PROJECT REPORT

TITLE: SMART SDLC – AI-POWERED SOFTWARE-DEVELOPMENT-LIFE-CYCLE ASSISTANT USING IBM GRANITE

1. Introduction

SmartSDLC is an AI-powered language-learning assistant designed to provide real-time grammar correction, multilingual exercises, text analytics, and visual feedback. It supports six major languages and aims to enhance writing fluency and comprehension by combining generative AI with user-centric design.

PURPOSE

The primary goal is to empower language learners with instant, accurate corrections and exercises, coupled with clear explanations and visual insights—bridging the gap between self-study and guided learning through an accessible, scalable tool.

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2. Ideation Phase

2.1 Problem Statement

Learners often struggle to find instant, multilingual feedback that corrects grammar, explains errors, and offers targeted practice, especially for less-commonly supported languages.

2.2 Empathy Map Canvas

We mapped the Learner persona across four fields:

- Says: “I’m unsure how to fix that sentence.”
- Thinks: “I need help with verb tenses.”

- Does: Attempts writing exercises online.
- Feels: Frustrated by slow or incomplete guidance.
  Empathy mapping helps focus on learner pain points and requriments

Brainstorming

Identified solutions: real-time correction, multilingual exercises, performance visualization, language detection, and a user-friendly interface.

Requirement Analysis

Functional and non-functional needs were distilled from user stories and ideation insights, clarifying MVP scope.

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3. Customer Journey Map

Outlined user flow: Launch app → Input text/select exercise → Receive instant correction/exercise → View explanations and charts → Iterate writing. Identified UX optimization opportunities at each stage (e.g., feedback clarity, correction speed).

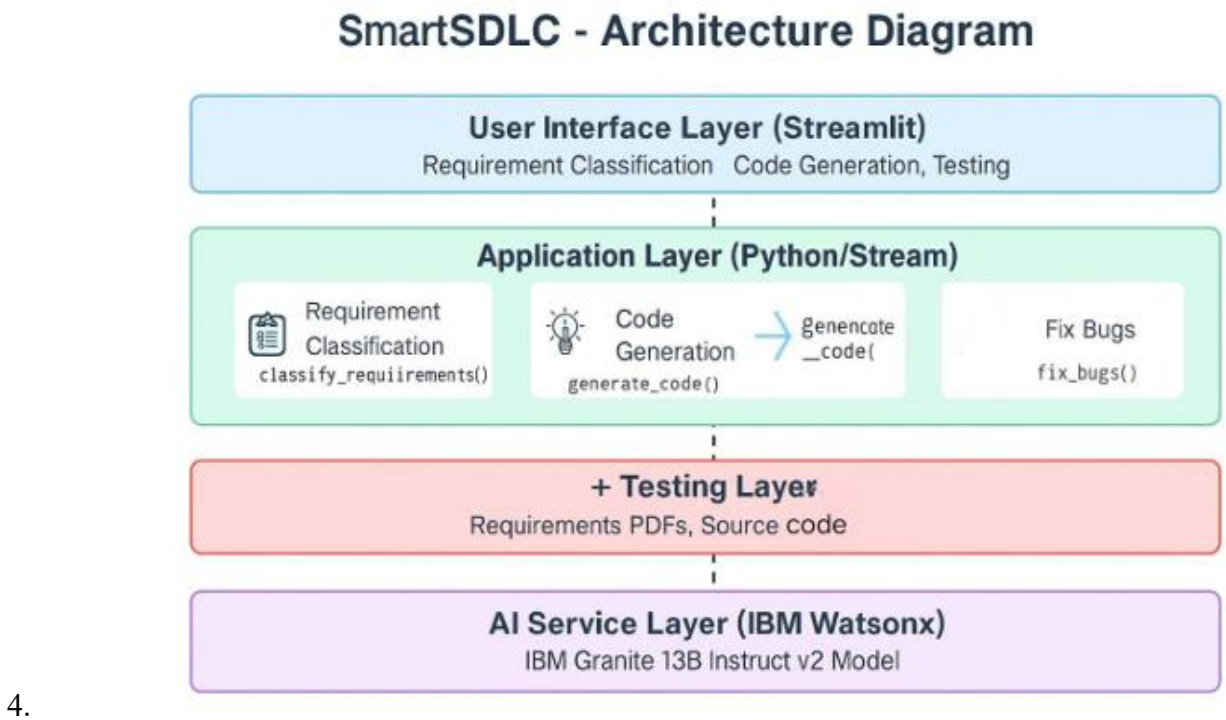
Session Requirements

Each session preserves state: identified language, selected exercise type, text history, and performance metrics, ensuring context continuity.

Data Flow Diagram

Level 1 flow:

1. User enters text → langid module detects language → system routes to either correction or exercise module.

2. Text sent to IBM Granite model via HF Transformers; responses cached.
3. Model output is post-processed: corrections + explanations, metrics calculated, charts generated, and results rendered via Gradio UI.
4. 

Technology Stack

Outlined in a modular stack table:

- UI & Hosting: Gradio, Google Colab, ngrok
- Language Detection: langid
- Model Inference: IBM Granite 3.3-2B with Transformers/PyTorch/Accelerate, quantized GGUF variants
- Caching: In-memory lru_cache

- Visualization: Matplotlib / Plotly
- API & Deployment: Optional FastAPI, Docker, Redis
- Logging & Monitoring: Python logging, Prometheus/Grafana (optional)

Project Design

4.1 Problem–Solution Fit

Learner challenges map to immediate fixes, guided exercises, and comprehension tools—SmartSDLC addresses all by integrating help with explanation and visual feedback**.**

Proposed Solution

A cloud-hosted Gradio app using Granite for intelligent corrections and exercises, transforming text into learning experiences with analytics and visuals.

Solution Architecture

Follows a layered architecture: Input → Detection → Inference → Analysis & Visualization → UI rendering, with caching and deployment flexibility.

Project Planning and Scheduling

A rough roadmap:

- Sprint 1: Setup Colab environment, Gradio interface, language detection
- Sprint 2: Model integration (Granite), correction workflow
- Sprint 3: Exercise modules and caching

- Sprint 4: Visualization layer and testing
- Sprint 5: Deployment tooling (ngrok, Docker, FastAPI)
- Sprint 6: Performance optimization, monitoring, documentation

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Functional and Performance Testing

- Functional tests: Grammar correction, multilingual detection, exercises, error handling
- Performance metrics: Cold-start <10 s, cached inference <2 s, detection confidence ≥90% (noted Arabic ~85%)
- Edge cases: Empty/gibberish inputs produce user-friendly feedback; cache mechanism ensures low latency

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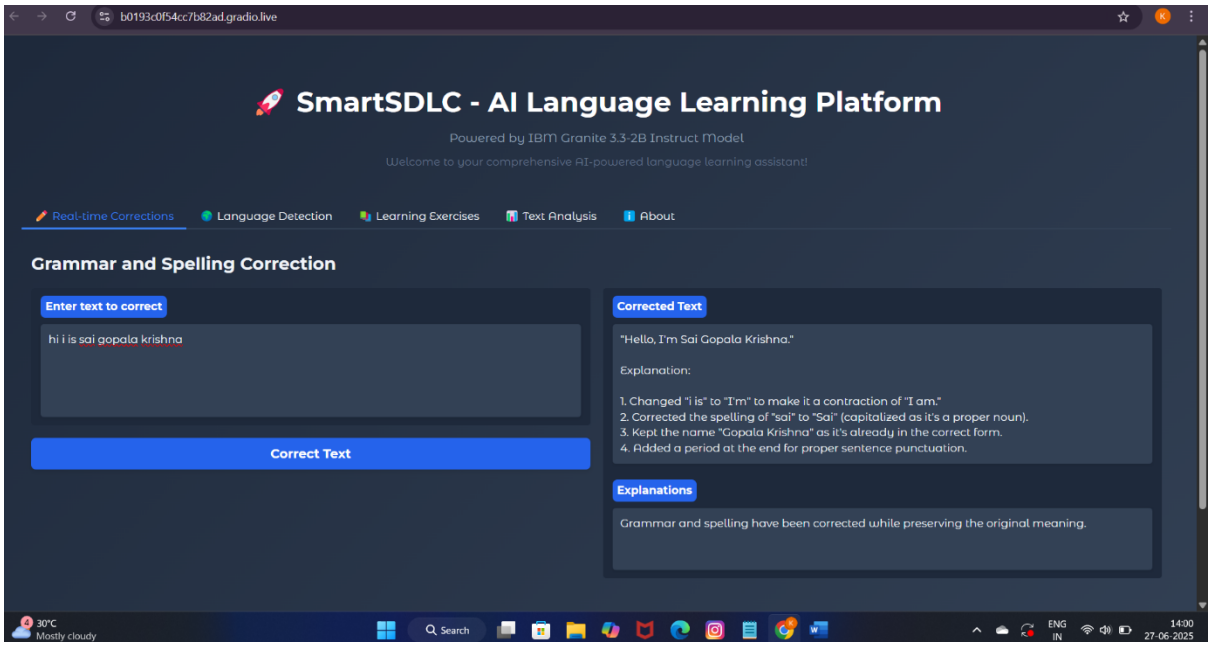
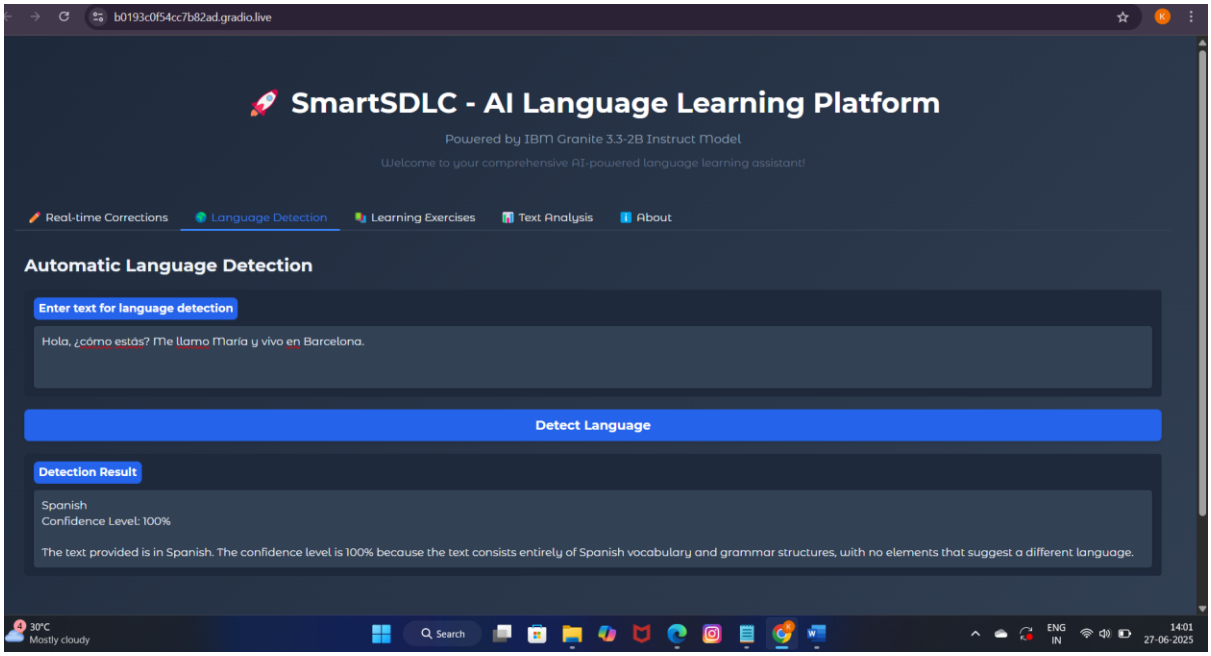
RESULTS:

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SmartSDLC - AI Language Learning Platform
Powered by IBM Granite 3.3-2B Instruct Model
Welcome to your comprehensive AI-powered language learning assistant!
Real-time Corrections
Language Detection
Learning Exercises
Text Analysis
About
Automatic Language Detection
Enter text for language detection
Hola, ¿cómo estás? Me llamo María y vivo en Barcelona.
Detect Language
Detection Result
Spanish
Confidence Level: 100%
The text provided is in Spanish. The confidence level is 100% because the text consists entirely of Spanish vocabulary and grammar structures, with no elements that suggest a different language.
30°C
Mostly cloudy
Search
ENG
IN
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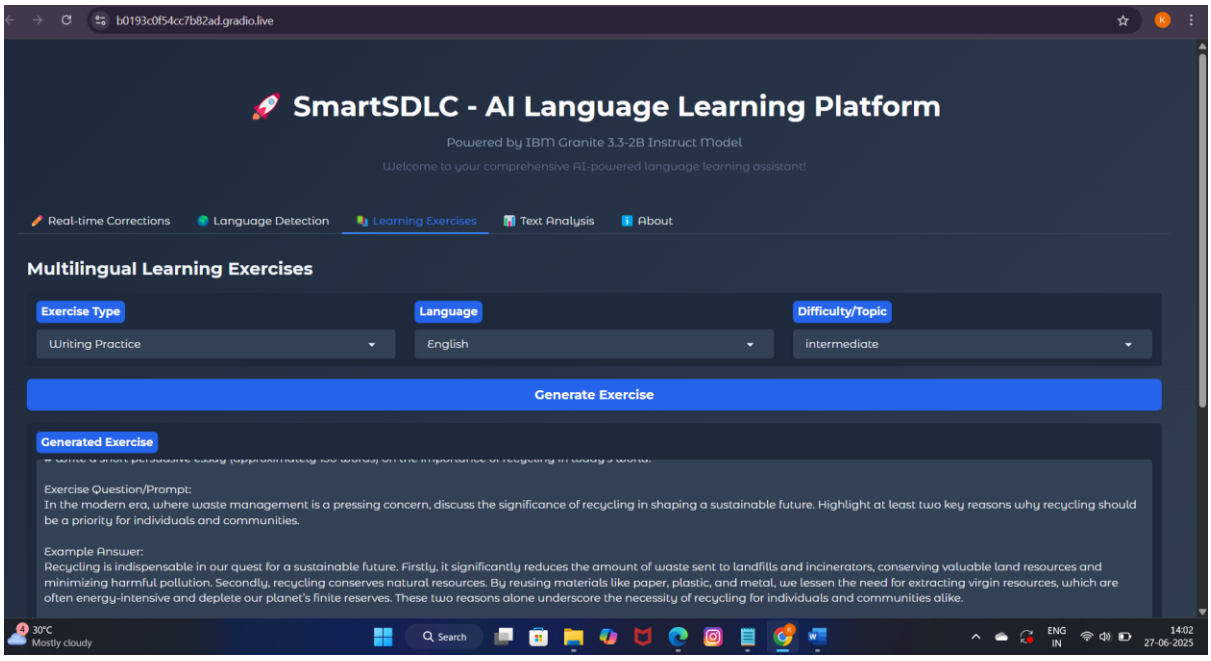
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SmartSDLC - AI Language Learning Platform
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Welcome to your comprehensive AI-powered language learning assistant!
Real-time Corrections
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Learning Exercises
Text Analysis
About
Multilingual Learning Exercises
Exercise Type
Writing Practice
Language
English
Difficulty/Topic
intermediate
Generate Exercise
Generated Exercise
Exercise Question/Prompt:
In the modern era, where waste management is a pressing concern, discuss the significance of recycling in shaping a sustainable future. Highlight at least two key reasons why recycling should be a priority for individuals and communities.
Example Answer:
Recycling is indispensable in our quest for a sustainable future. Firstly, it significantly reduces the amount of waste sent to landfills and incinerators, conserving valuable land resources and minimizing harmful pollution. Secondly, recycling conserves natural resources. By reusing materials like paper, plastic, and metal, we lessen the need for extracting virgin resources, which are often energy-intensive and deplete our planet's finite reserves. These two reasons alone underscore the necessity of recycling for individuals and communities alike.
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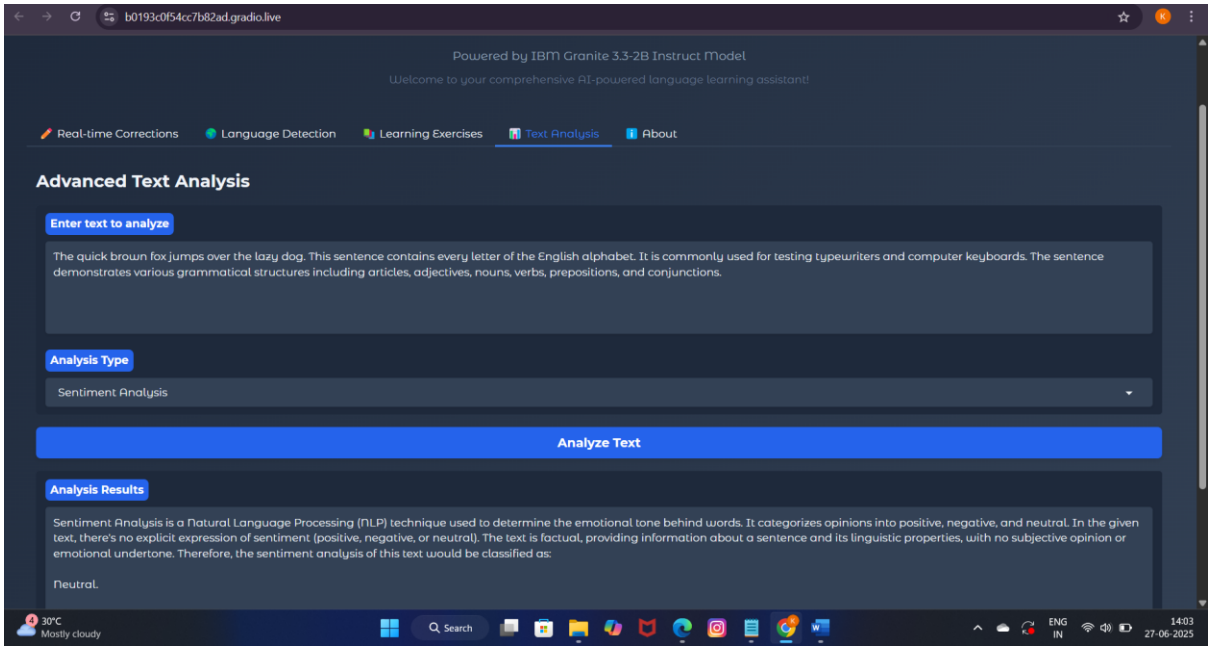

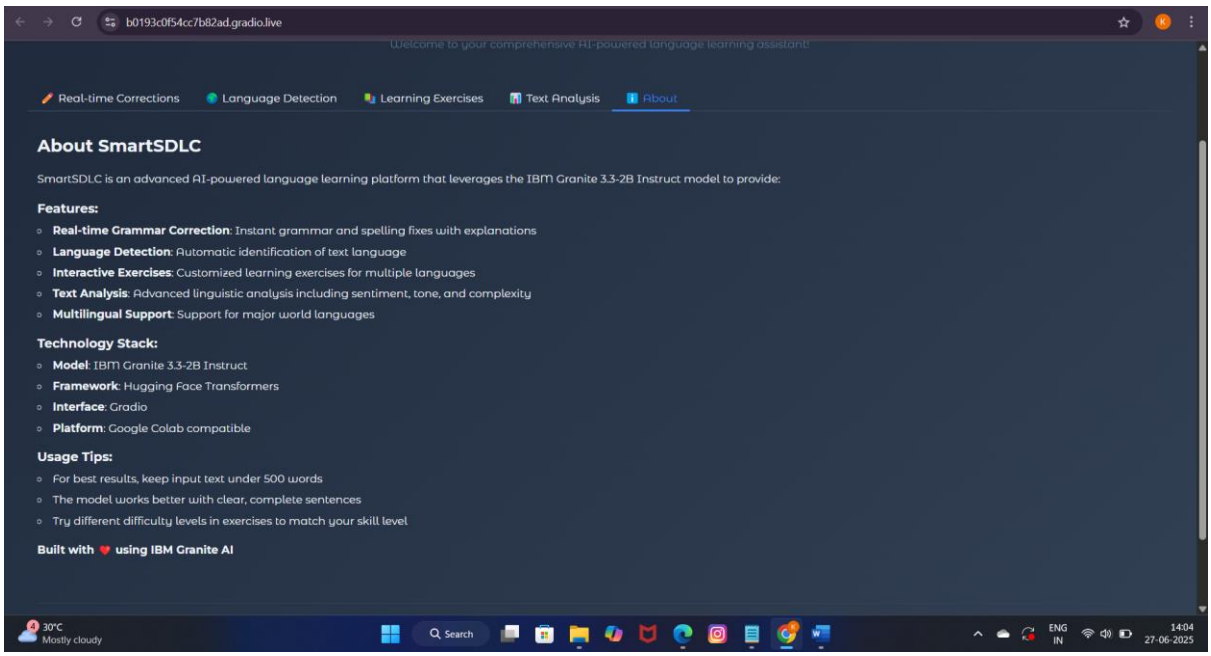

Advantages and Disadvantages

Advantages:

- Real-time, multilingual corrections + exercises
- Visual feedback enhances comprehension
- Modular and scalable design
- Uses open-source tools for rapid MVP

Disadvantages:

- Cold start latency (~10 sec)
- Model size demands significant RAM
- Language detection less accurate in niche languages
- Explanations can be technically dense without refinement

Conclusion

SmartSDLC offers a unique platform for language learning by integrating AI-powered correction, exercises, analytics, and visualization. The MVP enables rapid iteration, and its architecture supports expansion into production. Future work will focus on performance tuning, improving detection accuracy, and UX refinement.