CODE GUIDE AI – EMPOWERING BEGINNERS TO CODE SMARTER

A Project Report submitted to

JNTUA, Anantapuramu

In partial fulfilment of the requirements for the award of the degree of

Bachelor of Technology

Computer Science and Engineering

By

A.Bhavishya (21KB1A0503)

B.Archana (21KB1A0514)

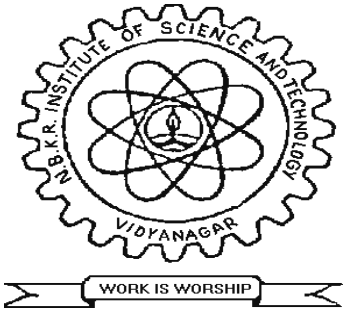
D.Muni Harshavardhan Reddy (21KB1A0527)

K.Devi Srinivas(21KB1A0566)

Under the esteemed Guidance of

Dr. S.Suresh Babu, M.Tech., Ph.D.,

Associate Professor, Dept. of CSE



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

N.B.K.R. INSTITUTE OF SCIENCE AND TECHNOLOGY

(Autonomous)

VIDYANAGAR, TIRUPATI DIST, AP - 524413

MAY-2025

Website: www.nbkrist.org. **Ph: 08624-228 247**
Email: ist@nbkrist.org. **Fax: 08624-228 257**

N.B.K.R. INSTITUTE OF SCIENCE & TECHNOLOGY
(Autonomous)

(Approved by AICTE: Accredited by NBA: Affiliated to JNTUA,Anantapuramu)

An ISO 9001-2000 Certified Institution

Vidyanagar -524 413, Tirupati District, Andhra Pradesh, India

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BONAFIDE CERTIFICATE

This is to certify that the project work entitled " CODE GUIDE AI: EMPOWERING BEGINNERS TO CODE SMARTER " is a bonafide work done by A.Bhavishya (21KB1A0503), B.Archana (21KB1A0514), D.Muni Harshavardhan Reddy (21KB1A0527), K.Devi Srinivas (21KB1A0566) in the Department of Computer Science and Engineering, N.B.K.R. Institute of Science & Technology, Vidyanagar and is submitted to JNTUA, Anantapuramu in the partial fulfillment for the award of B.Tech degree in Computer Science & Engineering. This work has been carried out under my supervision.

Dr.S.Suresh Babu
Associate Professor
Department of CSE
NBKRIST, Vidyanagar

Dr. A. Rajasekhar Reddy
Professor & Head
Department of CSE
NBKRIST, Vidyanagar

Submitted for the Viva-Voce Examination held on_____

Examiner-1 Examiner-2

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ABSTRACT

In today's dynamic software development environment, maintaining high code quality is crucial for building robust and efficient applications. To meet this need, we present **Code Guide AI** – an intelligent solution designed to transform how developers analyze and improve their code. By harnessing the capabilities of machine learning, Code Guide AI delivers automated, insightful feedback to help developers write cleaner, more reliable code.

At its core, Code Guide AI is a smart code analysis tool that identifies bugs and ensures adherence to coding standards. It scans the codebase to detect common issues, promote consistency, and improve readability. By catching errors early in the development cycle, it saves time and effort while enhancing overall code quality.

What sets Code Guide AI apart is its integration of continuous feedback loops. The tool evolves over time by learning from user interactions and adapting to specific coding patterns, becoming more effective at identifying context-sensitive concerns and recommending best practices.

The user interface is designed with simplicity and usability in mind, allowing developers to effortlessly submit code snippets, receive detailed feedback, and take corrective actions through an intuitive workflow. Whether working on individual projects or as part of a collaborative team, Code Guide AI streamlines development and promotes high standards across the board.

In summary, Code Guide AI represents a significant advancement in modern software development. By combining powerful machine learning algorithms with a user-centric design, it empowers developers to write high-quality code and accelerate the software development lifecycle with confidence.

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LIST OF ABBREVIATIONS

SHORT FORM	FULL FORM
HTTP	Hyper Text Transfer Protocol
UML	Unified ling Language
HTML	Hyper Text Markup Language
API	Application Programming Interface
IDE	Integrated Development Environment
UI	User Interface

CHAPTER-1

INTRODUCTION

1.1 INTRODUCTION

Introducing **Code Guide: Empowering beginners to code smarter** — your intelligent AI-powered coding companion. In today's technology-driven world, coding has become a foundational skill. However, for beginners, the journey of learning to code is often filled with challenges, from understanding logic flow and syntax to adhering to clean coding standards. Code Guide is designed to transform this journey by acting as a virtual mentor that offers smart, real- time feedback to help users write better code with greater confidence.

At the heart of Code Guide lies the power of Artificial Intelligence and Machine Learning, which are used to evaluate code submissions and provide constructive, beginner-friendly suggestions. Whether a user is working on an assignment, building a project, or practicing for interviews, the platform analyzes the input code, identifies areas of improvement, and offers precise corrections related to structure, logic, naming conventions, or optimization. This ensures that users receive immediate, personalized assistance tailored to their learning needs.

Code Guide's intuitive web interface is built to simplify the user experience. It allows users to input code in various supported languages and instantly receive feedback in a clear, easy-to-understand format. Unlike traditional static code checkers, Code Guide provides meaningful explanations and actionable advice, making it easier for beginners to grasp complex concepts without external help. It promotes independent learning while reinforcing good coding habits from the start.

Unlike manual code reviews that may take time or be inaccessible to many self-learners, Code Guide is available anytime, anywhere. It not only addresses the lack of accessible mentorship but also showcases the seamless integration of intelligent systems into educational tools. By combining powerful backend technologies with a user-focused design, Code Guide makes coding a smarter, faster, and more enriching experience for the next generation of developers.

1.2 BACKGROUND AND MOTIVATION

The inspiration behind Code Guide lies in the challenges that beginners commonly face while learning to program. Most newcomers struggle with understanding how to structure their code

properly, write logic efficiently, or adhere to best practices. With limited access to mentors and peer feedback, they often rely on online forums or tutorials, which may not always provide relevant or timely assistance. This lack of guidance can slow progress and reduce confidence, making the learning curve steeper than it needs to be.

Modern learners are shifting towards platforms that offer real-time interactivity, personalization, and hands-on support. Traditional classroom methods, while valuable, may not provide enough individual attention or instant feedback. As more people learn to code through self-paced online courses and independent projects, the need for a tool like Code Guide has become evident. It bridges the gap by acting as a 24/7 coding assistant that reviews submitted code and offers actionable suggestions instantly.

Advancements in Artificial Intelligence and Machine Learning have created exciting opportunities to enhance education through automation and smart evaluation systems. Code Guide taps into these technologies to offer a meaningful, personalized experience that adapts to the user's level and coding style. It is designed not just to detect errors, but to help users understand the *why* behind the suggestions, turning each correction into a valuable learning moment.

Ultimately, Code Guide aims to empower users to code smarter and more confidently. By transforming code reviews into an engaging, informative, and self-improving experience, it helps beginners build strong foundational skills. Whether they're preparing for interviews, improving personal projects, or just starting their journey into programming, learners can rely on Code Guide to support and accelerate their growth.

1.3 PROBLEM STATEMENT

Learning to code can be confusing for beginners. They often face problems like not knowing if their code is correct, how to fix errors, or how to make their code better. While there are many tutorials and courses, they don't always give instant help when someone is stuck. Getting feedback from teachers or friends takes time, and beginners may feel lost or unsure about what to do next.

Most tools that check code only show errors but don't explain them in a simple way. They don't help users understand why something is wrong or how to improve it. Because of this, many beginners fix errors without actually learning. Code Guide solves this problem by giving smart, real-time feedback that explains things clearly. It helps users learn from their mistakes and become better at coding step by step.

1.4 OBJECTIVES AND SCOPE

1.4.1 OBJECTIVES

Develop a User-Friendly Interface: Design a simple and easy-to-use web interface where beginners can submit their code and view feedback without confusion.

Offer Beginner-Friendly Explanations: Ensure the system explains feedback in a clear, understandable way so users learn from their mistakes.

Support Personalized Learning: Provide customized suggestions based on each user's skill level and coding style.

Ensure Compatibility and Scalability: Make sure Code Guide works smoothly across different devices and can support many users at the same time.

Gather User Feedback: Collect suggestions and opinions from users to understand what's working and what needs to be improved.

Continuous Updates and Improvements: Regularly update features based on feedback and new technologies to keep the platform helpful and relevant.

1.4.2 SCOPE

Code Guide focuses on helping beginners write better code through smart, real-time AI feedback. It checks for errors, suggests improvements, and explains problems in a simple way. The platform will support basic programming languages (starting with Python) and help users understand good coding practices. It will work on different devices and can be accessed anytime. As more users join, Code Guide will continue to grow and improve based on user feedback, making it a smarter and more helpful learning tool for everyone.

1.5 ORAGANIZATION OF PROJECT REPORT

1. **Introduction**

The introduction section gives a complete overview of the project **Code Guide**,including the background, motivation, objectives, and scope. It explains the importance of the project and highlights the problem it aims to solve—helping beginners write better code with AI-powered guidance. This section also outlines the structure of the project report to help readers navigate through the upcoming chapters.

2. Literature Review

This section explores existing tools and methods used for code reviewing, such as linters, static analyzers, and peer review platforms. It highlights their advantages, limitations, and areas where they fall short for beginners. Relevant technologies like artificial intelligence and machine learning are discussed to understand their use in automating and improving code quality feedback. Related systems and academic studies are also analyzed to gain insights that contributed to the development of **Code Guide**.

3. Requirements Analysis

The requirements analysis defines both the functional and non-functional needs of **Code Guide**. It outlines the essential features like code submission, AI-generated feedback, and a user-friendly interface. It also considers performance, reliability, and usability. Use case diagrams and scenarios are presented to demonstrate how users interact with the system to review and improve their code.

4. System Design

This section explains the overall architecture of **Code Guide**, describing how different modules interact and work together. It includes UML diagrams such as class diagrams, use case diagrams, sequence diagrams, activity diagrams, component diagrams, and deployment diagrams to visually represent the system. Input and output design details are also discussed to ensure a smooth and intuitive experience for users.

5. Implementation

The implementation chapter provides an in-depth look into the technology stack used—such as Python, Flask, and AI libraries like Hugging Face Transformers. It explains how each module, including the frontend interface and the AI-driven code analysis engine, was built. The development environment and tools used throughout the process are also described.

6. Testing and Evaluation

This section outlines the different types of testing applied to the project, including unit testing, integration testing, and user acceptance testing. It presents the results of these tests and evaluates the system's accuracy, speed, and usability. Feedback from test users is analyzed to measure the effectiveness and practicality of **Code Guide** in real use.

7. Results and Discussion

Here, the key results of the project are presented. It discusses how effectively **Code Guide** met its original goals and objectives. Challenges encountered during development are explained, and the

solutions or workarounds are described. The section reflects on the insights gained during the process and evaluates the overall success of the project.

8. **Future Enhancements**

This section outlines potential future improvements to **Code Guide**. These may include expanding language support, adding voice-based input, integrating with online IDEs, or implementing gamified learning features. Enhancements are proposed based on user feedback, technology trends, and new ideas to improve learning outcomes.

9. **Conclusion**

The conclusion summarizes the achievements and outcomes of the project. It highlights how **Code Guide** addresses the needs of beginners by offering smart and educational code reviews. Lessons learned and key takeaways are also shared, along with reflections on the overall development journey.

10. **References**

This final section lists all the sources cited throughout the report, including academic papers, tools, frameworks, and websites used during the research and development of **Code Guide**. Proper citation formats are followed to ensure all contributors and references are credited accurately.

1.6 SUMMARY

The introduction lays the foundation for the **Code Guide** project by offering a complete overview of its background, motivation, objectives, and scope. It highlights the common struggles faced by beginners when learning to code, such as lack of real-time feedback and difficulty in understanding best practices. It emphasizes the need for a smarter, more accessible solution that helps users improve their coding skills effectively.

Code Guide addresses these challenges by using Artificial Intelligence and Machine Learning to review user-submitted code and provide beginner-friendly suggestions and explanations. The platform is designed to make learning interactive and personalized, helping users write better code with confidence. This section also outlines the structure of the entire project report, which guides the reader through the later chapters covering development, implementation, testing, and evaluation of the system.

CHAPTER-2

LITERATURE REVIEW

2.1 INTRODUCTION

Code Guide AI represents an innovative solution designed to streamline code review, optimization, plagiarism detection, and automated documentation generation. This literature review explores recent advancements and research findings related to the integration of artificial intelligence (AI) in software development tools, with a focus on technologies, methodologies, and user experiences. The review aims to provide insights into the evolving landscape of AI-driven code analysis and documentation. Additionally, ethical considerations, such as ensuring transparency in plagiarism detection and maintaining user data privacy, are examined. Emerging trends, including the integration of large language models and real-time collaboration tools, are poised to further revolutionize AI-assisted software development.

By synthesizing existing knowledge and highlighting emerging trends, this survey seeks to offer valuable insights for researchers, developers, and practitioners aiming to advance the capabilities and usability of AI-driven tools like CodeGuide AI in the software development ecosystem.

2.2 LITERATURE SURVEY

1. AI in Code Review

Recent studies underscore the growing adoption of AI in code review processes. For instance, research by Leeetal. (2023) demonstrated that AI-driven tools can significantly reduce manual review time by identifying syntax errors, logical flaws, and adherence to coding standards with high accuracy.

2. Code Optimization Techniques

Advancements in machine learning have enabled automated code optimization. Tools leveraging deep learning models, such as those discussed by Patel & Kumar (2022), analyze codebases to suggest performance improvements, reduce computational complexity, and enhance readability.

3. Plagiarism Detection in Code

Plagiarism detection in software development has gained attention due to the proliferation of open-source repositories. Research by Wang & Chen (2024) introduced a hybrid approach combining syntactic and semantic analysis to detect code similarities, ensuring ethical reuse of code while respecting intellectual property.

4. Automated Documentation Generation

Automated documentation generation has transformed how developers maintain project documentation. Studies by Garcia & Lopez (2023) highlight the effectiveness of transformer- based models in generating coherent, context-aware documentation from code comments and structures.

5. Integration of External APIs for Real-Time Analysis

Integrating external APIs for real-time code analysis, such as linters and static analysis tools, is a common practice in AI-driven development tools. Research by Kim & Zhang (2022) emphasized the importance of seamless API integration to provide real-time feedback without disrupting developer workflows.

6. User Experience in AI-Driven Development Tools

User experience design for AI-driven tools prioritizes intuitive interfaces and actionable feedback. Recent work by Chenetal. (2023) found that developers prefer tools with clear, concise recommendations and minimal false positives to maintain trust in AI suggestions.

7. Ethical and Privacy Considerations

Ethical concerns, such as bias in AI recommendations and privacy in code analysis, are critical. Johnson & Patel (2023) discussed the need for transparent algorithms and secure handling of proprietary code to build trust among users.

8. Future Directions and Emerging Trends

Future research is expected to focus on enhancing AI's contextual understanding of codebases, improving real-time collaboration features, and addressing ethical concerns. Trends like multimodal AI and integration with IDEs are likely to shape the next generation of tools like CodeGuide AI (Li & Wang, 2024).

2.3 EXISTING SYSTEM

- **Limited Automation**: Existing code review tools often rely on manual processes or basic static analysis, lacking comprehensive AI-driven insights.
- **Inconsistent Plagiarism Detection**: Many tools struggle to differentiate between legitimate code reuse and plagiarism, leading to false positives or undetected violations.
- **Documentation Challenges**: Generating accurate and comprehensive documentation remains time-consuming, with most tools offering limited automation.
- **Performance Overhead**: Some tools introduce significant delays in workflows due to inefficient processing or lack of real-time feedback.
- **Privacy Risks**: Tools that upload code to cloud servers for analysis may expose sensitive intellectual property, raising privacy concerns.

Disadvantages

- **Limited Automation**: Manual code reviews are time-intensive and prone to human error, reducing efficiency.
- **Inconsistent Plagiarism Detection**: Inaccurate detection can erode trust and fail to address ethical concerns in code reuse.
- **Documentation Gaps**: Lack of automated documentation leads to incomplete or outdated project records, hindering collaboration.
- **Performance Issues**: Slow analysis or high computational requirements can disrupt developer workflows.
- **Privacy Concerns**: Uploading proprietary code to external servers risks data breaches or unauthorized access.

2.4 PROPOSED SYSTEM

CodeGuide AI introduces a transformative approach to software development by integrating AI-driven code review, optimization, plagiarism detection, and documentation generation. By leveraging advanced machine learning models, the system analyzes codebases to provide actionable insights, optimize performance, and ensure ethical code practices. Documentation generation creates clear, context-aware technical documents, reducing manual effort. The system operates locally or on secure servers to address privacy concerns, offering developers a seamless, efficient, and trustworthy tool to enhance productivity.

Advantages

- **Enhanced Productivity**: Automates repetitive tasks like code review and documentation, allowing developers to focus on core development.
- **Accurate Plagiarism Detection**: Combines syntactic and semantic analysis to accurately identify code similarities while respecting legitimate reuse.
- **Real-Time Feedback**: Provides instant recommendations and optimizations, integrating seamlessly into developer workflows.
- **Privacy-Focused**: Local processing options and secure data handling ensure proprietary code remains protected.
- **Comprehensive Documentation**: Generates accurate, up-to-date documentation, improving project maintainability and collaboration.

2.5 FEASIBILITY ANALYSIS

The feasibility of CodeGuide AI is evaluated across five key dimensions to ensure its viability and alignment with project goals.

1. Economic Feasibility

- **Cost-Effectiveness**: Assess development costs (software, AI model training, API usage) and operational expenses against potential revenue streams like subscriptions or enterprise licenses.
- **ROI Evaluation**: Conduct a cost-benefit analysis to compare projected productivity gains with development and maintenance costs.
- **Revenue Streams**: Explore subscription models, premium features, or partnerships with IDE providers to ensure economic viability.

2. Technical Feasibility

- **Technology Availability**: Confirm the availability of required tools, such as machine learning frameworks (e.g., TensorFlow, PyTorch), and static analysis libraries.
- **Scalability**: Ensure the system can handle large codebases and growing user bases without performance degradation.
- **Compatibility**: Verify integration with popular IDEs and version control systems like Git.
- **Challenges**: Address potential issues, such as model accuracy or real-time processing demands, through iterative testing and optimization.

3. Social Feasibility

- **User Acceptance**: Evaluate developer attitudes toward AI-driven tools via surveys or beta testing to ensure alignment with user needs.
- **Privacy Assurance**: Implement transparent data policies and local processing options to address privacy concerns.
- **Inclusivity**: Design intuitive interfaces and provide multilingual support to cater to diverse developer communities.

4. Schedule Feasibility

- **Project Timeline**: Develop a detailed plan with milestones for model training, feature development, and testing.
- **Risk Mitigation**: Identify risks like delays in model training or integration challenges and prepare contingency plans.
- **Resource Allocation**: Ensure adequate personnel and computational resources to meet deadlines.5. Financial Feasibility

- **Cost Breakdown**: Account for development (software, AI training), hosting, and API usage costs.
- **Revenue Potential**: Explore monetization through subscriptions, enterprise plans, or integrations with development platforms.
- **Sustainability**: Ensure long-term financial viability by balancing costs with scalable revenue models.

CHAPTER-3

METHODOLOGY

3.1 INTRODUCTION

The methodology for CodeGuide AI outlines a structured approach to developing an AI-driven tool for code review, optimization, plagiarism detection, and automated documentation generation. This chapter details the research design, data collection, technology selection, system development, evaluation, testing, and iterative improvement processes to achieve the project's objectives.

1. Research Design

The research design for CodeGuide AI combines qualitative and quantitative methods to ensure comprehensive development and evaluation. An exploratory approach is used to identify developer needs, while experimental methods validate the effectiveness of AI-driven features.

2. Data Collection

Data collection involves gathering codebases from open-source repositories and proprietary datasets for analysis. User feedback is collected through surveys and usability testing to assess system performance and developer satisfaction.

3. Technology Selection

The methodology includes selecting technologies for code analysis, optimization, plagiarism detection, and documentation generation. Factors such as scalability, compatibility, and performance guide the selection process.

4. System Development

System development entails designing, implementing, and testing CodeGuide AI's core modules, including code review, optimization, plagiarism detection, and documentation generation. The process adheres to agile development principles with iterative cycles.

5. Evaluation and Testing

Evaluation and testing ensure the reliability, accuracy, and usability of CodeGuide AI. Methods include unit testing for individual modules, integration testing for system-wide functionality, and user acceptance testing to validate developer experience.

6. User Feedback Analysis

User feedback is collected through surveys, interviews, and usability testing. Analysis identifies strengths, weaknesses, and opportunities for improvement, driving iterative refinements to align with developer needs.

7. Performance Evaluation

Performance evaluation measures the efficiency and effectiveness of CodeGuide AI. Key performance indicators include analysis speed, recommendation accuracy, plagiarism detection precision, and user satisfaction.

8. Iterative Improvement

An iterative improvement process incorporates feedback and evaluation results to enhance CodeGuide AI. This approach ensures continuous adaptation to developer requirements and technological advancements.

3.2 DESCRIPTION OF TOOLS AND TECHNOLOGIES USED

1 Python

Python is the primary programming language for CodeGuide AI due to its versatility, readability, and extensive library ecosystem. It supports the implementation of AI models, data processing, and system integration.

2 Pylint and Flake8 (Code Analysis)

Pylint and Flake8 are static code analysis tools used to identify syntax errors, code smells, and adherence to coding standards. They form the foundation for CodeGuide AI's code review and optimization modules.

3 Moss (Plagiarism Detection)

Moss (Measure of Software Similarity) is integrated for plagiarism detection, analyzing code for syntactic and semantic similarities to ensure ethical code practices and detect unauthorized reuse.

4 Requests (HTTP Library)

The Requests library facilitates communication with external APIs for real-time data, such as fetching coding standards, library documentation, or open-source repository metadata.

5 Flask (Web Framework)

Flask, a lightweight Python web framework, is used to develop the user interface and RESTful APIs for CodeGuide AI. It enables seamless interaction between the frontend and backend components.

6 GitPython (Version Control Integration)

GitPython is used to integrate CodeGuide AI with version control systems, allowing analysis of code changes and commit histories for plagiarism detection and optimization recommendations.

3.3 SUMMARY

CodeGuide AI's methodology combines qualitative and quantitative research to develop an AI-driven tool for software development. It collects codebases and user feedback, using Python and specialized libraries for code analysis and plagiarism detection.

The system is built with modular components for code review, optimization, plagiarism detection, and documentation, following agile principles. Testing ensures reliability and usability, while user feedback drives improvements. Performance metrics confirm efficiency, making CodeGuide AI a robust tool for enhancing developer productivity and code quality.

CHAPTER-4

SYSTEM DESIGN

4.1 INTRODUCTION

The system design of CodeGuide AI provides the architectural blueprint and structural framework for its functionality and operation. It outlines how various components and modules interact to achieve the project's objectives of code review, optimization, plagiarism detection, and automated documentation generation. The design prioritizes scalability, reliability, flexibility, and usability to ensure optimal performance and developer satisfaction.

At its core, CodeGuide AI integrates multiple technologies and functionalities, including modules for code analysis, optimization, plagiarism detection, documentation generation, and user interface. Each module is designed with clear interfaces and dependencies to enable interoperability and simplify maintenance.

4.2 DETAILED DESIGN OF COMPONENTS

System design is a critical phase in the software development lifecycle, defining the technical specifications for implementation. It translates user requirements into a functional system through detailed planning. The design process ensures that the system meets performance, reliability, scalability, and maintainability requirements, producing high-quality software. Without a robust design, the system risks instability, testing difficulties, or failure to meet user needs.

The design phase specifies how outputs (e.g., code review reports, optimized code, documentation) are generated and in what format. It also defines input data structures, database schemas, and processing logic, ensuring alignment with project goals. Quality is central to the design, enabling the creation of a stable, testable, and maintainable system.

To Meet Specific Requirements

System design ensures CodeGuide AI meets key requirements, including fast code analysis, accurate plagiarism detection, and user-friendly documentation generation. A clear design plan prevents performance issues, ensures scalability, and supports seamless integration with development environments.

4.2.1 SYSTEM ARCHITECTURE

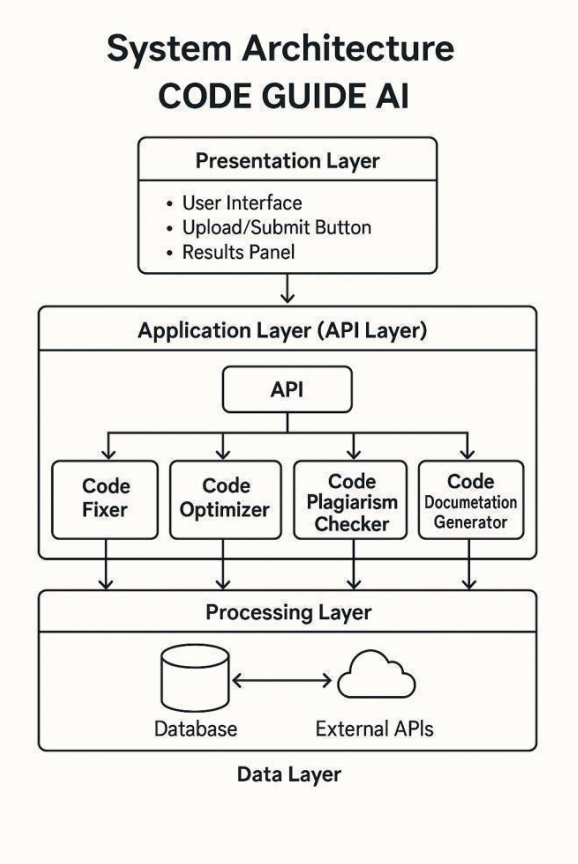

Fig 4.1 System Architecture

INTRODUCTION

The system architecture of CodeGuide AI is a layered framework designed to ensure modularity, scalability, and maintainability while delivering its core functionalities: code error fixing, optimization, plagiarism checking, and documentation generation. The architecture is structured into four distinct layers: the Presentation Layer, Application Layer (API Layer), Processing Layer, and Data Layer, as illustrated in the accompanying diagram. Each layer plays a specific role, interacting seamlessly to provide a cohesive user experience. Built using Visual Studio Code with a Flask-based backend and an HTML/CSS frontend, CodeGuide AI supports multiple programming languages, including Python, Java, and C, catering to diverse developer needs. This section details each layer's purpose, components, interactions, and contributions to the system's overall functionality, ensuring a robust and efficient tool for developers.

PRESENTATION LAYER

The Presentation Layer serves as the user-facing interface of CodeGuide AI, enabling interaction with the system's core features through a web-based frontend. It is responsible for capturing user inputs, displaying results, and ensuring a seamless user experience. This layer includes several key components:

User Interface: The interface is implemented using HTML templates rendered by Flask, providing a clean and intuitive layout. These templates feature a side-by-side design for input and output visibility, a navigation bar for easy access to different features, and CSS styling for light/dark mode compatibility, ensuring accessibility across themes (as you requested on April 8, 2025). The interface supports code submission in multiple languages, with dropdowns for language selection.

Upload/Submit Button: Each template includes a form with an upload or submit button, allowing users to input code via a textarea or file upload. The form submission triggers a POST request to the corresponding Flask route, passing the code and language parameters to the Application Layer for processing.

Results Panel: The results panel displays the outputs of each module, such as corrected code, optimization metrics, plagiarism scores, or generated documentation. For instance, the error fixing page shows the corrected code, error report, and error count in a structured layout, ensuring users can compare inputs and outputs easily.

The Presentation Layer communicates with the Application Layer by sending user requests via HTTP (GET for rendering forms, POST for processing submissions) and receiving responses to render dynamically. This layer prioritizes usability, ensuring CodeGuide AI is an intuitive tool for developers.

APPLICATION LAYER (API LAYER)

The Application Layer, also referred to as the API Layer, acts as the central hub of CodeGuide AI, orchestrating interactions between the Presentation Layer and the Processing Layer. It is implemented using Flask, which defines API endpoints for each module

API: The API consists of Flask routes that handle HTTP requests from the Presentation Layer. Each route corresponds to a specific module: one for code error fixing, another for code optimization, a third for plagiarism checking, and a fourth for documentation generation. For example, the route handling error fixing receives code and language inputs, invokes the appropriate backend logic, and returns the corrected code, error report, and error count to the frontend.

Code Fixer: This component processes code to detect and correct syntax, runtime, and semantic errors, producing detailed error reports for user feedback.

Code Optimizer: It focuses on optimizing code performance, reducing execution time and memory usage, and provides metrics like execution time and optimization level.

Code Plagiarism Checker: This component analyzes code for similarities, modifies it to ensure originality, and generates a plagiarism score to indicate authenticity.

Code Documentation Generator: It parses code to create structured documentation, offering both text and PDF outputs for professional use.

The Application Layer validates incoming requests, routes them to the appropriate module in the Processing Layer, and formats responses for the Presentation Layer. It ensures modularity by decoupling the frontend from backend logic, allowing independent updates to each module without impacting the user interface.
Additionally, it handles request routing efficiently, supporting concurrent user interactions through Flask's capabilities.

PROCESSING LAYER

The Processing Layer encapsulates the core logic of CodeGuide AI's modules, handling the computational tasks required for each feature. It performs the intensive processing for error fixing, optimization, plagiarism checking, and documentation generation, interacting with the Data Layer for storage and external API access:

Code Fixer: Utilizes static analysis tools to detect and correct errors, applying language- specific rules for Python, Java, and C. It leverages tools like linters to identify issues such as syntax violations or potential runtime errors, ensuring robust error correction.

Code Optimizer: Employs profiling techniques to identify inefficiencies and applies optimizations, such as reducing time complexity or optimizing memory usage, tailored to each language's best practices.

Code Plagiarism Checker: Uses text similarity algorithms or specialized tools to detect plagiarism, modifying code to ensure uniqueness by restructuring or renaming elements while preserving functionality.

Code Documentation Generator: Parses code to extract structural elements and comments, generating documentation in text format and converting it to PDF using libraries like pdfkit and wkhtmltopdf (as noted in your April 14, 2025, references).

This layer ensures efficient execution through caching, optimized algorithms, and robust error handling (as you requested on April 7, 2025). It communicates with the Data Layer to store analysis results or fetch external data, supporting scalability and performance for large-scale usage.

DATA LAYER

The Data Layer supports persistent storage and external interactions, comprising two key components: Database: While not explicitly implemented in the current codebase, a database (potentially PostgreSQL, as you mentioned on April 4, 2025) could store user- submitted code, analysis results, or plagiarism check data. For instance, the plagiarism checker might use a local database to store code patterns for similarity detection, enabling fast lookups and historical tracking.

External APIs: The Processing Layer may interact with external APIs, such as AI-based services for code analysis or plagiarism detection tools (e.g., a service like MOSS). These APIs enhance functionality by providing advanced features, such as large-scale code similarity checks or AI-driven documentation generation, which may not be feasible locally.

The Data Layer ensures data persistence and access to external resources, enabling CodeGuide AI to maintain state (e.g., logging analysis history) and leverage third-party services for enhanced capabilities. It also supports scalability by allowing the system to offload complex

computations to external services when needed.

LAYER INTERACTIONS

The layers interact in a structured, top-down flow to deliver CodeGuide AI's functionality: The Presentation Layer captures user input through forms and sends HTTP requests to the Application Layer. The Application Layer routes these requests to the appropriate module in the Processing Layer, ensuring proper handling of each feature.

The Processing Layer performs the necessary computations, accessing the Data Layer for storage or external API calls as required (e.g., fetching plagiarism data or storing optimization history). Results are sent back through the Application Layer to the Presentation Layer, where they are rendered for the user in a clear, accessible format.

This architecture ensures separation of concerns, allowing each layer to focus on its specific role while interacting efficiently. It supports scalability through Flask's request handling and the potential use of Gunicorn workers (as discussed in prior sections), and it enhances maintainability by keeping frontend, backend, and data operations distinct. By structuring CodeGuide AI in this layered approach, the system delivers a robust, user-friendly experience for developers seeking to improve, validate, and document their code.

4.2.2 INPUT DESIGN

Input design is critical for enabling efficient and intuitive interaction with CodeGuide AI. It focuses on seamless code submission and configuration to enhance the developer experience.

Input Design:

- **Code Submission**: Developers input code via file uploads, direct text input, or integration with version control systems (e.g., Git).
- **Configuration Options**: Users specify preferences, such as coding standards, optimization goals, or documentation formats, through a graphical interface or command-line inputs.

Objectives of Input Design:

- **Efficiency**: Streamlines code submission and configuration to minimize developer effort.
- **Accuracy**: Ensures precise parsing and interpretation of input code and settings.
- **Intuitiveness**: Provides a user-friendly interface for seamless interaction without extensive training.
- **Accessibility**: Supports diverse input methods to accommodate varying developer preferences and abilities.
- **Flexibility**: Allows multiple input formats (e.g., source files, repositories) to suit different workflows.

The input design ensures developers can easily interact with CodeGuide AI, enhancing usability and productivity.

4.2.3 OUTPUT DESIGN

Output design focuses on delivering clear, actionable, and well-formatted results to users. It ensures that code review reports, optimization suggestions, plagiarism detection results, and generated documentation are easy to understand and integrate into workflows.

Objectives of Output Design:

- **Clarity**: Presents results (e.g., error reports, optimized code, documentation) in a concise and readable format.
- **Actionability**: Provides specific, implementable recommendations for code improvements.
- **Personalization**: Allows customization of output formats (e.g., PDF, Markdown for documentation) to meet user preferences.
- **Accessibility**: Ensures outputs are usable across devices and for developers with varying needs.
- **Consistency**: Maintains uniform formatting and terminology across all outputs to build trust and familiarity.

The output design enhances developer engagement by delivering high-quality, relevant, and accessible results.

4.3 UML DIAGRAMS

Unified Modeling Language (UML) is a standardized tool for specifying, visualizing, constructing, and documenting software systems. It provides a common language for modeling object-oriented systems, combining best engineering practices for large-scale system design. UML diagrams represent the system from multiple perspectives, including user, structural, behavioral, implementation, and environmental views.

Primary Goals of UML:

1. Provide an expressive visual modeling language for creating and sharing meaningful models.
2. Offer extensibility and specialization mechanisms to adapt core concepts.
3. Remain independent of specific programming languages or development processes.
4. Establish a formal basis for understanding the modeling language.
5. Foster growth in the object-oriented tools market.
6. Support advanced development concepts like collaborations, frameworks, and patterns.

4.3.1 CLASS DIAGRAM

A class diagram is a static UML diagram that visualizes the system's structure by showing classes, their attributes, operations, and relationships. It is used to design and document CodeGuide AI's components and supports direct mapping to object-oriented code.

Purpose:

- Analyze and design the static view of the application.
- Define class responsibilities.
- Serve as a foundation for component and deployment diagrams

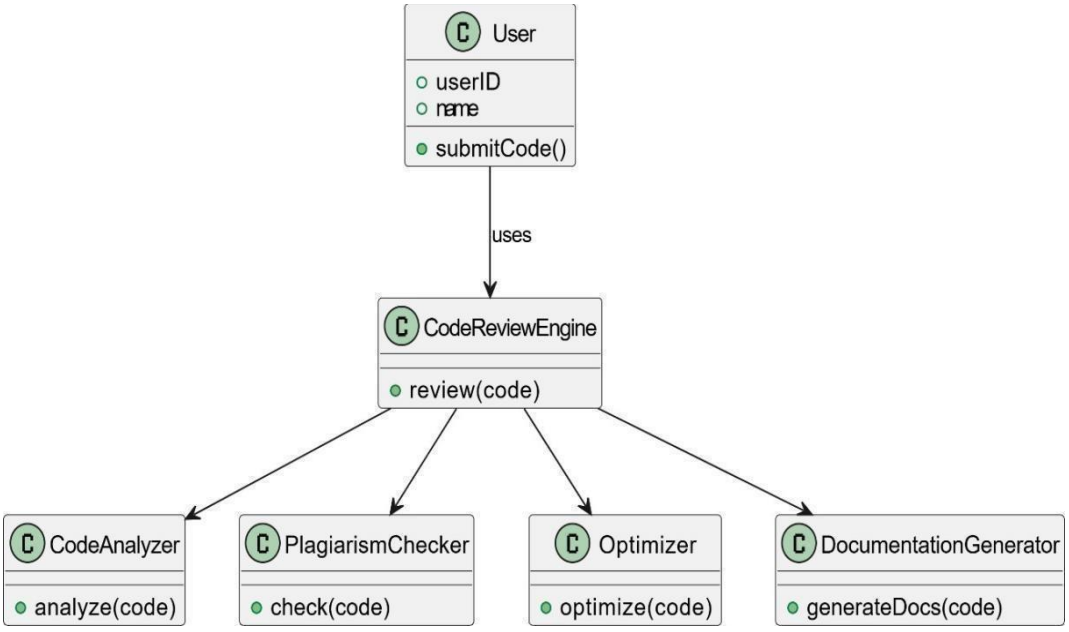

Fig 4.2 Class Diagram

4.3.2 USE CASE DIAGRAM

A use case diagram illustrates the system's functionality by depicting interactions between actors (e.g., developers) and use cases (e.g., code review, plagiarism detection). It provides a high-level overview of CodeGuide AI's features and user roles.

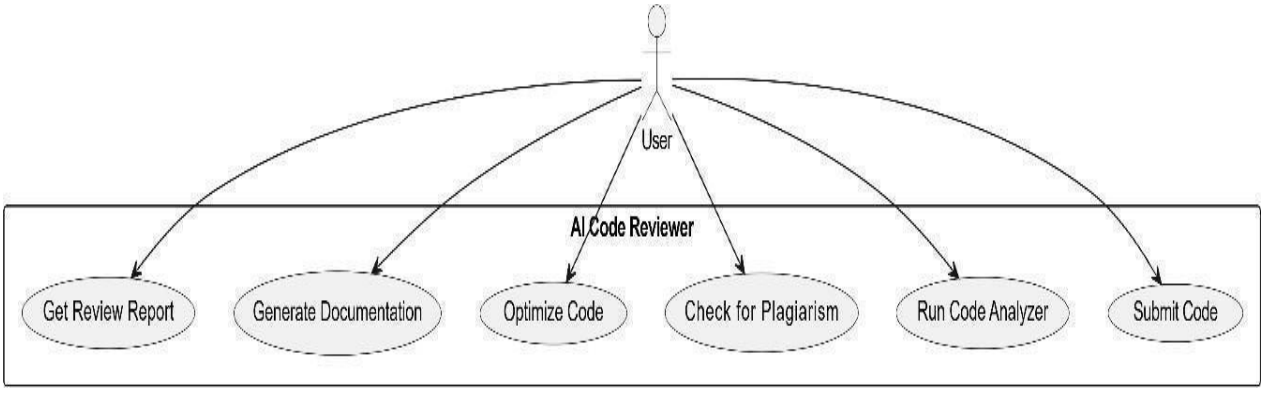

Fig 4.3 Use Case Diagram

4.3.3 SEQUENCE DIAGRAM

A sequence diagram shows how objects interact in a time-ordered sequence to execute specific functionalities, such as processing a code review request. It highlights the flow of messages between components in CodeGuide AI.

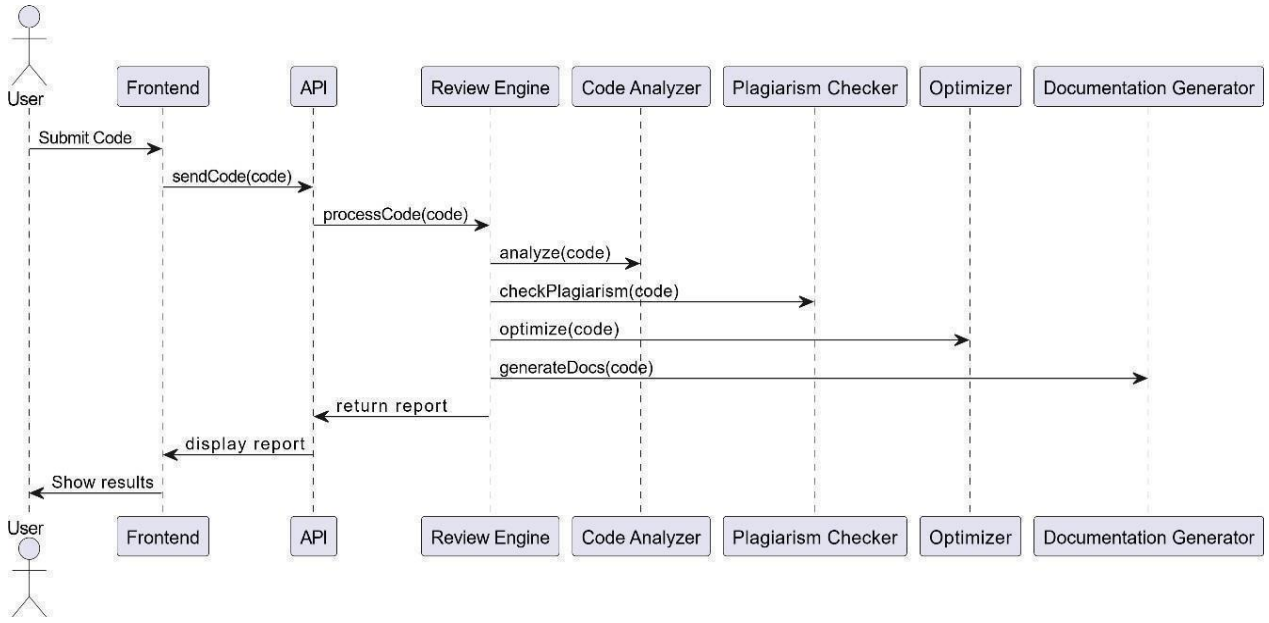

Fig 4.4 Sequence Diagram

4.3.4 ACTIVITY DIAGRAM

An activity diagram models the dynamic behavior of CodeGuide AI, showing the flow of control and data through processes like code analysis or documentation generation. It emphasizes sequence and conditions.

- **Initial State**: Marks the start of a process.
- **Final State**: Indicates process completion.
- **Action Box**: Represents specific actions within the flow.

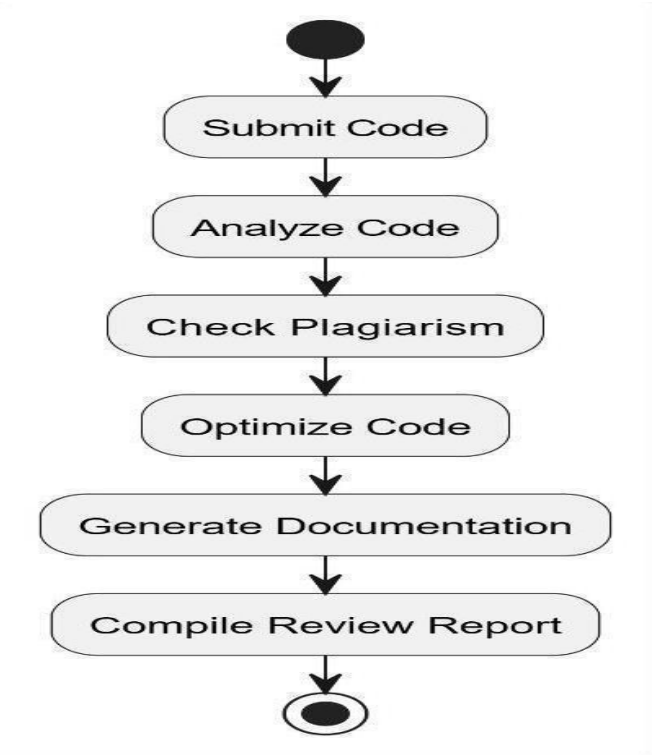

Fig 4.5 Activity Diagram

4.3.5 COMPONENT DIAGRAM

A component diagram illustrates how CodeGuide AI's modules (e.g., code analyzer, plagiarism detector) are interconnected to form the system. It shows the service consumer-provider relationships between components.

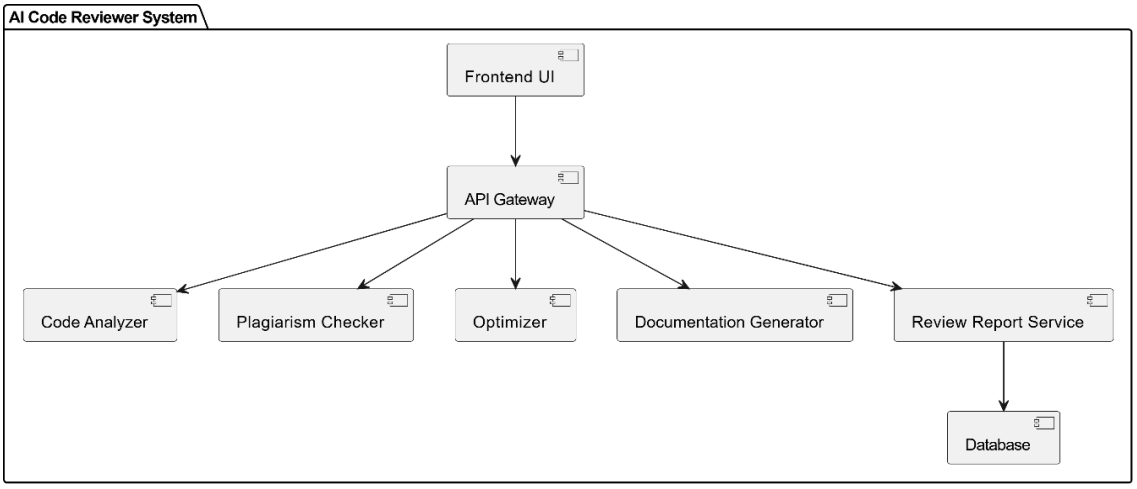

Fig 4.6 Component Diagram

4.3.6 DEPLOYMENT DIAGRAM

A deployment diagram models the physical deployment of CodeGuide AI's artifacts (e.g., application, database) on nodes (e.g., local machines, cloud servers). It depicts hardware and software connections, supporting both standalone and distributed setups.

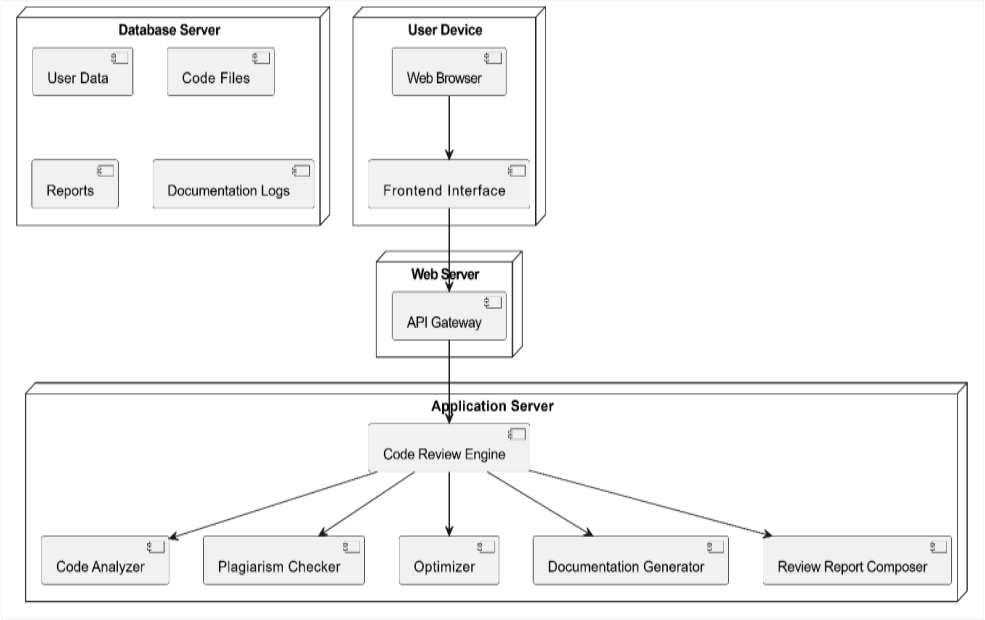

Fig 4.7 Deployment Diagram

4.4 SUMMARY

The system design of CodeGuide AI defines its architectural structure and functional blueprint, ensuring seamless interaction among components to meet project objectives. It includes modules for code analysis, optimization, plagiarism detection, documentation generation, and user interface, each designed with clear interfaces for interoperability and maintenance. The design integrates algorithms for code analysis and plagiarism detection, built to scale and support future enhancements. By prioritizing quality, scalability, and usability, the system design positions CodeGuide AI as a robust tool for enhancing developer productivity and code quality.

CHAPTER-5

IMPLEMENTATION

5.1 INTRODUCTION

In this section, we will delve into the structural organization of our project codebase for the "Code Guide AI". A well-organized codebase is crucial for ensuring readability, maintainability, and scalability of the project. By establishing a clear and intuitive structure, we aim to streamline development processes and facilitate collaboration among team members. The implementation focuses on optimizing code, analyzing its components, generating documentation, detecting plagiarism, identifying errors, formatting code, and providing a step-by-step guide to assist developers.

5.2 CODE STRUCTURE AND ORGANIZATION PROCEDURE

Root Directory Structure – Main Folder:

The root directory serves as the **starting point** of the **Code Guide AI** project and contains the following key components:

- **app.py:** This is the main entry point of the project. It acts as the central controller that handles routing, user interactions, and coordinates the communication between all modules including code fixing, optimization, plagiarism detection, and documentation generation.
- **test_5.py – Code Fixer Module:** This script contains the logic to analyze and automatically fix errors in the user's code. It may utilize tools like pylint or custom rule-based corrections.
- **test_7.py – Code Optimization Module:** Responsible for applying techniques to optimize user- submitted code. This includes improving performance, reducing redundancy, and ensuring clean, efficient practices.
- **test_8.py – Plagiarism Detection Module:** This module analyzes the code for potential plagiarism or code duplication by comparing it with existing samples or using AI-based similarity checks.
- **test_9.py – Documentation Generator:** Focused on generating human-readable documentation for the submitted code, possibly using NLP techniques from libraries like NLTK or summarization models.

- **templates/ Folder:** Contains the **HTML files** used to render the user interface (UI). This includes forms for code submission, results display, and downloadable documentation.

5.3 SYSTEM REQUIREMENTS

Software Requirements

Operating system	: Windows 7 and above,linux,mac
OS IDE	: VS Code
Technology	: Python 3.12.2 or high version
Data Base	: PostgreSQL
Tools	: Flask,pylint,tensorflow,nltk,psycopg2-binary

Hardware Requirements

RAM	: 8 GB and above
Processor	: Intel (i3 and above)
Hard Disk	: 128 GB and above

5.4 SYSTEM INSTALLATION

CodeGuide AI requires Python, Flask, and supporting dependencies, with development managed in VS Code. Below are the steps to set up the environment:

Installing Python and Dependencies

1. **Install Python**:

- Download Python 3.6 or higher from python.org.

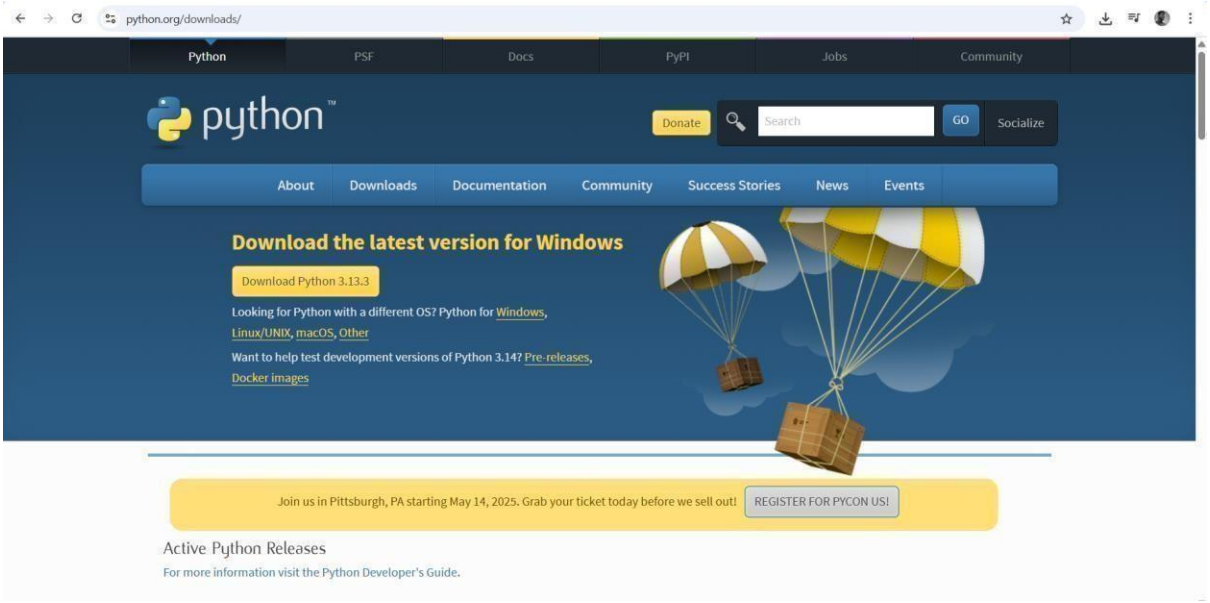

Fig 5.1 Python Installation

- During installation, check “Add Python to PATH” and install for all users (Windows).
- Verify installation:

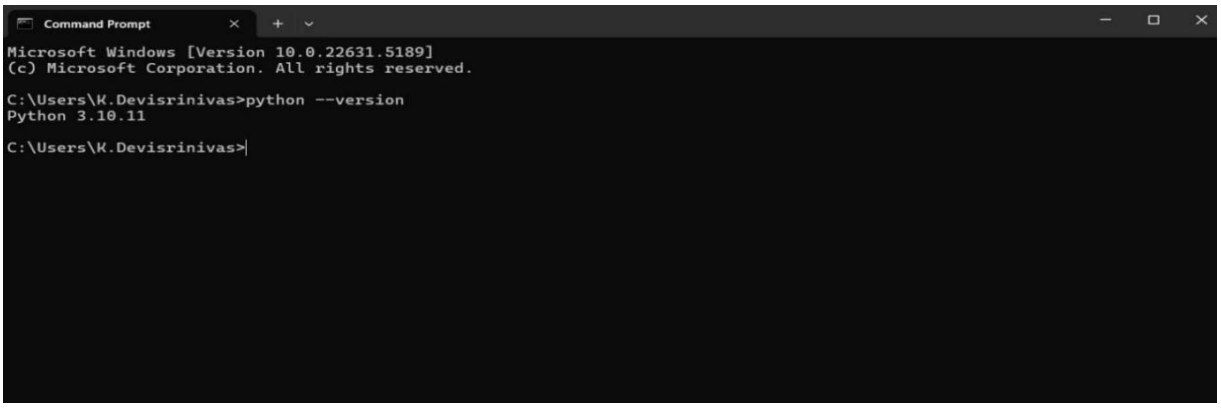

Fig 5.2 Checking Python version

python --version

2. **Install VS Code**:

- Download VS Code from code.visualstudio.com.

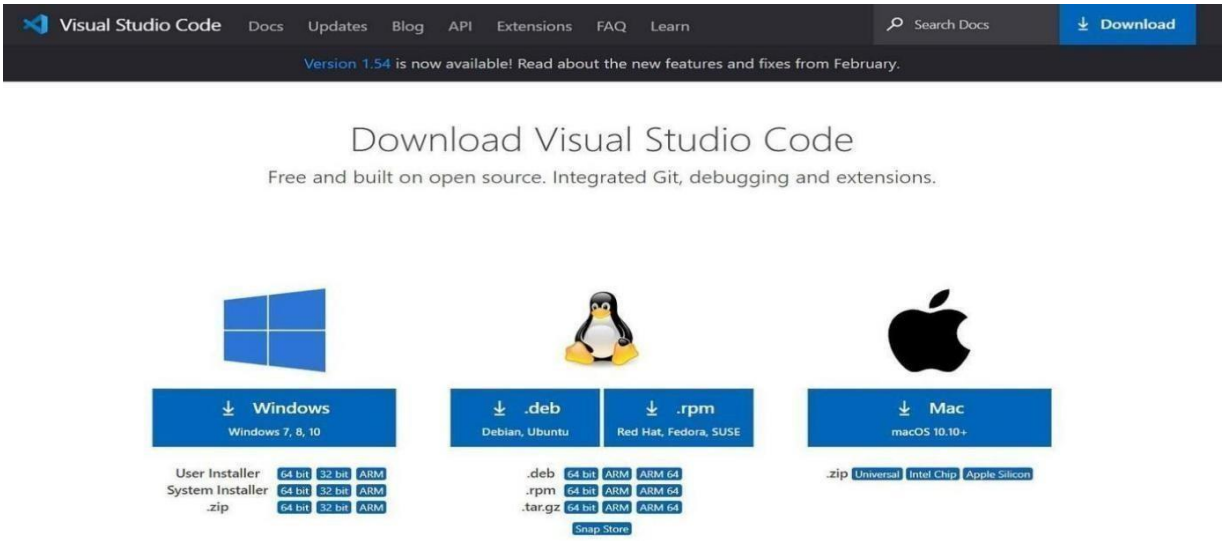

Fig 5.3 VSCode Downloading

- Install and open VS Code.

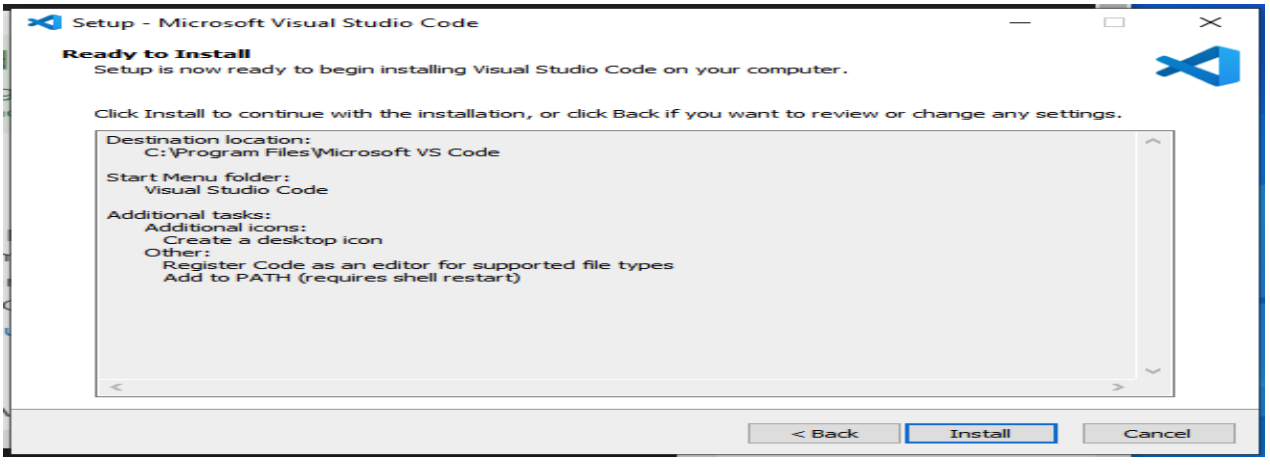

Fig 5.4 VSCode Installation

- Install the Python extension (by Microsoft) and Pylance for enhanced Python support.
- Optionally install Flask Snippets for faster Flask development.

3. **Set Up a Virtual Environment**:

- In VS Code, open the terminal (Ctrl+`) and navigate to the project directory: cd path/to/codeguide-ai
- Create and activate a virtual environment:
- python -m venv codeguide_venv

source codeguide_env/bin/activate # On Windows: codeguide_env\Scripts\activate

- In VS Code, select the virtual environment as the Python interpreter (Ctrl+Shift+P, then "Python: Select Interpreter").

4. **Install Flask and Dependencies**:

Based on app.py, install Flask and assumed packages:

pip install flask

Additional packages (likely for test*.py, adjust as needed): pip install pylint pdfkit

5. **Run the Application**:

- In VS Code, open app.py and run it using the "Run Python File" button or: python app.py
- Access the application at http://localhost:5000 in a web browser.

5.5 SYSTEM TESTING

5.5.1 INTRODUCTION

The purpose of testing is to discover errors. Testing is the process of trying to uncover every conceivable fault or weakness in the "Code Guide AI" system. It provides a way to check the functionality of components, sub-assemblies, assemblies, and the finished product. It is the process of exercising software with the intent of ensuring that the software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of tests. Each test type addresses a specific testing requirement.

5.5.2 TYPES OF TESTS

5.5.2.1 Unit Testing

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application; it is done after the completion of an individual unit before integration. This is a structural testing that relies on knowledge of its construction and is invasive. Unit tests perform basic tests at component level and test a specific business process, application, and/or system configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.

5.5.2.2 Integration Testing

Integration testing verifies the interaction between integrated units of the "Code Guide AI" system. It ensures that the combined components function together correctly, focusing on data flow and interface compatibility. Test cases will cover the integration of the optimizer, analyzer, documenter, plagiarism checker, error detector, and formatter modules, validating seamless operation and data consistency.

5.5.2.3 System Testing

System testing evaluates the complete "Code Guide AI" system as a whole. It checks that all integrated units work together to meet the specified requirements, including code optimization, analysis, documentation generation, plagiarism detection, error identification, and code formatting. Test scenarios will simulate real- world usage to ensure reliability and performance.

5.5.2.4 Acceptance Testing

Acceptance testing confirms that the "Code Guide AI" system meets the user’s needs and is ready for deployment. It includes user acceptance testing (UAT) with sample codebases to validate usability, accuracy of reports, and overall satisfaction. This phase ensures the system aligns with the

project's goals of enhancing code quality and developer productivity.

5.6 SYSTEM MODULES

5.6.1 INTRODUCTION

The CodeGuide AI system is centered around four core modules: Code Error Fixing, Optimization, Plagiarism Fixing, and Documentation Generation. These modules form a comprehensive toolkit for developers, automating critical tasks such as debugging, performance enhancement, originality verification, and documentation creation. Implemented as Flask routes in app.py, with backend logic in test5.py, test7.py, test8.py, and test9.py, the modules are accessed through HTML templates rendered via a web interface. Developed in Visual Studio Code, the system supports Python, Java, and C, catering to diverse programming needs. This section provides an in- depth explanation of each module's functionality, purpose, technical implementation, processing workflow, integration, and additional considerations like performance and scalability, ensuring a thorough understanding of their roles in CodeGuide AI.

5.6.2 CODE ERROR FIXING MODULE

Purpose

The Code Error Fixing module, accessible via the /fix-errors route, is designed to streamline the debugging process by automatically identifying and correcting errors in user-submitted code. It targets syntax, runtime, and semantic issues, serving as a critical tool for developers ranging from beginners learning to code to professionals maintaining large codebases. The module's primary goal is to reduce manual debugging effort, enhance code reliability, and prepare code for subsequent processing, such as optimization or plagiarism checking, by ensuring it is error-free.

Functionality

The module processes code input and a language selection (Python, Java, or C) submitted through a web form in fix_errors.html. The fix_code function in test5.py performs a multi-faceted analysis to detect and correct errors, producing three outputs: corrected code, a detailed error report, and an error count. Its key functionalities include:

- Syntax Error Detection: Identifies violations of language-specific grammar, such as missing colons or incorrect indentation in Python, missing semicolons or braces in Java, and improper preprocessor directives in C.

- Runtime Error Identification: Detects potential issues that could lead to program crashes, including division by zero, null pointer dereferences, array out-of-bounds access, or uninitialized variables, using static analysis techniques.
- Semantic Error Correction: Addresses logical errors, such as incorrect loop conditions, misused operators, or flawed function calls, by applying context-aware fixes derived from language-specific patterns and best practices.
- Error Reporting: Generates a comprehensive report listing each error's type, line number, description, and the correction applied, enabling users to understand the debugging process.
- Error Counting: Quantifies the total number of errors detected, providing a quick metric to assess code quality and the extent of required fixes.

Technical Implementation

The fix_code function likely leverages static analysis tools tailored to each language: Pylint for Python to detect syntax and style issues, Checkstyle or SpotBugs for Java to verify class structures and method declarations, and Clang or CPPCheck for C to ensure proper pointer usage and memory management. The implementation process involves several stages:

1. Input Parsing: Receives the code string and language parameter from the Flask route, validating input format and encoding to prevent parsing errors.
2. Language-Specific Analysis: Applies rule-based checks for syntax errors and static analysis for runtime and semantic issues. For Python, it scans for issues like unmatched brackets; for Java, it verifies interface implementations; for C, it checks for missing header inclusions.
3. Error Correction: Employs a combination of rule-based transformations (e.g., adding missing punctuation) and heuristic algorithms (e.g., adjusting loop bounds based on variable scope) to generate corrected code.
4. Output Generation: Produces a tuple (corrected_code, error_report, error_count), where corrected_code is the modified code string, error_report is a formatted text detailing each fix, and error_count is an integer tally.
5. Error Handling: Implements robust error handling to manage malformed inputs, unsupported language features, or tool limitations, logging issues for debugging The Flask route /fix -errors supports GET requests to render an empty form and POST requests to process submissions, passing outputs for the input to fix_errors.html to display in a side-by side layout.

Workflow

The user submits code and selects a language via fix_errors.html. The POST request triggers the /fix-errors route, which invokes test5.fix_code to analyze and correct the code. The corrected code, error report, and error count are rendered in the template, with the original code visible for comparison. The error report's detailed breakdown and error count provide actionable feedback,

enabling users to verify corrections and learn from the debugging process.

Integration

- Frontend: fix_errors.html includes a textarea for code input, a language dropdown, and result sections, styled with CSS in static/ for light/dark mode compatibility. A navbar ensures navigation to other modules.
- Backend: test5.py encapsulates the error-fixing logic, invoked by app.py.
- Dependencies: Likely uses Pylint for Python analysis, with equivalent tools for Java and C.

Additional Considerations

- Performance: For large codebases, the module optimizes analysis by caching

frequently checked code patterns and limiting redundant scans.

- Scalability: Handles concurrent user requests by leveraging Flask's threading and

Gunicorn workers (per Section 5.6, Deployment and Hosting).

- Edge Cases: Manages complex errors, such as ambiguous semantics or language-specific

quirks (e.g., Python's dynamic typing), by prioritizing safe fixes and flagging unresolved issues for manual review.

- User Experience: The error report is formatted for readability, with collapsible

sections for large reports to enhance usability on fix_errors.html.

This module is foundational to CodeGuide AI, ensuring robust code as a prerequisite for other functionalities.

5.6.3 OPTIMIZATION MODULE

Purpose

The Optimization module, accessed via the /optimize route, enhances the performance of user-submitted code by reducing execution time, memory usage, or computational complexity. It targets developers working on performance-critical applications, such as real-time systems or

large-scale data processing, where efficiency is paramount. The module's goal is to automate code optimization, eliminating the need for manual refactoring while providing detailed insights into performance improvements.

Functionality

The module processes code and a language selection submitted through optimize.html. The optimize_code function in test7.py analyzes the code, applies optimization techniques, and produces four outputs: optimized code, debug information, execution time metrics, and an optimization level. Its key functionalities include:

- Code Analysis: Identifies inefficiencies, such as redundant loops, suboptimal data structures (e.g., lists vs. sets in Python), or excessive memory allocations.
- Optimization Techniques: Applies language-specific transformations, including vectorized operations in Python, efficient collection usage (e.g., HashMap vs. ArrayList in Java), and inline functions or pointer optimizations in C.
- Performance Measurement: Quantifies execution time and resource usage before and after optimization, providing comparative metrics to validate improvements.
- Debug Information: Generates a report detailing each optimization, including the technique applied, its rationale, and expected performance gains (e.g., reduced time complexity from $O(n^2)$ to $O(n)$).
- Optimization Level: Assigns a qualitative rating (low, medium, high) based on the extent of performance enhancement, reflecting the impact on complexity or resource usage.

Technical Implementation

The optimize_code function likely integrates profiling tools like Python's cProfile for runtime analysis and language-specific optimizers for code transformation. The implementation process includes:

1. Input Validation: Verifies code syntax, potentially invoking test5.fix_code to ensure error- free input before optimization.
2. Profiling: Executes the code in a controlled environment to collect baseline metrics (execution time, memory usage, CPU cycles) and identifies bottlenecks using static analysis or runtime profiling.
3. Optimization Application: Implements transformations tailored to the language:
   - Python: Replaces iterative loops with list comprehensions or NumPy operations.
   - Java: Optimizes loop unrolling or leverages the Stream API for parallel processing.

- C: Applies inline functions, reduces pointer dereferences, or optimizes memory alignment.

4. Output Generation: Produces (optimized_code, debug_info, exec_time, opt_level), where optimized_code is the improved code, debug_info details changes, exec_time compares pre- and post- optimization metrics, and opt_level reflects the optimization's impact.

5. Performance Optimization: Caches analysis results for frequently processed code patterns and limits redundant computations to improve response time.

The /optimize route handles GET requests for the input form and POST requests to process and render results in optimize.html, maintaining the side-by-side layout for input visibility.

Workflow

The user submits code and selects a language via optimize.html. The /optimize route invokes test7.optimize_code to profile and optimize the code. The optimized code, debug information, execution time metrics, and optimization level are displayed, enabling users to assess performance

improvements. The debug information's detailed breakdown helps users understand the optimization process and its benefits.

Integration

- Frontend: optimize.html includes a textarea, language selector, and result sections, with a navbar for navigation and CSS styling for dark mode (per your April 8, 2025, request).
- Backend: test7.py handles optimization logic, invoked by app.py.
- Dependencies: Likely uses cProfile or similar profiling tools, with Pylint for initial validation (per your April 14, 2025, reference).

Additional Considerations

- Scalability: Supports multiple concurrent optimizations by leveraging Flask's request handling and Gunicorn's worker model, ensuring low latency for high user loads.
- Edge Cases: Handles complex codebases with recursive functions or heavy I/O operations by prioritizing lightweight optimizations and flagging computationally intensive tasks for manual review.
- Performance: Optimizes the profiling phase by sampling execution rather than full runs for large code, reducing server load.
- User Experience: The debug information is presented in a tabular format on optimize.html, with tooltips explaining technical terms to aid non-expert users.

This module drives CodeGuide AI's commitment to efficient, high-performance code production.

5.6.4 PLAGIARISM FIXING MODULE

Purpose

The Plagiarism Fixing module, accessible via /check-plagiarism, ensures the originality of user-submitted code by detecting and mitigating similarities with existing codebases. It is essential for maintaining academic integrity and professional ethics, particularly in educational institutions and collaborative projects. The module's primary purpose is to identify potential plagiarism, modify code to enhance uniqueness, and provide a quantifiable measure of originality, empowering users to produce authentic work.

Functionality

The module processes code and a language selection submitted through plagiarism.html. The check_plagiarism_and_fix function in test8.py analyzes code similarity, modifies similar segments, and produces three outputs: cleaned code, debug information, and a plagiarism score.Its key functionalities include:

- Similarity Detection: Compares input code against a database of known code, online repositories, or common algorithmic patterns to identify structural or textual similarities.
- Code Cleaning: Modifies similar code segments by altering variable names, restructuring algorithms, or adopting alternative implementations to reduce similarity while preserving functionality.
- Plagiarism Score: Calculates a similarity percentage (0–100%) based on the extent of matching code fragments, providing a clear metric for assessing originality.
- Debug Information: Generates a detailed report identifying similar code segments, their potential sources, and the modifications applied to ensure uniqueness.

Technical Implementation

The check_plagiarism_and_fix function likely employs text similarity algorithms (e.g., cosine similarity, Jaccard index) or specialized tools like MOSS (Measure of Software Similarity) for academic plagiarism detection. The implementation process includes:

1. Code Preprocessing: Normalizes the code by removing comments, standardizing whitespace, and converting to a canonical form to focus on structural similarity, reducing false positives.
2. Similarity Analysis: Tokenizes the code into an abstract syntax tree (AST) or n-grams,

comparing it against a local database or external repositories. The analysis accounts for language-specific syntax (e.g., Python's decorators, Java's interfaces).

3. Modification: Applies transformations to reduce similarity, such as renaming variables (emphasized in your April 19, 2025, request), reordering non-critical statements, or substituting equivalent algorithms (e.g., replacing a bubble sort with a merge sort implementation).

4. Output Generation: Produces (cleaned_code, debug_info, plagiarism_score), where cleaned_code is the modified code, debug_info lists similarities and fixes, and plagiarism_score quantifies similarity.

5. Error Handling: Manages cases where similarity detection fails (e.g., due to network issues for external APIs) by falling back to local pattern matching (per your April 7, 2025, request for robust error handling).

The /check-plagiarism route ensures lowercase language input for consistency, processing submissions and rendering results in plagiarism.html with a side-by-side layout.

Workflow

The user submits code and selects a language via plagiarism.html. The /check-plagiarism route invokes test8.check_plagiarism_and_fix to analyze and modify the code. The cleaned code, debug information, and plagiarism score are displayed, guiding users to ensure originality. The debug information's detailed breakdown helps users understand similarity sources and applied fixes.

Integration

- Frontend: plagiarism.html features a textarea, language dropdown with visible text in dark mode (per your April 8, 2025, fix), and result sections, with a navbar for navigation.
- Backend: test8.py encapsulates plagiarism logic, invoked by app.py.
- Dependencies: May use libraries like difflib for similarity analysis or external APIs for broader comparisons.

Additional Considerations

- Performance: Optimizes similarity detection by indexing the local database and using efficient algorithms to handle large codebases.
- Scalability: Supports concurrent plagiarism checks by distributing analysis across Flask's request handlers, minimizing latency.
- Edge Cases: Handles code with minimal content (e.g., single-line functions) by adjusting similarity thresholds to avoid false positives.
- User Experience: The plagiarism score is accompanied by a visual indicator (e.g.,

color- coded gauge) on plagiarism.html to make originality assessment intuitive. This module reinforces CodeGuide AI's commitment to ethical coding practices.

5.6.5 DOCUMENTATION GENERATION MODULE

Purpose

The Documentation Generation module, accessed via /document, automates the creation of comprehensive documentation for user-submitted code, enhancing maintainability and facilitating collaboration. It is designed for developers needing professional documentation for project submissions, team handoffs, or long-term code maintenance. The module's goal is to extract code structure and intent, producing clear, structured documentation in both text and PDF formats.

Functionality

The module processes code and a language selection submitted through document.html. The generate_documentation function in test9.py parses the code, generates documentation, and provides an optional PDF output. Its key functionalities include:

- Code Parsing: Analyzes code to identify functions, classes, variables, and comments, extracting metadata like signatures, purposes, and dependencies.
- Documentation Content: Produces structured documentation with sections for each code element, detailing function signatures, parameter descriptions, return values, and extracted comments, formatted for clarity.
- PDF Generation: Converts the documentation into a downloadable PDF, suitable for professional presentation or archival purposes.
- Language Support: Adapts to Python, Java, and C conventions, ensuring accurate representation of language-specific features (e.g., Python decorators, Java annotations).

Technical Implementation

The generate_documentation function likely uses parsing libraries like Python's ast module for code analysis and pdfkit for PDF generation (per your April 14, 2025, reference). The implementation process includes:

1. Code Analysis: Parses the code to build a structured representation, identifying key elements (e.g., functions, classes) and extracting inline comments or docstrings.
2. Documentation Generation: Formats the extracted information into a structured text output, using predefined templates to ensure consistency across languages (e.g., standardized sections for function descriptions).

3. PDF Conversion: Renders the documentation as an HTML intermediate, applying CSS for professional formatting, then uses pdfkit with wkhtmltopdf to generate a PDF buffer.

4. Output Generation: Produces (documentation, pdf_buffer), where documentation is the text output and pdf_buffer is a binary stream for PDF download.

5. Error Handling: Manages large or complex codebases by chunking parsing tasks and logging errors for debugging (per your April 14, 2025, request for robust database handling in test9.py).

The /document route supports GET requests for the input form, POST requests for text output, and a PDF download option via send_file, ensuring flexible delivery.

Workflow

The user submits code and selects a language via document.html. The /document route invokes test9.generate_documentation to create documentation and a PDF buffer. The text documentation is displayed, with a button to download the PDF. The side-by-side layout ensures the input code remains visible for reference, enhancing usability.

Integration

- Frontend: document.html includes a textarea, language selector, result section, and PDF download button, styled for usability with a navbar for navigation.
- Backend: test9.py handles documentation logic, invoked by app.py.
- Dependencies: Relies on pdfkit and wkhtmltopdf for PDF generation.

Additional Considerations

- Performance: Optimizes PDF generation by caching HTML intermediates for frequently processed code, reducing server load.
- Scalability: Handles multiple documentation requests by leveraging Flask's asynchronous capabilities.
- Edge Cases: Manages undocumented code or minimal comments by generating placeholder descriptions based on code structure.
- User Experience: The documentation output includes a table of contents on document.html for easy navigation, with PDF versions formatted for print compatibility.

This module supports CodeGuide AI's goal of fostering maintainable, collaborative codebases.

5.7 SOURCE CODE

app.py:

```
from flask import Flask, request, render_template,
send_file import test5

import test7
import test8
import test9
import io
app = Flask(__name__)


@app.route('/') def home():
return render_template('index.html')

# Error Fixer
@app.route('/fix-errors', methods=['GET', 'POST']) def fix_errors():
if request.method == 'POST': code = request.form['code']
language = request.form['language']
corrected_code, error_report, error_count = test5.fix_code(code, language) return
render_template('fix_errors.html',
code=code, result=corrected_code, report=error_report, error_count=error_count,
language=language) return render_template('fix_errors.html', code=None, result=None,
report=None, error_count=None)


# Optimizer
@app.route('/optimize', methods=['GET', 'POST']) def optimize():
if request.method == 'POST':
code = request.form['code'] language = request.form['language']
optimized_code, debug_info, exec_time, opt_level = test7.optimize_code(code, language) return
render_template('optimize.html',
code=code, result=optimized_code, report=debug_info, exec_time=exec_time, opt_level=opt_level,
language=language)
return render_template('optimize.html', code=None, result=None, report=None, exec_time=None,
```

```
opt_level=None)

# Plagiarism Checker
@app.route('/check-plagiarism', methods=['GET', 'POST']) def
check_plagiarism(): if request.method == 'POST': code = request.form['code']
language = request.form['language'].lower()  # Ensure lowercase  for consistency
cleaned_code, debug_info, plagiarism_score = test8.check_plagiarism_and_fix(code,  language) return
render_template('plagiarism.html',
code=code, result=cleaned_code, report=debug_info, score=plagiarism_score,
language=language) return render_template('plagiarism.html',  code=None, result=None,
report=None,  score=None)

# Documentation Generator @app.route('/document', methods=['GET', 'POST']) def
document():  if request.method == 'POST': code = request.form['code']
language =  request.form['language']
documentation, pdf_buffer = test9.generate_documentation(code,  language) if
request.form.get('download') == 'pdf':
pdf_buffer.seek(0)
return send_file( pdf_buffer, as_attachment=True,
download_name='code_documentation.pdf', mimetype='application/pdf')

return render_template('document.html',
code=code, result=documentation,  language=language)
return render_template('document.html',  code=None,  result=None)

if _name_== '_main_':
        app.run(debug=True)
```

index.html:

```
<!DOCTYPE  html>
<html lang="en">
<head>
<meta  charset="UTF-8">
<meta  name="viewport"  content="width=device-width,  initial-scale=1.0">
```

<title>Auralint</title>

<link href="https://fonts.googleapis.com/css2?family=Orbitron:wght@400;500;600&display=swap"

rel="stylesheet">

<link href="https://fonts.googleapis.com/css2?family=Inter:wght@300;400;500;600&display=swap"

rel="stylesheet">

<link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/6.0.0/css/all.min.css">

<style>

:root {

--accent-color: #00ff9d; --accent-glow: rgba(0, 255, 157, 0.5); --accent-glow-strong: rgba(0, 255, 157,0.7);

--bg-primary: #010314; --bg-secondary: rgba(1, 3, 20, 0.95); --text-primary: #ffffff; --text-secondary:

rgba(255, 255, 255, 0.7);

--card-bg: rgba(0, 255, 157, 0.03); --border-color: rgba(0, 255, 157, 0.2);}

[data-theme="light"] {

--accent-color: #e91e63; --accent-glow: rgba(233, 30, 99, 0.5); --accent-glow-strong: rgba(233, 30, 99, 0.7);

--bg-primary: #f5f5f5; --bg-secondary: rgba(245, 245, 245, 0.95); --text-primary: #333333; --text-

secondary: rgba(51, 51, 51, 0.7);

--card-bg: rgba(255, 255, 255, 0.9); --border-color: rgba(233, 30, 99, 0.2);

} { margin: 0; padding: 0; box-sizing: border-box; } body {

font-family: 'Inter', sans-serif; background: var(--bg-primary); color: var(--text-primary); min-

height: 100vh; display: flex; flex-direction: column; line-height: 1.6;

transition: background-color 0.3s ease, color 0.3s ease;}

.header {

position: fixed; width: 100%; z-index: 1000; background: var(--bg-secondary); backdrop-filter:

blur(10px);

padding: 0; border-bottom: 1px solid var(--border-color);

}

.header-top {

padding: 1rem 2rem; display: flex; justify-content: space-between; align-items: center;

position: relative;

}

.header-top::after {

content: ''; position: absolute; bottom: 0; left: 0; width: 100%; height: 1px;

```
background: linear-gradient(90deg, transparent 0%, var(--border-color) 25%, var(--accent-color) 50%,
var(--border-color) 75%, transparent 100%);
}
.logo-container { display: flex; align-items: center; gap: 1.2rem; }
.logo-svg { width: 38px; height: 38px; position: relative; }
.logo-svg::before {
content: ''; position: absolute; top: -5px; left: -5px; right: -5px; bottom: -5px;
background: radial-gradient(circle, var(--accent-glow) 0%, transparent 70%); border-radius: 50%;
animation: pulse 2s infinite;
}
@keyframes pulse {
0% { transform: scale(1); opacity: 0.5; } 50% { transform: scale(1.2); opacity: 0.2; } 100% {
transform: scale(1); opacity: 0.5; }
}
.logo-text {
font-family: 'Orbitron', sans-serif; font-size: 1.8rem; font-weight: 600; color: var(--accent-color); text-shadow: 0 0 10px var(--accent-glow); letter-spacing: 2px;
}
.header-actions { display: flex; align-items: center; gap: 1.5rem; }
.theme-toggle {
background: none; border: 1px solid var(--border-color); border-radius: 50%; width: 36px;
height: 36px;
display: flex; align-items: center; justify-content: center; color: var(--accent-color); cursor: pointer;
transition: all 0.3s ease;
}
.theme-toggle:hover { background: var(--card-bg); }
.theme-toggle i { font-size: 1.1rem; z-index: 1; }
.hero {
padding: 10rem 2rem 6rem; text-align: center; background: linear-gradient(180deg, rgba(0, 255, 157, 0.15) 0%, rgba(0, 255, 157, 0) 100%);
position: relative; overflow: hidden;
}
```

```
[data-theme="light"] .hero { background: linear-gradient(180deg, rgba(233, 30, 99, 0.15) 0%, rgba(233,
30, 99, 0) 100%); }
.hero-title {
font-size: 4rem; font-weight: 700; margin-bottom: 2rem; line-height: 1.2; color: var(--accent-
color); text-shadow: 0 0 20px var(--accent-glow), 0 0 40px var(--accent-glow); animation:
titlePulse 3s infinite;}

@keyframes titlePulse {
0%, 100% { text-shadow: 0 0 20px var(--accent-glow), 0 0 40px var(--accent-glow); }
50% { text-shadow: 0 0 30px var(--accent-glow-strong), 0 0 60px var(--accent-glow); }
400;}
.hero-subtitle {
font-size: 1.3rem; color: var(--text-secondary); max-width: 700px; margin: 0 auto 3rem; font-weight:
}
.main-content { flex: 1; max-width: 1400px; margin: 0 auto; width: 100%; padding: 2rem; position:
relative; }
.code-card {
background: var(--bg-secondary); border: 1px solid var(--border-color); border-radius: 20px;
padding:
3rem;
backdrop-filter: blur(15px); box-shadow: 0 8px 32px rgba(0, 255, 157, 0.1); position: relative;
overflow: hidden;
margin-bottom: 2rem;
}
.code-card::before {
content: ''; position: absolute; top: 0; left: 0; right: 0; height: 2px;
background: linear-gradient(90deg, transparent, var(--accent-color), transparent);
}
.toolbar { display: flex; justify-content: space-between; margin-bottom: 1.5rem; }
.left-tools, .right-tools { display: flex; gap: 0.75rem; }
.language-section { margin-bottom: 0; }
.language-label {
display: block; margin-bottom: 0.5rem; color: var(--accent-color); font-size: 1.1rem; font-
weight: 500; letter-spacing: 1px; text-shadow: var(--accent-glow);
```

```
}
.language-select {
padding: 0.5rem 1rem; border: 1px solid var(--border-color); border-radius: 10px;
font-size: 1rem; color: var(--text-primary); background: var(--card-bg); cursor: pointer;
transition: all 0.3s ease;
}
.language-select:focus { outline: none; box-shadow: 0 0 20px var(--accent-glow); }
.editor { display: flex; gap: 1rem; margin-bottom: 1.5rem; }
.code-area, .output {
width: 50%; min-height: 350px; padding: 1.5rem; border: 1px solid var(--border-color);
border- radius:
10px;
font-family: 'Inter', monospace; font-size: 1rem; line-height: 1.6; background: var(--bg-
secondary); color: var(--text-primary); transition: all 0.3s ease;
}
.code-area { resize: vertical; }
.output { overflow-y: auto; }
.code-area:focus, .output:focus { outline: none; box-shadow: 0 0 20px var(--accent-glow); }
.button {
padding: 0.5rem 1rem; border: 1px solid var(--border-color); border-radius: 10px;
background: var(--card-bg); color: var(--accent-color); font-size: 1.1rem; font-weight: 500;
cursor: pointer; transition: all 0.3s ease; letter-spacing: 1px; text-shadow: var(--accent-glow); text-
decoration: none;
}
.button:hover { background: var(--card-bg); box-shadow: 0 0 20px var(--accent-glow); }
.benefits-container { max-width: 1200px; margin: 0 auto; padding: 2rem; }
.benefits-grid {
display: grid; grid-template-columns: repeat(auto-fit, minmax(300px, 1fr)); gap: 2rem; margin-top:
.benefit-card {
background: var(--card-bg); border: 1px solid var(--border-color); border-radius: 15px;
padding: 2rem; text-align: center; transition: all 0.3s ease; position: relative; overflow:
hidden;
}
```

```
.benefit-card::before {
content: ''; position: absolute; top: 0; left: 0; right: 0; height: 2px;
background: linear-gradient(90deg, transparent, var(--accent-color), transparent);
transform: translateX(-100%); transition: transform 0.5s ease;
}
.benefit-card:hover::before { transform: translateX(100%); }
.benefit-card:hover { transform: translateY(-5px); box-shadow: 0 10px 20px rgba(0, 255, 157, 0.1); }
.benefit-icon {
font-size: 2.5rem; color: var(--accent-color); margin-bottom: 1.5rem; filter: drop-shadow(0 0 10px var(-
-accent-glow));
}
.benefit-card h3 { color: var(--accent-color); font-size: 1.4rem; margin-bottom: 1rem; font-weight: 600; }
.benefit-card p { color: var(--text-secondary); font-size: 1rem; line-height: 1.6; }
.content-section {
background: var(--bg-secondary); border: 1px solid var(--border-color); border-radius: 20px; padding:
2rem;
margin-bottom: 2rem; box-shadow: 0 8px 32px rgba(0, 255, 157, 0.1); position: relative;
}
.content-section h2 { color: var(--accent-color); margin-bottom: 1rem; text-shadow: 0 0 10px
var(-- accent-glow); }
.content-section p, .content-section ul, .content-section ol { color: var(--text-secondary);
margin- bottom: 1rem; }
.content-section ul, .content-section ol { padding-left: 1.5rem; }
.content-section li { margin-bottom: 0.5rem; }
.footer {
background: var(--bg-secondary); border-top: 1px solid var(--border-color); padding: 4rem
2rem 2rem; position: relative; overflow: hidden;
}
.footer::before {
content: ''; position: absolute; top: 0; left: 0; right: 0; height: 1px;
background: linear-gradient(90deg, transparent 0%, var(--accent-color) 50%, transparent 100%);
```

```
filter: blur(1px);
}
.footer-content { max-width: 1200px; margin: 0 auto; position: relative; z-index: 1; }
.footer-grid {
display: grid; grid-template-columns: repeat(auto-fit, minmax(250px, 1fr)); gap: 3rem; margin-bottom:3 rem;
}
.footer-section { padding: 1rem; border-radius: 12px; transition: all 0.3s ease; }
.footer-section:hover { background: rgba(0, 255, 157, 0.03); transform: translateY(-5px); }
.footer-section h3 {
color: var(--accent-color); font-size: 1.2rem; font-weight: 500; margin-bottom: 1.5rem;
display: flex; align-items: center; gap: 0.5rem; text-shadow: 0 0 10px var(--accent-glow);
}
.footer-links { list-style: none; display: flex; flex-direction: column; gap: 1rem; }
.footer-links a {
color: var(--text-secondary); text-decoration: none; display: flex; align-items: center; gap: 0.8rem;
transition: all 0.3s ease; padding: 0.5rem; border-radius: 6px;
}
.footer-links a i { color: var(--accent-color); font-size: 1.1rem; transition: all 0.3s ease; }
.footer-links a:hover { color: var(--accent-color); background: rgba(0, 255, 157, 0.05); transform:
translateX(8px); }
.footer-links a:hover i { transform: scale(1.2); }
.social-links { display: flex; gap: 1.5rem; margin-top: 1rem; }
.social-link {
color: var(--text-secondary); font-size: 1.8rem; transition: all 0.3s ease; position: relative;
}
.social-link::before {
content: ''; position: absolute; inset: -8px; border-radius: 50%; background: var(--accent-glow);
opacity: 0; transition: all 0.3s ease;
}
.social-link:hover { color: var(--accent-color); transform: translateY(-5px); }
.footer-bottom::before {
content: ''; position: absolute; top: -1px; left: 50%; transform: translateX(-50%); width: 200px;
height:
```

```
1px;
background: var(--accent-color); filter: blur(1px);
}
.footer-bottom p { color: var(--text-secondary); font-size: 0.9rem; display: flex; align-items:
center; justify-content: center; gap: 0.5rem; }
.footer-bottom i.fa-heart { color: var(--accent-color); font-size: 1rem; animation: pulse 1.5s infinite;
} @media (max-width: 768px) {
.hero { padding: 6rem 1rem 3rem; }
.hero-title { font-size: 2.5rem; }
.main-content { padding: 1rem; }
.header-top { padding: 0.5rem 1rem; }
.code-card { padding: 1.5rem; }
.footer { padding: 3rem 1rem 1.5rem; }
.footer-grid { gap: 2rem; }
.footer-section { padding: 0.8rem; }
.social-links { justify-content: center; }
.benefits-grid { grid-template-columns: 1fr; gap: 1.5rem; }
.benefit-card { padding: 1.5rem; }
.editor { flex-direction: column; }
.code-area, .output { width: 100%; }
}
</style>
</head>
<body data-theme="dark">
<header class="header">
<div class="header-top">
<div class="logo-container">
<svg class="logo-svg" viewBox="0 0 100 100" xmlns="http://www.w3.org/2000/svg">
<defs>
<linearGradient id="grad1" x1="0%" y1="0%" x2="100%" y2="0%">
<stop offset="0%" style="stop-color:#0f6544;stop-opacity:1" />
<stop offset="100%" style="stop-color:#06603d;stop-opacity:0.7" />
</linearGradient>
```

<filter id="glow">
<feGaussianBlur stdDeviation="2" result="coloredBlur"/>
<feMerge>
<feMergeNode in="coloredBlur"/>
<feMergeNode in="SourceGraphic"/>
</feMerge>
</filter>
</defs>
<circle cx="50" cy="50" r="35" fill="none" stroke="url(#grad1)" stroke-width="4" stroke-dasharray="6" filter="url(#glow)"/>
<path d="M35 45 L50 60 L65 45" stroke="#00ff9d" stroke-width="4" fill="none" filter="url(#glow)"/>
</svg>
Auralint

<button class="theme-toggle" onclick="toggleTheme()">

</button>

</header>

<section class="hero">

<h1 class="hero-title">Say Hello to Optimized Code, Reduced Complexity, and Goodbye to Bugs</h1>

<h3>Instant Analysis</h3>
Get immediate feedback on your code quality, style, and potential issues

<h3>Bug Detection</h3>
Identify and fix potential bugs before they reach production

<h3>Code Optimization</h3>
Receive suggestions to improve code performance and readability

<h3>Code Documentation</h3>
Generate detailed, professional documentation with problem statements and examples

<h3>Time Saving</h3>
Reduce code review time by up to 80% with AI-powered analysis

<h3>Learning Tool</h3>
Learn best practices and improve your coding skills with AI guidance

</section>

<main class="main-content">

<h2>Quick Access</h2>
Code Error Fixer
Code Optimizer
Code Plagiarism Checker

```
<a href="/document" class="button">Code Documentation</a>
</div>

<div class="code-card">
<div class="toolbar">
<div class="left-tools">
<button class="button" onclick="submitForm('/fix-errors')">Fix Errors</button>
<button class="button" onclick="submitForm('/optimize')">Optimize Code</button>
<button class="button" onclick="submitForm('/check-plagiarism')">Check Plagiarism</button>
<button class="button" onclick="submitForm('/document')">Document Code</button>
</div>
<div class="right-tools">
<div class="language-section">
<select class="language-select" id="language">
<option value="Python">Python</option>
<option value="Java">Java</option>
<option value="C">C</option>
</select>
</div>
<button class="button" onclick="pasteText()">Paste</button>
<button class="button" onclick="copyText()">Copy</button>
</div>
</div>
<div class="editor">
<textarea class="code-area" id="code" placeholder="Paste or type your code here..."></textarea>
<div class="output" id="outputArea">Output will appear here...</div>
</div>
</div>

<footer class="footer">
<div class="footer-content">
div class="footer-grid">
<div class="footer-section">
<h3>Company</h3>
<ul class="footer-links">
```

```
<li><a href="#" class="hover-effect"><i class="fas fa-info-circle"></i>About</a></li>
<li><a href="#" class="hover-effect"><i class="fas fa-users"></i>Team</a></li>
<li><a href="#" class="hover-effect"><i class="fas fa-newspaper"></i>Blog</a></li>
</ul>
</div>
<div class="footer-section">
<a href="#" class="social-link" title="GitHub"><i class="fab fa-github"></i></a>
<a href="#" class="social-link" title="Twitter"><i class="fab fa-twitter"></i></a>
<a href="#" class="social-link" title="LinkedIn"><i class="fab fa-linkedin"></i></a>
<a href="#" class="social-link" title="Discord"><i class="fab fa-discord"></i></a>
</div>
</div>
</div>
<div class="footer-bottom">
<p>© 2025 Auralint. All rights reserved. | Made with <i class="fas fa-heart"></i> by <a
href="#">Auralint Team</a></p>
</div>
</div>
</footer>
<script>
function toggleTheme() { const body = document.body;
const currentTheme = body.getAttribute('data-theme'); const newTheme = currentTheme === 'dark'
? 'light' : 'dark'; body.setAttribute('data-theme', newTheme);
const icon = document.querySelector('.theme-toggle i'); if (newTheme ===
'dark') { icon.classList.remove('fa-sun'); icon.classList.add('fa-moon');
} else {
icon.classList.remove('fa-moon'); icon.classList.add('fa-sun');
}
localStorage.setItem('theme', newTheme);
}

document.addEventListener('DOMContentLoaded', () => { const savedTheme =
localStorage.getItem('theme') || 'dark'; document.body.setAttribute('data-theme',
savedTheme); const icon = document.querySelector('.theme-toggle i');
```

```
if (savedTheme === 'dark') { icon.classList.remove('fa-sun'); icon.classList.add('fa-moon');
} else {
icon.classList.remove('fa-moon'); icon.classList.add('fa-sun');
}
});

function submitForm(action) {
let language = document.getElementById('language').value; const code =
document.getElementById('code').value;
if (action === '/check-plagiarism') {
language = language.toLowerCase(); // Convert to lowercase for plagiarism checker
}
const form = document.createElement('form');
form.method = 'POST'; form.action = action;
const langInput = document.createElement('input'); langInput.type = 'hidden';
langInput.name = 'language'; langInput.value = language;
const codeInput = document.createElement('input'); codeInput.type = 'hidden';
codeInput.name = 'code'; codeInput.value = code; form.appendChild(langInput);
form.appendChild(codeInput); document.body.appendChild(form); form.submit();
}

function copyText() {
const code = document.getElementById('code'); code.select();
document.execCommand('copy'); alert('Code copied to clipboard!');
}function pasteText() { navigator.clipboard.readText().then(text => {
document.getElementById('code').value = text;
});
}
</script>
</body>
</html>
```

5.8 ALGORITHMS AND TECHNIQUES IMPLEMENTED

Python: Python is a versatile and powerful programming language used extensively in Code Guide AI for its readability, simplicity, and the wide range of available libraries. It serves as the core developmentlanguage for implementing the backend logic, including error detection, code optimization, plagiarism analysis, and documentation generation.

Flask (Web Framework): Flask is a lightweight and flexible web framework used to develop the web interface and RESTful APIs for Code Guide AI. It handles user interactions, input/output routing, and connects frontend forms with backend logic to provide real-time code analysis and suggestions.

Pylint (Static Code Analysis): Pylint is used to perform static code analysis on user-submitted Python code. It helps identify syntax errors, code smells, unused variables, and potential bugs. This tool forms the basis for the code fixing module (test_5.py) in the system.

TensorFlow (Machine Learning Framework: TensorFlow is used to power any AI-driven logic for optimizing code or detecting plagiarism. Pre-trained models or custom-trained models may analyze patterns and suggest performance improvements or detect similar code structures indicative of plagiarism.

NLTK (Natural Language Toolkit): NLTK is a leading library for natural language processing. In Code Guide AI, it is used for generating documentation by processing code comments and structure to produce human-readable explanations and summaries. This is integrated in the documentation generation module (test_9.py).

PostgreSQL (Database System): PostgreSQL is a powerful, open-source relational database management system (RDBMS) used to store and manage structured data in Code Guide AI.

CHAPTER-6

RESULTS AND ANALYSIS

6.1 OUTPUT SCREENSHOTS

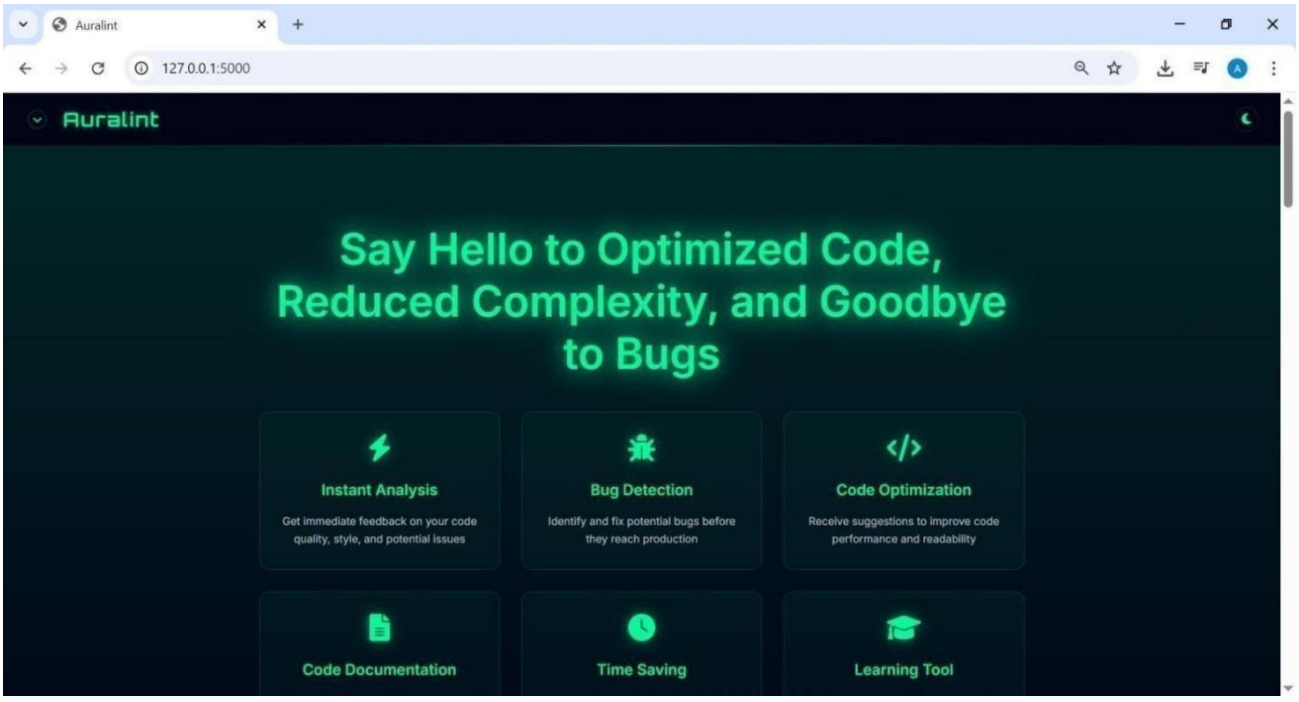

Fig 6.1 Home Page

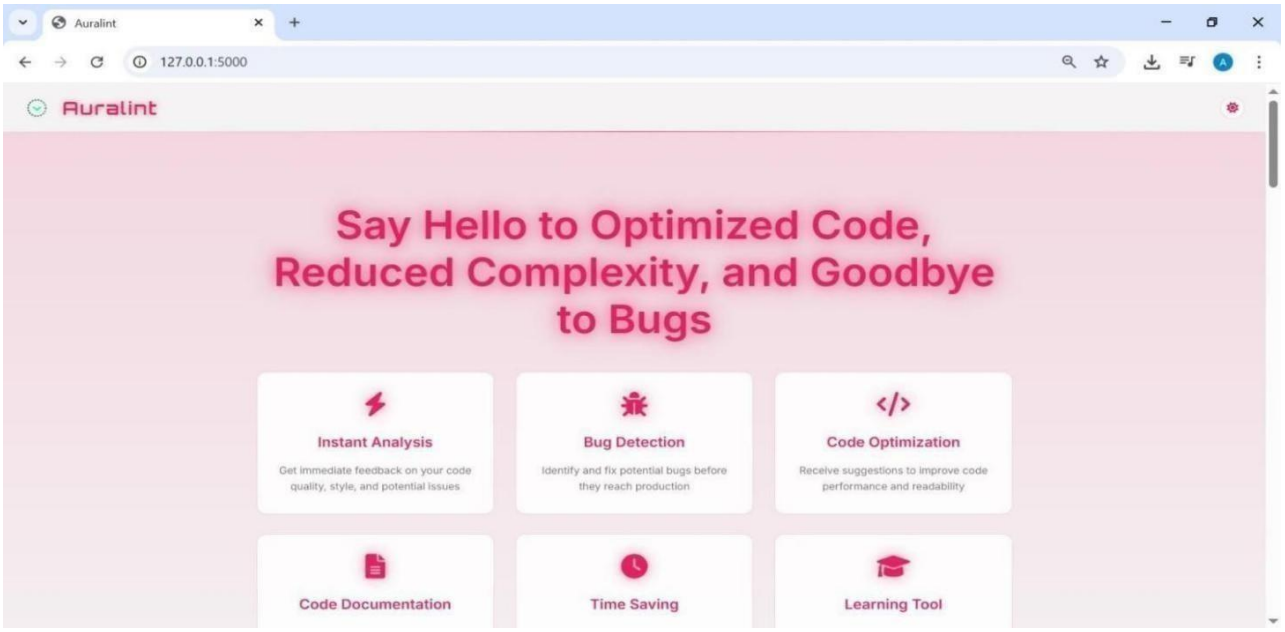

Fig 6.2 Theme changed

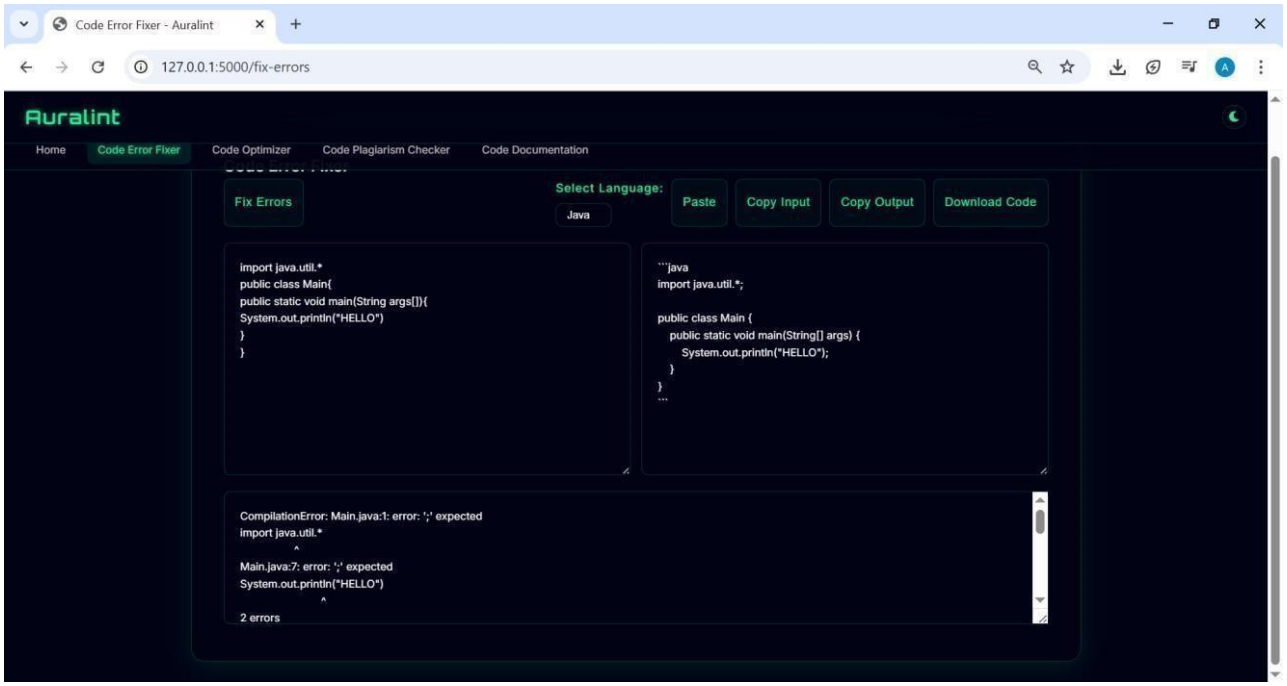

Fig6.3 Code Error Fixer

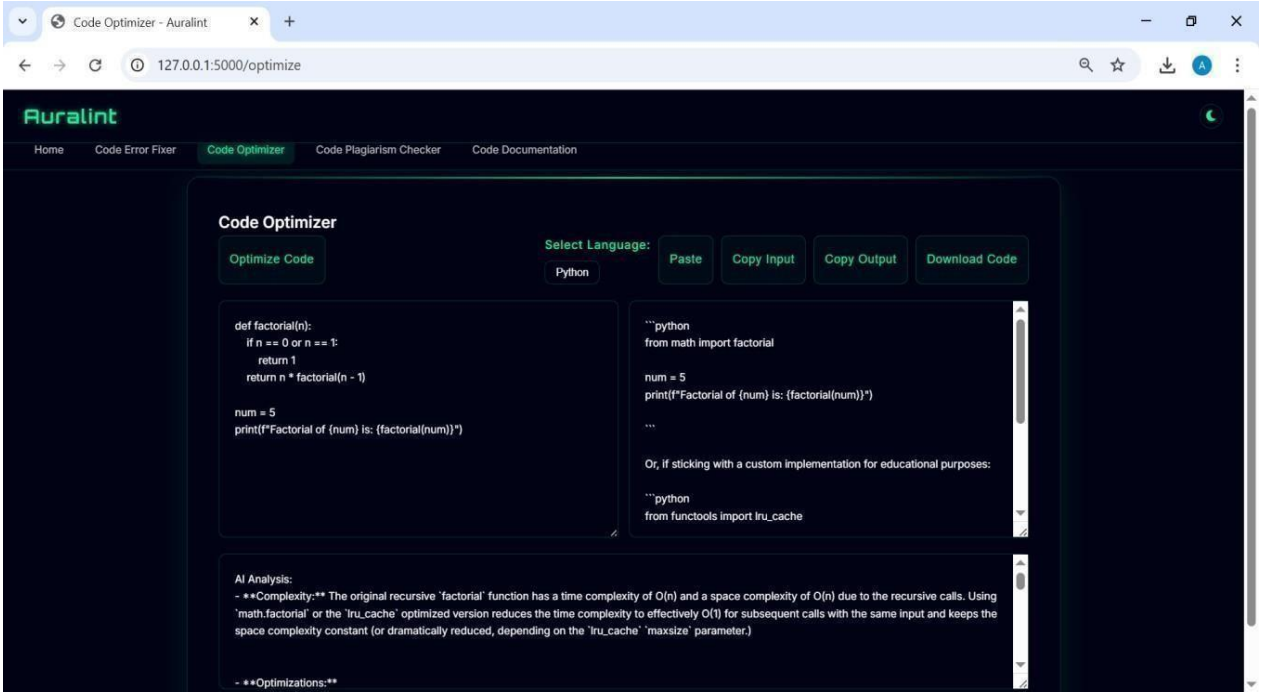

Fig6.4 Code Optimizer

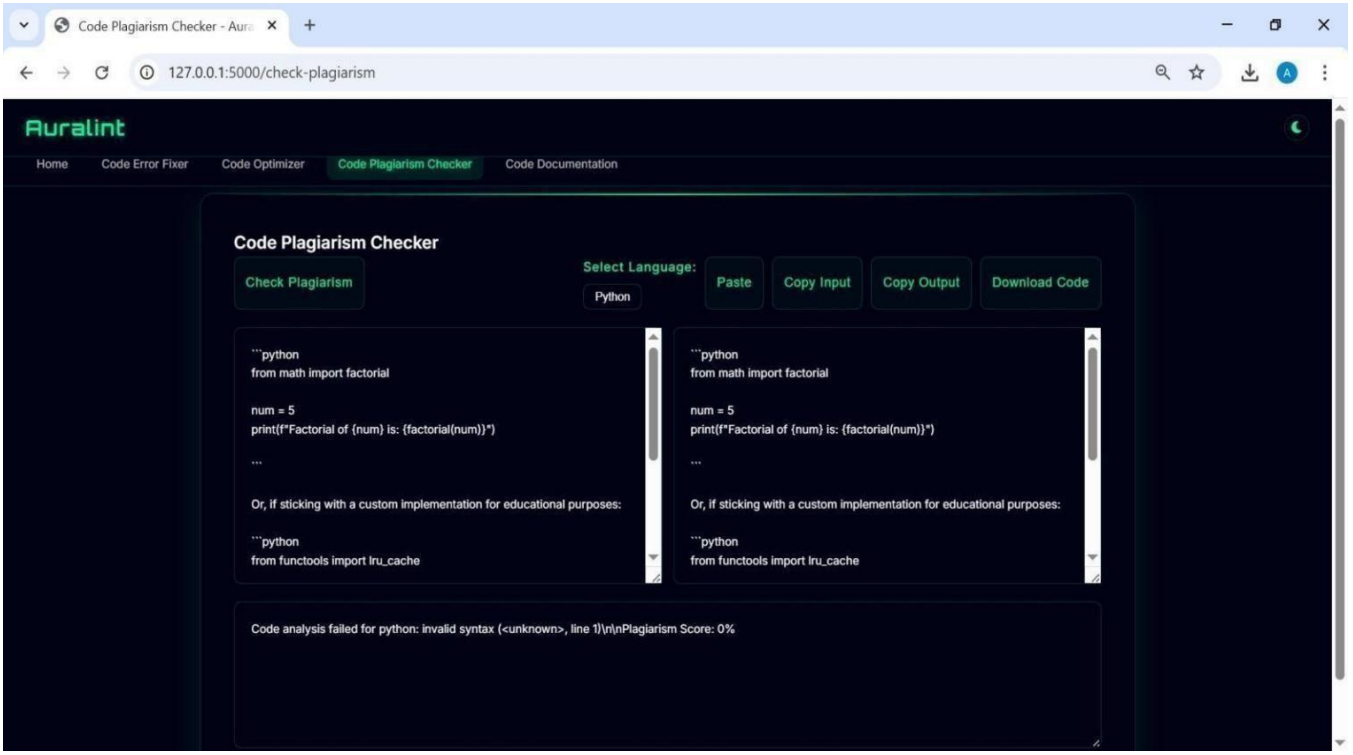

Fig6.5 Code PlagarismChecker

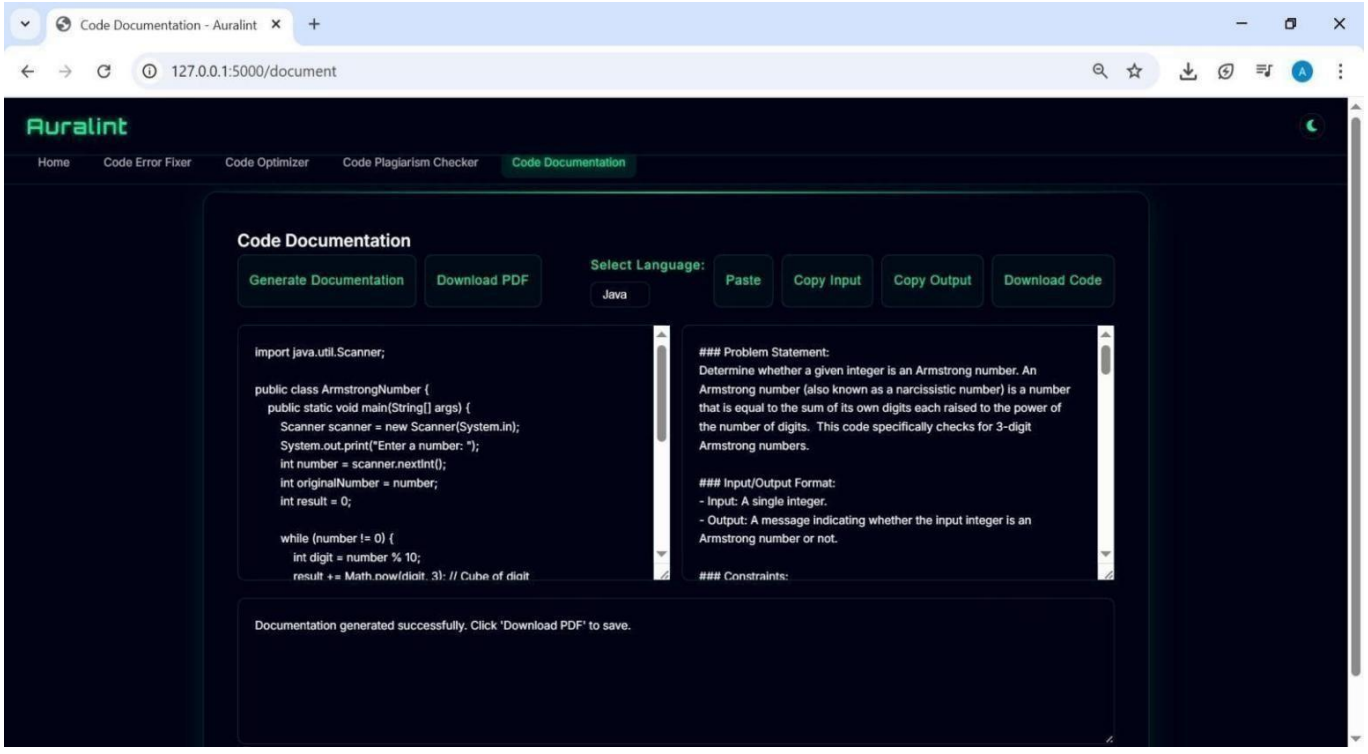

Fig 6.6 Code Documentation

CHAPTER-7

CONCLUSION AND FUTURE WORK

7.1 Conclusions Drawn from the Study

In conclusion, the development of Code Guide AI represents a major advancement in making programming more accessible, error-free, and efficient, especially for beginners. By integrating intelligent features such as code error fixing, code optimization, plagiarism detection, and automatic documentation generation, Code Guide AI serves as a powerful companion for developers at all levels. Leveraging machine learning, natural language processing, and advanced analysis tools, the platform simplifies complex debugging and refactoring tasks. Through a user- friendly interface, users can submit code snippets and instantly receive optimized versions, bug reports, or documentation – streamlining the entire development workflow. The modular and scalable design ensures that Code Guide AI is not just a tool for today's challenges but a foundation for future intelligent coding platforms.

7.2 Suggestions for Future Work

Future enhancements of Code Guide AI could significantly boost its performance, reach, and impact:

Multi-language Support: Extend the platform's capabilities to support additional programming languages like C++, Java, and Kotlin to assist a broader audience of developers.

AI-Based Code Recommendations: Use deeper learning techniques to offer intelligent suggestions, such as better coding practices, security improvements, or performance enhancements.

IDE Integration: Provide plugins or extensions for popular IDEs like VS Code, IntelliJ, or Eclipse for real-time assistance and seamless development experience.

Collaborative Features: Introduce shared debugging or code review spaces where teams can work together and get instant feedback from the AI.

Version Control Assistance: Integrate Git-based versioning and suggestions on meaningful commit messages or conflict resolution strategies.

Voice Assistant Integration: Enable voice-guided debugging or optimization through integration with smart assistants.

Performance Metrics and Feedback: Offer developers insights into their coding progress, such as most common errors, learning trends, and improvement over time.

CHAPTER-8

REFERENCES

8.1 List of References Cited in the Report

8.1.1 Manual References

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8.1.2 Base Papers references

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