PROJECT DEVELOPMENT PHASE
DOCUMENTATION Civil Engineering Insight Studio

1. Introduction
The Project Development Phase involves the actual construction of the Civil Engineering Insight Studio application based on the design specifications. During this phase, the system components are implemented, integrated, and prepared for testing. The focus is on transforming design concepts into a functional software product.

2. Development Environment
The application is developed using Python as the primary programming language. Streamlit is used as the web framework to create an interactive user interface, while Google Gemini API provides the artificial intelligence capabilities. Supporting libraries such as Pillow and python-dotenv are used for image processing and environment management.

3. Module Implementation
• Input Module: Implements text input fields and image upload functionality.
• Processing Module: Converts uploaded images into the required format and prepares data for AI processing.
• AI Integration Module: Connects to the Gemini multimodal model using the API key and generates responses.
• Output Module: Displays the generated structural description on the web interface.

4. API Integration
The Google Generative AI API is integrated into the application using a secure API key stored in environment variables. This enables communication between the application and the Gemini model for content generation.

5. User Interface Development
The interface includes a header, input field, file uploader, image preview area, submit button, and output display section. The design prioritizes simplicity, clarity, and ease of use for students and non-expert users.

6. Integration of Components
All modules are integrated to ensure seamless data flow from user input to AI processing and output generation. Proper error handling mechanisms are implemented to manage invalid inputs and system issues.

7. Testing During Development
Unit testing and functional testing are performed continuously to verify that each module operates correctly and that the integrated system behaves as expected.

8. Version Control
Git is used for version control to track code changes, manage revisions, and maintain project history. The project repository is hosted on GitHub for backup and collaboration purposes.

9. Constraints
Development is dependent on internet connectivity for API access and compatibility of libraries with the system environment.

10. Conclusion
The Project Development Phase results in a fully functional prototype of the Civil Engineering Insight Studio application, ready for comprehensive testing and deployment. This phase transforms the planned design into an operational system.