



جامعة روتشستر الأمريكية للتكنولوجيا في دبي
A Global American University in Dubai

Department of Electrical Engineering & Computing Sciences	
Academic Year	2025-2026
Semester	<input checked="" type="radio"/> Fall <input type="radio"/> Spring <input type="radio"/> Summer
Course Code - Name	ISTE-500.600 Senior Development Project I
Instructor	
Exam	<input type="radio"/> Quiz/Test <input type="radio"/> Assignment <input type="radio"/> Mid <input type="radio"/> Final <input checked="" type="radio"/> Other <div>Deliverable2 Report</div>
Start Date	Mon., Oct 6, 2025
Duration	~ 5 weeks

- Write and submit deliverable2 report based on report template guidelines and your mentors, instructor's guidance
- The report should include all sections mentioned in syllabus for deliverable2

Student ID	Student Name
396001477	Jeeda Kotob
396004854	Ryma Ait Tayeb
771008583	Ibraheem Mustafa

CLOs:

1. Apply requirements elicitation methods in an extra-classroom environment.
2. Architect an effective, user-centric solution.
3. Apply contemporary software development practices.
4. Create and document a proper project plan.

If the assessment maps to a single CLO, state the CLO below:

CLO	Max Score	Students Average Score
2,3,4	20	

CourseGenie+: Centralized Academic Workflow Automation

by

Jeeda Kotob, 396001477 , CIT
Ryma Ait Tayeb, 396004854, CIT
Ibraheem Mustafa, 771008583, CIT

A Capstone Project Submitted to RIT-Dubai

Fall 2025

Mentors

Dr. Ali Assi
Mr. Qusai Hasan

ABSTRACT

Learning management systems are an essential component of higher education institutions. Existing platforms often prioritize student services and tend to underrepresent requirements from instructors and administrators. We present CourseGenie+, a web-based application with customized dashboards that streamlines faculty workflows by automating manual and time-consuming tasks. The system integrates syllabus and assessment management, grading statistics, course peer-reviewing, exam scheduling, room distributions, and reporting tools for course and program evaluation. CourseGenie+ also allows administrators to track syllabus submissions, collect Course Assessment Reports, configure course sections and manage faculty workflow. Integration of CourseGenie+ establishes it as a centralized academic workflow automation tool that bridges the gap between teaching, administration, and accreditation, enabling faculty to focus more on teaching while ensuring administrators meet compliance and quality standards.

Keywords

Learning Management Systems, Workflow Automation, Academic Administration, Dashboards, Course Assessment Reports, Course Learning Outcomes, Program Learning Outcomes.

TABLE OF CONTENTS

LIST OF TABLES	vi
I. Introduction	1
II. Problem Statement	2
III. Norms and Values	3
A. Work and Quality	3
B. Collaboration and Participation.....	3
C. Accountability	3
IV. Literature Review	4
A. Introduction.....	4
B. Features and Comparisons	4
C. Gaps and Limitations in LMSs.....	5
D. Visualization and Analytics in LMSs	6
E. Assessment and Accreditation Needs.....	8
F. Peer Review in Academic Systems	9
G. Conclusion	11
V. Benchmarking	12
V. Requirements Elicitation Methods.....	13
A. Brainstorming.....	13
B. Observations.....	13
C. Interviews	13
1) Interviews with Professors.....	13
2) Interview with Institutional Effectiveness Manager.....	14
VI. Initial Project Scope.....	14
A. Project Scope.....	14
1. Included Scope.....	14
2. Excluded Scope.....	15
VII. Development Methodology and Process.....	15
A. Flexibility	15
B. Iterative Improvement with Focus on Value.....	15
C. Stakeholder Engagement.....	15
VIII. Stakeholders	16

A. Primary	16
1) Professors.....	16
2) Administrators	16
B. External	16
1) Accreditation Bodies	16
IX. System Requirements and Documentation	17
A. Functional and Non-Functional Requirements	17
1. Functional Requirements:	17
2. Non-Functional Requirements:	18
B. User Stories	18
C. Use Cases	42
1. User Login & Dashboard Access.....	42
2. System-Generated CAR Preview & Submission.....	44
D. System Use Case Diagram.....	46
X. Project Planning	46
A. Work Breakdown Structure	47
B. Gant Chart	47
XI. Risk Assessment	48
XII. Resources and Budget Planning.....	53
A. Resources	53
1. Human Resources	53
2. Technical Resources	54
3. Logistical Resources	55
B. Cost Estimate and Budgeting	55
1. Software and Tools	56
C. Initial Bill of Materials (BoM)	56
1. BoM Summary:.....	56
3. Budget Overview	57
XIII. Test Plan (First Cut).....	58
REFERENCES	63

LIST OF FIGURES

Figure 1: Work Breakdown Structure 47

Figure 2: Gant Chart 47

Figure 3: BoM..... 57

LIST OF TABLES

Table 1: Project Benchmark.....	12
Table 2: Project User Stories	42
Table 3: UC01 - User Login & Dashboard Selection.....	44
Table 4: UC02 - System-Generated CAR Review & Submission.....	46
Table 5: System Use Case Diagram.....	46
Table 6: 5x5 Risk Assessment Matrix	49
Table 7: Risk Level Interpretation Legend	49
Table 8: Project Risk Register & Mitigation Strategies.....	53
Table 9: Test Plan	62

I. Introduction

Learning Management Systems (LMSs) have become essential tools in higher education systems, providing digital support for teaching, learning, and administration. At RIT, the LMS used is MyCourses by Brightspace. MyCourses supports students through their learning journey, by providing features such as assignment submission, content delivery, grade viewing and attendance tracking. These features are also provided for instructors, however, they are considered limited compared to the required teaching workflows.

To fill in these gaps, faculty often tend to rely on external solutions such as spreadsheets, email, online review forms and text reports. These methods not only require extra manual work, but are time consuming and prone to errors, inconsistencies and difficulties in meeting accreditation and academic requirements.

CourseGenie, a previous capstone project, demonstrated the potential of extending the LMS functionality with a narrowed focus on professor-centered tools as assessment management, syllabus generation and grading statistics. However, the system still lacks many advanced features and several unresolved issues.

CourseGenie+ introduces dedicated dashboards for both instructors and administrators. These dashboards will centralize the academic workflow and automate key academic tasks including, but not limited to, Course Assessment Report (CAR) file generation, course calendar generation, exam management, etc. By creating role-specific dashboards, CourseGenie+ aims to increase efficiency, reduce manual work, prevent errors and provide an enhanced visibility to course and program level performance.

II. Problem Statement

Within higher education institutions, there is growing pressure on faculty members and educational administrators to carry out an ever-expanding number of repetitive, time-consuming academic management activities. These include drafting and collecting syllabi, compiling CAR files, mapping Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs), and managing examination logistics such as scheduling and room allocation. Additional requirements, such as peer-review documentation, further add to the administrative responsibilities.

Currently, most of these activities are completed manually through emails, spreadsheets, and limited LMS tools. This fragmented approach results in inefficiencies, delays, and a lack of centralized oversight. For administrators, the absence of automated systems to track progress or alert relevant personnel often leads to missed deadlines, delayed course reviews, and difficulties in ensuring compliance with accreditation standards.

The core problem lies in the lack of centralized, automated tools to support professor and administrator workflows in existing LMS platforms, particularly MyCourses. Without such tools, inefficiencies persist, compliance becomes difficult, and academic staff are unable to fully focus on teaching and institutional quality improvement.

III. Norms and Values

The team has established clear norms and values to be adapted by the team to ensure consistent quality, accountability, and collaboration throughout the project.

A. Work and Quality

All deliverables are expected to be completed, clean, and professional, reflecting both qualitative and quantitative effort. The team places emphasis on meaningful progress and constructive feedback, ensuring that all work contributes to the overall success of the project.

B. Collaboration and Participation

Tasks are assigned by skills, but all members are responsible for understanding all aspects of the project. This guarantees that during assessments and presentations, every member can answer questions and contribute fully. Open discussions in weekly meetings and ongoing communication through group chats provide space for all members to share ideas, raise issues, and propose solutions.

C. Accountability

Punctual attendance at team meetings is required, with any exceptions communicated in advance. Each member is responsible for meeting deadlines and delivering high-quality work. Team members are expected to take ownership of tasks, demonstrate initiative, and commit fully to the project, going beyond minimum requirements where necessary.

IV. Literature Review

A. Introduction

Learning Management Systems play a critical role in the higher education learning systems affecting all aspects of teaching, learning and administration. Several systems have been implemented and have reached a universal level. However, the literature shows that these systems vary significantly in terms of usability, reporting capabilities and support for different stakeholders. This review explores five major themes that have been identified across recent studies: core features and comparisons, common gaps and limitations in current LMSs, system visualization and analytics, assessment and accreditation requirements, and peer review in academic systems. These themes highlight the strengths and limitations of existing learning management systems which will aid in the process of delivering CourseGenie+.

B. Features and Comparisons

One of the most recurrent conclusions in the literature is that learning management systems offer a “core toolkit” of features. Sánchez et al. [1] conducted a comparative study of 45 LMSs based on six categories: interoperability, accessibility, productivity tools, communication tools, learning tools, and security. They found that almost all systems included common functions such as assignment submissions, content repositories, announcements, and gradebooks. These are considered essential for course delivery and serve as the foundation of current LMSs. However, the authors also showed that systems differed significantly in adaptability and usability. For example, Moodle and Paradiso were rated as the strongest overall, as they offered greater adaptability and smoother integration of tools across categories. Brightspace, on the other hand, scored only average, providing the core toolkit but with less flexibility and limited support for

broader institutional workflows. The authors concluded that effectiveness depends not only on features themselves, but also on how well tools align with institutional needs and instructor workflows.

Another common theme is the trade-off between administrative strength and usability. Yamani, Alharthi, and Smirani [2] compared Brightspace and Blackboard with surveys of over 500 students. They found that Brightspace was preferred for its clean, user-friendly interface, while Blackboard was rated higher for its reporting and administrative capabilities. This variation reflected differences in design priorities: Blackboard emphasized administration and refined reporting, while Brightspace prioritized student accessibility and ease of use. At RIT Dubai, where MyCourses is based on Brightspace, this trade-off means students benefit from simplicity, but instructors and administrators face limitations in reporting and course management. CourseGenie+ aims to fill this gap by maintaining usability while introducing professor- and administrator-oriented tools such as CAR file generation, and exam scheduling.

These studies collectively show that while contemporary LMSs meet a baseline of shared features, they tend to prioritize students over faculty. This leaves instructors without sufficient tools for accreditation-related tasks or advanced analytics. For CourseGenie+, this evidence highlights the value of extending MyCourses by building on the core toolkit with enhanced visualization, reporting, and accreditation tools.

C. Gaps and Limitations in LMSs

While LMSs are effective at delivering core teaching tools, multiple studies highlight persistent gaps in how they serve instructors and administrators. These gaps arise not only from missing features but also from the limited adoption and usability of tools that already exist.

Simon et al. [3], in a mixed-methods study with 41 instructors and 41 students, found that Moodle was primarily used as a repository for slides and announcements. Instructors avoided its collaboration features, preferring email or WhatsApp, while students reported built-in tools were confusing and time-consuming. The authors concluded that tool utilization depends more on alignment with teaching practices than on availability.

Li, Jung, and Wise [4] studied instructor engagement with learning analytics dashboards and found two patterns: some teachers attempted to adapt their teaching, while others only monitored performance. Yet, in both cases, dashboards were difficult to interpret, and instructors lacked institutional support to use the data effectively. The authors argued that dashboards often fail when they present complex data without actionable context.

Together, these studies show that LMSs often provide advanced features that are underutilized or ineffective in practice. Instructors rely on external tools for communication and spend extra time manually interpreting abstract data. For CourseGenie+, these insights reinforce the need to avoid duplicating replaceable features (e.g., chat forums) and instead focus on automating essential workflows such as CLO–PLO mapping, syllabus tracking, and CAR reporting. Its contextualized grade visualization and statistics aim to reduce manual effort while directly supporting instructor decision-making.

D. Visualization and Analytics in LMSs

The use of visualization and analytics in Learning Management Systems has grown to be essential for improving efficiency and vital decision-making. Hernández-de-Menéndez et al. [5] explained that learning analytics allows educators to gather, process, and interpret large amounts of data to better evaluate performance, boost student engagement, and refine teaching strategies.

Their research highlights that well-designed visualization dashboards can turn complex datasets into clear, actionable insights. These tools help instructors and administrators recognize trends, monitor progress, and make more informed decisions. This idea directly connects to the goals of CourseGenie+, which plans to include interactive dashboards that display grading trends, assessment completion, and course review updates for both professors and administrators.

Ngulube and Ncube [6] further emphasize that analytics should not only measure academic performance but also enhance the overall user experience (UX) of LMS platforms. Their review found that features such as progress charts, heatmaps, and interactive dashboards greatly improve engagement and usability, especially for instructors. When analytics are integrated in intuitive and concise ways, they argue that they help reduce mental effort and ease users in finding helpful insights quickly. In the same way, CourseGenie+ uses visual analytics within its professor and admin dashboards to simplify everyday tasks, such as monitoring syllabus submissions, tracking CAR file progress, and analyzing assessments.

Kui et al. [7] conducted a comprehensive survey of visual analytics techniques that are used in online education. They concluded that visual analytics bridge untapped educational data with actionable decision-making. The authors describe different visualization models, like temporal, comparative, and hierarchical, that enable educators to monitor student progress, recognize struggling learners, and analyze learning outcomes. They state that visual analytics encapsulates the intersection of untapped educational data and actionable data-driven decisions. Following the same logic, CourseGenie+ incorporates similar analytics to not only generate student performance visualization but also attend to institutional needs such as CLO–PLO mapping and monitoring course performance trends. These are the studies reinforcing the value

that analytics and visualization bring toward enhancing the quality of teaching and streamlining the administrative functions of an institution. Still, the majority of legacy LMS systems continue to prioritize the student-facing analytics while the faculty workflow components, like assessment documentation and peer-review tracking, remain underappreciated. Learning analytics in CourseGenie+ expands on this paradigm by offering comprehensive tools to document transparent, goal-directed, and collaborative efforts to bridge faculty and administrators.

E. Assessment and Accreditation Needs

Assessment and accreditation are central to quality assurance in higher education, ensuring that academic programs meet established educational standards. Vlachopoulos et al. [8] conducted a systematic review on “genuine assessment” and emphasized the importance of evaluation methods that reflect real-world outcomes and generate evidence-based data for accreditation. Their evaluation covers over a decade of research and shows the need and value of digital assessment systems in providing accurate, evidence-based data to accrediting authorities. This is consistent with CourseGenie+, which aims to improve consistency and transparency in the reports by automating CAR files and linking CLOs with PLOs. The same review pointed out that traditional assessment and reporting methods are often slow, inconsistent, and error-prone, creating major challenges during accreditation audits. They call for integrated digital systems that can centralize evidence, automate report generation, and simplify faculty participation within outcome-based education (OBE) frameworks. CourseGenie+ answers this need by offering a unified platform that streamlines CAR & Syllabus files management and submissions, CLO–PLO mappings, grade statistics and more. Automating these processes reduces administrative effort while maintaining the precision and accountability necessary for accreditation. The review further emphasizes that authentic assessment should go beyond checking boxes for compliance, and it should encourage

continuous improvement and reflective teaching. This necessitates systems that capture data over extended periods and associate assessment data with changes in the curriculum [8].

To summarize, while the literature demonstrates how technology has transformed assessment and accreditation, it also points to the absence of integrated solutions that consolidate all these disparate elements. CourseGenie+ addresses these issues by having a comprehensive and data-empowered solution that leverages valuable assessment, continuous improvement, and accreditation readiness to ensure the establishment is always prepared.

F. Peer Review in Academic Systems

A study done by Jenkins et al. [9] identified how a structured faculty peer-review process can enhance teaching quality and institutional culture. The study was conducted at Johns Hopkins School of Nursing, where they used the Design for Six Sigma (DMADV) framework: Define, Measure, Analyze, Design, Verify. The paper focused on the first three stages by conducting methods like surveys (Define), literature benchmarking (Measure), and taskforce discussions (Analyze), which helped to identify best practices in peer review of teaching [9]. These principles can guide the implementation of a digital peer review feature, where structured workflows, automated report generation, and survey integration ensure the process is systematic and transparent.

In the define phase, the Faculty Peer Review of Teaching Taskforce was created, composed of 11 members across different academic ranks and disciplines. Through earlier literature research, the group identified four key themes: (1) peer observation is useful but needs a supportive environment, (2) success requires clear goals, consistent tools, and trained reviewers, (3) post-observation discussions are essential, and (4) faculty ownership increases adoption. Benchmarking

across eight peer institutions revealed substantial variations, with some having formal models and others using peer review informally. This highlights the lack of a standardized model across higher education. CourseGenie+ could use these findings by embedding standardized peer review templates and structured discussion fields into its professor dashboard, improving consistency and collaboration.

To understand faculty opinions, the researchers conducted a Qualtrics survey on “qualities of good teaching” and “peer review procedures.” Out of 68 full-time faculty, 27 responded ($\approx 40\%$), strongly supporting ideas like active learning, student–faculty interaction, prompt feedback, and inclusiveness in teaching. These findings aligned with Chickering and Gamson’s (1987) seven principles of good practice. While most faculty agreed with the teaching-quality indicators, weaker areas were related to online teaching and time management, showing that digital or hybrid instruction needs more institutional support. In CourseGenie+, similar surveys can be built directly into the system to collect feedback, with results visualized and linked to peer review reports to create a continuous improvement loop.

Most faculty also supported a formative and recurring peer review approach rather than a one-time evaluation. About 81% saw reviews as developmental, 93% preferred reviewers with several years of teaching experience, and all agreed that new faculty should receive a review within two years. Many suggested repeating reviews every 3–5 years and coordinating them through the Office of Teaching and Learning. This shows that faculty prefer a system focused on mentorship, reflection, and collaboration instead of ranking. The CourseGenie+ platform can apply this by automatically scheduling review cycles, sending alerts, and keeping data confidential, ensuring the process is efficient and consistent.

The main limitation of the study is that it was conducted at one institution with only full-time faculty, excluding adjunct and part-time instructors whose roles often differ. Despite this, the research provides a strong foundation for building peer review systems in higher education. For CourseGenie+, this means developing flexible tools that support all types of faculties and can be scaled across diverse academic contexts.

G. Conclusion

In conclusion, from the literature work, we noticed a recurring pattern that most LMS platforms provide a common set of features, such as gradebooks, submissions, and content repositories. However, they tend to fail to meet instructor and administrative needs. Comparative studies emphasized usability trade-offs, with systems like Brightspace favoring student experience but limiting advanced reporting and administrative workflows. Other studies showed that even when analytics and collaboration tools are present, they are often underutilized due to complexity or lack of alignment with educational needs. Together, these results highlight major weaknesses in the current LMS architecture and highlight the need for solutions that go beyond features that directly affect students to facilitate faculty collaboration, accreditation, and administrative management.

V. Benchmarking

Benchmarking was conducted to evaluate comparable Learning Management Systems (LMSs) and academic workflow platforms. The objective of this analysis is to identify best practices, performance standards, and functional gaps that guide the design and enhancement of *CourseGenie+*.

Platform / System	Core Features	Limitations Identified	Relevance to CourseGenie+
Brightspace (MyCourses)	Official LMS used at RIT; supports assignment submission, grading, announcements, and attendance tracking	Lacks comprehensive faculty tools such as CAR file generation, syllabus tracking, and peer-review management	Serves as integration reference; highlights the need for professor- and admin-centered automation
Blackboard	Provides advanced administrative and reporting tools	Complex interface and less user-friendly for instructors	Demonstrates the trade-off between functionality and usability
Moodle	Open-source LMS with customizable modules and plugin support	Limited data visualization and less intuitive analytics dashboards	Serves as a model for extensibility but indicates need for improved reporting and visualization
CourseGenie (Phase 1)	Previous capstone project with core syllabus and assessment management	Missing automation features for CAR files, peer-review workflows, and exam management	Establishes the baseline system; informs the iterative enhancements in <i>CourseGenie+</i>

Table 1: Project Benchmark

The existing LMSs' shortcomings are that they are either heavily student-oriented, like Brightspace, or emphasize administrative depth (e.g., Blackboard), often at the expense of usability and workflow automation. CourseGenie+ differentiates itself by specifically targeting faculty and

administrative efficiency through the automated generation of CAR files with integrated CLO-PLO mapping, streamlined syllabus submission with progress tracking for administrators, a structured peer-review workflow for evaluation, and an enhanced dashboard with analytics and visualization features. These benchmarking insights directly shaped the system architecture and feature priorities of CourseGenie+, ensuring that it aligns with institutional requirements while addressing limitations found in existing LMSs.

V. Requirements Elicitation Methods

A. Brainstorming

The team conducted brainstorming sessions in the initial weekly meetings alongside the project mentors. These discussions helped gather project requirements from the mentors. In addition, the brainstorming sessions also allowed the team members to collaborate with mentors in the process of identifying new features for the project.

B. Observations

The team closely inspected the existing CourseGenie Phase 1 system to identify implemented features, gaps, and usability issues. Observing how some features were implemented revealed some bugs and limitations based on the requirements. In addition, the team reviewed the university's current LMS platform, MyCourses, from a faculty perspective to better understand the limitations and benchmark potential features for the project.

C. Interviews

1) Interviews with Professors: Weekly meetings with project mentors Dr. Ali Assi and Mr. Qusai Hassan served as informal interviews for the requirement gathering stage. In these sessions,

the mentors introduced the limitations of the current system being used, MyCourses, and the academic processes outside the lecture halls. They also provided suggestions on what enhancements and functionalities they expect in their roles as Professors at RIT Dubai.

2) *Interview with Institutional Effectiveness Manager*: To capture the administrative perspective, the team interviewed Ms. Dezzil Castelino, Institutional Effectiveness Manager at RIT Dubai. As a potential administrative user role in the proposed system, she highlighted the need for features such as an admin dashboard, syllabus submission tracking, CAR files collection and initiation of peer-review processes. This ensured that the system requirements addressed not only professor needs but also administrative oversight.

VI. Initial Project Scope

A. Project Scope

1. *Included Scope*: The initial scope of CourseGenie+ focuses on extending existing LMS functionalities with features specifically targeted toward professors and administrators. For professors, the scope includes tools such as assessment management, syllabus generation, grade visualization and statistics, CLO management, CAR file generation, CLO–PLO mapping, course review reports, and exam-related management (room allocation, schedules, notifications). Additionally, CourseGenie+ will provide a customizable course calendar with drag-and-drop functionality and professor profile management.

For administrators, the scope includes a dedicated dashboard to configure courses and sections, monitor syllabus submission, collect CAR files, and initiate peer-review processes. These features will ensure that CourseGenie+ serves as a centralized and streamlined platform for academic management while complementing existing student-oriented systems like MyCourses.

2. *Excluded Scope:* To avoid duplication of functionality already well-served by MyCourses, CourseGenie+ will not include student dashboard features such as assignment submissions, gradebooks, attendance and course content view.

VII. Development Methodology and Process

This project is managed using the Agile Scrum methodology, which provides a flexible and collaborative framework to ensure the timely delivery of a useful product. Agile is particularly effective in team projects where requirements evolve and continuous contributions are needed from members with diverse skills.

A. Flexibility

Agile offers the flexibility needed for a team working together for the first time. As members become familiar with one another's strengths, roles can be adjusted dynamically. This adaptability ensures that efforts are focused on producing high-quality results rather than on rigid reporting structures.

B. Iterative Improvement with Focus on Value

The system includes a wide range of features such as CAR file generation, CLO–PLO mapping, syllabus tracking, exam management, and collaboration tools. Agile Scrum supports development by delivering these features in increments, with each sprint focusing on the most important functionality. This approach prevents stagnation, allows for continuous refinement, and ensures steady progress toward a high-quality final product.

C. Stakeholder Engagement

A central strength of Scrum is its emphasis on stakeholder feedback. The team holds regular meetings with the mentor, co-mentor, and institutional effectiveness representative to validate progress and gather input. This ensures that the evolving system remains relevant to professors and administrators and supports their actual workflows.

VIII. Stakeholders

Our project involves multiple stakeholders with different priorities and interests. These stakeholders can be classified into primary, secondary and external groups based on their level of involvement and interaction with the system.

A. Primary

1) *Professors*: They are the main users of the system. Professors use the dashboards to create and manage assessments, generate syllabi, visualize grades, and produce CAR files.

2) *Administrators*: Represented by the Institutional Effectiveness Manager and related staff, administrators use the system to configure courses, track syllabus submission, collect CAR files, and manage the peer-review process.

B. External

1) *Accreditation Bodies*: Organizations such as the KHDA, set the standards for curriculum alignment and reporting. While they do not interact with the system directly, their requirements influence features such as CLO–PLO mapping, CAR reports, and syllabus submission tracking.

IX. System Requirements and Documentation

A. Functional and Non-Functional Requirements

1. Functional Requirements:

- The system must allow professors to generate and manage assessments with weights and descriptions.
- The system must allow professors to edit syllabi content and regenerate the file.
- The system must display student grades with visualization and summary statistics.
- The system must generate CAR files including CLO–PLO mapping and performance metrics.
- The system must provide professor profiles that can be edited (office hours, office location, email).
- The system must support cross-course collaboration by displaying professors teaching the same course and enabling communication.
- The system must support exam management by distributing students into rooms, generating reports, and sending notifications with exam date, time, and room details.
- The system must generate a course calendar automatically from assessments and allow drag-and-drop updates.
- The system must allow professors to create course review reports for remarks, suggestions, and peer review
- The system must allow admins to configure which courses professors can view.
- The system must track syllabus submission progress and display completion status.
- The system must provide a centralized collection of CAR files.

- The system must allow admins to initiate the peer-review process, assign reviewers, and set deadlines.

2. Non-Functional Requirements:

- Given that multiple professors access the system simultaneously, the system must handle the load without crashing or significant performance degradation.
- Given that a professor or admin performs an action, when the action is being executed, then the system must respond within 2 seconds.
- Given that professors and admins may access the system across different devices, when the system is used on desktops, tablets, or mobiles, it must remain accessible and usable.
- Given that academic data is sensitive, when users log in or perform actions, the system must ensure session management and security to protect confidentiality.

B. User Stories

Title	User Story	Acceptance Criteria	Priority	Estimate
1. User Login & Dashboard Selection	As a user who may have one or multiple roles (Admin and/or Professor), I want to log in and when applicable, choose my role so that I am taken	Given the user has Professor role only, when the user logs in successfully, then the user is navigated directly to the Professor Dashboard.	High	5

	<p>directly to the corresponding dashboard.</p>	<p>Given the user has Admin role only, when the user logs in successfully, then the user is navigated directly to the Admin Dashboard.</p> <p>Given the user has both Admin and Professor roles, when the user logs in successfully, then the system displays a role-selection popup with options “Continue as Admin” and “Continue as Professor”</p> <p>Given the role-selection popup is displayed, when the user selects “Continue as Professor”,</p>		
--	---	--	--	--

		<p>then the user is navigated directly to the Professor Dashboard.</p> <p>Given the role-selection popup is displayed, when the user selects “Continue as Admin”, then the user is navigated directly to the Admin Dashboard.</p>		
2. Admin Dashboard	As an admin, I want to have an administrative dashboard, so that I can manage courses and sections efficiently.	<p>Given the admin is on the admin dashboard page, when the page loads, then the dashboard should display courses as clickable cards.</p> <p>Given the dashboard displays course cards, when the admin clicks on a course card, then</p>	High	5

		the admin should be navigated to the course page showing its section cards.		
3. Syllabus Submission Tracking	As an admin, I want to view syllabi submission progress bars for professors, so that I can easily track uncompleted syllabus submissions.	<p>Given an admin on the admin dashboard, when the admin selects the syllabus tab, then the system should redirect the admin to the Syllabus Page.</p> <p>Given an admin is on the Syllabus Page, when the page loads, then the admin should see progress bars displaying professors' syllabus submission progress, organized by department.</p>	High	5

<p>4. Viewing Syllabus Submissions</p>	<p>As an admin, I want to view syllabus submissions in a designated tab so that I don't have to manually collect submissions.</p>	<p>Given the admin is on the syllabus page, when the admin clicks on a professor's name, then the system should display all syllabi submitted by that professor.</p> <p>Given the admin is viewing a professor's syllabus submissions, when the admin selects a syllabus, then the system should open a preview of the selected syllabus for review.</p> <p>Given the admin is viewing a professor's syllabus submissions, when the admin clicks the download button,</p>	<p>High</p>	<p>8</p>
--	---	---	-------------	----------

		<p>then the system should download the file in PDF format.</p> <p>Given a professor has no syllabus submissions, when the admin views that professor's record then the system should indicate that no submissions are available.</p> <p>Given the admin is viewing the list of syllabus submissions for a professor, when a submission's timestamp is later than the designated deadline, then the system should display an 'Overdue'</p>		
--	--	---	--	--

		indicator next to that syllabus entry.		
5. Sending Syllabus Submission Reminders	As an admin, I want the system to automatically send reminders to professors who have not submitted their syllabi so that I don't have to manually follow up.	Given a professor has not submitted the syllabus file, when the due date is 2 days away, then the system should automatically send an email reminder that includes the course section and due date.	Medium	3
6. Course Section Creation	As an admin, I want to configure new course sections from the system so that I can manage semester schedules efficiently.	<p>Given an admin is viewing a course page, when the page loads, then an "Add Section" button is displayed.</p> <p>Given an admin is on the course page, when the admin clicks "Add Section", then a create</p>	Medium	3

		section form popup is opened.		
7. CAR File Submission Tracking	As an admin, I want to view progress bars for professors, so that I can easily track uncompleted CAR file submissions.	<p>Given an admin on the admin dashboard, when the admin selects the CAR Files tab, then the system should redirect the admin to the CAR files page.</p> <p>Given an admin is on the CAR files page, when the page loads, then the admin should see progress bars displaying professors' CAR files submission progress, organized by department.</p>	High	5
8. Viewing CAR File Submissions	As an admin, I want to view CAR file submissions in a designated tab so that	Given the admin is on the CAR File page, when the admin clicks on a professor's name,	High	8

	<p>I don't have to manually collect submissions.</p>	<p>then the system should display all CAR files submitted by that professor.</p> <p>Given the admin is viewing a professor's CAR file submissions, when the admin selects a file, then the system should open a preview of the selected CAR for review.</p> <p>Given the admin is viewing a professor's CAR submissions, when the admin clicks the download button, then the system should download the file in PDF format.</p>		
--	--	---	--	--

		<p>Given a professor has no CAR file submissions, when the admin views that professor's record then the system should indicate that no submissions are available.</p> <p>Given the admin is viewing the list of CAR File submissions for a professor, when a submission's timestamp is later than the designated deadline, then the system should display an 'Overdue' indicator next to that CAR entry.</p>		
9. Sending CAR	As an admin, I want the system to	Given a professor has not submitted the CAR	Medium	3

Submission Reminders	automatically send reminders to professors with uncompleted CAR submissions, so that I don't have to manually follow up with them.	file, when the due date is 2 days away, then the system should automatically send an email reminder that includes the course section and due date.		
10. Peer Review Reports Submission Tracking	As an admin, I want to view progress bars for professors, so that I can easily track uncompleted peer review report submissions.	<p>Given an admin on the admin dashboard, when the admin selects the Peer Review tab, then the system should redirect the admin to the peer review page.</p> <p>Given an admin is on the peer review page, when the page loads, then the admin should see progress bars displaying professors' peer review submission</p>	Medium	5

		progress, organized by department.		
11. Exam Room Allocation	As an admin, I want to assign available rooms to each course's exam in the system, so that I can eliminate the manual process of sending room lists, collecting responses and resolving conflicts.	<p>Given the admin is on the Exam Room page, when the admin selects one or more rooms for a course and clicks Save, then the selected rooms are assigned to that course in the system.</p> <p>Given the room allocations have been saved, when professors view the exam room assignment page, then they only see the rooms allocated to their course.</p>	High	5
12. System-Generated CAR	As a professor, I want the system to automatically generate the CAR file for my	Given the professor is on a course section page, when they open the CAR Report tab,	High	8

<p>Preview & Submission</p>	<p>course section so that I can reduce manual effort, minimize errors and streamline the reporting process.</p>	<p>then the system generates and displays a CAR preview with available course data.</p> <p>Given the CAR preview is displayed and required data is missing, when the professor views the preview, then the system indicates missing information and disables the Submit button.</p> <p>Given the CAR preview is displayed, when the professor selects Download, then the system generates and downloads the CAR as PDF.</p>		
-------------------------------------	---	---	--	--

		Given the CAR preview is displayed and required data is complete, when the professor selects Submit, then the system records the CAR submission and displays a confirmation message.		
13. Peer Review Evaluation (Reviewer)	As a reviewer, I want to complete my peer-review evaluation within the system through a guided workflow so that I can provide structured and unbiased feedback without coordination delays.	<p>Given the reviewer is logged in, when they open the peer review page, then the system displays a “Pending Reviews” section listing professors they must review.</p> <p>Given a pending review is listed, when the reviewer selects “Start Review”, then the system displays the</p>	Medium	5

		<p>evaluation form with required rating and comment fields.</p> <p>Given the reviewer completes all required fields, when the reviewer submits the evaluation, then the system saves the evaluation and displays a confirmation message.</p> <p>Given required fields are missing, when the reviewer attempts to submit, then the system prevents submission and shows a warning.</p>		
14. Peer Review Evaluation (Reviewee)	As a reviewee, I want to access the peer-review feedback I received and submit	Given the reviewer has submitted feedback, when the reviewee navigates to their peer	Medium	5

	<p>my reflection separately so that I can provide unbiased responses without time constraints.</p>	<p>review page, then the system displays a “Received Feedback” section containing the submitted evaluation.</p> <p>Given the feedback is visible, when the reviewee selects “Add Reflection” the system displays a text field for entering reflection.</p> <p>Given the reviewee enters a reflection, when they submit the reflection, then the system saves the reflection and displays a confirmation message.</p>		
15. User Profile	As a user, I want to view and update my personal information	Given a user is on any page, when the user clicks the avatar in the	Low	3

	<p>such as office hours and contact details on my dashboard so that I can keep my profile accurate and up to date.</p>	<p>top-right, then a menu options with ‘Edit Profile’ option.</p> <p>Given the menu is open, when the user clicks Edit Profile, then the profile page opens displaying current user info.</p> <p>Given the profile page is open, when the user edits the fields and clicks Save, then the changes are saved and shown on the profile.</p>		
<p>16. Course Calendar Generation</p>	<p>As a professor, I want all course assessments to be automatically added to my course calendar and be able to modify them when</p>	<p>Given a professor is on a course overview page, when they toggle the sidebar menu, they should see a “Course Calendar” option listed.</p>	High	8

	<p>needed so that I can maintain an organized and up to date schedule.</p>	<p>Given a professor is on a course overview page, when they click on the “Course Calendar” option from the sidebar, then they should be redirected to the calendar page for that specific course section.</p> <p>Given a professor is on the calendar page, when the page loads, then a weekly course calendar is displayed with labeled week cards containing assessment cards assigned to that week.</p> <p>Given the course calendar page is displayed, when there</p>		
--	--	--	--	--

		<p>are unassigned assessments, then they appear in an Unscheduled Assessments section.</p> <p>Given the calendar and assessment cards are displayed, when the professor drags and drops an assessment to any week, then the card appears under that week.</p> <p>Given the professor has moved assessment cards, when they click Save, then the updated placements are saved.</p>		
17. Exam Room Assignment	As a professor, I want to assign my section's students to the available exam rooms	Given the rooms are assigned to the course, when the professor opens Exam Room	High	8

	<p>in the system so that the allocation is completed correctly without needing manual student distribution or coordination with other instructors.</p>	<p>Assignment, then the available rooms and their capacities are displayed.</p> <p>Given the professor selects one or more rooms, when they confirm the selection then the system automatically distributes the enrolled students across the selected rooms based on capacity.</p> <p>Given the professor has confirmed the selection, when they click save, then the room assignment is saved and visible to other instructors.</p>		
--	--	--	--	--

18. Exam Notifications	As a professor, I want students to automatically receive email notifications with the assigned exam room, date, and time so that I can ensure timely and accurate communication of exam details.	Given the professor has completed the exam room assignment for their section, when the professor clicks save, then the system automatically generates and sends an email notification to all enrolled students containing exam date, time and their assigned exam room.	Medium	3
19. Exam Room Allocations Report	As a professor, I want to access and print a report showing students assigned exam rooms so that I can easily verify allocations and assist with on-site coordination during exams.	Given the exam room assignment has been completed, when the professor clicks view report, then a report should be displayed showing each student and their assigned room.	Medium	5

		Given the report is displayed, when the professor clicks download, then the report should be exported in a printable format.		
20. Cross-Course Collaboration	As a professor, I want to view professors teaching the same courses and have direct links for individual and group emails so that we can collaborate more efficiently and maintain alignment in course delivery.	<p>Given a professor is on a course overview page, when the page loads, then a card is displayed listing other professors teaching the same course.</p> <p>Given the collaboration card is displayed, when a professor clicks an individual name or the group email option, then an email window opens addressed to that professor or group.</p>	Low	3

21. Grade Coloring	As a professor, I want grades in the gradebook to be automatically color-coded highlighting top, average and bottom performers per assessment so that I can quickly identify performance trends without manual review.	<p>Given a professor is on a course overview page, when they toggle the sidebar menu, they should see a “Grading” option listed.</p> <p>Given a professor is on a course overview page, when they click on the “Grading” option from the sidebar, then they should be redirected to the grade book page for that specific course section.</p> <p>Given a professor is on the grading page, when the page loads, then a gradebook table is displayed showing</p>	High	5
---------------------------	--	---	------	---

		<p>students as rows and assessments as columns.</p> <p>Given the gradebook is displayed, when assessment scores appear, then the two highest scores in that column are highlighted in green, the two scores closest to average are highlighted in yellow, and the two lowest scores in that column are highlighted in red.</p>		
22. Grade Statistics	As a professor, I want to view grade statistics such as class averages, grade distributions, and pass rates so that I can analyze overall class performance and	Given a professor is on a course overview page, when they toggle the sidebar menu, they should see a “Grade Statistics” option listed.	Medium	5

	identify areas for improvement.	Given a professor is on a course overview page, when they click on the “Statistics” option from the sidebar, then the dashboard should display overall class performance statistics such as average score, highest score, lowest score, pass/fail rate, grade distribution, etc.		
--	---------------------------------	--	--	--

Table 2: Project User Stories

C. Use Cases

1. User Login & Dashboard Access

Name	User Login & Dashboard Access
Identifier	UC01
Description	The system authenticates a user and navigates them to the appropriate dashboard based on their assigned role(s). If the user has both Admin and Professor roles, the system prompts the user to select which dashboard to access.

Goal	Ensure authenticated users are directed to the correct dashboard based on their role(s).
Actors	User (Admin, professor or both), Authentication System
Preconditions	<ol style="list-style-type: none"> 1. The user account exists 2. The user's role assignments are defined in the system
Assumptions	The login page shows username, password, a log in button and a reset password link.
Frequency	Multiple times per day during active semesters.
Main Flow	<ol style="list-style-type: none"> 1. User enters login credentials and submits login request. 2. The system authenticates the credentials. 3. The system retrieves the role(s) assigned to the user. 4. The system navigates the user to the appropriate role-specific dashboard. 5. The use case ends when the appropriate dashboard is displayed.
Alternate Flows	<p>AF 2.1: Invalid Credentials</p> <ul style="list-style-type: none"> • At step 2: If the credentials are invalid: <ol style="list-style-type: none"> ○ 2a. The system displays an error message ("Invalid username or password"). ○ 2b. The user may try again or click Reset Password. <p>AF 3.1: User Has Multiple Roles (Admin + Professor)</p> <ul style="list-style-type: none"> • At step 3: If more than one role is assigned: <ol style="list-style-type: none"> ○ 3a. The system displays a role-selection popup with options ("Continue as Admin" / "Continue as Professor").

	<ul style="list-style-type: none"> ○ 3b. The user selects the desired role for the current session. ○ 3c. The system proceeds to step 4, redirecting to the chosen role's dashboard.
Post Conditions	<ul style="list-style-type: none"> • Success: The user is authenticated and redirected to the role-specific dashboard. • Failure: The user remains on Login page with an error message shown.

Table 3: UC01 - User Login & Dashboard Selection

2. System-Generated CAR Preview & Submission

Name	System-Generated CAR Preview & Submission
Identifier	UC02
Description	When a professor selects one of their course sections and opens the CAR tab, the system automatically generates and displays a preview of the CAR. The professor may download the CAR or submit it if all required data is complete.
Goal	Provide professors with a generated CAR that reduces manual reporting effort and supports review, download, and submission.
Actors	Professor (Primary) , Database (Supporting System)
Preconditions	<ol style="list-style-type: none"> 1. The professor is logged in. 2. The professor has at least one assigned course section. 3. CAR generation data sources (grades, CLO mapping, assessment records, etc.) exist in the database.
Frequency	Preview can be accessed multiple times during semester. Submission is only done once per semester.

Main Flow	<ol style="list-style-type: none"> 1. The professor logs in and is navigated to the Professor Dashboard. 2. The professor selects one of the course sections displayed on the dashboard. 3. The professor opens the CAR tab. 4. The system generates and displays the CAR preview for the selected section. 5. The use case ends when the CAR preview is visible.
Alternate Flows	<p>AF 4.1: Incomplete Required Data</p> <ul style="list-style-type: none"> • At step 4: <ol style="list-style-type: none"> ○ 4a. The system detects that required CAR data is missing. ○ 4b. The system displays a notice indicating missing information. ○ 4c. The Submit action is disabled until the missing information is completed. ○ 4d. The flow returns the professor reviewing the preview. <p>AF 4.2: Download CAR</p> <ul style="list-style-type: none"> • At step 4: <ol style="list-style-type: none"> ○ 4a. The professor selects Download ○ 4b. The system generates the CAR as a PDF. ○ 4c. The system initiates the download. ○ 4d. The flow ends, the professor remains on the CAR preview. <p>AF 4.3: Submit CAR</p> <ul style="list-style-type: none"> • At step 4:

A. Work Breakdown Structure

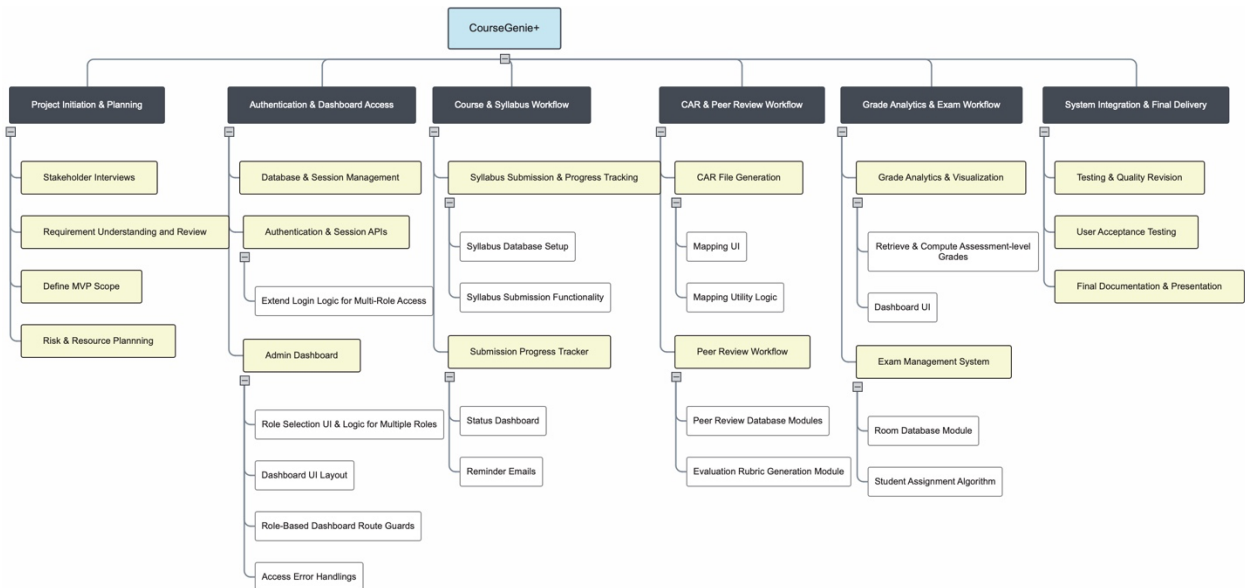


Figure 1: Work Breakdown Structure

B. Gant Chart

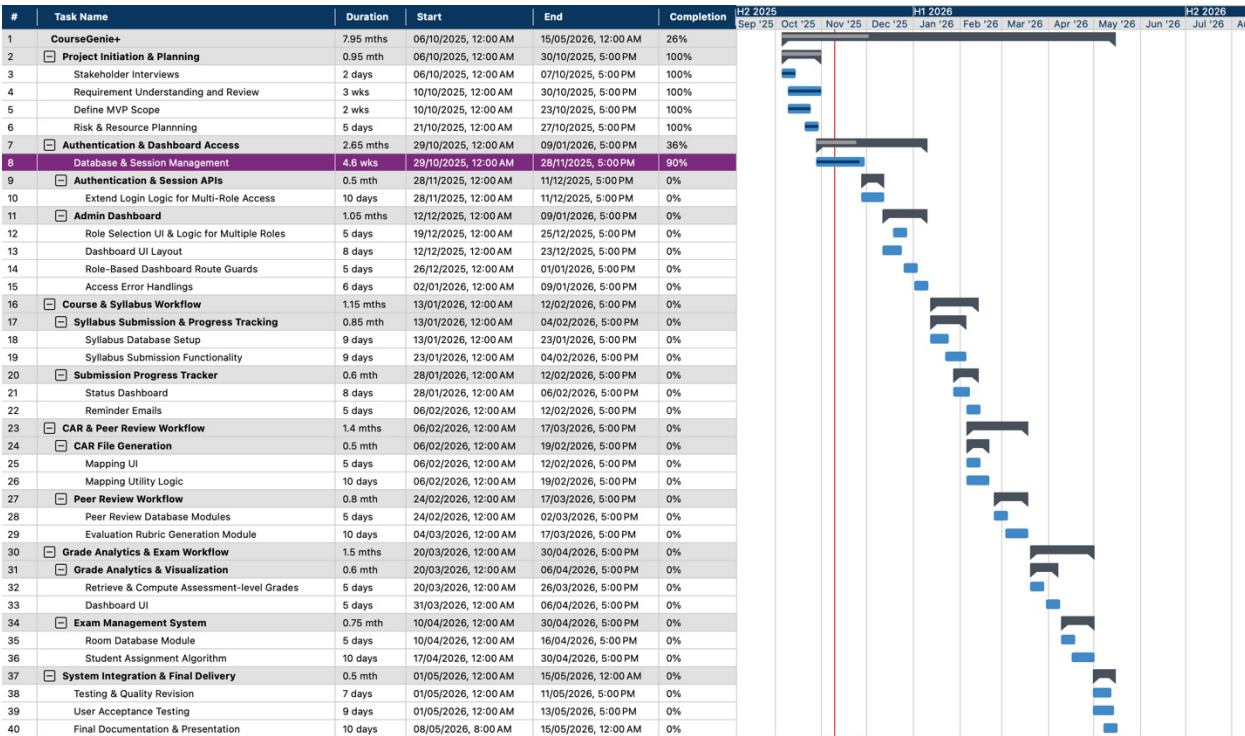


Figure 2: Gant Chart

XI. Risk Assessment

Risk assessment is conducted to proactively identify potential challenges that may impact the success of CourseGenie+.

A. Risk Matrix

Impact						
Likelihood		1 (Insignificant)	2 (Minor)	3 (Noticeable)	4 (Major)	5 (Critical)
	5 (Very High)	Medium	High	High	Critical	Critical
	4 (High)	Medium	Medium	High	High	Critical
	3 (Moderate)	Low	Medium	Medium	High	High

	2 (Low)	Low	Low	Medium	Medium	High
	1 (Very Low)	Negligible	Low	Low	Medium	Medium

Table 6: 5x5 Risk Assessment Matrix

B. Legend

Risk Level	Score Range	Meaning / Required Action
Low	1-7	Acceptable risk, no special intervention needed.
Medium	8-14	Needs monitoring during development.
High	15-19	Required planned mitigation and follow up in sprints to prevent delays and quality issues.
Critical	>=20	Must be addressed immediately, risks timeline or project success

Table 7: Risk Level Interpretation Legend

C. Project Risk Register & Mitigation

Risk	Type	Likelihood (1–5)	Impact (1–5)	Risk Score	Risk Level	Mitigation Strategy
------	------	---------------------	-----------------	---------------	---------------	------------------------

Learning Curve in Spring Boot (Backend) and Angular (Frontend) Development	Technical	4	4	16	High	Allocate dedicated learning sprints, follow Spring Boot documentation, pair-program with mentor feedback, prototype incrementally.
UI Complexity or User Confusion	Technical	3	4	12	Medium	Apply consistent labeling, minimize clicks, include tooltips, conduct usability testing with 2–3 professors before release.
Database Relationship Misconfiguration Leading to Data Integrity Issues	Technical	3	5	15	High	Use ERD modeling, enforce referential integrity, conduct database testing early before implementing dependent modules.

Time Constraints Due to Academic Workload	Project Management	5	4	20	Critical	Adopt strict weekly sprint plans, set non-negotiable task deadlines, shift secondary features to later milestones.
Inability to Integrate with MyCourses Database (Permission Restrictions)	Technical/External	5	3	15	High	Build CourseGenie+ as a standalone workflow system and allow professors/admins to import/export required data manually (e.g., CSV uploads), avoiding the need for direct MyCourses API integration.
Scope Creep Due to Continuous Feature Ideas	Project Management	4	4	16	High	Establish a fixed MVP scope; implement a change request list; new features are only added after milestone validations.

Unclear or Evolving Requirements	Requirements / Stakeholder	3	4	12	Medium	Conduct requirement clarification meetings per milestone; finalize workflows before development; maintain change log.
Low Adoption by Professors	User Adoption / Behavioral	3	5	15	High	Ensure UI simplicity, provide quick video tutorials, run short demo workshops, and collect feedback early.
Incorrect Room Capacity Handling	Operational	2	5	10	Medium	Automatically validate student count against room capacity; display warning messages and prevent confirmation if capacity exceeded.

Data Entry or Selection Errors	Human Error / Functional	4	3	12	Medium	Use dropdown validations, confirmation dialogs, auto-default safe values, and highlight required fields to prevent mistakes.
---------------------------------------	--------------------------	---	---	----	---------------	--

Table 8: Project Risk Register & Mitigation Strategies

XII. Resources and Budget Planning

Effective resource planning is essential to ensure that CourseGenie+ progresses smoothly across all development phases. Since the project is conducted within an academic context, resource allocation focuses on optimizing team expertise, available technology, and institutional support rather than financial assets. This section outlines the human, technical, and logistical resources required to successfully complete the project.

A. Resources

1. Human Resources: The CourseGenie+ team consists of three senior students in the Computing and Information Technologies program, each contributing specialized skills while collaborating on all parts of the project.

- Jeeda Kotob - Full Stack Developer: Integrating the backend and frontend, managing the database, and maintaining the flow of information between the various components of the system.

- Ryma Ait Tayeb - Back End Developer: Building and maintaining the server-side logic, implementing the APIs through Spring Boot, and managing the security and integrity of the data.
- Ibraheem Mustafa - Front End Developer: Using Angular, Ibraheem designs the interfaces, builds responsive dashboards, and creates a seamless experience for the users, including professors and administrators.

As project mentors, Dr. Ali Assi and Mr. Qusai Hasan provide technical and architectural supervision. As an external stakeholder, Ms. Dezzil Castelino, the Institutional Effectiveness Manager, offers insights into administrative workflows and accreditation-related requirements. To foster coordination, accountability, and quality assurance in the project, all stakeholders participate in compliance with scheduled activities, including weekly mentor meetings and sprint reviews.

2. Technical Resources: CourseGenie+ is built using a combination of open-source and educationally licensed technologies that support scalability and maintainability. The following tools and platforms form the core of the project's technical infrastructure:

- Backend Framework: Spring Boot for secure and modular application logic.
- Frontend Framework: Angular for dynamic user interfaces and dashboard development.
- Database System: MySQL for structured data management and reliable storage.
- Version Control: GitHub for collaborative coding, version tracking, and repository management.
- Development Tools: Visual Studio Code and IntelliJ IDEA for coding, debugging, and testing.

- **Diagramming and Documentation:** PlantUML for system diagrams such as system use case diagram.

These tools collectively support an agile development cycle, enabling rapid prototyping, continuous integration, and iterative testing without financial overhead.

3. Logistical Resources: Since CourseGenie+ is developed within RIT Dubai, the team benefits from institutional facilities and services essential to project execution.

- **Development Hardware:** Each member uses a personal laptop, meeting project specifications.
- **Campus Resources:** Access to RIT labs, meeting rooms, and classrooms for collaborative work and presentations.
- **Communication and File Sharing:** Google Drive and GitHub for real-time file exchange, progress updates, and document synchronization.
- **Mentorship and Feedback Sessions:** Weekly review meetings to ensure progress tracking and provide opportunities for technical and strategic feedback from mentors.

B. Cost Estimate and Budgeting

CourseGenie+ is a university-supported academic project that operates with no direct financial expenditures. All required development and testing resources are provided through institutional access or open-source platforms, ensuring a cost-effective and sustainable workflow.

1. Software and Tools: Every framework and tool used in this project is open-source or accessible under free academic plans. Hence, there is no need for external subscriptions or paid proprietary tools. These include Spring Boot, Angular, MySQL, Postman, IntelliJ IDEA, and GitHub. All project components are therefore free.

RIT Dubai provides the computing resources and project development, storage, version control, and testing facilities. Hence, the entire implementation is cost-free.

2. Infrastructure and Hosting: The development and testing environments are your personal laptops or those provided by RIT. For demonstration purposes, the temporary deployment will use internal virtual machines or RIT institutional servers. There is no cost for external commercial hosting. Educational or free-tier services like GitHub or MySQL will provide data storage and repositories.

C. Initial Bill of Materials (BoM)

The Bill of Materials would identify all the necessary components, technologies, and resources that are required for the successful making and development of CourseGenie+. Since the project is software-based, the BoM emphasizes hardware development and testing, as well as the major software frameworks and services that we are using.

1. BoM Summary:

Category	Component	Source	Purpose of Need	Estimated Cost

Hardware	Developer Laptops	Personal / RIT Dubai	Used for software development, testing, and demonstrations	Provided / Available
Software	Spring Boot Framework	Open Source	Backend development and API integration	Use Existing / Free
Software	Angular Framework	Open Source	Frontend user interface development	Use Existing / Free
Database	MySQL Server	Oracle Community	Data storage and management	Use Existing / Free
Version Control	GitHub	GitHub Education	Repository management and collaborative development	Use Existing / Free
Design Tools	PlantUML	Open Source	UI/UX wireframing and documentation	Use Existing / Free

Figure 3: BoM

3. *Budget Overview*: The mentioned components are either open-source or already provided at no cost. Therefore, the BoM fully complies with the zero-cost project budget as outlined in Section XII. No additional funding is required as of what is foreseeable from now, and the identified resources are efficient enough for completing all project deliverables within the planned timeline.

XIII. Test Plan (First Cut)

ID	Title	Precondition	Input	Steps	Expected Output	Actual Output	Pass/Fail
1	Admin Login (Correct Credentials)	Admin account exists	Username: axacad5@rit.edu Password: Ali123	1. Open Login Page 2. Enter credentials 3. Click Login	System redirects to Admin Dashboard		
2	Professor Login (Correct Credentials)	Professor account exists	Username: qxhcad@rit.edu Password: Q123	1. Open Login Page 2. Enter credentials 3. Click Login	System redirects to Professor Dashboard		
3	Login (Wrong Password)	Any user exists	Username: admin@rit.edu Password: WrongPass45	1. Enter username 2. Enter wrong password 3. Click Login	System displays “Incorrect username or password.”		
4	Login (Empty Password)	Any user exists	Username: hkscad@rit.edu Password: “ ”	1. Enter username 2. Leave password blank 3. Click Login	System displays “Password is required.”		

5	Login (Empty Username)	Any user exists	Username: “ ” Password: Admin123	1. Leave username blank 2. Enter password 3. Click Login	System displays “Username is required.”		
6	Login (Both Fields Empty)	Login page loaded	Username: “ ” Password: <i>(blank)</i>	1. Leave both fields empty 2. Click Login	System displays “Enter username and password.”		
7	Login (Case Sensitivity Check)	Admin account exists	Username: AXMCAD4@RIT.EDU Password: ADMIN123	1. Enter incorrect case username 2. Click Login	System displays “Incorrect username or password.”		
8	Open Syllabus Page	Professor logged in	—	1. Click Syllabus tab	Syllabus generation UI loads		
9	Generate Syllabus	Professor logged in	Course information present	1. Click Generate Syllabus	System generates syllabus PDF		
10	Submit Syllabus	Syllabus already generated	Click Submit Syllabus	1. Generate syllabus 2. Click Submit	Status changes to Submitted		

11	Prevent Submit Without Generating	Professor logged in	Attempt submit without generating	1. Click Submit Syllabus before generating	System displays “Generate syllabus before submitting.”		
12	Edit Fields Before Generating Syllabus	Professor logged in	Change course title → “Data Mining - Fall 2025”	1. Edit fields 2. Click Generate Syllabus	Generated syllabus reflects updated data		
13	Prevent Double Submission	Syllabus already submitted	Click Submit Syllabus again	1. Re-open syllabus page 2. Click Submit	System displays “Syllabus already submitted.”		
14	Syllabus Tracking View (Admin)	Multiple professors exist	Example: Huda = Submitted, Ahmed = Not Submitted	1. Admin opens Syllabus Tracking page	Submission status list displays correctly		
15	CAR File Template Generation	Professor logged in	Click Generate CAR	1. Go to CAR Page 2. Click Generate	CAR PDF generated with placeholders		
16	Prevent CAR Generation With No Data	No assessments recorded	Click Generate CAR	1. Go to CAR Page 2. Click Generate	System displays “No assessment data available.”		

17	CLO–PLO Mapping Selection	CLOs and PLOs exist	Select: CLO1 → PLO5	1. Open Mapping Page 2. Apply mapping	Mapping shows selected and saved visually		
18	Clear CLO–PLO Mapping	A mapping already exists	Click Clear Mapping	1. Open Mapping Page 2. Click Clear	Mapping resets to empty state		
19	Assign Peer Reviewer	Admin logged in	Reviewer: hkscad@rit.edu Reviewee: qxhcad@rit.edu	1. Open Peer Review page 2. Assign pair 3. Save	Reviewer sees task in dashboard		
20	Prevent Self-Assignment in Peer Review	Admin logged in	Reviewer: hkscad@rit.edu Reviewee: hkscad@rit.edu	1. Open Peer Review page 2. Select same professor for both fields 3. Save	System displays “Reviewer and reviewee cannot be the same.”		
21	Exam Scheduling Page Loads	Rooms & sections exist	Rooms: B-102, B-202 Section: GCIS.124.600	1. Open the Exam Scheduling page. 2. Select course section GCIS.124.600. 3. Enter a random number of students for Room B-102.	UI displays rooms and sections		

				4. System assigns the remaining students to Room B-202. 5. Click Save.			
22	Display Room Capacity	Room exists in DB	Click on View room details	1. Open Exam Scheduling 2. View room details	UI displays: B-102 (Capacity: 30)		

Table 9: Test Plan

REFERENCES

- [1] J. Sánchez, M. Serrano, A. Duarte and F. García, "Learning Management Systems for Higher Education: A Comparative Study," *Journal of Educational Technology*, vol. 21, no. 2, pp. 145-162, 2024.
- [2] A. Yamani, S. Alharthi and H. Smirani, "Blackboard vs. Brightspace: A Comparative Study," *International Journal of Emerging Technologies in Learning (iJET)*, vol. 17, no. 9, pp. 45-58, 2022.
- [3] B. Simon, K. Müller and R. Patel, "Adoption of Moodle Tools: Instructor and Student Perspectives," *Education and Information Technologies*, vol. 29, no. 4, pp. 2105-2122, 2024.
- [4] Q. Li, Y. Jung and A. F. Wise, "How instructors use learning analytics: The pivotal role of pedagogy," *Journal of Computing in Higher Education*, vol. 37, pp. 55-75, 2025.
- [5] M. Hernández-de-Menéndez, R. Morales-Menendez, C. A. Escobar and R. A. Ramírez Mendoza, "Learning analytics: state of the art," *International Journal on Interactive Design and Manufacturing (IJIDeM)*, vol. 16, no. 3, pp. 1209-1230, 2022.
- [6] P. Ngulube and M. M. Ncube, "Leveraging Learning Analytics to Improve the User Experience of Learning Management Systems in Higher Education Institutions," *Information*, vol. 16, no. 5, pp. 419-419, 2025.
- [7] X. Kui, N. Liu, Q. Liu, J. Liu, X. Zeng and C. Zhang, "A survey of visual analytics techniques for online education," *Visual Informatics*, vol. 6, no. 7, 2022.
- [8] D. Vlachopoulos and A. Makri, "A systematic literature review on authentic assessment in higher education: Best practices for the development of 21st century skills, and policy considerations," *Studies in Educational Evaluation*, vol. 83, p. 101425–101425, 2024.
- [9] E. Jenkins, R. D'Aoust, S. de Souza Elias, H.-R. Han, P. Sharps and C. Alvarez, "Faculty peer review of teaching taskforce: A quantitative descriptive research study for the peer review process," *Nurse Education Today*, vol. 106, p. 105055, 2021.