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Design and Development of a Lightweight Agile Workflow Management Tool for Collaborative Project Management

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Abstract: *In the modern software development environment, effective project coordination and workflow management are essential for ensuring productivity, collaboration, and timely delivery of tasks. Traditional project management approaches and existing enterprise tools often become complex, costly, and difficult to manage for small organizations, startups, and academic teams. To overcome these limitations, this research presents the Design and Development of a Lightweight Agile Workflow Management Tool for Collaborative Project Management, named PROJECTLITE.*

The proposed system is designed to simplify Agile-based project management by providing an intuitive and scalable platform for managing projects, tasks, epics, sprints, and team collaboration. The system incorporates essential Agile workflow functionalities such as Kanban-based task tracking, sprint planning, real-time notifications, role-based access control, and performance monitoring. Additionally, the platform integrates an AI-powered editor to improve content generation and productivity during task creation and documentation.

The application is developed using modern web technologies including Next.js for frontend development, NestJS for backend services, and MongoDB as the database management system. Secure authentication and authorization are implemented using JWT (JSON Web Token), while Socket.IO enables real-time communication and notifications between users. The system is deployed on Vercel, ensuring scalability, high availability, and efficient cloud hosting. The proposed solution enhances workflow transparency, improves task tracking efficiency, and enables better collaboration among team members through a centralized and user-friendly interface. The lightweight architecture and modular design make PROJECTLITE suitable for educational institutions, startups, and small-to-medium organizations seeking an affordable and customizable Agile workflow management solution..

Keywords: Agile Workflow, Collaborative Project Management, Task Tracking, Sprint Management, Kanban Board, JWT Authentication, MongoDB Next.js, Nest.js, AI Editor, Real-Time Collaboration, Workflow Automation, Project Management System, Role-Based Access Control (RBAC), Cloud Deployment

I. INTRODUCTION

In today's rapidly evolving digital environment, organizations and software development teams require efficient project management systems to handle complex workflows, monitor progress, and ensure timely completion of tasks. As modern projects involve multiple teams, continuous collaboration, and dynamic requirements, traditional methods such as spreadsheets, manual tracking, and basic task lists are no longer sufficient for managing workflows effectively. These outdated approaches often result in communication gaps, inefficient task allocation, poor transparency, and delays in project execution.

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To address these challenges, Agile project management methodologies have become widely adopted across the software industry. Agile practices focus on iterative development, sprint planning, real-time collaboration, and continuous delivery, enabling teams to adapt quickly to changing requirements. Popular tools such as Jira, Trello, and Asana provide Agile workflow support; however, these platforms are often expensive, overly complex, and difficult to customize for small organizations, startups, and educational institutions.

This research presents the Design and Development of a Lightweight Agile Workflow Management Tool for Collaborative Project Management, named PROJECTLITE. The proposed system is designed to provide a lightweight, scalable, and user-friendly platform that simplifies Agile workflow management while maintaining essential project tracking and collaboration features. The system enables users to create projects, manage tasks, organize sprints, assign responsibilities, track progress, and collaborate efficiently through a centralized interface.

PROJECTLITE incorporates modern technologies such as Next.js for frontend development, NestJS for backend services, and MongoDB for database management. The system uses JWT-based authentication to ensure secure access control and integrates Socket.IO for real-time notifications and collaboration. Additionally, the platform includes an AI-powered editor that assists users in content generation and task documentation, enhancing productivity and workflow efficiency.

The primary objective of the proposed system is to bridge the gap between complex enterprise-level project management tools and the need for a simple, affordable, and customizable solution suitable for collaborative project environments. By integrating Agile principles with modern web technologies, PROJECTLITE aims to improve communication, transparency, accountability, and overall productivity within teams and organizations.

II. PROBLEM STATEMENT

In today's software development environment, effective project management and team collaboration are essential for ensuring productivity and timely task completion. Although several project management tools such as Jira, Trello, and Asana are available in the market, many of these systems are designed primarily for large enterprise environments and often introduce unnecessary complexity for small organizations, startups, and educational teams.

Existing workflow management tools provide numerous advanced features, but their complex interfaces and extensive configurations make them difficult for beginners and small teams to understand and use effectively. Users often face challenges in managing tasks, organizing sprints, and maintaining workflow transparency due to complicated navigation and overloaded functionalities.

Another major issue is the high subscription cost associated with many enterprise-level project management platforms. Small businesses, startups, and student teams may not have the financial resources to adopt expensive workflow management solutions, limiting their ability to implement proper Agile methodologies within their projects. Additionally, many existing systems lack flexibility and customization according to specific organizational needs. Teams often require lightweight and adaptable solutions that can support collaborative workflows without unnecessary features or operational overhead. Limited customization options reduce efficiency and make workflow management less suitable for smaller development environments.

Therefore, there is a need for a lightweight, scalable, and user-friendly Agile workflow management system that simplifies collaborative project management while maintaining essential features such as task tracking, sprint management, real-time collaboration, secure authentication, and customizable workflows. The proposed system, PROJECTLITE, addresses these challenges by providing an affordable and efficient platform designed specifically for collaborative project management in small-to-medium teams and educational environments.

III. OBJECTIVES

The primary objective of the proposed system is to design and develop a lightweight Agile workflow management tool that simplifies collaborative project management for organizations, startups, and educational teams. The specific objectives of the system are as follows:

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1. To develop a lightweight and user-friendly workflow management platform for efficient project and task management.
2. To implement real-time task management and collaboration features for improving team communication and workflow transparency.
3. To provide sprint and epic management functionalities based on Agile methodologies such as Scrum and Kanban.
4. To implement secure user authentication and authorization using JWT (JSON Web Token) for role-based access control.
5. To integrate an AI-based editor that assists users in task creation, documentation, and content generation.
6. To improve productivity, accountability, and collaboration among project teams through a modern web-based interface.

IV. LITERATURE SURVEY

Agile workflow management systems play a significant role in improving project collaboration, task tracking, and workflow efficiency in software development environments. Various project management tools such as Jira, Trello, and Asana are widely used across organizations for implementing Agile methodologies. However, these systems also present several limitations, especially for small teams, startups, and educational institutions.

The following table presents a comparative literature survey of existing systems and their drawbacks:

Existing System	Description	Drawbacks
Jira	Jira is a popular Agile project management tool developed by Atlassian that supports sprint planning, issue tracking, workflow automation, and reporting. It is widely used in enterprise-level software development environments.	High subscription cost, complex user interface, difficult configuration for beginners and small teams.
Trello	Trello provides a visual Kanban-based task management system that helps teams organize tasks using boards, lists, and cards. It is simple and easy to use for basic project tracking.	Limited Agile functionalities, lack of advanced sprint management, limited reporting and workflow customization features.
Asana	Asana is a collaborative project management platform that supports task assignment, project tracking, and workflow organization for teams.	Complex workflow configuration, limited flexibility for Agile-oriented development environments, premium features require paid subscriptions.
PROJECTLITE (Proposed System)	PROJECTLITE is a lightweight Agile workflow management tool designed for collaborative project management. The system integrates sprint handling, Kanban workflow, JWT authentication, AI editor support, and real-time collaboration using modern web technologies.	Currently focused on web-based deployment only; advanced AI prediction and mobile application features are planned for future development.

Based on the literature survey, it is observed that existing project management tools either provide excessive enterpriselevel complexity or lack essential Agile workflow functionalities required by modern collaborative teams. Therefore, there is a need for a lightweight, customizable, and scalable Agile workflow management system that combines essential project management features with simplicity and affordability. PROJECTLITE is proposed to address these limitations by providing a user-friendly and modern collaborative workflow management platform.

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V. PROPOSED SYSTEM

The proposed system, PROJECTLITE: Design and Development of a Lightweight Agile Workflow Management Tool for Collaborative Project Management, is a modern web-based application designed to simplify Agile project management and improve collaboration among team members. The system provides a centralized platform where administrators, project managers, and employees can efficiently manage projects, tasks, sprints, and workflow activities in real time.

The architecture of PROJECTLITE follows a modular three-tier architecture consisting of the Presentation Layer, Application Layer, and Database Layer. The frontend is developed using Next.js, which provides a responsive and interactive user interface. The backend is implemented using NestJS, which handles business logic, API communication, authentication, and workflow processing. MongoDB is used as the database management system for storing project, sprint, task, and user information securely and efficiently. JWT-based authentication is implemented to provide secure access control and role-based authorization.

The system workflow begins with user authentication, where users log into the platform using secure JWT authentication. Based on assigned roles and permissions, users can access different modules of the system. The dashboard acts as the central control panel and provides an overview of projects, sprint progress, pending tasks, notifications, and performance analytics.

Overall, the proposed system provides a lightweight, scalable, and collaborative Agile workflow management platform that combines modern web technologies, secure authentication, real-time communication, and AI-assisted productivity features to improve project management efficiency.

VI. SYSTEM ARCHITECTURE

Figure 6: Architecture Diagram

The architecture of PROJECTLITE: Design and Development of a Lightweight Agile Workflow Management Tool for Collaborative Project Management is designed using a modern full-stack web application architecture to ensure

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scalability, maintainability, security, and real-time collaboration. The system follows a three-tier architecture consisting of the Presentation Layer, Application Layer, and Database Layer.

The proposed architecture integrates modern technologies such as Next.js, NestJS, MongoDB, JWT Authentication, Socket.IO, and Vercel Deployment to provide a secure and efficient Agile workflow management platform.

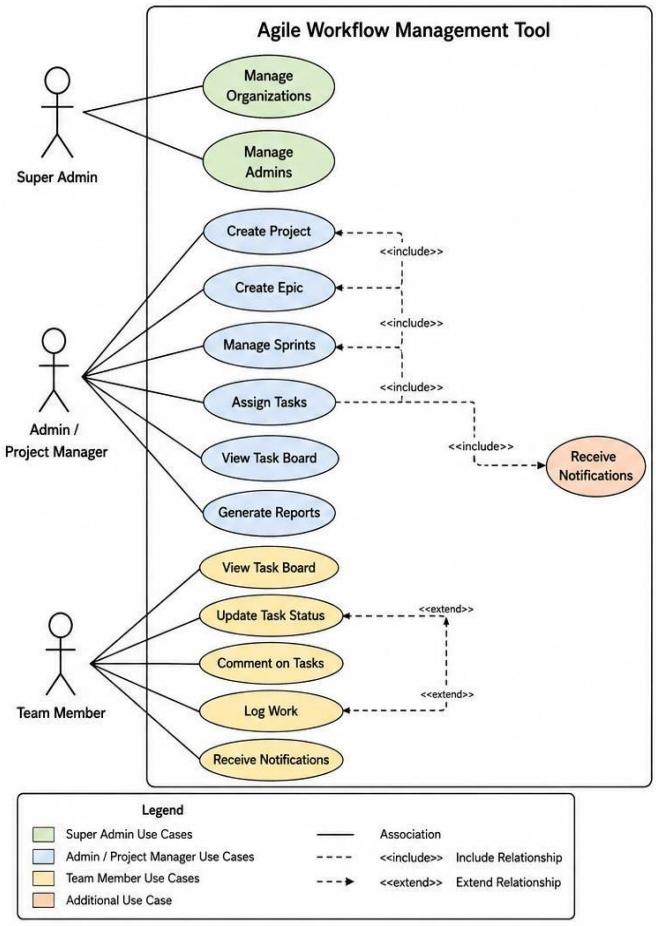
Overall Working of the System

The system workflow begins when users authenticate through JWT-based login. After successful authentication, users access the dashboard according to their assigned roles and permissions. Users can create projects, manage sprints, assign tasks, update Kanban workflow statuses, and receive real-time notifications through Socket.IO. The frontend communicates with the Nest.js backend through REST APIs, while MongoDB stores and manages all workflow-related data efficiently.

The proposed architecture ensures that PROJECTLITE remains lightweight, scalable, secure, and suitable for collaborative Agile project management environments.

VII. UML DIAGRAMS

7.1 Use Case Diagram:



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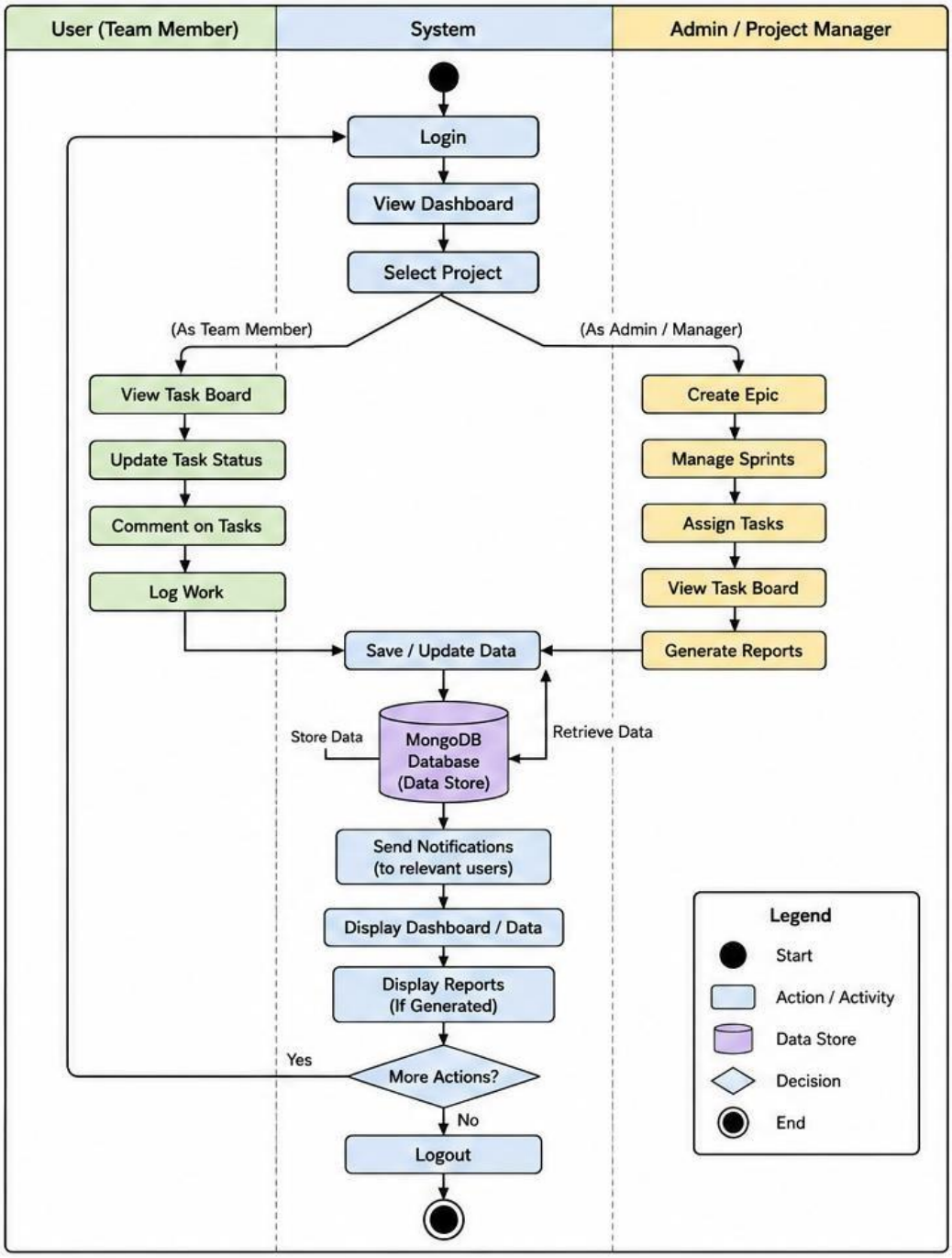
7.2 Activity Diagram:



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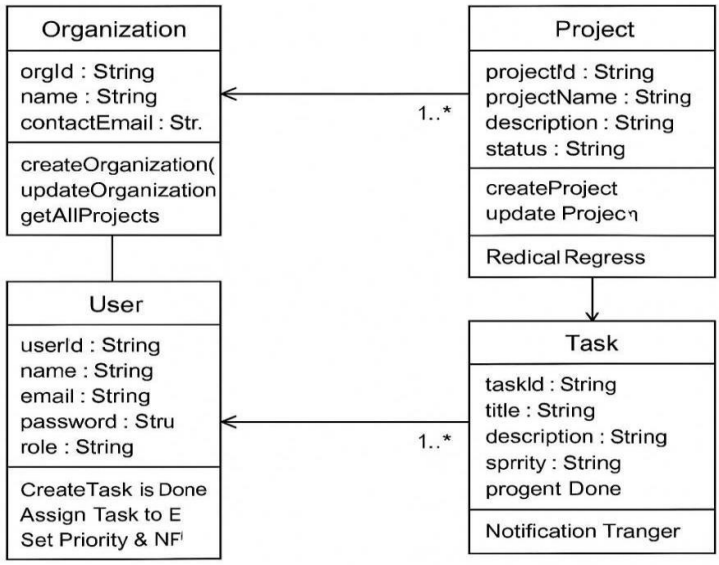
7.3 Class Diagram:



VIII. METHODOLOGY

The development of PROJECTLITE was carried out using the Agile Software Development Methodology. Agile methodology focuses on iterative development, continuous improvement, collaboration, and flexibility throughout the software development lifecycle. It allows the development team to deliver modules incrementally while adapting to changing project requirements efficiently.

The Agile approach helped in managing tasks, sprint planning, workflow tracking, testing, and deployment in a structured and collaborative manner.

IX. TECHNOLOGIES USED

The PROJECTLITE Task Flow Management System was developed using modern web technologies to ensure scalability, security, real-time communication, and efficient project workflow management.

Component	Technology Used
Frontend	Next.js
Backend	NestJS
Database	MongoDB
Authentication	JWT (JSON Web Token)
Realtime Communication	Socket.IO
Deployment Platform	Vercel
Component	Technology Used
AI Editor	AI Feature

X. IMPLEMENTATION DETAILS

The implementation phase of PROJECTLITE focuses on developing the core modules required for Agile workflow management, project collaboration, task tracking, and secure system access. Each module was implemented using

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modern web technologies such as Next.js, NestJS, MongoDB, JWT, and Socket.IO. The following modules were implemented in the system:

10.1 Authentication Module
10.2 Project Creation Module
10.3 Ticket System
10.4 Sprint Management Module
10.5 Kanban Board Module
10.6 Reports Module
10.7 Notifications Module
10.8 AI Editor Module

XI. TESTING

Testing is one of the most important phases in the software development lifecycle, as it ensures that the PROJECTLITE system functions correctly, securely, and efficiently. Various testing methods were performed to validate the functionality, performance, security, and reliability of the application.

The testing process focused on verifying all modules including authentication, project management, sprint handling, task tracking, real-time notifications, and API communication.

The following testing methods were implemented during the development of the PROJECTLITE Task Flow Management System:

11.1 Unit Testing
11.2 API Testing
11.3 UI Testing
11.4 Authentication Testing

Testing Outcome:

The testing process confirmed that the PROJECTLITE system performs efficiently and securely under normal operating conditions. All major functionalities including task management, sprint handling, Kanban workflow updates, notifications, and authentication were successfully validated.

The use of Postman, manual testing, and module-wise verification ensured the reliability, usability, and scalability of the system.

XII. RESULTS AND DISCUSSION

The implementation of PROJECTLITE successfully improved Agile workflow management and collaborative project tracking through a lightweight and user-friendly platform. The system enables faster workflow execution, secure project management, and efficient sprint handling using modern web technologies.

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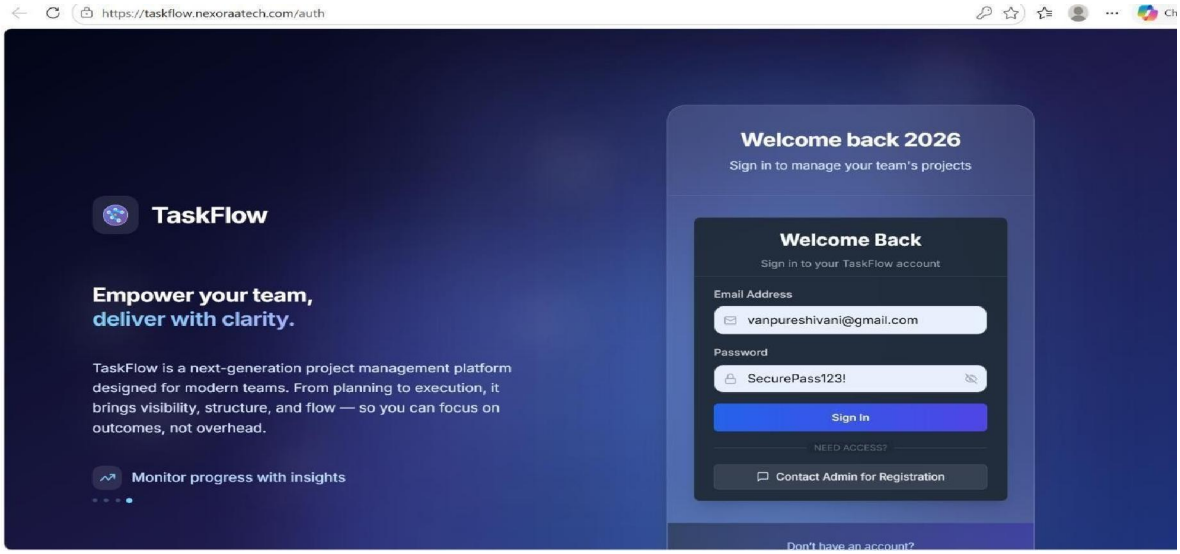
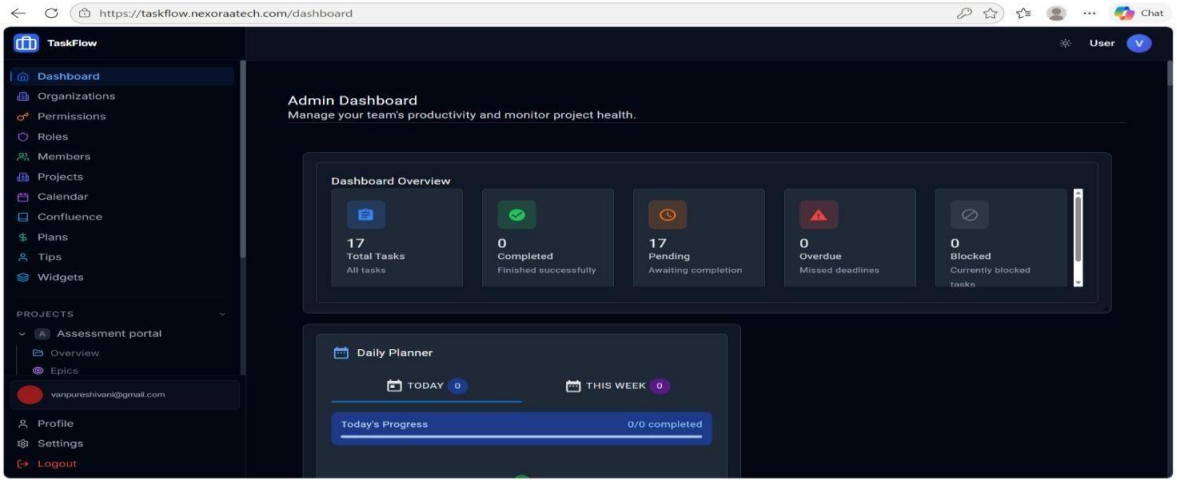


Figure 14.1: User Authentication Interface

The authentication module uses JWT-based security to provide secure login and role-based access control for users. The system validates user credentials securely and restricts unauthorized access to protected resources.

Figure 14.2: PROJECTLITE Dashboard



The dashboard provides a centralized overview of project activities including total tasks, completed tasks, pending tasks, overdue tasks, and blocked tasks. It also helps users monitor workflow progress and team productivity efficiently.

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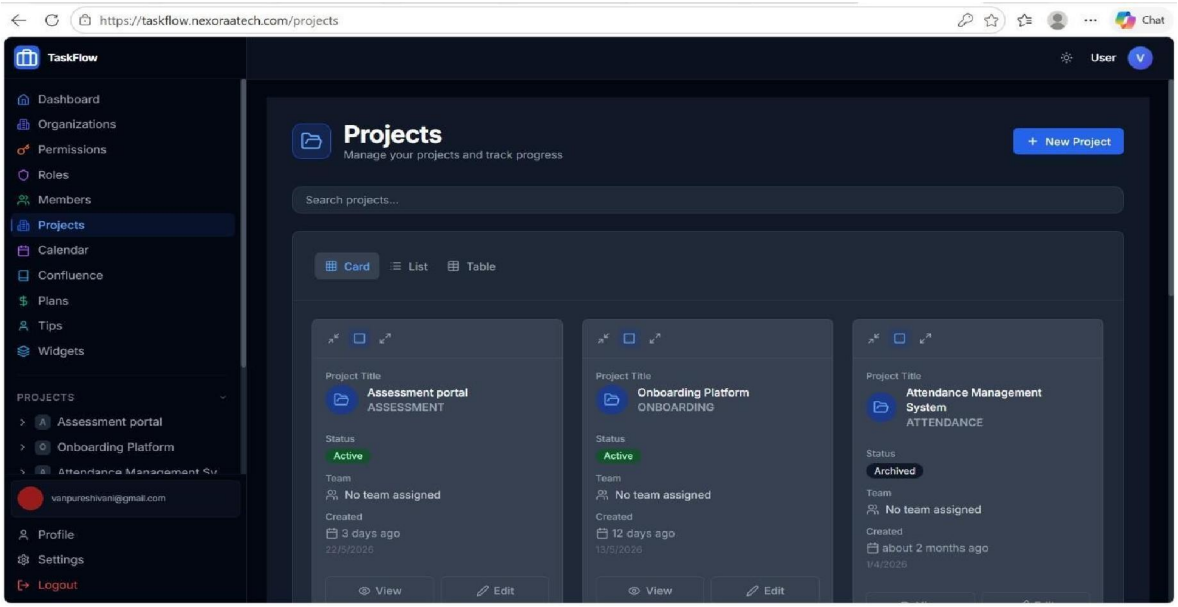
Figure 14.5: Project Workspace Interface



The project workspace section helps users organize project-related activities efficiently. It provides access to project management features, organization details, user settings, and workflow operations within a centralized interface.

XIII. DISCUSSION

PROJECTLITE successfully achieved its objective of providing a lightweight Agile workflow management solution for collaborative project management. The system improved workflow execution, team collaboration, secure access management, and sprint tracking. The integration of modern technologies such as Next.js, NestJS, MongoDB, and Vercel deployment enhanced the scalability, responsiveness, and overall performance of the application.

XIV. ADVANTAGES

The PROJECTLITE system provides several advantages for collaborative project management and Agile workflow execution.

- Lightweight and user-friendly interface
- Secure JWT-based authentication and role management
- Real-time collaboration using Socket.IO
- Efficient sprint and task tracking

XV. LIMITATIONS

Although PROJECTLITE provides efficient workflow management features, the current version has certain limitations:

- Mobile application support is not currently available
- Advanced analytics and reporting features are limited
- Third-party integrations are not fully implemented in the current version

XVI. FUTURE SCOPE

The PROJECTLITE system can be further enhanced by implementing the following features in future versions:

- Development of Android and iOS mobile applications

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- AI-based task prediction and smart workflow recommendations
- Integration with GitHub for version control and repository management
- Advanced analytics and reporting dashboards

XVII. CONCLUSION

The PROJECTLITE system successfully achieves the objective of developing a lightweight Agile workflow management platform for collaborative project management. The system simplifies project execution by providing features such as sprint management, Kanban workflow tracking, real-time notifications, JWT-based authentication, and AI-assisted editing.

The implementation of modern technologies including Next.js, NestJS, MongoDB, Socket.IO, and Vercel deployment ensures scalability, security, and efficient performance. The system improves collaboration, task tracking, and workflow transparency while remaining user-friendly and cost-effective for startups, educational institutions, and small-to-medium organizations.

Overall, PROJECTLITE provides an effective and modern solution for Agile project management and establishes a strong foundation for future enhancements such as AI-based automation, mobile application support, and advanced analytics.

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