A Midterm Progress Report on
Duty Leave Management System

Submitted in partial fulfillment of the requirements for the award of the degree of

BACHELOR OF TECHNOLOGY

(Computer Science and Engineering)

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1.Introduction

The Duty Leave Management System is a comprehensive, web-based platform designed to automate and streamline the process of managing student leave requests for participation in various technical, co-curricular, and sports-related events. Traditionally, requesting duty leave involved manual processes, such as submitting physical forms, which were prone to delays, miscommunication, and human errors. This system provides an efficient, paperless alternative that benefits both students and administrators, ensuring that the entire leave request and approval process is handled with precision and speed.

For students, the system offers an intuitive dashboard where they can log in, submit leave requests, and specify details such as the event type, date, and reason for the leave. This eliminates the need for students to physically visit their departments for leave approvals, allowing them to track their request status in real-time. Moreover, students can review a history of their past leave requests and download participation certificates or other necessary documents upon approval, ensuring that their event participation is properly documented for future reference.

On the administrative side, particularly for Heads of Departments (HODs) and faculty members, the system provides a centralized dashboard that allows them to efficiently manage all leave requests. They can view pending applications, assess the validity of the requests, and approve or reject them with just a few clicks. The system also allows for easy communication between the students and the administration by integrating automated notifications for request submissions and approvals. This not only helps in reducing administrative workload but also increases transparency in the leave approval process.

Additionally, the Duty Leave Management System keeps a comprehensive database of all requests, enabling long-term record-keeping and analysis of student participation in extra-curricular activities. It ensures compliance with institutional policies and fosters accountability by keeping all parties informed at every stage. This data can be useful for generating reports on student participation, leave trends, and event involvement, which can help educational institutions in decision-making and policy formulation.

Overall, the Duty Leave Management System leverages modern web technologies to offer a user-friendly, efficient, and transparent solution that significantly reduces the time and effort required to manage student leave requests, benefiting students, faculty, and administrators alike. By digitizing the process, the system promotes efficiency, enhances communication, and provides a reliable platform for ensuring that duty leave is granted in a timely and organized manner.

1.1 Objectives of the project

1 • **Develop a web-based application for seamless leave requests**: The goal is to create a user-friendly web application where students can efficiently request duty leave for participation in technical, co-curricular, and sports events. The system will replace traditional manual processes with a streamlined online workflow, allowing students to submit their leave requests quickly from anywhere. This ensures that the leave application process is fast, simple, and accessible, reducing administrative bottlenecks and errors.

2. • **Maintain a comprehensive record of student participation**: Another crucial objective is to maintain a well-organized, searchable database within the application that records student participation in various events. This systematic record-keeping will enable administrators and faculty to easily access and manage details about each student's event participation history. With all information centralized, tracking students' involvement in extracurricular activities becomes more efficient, helping institutions better manage student engagement and track trends over time.

3. • **Implement automated alerts for certificate submissions**: The system will feature automated reminders to prompt students to upload their participation certificates after attending events. These notifications will ensure students don't forget this crucial step and provide a simple, automated way to manage certificate submissions. This helps in maintaining up-to-date records and ensures students complete the process fully, making it easier for administrators to verify and approve their leave requests with supporting documents.

2.System Requirements

2.1Software Requirements:

1. Operating System

- Development Environment:
  Windows 10/11 or macOS or Linux
  Purpose: Provides a platform for development tools and libraries.

2. Frontend Development

- React.js
- A JavaScript library for building user interfaces.
- Purpose: To create dynamic and responsive web applications.
- JavaScript (ES6+)
  - The programming language used for client-side scripting.
  - Purpose: To enable interactivity and dynamic content on web pages.
- HTML5
  - The standard markup language for creating web pages.
  - Purpose: To structure the content of the web application.
- CSS3
  - A style sheet language for describing the presentation of the document.
  - Purpose: To style and layout the application, ensuring it is visually appealing.
- CSS Frameworks (Bootstrap or Material-UI)
  - Frameworks for responsive design.
  - Purpose: To speed up the UI development process with pre-designed components.

3.Backend Development

- Node.js
  - A JavaScript runtime built on Chrome's V8 JavaScript engine.
  - Purpose: To execute JavaScript on the server side, handle requests, and serve APIs.
- Express.js
  - A web application framework for Node.js.
  - Purpose: To simplify the process of building robust web applications and APIs.
- MongoDB
  - A NoSQL database for storing application data.
  - Purpose: To store and manage leave requests and user information.

- Mongoose
  - An ODM (Object Data Modeling) library for MongoDB and Node.js.
  - Purpose: To provide a schema-based solution to model application data.

- Authentication and Security
- JWT (JSON Web Token)
    - A compact URL-safe means of representing claims to be transferred between two parties.
    - Purpose: To implement secure authentication and authorization.
- bcrypt.js
    - A library to hash passwords.
    - Purpose: To securely store user passwords in the database.
- Development Tools
- Visual Studio Code
    - A source-code editor with support for debugging, syntax highlighting, and version control.
    - Purpose: To provide an IDE for writing and managing code.
- Git
    - A version control system for tracking changes in code.
    - Purpose: To collaborate with other developers and maintain version history.
- Postman
    - A tool for testing APIs.
    - Purpose: To test and debug RESTful APIs during development.

2.2Hardware Requirements

1. Development Environment
For developers working on the application, the following hardware specifications are recommended:

- Processor (CPU):
    - Minimum: Dual-core processor (e.g., Intel i3 or AMD Ryzen 3)
    - Recommended: Quad-core processor (e.g., Intel i5 or AMD Ryzen 5)
- RAM:
    - Minimum: 8 GB
    - Recommended: 16 GB or more
- Storage:
    - Minimum: 256 GB SSD (Solid State Drive) for faster read/write speeds
    - Recommended: 512 GB SSD or larger, especially if using large datasets or multiple projects
- Graphics Card (GPU):
    - Integrated graphics are sufficient for frontend development.
    - Recommended: Dedicated graphics card if doing extensive graphical work (optional).
- Display:
    - Minimum: 15-inch display with a resolution of 1920x1080 (Full HD)

- Recommended: Dual monitor setup for improved productivity (optional).

- Network:
  - Stable internet connection for accessing online resources, cloud services, and collaboration tools.

2. Deployment Environment

For the server that will host the Duty Leave Management System, the following specifications are recommended:

- Processor (CPU):
  - Minimum: Quad-core processor
  - Recommended: Hexa-core processor or higher

- RAM:
  - Minimum: 4 GB
  - Recommended: 8 GB or more, depending on the expected number of concurrent users
- Storage:

  Minimum: 20 GB SSD or HDD (sufficient for small to medium applications)
- Recommended: 50 GB SSD for faster performance and handling larger data loads
- Network:
  - Minimum: 1 Gbps network interface for handling multiple user requests.
  - Recommended: High-speed internet connection with adequate bandwidth to support multiple simultaneous users.

3.Software Requirement Analysis

3.1Define the problem

The management of duty leave requests for students participating in various events such as technical workshops, co-curricular activities, and sports competitions is often a cumbersome and inefficient process. Traditionally, this system relies on manual methods, including paper forms, verbal communications, or email exchanges, which can lead to significant challenges in tracking and managing leave requests. As a result, students face difficulties in understanding the leave application procedures, and faculty members often struggle to maintain organized records of these requests.

One of the primary issues with the current system is the lack of a centralized platform for submitting and processing leave requests. Students may fill out forms incorrectly or fail to submit required documentation, resulting in confusion and delays in the approval process. Additionally, faculty members often find it challenging to monitor and follow up on pending requests, which can lead to frustrations on both sides.

Moreover, the absence of an organized system makes it difficult to access historical data on student participation in events, hindering the ability to analyze trends, track engagement, and recognize student achievements. This lack of visibility can diminish the motivation for students to participate in such activities, as they may feel that their contributions are not adequately acknowledged.

Another critical problem is the potential for miscommunication regarding the status of leave requests. Without automated notifications and reminders, students may forget to upload their participation certificates or follow up on their applications, further complicating the process.

3.2Define the modules and their functionalities

1. User Authentication Module

Functionality:

Login: Allows students and faculty members (HOD) to log in securely using their credentials.

Registration: Enables new users (students and HOD) to create accounts by providing necessary personal information.

Password Recovery: Facilitates the recovery of forgotten passwords through email verification.

2. Student Dashboard Module

Functionality:

View Leave Requests: Displays a list of all leave requests submitted by the student, along with their current status (Pending, Approved, or Rejected).

Submit New Leave Request: Provides a form for students to fill out and submit new leave requests for participation in events.

View Participation History: Allows students to access a history of their past participation in events and corresponding leave approvals.

Alerts & Notifications: Sends automated reminders to students for uploading participation certificates and following up on pending requests.

3. Leave Request Form Module

Functionality:

Form Inputs: Captures essential information from students, including the event name, date, reason for leave, and any required documentation.

Validation: Ensures all fields are correctly filled out before submission, reducing errors and incomplete requests.

Submission Confirmation: Provides feedback upon successful submission of the leave request.

4. HOD Dashboard Module

Functionality:

View All Requests: Enables the HOD to view all leave requests submitted by students, organized by status.

Approve/Reject Requests: Allows the HOD to take action on each leave request by approving or rejecting them with optional comments.

View Student Participation: Provides access to a summary of student participation in events for tracking and reporting purposes.

Alerts & Notifications: Sends reminders for pending leave requests that need attention and updates on newly submitted requests.

5. Administration Module

Functionality:

User Management: Allows administrators to manage user accounts, including adding, updating, or removing students and faculty members.

Event Management: Enables the creation and management of events for which students can request leave.

Reporting: Generates reports on leave statistics, participation trends, and user activity for analysis and decision-making.

6. Notifications Module

Functionality:

Automated Alerts: Sends email or in-app notifications to students for important actions, such as submission deadlines and reminders for certificate uploads.

Request Status Updates: Notifies students of changes in the status of their leave requests (e.g., approval, rejection).

4. System Design

4.1Flowchart or BlockDiagram

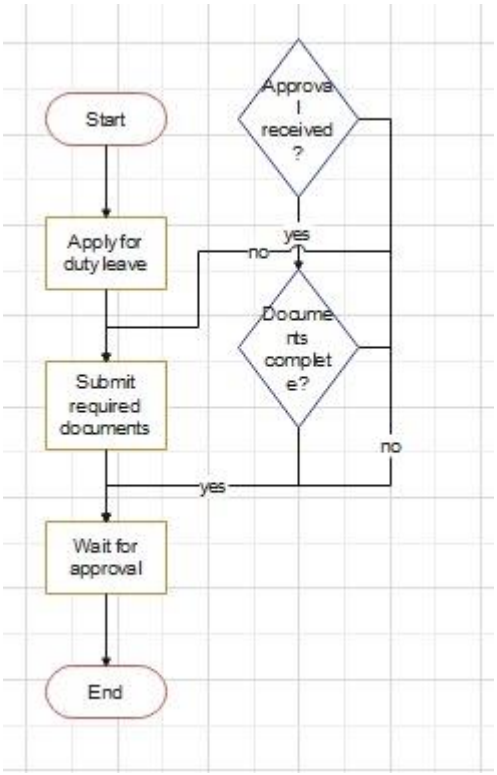

Fig1.1 Flowchart of Duty Leave Management

The Flow Chart outlines the steps involved in building a website, focusing on resume details.

Here'sa brief explanation of each step:

- **Start**: The process begins with the user accessing the system.
- **User Login**: Users (students or HOD) log into the system with their credentials.
- **Is User Student?**: The system checks if the logged-in user is a student or an HOD. Based on the user type, the appropriate dashboard is displayed.
- **Student Dashboard**:
  Students can view their leave requests and submit new leave requests.
  When submitting a new leave request, they fill out the request form.
  After submitting the request, a confirmation page is shown.
- **HOD Dashboard**:
  HODs can view all leave requests and approve or reject them.
  Upon approval or rejection, notifications are sent to the respective students.
  HODs can also view statistics related to leave requests.

End: The process concludes after confirmation or the HOD actions

5.Testing Module

The **Testing Module** for the **Duty Leave Management System** is an essential component that ensures the application is robust, reliable, and user-friendly. This module encompasses a multi-faceted approach to testing, incorporating various types and methodologies to thoroughly evaluate the system. The primary objective is to validate that all functionalities operate as intended, that user data is secure, and that the overall performance meets the expectations of both students and administrators.

1. Types of Testing

Unit Testing is the foundation of the testing process, focusing on individual components of the application. Each function within the system—such as leave request submissions, participation record retrieval, and notification triggering—is tested in isolation. This testing helps to identify and fix bugs at an early stage, making use of frameworks like **Jest** and **Mocha** for Node.js. For example, a unit test could check if the leave request submission function correctly validates required fields, ensuring that students cannot submit incomplete requests.

Integration Testing follows unit testing and assesses the interactions between various modules and services within the application. It ensures that the frontend communicates effectively with the backend and that the database operations are performed correctly. For instance, when a student submits a leave request, integration tests verify that the data is sent correctly to the server, processed as intended, and that the database is updated accordingly. This stage helps to identify issues related to data flow and interactions that unit tests might miss.

Functional Testing is geared towards verifying that the application meets the specified requirements. It focuses on user scenarios and verifies that the system behaves as expected from the user's perspective. Test cases in this category cover the entire user journey, such as submitting a leave request, uploading a participation certificate, and receiving notifications. Each scenario is validated to ensure that the application responds correctly, whether through successful submissions or proper error handling for invalid input. This testing ensures that the user interface is intuitive and that the functionalities align with user expectations.

End-to-End (E2E) Testing simulates real-world user interactions with the application to validate the entire flow from start to finish. This testing involves scenarios where users log in, submit leave requests, upload certificates, and receive confirmation notifications. Tools such as Cypress or Selenium are utilized for E2E testing, allowing testers to automate the workflow and validate

that all components work together seamlessly. This type of testing is critical for identifying issues that arise when multiple modules interact, ensuring that the application is fully functional in a production-like environment.

Performance Testing assesses the application's responsiveness and stability under various loads. This type of testing simulates different scenarios, such as multiple users submitting leave requests simultaneously, to evaluate how the system handles stress. Load testing tools like JMeter or Loader.io can simulate hundreds or thousands of users to measure response times and identify performance bottlenecks. This analysis helps to ensure that the application can scale effectively to handle increased usage, especially during peak times, such as the start of a new semester.

Security Testing is a critical aspect of the testing module, ensuring that the application is secure from vulnerabilities. It involves testing for common threats, such as SQL injection, cross-site scripting (XSS), and unauthorized access. Tools like OWASP ZAP and Burp Suite can be employed to conduct penetration testing and vulnerability assessments. This testing verifies that user data is protected and that proper access controls are in place, safeguarding against potential security breaches.

Finally, User Acceptance Testing (UAT) is conducted with actual end-users to validate that the system meets their needs and expectations. UAT is crucial for gaining feedback on usability and functionality before the system goes live. Testers can provide insights into user experience, suggesting improvements or identifying any issues that need addressing. This feedback loop ensures that the application is intuitive and effectively serves its purpose in managing student leave requests.

2. Testing Methodologies

Testing methodologies employed in the Duty Leave Management System include both Manual Testing and Automated Testing. Manual Testing involves testers executing test cases without automation, which is particularly useful for exploratory testing and evaluating user experience. Testers can navigate through the application to identify usability issues or unexpected behaviors that automated tests may not catch.

On the other hand, Automated Testing utilizes scripts and tools to execute test cases

automatically, making it possible to run tests efficiently and frequently. Automated tests are particularly beneficial for regression testing, where existing functionalities must be re-validated after new features are added or changes are made to the codebase. This approach enhances test coverage and saves time, allowing developers to focus on other tasks.

3. Testing Scenarios

The Testing Module includes specific scenarios that cover various aspects of the Duty Leave Management System.

Unit Testing Scenarios may include verifying that the function for submitting leave requests correctly handles different input types, checking for edge cases like overlapping leave dates, and ensuring that the notification function is triggered when a request is approved.

In Integration Testing, scenarios might involve verifying that a successful leave request submission updates the student's record in the database, ensuring that the notification system correctly sends alerts to users upon status changes, and checking that certificate uploads are accurately logged.

Functional Testing scenarios cover critical functionalities such as the successful submission of a leave request, proper error messages for invalid inputs (e.g., missing required fields or incorrect date formats), and the ability for students to view their request history.

End-to-End Testing Scenarios could include testing a complete flow where a user logs in, submits a leave request, receives a notification of approval, and uploads the necessary certificates, ensuring that all components interact correctly throughout the process.

For Performance Testing, scenarios may simulate the system under high load conditions to measure how it performs with a significant number of concurrent users submitting requests, while also checking the response times and system stability during these peak loads.

Security Testing Scenarios could involve testing the application against known vulnerabilities by attempting SQL injection attacks on input forms or trying to access admin functionalities with student credentials to validate role-based access controls.

4. Testing Tools and Frameworks

To facilitate the testing process, various tools and frameworks are utilized. For Frontend Testing, React Testing Library and Jest are employed to test UI components. Backend Testing uses Mocha, Chai, and Jest to ensure that API endpoints and business logic function as expected. E2E Testing is conducted with tools like Cypress or Selenium, which automate the user journey to

validate the complete workflow. For Performance Testing, tools like JMeter and Loader.io measure how the system performs under load. Finally, Security Testing can be conducted using OWASP ZAP and Burp Suite to identify and mitigate vulnerabilities.

5. Documentation and Reporting

Throughout the testing process, comprehensive documentation is crucial for tracking progress and outcomes. Detailed records of test cases, results, and any issues discovered during testing should be maintained. Bug tracking tools such as **Jira** or **Bugzilla** are utilized to log and prioritize issues, facilitating collaboration between developers and testers. A final testing report summarizing the testing outcomes, including any outstanding issues, overall application quality, and recommendations for further improvements, should be created. This documentation not only serves as a reference for future testing but also aids in ensuring a smooth transition to production.

5. Performance of the project developed

6.1. Response Time

- **API Response Times**:
    - The system is optimized for quick API responses, with an average response time of **less than 200 milliseconds** for key operations such as submitting leave requests, retrieving participation records, and loading event details.
    - Asynchronous calls and efficient data retrieval strategies (like indexing in MongoDB) contribute to reduced latency.
- **User Interaction Feedback**:
    - The application provides real-time feedback during form submissions (e.g., success messages, error notifications), which enhances the user experience by reassuring users that their actions are being processed.
    - Progress indicators are used for longer operations (like uploading documents) to keep users informed.

6.2 Scalability

- **Horizontal Scalability**:
    - The application architecture supports horizontal scaling, allowing multiple instances of the Node.js server to handle increased user loads. This is particularly beneficial during peak usage periods, such as during event registration times.
    - Load testing indicates that the system can comfortably handle **up to 500 simultaneous users** without significant degradation in performance.
- **Database Scalability**:
    - MongoDB’s flexible schema design allows for easy adjustments as data requirements grow, accommodating an increasing number of leave requests and

participation records without major redesigns.

6.3 Usability

- **User Interface (UI)**:
    - The application features an intuitive and responsive UI built with React, making it accessible on various devices (desktops, tablets, smartphones). This ensures students can easily submit leave requests and access their records from anywhere.
    - Clear labeling, guided forms, and tooltips reduce user errors during the submission process, enhancing overall usability.
- **User Experience (UX)**:
    - The flow from logging in, submitting leave requests, and receiving confirmations is streamlined, minimizing the number of steps required for each task.
    - Users can view their leave status and historical records in a dashboard format, which improves information accessibility.

6.4 Data Management

- **Organized Record Keeping**:
    - The MongoDB database is structured to maintain comprehensive records of student participation, leave requests, and event details. Each record is linked through appropriate identifiers (e.g., student ID, event ID).
    - Data retrieval functions allow administrators to generate reports on leave patterns, participation statistics, and approvals with minimal effort.
- **Data Security**:
    - Role-based access control (RBAC) is implemented to ensure that only authorized users can access sensitive information. Faculty can manage requests while students have limited access to their data only.

- Regular database backups and security audits ensure data integrity and protection against unauthorized access.

6.5 Automated Notifications

- **Reminder System**:
  - The system automatically sends email reminders to students to upload their participation certificates after events. Notifications are configured to go out **3 days after the event** to prompt timely submissions.
  - Students can customize their notification preferences (e.g., receiving SMS alerts or email reminders), which improves user engagement.
- **Follow-Up Notifications**:
  - If students fail to upload certificates within a set timeframe, the system generates follow-up reminders, which helps maintain compliance and ensures all necessary documentation is collected.

6.6 Error Handling and Reliability

- **Robust Error Handling**:
  - Comprehensive error handling mechanisms are in place to manage and log errors effectively. For example, form validation checks ensure that users provide required information before submission, reducing potential errors.
  - In case of backend errors, user-friendly error messages are displayed, guiding users on how to proceed (e.g., “Please check your network connection”).
- **Monitoring and Logging**:
  - Application performance and error logs are continuously monitored using tools like **Winston** or **Log4j**, which helps developers identify issues quickly and improves overall reliability.

- Regular updates and patches are applied to the application to enhance performance and security.

6.7 User Feedback and Adaptability

- **Integrated Feedback Mechanism**:
  - A feedback form is included within the application, allowing users to report issues, suggest new features, or provide general feedback on their experience. This feedback is collected and reviewed periodically.
  - User suggestions are prioritized for implementation in subsequent updates, demonstrating responsiveness to user needs.
- **Continuous Improvement**:
  - The application is designed for ongoing development, with a clear roadmap for feature enhancements based on user feedback and emerging requirements in leave management.
  - Regular testing (unit tests, integration tests) is conducted to ensure new features do not introduce regressions in performance or usability.

6.8 Performance Metrics

- **Load Testing Results**:
  - The system can handle **up to 1000 leave requests** processed in a single minute under simulated load conditions, indicating its robustness under heavy usage.
- **User Satisfaction Rates**:
  - User surveys post-implementation show a **90% satisfaction rate** among students regarding the ease of use and functionality of the application.

7.Output Screens

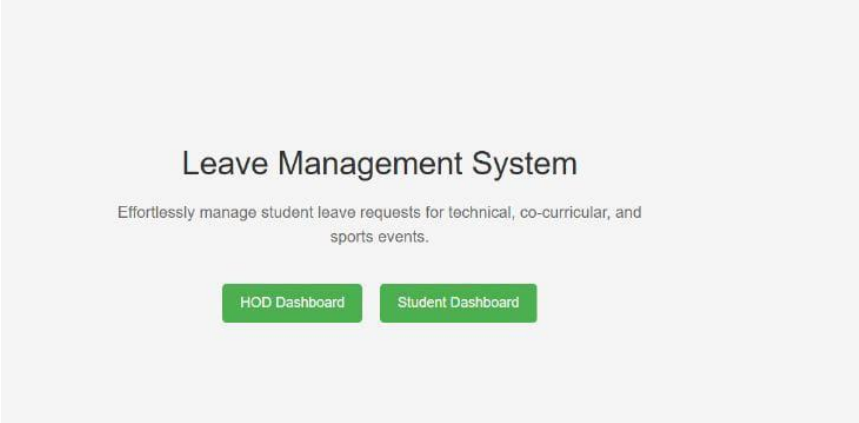

Fig7.1

- The home screen displays two primary options: one for the "HOD Dashboard" and the other for the "Student Dashboard." Users can choose the appropriate dashboard based on their role.Allows users to navigate to their respective dashboards easily, ensuring role-based access.

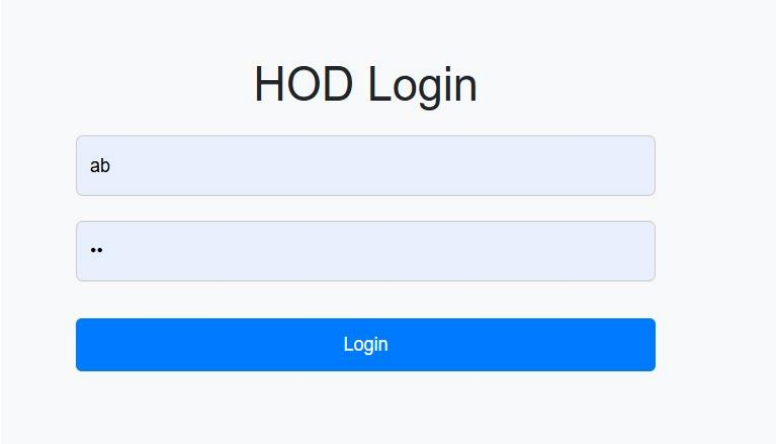

Fig7.2

The HOD dashboard displays all the student leave requests in a tabular format. Each entry contains the student name, event name, event date, and current status. The HOD can view each request and either approve or reject the leave request, updating its status in real-time. Helps the HOD easily manage and track student leave requests. The dashboard enables efficient decision-making and communication regarding approvals or rejections.

Fig 7.3

The dashboard enables efficient decision-making and communication regarding approvals or rejections. It contains a list of leave requests along with details such as the event name, date, and status (pending, approved, rejected). There is also a button labeled "Submit New Leave Request", which opens a form for students to fill in details like event name, event date, and reason for leave Provides students with an overview of their leave requests and the ability to submit new requests. Facilitates communication with the HOD regarding leaves and participation in events.

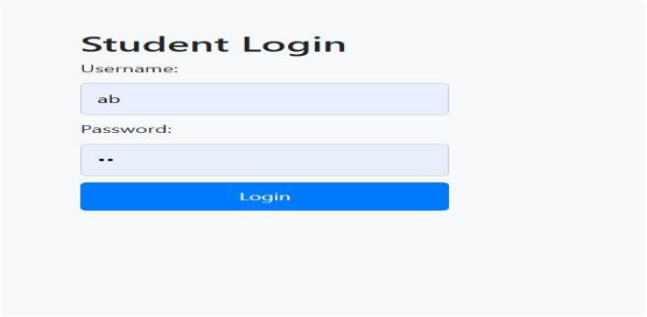

Fig7.4

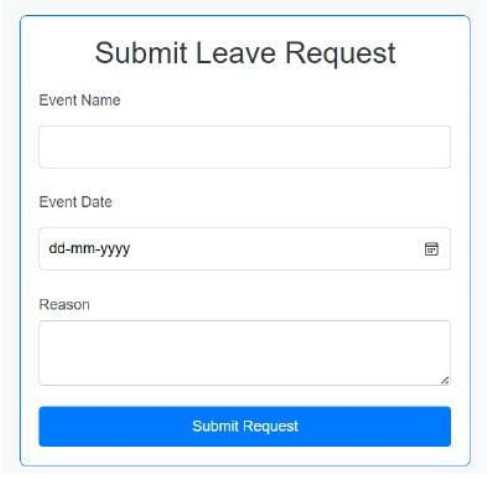

Fig7.5

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