**Project Design Phase**

**Date: 27 June 2025**

**Team ID:** LTVIP2025TMID22707

**Project Name: SmartSDLC: AI-Enhanced Software Development Lifecycle**

**Maximum Marks: 2 Marks**

**Proposed Solution Template:**

**Project team shall fill the following information in the proposed solution template**

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| | **Sl.No** | **Parameter** | **Description** | | --- | --- | --- | |  |  |  | | 1 | **Application Name** | SmartSDLC - Smart Software Development Life Cycle Language Assistant | | 2 | **Core AI Model** | IBM Granite 3.3-2B-Instruct from Hugging Face Transformers | | 3 | **Deployment Platform** | Google Colab with Gradio Interface | | 4 | **Primary Language** | Python 3.8+ | | 5 | **Main Framework** | Gradio for web interface, Transformers for model integration | | 6 | **Model Architecture** | Transformer-based instruction-tuned language model (2B parameters) | | 7 | **Model Loading Method** | AutoTokenizer and AutoModelForCausalLM from transformers library | | 8 | **Language Detection Engine** | langid.py library for automatic language identification | | 9 | **Supported Languages** | English, Spanish, French, German, Italian, Portuguese (6 major languages) | | 10 | **Grammar Correction Module** | Custom prompting system using IBM Granite model | | 11 | **Spell Check Integration** | Built-in correction via model + custom validation logic | | 12 | **Text Analysis Engine** | Custom Python functions for linguistic metrics calculation | | 13 | **Visualization Library** | Matplotlib and Plotly for charts and graphs | | 14 | **Exercise Generation** | Prompt-based system generating grammar, sentence formation, and verb tense exercises | | 15 | **Real-time Processing** | Gradio's live interface with instant feedback capability | | 16 | **Output Format** | Structured response with corrections, explanations, and confidence scores | | 17 | **Memory Management** | Optimized for Colab's GPU/CPU resources with efficient tokenization | | 18 | **User Interface Components** | Text input, dropdown menus, tabs, progress bars, and interactive charts | | 19 | **Metrics Calculation** | Word count, average word length, sentence complexity, readability scores | | 20 | **Chart Types** | Bar charts for metrics, radar charts for language competency visualization | | 21 | **Language Confidence Score** | Percentage-based confidence from langid detection algorithm | | 22 | **Exercise Categories** | Grammar Practice, Sentence Formation, Verb Tense Exercises with difficulty levels | | 23 | **Answer Key System** | Comprehensive explanations with examples for each exercise | | 24 | **Error Handling** | Robust exception handling for model loading, API calls, and user input | | 25 | **Performance Optimization** | Batch processing, caching mechanisms, and efficient prompt engineering | | 26 | **Input Validation** | Text length limits, language verification, and sanitization | | 27 | **Output Formatting** | Markdown-styled responses with highlighted corrections and structured explanations | | 28 | **Interactive Features** | Real-time text analysis, dynamic chart updates, and progressive learning paths | | 29 | **Scalability Design** | Modular architecture allowing easy addition of new languages and features | | 30 | **Data Privacy** | Local processing in Colab environment, no external data storage | | 31 | **Dependencies** | transformers, torch, gradio, matplotlib, plotly, langid, numpy, pandas | | 32 | **Model Quantization** | Optional 8-bit quantization for memory efficiency on Colab | | 33 | **Prompt Engineering** | Carefully crafted system prompts for each functionality (correction, exercises, analysis) | | 34 | **Multi-tab Interface** | Separate tabs for corrections, exercises, analysis, and language detection | | 35 | **Progress Tracking** | Visual progress indicators and competency scoring system | | 36 | **Custom CSS Styling** | Enhanced UI with modern design elements and responsive layout | | 37 | **Error Categories** | Grammar, spelling, punctuation, style, and syntax error classification | | 38 | **Explanation System** | Detailed linguistic explanations with rule references and examples | | 39 | **Exercise Difficulty** | Beginner, Intermediate, Advanced levels with adaptive complexity | | 40 | **Competency Assessment** | Multi-dimensional scoring across different language skills | | 41 | **Real-time Feedback** | Instant corrections and suggestions as user types | | 42 | **Language Learning Path** | Structured progression through different skill levels | | 43 | **Export Functionality** | Option to download analysis reports and exercise results | | 44 | **Accessibility Features** | Screen reader support, keyboard navigation, and high contrast options | | 45 | **Mobile Responsiveness** | Gradio interface optimized for mobile and tablet devices | | 46 | **Session Management** | Temporary storage of user progress within Colab session | | 47 | **API Integration** | Modular design allowing future integration with external language APIs | | 48 | **Testing Framework** | Built-in validation tests for each module and functionality | | 49 | **Documentation** | Comprehensive inline comments and user guide integration | | 50 | **Version Control** | Structured codebase with clear module separation and versioning | |