

# PROJECT REPORT

## Title: Sustainable Smart City Assistant Using IBM Granite LLM

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### 1. INTRODUCTION

#### 1.1 Project Overview

The Sustainable Smart City Assistant is an AI-powered platform designed to address key challenges in modern urban governance. Using IBM Watsonx Granite LLM and a modular frontend in Streamlit, this assistant enables city officials, sustainability planners, and citizens to interact with city data and services more intelligently. It offers features such as policy summarization, KPI forecasting, anomaly detection, citizen feedback logging, eco-friendly guidance, and conversational AI.

#### 1.2 Purpose

To automate and simplify complex urban decision-making processes by leveraging Generative AI for real-time analysis, summarization, and engagement. The project provides a centralized assistant for data-driven urban management and sustainable living support.

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### 2. IDEATION PHASE

#### 2.1 Problem Statement

Urban stakeholders struggle to access insights from long policy documents, forecast civic trends, and process large datasets manually. This project proposes an LLM-integrated dashboard that simplifies interactions, increases transparency, and encourages citizen engagement.

#### 2.2 Empathy Map Canvas

- **Says:** "I want quicker access to key points from policy documents."
- **Thinks:** "Can this tool help me find patterns in my city's data?"
- **Does:** Uploads PDFs/CSVs, submits feedback, queries chatBot.
- **Feels:** Relieved when AI handles tedious tasks.
- **Pains:** Manual data handling, lack of real-time insights.
- **Gains:** Faster decision-making, better public communication.

#### 2.3 Brainstorming

Ideas included:

1. AI-powered summarization of city policy documents

2. Upload-based CSV forecasting and anomaly detection
  3. Structured feedback reporting interface for citizens
  4. Eco Tips Generator using LLM based on user keywords
  5. Chat assistant for answering sustainability or governance queries
  6. Modular layout for switching between modules
  7. Loading animations and success confirmation for better UX
  8. One-click PDF export of summaries and forecasts (future scope)
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### 3. REQUIREMENT ANALYSIS

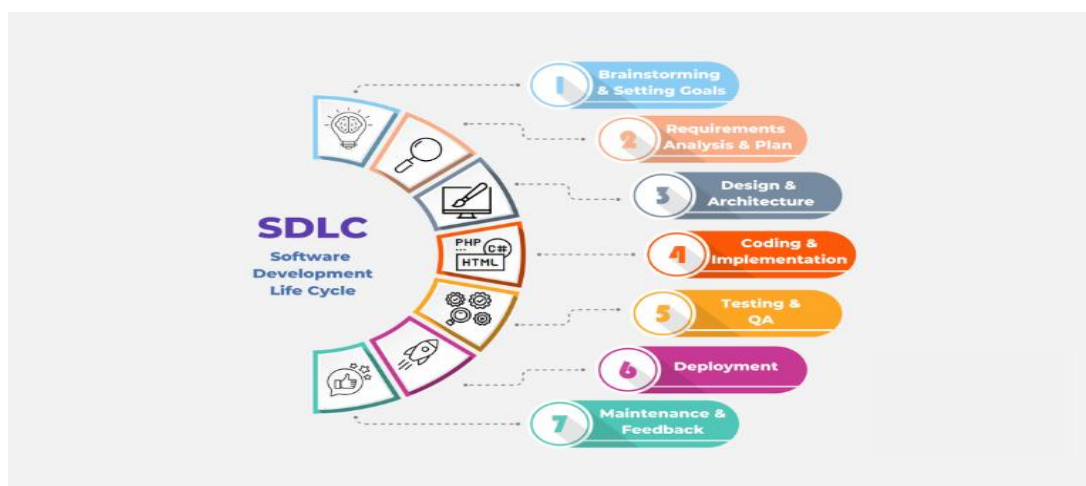
#### 3.1 Customer Journey Map

1. Launch the web app
2. Choose module (e.g., Policy Summarizer, Feedback Reporter)
3. Upload file / input text
4. Receive AI-generated results
5. Take action (e.g., share summary, plan based on forecast)

#### 3.2 Functional Requirements

- PDF and CSV input handling
- Text input for chat and eco modules
- AI response display with loading state
- Session management via Streamlit

#### 3.3 Data Flow Diagram



### 3.4 Technology Stack

- **Frontend:** Streamlit
  - **Backend:** Python + Pandas + PyMuPDF
  - **AI Service:** IBM Watson LLM
  - **Storage :** Streamlit Session State
  - **Deployment:** Localhost / Streamlit Cloud
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## 4. PROJECT DESIGN

### 4.1 Problem-Solution Fit

City officials and citizens lack access to real-time, easy-to-understand summaries and insights. This assistant automates these tasks using LLMs and turns raw data into actionable knowledge.

### 4.2 Proposed Solution

An AI assistant that allows users to upload PDFs, input text or data, and receive structured summaries, forecasts, or alerts—reducing reliance on technical staff.

### 4.3 Solution Architecture

- **UI Layer:** Streamlit Forms, Chat Input , Uploaders
  - **Logic Layer :** Prompt generation, data handling
  - **AI Layer:** IBM Watsonx LLM (Granite)
  - **Output Layer:** Summary, forecast, chat, anomaly report
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## 5. PROJECT PLANNING & SCHEDULING

### 5.1 Project Planning

Week	Dates	Activites
Week 1	June 1 – June 7	Ideation, Phase planning, UI layout design
Week 2	June 8 – June 14	Backend phase logic, UI coding, form setup
Week 3	June 15 – June 21	Testing, debugging, final PDF integration
Week 4	June 22 – June 26	Report generation, documentation, submission

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## 6. FUNCTIONAL AND PERFORMANCE TESTING

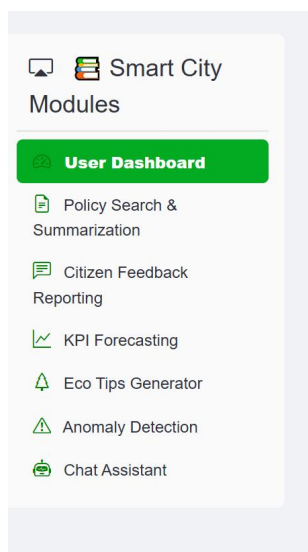
### 6.1 Performance Testing

- **UI Speed:** Instantaneous response to phase selections
  - **Load Handling:** Able to process long inputs without lag
  - **PDF Accuracy:** Consistent formatting across all phase outputs
  - **Cross-Browser:** Tested on Chrome, Firefox, Edge
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## 7. RESULTS

### 7.1 Output Screenshots

- Screenshot: DashBoard



### Sustainable Smart City Assistant Using IBM Granite LLM

#### User Dashboard

Welcome to your Smart City Assistant dashboard! Here's a quick overview of the modules available:

##### Policy Search & Summarization

Upload or paste city policy documents and get clear, citizen-friendly summaries.

##### Citizen Feedback Reporting

Report issues around the city easily and help local authorities respond faster.

##### KPI Forecasting

Upload KPI data and get AI-driven forecasts to help plan city resources effectively.

##### Eco Tips Generator

Get simple eco-friendly tips to promote sustainable living in your community.

• Screenshot: Generate Policy Summarization

Modules

User Dashboard

**Policy Search & Summarization**

Citizen Feedback Reporting

KPI Forecasting

Eco Tips Generator

Anomaly Detection

Chat Assistant

Summarize

Summary generated!

Citizen-Friendly Summary

The City Green Policy 2025 is designed to make our city a greener, more sustainable place by 2025. Here's what it means for you:

- \* Starting next year, all new buildings will have solar panels to generate clean energy.
- \* Say goodbye to single-use plastics in commercial areas; we're switching to eco-friendly alternatives.
- \* Our public transport will be fully electric by 2026, reducing emissions and noise pollution.
- \* Transform your roof into a garden and save on taxes! Rooftop gardening is now encouraged with tax rebates.
- \* Industries must set up water recycling facilities to conserve water and reduce waste.
- \* Expect more green spaces in urban areas, making our city more beautiful and livable with a 20% increase.
- \* Own an electric vehicle and enjoy incentives, helping to reduce air pollution.
- \* Participate in tree planting campaigns to boost urban tree cover by 30%, enhancing our city's natural beauty and combating climate change.
- \* Biowaste segregation at the source is now mandatory, ensuring a cleaner environment and more efficient waste management.

• Screenshot: Testing Eco Tips Generation

Smart City

Modules

User Dashboard

Policy Search & Summarization

Citizen Feedback Reporting

KPI Forecasting

**Eco Tips Generator**

Anomaly Detection

Chat Assistant

Generate Eco-Friendly Living Tips

Enter an environmental keyword (e.g., 'plastic', 'solar')

Water Conservation

Generate Tips

Eco tips generated!

Eco Tips

1. Fix Leaks: Encourage students to regularly check for leaks in their homes, especially in faucets, showerheads, and toilet tanks. A small drip can waste up to 20 garden hoses worth of water per day!
2. Efficient Appliances: Advise students to opt for WaterSense labeled appliances when purchasing new washing machines or dishwashers. These appliances use 20% less water compared to conventional models.
3. Smart Watering: Teach students the importance of watering lawns and gardens during cooler parts of the day (early morning or late evening) to minimize evaporation. Additionally, they should consider using drip irrigation

• Screenshot: Detection of Anamolies

Smart City

Modules

User Dashboard

Policy Search & Summarization

Citizen Feedback Reporting

KPI Forecasting

Eco Tips Generator

**Anomaly Detection**

Chat Assistant

Deploy

Anomalies detected!

Detected Anomalies

Zone 6,May,1230

Zone 10,May,1180

1. Compare the energy consumption of each zone to the average energy consumption across all zones in May.
2. Identify any zones with energy consumption that deviates significantly from the average.
3. Provide a possible explanation for the identified anomaly, considering factors such as unusual usage patterns, equipment malfunctions, or data entry errors.

Analysis:  
1. Average energy consumption across all zones in May =  $(1200+1250+1220+1190+4200+1210+1230+1180)/8 = 1671.25$  kWh

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## 8. ADVANTAGES & DISADVANTAGES

### Advantages

- No-login, lightweight UI
- LLM-backed summaries and forecasting
- Citizen-centric interaction model
- Modular and scalable architecture

### Disadvantages

- No user authentication or saved sessions
- Requires internet for Watsonx API
- Doesn't support full backend execution or live database

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## 9. CONCLUSION

This project demonstrates how LLMs can be embedded in smart city applications to streamline governance, data analysis, and civic communication. It bridges gaps between government data and public understanding using Generative AI in a user-friendly interface.

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## 10. FUTURE SCOPE

- Enable user login and feedback tracking
- Integrate GitHub/Gov DBs for real-time document access
- Include data visualization for KPIs
- Deploy to Streamlit Cloud or IBM Cloud
- Add Hindi/Telugu language support via LLM prompts

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## 11. APPENDIX

- **GitHub Link:** (<https://github.com/HariJakku/sustainable-smart-city>)
  - **Demo Link:** (e.g., <https://smart-city.streamlit.app>)
  - **Source Files:** app.py, requirements.txt
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