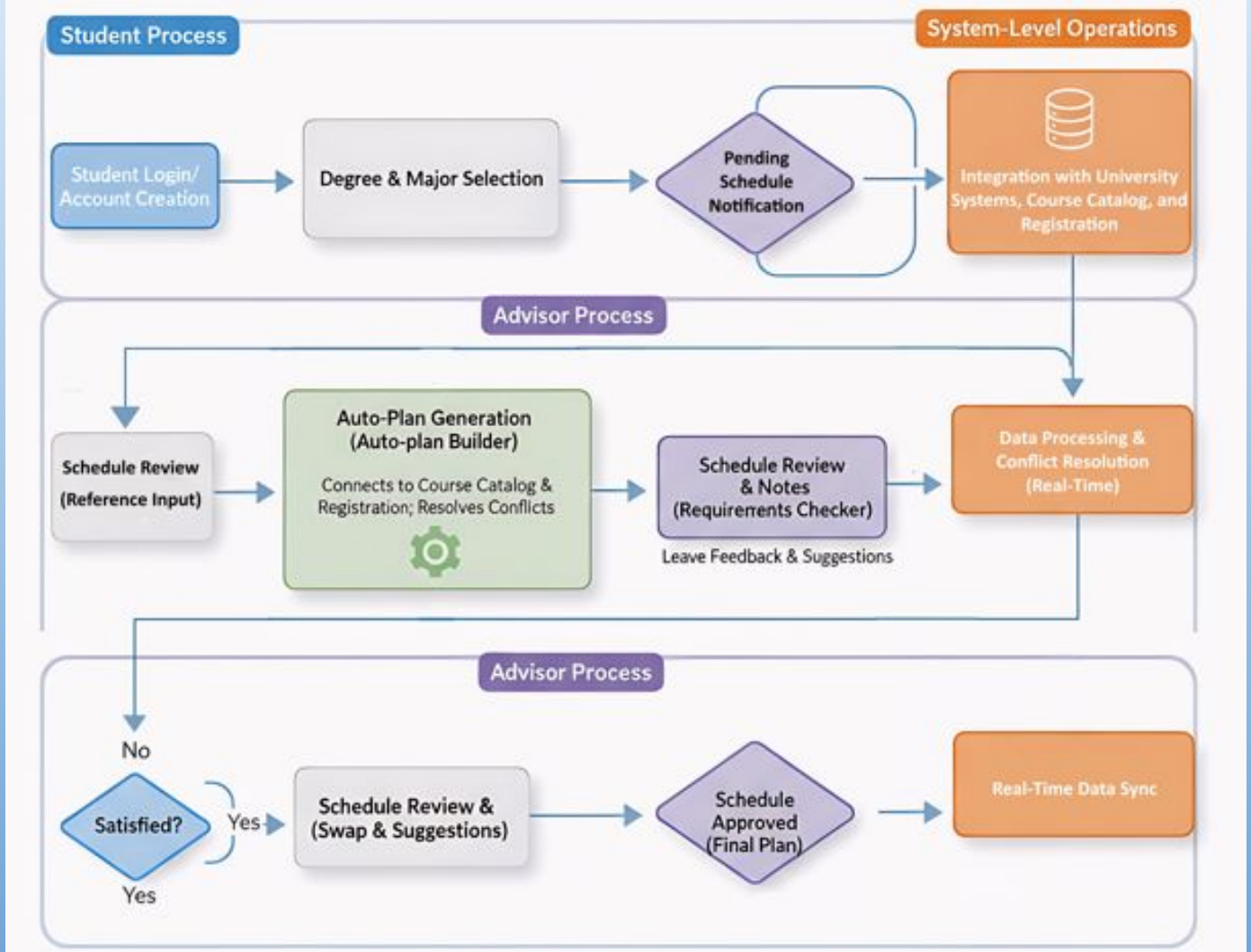
The Problem Characteristics

- Human Limitations/Error: An overload of information can be difficult for people to process properly, thus leading to difficulties forming a new class schedule. Additionally, people may simply forget valuable information that should affect their scheduling.

- Schedule Balancing: Properly balancing school, work, and personal life can be an arduous task that requires great scrutiny to properly complete.

- Site Navigation: Coursework scheduling sites are oftentimes difficult to navigate properly, with a lacking UI.

The Current Process Flow Diagram



The Solution

- Our solution is Gradmap, a web application that helps college students and advisors create seamless, conflict-free, and degree compliant schedules in a matter of minutes.

- Gradmap auto-builds personalized class plans based off individual student's degree requirements, availability and preferences. It then submits a reviewer rough draft for approval by the advisor.

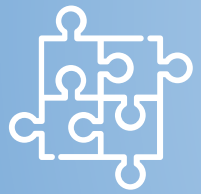
- Gradmap serves primarily undergraduate and graduate students as primary users. The secondary users are academic advisors and program directors.

- Unlike current traditional competitors such as Degreeworks, Gradmap combines degree requirements, course availability, personal preferences/constraints, and advisor collaboration into one complete platform. It's real-time smart suggestions and conflict alerts set it apart from the competition. This is truly a graduation success platform that keeps students on track and eliminates registration headaches.

Solution Characteristics

Problem Characteristic: Human Limitation/Error

Solution Characteristic: **Automated smart scheduling and conflict detection** - GradMap processes requirements, availability, and preferences that reduce cognitive load



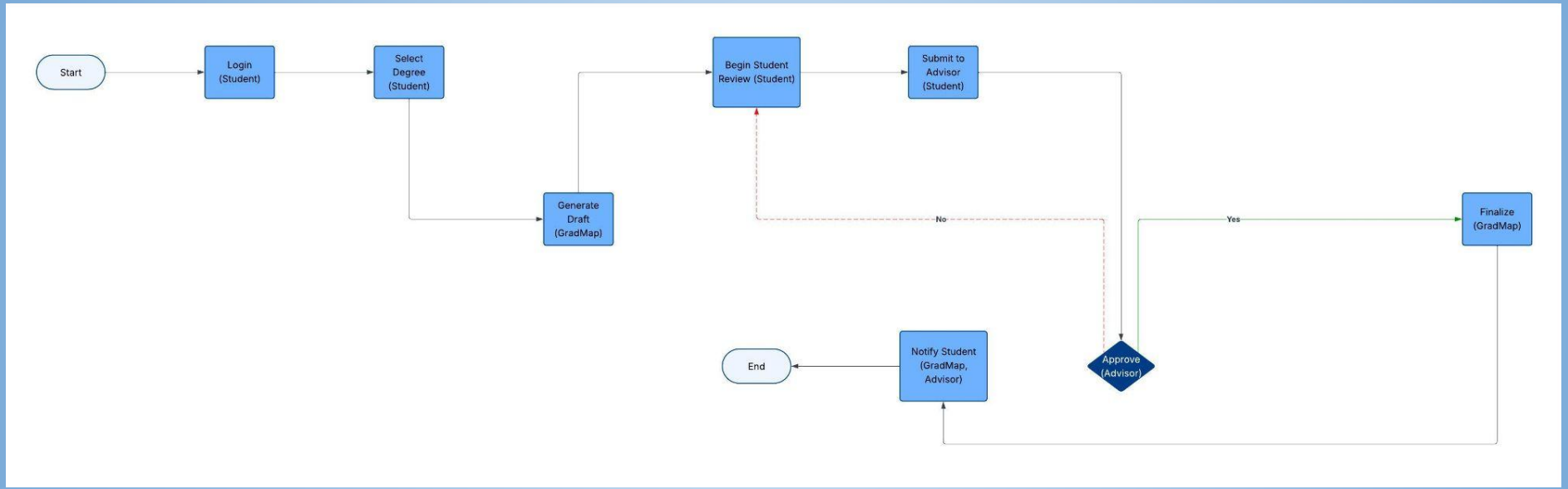
Problem Characteristic: Schedule Balancing

Solution Characteristic: **Load-balancing recommendations** - Suggests optimal course combinations to avoid burnout

Problem Characteristic: Site Navigation

Solution Characteristic: **Streamlined workflow** - Step-by-step guided scheduling process

Solution Characteristic Flow Chart



Competition Matrix

Features	GradMap	Degreeworks	Internal University Registration Systems
Automated Smart Scheduling			
Conflict Detection		✔	✔
Load-Balancing Recommendations			
Streamlined Workflow		✔	
Constraint Blocks for Students			✔
Advisor Review		✔	✔
Requirements Checker		✔	✔

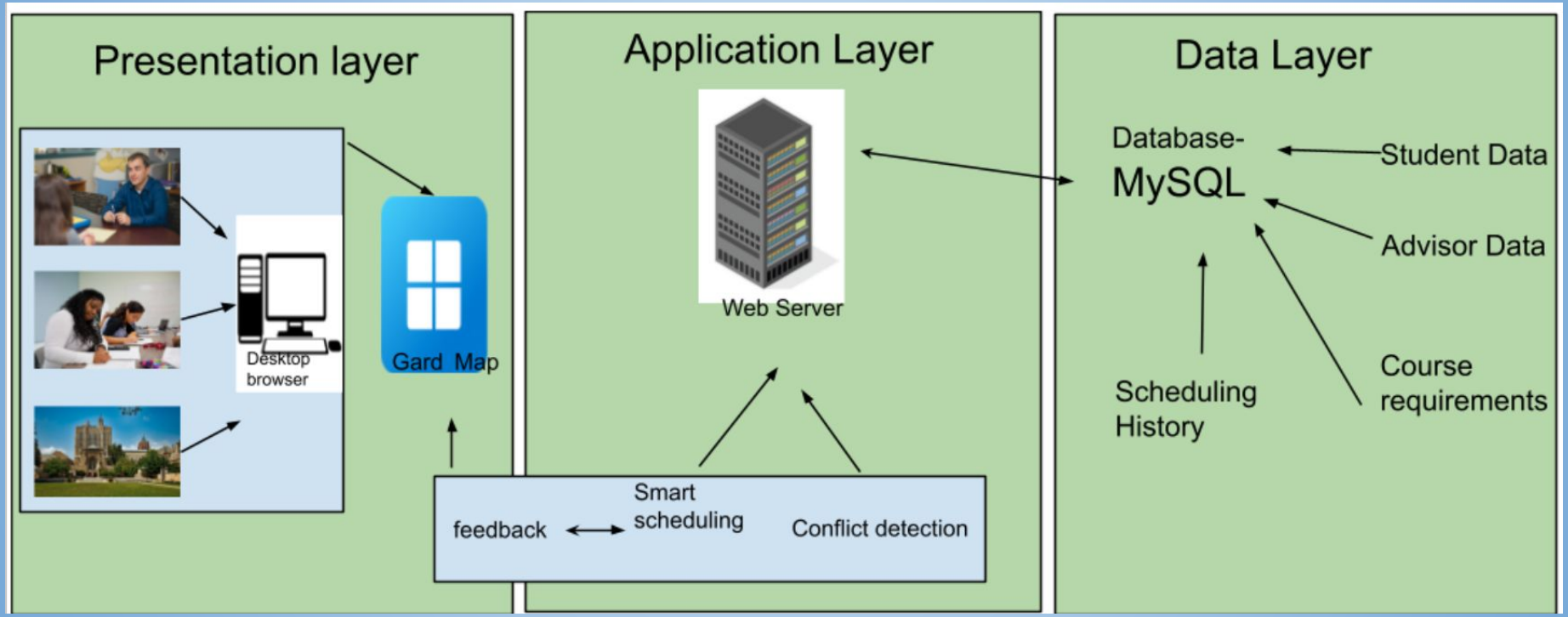
DegreeWorks - (South Texas College)

Internal Systems - (Coursedog)

Major Functional Components

- Operating System - Cross platform(windows, macOS, linux) Our system will work on any OS where the web server and database are supported.
- Web Server - Apache, Nginx, or Microsoft IIS
- Database - MySQL will store schedules, requirements, and user data..
- Server Side Language - Java

Major Functional Components Diagram



Development Tools

- **Integrated Development Environment (IDE)** - VSCode
- **Version Control** - Git through GitHub
- **Continuous Integration (CI) and Continuous Deployment (CD)** - GitHub Actions and GitHub Workflows all through GitHub

What It Will Do

Functionality

- GrapMap is a web application that automatically build personalized class schedules for students that will do the following:
  - Individual degree requirements
  - Course availability
  - Personal preferences
  - Generates a draft plan that is shared with advisors for review and approval

What It Will Do (cont.)

Automated Smart Scheduling

- Instantly generates personalized class schedule that will just take moments for students and even the advisors
- Accounts for degree requirements, prerequisites, and course availability which all impact student course scheduling
- Integrates student preferences and time constraints that allow for the student to have a say of what their schedule looks like
- Provides real-time conflict detection and alerts

What It Will Do (cont.)

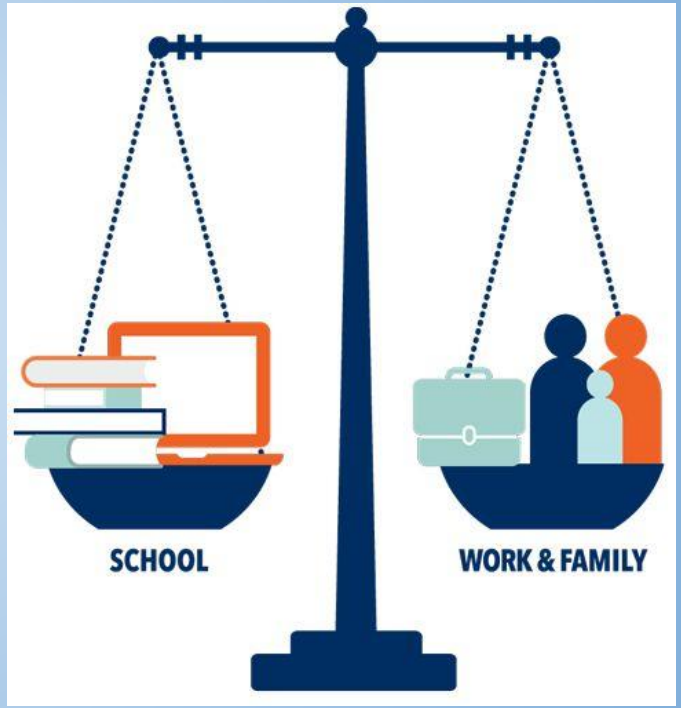
Conflict Detection

- Identifies time conflicts between courses instantly
- Flags any degree requirement gaps to present delays in graduation which will save time and money
- Alerts users of overlapping prerequisites or corequisites
- Detects course credit overloads and underloads if applicable
- Ensures that every schedule will remain degree complaints and will be on track for you to graduate on time

What It Will Do (cont.)

Load-Balancing Recommendations:

- Recommend a student to take less courses if they choose multiple
- Recommend taking classes before or after others to help further student education
- Try to recommend courses if not a lot of them have been chosen
- Factor in student availabilities

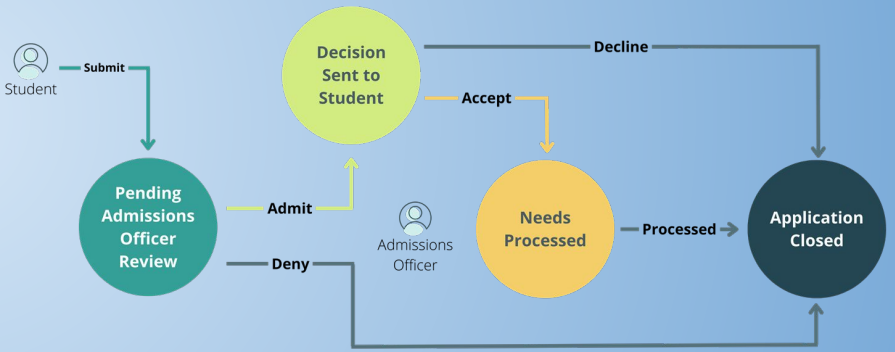


(Pinterest)

What It Will Do (cont.)

Streamlined Workflow:

- Suggest courses that should come next as the student works towards their desired degree
- Suggest valid electives that will work towards the degree
- Keep track of past courses



(CognitoForms)

What It Will Do (cont.)

Constraint Blocks for Students

- GradMap will be personalized for each student, and for constraints that conflict with necessary class scheduling, it will compile a list of recommended actions to take in the case of an unavoidable time conflict.
- If the conflict cannot be resolved, it will compile a list of recommended substitute classes, or if the class is a necessary prerequisite, then it will inform the student that their schedule needs to change immediately.

What It Will Do (cont.)

Advisor Review

- The program will combine all of the User's preferences and availability into a schedule to be sent to their advisor for review.
- The advisor can navigate to the schedule and click to approve or reject the prototype schedule.
- In the case of a rejection, the advisor must put in additional information as to what is wrong with the schedule and suggestions to amend it.

What It Will Do (cont.)

Requirements Checker:

- Degree Requirement Validation
- Real-Time Feedback
- Progress Tracking
- Error Prevention
- Advisor Collaboration Support

What It Will NOT Do

Automated Registration

We will generate conflict-free schedules, but actual enrollment will still be handled through the university's official registration system for security and policy reasons.

Financial Aid / Billing

These functions involve sensitive financial data outside the scope of course scheduling.

Major/Program Changes

Students must still meet with advisors to formally switch majors or degree plans. We will only display degree progress for the current program.

Risk Matrix

	Insignificant	Minimal	Moderate	Major	Critical
Certain					
Likely				Lack of Training and Support High Server Load	
Possible		Copyright Infringement	Integration with School Systems Conflict Detection Error		Data Breach
Unlikely				Unreliable Data Storage	Inaccurate Advice
Rare					

Customer & End User

Inaccurate Advice:

- Risk:
  - Advice is given to a student causing (Searcy):
    - Conflicts of Interest
    - False Degree Paths
- Probability:
  - 2 out of 5
- Impact:
  - 5 out of 5

Inaccurate Advice:

- Mitigation:
  - Design a filter that blocks out certain courses from being advised based on:
    - Student's History
    - Student's Degree Path
    - Student's Time Constraints
  - This will keep the system from providing any false suggestions and keep a student from choosing to take incorrect courses

Customer & End User (cont.)

Lack of Training and Support:

- Risk:
  - A student is unable to ask questions about courses and receive reliable responses causing (Searcy):
    - Unwanted Stress on the Student
    - Miscommunication with the Student
    - Misunderstanding with the Student
- Probability:
  - 4 out of 5
- Impact:
  - 4 out of 5

Lack of Training and Support:

- Mitigation:
  - Implement a training and support system:
    - Training the System on Frequently Asked Questions
    - Providing Ways to Contact Human Advisors for Help
  - This will grant students ways to get help and understand something they have questions about

Technical

Risk ID	Description	Impact	Probability	Mitigation
T1	Integration with existing college systems such as Degreeworks may fail or produce inconsistent data due to incompatibilities.	Major, 3/5	Possible, 3/5	Take care of this with early testing of sample university data, create robust API and failure handling API.
T2	High server load may lead to slow performance during peak registration times, affecting the stability of our application.	Critical, 4/5	Likely, 4/5	Implement cloud infrastructure, use load balancing, and perform alot of testing under simulated peak times.
T3	Errors in schedule conflict detection could generate inaccurate results for students. This could cause user mistrust in the app.	Major, 3/5	Possible, 3/5	Use unit testing with known conflicts or issues. Review with advisors and student feedback to ensure errors are being detected and handled correctly.

Security

Data Breach/ Unauthorized Access

- Sensitive student and advisor data such as scheduling information, degree progress, and personal university information could be exposed due to poor access control.
- Probability:3/5
- Impact: 5/5
- Mitigation:
  - Use encrypted connections like HTTPS or SSl and database encryption to prevent easy data breaches
  - Potentially have regular security audits and testing that looks for any sort of data or access breaches (vulnerability testing, penetration testing)

Security (cont.)

Unreliable Data Storage

- Data could be intercepted or leaked if transmitted or stored without proper encryption
- Probability: 2/5
- Impact: 4/5
- Mitigation:
  - Use secure APIs and token-based authentications for communications between components
  - Update dependencies to patch vulnerabilities

Legal

Copyright Infringement

- Application could be seen as too similar to competitors, and used information can only be legally obtained.
- Probability: 3/5
- Impact: 2/5
- Mitigation:
  - Ensure layout and logo do not conflict with other competitors
  - Only use publicly available information and user inputted queries.

Feature Table

Feature	Student	Academic Advisor	Admin
Account Management			
Request an Account	x	x	x
Register for an Account	x	x	x
Update/Modify Password	x	x	x
Add User Details to Profile	x	x	x
Delete Account	x	x	x
View User Account	x	x	x
View User History	x	x	x
Preview GradMap Features	x	x	x
Scheduling			
Generate Conflict-Free Schedule	x	x	x
View Schedule Alternatives	x	x	x
Highlight Required/Critical Courses	x	x	x
Share Schedule with Advisor	x	x	x
Approve/Reject/Modify Student Schedule		x	x
Receive Alerts for Conflicts	x	x	x
Course Management			x
Track Degree Requirements	x	x	x
Suggest Alternative Courses		x	x
Access Historical Schedules		x	x
Notifications & Alerts			
Receive Schedule Updates	x	x	x
Advisor Feedback Notifications	x	x	x
System Alerts for Admin			x
System Administration			
Manage Users & Roles			x
Customize Course & Semester Settings			x
Monitor System Activity & Logs			x
Ensure Data Privacy & Compliance			x

User Stories (Administration)

As an administrator, I would like to…

- Add courses for students to be able to sign up for using the GradMap Application.
- Add or remove professors and other staff members from the system.
- Manage prerequisites and corequisites for classes.
- Add external restrictions relating to majors or minors in certain classes.
- Update class information at any time.
- Add new areas of study (majors, minors, postgrad).
- Collect data and analytics regarding classes.
- Manage registration deadlines.
- Be able to track student enrollment numbers and trends
- Generate and access reports on course demand, enrollment, and graduation numbers.
- Monitor overall system activity to ensure accurate data and performance.

User Stories (Advisor)

As an advisor I would like to…

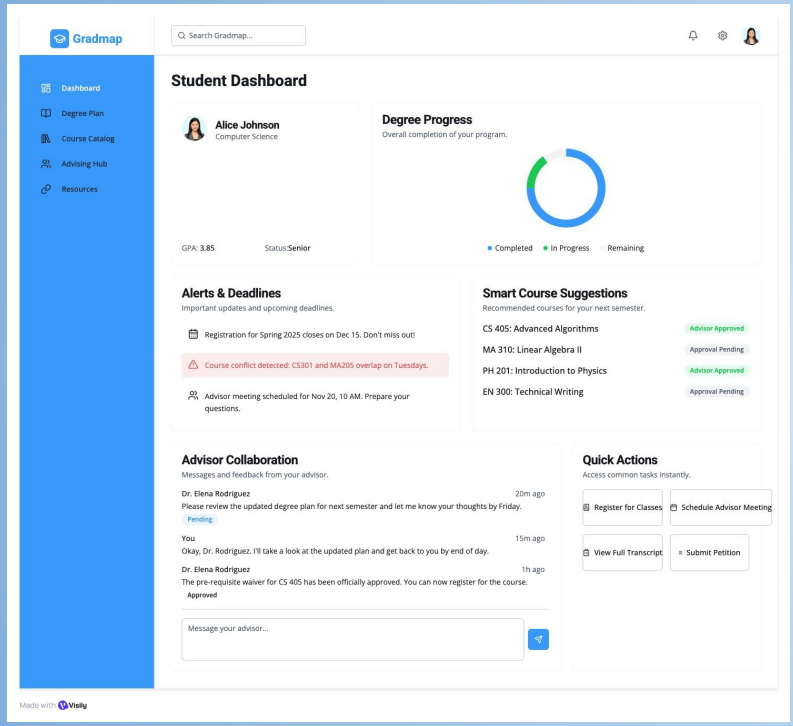
- Review and approve my student's courses for the next term.
- See the student's university information.
- Visit the student's current degree progress.
- Search up any of my student's GradMap.
- Comment on any of my student's planners.
- Contact any of my students through GradMap.
- Send global alerts to all of my students.
- Approve advising appointments scheduled by students.
- Check if students meet prerequisites before course approval.
- Identify and resolve potential schedule conflicts for students.
- Monitor long-term student progress.
- Identify popular course patterns.

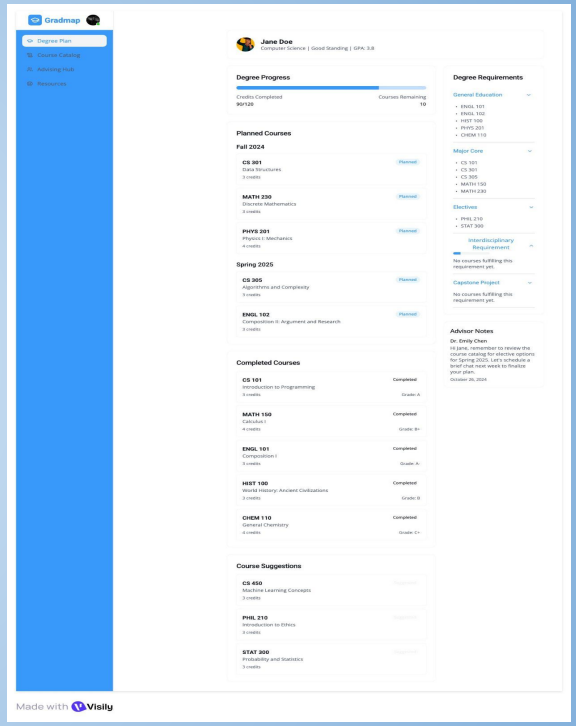
User Stories (Student)

As a student, I would like to …

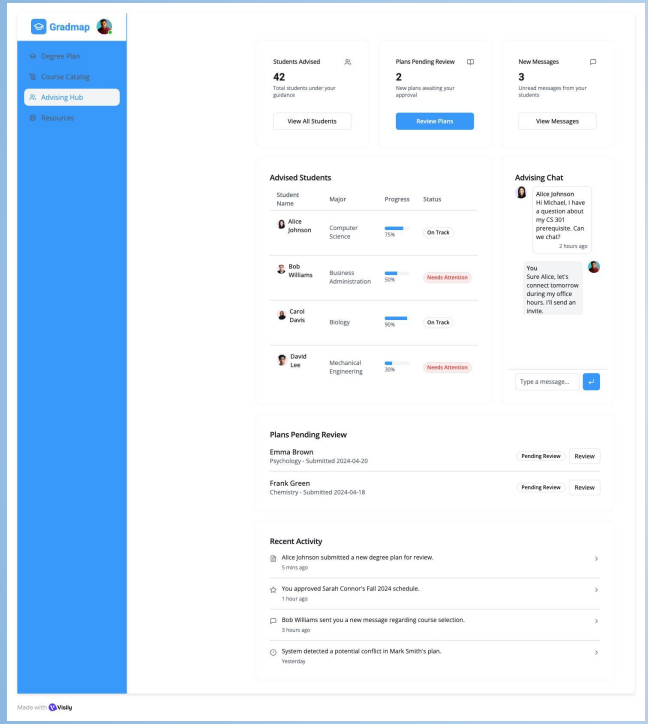
- Have a draft of my course schedule that keeps me on track to graduate on time each semester.
- Have a way to reach out to a human advisor if I require assistance.
- Have a history of my previously taken courses so I can keep track of what I have done.
- Get alerts for when class registration is open to not miss the deadline.
- Manage my class registration and withdrawal if needed.
- View my class schedule in GradMap interface.
- View all prerequisites and corequisites regarding available courses.
- View my projected time until graduation.
- Receive alerts for schedule conflicts or missing prerequisites.
- Get reminders for key semester deadlines.
- View personalized course recommendations.
- Receive notifications or messages from advisors through GradMap.

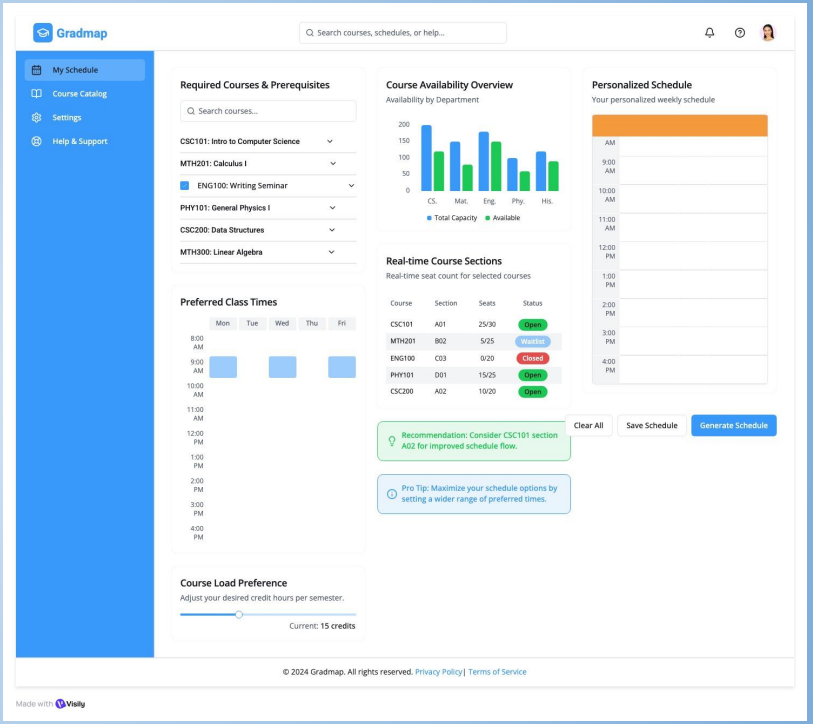
User Interface Mockups





User Interface Mockups





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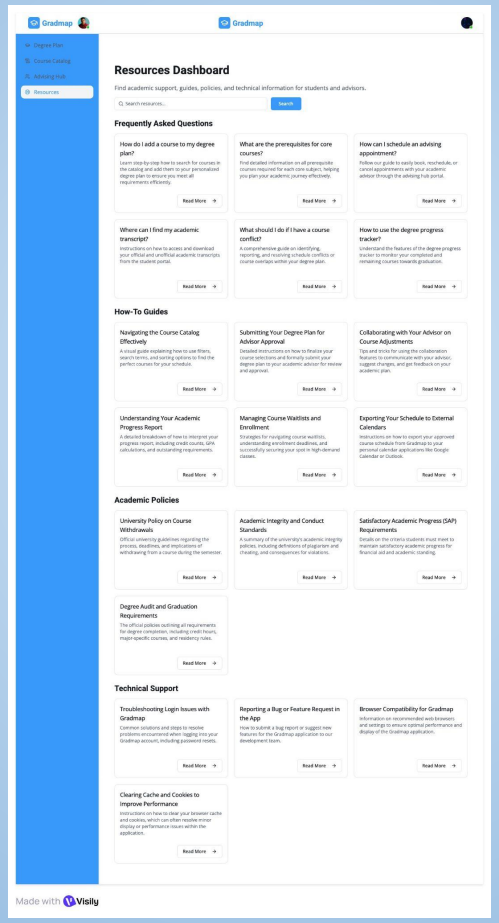
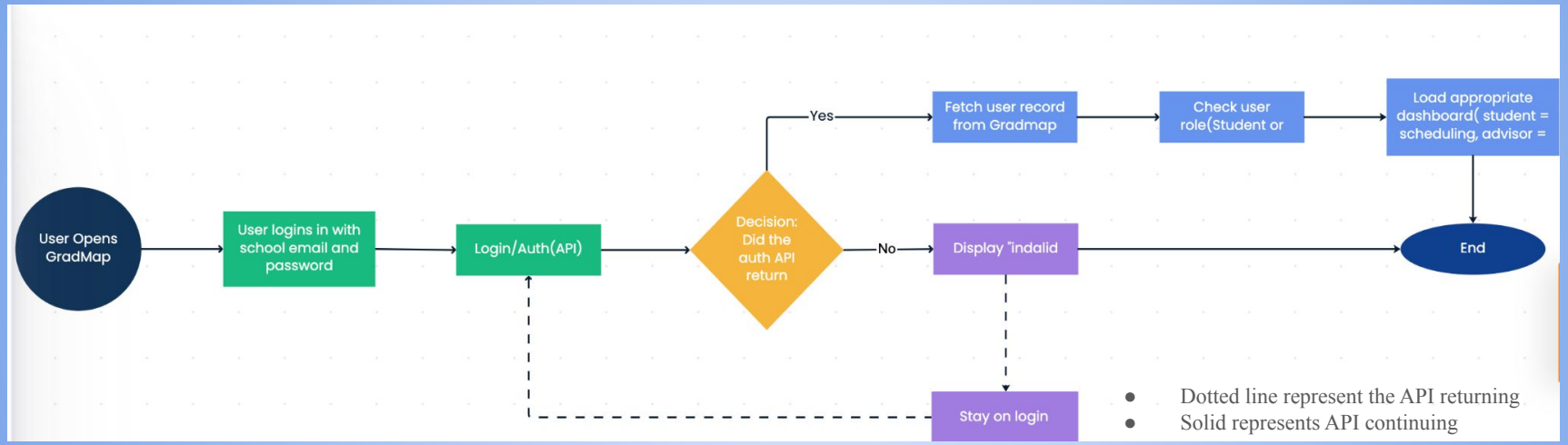


Algorithms

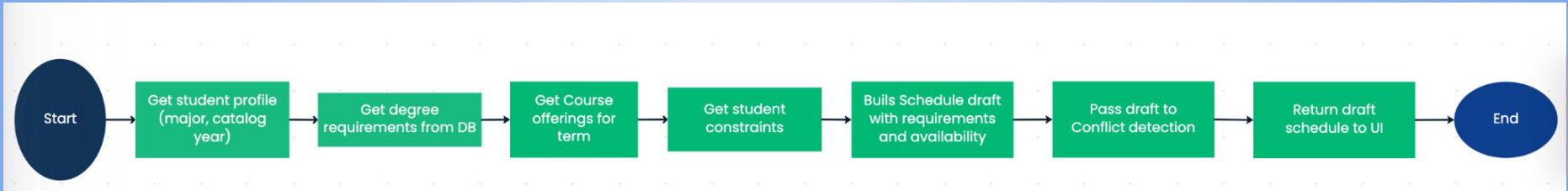
Non-Trivial Backend Logic Task:

- Authenticate User- Handles secure student/advisor login and account access.
- Schedule Generation- Auto builds a draft class schedule using degree requirements, course availability, and student time constraints.
- Conflict detection- detects overlapping class times, prerequisite problems, and credit overload in real time.
- Requirements Validation- Check the generated schedules against the student's degree pan to ensure it is degree- compliant.
- Substitute Course Suggestions- When a conflict/constraint occurs, find vails alternatives or electives that still allows the student to move forward with their degree.
- Advisor Review- Routes the draft schedule to the advisor, records and approval or rejection and records any advisor feedback.
- Notification Email(API)- send an email alert when schedule is ready or when advisor leaves feedback.

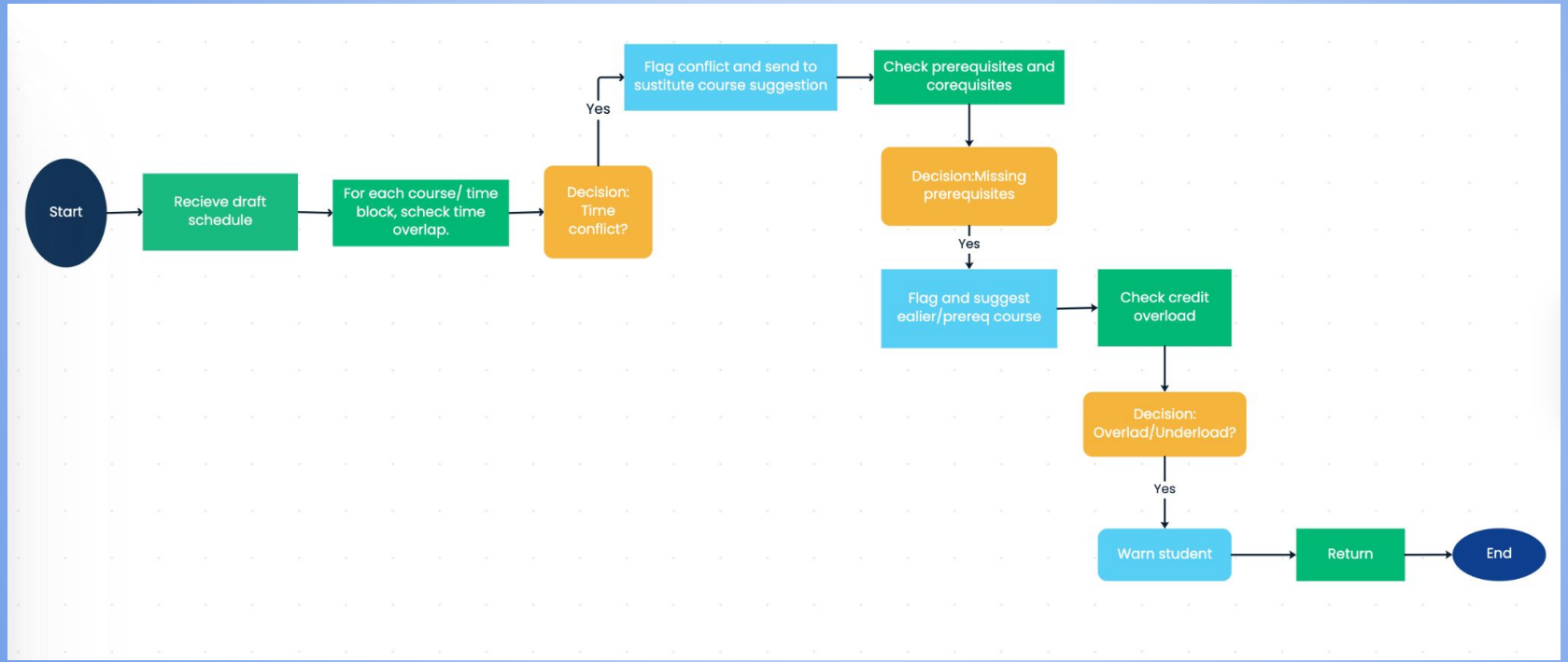
Algorithms - Authenticate User



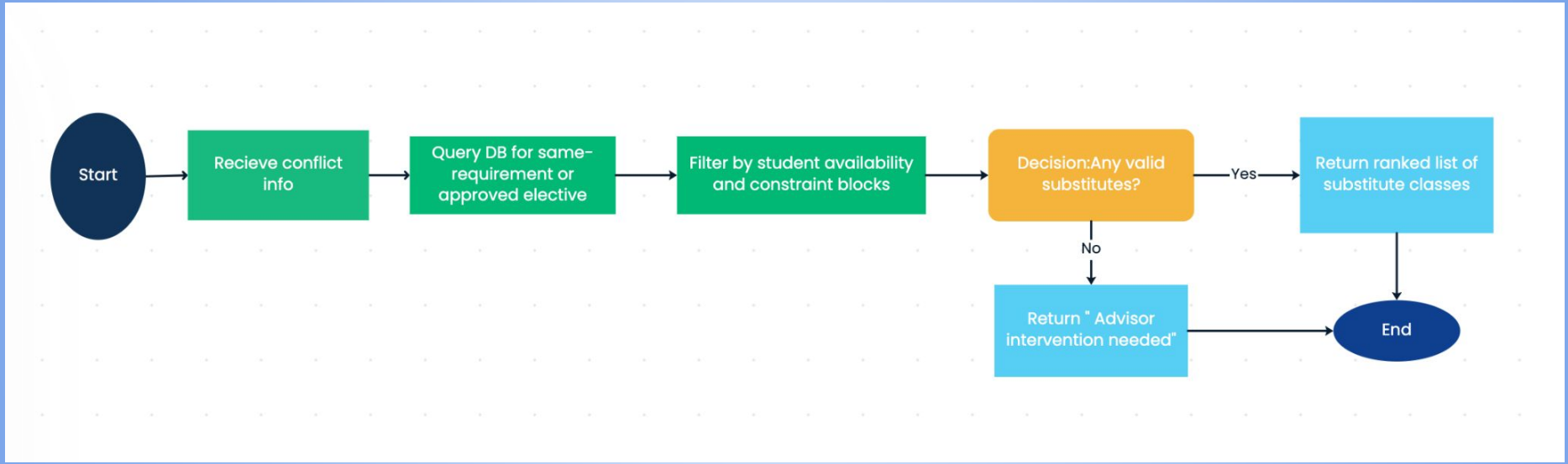
Algorithms- Schedule Generation



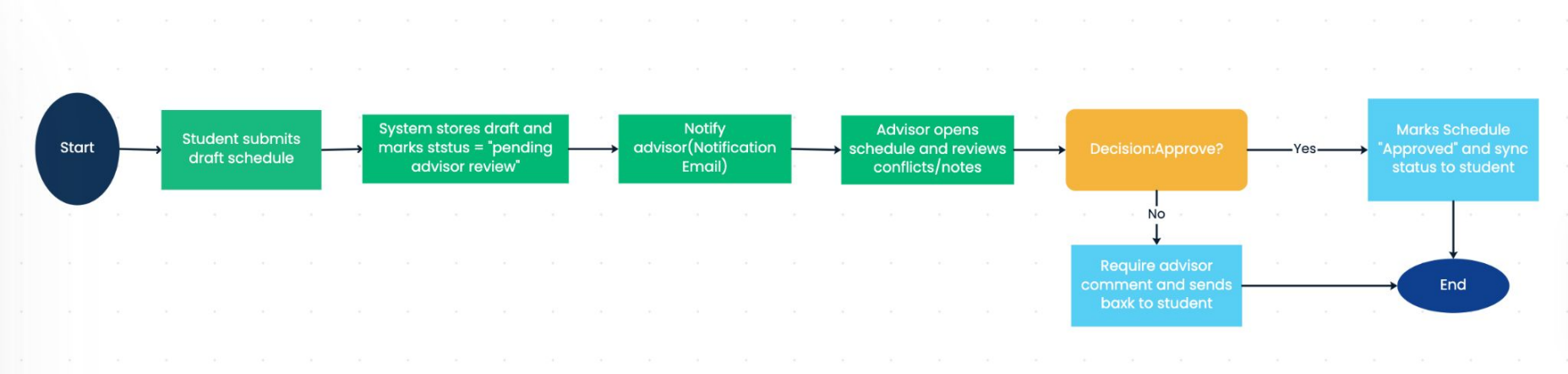
Algorithms- Conflict Detection



Algorithms- Substitute Course Suggestion



Algorithms- Advisor Review



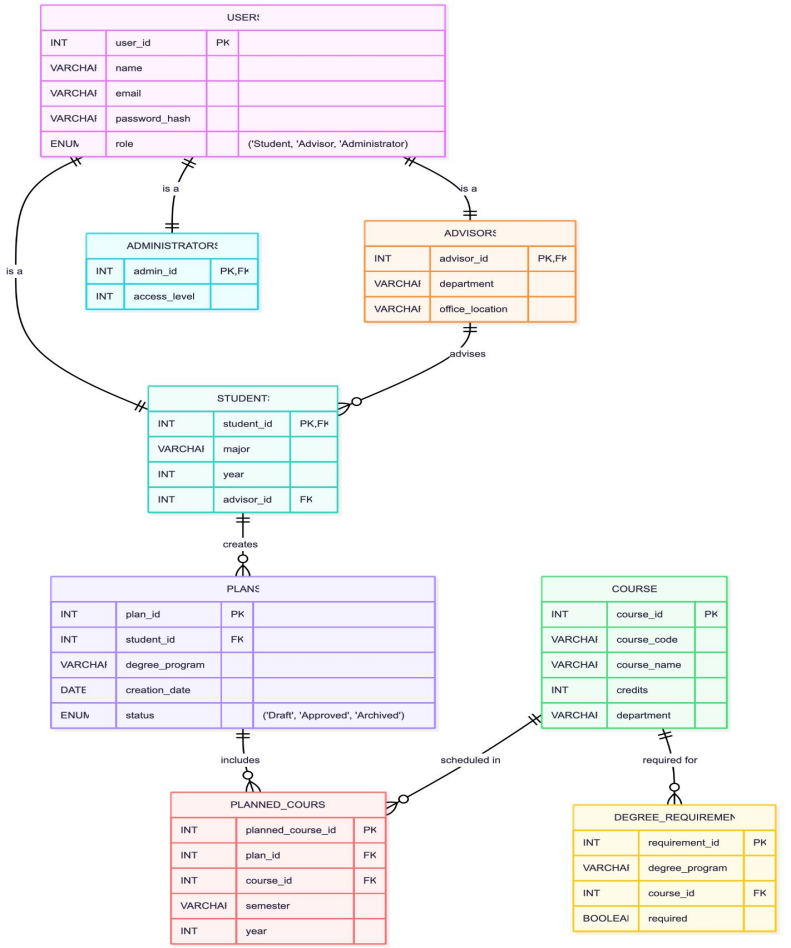
External APIs

- Login/Auth API- Used only in Authenticate User module to validate user credentials and load role.
- Email/Notification API- Used in Advisor Review module and notifications email module to tell advisor and students that a schedule was submitted, approved, or needs changes.

Implementable Module(verb)

- Authenticate User Module
- Schedule Generation Module
- Conflict Detection Module
- Requirement Validation Module
- Substitute Course Suggestion Module
- Advisor Review Module
- Notification Email Module

Database Schema



Data Management Approach:

This will use normalization to eliminate redundancy and maintain integrity across all tables.This will implement primary keys, foreign keys, and check constraints for enforcement. Providing stored procedures and use indexing strategies will improve query performance and help with repeatable logic with the data. Incorporating cloud-based scaling will allow the data to be scalable and well supported using a relational database (MySQL, SQL Server, etc.).

Sprint Plan

Sprint 0:

- Students, administrators, and advisors will have a way to login to GradMap
- Students and advisors will each have a profile to contain their information
- Administrators will be able to use a student view mode

Sprint 1:

- Students will be able to view a class schedule in GradMap interface
- Students will have a history of their previously taken courses so they can keep track of what they have done
- Advisors will be able to search up any of their student's GradMap
- Advisors will be able to see a student's university information

Sprint Plan (cont.)

Sprint 2:

- Administrators will be able to add or remove professors and other staff members from the system
- Administrators will be able to add new areas of study (majors, minors, postgrad)
- Administrators will be able to add courses for students to be able to sign up for using the GradMap Application
- Administrators will be able to update class information at any time
- Students will have a way to create a draft of their course schedule that keeps them on track to graduate on time each semester

Sprint 3:

- Administrators will be able to manage prerequisites and corequisites for classes
- Students will be able to view all prerequisites and corequisites regarding available courses
- Administrators will be able to manage registration deadlines
- Students will get alerts for when class registration is open to not miss the deadline
- Students will get reminders for key semester deadlines

Sprint Plan (cont.)

Sprint 4:

- Advisors will be able to review and approve their student's courses for the next term
- Advisors can check if students meet prerequisites before course approval
- Advisors will be able to look at their student's current degree progress
- Students will be able to view their projected time until graduation
- Students will be able to manage their class registration and withdrawal if needed
- Advisors will be able to identify and resolve potential schedule conflicts for students
- Advisors will be able to monitor long-term student progress

Sprint 5:

- Advisors will be able to comment on any of their student's planners
- Students will have a way to reach out to a human advisor if they require assistance
- Advisors will be able to approve advising appointments scheduled by students
- Advisors will be able to contact any of their students through GradMap
- Advisors will be able to send global alerts to all of their students
- Students will receive alerts for schedule conflicts or missing prerequisites
- Students will be able to receive notifications or messages from advisors through GradMap

Sprint Plan (cont.)

Sprint 6:

- Administrators will be able to add external restrictions relating to majors or minors in certain classes
- Administrators will be able to collect data and analytics regarding classes
- Administrators can generate and access reports on course demand, enrollment, and graduation numbers
- Administrators can monitor overall system activity to ensure accurate data and performance

Sprint 7:

- Administrators will be able to track student enrollment numbers and trends
- Advisors can identify popular course patterns
- Students will be able to view personalized course recommendations

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