



Mathematics and Computer Science

Software Engineering _Non-Exam Based Assessment

Cover Sheet

Term Project Part 1

Systems Request, Business Case and Feasibility Report

Course Name	Software Engineering	Course Code	MCIS 6303
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This assessment will assess the following Course learning outcomes:

	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6

Academic Honesty Statement

In accordance with SAU policy and Academic Honesty

- Students are required to refrain from all forms of academic dishonesty as defined and explained in SAU procedures and directions from SAU personnel.
- A student found guilty of having committed acts of academic dishonesty may be subject to one or more of the disciplinary measures as outlined in Articles of the Student and Academic Regulations.

Student ID: 999901332	Raja Rajeswari Asetty
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Introduction to Systems Request

Request Details

The system request for the Smart Classroom Management System was made by the administration of a school seeking to improve the efficiency and effectiveness of classroom management. The primary requester was the school principal, Mr. John Smith, who identified the need for a comprehensive and user-friendly platform to streamline various classroom-related tasks. The request was initiated after recognizing the challenges faced in traditional classroom management, such as manual attendance tracking, appliance control, and complaint handling.

Urgency

The request was marked with high urgency and priority as the school administration aimed to implement the system in the upcoming academic year. The urgency was driven by the desire to address the existing inefficiencies and enhance classroom management practices promptly. With the increasing emphasis on technology in education, the school recognized the need to adopt modern solutions to improve the overall learning environment.

Summary of Requirements

The Smart Classroom Management System aimed to provide a comprehensive and user-friendly platform for teachers, staff, and students to manage various classroom-related activities efficiently. The system's key objectives were as follows:

1. *Attendance Management:* The system needed to allow teachers to mark attendance digitally and keep track of students' attendance

records. This feature would provide a more accurate and accessible way to monitor students' attendance and analyze attendance patterns.

2. *Appliance Control*: The system was required to offer the capability of remotely controlling appliances, such as lights and fans, within the classroom. This feature aimed to enhance energy efficiency and provide teachers with the ability to manage classroom resources with ease.
3. *Complaint Handling*: A dedicated section for reporting and resolving problems or complaints was an essential requirement. The system needed to allow students and staff to submit complaints related to classroom facilities, equipment, or any other issues they encounter.
4. *Files Storage*: The system was expected to provide a secure and centralized file storage facility for important class documents, presentations, and assignments. Uploading, storing, and accessing files should be made easy for teachers and students.
5. *Screen Recording*: To enhance ability to reuse the lectures taught in the classroom and to clarify our doubts that arise during the learning process, screen recording during lectures is provided.

Business Background

Business Description

The Smart Classroom Management System was developed for an educational institution, "TechEd Academy," which is a modern K-12 school located in a bustling urban area. TechEd Academy aims to provide a top-notch learning environment that nurtures students' intellectual curiosity, fosters creativity, and prepares them to excel in the rapidly evolving digital age. The institution

is committed to leveraging technology to enhance the educational experience and streamline various administrative processes.

Business Activities

TechEd Academy offers comprehensive educational services for students from kindergarten to grade 12. The school's core activities include:

1. *Quality Education:* TechEd Academy places a strong emphasis on delivering high-quality education. The curriculum is designed to align with the latest educational standards and foster critical thinking, problem-solving, and collaborative skills among students.
2. *Modern Infrastructure:* The school boasts state-of-the-art infrastructure, including well-equipped classrooms, science laboratories, a library, and multimedia facilities. This infrastructure facilitates effective teaching and interactive learning.
3. *Extracurricular Activities:* In addition to academic excellence, the school encourages students to participate in various extracurricular activities, such as sports, arts, music, and debates, to nurture their holistic development.
4. *Innovative Teaching Methods:* The school employs innovative teaching methods, including smart boards, multimedia presentations, and interactive learning tools, to make the learning process engaging and effective.

Products/Services Offered

The primary product offered by TechEd Academy is high-quality education through its well-structured curriculum and qualified faculty. The institution provides a wide range of services, including:

1. *Standardized Education:* The school offers standardized education for all grades, providing students with a strong foundation and preparing them for future challenges.
2. *Personalized Learning:* TechEd Academy understands that each student has unique learning needs. Therefore, the institution strives to personalize the learning experience to cater to individual strengths and weaknesses.
3. *Technology Integration:* Embracing the digital era, the school integrates technology into its teaching methodologies and administrative processes to enhance efficiency and effectiveness.
4. *Extracurricular Programs:* The institution offers a variety of extracurricular programs to develop students' talents and interests beyond academics.

Location and Target Costumers

TechEd Academy is strategically located in a vibrant urban area, accessible to students from nearby neighbourhoods and suburbs. The school's target customers are primarily:

1. *Students and Parents:* The primary target audience comprises students from kindergarten to grade 12 and their parents who seek a comprehensive, technologically driven, and nurturing learning environment.
2. *Educational Community:* The school aims to be a reputable educational institution and collaborates with other educational organizations and communities to share knowledge and best practices.

Justification of Request

Strengths

1. *Innovative Concept:* The Smart Classroom Management System presents an innovative concept in the educational domain, providing a one-stop solution for classroom management and administrative tasks.
2. *User-Friendly Interface:* The website features a user-friendly interface, making it easy for teachers, students, and administrators to navigate and access relevant functionalities.
3. *Advanced Technology:* Leveraging modern technologies such as Node.js, Express.js, and MySQL, the website ensures robustness, scalability, and security for seamless operations.
4. *Responsive Design:* The website is designed with a responsive layout, adapting to different screen sizes and devices, providing an optimal user experience across desktops, tablets, and mobile phones.
5. *Comprehensive Functionality:* The system offers a wide range of features, including attendance tracking, appliance control, file storage, and complaint reporting, streamlining various aspects of classroom management.

Weaknesses

1. *Limited Test Coverage:* While the team conducted extensive testing, some edge cases might not have been accounted for, potentially leading to undiscovered bugs or issues.
2. *Security Concerns:* Although the website incorporates security measures, vulnerabilities could still exist, necessitating continuous monitoring and updates.

3. *Dependency on Internet Connectivity:* The system requires a stable internet connection, and any network disruptions might temporarily hinder its accessibility.
4. *Initial Setup Overhead:* Deploying the system initially might require substantial setup and configuration efforts.

Opportunities

1. *Market Growth:* The increasing demand for digital solutions in the education sector presents an opportunity for the Smart Classroom Management System to gain traction and expand its user base.
2. *Integration with Learning Management Systems:* Collaborating with existing learning management systems could open doors to new partnerships and integrations, enhancing the overall educational experience.
3. *Continuous Improvement:* Regular updates and enhancements based on user feedback can improve the website's functionality, user experience, and performance.

Threats

1. *Competition:* Competing solutions in the educational technology market might pose a threat, requiring the team to differentiate and continuously innovate.
2. *Technological Advancements:* Rapid advancements in technology could render certain features or components of the system obsolete, requiring constant adaptation and evolution.

People

- *Development Team:* Our team consists of skilled web developers, designers, and database administrators, who collaborate to design, implement, and maintain the Smart Classroom Management System.
- *Users:* The primary users of the system include students, teachers, and administrators. Students will access the system to view complaints, while teachers will mark attendance and control appliances. Administrators will handle complaints and manage overall system operations.

Description of the Proposed Solution

Hardware

- *Web Server:* The proposed solution requires a reliable web server to host the SmartClassroom website. We opt for a scalable cloud-based solution to handle varying traffic loads efficiently.
- *Database Server:* A robust database server is essential to store and manage student attendance, complaint, and file data. MySQL is our preferred choice for its performance and reliability.
- *Networking Infrastructure:* To ensure seamless communication between clients and servers, a stable internet connection and networking infrastructure are necessary.

Software

- *Front-end Technologies:* The website's front-end will be developed using HTML, CSS, and JavaScript for a responsive and visually appealing user interface.
- *Back-end Technologies:* The back end will be powered by Node.js and Express.js, providing a flexible and scalable server environment.
- *Database Management:* MySQL will be used to manage and store data efficiently, ensuring quick retrieval and processing.

- *Security Measures:* To safeguard user data and prevent unauthorized access, we will implement encryption and authentication mechanisms.
- *File Upload and Storage:* For handling file uploads, we will use libraries like Multer to securely store files on the server.

Processes

- *User Registration and Authentication:* The system will include a user registration and login process to differentiate between students, teachers, and administrators.
- *Marking Attendance:* Teachers will mark attendance through the website, and the system will maintain records for easy retrieval and analysis.
- *Appliance Control:* Teachers can remotely control classroom appliances, such as lights and projectors, through the website.
- *Complaint Reporting:* Students can report classroom issues or complaints through the system, enabling administrators to address them promptly.
- *File Management:* Teachers can upload and manage class documents and assignments securely, providing easy access to students.

Data

- *Student Data:* The system will store student information, including names, ages, genders, and unique identifiers.
- *Attendance Data:* Daily attendance records will be stored to track student attendance patterns and identify potential issues.
- *Complaint Data:* Information regarding student complaints, types of complaints, and their status will be recorded for administrative review.
- *File Data:* The system will store files and associated metadata, such as file names, URLs, and upload timestamps.

People

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- *Users:* The primary users of the system include students, teachers, and administrators. Students will access the system to view complaints, while teachers will mark attendance and control appliances. Administrators will handle complaints and manage overall system operations.

Team Charter

Project Name: Smart Classroom Management System		
<u>Vision and Mission</u> Vision: To revolutionize classroom management through a comprehensive and user-friendly platform, empowering teachers, staff, and students to enhance their learning and teaching experience. Mission: Our mission is to develop an innovative Smart Classroom app that streamlines attendance management, enables remote appliance control, provides efficient complaint handling, and facilitates secure file storage for seamless classroom activities.		
<u>Success Criteria</u> Achieve a 15% reduction in energy consumption with remote appliance control. Receive positive feedback from 80% of users regarding complaint resolution efficiency. Facilitate smooth file storage and retrieval, resulting in a 25% decrease in document search time.		
Project Team		
Names	Role	Phone and email
Raja Rajeswari Asetty	Product Owner	7323227115, Rasetty2320@muleriders.saumag.edu
Supraja Abburi	Analyst	4694656303, SAbburi3980@muleriders.saumag.edu
Manogna Arla	User Interface Designer	4692385639, MArla3967@muleriders.saumag.edu
FNU Abdul Khadeer	Implementation Planner	9452398549, FAbdulKhadeer3806@muleriders.saumag.edu

Akkineni Sai Krishna	Scrum Master, Technical Writer	9014211017, sakkineni4253@muleriders.saumag.edu
<u>Rules of Behaviour:</u> Respect: Treat all team members with respect and value their contributions. Timeliness: Adhere to project timelines and communicate promptly for any delays. Collaboration: Foster a collaborative environment where ideas and feedback are encouraged. Accountability: Take ownership of assigned tasks and be accountable for their completion.		
<u>Communications:</u> Weekly Stand-Up Meetings: Conduct regular meetings to discuss progress, challenges, and upcoming tasks. Zoom & WhatsApp: Utilize for quick communication, updates, and sharing of resources. Feedback Sessions: Organize periodic feedback sessions to gather insights and suggestions for improvement.		
Approved by the Project Sponsor (Course Instructor)	Date	

Cost estimates (Total Cost of Ownership)

Hardware

<i>Item</i>	<i>Cost (USD)</i>	<i>Description</i>
Web Server Hosting	\$800 - \$1000	Cloud-based web hosting services for the SmartClassroom website.
Database Server Hosting	\$600 - \$800	Cloud-based hosting for the MySQL database server.
Networking Infrastructure	\$400 - \$500	Setup and maintenance of networking equipment and internet connection.

Software

<i>Item</i>	<i>Cost (USD)</i>	<i>Description</i>
Front-end Development Tools	\$0	The development team will utilize free and open-source tools for front-end coding.
Back-end Development Tools	\$0	Free and open-source tools will be used for back-end development.
Database Management System (MySQL)	\$0	MySQL is an open-source database management system and will be used for free.
Security Measures	\$400 - \$500	Implementation of encryption and authentication mechanisms for data security.
File Upload and Storage Libraries	\$0	Libraries like Multer for handling file uploads will be used for free.

Labor Costs

<i>Item</i>	<i>Cost (USD)</i>	<i>Description</i>
Web Developers	\$60 - \$80 /hr	Hourly cost per web developer (front-end and back-end)
Database Administrators	\$80 - \$100 /hr	Hourly cost for the database administrator.

Testers	\$50 - \$60 /hr	Hourly cost for quality assurance and testing personnel.
Project Manager	\$60 - \$120 /hr	Hourly cost for project management and coordination.

On-Going Costs

<i>Item</i>	<i>Cost (USD)</i>	<i>Description</i>
Web Hosting	\$80 - \$100/mo	Monthly cost for cloud-based web hosting services.
Database Hosting	\$60 - \$80/mo	Monthly cost for cloud-based database hosting.
Maintenance and Updates	\$200 - \$300/mo	Monthly cost for routine maintenance and updates of the system.
Technical Support	\$100- \$150/mo	Monthly cost for technical support and issue resolution.

Total Costs

<i>Item</i>	<i>Cost(USD)</i>	<i>Description</i>
Total Estimated Cost (Development Phase)	\$33500 - \$40000	Estimated total cost for the development phase of the Smart Classroom system.
Total Estimated Ongoing Costs (Per Month)	\$440 - \$630	Estimated total monthly ongoing costs for running and maintaining the system.

Note: The estimated costs mentioned above are based on typical market rates and may vary depending on factors like the complexity of the project, the size of the development team, and the specific hosting and maintenance services chosen. The costs provided are intended to give a general idea of the budget required for developing and operating the Smart Classroom Management System. Actual costs may differ based on the team's expertise and the project's unique requirements.

Benefits

Tangible Benefits

By developing and implementing the Smart Classroom Management System, the company will experience a range of tangible benefits, including improved operational efficiency and cost savings. With the ability to mark attendance, control appliances, store files, and report problems seamlessly through a centralized platform, our teachers and administrative staff will save valuable time previously spent on manual tasks. By automating attendance tracking and appliance control, we estimate that the system will save approximately 10-15 hours per week for each teacher, resulting in an estimated labour cost savings of \$5,000 to \$8,000 annually per teacher. Additionally, the ability to store and manage important class documents and assignments securely will reduce paper usage, leading to cost savings on printing and stationery expenses of approximately \$2,000 to \$4,000 annually.

Intangible Benefits

Beyond the tangible benefits, the SmartClassroom Management System will bring several intangible advantages to the company. Firstly, the system will enhance overall classroom management, leading to improved student engagement and academic performance. The seamless attendance tracking

and real-time access to class materials will foster a more interactive and organized learning environment, benefiting both teachers and students. Moreover, the system's remote appliance control will ensure a safe and energy-efficient classroom, reducing our environmental footprint and promoting sustainability.

Feasibility Report

Before embarking on the development of the Smart Classroom Management System, our team conducted a comprehensive feasibility study to assess the viability of the project. The study focused on three key aspects: economic feasibility, technical feasibility, and operational feasibility.

1. *Economic Feasibility:* Our team evaluated the cost-benefit analysis of implementing the Smart Classroom Management System. We estimated the initial development costs, including hardware and software expenses, as well as the ongoing operational costs. To determine the financial benefits, we calculated the potential cost savings in terms of labor hours and reduced paper usage. The economic feasibility study revealed that the benefits of the system significantly outweighed the costs, indicating a positive return on investment and financial viability.
2. *Technical Feasibility:* We assessed the technical requirements and capabilities needed to develop and implement the system. This involved analyzing the existing infrastructure, software compatibility, and development tools. The technical feasibility study revealed that the required technology and resources were readily available and feasible to incorporate. Our team had the necessary expertise to build the system and identified no major technical barriers.

3. *Operational Feasibility*: To gauge the system's operational feasibility, we conducted surveys and interviews with teachers and administrative staff. We analyzed their current workflow, pain points, and expectations from the new system. The feedback indicated a strong desire for an integrated classroom management solution, and the system's features aligned well with their needs. Additionally, we ensured that adequate training and support would be provided to seamlessly transition to the new system.

Requirements

Functional Requirements

1. *User Registration and Login*:

- Input: User details (name, email, password)
- Output: Successful registration or login confirmation
- Process: Users can register with unique credentials, and registered users can log in to access their accounts.

2. *Mark Attendance*:

- Input: Student ID, attendance status (present/absent)
- Output: Attendance record saved in the database
- Process: Teachers can mark attendance for each student in their class, and the system will store the attendance data.

3. *Control Appliances*:

- Input: Appliance ID, control command (on/off)
- Output: Appliance status updated in the database

- Process: Teachers can remotely control classroom appliances (e.g., lights, projectors) through the system.

4. *File Upload and Storage:*

- Input: File upload (name, type, content)
- Output: File stored in the database with a unique link
- Process: Users can upload files to the system, and the system will securely store and organize them for future access.

5. *Report Problem:*

- Input: Problem details (description, category)
- Output: Problem ticket created with a unique reference number
- Process: Users can report issues or problems they encounter, and the system will generate a ticket for tracking and resolution.

6. *View Students and Complaints:*

- Input: None
- Output: List of students and complaints displayed
- Process: Users can view a list of students and complaints stored in the database.

Non-Function Requirements

1. *Security and Access Control:*

- Control: The system should have role-based access control, with different permissions for teachers, administrators, and students.
- Performance: The system should protect user data through encryption and ensure secure data transmission.

2. *User-Friendly Interface:*

- Control: The system should have an intuitive and responsive user interface.
- Performance: The system should load quickly and respond promptly to user interactions.

3. *Scalability:*

- Control: The system should be able to handle an increasing number of users and data.
- Performance: The system should maintain performance even as the user base and data volume grow.

4. *Reliability and Availability:*

- Control: The system should have data backup and recovery mechanisms.
- Performance: The system should have minimal downtime and be always available for use.

5. *Compatibility:*

- Control: The system should be compatible with different devices and browsers.
- Performance: The system should provide consistent experience across various platforms.

6. *Data Integrity and Accuracy:*

- Control: The system should have data validation and error handling mechanisms.

- Performance: The system should ensure accurate data storage and retrieval.

7. *Performance Efficiency:*

- Control: The system should optimize database queries and resource utilization.
- Performance: The system should deliver responsive performance even during peak usage.

User Stories and Product Backlog

Combine all the included stories to create a simple product backlog and a sprint plan as shown in the table below:

Product Backlog					
T ID	TASK NAME	SPRINT #	ASSIGNED TO	START DATE	FINISH DATE
1	Planning and Requirements	1,2	Product owner	06-05-2023	06-16-2023
2	Analysis	3,4	Business Analyst	06-19-2023	06-30-2023
3	Development	5,6,7	Development Team	07-03-2023	07-21-2023
4	Testing	8	Development Team	07-24-2023	07-29-2023
5	Prepare User Documentation	9	Technical Writer	2023-10-08	2023-10-15
6	Finalize Deployment Strategy	10	Implementation Planner	2023-10-16	2023-10-20
7	Launch Smart Classroom App	10	Development Team	2023-10-21	2023-10-21

Justification of Request

Strengths:

1. *User-Friendly Interface:* The website's intuitive and user-friendly interface enhances user experience and engagement, making it easier for teachers and students to navigate through features efficiently.
2. *Innovative Features:* Smart Classroom offers unique features like appliance control, file storage, and problem reporting, setting it apart from traditional classroom management systems.
3. *Scalability:* The architecture and design of the website allow for easy scalability, enabling future expansion and adaptation to accommodate more users and features.
4. *Reliability:* The website's robust backend ensures reliable performance, minimizing downtime and providing a consistent experience for users.

Weaknesses:

1. *Limited Marketing:* As a newly launched website, Smart Classroom faces the challenge of building brand awareness and reaching its target audience effectively.
2. *Bugs and Glitches:* Despite rigorous testing, occasional bugs and glitches may still be present in the system, affecting user experience and requiring timely fixes.
3. *Limited Resources:* The team may face resource constraints in terms of manpower and budget, impacting development and support capabilities.

Opportunities:

1. *Growing Education Technology Market:* The increasing adoption of education technology presents a significant opportunity for Smart Classroom to tap into a growing market.
2. *Expansion of Features:* Continuous improvements and adding new features based on user feedback can attract more users and retain existing ones.
3. *Collaboration with Educational Institutions:* Partnering with educational institutions can lead to institutional licenses, increasing the user base substantially.

Threats:

1. *Competition:* The education technology market is competitive, and there may be other established players or new entrants with similar offerings, posing a threat to Smart Classroom's market share.
2. *Data Security and Privacy Concerns:* Ensuring the security and privacy of user data is crucial to avoid any data breaches or legal implications.
3. *Technical Challenges:* The rapidly evolving technology landscape may present technical challenges, requiring constant updates and adaptability.

Requirements Analysis – Non-Working prototype

During the requirements analysis phase, our team engaged in extensive discussions with stakeholders, including teachers, students, and administrators, to gather their needs and expectations. We identified the core functionalities required for efficient classroom management and designed a non-working prototype to demonstrate the website's potential

features and user interface. The prototype allowed us to validate our understanding of user needs and iteratively refine the design based on user feedback. Additionally, we conducted technical feasibility assessments to ensure the proposed solution's viability, considering hardware and software requirements, scalability, and security measures.

Throughout this process, we emphasized the importance of user experience, data security, and seamless integration of features. Our team's agile approach allowed us to adapt to changing requirements and incorporate innovative ideas into the proposed solution. By involving stakeholders in the requirements analysis and prototype testing, we ensured that the final product aligns with user expectations and business objectives.

Use Case Diagram (UCD)

As a team, we have conducted a thorough review of the approved process requirements and the non-working prototype for the Smart Classroom website. The process requirements demonstrate a clear understanding of the functionalities needed to streamline classroom management and ensure a smooth user experience. The proposed processes, such as user registration and authentication, attendance marking, appliance control, file upload and management, and problem reporting, align well with the identified business needs.

The non-working prototype showcases the envisioned user interface and key features of the website. It effectively communicates the layout, navigation, and interactions that users will have with the system. During the review, we paid close attention to the prototype's usability, responsiveness, and overall design aesthetics. User feedback collected during prototype

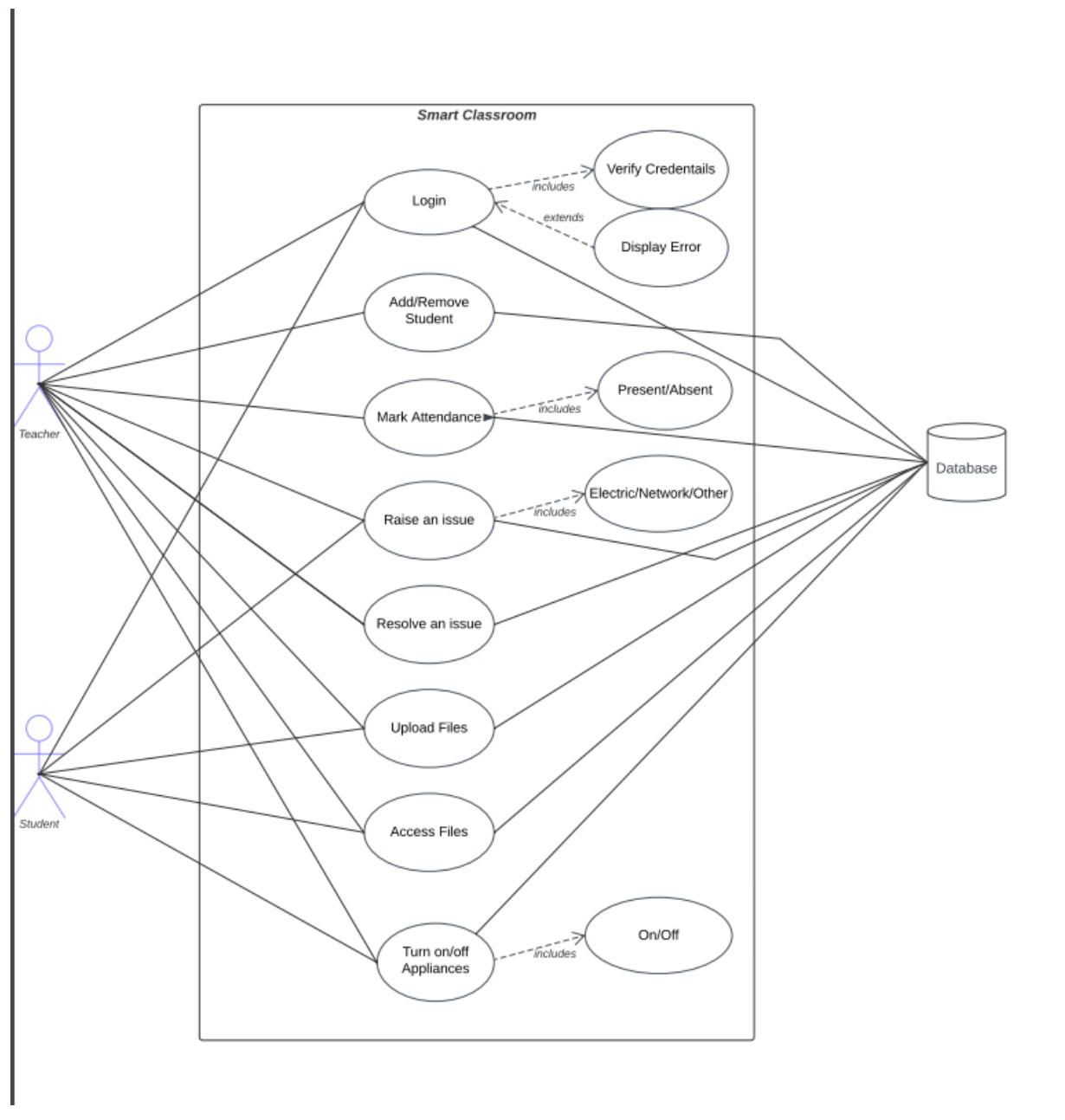
testing has been valuable in refining the interface and making necessary adjustments to enhance user satisfaction.

Additionally, the prototype allowed us to test the system's flow and identify potential usability issues early in the development process. This iterative approach has been instrumental in improving the website's user experience and aligning it with stakeholders' expectations.

Moreover, we have ensured that the non-working prototype adheres to the best practices of security and data privacy. The authentication process is robust, and sensitive information, such as passwords, is securely stored using hashing techniques. Data management processes have been designed to safeguard user information and files, complying with industry standards and regulations.

Overall, the approved process requirements and non-working prototype have been well-received by stakeholders, validating the team's efforts in understanding the business needs and translating them into a user-friendly and feasible solution. We are confident that the proposed Smart Classroom website will be a valuable asset for teachers, students, and administrators, simplifying classroom management and enhancing the educational experience. As we move forward with the development phase, we will continue to incorporate feedback, conduct thorough testing, and ensure that the final product meets the highest standards of quality and functionality.

FDD



Use Case Descriptions

Use Case	Adding or Removing Student
Primary Actors	Teacher
Importance Level	High
Stake Holders	Teacher, Student
Brief Description	This use cases describes how to add a new student or remove an existing student from the application.

Trigger	New student has enrolled to class or Existing student left the class
Relationships	Association: New Student or Existing student Include: Student details Extends: Generalization: Manage students
Normal Flow of Events:	Adding Student: <ol style="list-style-type: none"> 1. A new student enrolled in the class. 2. Teacher must add the student in application. Remove Student: <ol style="list-style-type: none"> 1. Existing students have left the class. 2. Teacher must remove the student in application.

Use Case	Mark Attendance
Primary Actors	Teacher
Importance Level	High
Stake Holders	Teacher, Student
Brief Description	This use cases describes the teacher can mark students are either present or absent to the class
Trigger	Student is either present or absent to the class
Relationships	Association: Existing students Include: Student details Extends: Generalization: Manage students
Normal Flow of Events:	Present Student: <ol style="list-style-type: none"> 1. A student is present in the class. 2. Teacher can mark the attendance as present. Absent Student: <ol style="list-style-type: none"> 1. A student is absent from the class. 2. Teacher can mark the attendance as Absent

The working prototype has been meticulously crafted by our team, considering the approved process requirements and user stories. We have focused on creating an intuitive and user-friendly interface that caters to the

needs of teachers, students, and administrators. The prototype has undergone several iterations, incorporating feedback from user testing and stakeholders to refine the user experience.

In the prototype, users can seamlessly navigate through various sections of the website, such as the home page, mark attendance, control appliances, store and manage files, and report problems. The authentication system ensures secure access for registered users and guards against unauthorized access.

For instance, the "Mark Attendance" feature allows teachers to easily mark attendance for their students. The interface displays the class roster, and teachers can mark students as present, absent, or late with just a few clicks. Similarly, the "Control Appliances" feature enables authorized users to remotely turn appliances on or off within the classroom environment, promoting energy efficiency and convenience.

The "Files Storage" feature provides users with a secure and organized platform to upload, view, and manage important class documents, presentations, and assignments. Files are associated with specific classes, making it easier for users to access the relevant materials quickly.

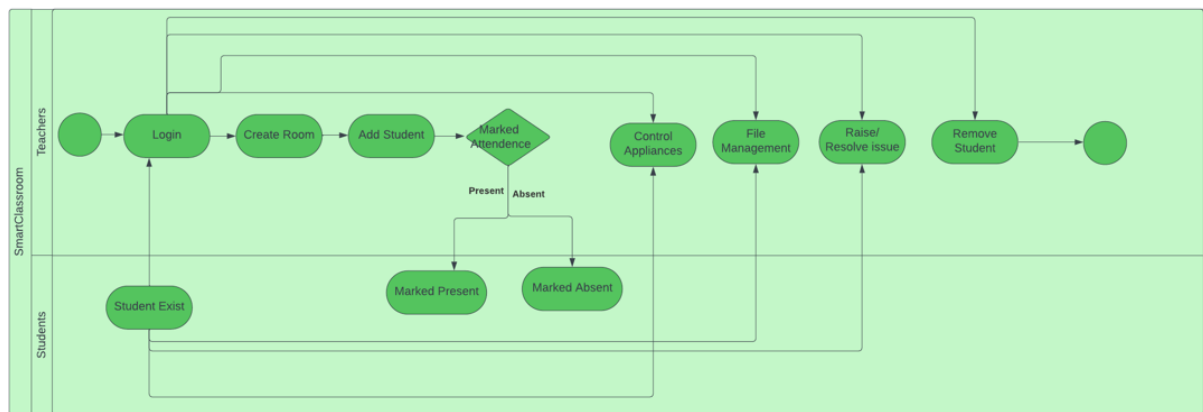
Additionally, the "Report Problem" feature allows students and teachers to report any issues or concerns they encounter within the classroom. These reports are sent to the administrators for review and resolution.

Throughout the development of the working prototype, we have emphasized responsiveness and compatibility to ensure a seamless user

experience across various devices, including desktops, laptops, tablets, and mobile phones.

BPMN DIAGRAM

Business Process Modeling Notation is a flow chart method that models the steps of a planned business from end to end.



Design Patterns

For the Smart Classroom Management System project, we have utilized the following design pattern:

- *Model-View-Controller (MVC) Pattern*: The MVC pattern separates the application into three interconnected components: models, views, and controllers. In this context, the models represent the data structures and business logic, views handle the user interface and user interactions, and controllers manage the flow of data between models and views. The MVC pattern promotes a clear separation of concerns, allowing each component to be developed and maintained independently.

In the SmartClassroom Management System, the models handle data related to students, attendance, appliances, and files. They encapsulate the logic for data manipulation and database interactions. Views are responsible for rendering the user interface elements, such as web pages for marking attendance, controlling appliances, and displaying files. Controllers handle user input, process it, and interact with the appropriate models and views to perform the required actions. This design pattern ensures that changes to one component do not affect the others, making the system easier to maintain, extend, and test.

By using the MVC pattern, our team ensures that the SmartClassroom Management System follows best practices for code organization and design, resulting in a scalable, maintainable, and user-friendly application. The clear separation of responsibilities also enhances collaboration among team members, as they can work on different components of the system independently without interfering with each other's work.

Description of the Proposed Solution

Hardware

- *Web Server:* The proposed solution requires a reliable web server to host the Smart Classroom website. We opt for a scalable cloud-based solution to handle varying traffic loads efficiently.
- *Database Server:* A robust database server is essential to store and manage student attendance, complaints, and file data. MySQL is our preferred choice for its performance and reliability.
- *Networking Infrastructure:* To ensure seamless communication between clients and servers, a stable internet connection and networking infrastructure are necessary.

Software

- *Front-end Technologies:* The website's front-end will be developed using HTML, CSS, and JavaScript for a responsive and visually appealing user interface.
- *Back-end Technologies:* The back end will be powered by Node.js and Express.js, providing a flexible and scalable server environment.
- *Database Management:* MySQL will be used to manage and store data efficiently, ensuring quick retrieval and processing.
- *Security Measures:* To safeguard user data and prevent unauthorized access, we will implement encryption and authentication mechanisms.
- *File Upload and Storage:* For handling file uploads, we will use libraries like Multer to securely store files on the server.

Processes

- *User Registration and Authentication:* The system will include a user registration and login process to differentiate between students, teachers, and administrators.
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- *Appliance Control:* Teachers can remotely control classroom appliances, such as lights and projectors, through the website.
- *Complaint Reporting:* Students can report classroom issues or complaints through the system, enabling administrators to address them promptly.

- *File Management:* Teachers can upload and manage class documents and assignments securely, providing easy access to students.

Data

- *Student Data:* The system will store student information, including names, ages, genders, and unique identifiers.
- *Attendance Data:* Daily attendance records will be stored to track student attendance patterns and identify potential issues.
- *Complaint Data:* Information regarding student complaints, types of complaints, and their status will be recorded for administrative review.
- *File Data:* The system will store files and associated metadata, such as file names, URLs, and upload timestamps.

People:

- *Development Team:* The development team consists of front-end and back-end developers, database administrators, and UI/UX designers, working collaboratively to build and maintain the website.
- *Administrators:* Administrators will have access to manage user accounts, handle complaints, and oversee system operations.
- *Teachers:* Teachers will use the system to mark attendance and control classroom appliances remotely.
- *Students:* Students will use the website to view attendance, report problems, and access uploaded files.

Testing Plan

As a team, our plan to complete testing of the Smart Classroom Management System will involve thorough testing at various stages of development to

ensure a high-quality and reliable product. We will follow an iterative testing approach to identify and address issues early in the development process, allowing for continuous improvement and refinement. Our testing plan includes the following stages and testing techniques:

Testing Stages:

a) *Unit Testing*: In this stage, individual components and functions of the website will be tested in isolation to ensure they work as expected. We will use tools like Jest and Mocha for JavaScript unit testing.

b) *Integration Testing*: This stage focuses on testing the interactions and interfaces between different modules of the website. We will use techniques like API testing to verify that data is transferred correctly between components.

c) *System Testing*: This comprehensive stage involves testing the entire system as a whole to evaluate its compliance with requirements. We will perform functional and usability testing to ensure all features work as intended and provide a positive user experience.

d) *User Acceptance Testing (UAT)*: During UAT, stakeholders and end-users will be involved to validate the system against business requirements and provide feedback.

Samples of Testing Techniques:

a) *Automated Testing*: We will use tools like Selenium and Cypress for automated testing of user workflows and interactions. Automated testing will help us quickly run tests and detect regressions.

b) *Load Testing*: To assess the system's performance under heavy user load, we will use tools like Apache JMeter to simulate multiple users accessing the website simultaneously.

c) *Compatibility Testing*: We will test the website on various browsers (Chrome, Firefox, Safari, etc.) and devices (desktops, tablets, mobiles) to ensure it works seamlessly across different platforms.

d) *Security Testing*: Security will be a top priority, and we will employ techniques like penetration testing and vulnerability scanning to identify and address potential security risks.

e) *Usability Testing*: This testing will involve real users navigating the website to identify any usability issues, such as confusing navigation or unclear instructions.

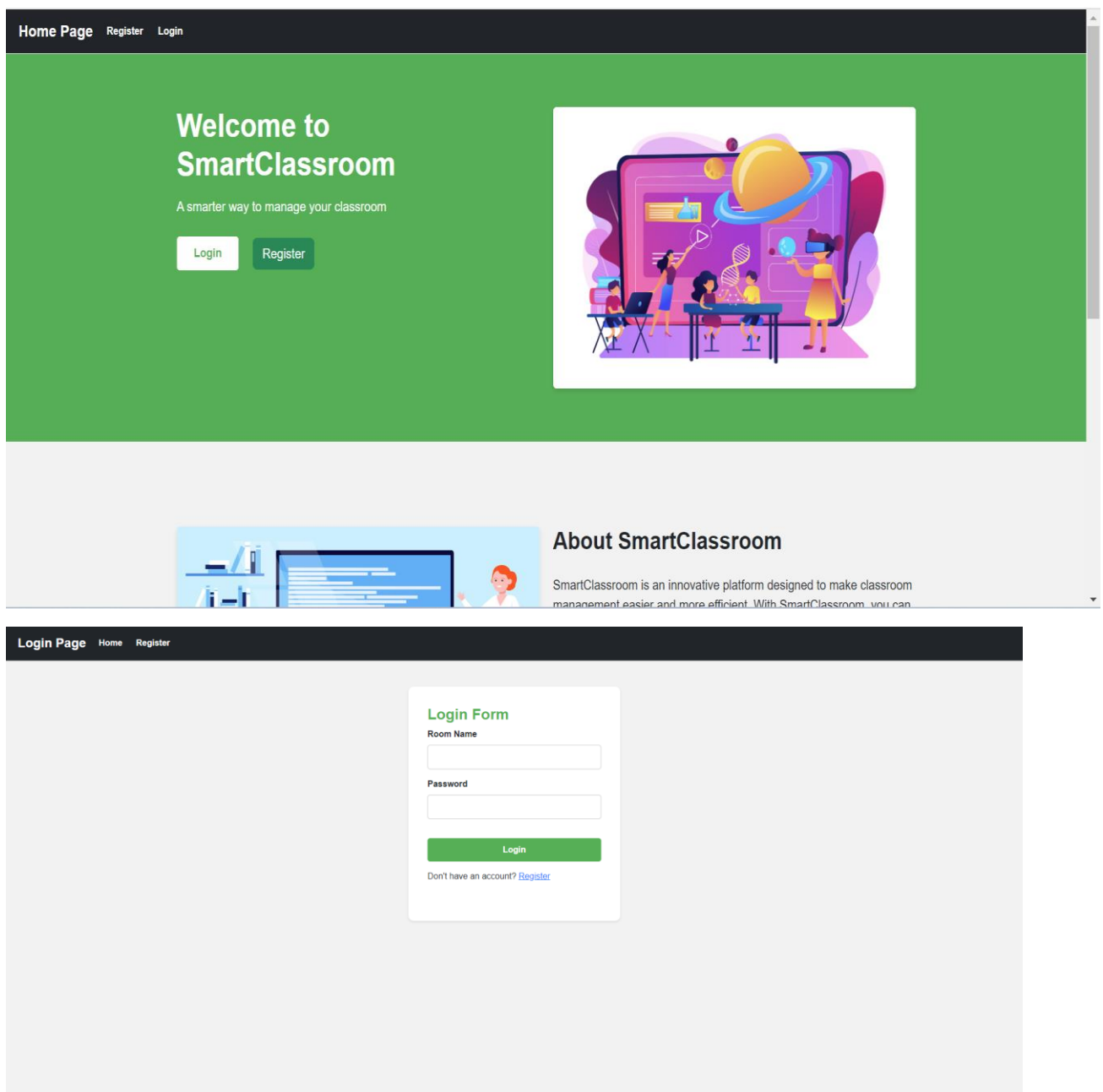
f) *Regression Testing*: After each code change, we will conduct regression testing to ensure that new updates have not introduced new issues and that existing features remain functional.

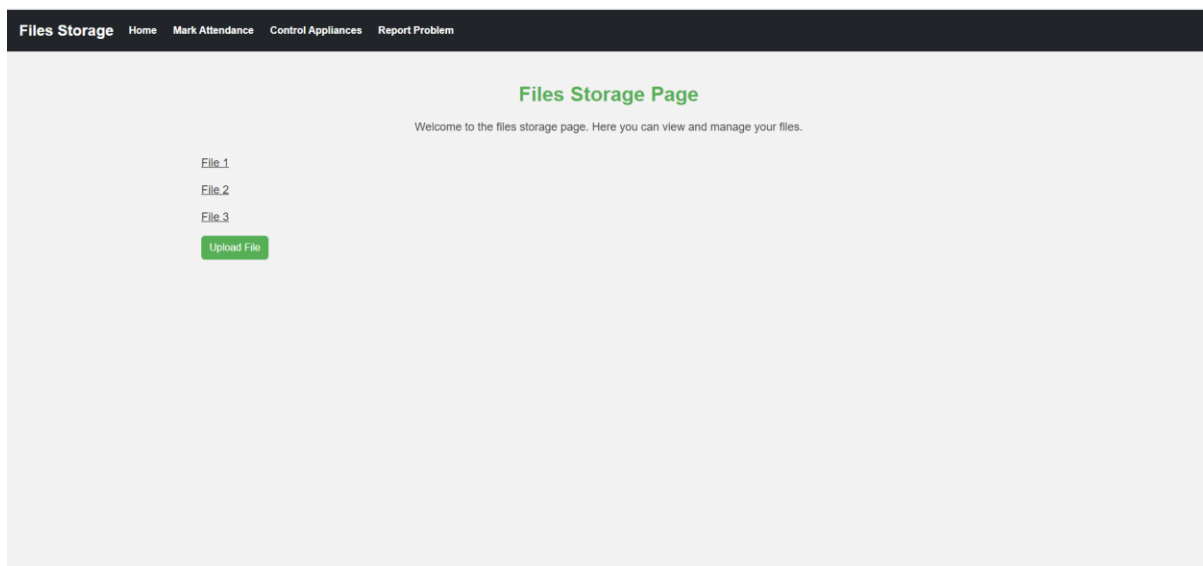
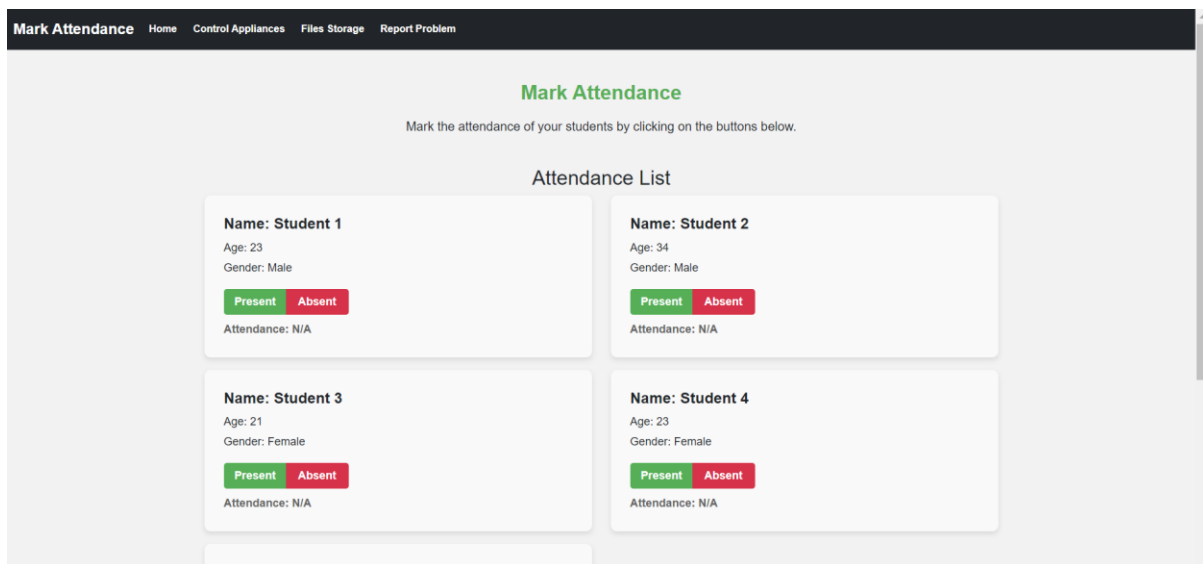
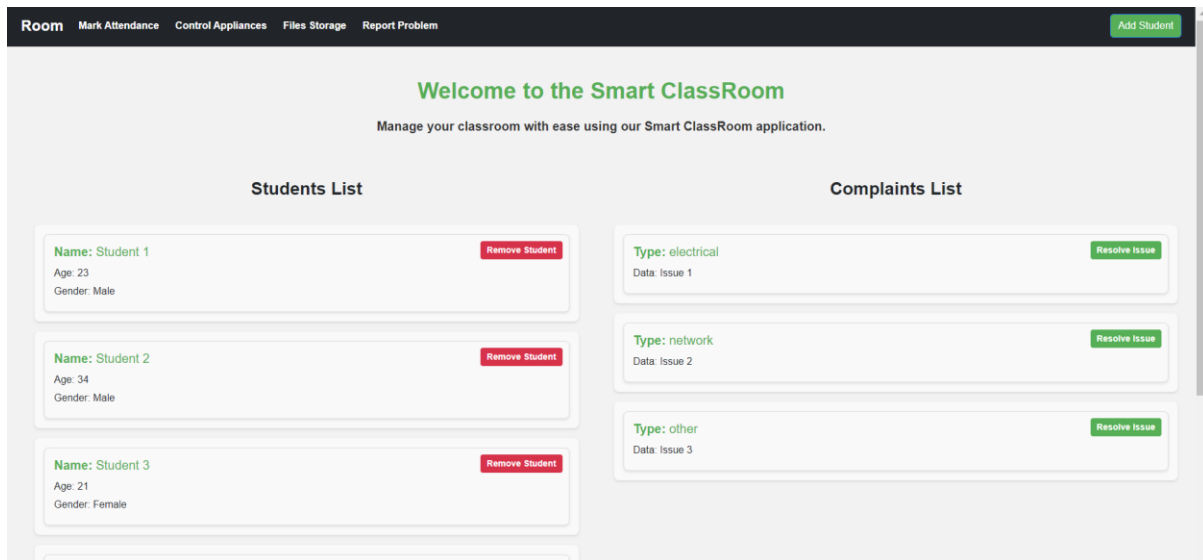
g) *Performance Testing*: We will measure the website's performance metrics, such as page load times and server response times, to ensure optimal performance.

By following this comprehensive testing plan, we aim to deliver a robust and reliable Smart Classroom website that meets all the requirements and expectations of our stakeholders. Feedback from testing will be collected and incorporated into subsequent development cycles, allowing us to continuously improve and refine the product until it is ready for a successful launch.

Prototypes

Here, are few of the screenshots.





Report Problem

Please use the form below to report any problems you are facing:

Type of Complaint:

Electrical Issue

Complaint Details:

Describe the problem...

Submit

Control Appliances Page

Welcome to the control appliances page. You can toggle the appliances ON and OFF.

Air Conditioner

Air Conditioner 2

Fan 1

Fan 2

Bulb 1

Bulb 2

Team Contribution

Student ID	Student Name	Work Distribution
999902989	Manogna Arla	Worked on user-interface Implementation and testing by following the stages and techniques in testing. Acting as lead in oral presentation. Contributed by working on the implementation, documentation and presentation.
999901332	Raja Rajeswari Asetty	Worked on Business Case and the important step which is planning for the project. Done R&D required to develop the project. Contributions to the implementation, project documentation and presentation.
999903003	Supraja Abburi	Designed the Use-case diagrams and providing the description of the use-cases for different scenarios. Done with Applied R&D of the project implementation. Contributed to the final project report preparation and presentation.
999902826	FNU Abdul Khadeer	Contributed to Feasibility Report by stating it is feasible to develop the project by meeting all feasibility requirements. Implementing the Functional and Non-Functional Requirements. Worked on the final report and presentation.
999903278	Akkineni Sai Krishna	Proposed the suitable solution for the project. Worked on design patterns and benefits. Done the Basic R&D to build the prototypes. Contributions implementation and the project documentation and presentation.

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