

SmartCodeHub

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Abstract - In the modern software development environment, efficient project management and effective debugging tools are essential for improving developer productivity and code quality. Traditional code repositories mainly provide storage and sharing capabilities but lack intelligent support for detecting and correcting programming errors. This project proposes SmartCodeHub, a unified web-based platform that combines project collaboration with AI-based code correction. The system allows users to register and upload their software projects after receiving approval from an administrator. Each user can manage their own projects while also viewing and downloading projects shared by other users. The platform ensures secure access control by allowing only project owners to modify or delete their uploaded files, while administrators can monitor and manage all users and projects within the system.

In addition to project management features, SmartCodeHub integrates an AI-powered Code Assistant built using the Gemini 2.5 Flash model through the LangChain framework. This intelligent module enables users to submit code containing errors, automatically analyze the code, and receive corrected versions along with clear explanations. The integration of artificial intelligence transforms the platform into a smart development environment that supports both collaboration and learning. The proposed system improves development efficiency, simplifies debugging, and promotes knowledge sharing among developers, making it a valuable tool for students, programmers, and software development teams.

Key Words: SmartCodeHub, Code Repository, AI Code Assistant, Gemini AI, LangChain, Django, Code Debugging, Project Collaboration, Software Development, Web Application.

1.INTRODUCTION

The rapid growth of software development and collaborative programming has increased the demand for platforms that support efficient project management, code sharing, and debugging. Modern software projects often involve multiple developers working together, which requires reliable repositories to store, manage, and distribute code efficiently. Traditional code hosting platforms mainly focus on project storage and version control but provide limited support for intelligent debugging and automated error correction. As a result, developers frequently rely on external tools and

documentation to identify and fix programming errors, which can slow down the development process and affect productivity [1], [2].

With the advancement of artificial intelligence and machine learning technologies, intelligent systems can now assist developers in analyzing and improving their code. Recent research shows that large language models and deep learning techniques are capable of understanding programming languages, detecting errors, and suggesting improvements automatically [3], [4]. These technologies have opened new opportunities for integrating AI-driven code assistance into development platforms, enabling developers to receive instant feedback and corrections.

To address these challenges, this project proposes SmartCodeHub, a unified platform that integrates project repository management with an AI-based code correction system. The platform allows users to upload, manage, and share their projects while also receiving intelligent support for debugging and improving their code.

1.1 Code Repository Platforms

Code repository systems play a vital role in modern software development by providing a centralized environment where developers can store and share their code. Platforms such as Git-based repositories enable users to collaborate on projects, track changes, and maintain code history. These systems help improve team coordination and ensure that project files are securely stored and easily accessible [5], [6]. However, most repositories primarily focus on storage and collaboration features rather than intelligent assistance for debugging and learning.

1.2 Artificial Intelligence in Software Development

Artificial intelligence has significantly transformed many aspects of software engineering. Machine learning models and large language models can analyze programming code, identify patterns, and detect potential errors. Studies have shown that AI-based tools can automatically generate code suggestions, detect bugs, and recommend improvements, thereby reducing the effort required for manual debugging [7], [8]. The integration of such intelligent systems into development platforms can enhance coding efficiency and support developers in solving programming problems more effectively.

1.3 Need for an Intelligent Development Platform

Despite the availability of code repositories and AI tools, many developers still use separate systems for project management and code debugging. This separation creates inefficiencies and increases the time required to identify and correct errors. An integrated platform that combines project repository features with AI-powered code analysis can significantly improve developer productivity and learning. By providing both collaboration and intelligent debugging support in a single environment, developers can manage their projects more efficiently and resolve coding issues quickly [9], [10].

1.4 Overview of the Proposed System

The proposed SmartCodeHub platform aims to provide a secure and intelligent environment for project collaboration and code correction. The system allows users to register, upload their projects, and access projects shared by other users while maintaining strict access control. An administrator module ensures system security by approving user registrations and managing project content. In addition, the platform integrates an AI Code Assistant powered by the Gemini model through the LangChain framework, which analyzes user-submitted code and provides corrected code along with explanations. This integration transforms the platform into a smart development environment that supports both collaboration and automated debugging.

2. PROPOSED SYSTEM

The proposed system, SmartCodeHub, is a web-based platform designed to integrate project repository management with an AI-powered code assistance mechanism. The system provides a secure environment where users can upload, manage, and share their projects while also receiving intelligent support for debugging and correcting code. The platform is built using the Django web framework and integrates advanced artificial intelligence services through the Gemini API. The system ensures secure user authentication, role-based access control, and centralized administration for monitoring and managing user activities.

The architecture of SmartCodeHub consists of several interconnected modules including the user module, admin module, project module, and AI chatbot module. These modules interact with a centralized database to store user information and project files. Additionally, the AI chatbot communicates with the Gemini API hosted in the cloud to analyze and correct programming code submitted by users.

2.1 User Management Module

The User Management Module handles user registration, authentication, and account management. New users must first register by providing their basic details such as name,

email, and password. Once registered, the account remains inactive until it is approved by the administrator. After approval, users can log in to the system and access their personalized dashboard.

From the dashboard, users can upload projects, view their own projects, browse projects uploaded by other users, and download shared files. However, users are allowed to edit or delete only their own projects, ensuring proper access control and data ownership.

2.2 Admin Management Module

The Admin Management Module provides centralized control over the system. The administrator logs into the platform using secure credentials and can monitor all registered users and uploaded projects. One of the primary responsibilities of the administrator is approving new user registrations to maintain system security and prevent unauthorized access.

The administrator can also view projects uploaded by any user and delete inappropriate or unnecessary files if required. This module ensures that the platform maintains a structured and controlled environment for project sharing.

2.3 Project Repository Module

The Project Repository Module manages the storage and retrieval of project files within the system. Users can upload their project files, which are stored securely in the server and linked with their respective accounts in the database. The module allows users to view and download projects uploaded by others, encouraging collaboration and knowledge sharing.

By maintaining a centralized repository, the system ensures that project files are organized and easily accessible while maintaining proper access restrictions.

2.4 AI Code Assistant Module

The AI Code Assistant Module is a key component of the SmartCodeHub platform. This module enables users to paste programming code containing errors or inefficiencies into the system. The submitted code is then sent to the Gemini AI model through the LangChain framework for analysis.

The AI model processes the code, identifies errors, and generates corrected code along with explanations. This helps users understand their mistakes and improves their coding skills while significantly reducing debugging time.

2.5 System Architecture

The system architecture of SmartCodeHub illustrates the interaction between the user interface, application server, database, and AI services. Users access the platform through a web browser, which communicates with the Django-based

web interface. The server processes requests through various modules such as the user module, admin module, project module, and AI chatbot module.

All user data and project information are stored in the central database. When a user interacts with the AI assistant, the request is sent to the Gemini API through the AI chatbot module, which returns the corrected code and explanation. This architecture ensures efficient communication between system components and enables seamless integration of AI capabilities into the platform.

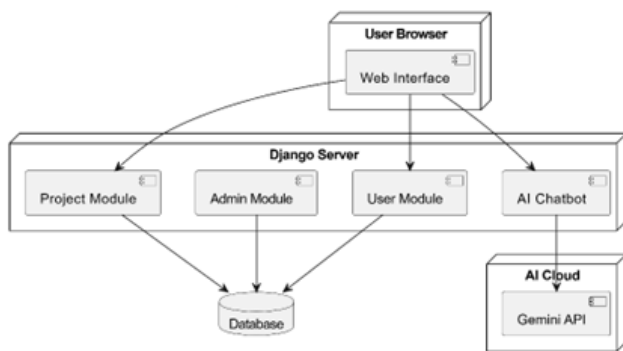


Fig - 1. System Architecture of SmartCodeHub

The architecture demonstrates how different modules collaborate to provide secure project management and intelligent code correction within a unified development platform.

3. IMPLEMENTATION DETAILS

The SmartCodeHub system is implemented as a web-based application using the Django framework, which follows the Model-View-Template (MVT) architecture. The platform integrates multiple modules including user management, project repository management, administrative control, and an AI-powered code assistant. The implementation ensures secure authentication, structured data storage, and seamless interaction between the user interface and backend services. The system also integrates artificial intelligence capabilities through the Gemini 2.5 Flash model using the LangChain framework for intelligent code analysis and correction.

3.1 Development Environment

The development of SmartCodeHub is carried out using modern web technologies to ensure reliability and scalability. The backend of the system is developed using Python and the Django web framework, which provides built-in features for authentication, database handling, and security. The frontend is developed using HTML, CSS, and basic JavaScript, providing an interactive and user-friendly interface for users and administrators. The system uses SQLite as the database for storing user credentials and project information.

The application is deployed locally using the Django development server, and project files uploaded by users are stored in the server’s media directory. The integration of external AI services is achieved through API communication with the Gemini model.

3.2 User Authentication and Registration

The user authentication module is implemented to manage registration, login, and logout processes. Users must register by providing their personal details such as name, email, and password. After registration, the account remains inactive until it is approved by the administrator.

Django session management is used to maintain login sessions and ensure secure access to system features. Once approved by the administrator, users can log into the platform and access their personalized dashboard where they can upload and manage projects.

3.3 Project Repository Implementation

The project repository module allows users to upload, view, and download project files. The uploaded files are stored in the server’s media folder and are linked to the user’s account in the database. Each project entry contains information such as project title, file path, upload date, and user details.

Users can view their own uploaded projects through the My Projects section, while the All Projects section allows them to browse projects uploaded by other users. Access control mechanisms ensure that users can modify or delete only their own projects.

3.4 Admin Control Implementation

The administrator module is implemented to monitor and manage the entire system. The administrator logs into the system using predefined credentials and can view all registered users. One of the primary tasks of the administrator is approving newly registered users before they gain access to the platform.

The administrator can also view the list of projects uploaded by any user and delete projects when necessary. This ensures that the system remains secure and free from unauthorized or inappropriate content.

3.5 AI Code Assistant Integration

A significant feature of SmartCodeHub is the integration of the AI Code Assistant. This module is implemented using the LangChain framework, which acts as an interface between the Django application and the Gemini 2.5 Flash model.

Users can paste programming code into the chatbot interface, and the system sends this code to the Gemini API for analysis. The AI model processes the input code, detects possible errors, and generates corrected code along with

explanations. The response from the AI service is then displayed on the user interface, allowing users to understand the issue and apply the suggested improvements.

3.6 File Storage and Database Management

The system uses Django's file handling mechanisms to store uploaded project files securely in the media directory. The database stores important information such as user details, project metadata, and approval status.

By combining structured database storage with secure file management, the platform ensures efficient retrieval of project data and reliable system performance.

4. RESULTS AND PERFORMANCE ANALYSIS

The SmartCodeHub platform was successfully implemented and tested to evaluate its functionality, usability, and performance. The system integrates project repository management with an AI-powered code assistant, providing users with a secure and intelligent development environment. The results demonstrate that the system effectively manages user authentication, project uploads, administrative control, and AI-based code correction. The performance evaluation focuses on system usability, response time, and accuracy of the AI-assisted debugging feature.

4.1 Home Page Interface

The home page serves as the entry point to the SmartCodeHub platform. It provides navigation options for users and administrators to access different functionalities such as user registration, user login, and administrator login. The interface is designed to be simple and intuitive, enabling users to quickly understand the purpose of the platform. The layout includes clearly labeled sections and buttons that guide users to different system modules.



Fig - 2. SmartCodeHub Home Page

The homepage highlights the core purpose of the platform, which is to provide an intelligent repository for project collaboration and AI-powered code assistance.

4.2 User Dashboard

After successful authentication and administrator approval, users can access their personalized dashboard. The dashboard provides options to upload new projects and explore various sections such as My Projects, All Users Projects, and the AI Code Assistant. The interface allows users to easily manage their projects and access the AI-based debugging system.

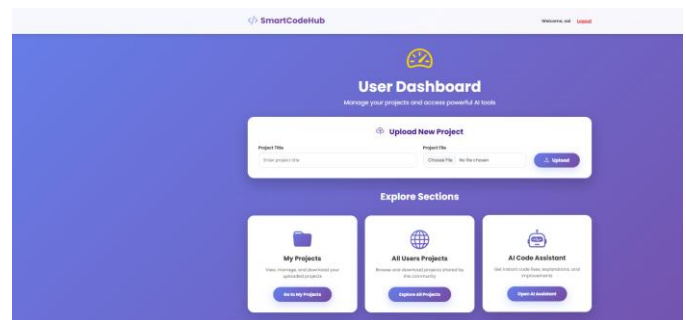


Fig - 3. User Dashboard

The dashboard also includes a project upload form that allows users to add project files along with project titles. Uploaded projects are stored securely and can be accessed later for viewing or downloading.

4.3 System Performance

The performance of the system was evaluated based on response time, system reliability, and user interaction efficiency. The Django-based backend ensures efficient request handling and secure session management. File uploads and downloads are processed quickly due to optimized database queries and server-side storage mechanisms.

The integration of the Gemini AI model through LangChain enables the AI Code Assistant to analyze and correct programming code in real time. The AI module successfully identifies coding errors and generates corrected code along with explanations, improving the debugging process for users. Overall, the SmartCodeHub system demonstrates reliable performance and provides a user-friendly environment for managing projects and receiving intelligent coding assistance.

5. CONCLUSIONS

The SmartCodeHub platform was developed to provide a unified environment for project collaboration and AI-based code assistance. The system successfully integrates project repository management with an intelligent debugging mechanism, allowing users to upload, manage, and share their software projects in a secure and organized manner. Through the implementation of user authentication and administrator approval mechanisms, the platform ensures that only authorized users can access and interact with the

system, thereby maintaining data integrity and security. One of the key contributions of this project is the integration of an AI Code Assistant powered by the Gemini 2.5 Flash model using the LangChain framework. This feature enables users to submit programming code containing errors and receive corrected code along with clear explanations. The AI-driven approach significantly reduces the time required for debugging and helps users understand programming concepts more effectively.

The system also provides a structured administrative module that allows administrators to monitor user registrations, approve accounts, and manage uploaded projects. This centralized control ensures that the platform operates efficiently and maintains high-quality project content. Additionally, the project repository module allows users to explore and download projects shared by other users, promoting collaboration and knowledge sharing among developers. Overall, SmartCodeHub transforms a traditional project repository into an intelligent development platform by combining collaboration, secure access control, and AI-powered code correction. The successful implementation and testing of the system demonstrate its effectiveness in improving coding efficiency, simplifying debugging processes, and supporting collaborative software development.

6. FUTURE WORK

Although the SmartCodeHub platform successfully integrates project repository management with AI-powered code assistance, several enhancements can be implemented in the future to improve its functionality and scalability. One possible improvement is the integration of version control features, which would allow users to maintain different versions of their projects and track changes over time. This feature would make the platform more similar to professional development environments used in the software industry.

Another important enhancement is the implementation of real-time collaboration, enabling multiple users to work on the same project simultaneously. This would support team-based development and improve communication among developers. Additionally, the AI Code Assistant can be extended to support multiple programming languages, provide code optimization suggestions, and generate automatic documentation or test cases for the uploaded code. Future work can also include adding advanced security mechanisms such as plagiarism detection, vulnerability scanning, and improved authentication methods to ensure the safety of project files and user data. The system can also be expanded with user profiles, project ratings, and feedback systems to enhance interaction among users.

Furthermore, deploying the platform on cloud infrastructure and developing a mobile-friendly interface would improve accessibility and scalability. These improvements would

transform SmartCodeHub into a more comprehensive and industry-ready development platform.

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