Software Requirements Specification (SRS) Document

Team 39
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1.Brief problem statement:

The task is to automate the process of generating optimized examination timetables for Mid-Semester and End-Semester exams for the Examination Cell of IIITH. The solution must involve designing an algorithm that extracts data such as course codes, student enrollments, faculty and examination rooms along with seating arrangements from a database to create a timetable that minimizes the number of students with consecutive exam slots, evenly distributes exams across specified slots, invigilation duties for each room, seating plan for students and provides statistical insights. The generated timetable should be available as both Excel and PDF documents

2.System requirements:

2.1 Functional Requirements

Frontend (User Interface)

- Web interface for Examination Cell to:
    - Input **Exam Type**, **Dates**, **Time Slots**, **Academic Year**, **Semester**, and **Courses**.
    - View and download the generated timetable in **Excel** and **PDF** formats.
    - Display **exam statistics** (e.g., exams per day, students per slot, consecutive exams).
    - Provide **visual insights** through graphs and charts.

Backend (Logic and API)

- **RESTful APIs** to:
    - Fetch/store **course, student, and schedule data**.
    - Process the **timetable generation algorithm** with constraints.
    - Generate Excel and PDF outputs of the timetable.
    - Provide statistical insights to the frontend.
- **Timetable Generation Algorithm** should:
    - Optimize exam scheduling by minimizing consecutive exams.
    - Evenly distribute exams across slots.
    - Assign **faculty invigilators** and generate a **seating plan**.
    - Detect and handle **scheduling conflicts**.

2.2 Non-Functional Requirements

- **Performance:**
    - Handle a large number of **students and courses efficiently**.
    - Ensure **fast response times** for timetable generation.
- **Reliability:**
    - Ensure accurate scheduling and statistical calculations.
    - Provide **error handling** for conflicts.
- **Usability:**
    - Intuitive UI for Examination Cell staff.
- **Security:**
    - Role-based access control.
    - Secure APIs and database interactions.

2.3 Technical Requirements

Frontend

- **React.js** for UI development.
- **Tailwind CSS** for styling.
- **Chart.js / D3.js** for graphs.

Backend

- **Node.js with Express.js** for APIs.
- **PDFKit/Puppeteer** for PDF generation.
- **ExcelJS** for creating Excel files.

Database

- **MySQL** to store student/course/exam data.
- Collections:
    - `students`: Student details & enrolled courses.
    - `courses`: Course details & enrolled students.
    - `faculty`: Faculty details & assigned courses.
    - `classroom`: Room details & capacity.

Hosting

- Deployment on IIITH servers.

2.4 Development Tools

- **Git & GitHub** for version control.
- **README and user manuals** for documentation

3.Users profile:

Users of this system would only be the Examination Cell of IIIT Hyderabad and the Academic Office

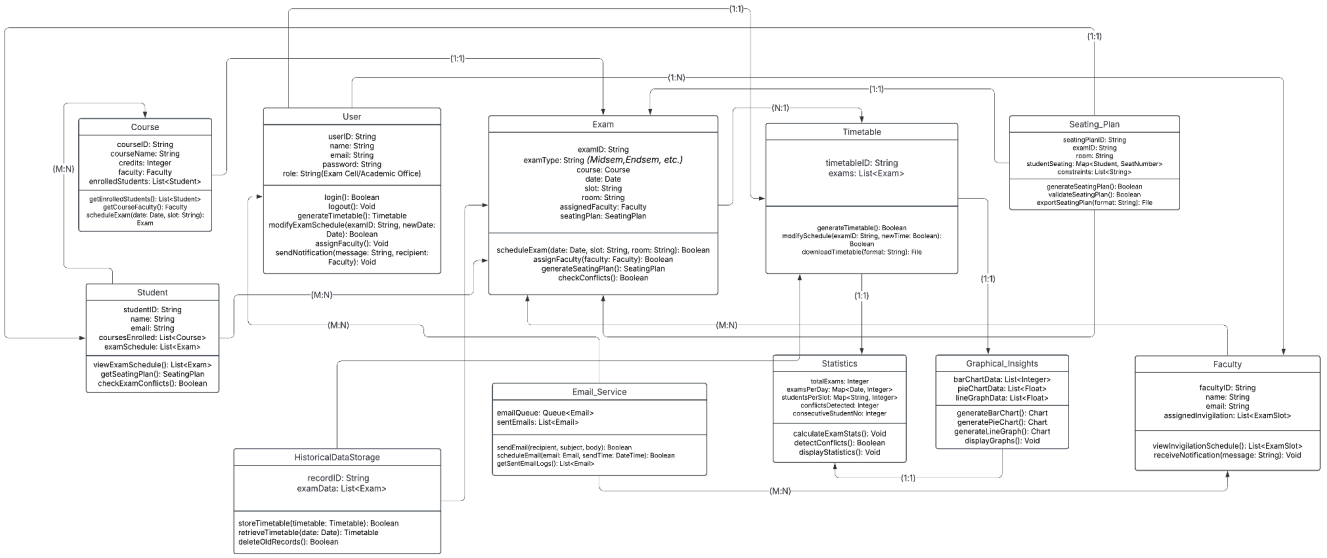
should also be given access. The Exam Cell staff would be able to navigate through our user interface with ease as the process of timetable generation is automated.

Feature requirements (described using use cases):

No.	User Case Name	Description	Release
1.	User Authentication	CAS-based login for the Examination Cell and Academic Office.	R1
2.	Exam Input Form	Users can input exam type, dates, slots and courses	R1
3.	Generate Timetable	A 'Generate Timetable' button should be present, and the top three timetables should be displayed for selection.	R1
4.	Choose Timetable	Option to choose one out of the three generated timetables.	R1
5.	Exam Statistics Dashboard	Displays exams per day, students per slot, and conflicts on a new tab.	R1
6.	Graphical Insights	Bar charts and graphs for better visualization displayed on a new tab.	R1
7..	Seating Plan Generation	Ensures no student seating conflicts according to the constraints given.	R2
8.	Faculty Invigilation	Auto-assign faculty to exam rooms	R2

	Assignment	based on student count according to given constraints.	
9.	Historical Data Storage	Stores past timetables for reference.	R2
10.	Modify Exam Schedule	Users can update the timetable before finalizing.	R2
11.	Download timetable	users can download the generated timetable in Excel & PDF formats for record-keeping and distribution.	R1
12.	Send Faculty Email	Automatically send emails to faculty members with their invigilation assignments and exam schedules .	R2
13.	Deployment	The final system is deployed on the IIIT Hyderabad servers, making it accessible to the Examination Cell staff.	R2

Use case diagram:
https://lucid.app/lucidchart/220429ba-fd39-486d-8b22-564bdae7cbf9/edit?viewport_loc=969%2C328%2C4104%2C1526%2CHWEp-vi-RSFO&invitationId=inv_57b54b35-62c5-49e1-b437-2429994f16f0



Use case description:

Use Case Number:	UC-01
Use Case Name:	User Authentication
Overview:	CAS-based login for the Examination Cell and Academic Office.
Actors:	Examination Cell Staff, Academic Office
Pre condition:	The authentication server or system must be online and accessible.
Flow:	Main (success) Flow: 1. User visits the login page. 2. User enters CAS credentials. 3. System verifies authentication. 4. User is redirected to the dashboard.
	Alternate Flows:If authentication fails, the system shows an error message and prompts the user to retry.
Post Condition:	User is logged in and can access the system.

Use Case	UC-02

Number:	
Use Case Name:	Exam Input Form
Overview:	Users can input exam type, dates, slots, and courses to generate a timetable.
Actors:	Examination Cell Staff, Academic Office
Pre condition:	User must be authenticated and logged into the system.
Flow:	Main (success) Flow: 1. User navigates to the exam input page. 2. User selects the Academic Year, Semester type and Exam Type (Mid-Semester, End-Semester),. 3. User selects Exam Dates from a calendar. 4. User selects the Time Slots and Number of Slots per Day. 5. User selects the Courses for which the exam is to be held. 6. User clicks Generate Timetable to save input data.
	Alternate Flow: If mandatory fields are left empty, the system prompts the user to enter the required details.
Post Condition:	Exam details are stored in the system and ready for timetable generation.

Use Case Number:	UC-03
Use Case Name:	Generate Timetable
Overview:	The system generates an optimized timetable based on the given constraints. A 'Generate Timetable' button should be present, and the top three timetables should be displayed for selection.
Actors:	Examination Cell Staff, Academic Office

Pre condition:	User must be authenticated and logged into the system.
Flow:	Main (success) Flow: 1. User clicks the 'Generate Timetable' button. 2. The system processes the exam input data and applies optimization constraints. 3. The system generates three optimized timetable options. 4. The generated timetables are displayed for the user to review.
	Alternate Flow: If no valid timetable can be generated due to conflicts, the system prompts the user to modify input constraints.
Post Condition:	The system generates three timetable options, ready for the user to review and select.

Use Case Number:	UC-04
Use Case Name:	Choose Timetable
Overview:	Users can select one out of the three generated timetables for finalization.
Actors:	Examination Cell Staff, Academic Office
Pre condition:	User must be authenticated and logged into the system, and generated timetables.
Flow:	Main (success) Flow: 1. User navigates to the Choose Timetables part. 2. The system displays the three generated timetable options. 3. User reviews the timetables and selects one. 4. The system confirms the selection and saves the chosen timetable as final.
	Alternate Flow: If the user does not approve any of the generated timetables, they can

	reset progress and regenerate a new set.
Post Condition:	The selected timetable is finalized and ready for further processing, such as download or modifications.

Use Case Number:	UC-05
Use Case Name:	Exam Statistics Dashboard
Overview:	Displays key statistics such as exams per day, students per slot, and conflicts to provide insights into the generated timetable.
Actors:	Examination Cell Staff, Academic Office
Pre condition:	A timetable must be generated and available in the system.
Flow:	Main (success) Flow: 1. User navigates to the Exam Statistics section. 2. The system retrieves timetable data and computes statistics. 3. The system displays exams per day, students per slot, and students with consecutive exams. 4. User can review and analyze statistics.
	Alternate Flow: If no timetable is available, the system notifies the user and redirects them to generate one.
Post Condition:	The user gains insights into exam scheduling and potential conflicts, aiding decision-making.

Use Case Number:	UC-06
Use Case Name:	Graphical Insights
Overview:	Displays visual representations of exam statistics using bar charts, pie charts, and graphs to enhance understanding.

Actors:	Examination Cell Staff, Academic Office
Pre condition:	A timetable must be generated and available in the system.
Flow:	Main (success) Flow: 1. User navigates to the Graphical Insights section. 2. The system retrieves timetable data and statistical metrics. 3. The system generates bar charts, pie charts, and graphs representing exam distribution, conflicts, and student load. 4. User can interact with the visual elements for deeper insights.
	Alternate Flow: If no data is available, the system notifies the user to generate a timetable first.
Post Condition:	The user can visually analyze the timetable data, making it easier to spot trends and conflicts.

Use Case Number:	UC-07
Use Case Name:	Seating Plan Generation
Overview:	Generates and displays an optimized seating plan for students, ensuring no seating conflicts according to constraints such as room capacity and student distribution.
Actors:	Examination Cell Staff, Academic Office
Pre condition:	A timetable must be generated and available in the system.
Flow:	Main (success) Flow: 1. User navigates to the Seating Plan section. 2. The system retrieves student, exam, and room data. 3. The system assigns students to available rooms, ensuring proper distribution and avoiding conflicts. 4. The generated seating plan is displayed for review.

	5. User can download the seating arrangement in Excel & PDF formats.
	Alternate Flow: If the system detects overcrowding or conflicts, it alerts the user to adjust exam slots or room allocations.
Post Condition:	A seating plan is successfully generated and available for review and download.

Use Case Number:	UC-08
Use Case Name:	Faculty Invigilation Assignment
Overview:	Automatically assigns faculty members to exam rooms based on the number of students and predefined invigilation rules.
Actors:	Examination Cell Staff, Academic Office
Pre condition:	A timetable must be generated and available in the system and a seating plan.
Flow:	Main (success) Flow: 1. User navigates to the Faculty Invigilation Assignment section. 2. The system retrieves faculty availability, exam schedule, and student distribution. 3. The system assigns 1-2 faculty members per exam room, depending on student count. 4. The generated faculty assignment list is displayed for review. 5. User can download the invigilation list in Excel & PDF formats.
	Alternate Flow: If there are insufficient faculty members, the system alerts the user to manually adjust the assignments.
Post Condition:	A faculty invigilation list is successfully generated and available for review and download.

Use Case Number:	UC-09

Use Case Name:	Historical Data Storage
Overview:	Stores past timetables for future reference and allows users to access previous exam schedules.
Actors:	Examination Cell Staff, Academic Office
Pre condition:	Past timetables, seating and invigilation suty must have been generated and saved in the system.
Flow:	Main (success) Flow: 1. User navigates to the Historical Data section. 2. The system retrieves and displays previously generated timetables. 3. User can search and filter timetables based on date, semester, or course. 4. User selects a past timetable to view details. 5. User can download the timetable in Excel & PDF formats.
	Alternate Flow: If no past timetables exist, the system notifies the user that no data is available.
Post Condition:	The user successfully retrieves and reviews a past timetable, which remains stored in the system.

Use Case Number:	UC-10
Use Case Name:	Modify Exam Schedule
Overview:	Allows users to update exam details such as dates, time slots, or courses before finalizing the timetable.
Actors:	Examination Cell Staff, Academic Office
Pre condition:	A timetable must be generated and available in the system.
Flow:	Main (success) Flow: 1. User navigates to the Modify Exam Schedule section.

	2. The system displays the existing timetable. 3. User can drag and drop an exam to modify. 4. User updates the exam details (e.g., date, time slot, or assigned room). 5. User clicks Save Changes. 6. The system updates the timetable and checks for scheduling conflicts and generates the latest statistics. 7. If no conflicts are found, the changes are saved.
	Alternate Flow: If the modification creates a scheduling conflict, the system alerts the user and suggests alternate slots..
Post Condition:	The updated exam schedule is saved, and the system ensures that no conflicts exist.

Use Case Number:	UC-11
Use Case Name:	Download Timetable
Overview:	Allows users to download the generated timetable in Excel & PDF formats for record-keeping and distribution.
Actors:	Examination Cell Staff, Academic Office
Pre condition:	A timetable must be generated and available in the system.
Flow:	Main (success) Flow: 1. User navigates to the Download Timetable section. 2. The system displays the finalized timetable. 3. User selects the desired format (Excel or PDF). 4. User clicks the Download button. 5. The system generates and downloads the file
	Alternate Flow: If no timetable is available, the system notifies the user to generate one first.
Post Condition:	The user successfully downloads the timetable in the selected format for further

	use.

Use Case Number:	UC-12
Use Case Name:	Send Faculty Email
Overview:	Automatically sends emails to faculty members with their invigilation assignments and exam schedules prior to the day of examination
Actors:	Examination Cell Staff, Academic Office
Pre condition:	The timetable, seating and faculty invigilation assignments must be finalized.
Flow:	Main (success) Flow: 1. User navigates to the Send Faculty Email section. 2. The system retrieves faculty invigilation assignments from the database. 3. The system compiles emails with exam dates, assigned rooms, and invigilation duties. 4. User clicks Send Emails. 5. The system sends emails to the assigned faculty members.
	Alternate Flow: If faculty details are missing, the system notifies the user and suggests updating assignments.
Post Condition:	Faculty members receive emails with their invigilation assignments.

Use Case Number:	UC-13
Use Case Name:	Deployment
Overview:	The final system is deployed on the IIIT Hyderabad servers, making it accessible to the Examination Cell staff.
Actors:	Examination Cell Staff, Academic Office

Pre condition:	The system must be fully developed, tested, and approved for deployment.
Flow:	Main (success) Flow: 1. The development team finalizes the system testing. 2. The system is packaged for deployment. 3. The system is uploaded to the IIIT Hyderabad servers. 4. The Examination Cell Staff is granted access to the deployed system. 5. A final check is performed to ensure proper functionality.
	Alternate Flow: If deployment fails, the system logs the error, and the development team troubleshoots and retries deployment.
Post Condition:	The system is successfully deployed and ready for use by the Examination Cell staff.