Sustainable Smart City Assistant – Project Documentation

1. Introduction

Project Title: Sustainable Smart City Assistant Using IBM Granite LLM
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2. Project Overview ■

Purpose:
This project is a Sustainable Smart City Assistant web application built using Gradio and Hugging Face Transformers. It leverages the ibm-granite/granite-3.2-2b-instruct model to perform two primary functions: 1) Generating eco-friendly tips for sustainable living, and 2) Summarizing policy documents for urban planning and governance.

Users can upload a PDF document or enter environmental problems, and the assistant will provide specific solutions, policy insights, and sustainable practices. The application is designed to be accessible through an easy-to-use Gradio interface.

3. Architecture ■■

The application's architecture is a simple monolithic structure with clear separation of concerns, all running within a single Python script.

- **Frontend (UI):** Built using Gradio, provides a web-based, interactive dashboard with two tabs: "Eco Tips Generator" and "Policy Summarization".
- **Backend (Core Logic):** Powered by IBM Granite LLM (ibm-granite/granite-3.2-2b-instruct). Handles model loading, eco-tip generation, and policy summarization.
- **PDF Handling:** Implemented using PyPDF2 for text extraction from uploaded documents.
- **AI Interaction:** The generate_response function prepares inputs for the transformer model, executes inference, and decodes outputs into human-readable responses.

4. Setup Instructions ■■

1. Clone the repository (if applicable).
2. Create and activate a virtual environment.
3. Install dependencies:
pip install gradio torch transformers PyPDF2
4. Run the Python script to launch the application.

5. Folder Structure ■

/smart-city-assistant/
■ README.md
■ app.py # Main application script with all code

6. Running the Application ■■

1. Navigate to the project directory.
2. Run: python app.py
3. Access the interface at http://127.0.0.1:7860

7. API Documentation ■

The application uses Gradio as the interaction layer:
- **Eco Tips Generator:** Takes environmental keywords and returns actionable sustainable tips.
- **Policy Summarization:** Takes PDF/text input and generates a structured summary with key points.

8. User Interface ■

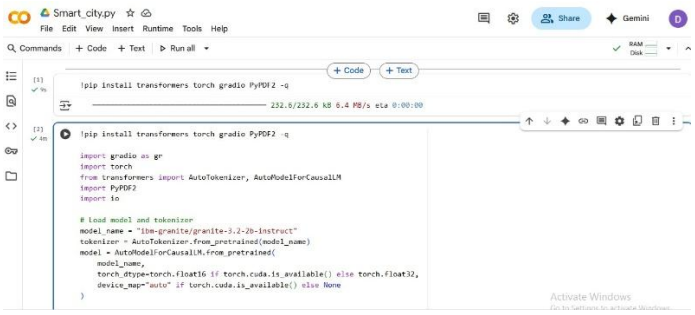
The UI is built with Gradio and has two tabs:
- Eco Tips Generator Tab: Input box for environmental problems and output box for generated solutions.
- Policy Summarization Tab: PDF upload/text input field and output box for summarized policy.

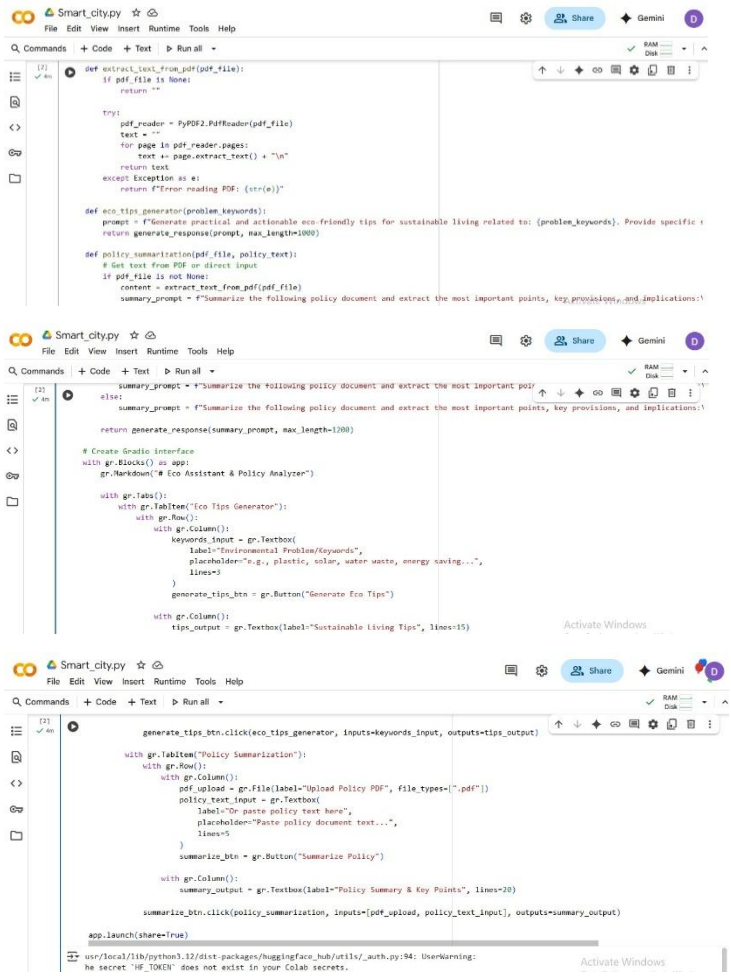
9. Testing ✔■

- Functional Testing: Ensure eco tips are generated correctly and policy summarization is accurate.
- Integration Testing: Verify UI buttons trigger correct backend functions.
- Performance Testing: Test response time for large PDFs and long prompts.
- Error Handling: Check invalid inputs such as non-PDF uploads or empty fields.

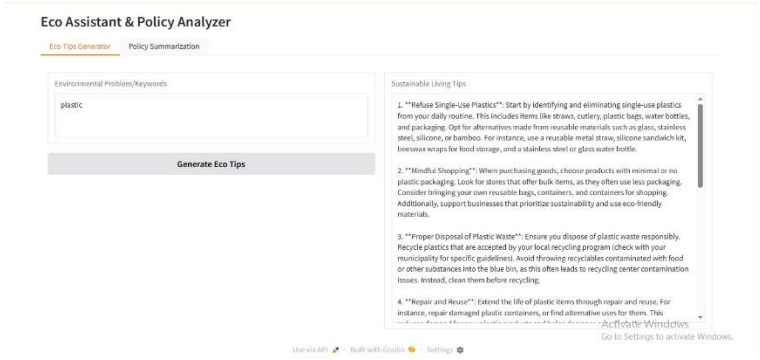
10. Screenshots ■

1. Input Screen (Eco Tips & Policy Summarization)





2. Output Screen (Generated Tips & Summarized Policies)



11. Conclusion ■

This project demonstrates how AI-powered assistants can support sustainable city initiatives by providing eco-friendly solutions and simplifying complex policy documents. By integrating IBM Granite LLM with Gradio, the assistant offers an interactive, user-friendly platform for both citizens and policymakers. The solution lays the groundwork for future expansion with features like real-time data monitoring and integration with IoT-enabled smart city systems.