

CS 411 Lab 1

Monarch Course Explorer Product Description

Phillip Wilson, Team Silver

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Version 2

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1. Introduction

Registering for classes is an important step and a necessary component to the journey of completing college and earning a degree. However, this process can be a stressful experience for many college students because the ramifications of selecting the wrong courses for a semester can be dire and result in the student wasting money spent on tuition, increasing his or her amount of student debt, delaying graduation, or even dropping out of college. As of 2022, 81 percent of students in the United States work jobs while they are attending college. (Wan,2022) Therefore it is crucial for students to choose courses that align with their lifestyle and work around their employment schedules. Regrettably, they often enroll in courses that fail to meet those criteria.

The main reason for students choosing courses that do not align with their lifestyle, work schedules, or other personal obligations is that they do not have enough information to base their decisions on which classes to take for the semester they are trying to register for. The students are missing updated, helpful, and readily accessible information to assist with making better course selections. They do not have access to course syllabi when registering for classes in a selected semester and some students may not have access to word-of-mouth information from peers or faculty on campus if they attend school online.

The lack of readily accessible information does not only affect students at Old Dominion University; it affects faculty as well. Faculty are limited with the feedback that they receive from students and are often unaware of the ever-changing needs specific to most students. Most faculty do not make syllabi accessible to students during registration periods because course instructors normally publish syllabi with course materials in learning management systems such as Canvas for the upcoming semester in the interim period between the previous and upcoming semesters. Then the course page on Canvas with course materials and syllabi are not accessible

until the first week of class after requiring the student to already be registered for the course. Colleges and Universities such as Old Dominion University lack a centralized platform that offers accessible comprehensive and well managed information on courses such as student feedback, syllabi and student evaluations amongst students and faculty to communicate and cultivate a more customizable and successful learning experience.

1.1 Problem Characteristics

After viewing course offerings in Banner, the registration application utilized by Old Dominion University, a typical O.D.U student looks at the different professors teaching a course and try to gather as much information about them and their courses as possible. They use methods such as asking their classmates, faculty they're acquainted with, or online websites such as reddit.com and ratemyprofessor.com. However, these methods can be very fruitless or unreliable. In fact, students who write reviews aren't verified on ratemyprofesor.com and professors can rate themselves. (Boccaccio, 2018). This often puts students in situations where they must randomly select a section of a course to register for and wait until the first week of class to determine if that class is compatible with their schedule and needs. If they are not satisfied with the original course, they may face obstacles trying to switch to another course. Obstacles such as the desired replacement course being full, which may require a student to join a waitlist where a seat may or may not become available as shown in Figure 1.

Current Process Flow

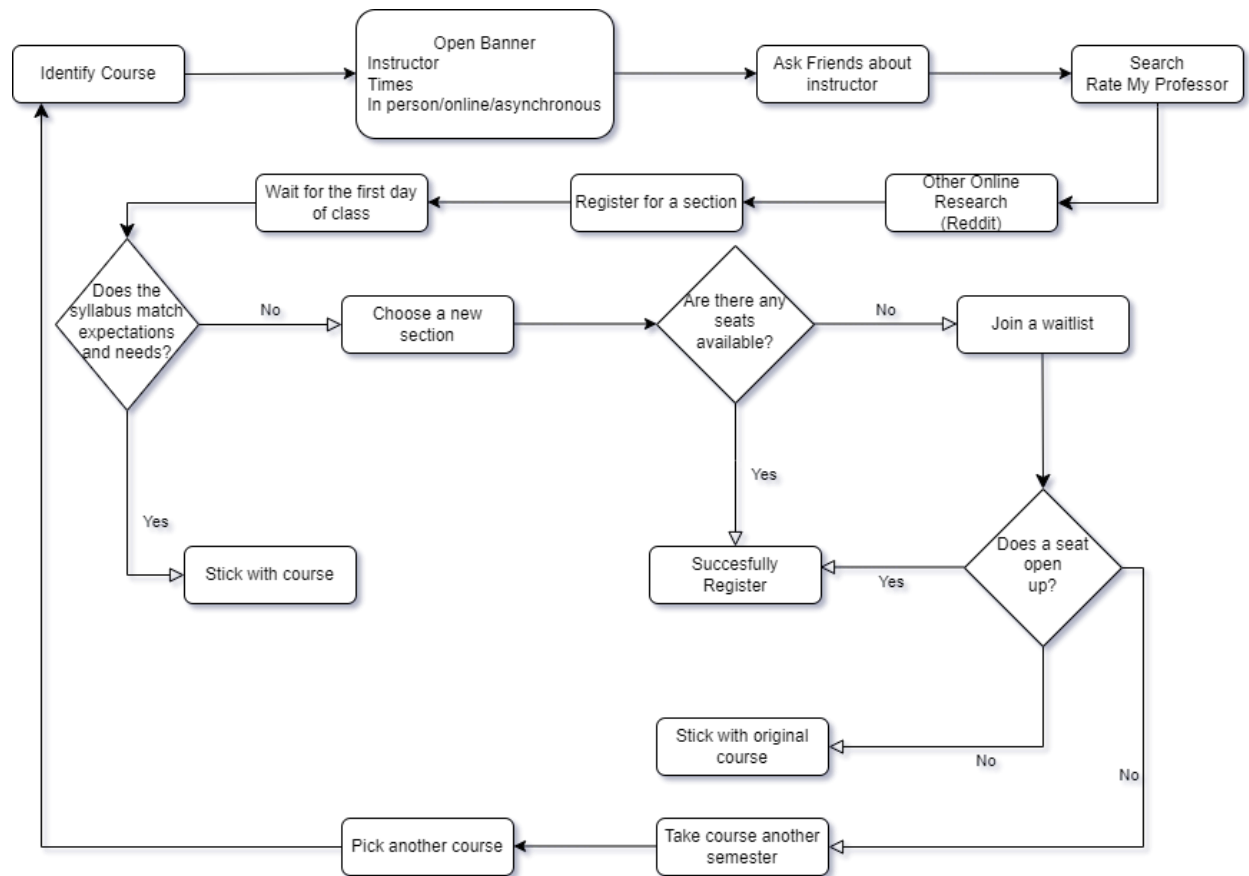


Figure 1 Current Process Flow

2. Monarch Course Explorer Product Description

Monarch Course Explorer aims to be a valuable resource that offers solutions to existing problems with inaccessible information about courses at ODU by offering features to address the characteristics of the problem.

2.1 Solution

The solution to the problem of students lacking enough accessible information to make the most well-informed decisions when registering for courses will be Monarch Course Explorer. Monarch Course Explorer is a program that provides a moderated platform at ODU for students

and faculty to exchange information about the wide range of courses offered, aiming to make the registration process easier for students.

2.2 Solution Characteristics

Students will gain access to syllabi for all courses they are interested in registering for in a selected semester. A syllabus offers the most comprehensive information about a course such as meeting times, grading scales, exam schedules, attendance policies, and all relevant information to give a student a reasonable expectation of the course. Students will also have access to feedback from their fellow students to gain additional insight into a course. After reviewing information from course syllabi and student feedback, the student can get a recommendation from Monarch Course Explorer about which class to take if the student is still uncertain. This will simplify the process as shown in the proposed solution flow (Figure 2), alleviating students from registering for unwanted courses and joining waitlists for classes that are full by the add/drop registration deadline.

Proposed Solution Flow

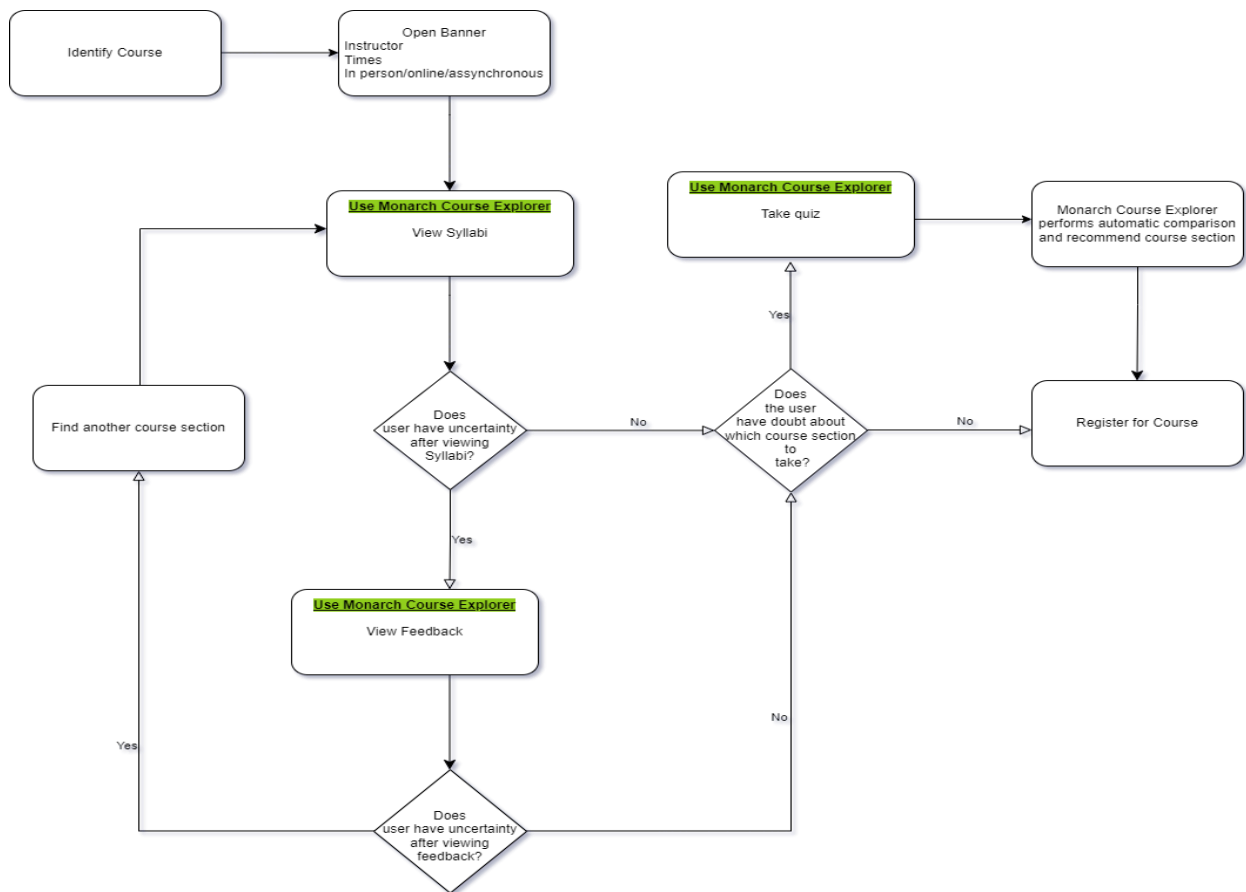


Figure 2 Proposed Solution Flow

2.3 Key Product Features and Capabilities

The key features and capabilities of Monarch Course Explorer were designed to incorporate all solution characteristics.

2.3.1 Core product features

Monarch Course Explorer has many core features to assist students and faculty.

- Monarch Course Explorer will be a repository for course syllabi.

- Monarch Course Explorer will authenticate its users as students and faculty whose members may consist of Advisers, Instructors, and Curriculum Committee Members.
- Monarch Course Explorer will offer students and Advisors the ability to view syllabi for all courses offered.
- Monarch Course Explorer will offer students the ability to sort syllabi by course, instructor, and semester.
- Monarch Course Explorer will offer students the ability to view feedback on courses and the assigned professor.
- Monarch Course Explorer will allow students to give feedback on a course they have taken.
- Monarch Course Explorer will offer course automated recommendations based on a student's preferences.
- Monarch Course Explorer will allow Instructors to upload syllabi.
- Monarch Course Explorer will offer timely feedback to instructors.
- Monarch Course Explorer will allow instructors to comment on feedback.
- Monarch Course Explorer will allow Curriculum Committee Members to review syllabi and ensure they meet necessary standards.

2.3.2 Product Uniqueness

Monarch Course Explorer is unique because it provides core features that simultaneously assist faculty with assessing syllabi and address student's problems of inadequate resources about courses during registration. Monarch Course Explorer will be able to generate course recommendations by matching a student's preferences with data available about the course and its instructor.

2.4 Major Components (Hardware/Software)

Monarch Course Explorer is a web-based application, accessed through a web browser, that requires a connection to the internet. The technologies that will be used to build Monarch Course Explorer will be HTML, CSS, JavaScript, Python, PostgreSQL, and Midas. HTML will be used for user display on the website, CSS will be used for formatting and design of the website, and JavaScript will be used for user interaction on the website. Python will also be utilized and equipped with libraries such as SpaCy and BeautifulSoup, as well as web frameworks such Django. SpaCy will use Natural Language Processing to transform syllabi, BeautifulSoup will be used for web scrapping, and Django will be used as a Rest API. Users will be authenticated by Midas and PostgreSQL will be the database that stores course information such as instructor, syllabus, and student feedback.

On the front end, student users and advisors can view syllabi, compare syllabi, and view feedback without logging in. However, students and faculty (Instructors and Curriculum Committee Members) will be required to log in for other features such as uploading syllabi, giving feedback, responding to feedback, and evaluating syllabi. On the backend, users will be authenticated with their MIDAS information and syllabi will be scraped, normalized, analyzed, and stored in a database (Figure 3).

Major Functional Component Diagram

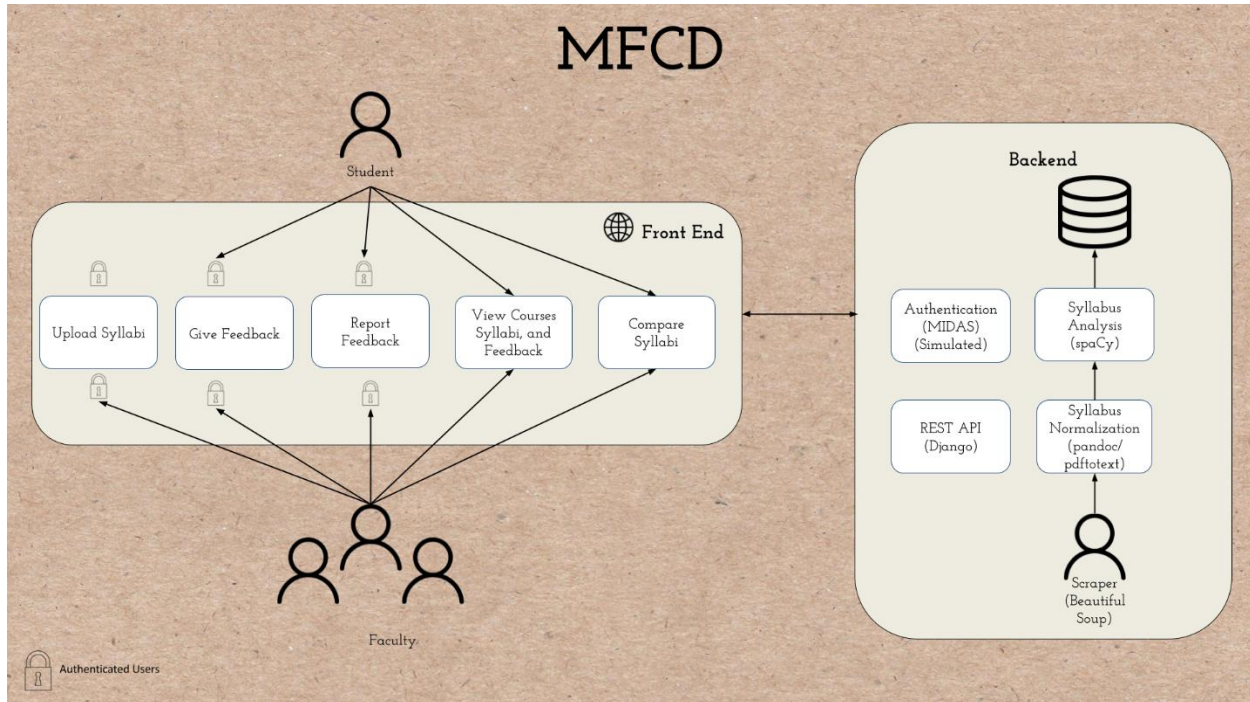


Figure 3 Major Functional Component Diagram


3. Identification of Case Study

The customers for Monarch Course Explorer will be universities such as Old Dominion University, who will offer it as an extension of the primary course catalog. End users such as students and faculty will have an additional resource to become knowledgeable about course offerings.

3.1 Old Dominion University

Old Dominion University has been identified as an initial case study for implementation of Monarch Course Explorer. Old Dominion University has been chosen because of its diverse

student population learning alongside award winning faculty in almost 100 undergraduate programs. Not only does Old Dominion University serve traditional college students who attend courses on campus, but Old Dominion University also serves a multitude of online students. As a result of Old Dominion University's innovative online learning initiatives, it is possible for students of all ages and across the world to attend and earn a degree. As represented in Table 1, the computer science department at ODU has shown consistent growth in the number of students across different age groups above the traditional college age of 18 -21 enrolled in courses from Fall 2013 through the Fall of 2022.



Factbook

Student Headcount

Student Credit hours

Student FTE

Degrees Conferred

Faculty

Headcount Term : Fall		College of Sciences , Computer Science									
		Fall 2013	Fall 2014	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020	Fall 2021	Fall 2022
Under 18		2	5	12	9	7	10	8	14	14	9
18 to 21		223	270	325	334	366	329	348	390	385	366
22 to 24		128	147	165	161	184	198	193	206	211	250
25 to 34		184	214	223	231	270	281	284	306	315	342
35 to 44		45	60	65	73	61	75	77	71	70	75
45 to 69		13	13	17	14	14	14	22	21	17	14
60 and Up		3	2	2		2	2	3	3	1	2
Total		688	711	809	822	904	909	936	1,011	1,013	1,068
Computer Science	Under 18	2	5	12	9	7	10	8	14	14	9
	18 to 21	223	270	325	334	366	329	348	390	385	366
	22 to 24	128	147	165	161	184	198	193	206	211	250
	25 to 34	184	214	223	231	270	281	284	306	315	342
	35 to 44	45	60	65	73	61	75	77	71	70	75
	45 to 69	13	13	17	14	14	14	22	21	17	14
	60 and Up	3	2	2		2	2	3	3	1	2
	Total	688	711	809	822	904	909	936	1,011	1,013	1,068
Total		688	711	809	822	904	909	936	1,011	1,013	1,068

Institutional Research: Figures include an unduplicated count of students enrolled for credit.

Table 1 Age Statistics for Computer Science Students

3.2 Future Adoption

Although Old Dominion University is the initial case study and will be the primary focus for implementing Monarch Course Explorer, the program can be adapted for use at other universities and learning institutions as well. Not only can the name be adapted to fit with another college and their mascot, but the program's authentication methods can also be adapted while leaving the program's primary functionality unchanged.

4. Monarch Course Explorer Product Prototype Description

Monarch Course Explorer's main goal is to be a centralized resource for students to access information about courses that can assist them with making decisions on which courses to register for during registration periods. Monarch Course Explorer will have many features from the real-world product in the prototype that will assist students deciding which courses to take based on information from course syllabi and feedback from other students. Monarch Course Explorer will also have many features from the real-world product in the prototype that will aid faculty with making syllabi accessible to students and improving courses by directly accessing student feedback, addressing student concerns, and reviewing course syllabi.

The features will be grouped by three main categories based on general functionality of the website (Table 5), functionality with course syllabi (Table 2 and Table 3), and functionality with feedback (Table 4). Features for university faculty are divided into subgroups of Professor, Advisor, and Curriculum Committee Members. All user groups will use authentication features to login to the website in the real-world product, but this feature will be partially implemented by simulation in the Monarch Course Explorer Prototype. Students will be able to receive course recommendations from take the Monarch Explorer Quiz, which get a student's preferences and match them with attributes from selected courses.

Monarch Course Explore will analyze syllabi in different formats such as pdf files, Microsoft Word documents, and HTML webpages. However, the implementation of this feature will be partial in the

Monarch Course Explorer Prototype compared to the real-world product. All user groups will be able to view a syllabus or multiple syllabi side by side in both the prototype and real-world product.

Additionally, students, advisors, and curriculum committee members will be able to filter and compare sections of syllabi. Professors will be able to upload syllabi and scrape syllabi. Curriculum committee members will be able to verify that all required sections of syllabi are present and see a report if something is missing when reviewing syllabi.

Monarch Course Explorer will also host as a platform for students to provide feedback for a course and allow professors to address student feedback and create healthy dialog to improve the course. Students, advisors, and professors will be able to view feedback on a course using filtering options by semester.

Features	Student	Faculty: Professor	Faculty: Advisor	Faculty: Curriculum Committee Member	Real World Product	Prototype
Upload Syllabi		✓		✓	✓	✓
Scrape Syllabi		✓		✓	✓	✓
View Syllabi	✓	✓	✓	✓	✓	✓
Side-By-Side View	✓	✓	✓	✓	✓	✓
Analyze Syllabi in Different Formats					✓	Partial

Table 2 Syllabi Features & Functionality 1

Features	Student	Faculty: Professor	Faculty: Advisors	Faculty: Curriculum Committee Member	Real World Product	Prototype
Verify Inclusion of Required Sections				✓	✓	✓
View Report of Missing Sections				✓	✓	✓
Filter by Sections	✓		✓	✓	✓	✓
Compare sections	✓		✓	✓	✓	✓

Table 3 Syllabi Features & Functionality 2

Features	Student	Faculty: Professor	Faculty: Advisor	Faculty: Curriculum Committee Member	Real World Product	Prototype
View Feedback	✓	✓	✓		✓	✓
Rate Feedback	✓	✓			✓	✓
Provide Feedback	✓	✓			✓	✓
Filter Feedback by Semester	✓	✓	✓		✓	✓

Table 4 Feedback Features & Functionality

Features	Student	Faculty: Professor	Faculty: Advisor	Faculty: Curriculum Committee Member	Real World Product	Prototype
Authentication	✓	✓	✓	✓	✓	Partial
Take Quiz	✓				✓	✓
View Course Recommendation	✓				✓	✓

Table 5 Other: Features & Functionality

4.1 Prototype Architecture (Hardware/Software)

The Monarch Course Explorer prototype has the same structure as the real-world product (Figure 3), with frontend and backend functionality. GitHub will host the project for the prototype and IDEs such as VSCode will be used for development. HTML, CSS, and JavaScript will be used for frontend development of the website. Backend development will consist of PostgreSQL for database development and Python with Beautiful Soup, SpaCy, and Django libraries. Beautiful Soup for web scraping, SpaCy for NLP transformation of syllabi, and Django for the rest API.

4.2 Prototype Features and Capabilities

The prominent features of the Monarch Course Explorer prototype involve course syllabi, course feedback, and generating a course recommendation based on a student's preferences.

4.2.1 Analyze and extract information from syllabi

The Monarch Course Explorer prototype will analyze and extract information from syllabi to support many features to assist students and faculty process the information (Table 5). After

syllabi are uploaded or scraped, the syllabi will be stored in a database and converted to a normalized format. The normalized syllabi will support analysis for the Monarch Course Explorer Quiz and allow users to easily search and access syllabi for all courses, filter syllabi by sections, compare sections of different syllabi, and aid curriculum review committees with evaluating course syllabi.

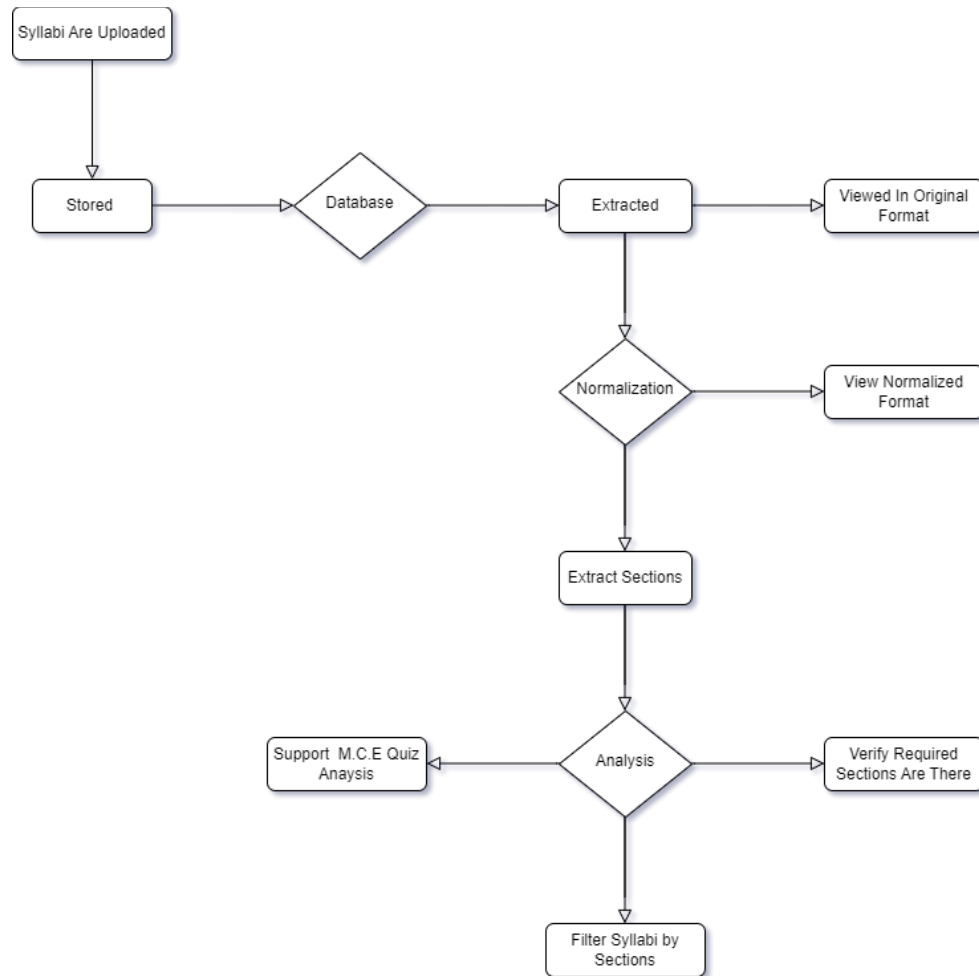


Figure 4 Syllabus Algorithm Flow Chart

4.2.2 Feedback on courses

The Monarch Course Explorer prototype will host a moderated platform for course feedback. The feedback will be stored in a database to support functionality of the Monarch Course Explorer Quiz and features for student, professor, and advisor features (Figure 5). Students will

be able provide view and rate existing feedback on a course, filter the feedback by semester, and provide feedback on courses taken. Professors and Advisors will be able view student feedback, while professors will have the addition capability of responding to student praises or concerns.

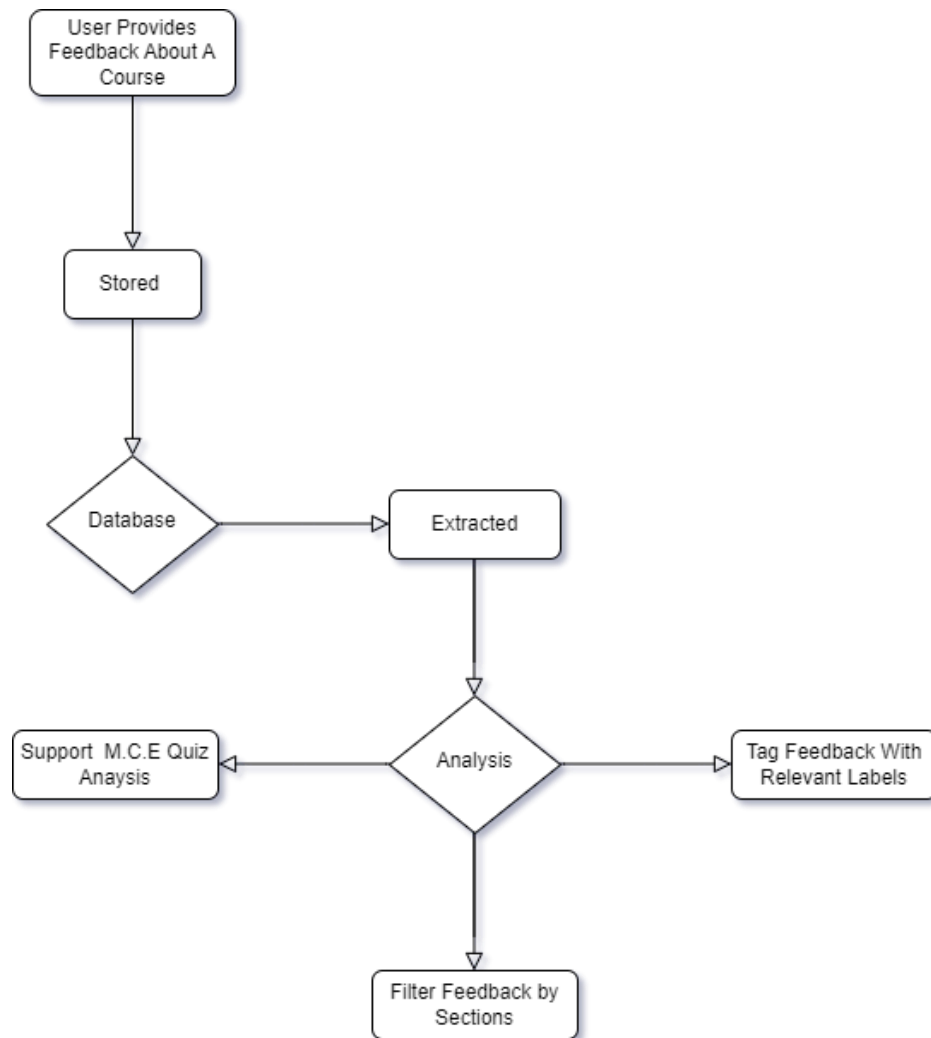


Figure 5 Feedback Algorithm Flow Chart

4.2.3 Assist students with finding courses that fit their learning style and personal schedule

The most prominent feature offered by the Monarch Course Explorer prototype will be automatic course comparisons that will give students a recommendation base on preferences a student make by completing a questionnaire (Figure 6). The questionnaire, M.C.E Quiz, will have a student select two courses to compare and a list of preferences they would like. The

prototype will use information extracted from the syllabi and feedback from those courses, along with the student's answers from the M.C.E Quiz, to perform an analysis that recommends which class to register for.

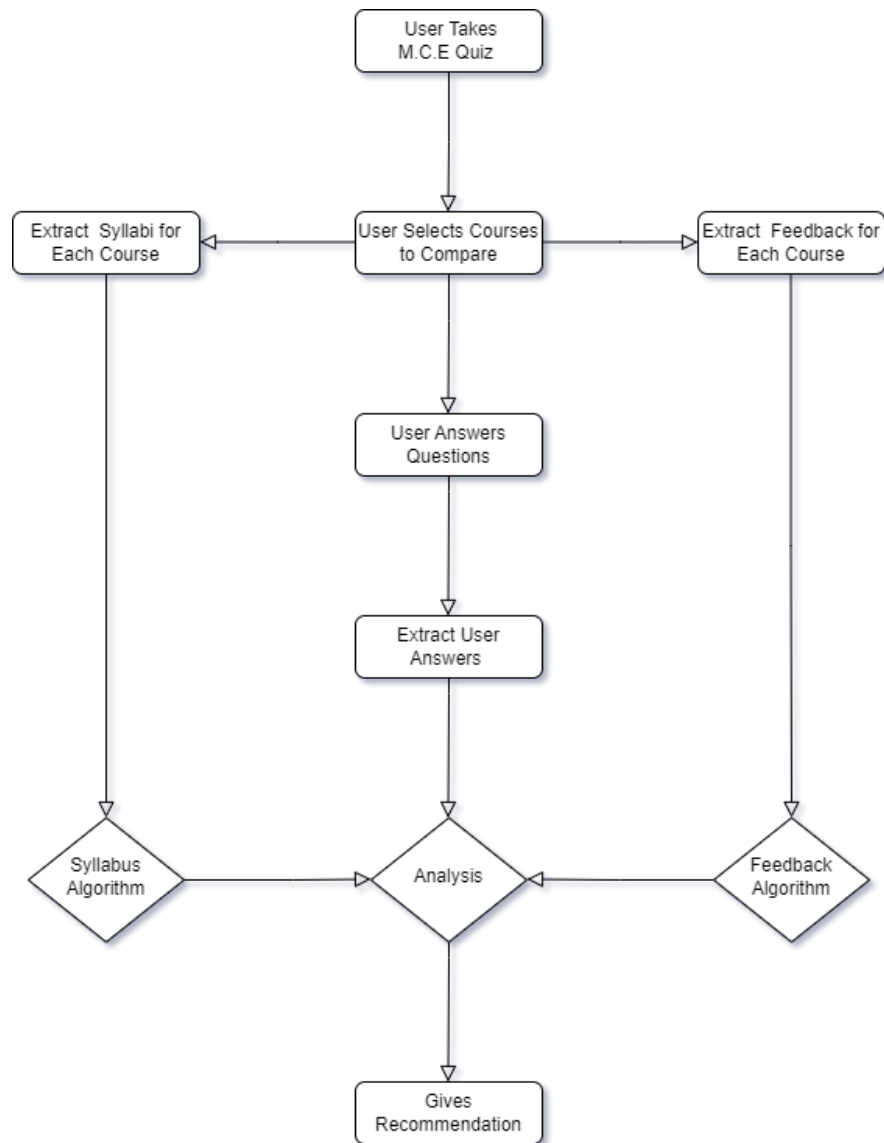


Figure 6 Recommendation Algorithm Flow Chart

4.3 Prototype Development Challenges

The projected challenges for developing the Monarch Course Explorer prototype will be present in the process for collecting data used by the program, the team learning the development tools, and issues with the technology that supports processing that information.

4.3.1 Data Collection

Collecting data from sources such as syllabi and course feedback will be a challenge during developmental stages because the product needs to be in use by its consumers for full implementation. However, scaling development and testing the prototype for use of the computer science department and its syllabi can exemplify the functionality and capabilities of the prototype. The computer science department at ODU has most of the syllabi available online and the developers of the Monarch Course Explorer prototype are in possession of syllabi for computer science courses.

4.3.2 Learning Development Tools

The team is tasked with learning new development tools and becoming proficient at the tools as they build the Monarch Course Explorer prototype. The team will need to learn how to use Docker as a container, Django as a framework, Postgres for the database, and JavaScript, HTML, and CSS for frontend development. The team will also have to learn how to effectively collaborate on GitHub to contribute to building the prototype. It will be necessary for the team to effectively communicate and share resources and knowledge with one another to overcome this challenge.

4.3.3 Supporting Technology Issues

Some developmental challenges that can be expected from supporting technology issues involve the process of normalizing syllabi and using natural language processing to perform analyses on syllabi and course feedback. Some important information may be excluded from the

normalized syllabi that was present in the original syllabi. Natural Language Processing may have errors that cause syllabi and course feedback analyses to be inaccurate. The prototype will need to be tested extensively to ensure accuracy.

4.4 Real World Product Risks

The real-world product has several customer, technical, security and legal risks that can be properly mitigated.

4.4.1 Customer Risks

Customer risks for Monarch Course Explorer include reliance on students and/or faculty to upload syllabi that are not already online, reliance on students to give feedback for courses that do not already have feedback online, and abuse of the platform, such as inappropriate or inaccurate feedback. However, these risks can be mitigated by coordinating the release of Monarch Course Explorer with ODU so that faculty can use it first and supply Monarch Course Explorer with course syllabi. Then ODU can use mailers to advertise Monarch Course Explorer to students and encourage them to give feedback about courses which would be moderated by a mix of human and automated moderation to mitigate platform abuse.

4.4.2 Technical Risks

The technical risks for Monarch Course Explorer included lack of time and effort to produce a scraper for each website, automated moderation may conceal good feedback, and technology issues involving the process of normalizing syllabi. Some information may be excluded from the original syllabi in the normalized syllabi, or some information may be misinterpreted. However, these risks can be mitigated by prioritizing high volume websites like ODU when building a scraper, using industry's best practices to protect against tactics like review bombing, allowing

users to see the original syllabi along with the normalized version, and to provide a disclaimer that encourage users to check the original syllaba for items that may be lost in translation.

4.4.3 Security Risks

Breaching the database pose a security risk for Monarch Course Explorer by exposing a student's identity and the feedback offered by that student. This can be mitigated by using parameterized queries, two-factor authentication methods, and following any other industry's best practices.

4.4.4 Legal Risks

Monarch Course Explore may encounter legal risks from Cease-and-Desist requests from scraped websites but it can be mitigated by reviewing the terms of service of those websites before scraping and honoring any Cease-and-Desist requests that are made.

5. Glossary

Beautiful Soup: A Python library for parsing structured data.

Curriculum Committee Member: A faculty member entrusted with the upholding and revising guidelines for academic programs.

Django: A free and open-source, Python-based web framework that follows the model–template–views architectural pattern.

HTML: Hypertext Markup Language, standard markup language for documents designed to be displayed in a web browser.

MIDAS: Monarch Identification and Authorization System, Old Dominion University’s log-in and password management system.

NLP: Natural Language Processing, A subfield of computer science and artificial intelligence (AI) that focuses on the interaction between computers and humans in natural language.

PostgreSQL: A free and open-source relational database management system emphasizing extensibility and SQL compliance.

RWP: Real World Product that will be developed and used.

spaCy: An open-source software library for advanced natural language processing, written in the programming languages Python and Cython.

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