DegreeFlow
System Requirements Document
Group 04

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Team Member Contributions

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• 5.5, 5.6, 5.7	Yanchun Wang

1.0 Revision History

Version Number	Authors	Description	Date
0	• Anderson Zhou • Aniruddh Arora • Anupam Raj • Harshit Sharma • Sarah Neelands • Yanchun Wang	Started Initial Draft	October 11th, 2024
1	• Anderson Zhou • Aniruddh Arora • Anupam Raj • Harshit Sharma • Sarah Neelands • Yanchun Wang	Final Draft	**Feb 15,2025**

1.Purpose of the Project

1.1 User Business

The McMaster Engineering Society (MES) requires a website to help students manage their degree progress, plan schedules, and receive real-time alerts on seat availability. The system will parse unofficial transcripts to suggest courses for graduation,help target minor completion, and provide pathways for students who switch programs.

1.2 Goals of the Project

DegreeFlow, will be a platform that tracks students' academic progress while offering course suggestions based on their unofficial transcripts for both degree and minor completion. It will also provide tailored academic paths for students who switch programs. The platform will also offer real-time alerts on course availability along with course difficulty ratings.

2. Stakeholders

2.1 Client

The client for this project is the McMaster Engineering Society (MES), represented by Luke Schuurman, the supervisor of the project. MES requires a tool to help students manage their degree progress, plan academic schedules, and receive real-time alerts regarding course availability and deviations from their academic plan.

2.2 Customer

The primary customers are McMaster University students. These students will use the platform to track their degree progress, explore different academic pathways, and optimise their schedules based on course availability and academic requirements. The platform will directly benefit students who need personalised, real-time academic planning solutions.

2.3 Other Stakeholders

Other stakeholders include:

- University Administration and Academic Advisors: They may interact with the system to help guide students in their academic planning, as well as monitor and ensure compliance with degree requirements.
- IT Department of McMaster University: Responsible for maintaining the systems (e.g., Mosaic, CreateMyTimetable) with which the platform integrates

2.4 Hands-On Users of the Project

The hands-on users of DegreeFlow will primarily be the students at McMaster University. These users will access the web-based platform to:

- View and plan their degree progression.
- Receive notifications about course availability (e.g., through a seat alert system).
- Explore alternative academic paths based on personal goals and completed courses.

2.5 Personas

- First-Year Students: A new student planning their courses for the upcoming years, ensuring they meet all prerequisites and plan their degree efficiently.
- Graduating Students: A student nearing the end of their degree, needing to ensure they have completed all the necessary courses for graduation.
- Students Switching Majors/Minors: A student looking to explore the effects of changing majors or minors and how it would impact their graduation timeline.
- Advisors: Academic advisors using the tool to assist students in planning their academic journeys(SRS overview).

2.6 Priorities Assigned to Users

- High Priority: Graduating students and students switching majors/minors who need real-time alerts and course planning to ensure they stay on track.
- Medium Priority: First-year and mid-program students who need to explore alternative paths or plan future courses.

2.7 User Participation

Students will engage with the system via a secure login, using McMaster's authentication protocols (OAuth via Auth0). They will provide ratings on courses difficulty, plan their academic path, and adjust it based on real-time alerts.

2.8 Maintenance Users and Service Technicians

Once handed over to MES, the IT department and System Administrators at McMaster University will be responsible for maintaining the backend and ensuring the system's smooth operation. Maintenance users will handle server management, database upkeep, and integration with McMaster's existing systems like Mosaic.

3. Glossary

Term	Definition
MES	McMaster Engineering Society – The client for this project, responsible for managing and overseeing the implementation and maintenance of the DegreeFlow platform.
DegreeFlow	The name of the platform being developed, which helps students plan their degree progress, receive real-time course alerts, and explore different academic pathways.
API	Application Programming Interface – Used to integrate the platform with external systems like McMaster's Mosaic and Academic Calendar for real-time data retrieval.
Mosaic	McMaster University's student information system, which provides course availability, student transcripts, and degree requirements that will be integrated into the DegreeFlow system.
CreateMyTimetable	A McMaster platform that students use to plan their academic schedules, which will be integrated into DegreeFlow to help optimise course selection and resolve conflicts.
Azure SSO	Azure Single Sign-On – Microsoft's identity service used by McMaster University for secure student login to the platform.
Seat Alert	A notification system that informs users when a spot becomes available in a previously full class, event, or booking system.
Academic Pathway	The personalised route students follow to complete their degree, including the courses they take, prerequisites, and requirements.
PDF Parsing	The process of extracting relevant academic information from student-uploaded PDF transcripts to suggest courses and track degree progress.
What-If Scenario	A feature that allows students to explore alternative academic paths and see how changing courses or majors would impact their time to graduation.

Prerequisite	A course or set of courses that a student must complete before enrolling in a higher-level course.
Gmail SMTP	A third-party service used for sending SMS notifications about seat availability and course changes.
Postgres	A backend-as-a-service solution used for real-time database management in the DegreeFlow platform.
AES-256	Advanced Encryption Standard – A data encryption method used to secure sensitive student data in the system.

4. Non functional requirements

Relevant facts

- This project will be hosted on the MES domain

Business rules

1. The time table can only contain a maximum of max_course_amount courses
2. Interactive degree builder can only contain a maximum of max_degree_amount degrees
3. Interactive degree builder can only contain a maximum of max_minor_amount degrees
4. User can only edit one schedule at a time
5. If a user has a conflict in their schedule, the appropriate alert message must be displayed immediately
6. If a user's plan is conflicted by their current selections, the appropriate conflict message must be displayed immediately
7. If a user provided incorrect/irrelevant information (incorrect transcript upload, .etc), then the appropriate error message must be displayed immediately

Assumptions

a) Technical assumptions
   i) Assume the users has a device that has connection to the internet
   ii) Assume the users has a device that can run basic websites like mosaic, MyTimeTable .etc
   iii) Assume the browser supports websites like mosaic, MyTimeTable .etc
   iv) Assume the users are able to login to their mosaic account

b) Operational assumptions
   i) Assume the users can navigate a basic website with intuitive UI
   ii) Assume the users understands the basics of drag & drop style uploading / uploading via file explorer
   iii) Assume the users understand the basics of degree planning (the idea of prerequisites, electives, technical electives, required courses .etc)
   iv) Assume the users has/can use & navigate mosaic / MyTimeTable
   v) Assume the users has access to their transcript

c) Business assumptions
   i) Assume that a stable internet connection will be available

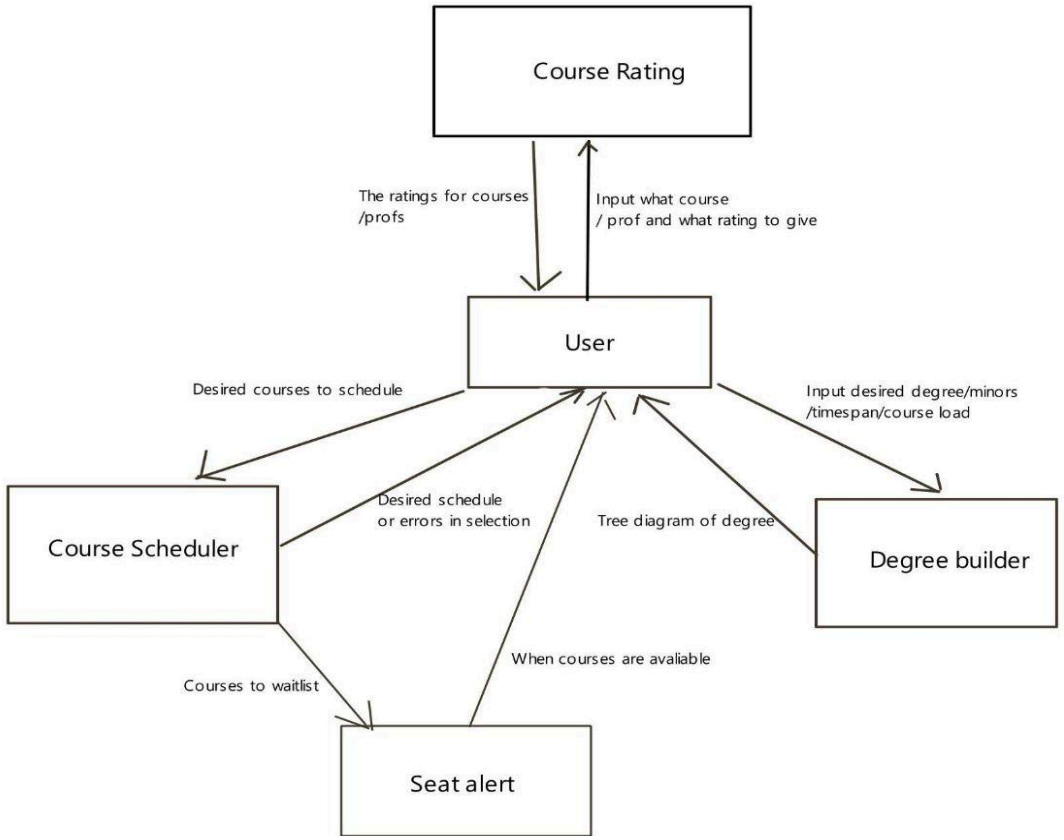
d) Environmental assumptions
   i) Assume that the user is in a region where all these services (mosaic, MyTimeTable, .etc) are not blocked

5. The scope of the work and product

5.1 The current situation

The current degree planning process at McMaster University presents several challenges to students. Many students are not aware of which classes need to be taken in which term. The academic calendar is marginally beneficial, but it becomes especially difficult when students deviate from the standard academic pathways. Many students rely on manual methods, such as making their own excel sheets to map out what their degree will look like. Additionally, the current system lacks the personalised insights into student performance. Our project aims to replace these outdated and inefficient methods with a comprehensive platform.

5.2 The context of the work



5.3 Work Partitioning

Event name	Input/Output	Summary
User inputs course/prof rating	Course rating(IN) / Course code(IN) / Prof rating (IN)/ Prof name(IN)	User chooses their rating for either a course or a prof
User inputs their desired degree/ minor	Desired degrees(IN)/ Desired minors(IN)/ Desired timespan(IN)/ Desired course load(IN)/ Interested courses(IN)/ Unfeasible degree plan (OUT)	User chooses what courses/degrees they are interested in and if it is unfeasible (too low/high of a course load, too long/ short of a timespan .etc) then the

		system will tell them
User inputs their desired course that's full right now	Course code(IN)/Notification when course is available (OUT)/waitlist position(OUT)	Notifying students about availability when more seats open for this specific course.
User inputs their desired courses	Desired courses(IN)/Desired time slots(IN)/ Errors in selection (OUT)	Users schedule their courses for the semester and if there are errors in selection (conflicts, too much courses, prerequisites missing .etc) then the appropriate error will be displayed

5.4 Specifying a business use case (BUC)

Real-time notifications: The students have an academic plan of their specific program stored in the system. The students will be able to receive timely notifications regarding any issues with their academic plans. For example, DegreeFlow will notify students when they deviate from their recommended academic paths, or if they miss any prerequisites or course availability changes.

5.5 Product Boundary

Internal Components:

- *User Interface (UI):* The system will have a web-based front end (and potentially a mobile version) that allows students to interact with their degree plans, view academic progress, and receive personalised recommendations.
- *Personalised courses recommendations:* The system will predict student success in courses and suggests optimal academic paths based on historical performance and other factors.
- *Backend & Data Management*: The backend will store students' information, course data and academic progress in a secure database. It will also integrate with the McMaster Academic Calendar API to gather course information.

External Components:

- *McMaster Academic Calendar API*: Provides real-time course data, including availability, prerequisites, and course descriptions.

Product Constraints:

- *Login Security*: The system must ensure secure login for students, and login credentials must be encrypted in transit to prevent any possible leak or unauthorised access.
- *Data Privacy*: The system's handling of student data requires adherence to McMaster University's data privacy policies as well as security standards.
- *Session Management*: Sessions must expire after a certain period of inactivity to prevent unauthorised access if a student forgets to log out of the system.

5.6 Product Use Case Table

ID	Use Case Name	Description	Actors
01	Degree Progress Tracking	Track a student's academic progress toward graduation.	Student
02	Real-Time Notifications	Notify students of deviations from their academic plan.	Student
03	What-If Scenario	Explore alternate academic paths and their impact on progress.	Student
04	Automatic Course Scheduling	Automatically suggest course schedules based on availability.	Student, System
05	Seat Availability Alerts	Notify students when seats in previously full courses open up.	Student
06	Authentication & User Management	Secure login and account management for students.	Student, System
07	PDF Parsing	Parse the PDF texts by the given unofficial transcripts of students.	Student
08	Difficulty Rating For Each Course	People give stars to the courses difficulty and we can show an average of all the ratings	Student

5.7 Individual Product Use Cases (PUC's)

Degree Progress Tracking

- Description: This feature allows students to view their current academic progress toward their degree, showing completed, ongoing, and pending courses.
- Preconditions: The student is logged in, their academic data is available in the system.
- Postconditions: The system displays an accurate, real-time view of the student's progress toward degree completion.

Seat Availability Alerts

- Description: Notify students when seats in previously full courses become available, enabling them to enroll.
- Preconditions: The student has requested seat availability notifications for specific courses.
- Postconditions: The student receives an alert when a seat becomes available in the selected course.

What-If Scenario

- Description: Students can explore alternate pathways and view how changing courses or programs affects their time to graduation.
- Preconditions: The student is logged in and has an academic plan available.
- Postconditions: The system displays the potential outcomes of alternate course choices or changes in major.

Automatic Course Scheduling

- Description: Generate a detailed schedule by semester based on their selected schedules in what - if.
- Preconditions: The system has access to course availability data and how students select their schedule in what - if.
- Postconditions: The student is able to view the selected schedule from what - if.

PDF Parsing

- Description: Parse the PDF texts from students' unofficial transcripts to extract data such as grades, courses, and academic history. This data is then used to provide a more personalised experience, such as degree tracking and course recommendations.
- Preconditions: The student has uploaded an unofficial transcript in PDF format.
- Postconditions: The system successfully parses and extracts the student's academic data from the PDF.

Difficulty Ratings For Each Course

- Description: Students give stars to the course difficulty and the system can show an average of all the ratings.
- Preconditions: The student is logged in and rate a course difficulty.
- Postconditions: The student's rating is submitted, and the course's average rating is updated and displayed.

6. Project Constraints

- The system will be integrated with the platform like the Academic Calendar API. This ensures real-time access to course data, and academic progress.
- The platform will only support unofficial transcripts for parsing. This constraint supports data acquisition but limits the scope of verification to unofficial documents provided by the students.
- Due to the sensitive nature of student academic data, the platform must adhere to McMaster's privacy policies and ensure secure handling of all user information. This includes encryption of data and secure login protocols via McMaster's Azure SSO.
- The platform will be web-based with a focus on desktop use. If time allows, a mobile app version may be developed.
- The platform needs to handle a large number of concurrent users and scale as necessary to meet demand during peak times, such as course registration periods.

7. Functional Requirements

The following functional requirements are priority ranked using the following priorities:

P0 (Minimum Viable Product)

- **Course Search:**
  - **Description:** Users can search for courses by filters such as subject code and level.
  - **Data Required:** Course Catalog.
  - **Back-end Features:** Search engine, filter processing.
  - **Front-end Features:** filter dropdowns, search results.
- **Schedule Generation:**
  - **Description:** Generate detailed schedule by semester based on their selected schedules in what - if.
  - **Data Required:** What if schedule, course offering in mytimetable.
  - **Back-end Features:** Scheduling algorithm.
  - **Front-end Features:** Detailed view on schedule by semester.

- **Integration with Academic Calendar API:**

        - **Description:** Access Academic Calendar API to find real-time information about courses and schedules.
        - **Data Required:** API access, course/schedule data.
        - **Back-end Features:** API calls, data synchronisation.
        - **Front-end Features:** Real-time data updates in the user interface.
    - **Transcript Parsing:**
        - **Description:** Parse unofficial transcript to display the student's current academic achievement and records.
        - **Data Required:** Unofficial transcripts (PDF), course history.
        - **Back-end Features:** PDF parsing, extract text.
        - **Front-end Features:** Upload button.

P1 (High Priority Requirements)

- **Secure Login:**
    - **Description:** Implement secure authentication using OAuth for user/admin login and data privacy.
    - **Data Required:** User credentials, session data, authentication tokens.
    - **Back-end Features:** OAuth integration, session management..
    - **Front-end Features:** Login forms.
- **Seat Alert:**
    - **Description:** Notify users when a seat becomes available in a course that is full.
    - **Data Required:** Real-time course capacity data, user subscriptions.
    - **Back-end Features:** Real time notification system, seat tracking.
    - **Front-end Features:** Subscribe button, real-time notifications.

P3 (Low Priority Features)

- **Course Difficulty Ratings:**
    - **Description:** Users can rate the courses difficulty and also view average difficulty ratings
    - **Data Required:** Student ratings, course data.
    - **Back-end Features:** Rating system.
    - **Front-end Features:** 5-star rating input, average ratings display.
- **Advanced What-If Scenarios:**
    - **Description:** Students can explore complex alternate academic paths and their impacts on graduation timelines.
    - **Data Required:** Comprehensive academic plan data, multiple scenario parameters.
    - **Back-end Features:** Advanced scenario modeling, impact analysis.
    - **Front-end Features:** Interactive scenario builder, detailed outcome reports.

8. Look and Feel Requirements

8.1 Appearance Requirements

Colour scheme: The header and main interface will follow McMasters official colour palette, including maroon and gold. The course planner tool will use a wider and brighter colour palette inspired by the mcmaster create my time table.
Layout and design: The interface will be a minimalist design to focus on ease of navigation. The tools like course planner will be presented clearly with intuitive icons. Furthermore the presentation of the degree flow will be simple, by having collapsible sections for the detailed information to reduce distractions.
Accessibility: The design will follow the web content accessibility guidelines, by ensuring that the colours contrast and the fonts that are selected are readable for all users.

8.2 Style Requirements

Consistency: All sections of the user interface will follow a consistent style. Button styles, Input fields and navigation bars will have consistent placement and appearances across all pages for a smooth user experience.
User centred design: The application will aim for the users to be able to navigate the application without guidance. This will be achieved through making use of universal icons, providing tips for feature description, and having an intuitive layout.

9. Usability and Humanity Requirements

9.1 Ease of Use Requirements

The Users must be able to intuitively and easily navigate the system, to ensure that they can perform tasks such as Upload Transcript, Course search, Course select and Turn on seat alerts.

9.2 Personalization and Internationalisation Requirements

The Users must be able to personalise their experience by saving preferences with the system such as favourite courses or departments. Support for the English language is required, with potential future expansion for multilingual support.

9.3 Learning Requirements

The system should require minimal learning, with clear instructions and tooltips to guide new users through the Course search, enrollment and scheduling processes.

9.4 Understandability and Politeness Requirements

All error messages and system responses should be respectful, polite, informative, and easy to understand. Technical terminology should be avoided wherever possible.

9.5 Accessibility Requirements

The system must comply with WCAG 2.1 accessibility standards, ensuring users with disabilities can navigate the platform, including keyboard navigation and screen reader support.

10. Performance requirements

Speed and latency requirements

- For all actions, users with stable connections should be able to obtain feedback < 3 seconds

Security critical requirements

- All user login info should be secure
- All user file uploads should be securely stored
- All user to server traffic should be encrypted
- Any external libraries utilised must introduce security weak points

Accuracy requirements

- The degree plans/course schedule displayed should fulfil user specifications and follow university policies/requirements or an appropriate error message shall be displayed describing the plans violation of graduation/ course enrollment policies.
- Seat alert should alert the correct users regarding the correct courses on time

Robustness / fault tolerance requirements

- These services should be able to handle upwards of thousands of users concurrently.
- There should be enough storage for all user profiles
- User information should not be accessible by any not authorised under all circumstances/errors

Scalability/ extension requirements

- All course scheduling / degree planning algorithms should be easily changeable by authorised personnel in accordance to future changes of university policies
- All course information should be easily editable by authorised persons as course information/availability may vary from semester to semester
- Degrees/ courses should be easily added/removed from the system

11. Security Requirements & Privacy

11.1 Access Requirements

- Authentication-Azure SSO via OAuth will be integrated, using McMaster's Shibboleth system, allowing secure login via the university's credentials (MacID). This ensures seamless and secure access, and simplifies authentication management.

11.2 Integrity Requirements

- Data Accuracy: The system must ensure that all data retrieved from the Academic Calendar API is accurate and up-to-date.Also ensure that correct parsing is done of the unofficial transcript.
- Transaction Integrity: When students upload transcripts or register for notifications for instance seat alert , the system should ensure that no data is lost or corrupted during the process.

11.3 Privacy Requirements

- Student data, including transcripts and academic plans, must be handled in accordance with McMaster's privacy policies.
- Data Encryption: The system will use encryption protocols such as HTTPS for transmission and AES-256 encryption at rest.

11.4 Audit Requirements

- Audit Logs: Logging functionality will be built into the system to track all interactions, such as transcript uploads, course recommendations, and seat alert notifications. After handover, MES will manage these logs for accountability and monitoring security.
- Access Monitoring: MES will regularly review access logs to ensure that no unauthorised individuals are accessing sensitive data. This will involve audits to verify the integrity and security of the system.

11.5 Immunity Requirements

- Automated vulnerability scanning tools such as OWASP ZAP will be used to detect security vulnerabilities like SQL injection, cross-site scripting (XSS), and brute-force attacks. These tools will run scheduled scans to identify and fix issues before they are exploited.
- Backup mechanisms and disaster recovery plans will be developed to ensure that student data is not lost in case of a system failure. Regular backups will be scheduled, and MES will be responsible for maintaining these backups.

12. Legal Requirements:

Data protection laws:

- The application will comply with the Personal Information Protection and Electronic Documents Act (PIPEDA) to protect students personal and academic data.
- The application will comply with the Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) by ensuring that any personal information collected from the students (such as their unofficial transcript) is handled securely.

Consent:

- Users will need to consent to their data being collected before any information is extracted from their unofficial transcript. The request for consent will be obtained through a user agreement displayed before acquiring the unofficial transcript.

13. Off-the-Shelf Solutions

- Azure SSO via OAuth for Authentication: This off-the-shelf solution will integrate McMaster's SSO system via OAuth, allowing secure login for students using their MacID. This will offer seamless authentication and ensure compliance with university policies for secure access.
- Gmail SMTP for Notifications: Gmail SMTP will be used for the seat alert functionality. This will allow for real-time notifications when a seat becomes available in a course.
- Postgres for Real-Time Database Management: Postgres will be used to store and synchronise seat alert data and course recommendations in real-time. It is a cost-effective, open-source alternative to Firebase, providing excellent scalability and minimal backend setup.
- Automated Data Validation Tools: Tools like Pedantic (Python) will be used to ensure that data entering the system is accurate and validated automatically.

- Automated Vulnerability Scanning Tools: Security tools like OWASP ZAP will be implemented to automatically scan the system for vulnerabilities. Will prevent issues like injection attacks

14. Risk and Predicted Issues

Risks

- System Integration: There is a risk that integrating DegreeFlow with systems like Mosaic and the Academic Calendar API could lead to compatibility issues.
- Data Security: Handling sensitive student data poses a risk of security breaches if proper encryption and access control measures fail.
- Scalability: During peak times, such as course registration, the system may not scale effectively, resulting in downtime or performance lags.
- Data Accuracy: Reliance on unofficial transcripts could result in inaccuracies in course recommendations if the data provided is incomplete or incorrect.
- User Adoption: Some students may find it difficult to adopt the system due to unfamiliarity, which poses a risk of low user engagement.
- Course Updates: Delays in updating course offerings or degree requirements could lead to outdated recommendations for students.
- Resource Limitations: Technical and financial constraints may limit the project's scope or cause delays in development.

Predicted Issues

- Integration Delays: Compatibility issues during integration with McMaster's systems may cause delays in accessing real-time data.
- Security Protocol Challenges: Ensuring full compliance with privacy standards may result in technical challenges during data encryption and securing sensitive student information.
- Overload During Peak Usage: System slowdowns or outages may occur during high-demand periods such as course registration, potentially affecting thousands of users.
- Transcript Parsing Errors: Inaccuracies in parsing unofficial transcripts may lead to errors in course suggestions, especially when students provide incomplete documents.
- Update Lag: There may be delays in reflecting new course offerings or degree requirements, causing students to receive outdated academic advice.