

AI - Enhanced Academic Project Monitoring System

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ABSTRACT

The AI-Enhanced Academic Project Monitoring System is an intelligent and scalable platform designed to transform the traditional approach to monitoring and evaluating final-year academic projects in higher education institutions. Conventional project tracking relies heavily on manual supervision and subjective assessment, often resulting in inconsistent evaluation, lack of transparency, and uneven contribution among team members. These challenges create accountability issues and make it difficult for faculty members to identify underperforming students within a group. To address these limitations, the proposed system introduces an automated, data-driven solution that integrates modern web technologies with machine learning techniques. The platform continuously monitors student activity through GitHub API integration, capturing key metrics such as commit frequency, code additions, and contribution consistency. This data is processed using the Isolation Forest algorithm, a robust anomaly detection model, to identify irregular activity patterns and flag students or teams at risk of falling behind. By leveraging intelligent analytics, the system ensures objective and unbiased evaluation of individual contributions. In addition to automated tracking, the system provides a collaborative ecosystem featuring an intelligent Kanban board for task management and threaded document annotations for detailed and contextual mentor feedback on weekly submissions. A background scheduling mechanism ensures real-time accuracy by synchronizing GitHub data daily without manual intervention. Furthermore, the platform generates automated insight reports to support final grading, significantly reducing faculty workload while improving evaluation efficiency. The proposed solution ultimately creates a transparent, accountable, and high-performance environment for academic project lifecycle management.

Keywords: AI, Monitor, Evaluation

INTRODUCTION

In today's rapidly evolving technological era, academic institutions are increasingly emphasizing project-based learning to enhance students' practical knowledge, innovation skills, teamwork, and real-world problem-solving abilities. Final-year academic projects, in particular, play a vital role in assessing a student's understanding of technical concepts and their capability to apply theoretical knowledge in practical environments. These projects not only prepare students for industrial challenges but also encourage collaboration, research, and independent learning. However, despite their importance, the methods traditionally used for monitoring and evaluating academic projects remain largely manual, subjective, and inefficient.

In conventional project evaluation systems, faculty members generally assess students based on periodic reviews, presentations, verbal updates, and final project demonstrations. While these approaches provide a general understanding of project progress, they fail to accurately capture the continuous contribution and involvement of individual team members throughout the project lifecycle. This creates several challenges, including unequal workload distribution, inconsistent participation, lack of transparency, delayed task completion, and the widely observed "*Free Rider*" problem, where some students receive equal credit despite contributing minimally to the project. Such issues reduce fairness in evaluation and make it difficult for mentors to identify underperforming students or teams at an early stage.

Another major limitation of traditional monitoring methods is the absence of real-time project tracking and objective evaluation mechanisms. Faculty members often have limited visibility into the actual development activities taking place within a team. Since most assessments are performed manually, the process becomes time-consuming and highly dependent on subjective judgment. Additionally, many institutions still lack

centralized systems that can effectively monitor coding activities, task completion status, and collaborative progress in a structured manner. As software development practices continue to evolve in the industry, there is a growing need for academic institutions to adopt smarter and more automated project management solutions that align with modern development workflows.

The increasing adoption of platforms such as GitHub in software development has created new opportunities for academic project monitoring. GitHub provides detailed insights into development activities, including commit history, code additions, issue tracking, collaboration patterns, and project consistency. These metrics can serve as valuable indicators of student participation and project progress when analyzed systematically. However, manually interpreting such large amounts of development data is impractical and inefficient. This creates the need for intelligent systems capable of automatically analyzing student activities and identifying irregularities in contribution behavior.

To overcome these limitations, the proposed project introduces an **AI-Enhanced Academic Project Monitoring System**, an intelligent and scalable platform designed to modernize the monitoring and evaluation process of final-year academic projects. The system integrates GitHub APIs to continuously collect development-related metrics such as commit frequency, code modifications, contribution consistency, and collaborative activity. These metrics are further analyzed using the **Isolation Forest** machine learning algorithm, which is widely used for anomaly detection. By applying this algorithm, the system can automatically identify unusual contribution patterns, detect inactive or inconsistent participation, and flag students or teams that may be falling behind in project development.

The proposed platform goes beyond automated activity tracking by providing a collaborative ecosystem that enhances communication and project organization. An intelligent Kanban board is integrated into the system to support task management, progress visualization, and team coordination. This enables mentors and students to efficiently manage project workflows and monitor task completion in real time. In addition, the system includes threaded document annotation features that allow mentors to provide structured, contextual, and detailed feedback directly on submitted reports and weekly updates.

Such features improve mentor-student interaction and support continuous project improvement throughout the development lifecycle. To ensure real-time monitoring and reduce manual intervention, the system incorporates a background scheduling mechanism that automatically synchronizes GitHub activity data at regular intervals. This ensures that project insights remain accurate and up to date without requiring faculty members to manually collect or verify development records. Furthermore, the platform generates automated analytical and performance reports that summarize individual and team contributions, helping faculty members perform fair and data-driven evaluations while significantly reducing workload and evaluation complexity.

The integration of machine learning techniques with collaborative project management tools makes the proposed system highly effective in addressing the shortcomings of traditional academic monitoring approaches. By combining automated contribution analysis, anomaly detection, real-time collaboration tracking, and intelligent reporting, the system creates a transparent, accountable, and efficient environment for academic project management.

Moreover, the proposed solution bridges the gap between academic learning and industry-standard software development practices by encouraging students to use professional tools such as GitHub for version control and collaboration. This not only improves the quality of academic project evaluation but also prepares students for real-world software engineering environments where version control systems, collaborative workflows, and continuous monitoring are essential.

In conclusion, the AI-Enhanced Academic Project Monitoring System aims to revolutionize the traditional academic project evaluation process by introducing automation, transparency, intelligent analytics, and collaborative management features. The system enhances fairness in assessment, improves mentor oversight, reduces faculty workload, and promotes accountability among students, ultimately contributing to a more effective and industry-oriented academic project lifecycle.

OBJECTIVES

The main objectives of the Mentora AI: An Intelligent Project Monitoring and Evaluation System are as follows:

- **To develop an automated project monitoring system** that integrates with GitHub to track student project activities and contributions in real time.
- **To implement an AI-based evaluation mechanism** using machine learning techniques to analyze student performance and identify irregular or low-contribution patterns.
- **To provide an intelligent project management platform** through Kanban boards, enabling efficient task planning, assignment, and progress tracking.
- **To facilitate effective collaboration and communication** between students and faculty through weekly progress logs and threaded annotation-based feedback.
- **To generate transparent and objective performance reports** that assist faculty in evaluating student contributions fairly while reducing manual monitoring efforts.

LITERATURE SURVEY

Kalliamvakou et al. (2014) proposed a study titled *"The Promises and Perils of Mining GitHub"*. [1] The authors investigated the reliability of GitHub repository data for software engineering research. The study analysed repository activities such as commits, forks, and pull requests to understand developer contributions. The findings highlighted the importance of accurately interpreting GitHub metrics for effective project monitoring and contributor evaluation.

Tsay, Dabbish, and Herbsleb (2014) presented the research *"Influence of Social and Technical Factors for Evaluating Contribution in GitHub"*. [2] The study explored how technical contributions and social interactions affect software development projects. The authors analyzed pull requests, commits, and collaboration activities, demonstrating that GitHub metrics can effectively represent individual participation and project engagement.

Borges et al. (2016) conducted research titled *"Understanding the Factors that Impact the Popularity of GitHub Repositories"*. [3] The study examined repository activities, developer engagement, and collaborative development practices. The results showed that repository analytics can provide meaningful insights into project growth, contributor participation, and overall project health.

Kikas et al. (2017) proposed a study on the *"Structure and Evolution of Package Dependency Networks"*. [4] The research analyzed software repositories to understand project evolution and development patterns. The findings demonstrated that repository activities can be continuously monitored to evaluate project progress and identify software development trends.

METHODOLOGY

SYSTEM DESIGN

The proposed AI-Enhanced Academic Project Monitoring System follows a modular and service-oriented architecture designed to support real-time project monitoring, intelligent data analysis, and collaborative workflow management. The methodology is divided into several phases, each contributing to the overall functionality and efficiency of the system.

- **System Architecture and Design**

The platform is developed using a **Flask-based Model-View-Controller (MVC) architecture** to ensure modularity, scalability, and maintainability. The MVC design pattern separates the application into different layers, allowing efficient management of business logic, user interfaces, and data processing components.

The backend is integrated with **SQLite/PostgreSQL databases** to provide secure and efficient storage of user information, project details, GitHub activity records, and evaluation

results. A **Role-Based Access Control (RBAC)** mechanism is implemented to manage permissions and responsibilities among different users, including HODs, Coordinators, Faculty Members, and Students. This architecture ensures secure access to project information and supports efficient academic workflow management.

- **GitHub Data Integration Pipeline**

A dedicated **GitHub Service Module** is implemented to establish communication with the GitHub REST API. The module continuously retrieves repository activity data from student-linked GitHub repositories.

The collected information includes:

- Commit history
- Code additions and deletions
- Repository activity patterns
- Contribution frequency
- Developer participation metrics

The retrieved data is processed and stored in the database, where it serves as the primary

SYSTEM ARCHITECTURE

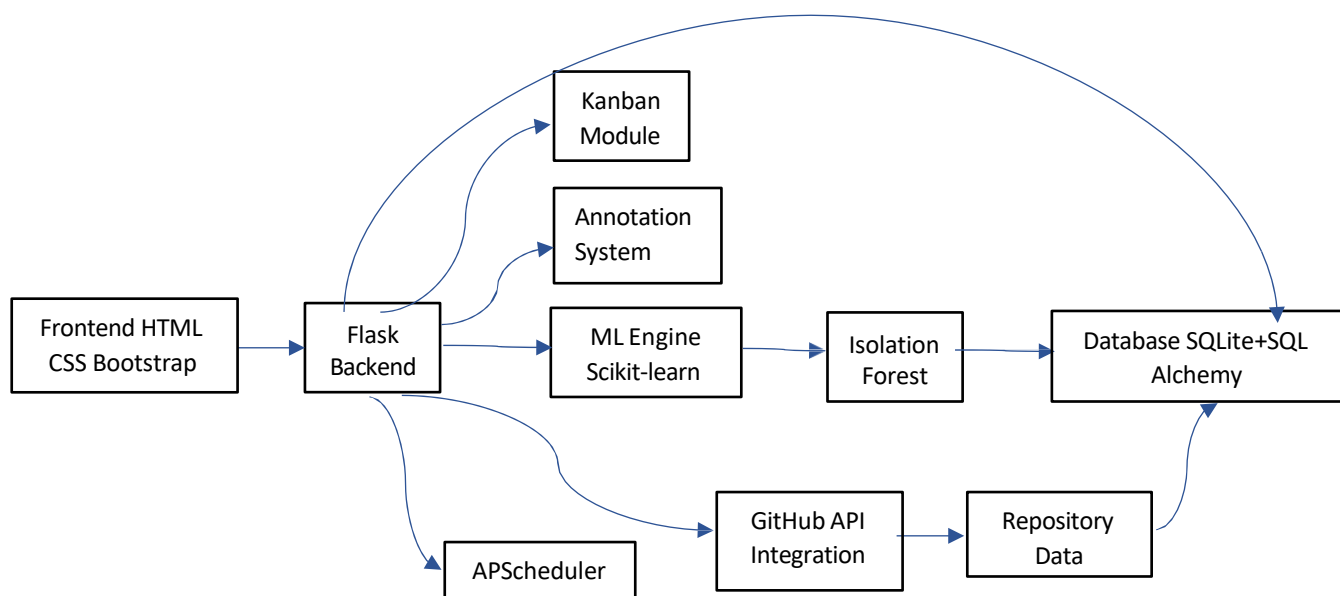


Fig 3.2.1 Schematic Architecture Diagram

IMPLEMENTATION

The implementation of the Mentora AI – An Intelligent Project Monitoring and Evaluation System was carried out using a modular full-stack architecture that integrates web technologies, database management, machine learning, and GitHub repository analytics. The system was developed to automate project monitoring, evaluate student contributions, and facilitate collaboration between students and faculty members.

- ❖ **User Authentication and Role Management**

- ❖ **Project and Team Management Module**
- ❖ **GitHub Repository Integration**
- ❖ **Activity Monitoring and Data Collection**
- ❖ **AI-Based Contribution Analysis**
- ❖ **Kanban-Based Task Management System**
- ❖ **Weekly Progress Logging and Annotation System**
- ❖ **Dashboard and Visualization Module**
- ❖ **Automated Report Generation**
- ❖ **Database Implementation**

RESULTS AND ANALYSIS

The Mentora AI system was successfully implemented and tested using multiple user roles, including HODs, Coordinators, Faculty Members, and Students. The system demonstrated effective project monitoring, contribution analysis, task management, and automated performance evaluation through GitHub repository integration and machine learning techniques.

AI-Based Contribution Analysis

The Isolation Forest algorithm successfully analyzed student contribution patterns using GitHub activity metrics. The system effectively identified irregular contribution behaviour, inactive students, and unequal workload distribution among team members. The generated contribution scores provided an objective and transparent method for evaluating individual performance.

Task Management and Project Tracking

The Kanban-based task management module enabled students to create, assign, and track project tasks efficiently. The visual workflow interface improved task organization and provided clear visibility into project status. Faculty members were able to monitor task completion and identify delays in project execution.

Weekly Log Submission and Feedback

The Weekly Log Module facilitated regular project updates from students. Faculty members successfully reviewed submitted logs and provided feedback through the threaded annotation system. This feature improved communication, documentation quality, and mentor-student interaction throughout the project lifecycle.

Dashboard and Analytics

The dashboard module presented project statistics, contribution metrics, task progress, and evaluation results in an easy-to-understand format. Different stakeholders were able to monitor project activities through graphical summaries and analytical reports, improving decision-making and project oversight.

Automated Report Generation

The system generated performance reports automatically using GitHub activity data and machine learning analysis. These reports included contribution scores, activity summaries, project progress information, and anomaly detection results. Automated reporting significantly reduced the manual workload involved in project evaluation.

CONCLUSION

The **AI-Enhanced Academic Project Monitoring System** successfully addresses the limitations

of traditional project evaluation methods by introducing an intelligent, automated, and data-driven approach to academic project management. The system integrates modern web technologies, machine learning techniques, and real-time collaboration tools to provide continuous monitoring and objective assessment of student contributions.

By leveraging GitHub activity tracking and the Isolation Forest algorithm, the system ensures fair evaluation by identifying contribution patterns and detecting underperforming team members. The inclusion of features such as Kanban boards and threaded annotations enhances communication and task management, creating a structured and transparent workflow for both students and faculty.

The project significantly reduces the manual workload of faculty by automating data collection, analysis, and report generation, while also promoting accountability and consistent development practices among students. Overall, the system improves the quality of academic projects and aligns the learning process with real-world software development practices.

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