SmartSDLC: AI-Enhanced Software Development Lifecycle

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1. Introduction:

GreenSpark AI is an eco-focused AI-powered project that leverages IBM Granite models to enhance the Software Development Lifecycle (SDLC). It automates requirement gathering, code generation, testing, deployment, and documentation, while also providing sustainability-focused solutions such as carbon footprint estimation, policy summarization, eco-friendly lifestyle tips, and green technology ideas.

2. Project Overview:

Purpose: The purpose of GreenSpark AI is to integrate AI-driven automation with eco-sustainability. It supports developers, researchers, and citizens in reducing environmental impact while demonstrating the power of SmartSDLC. Features: - EcoLife Guide: Generate eco-friendly lifestyle tips. - Policy Snapshot: Summarize environmental policy documents. - Carbon Meter: Estimate and suggest reduction for carbon footprint. - EcoTech Sparks: Recommend sustainable technology ideas.

3. Architecture:

Frontend: Gradio-based interactive UI Backend: Python with Hugging Face Transformers and Torch Model: IBM Granite 3.3-2B Instruct (Hugging Face) Deployment: Google Colab with GPU (T4) Version Control: GitHub for hosting and collaboration

4. Setup Instructions:

Prerequisites: - Python 3.9 or later - Install libraries: transformers, torch, gradio, pypdf - IBM Granite model access from Hugging Face - GPU-enabled runtime (Google Colab recommended) Steps: 1. Clone the repository 2. Install dependencies 3. Run the Python script 4. Launch the Gradio app 5. Interact with EcoLife, Policy Snapshot, Carbon Meter, and EcoTech modules

5. Folder Structure:

app/ – Core functions and logic ui/ – Gradio UI definitions models/ – Model integration with Hugging Face docs/ – Documentation and reports main.py – Entry point to run the project

6. Running the Application:

➢ Run the Python script ➢ Launch the Gradio interface in browser ➢ Navigate through tabs: EcoLife, Policy Snapshot, Carbon Meter, EcoTech ➢ Upload PDFs, enter activities, and generate responses

7. Module Documentation:

- Eco Tips Generator: Provides actionable eco-friendly suggestions. - Policy Summarization: Extracts and summarizes environmental policies from PDFs or text. - Carbon Footprint Estimator: Estimates monthly CO■ emissions and reduction strategies. - Green Tech Ideas: Suggests innovative sustainable technologies.

8. Authentication:

The current version does not include authentication. Future versions may implement role-based access and API key security for extended deployments.

9. User Interface:

The UI is built using Gradio with multiple tabs: - EcoLife Guide: Textbox input and AI-generated tips - Policy Snapshot: PDF upload/text input for summaries - Carbon Meter: Lifestyle activity input with footprint estimates - EcoTech Sparks: Sector/industry input for innovation ideas Additional features: Copy-to-clipboard buttons for outputs

10. Testing:

Testing includes: - Unit testing (functions and modules) - Manual testing of UI workflows - PDF text extraction validation - Edge case handling (invalid inputs, empty files)

11. Known Issues:

- Requires internet access to fetch model - Limited offline support - Performance depends on GPU availability - UI basic styling (can be improved)

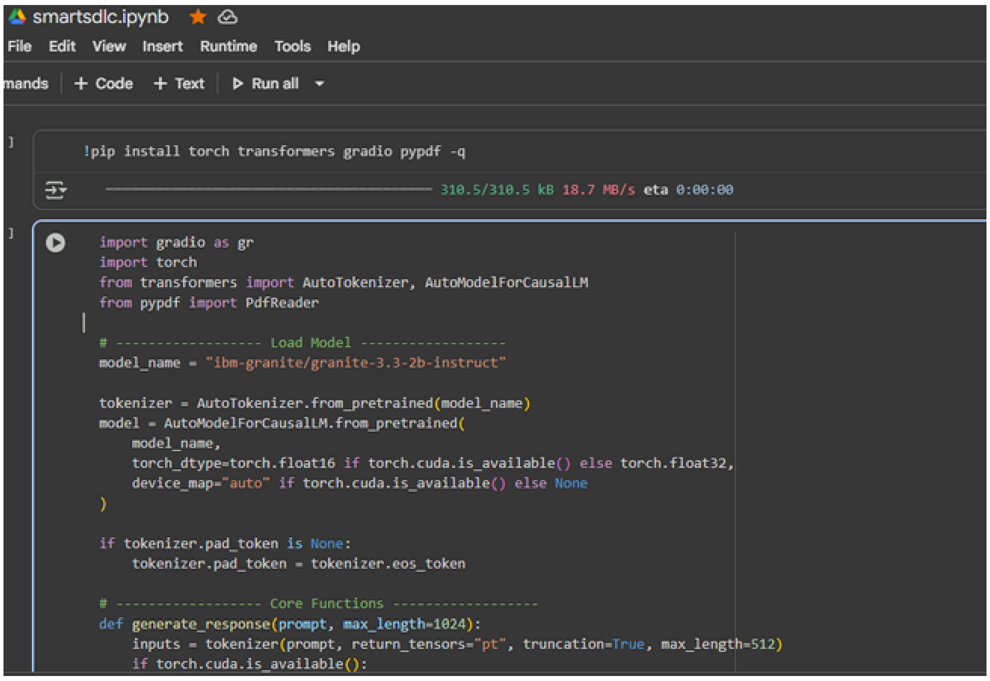
12. Future Enhancements:

- Mobile app version - Multi-language support - Voice-based eco-tips - IoT integration for real-time monitoring - Enhanced dashboards for visualization

13. Screenshots & Outputs:

[Insert screenshots of Gradio interface, sample outputs, and code execution here]

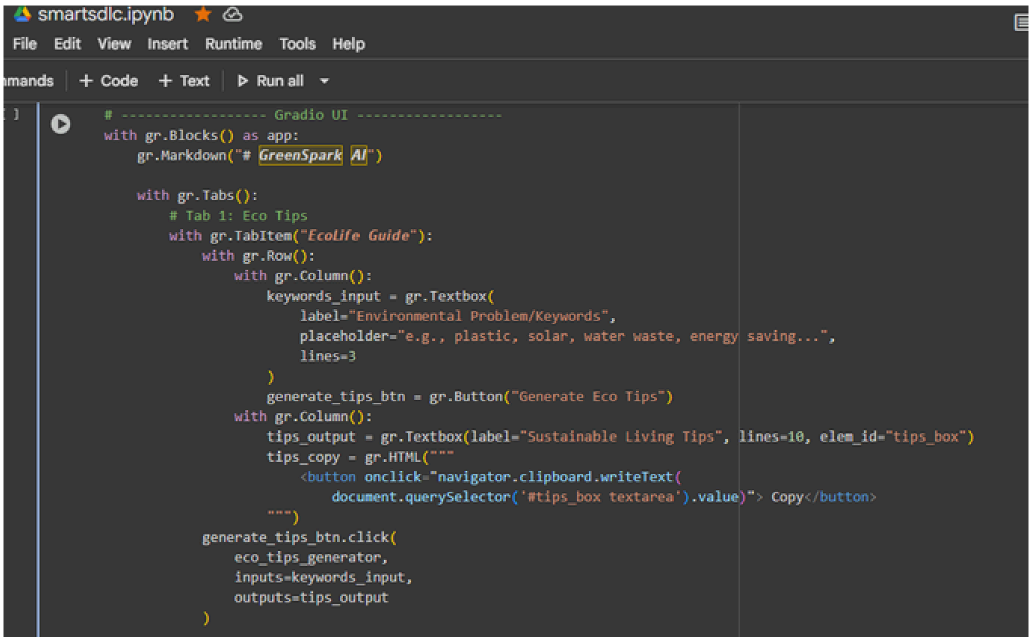
Program:


smartsdlc.ipynb
File Edit View Insert Runtime Tools Help
mands + Code + Text ▷ Run all

```
!pip install torch transformers gradio pypdf -q
```

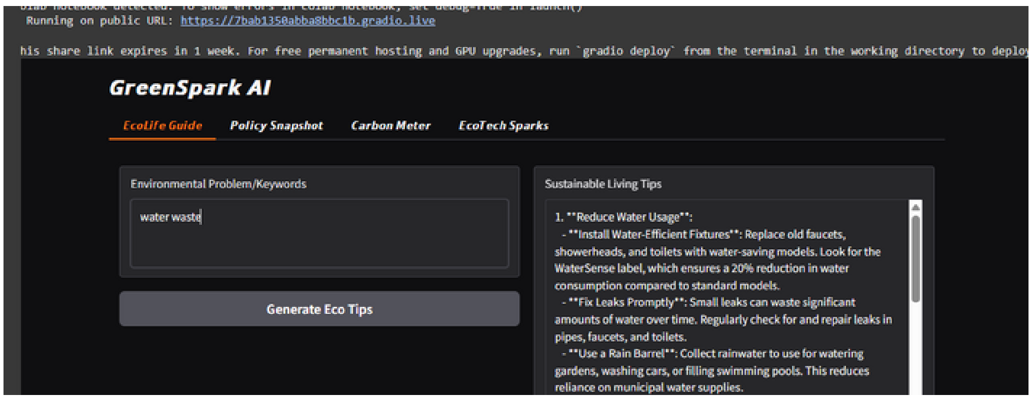
```
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 310.5/310.5 kB 18.7 MB/s eta 0:00:00
```

```python
import gradio as gr
import torch
from transformers import AutoTokenizer, AutoModelForCausalLM
from pypdf import PdfReader

# ------------------ Load Model ------------------
model_name = "ibm-granite/granite-3.3-2b-instruct"

tokenizer = AutoTokenizer.from_pretrained(model_name)
model = AutoModelForCausalLM.from_pretrained(
    model_name,
    torch_dtype=torch.float16 if torch.cuda.is_available() else torch.float32,
    device_map="auto" if torch.cuda.is_available() else None
)

if tokenizer.pad_token is None:
    tokenizer.pad_token = tokenizer.eos_token

# ------------------ Core Functions ------------------
def generate_response(prompt, max_length=1024):
    inputs = tokenizer(prompt, return_tensors="pt", truncation=True, max_length=512)
    if torch.cuda.is_available():
```



```python
# ----------------- Gradio UI -----------------
with gr.Blocks() as app:
    gr.Markdown("# GreenSpark AI")

    with gr.Tabs():
        # Tab 1: Eco Tips
        with gr.TabItem("EcoLife Guide"):
            with gr.Row():
                with gr.Column():
                    keywords_input = gr.Textbox(
                        label="Environmental Problem/Keywords",
                        placeholder="e.g., plastic, solar, water waste, energy saving...",
                        lines=3
                    )
                    generate_tips_btn = gr.Button("Generate Eco Tips")
                with gr.Column():
                    tips_output = gr.Textbox(label="Sustainable Living Tips", lines=10, elem_id="tips_box")
                    tips_copy = gr.HTML("""
                        <button onclick="navigator.clipboard.writeText(
                            document.querySelector('#tips_box textarea').value)"> Copy</button>
                    """)
            generate_tips_btn.click(
                eco_tips_generator,
                inputs=keywords_input,
                outputs=tips_output
            )
```

Output:

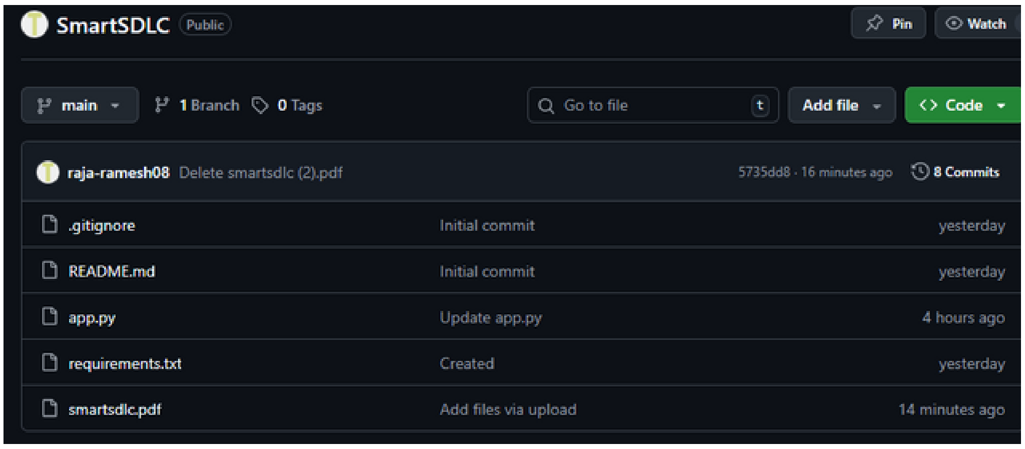


```
 Running on public URL: https://7bab1350abba8bbc1b.gradio.live

his share link expires in 1 week. For free permanent hosting and GPU upgrades, run `gradio deploy` from the terminal in the working directory to deploy
```

water waste

```
1. **Reduce Water Usage**:
  - **Install Water-Efficient Fixtures**: Replace old faucets, showerheads, and toilets with water-saving models. Look for the WaterSense label, which ensures a 20% reduction in water consumption compared to standard models.
  - **Fix Leaks Promptly**: Small leaks can waste significant amounts of water over time. Regularly check for and repair leaks in pipes, faucets, and toilets.
  - **Use a Rain Barrel**: Collect rainwater to use for watering gardens, washing cars, or filling swimming pools. This reduces reliance on municipal water supplies.
```

GitHub Repository:



raja-ramesh08 Delete smartsdlc (2).pdf — 5735dd8 · 16 minutes ago — 8 Commits

.gitignore	Initial commit	yesterday
README.md	Initial commit	yesterday
app.py	Update app.py	4 hours ago
requirements.txt	Created	yesterday
smartsdlc.pdf	Add files via upload	14 minutes ago