PHASE-1

BRAINSTORM & IDEATION PHASE

Brainstorm & Idea Prioritization

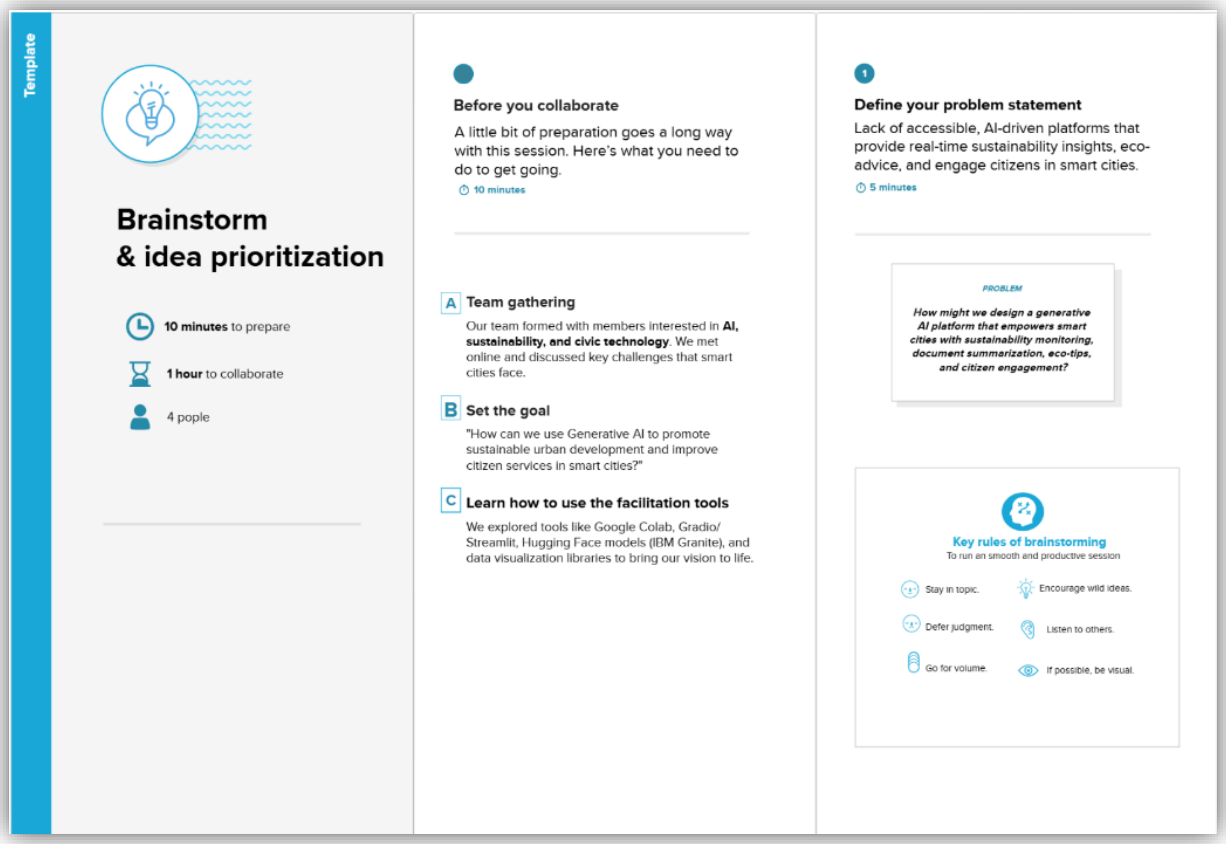
Date	25 JUNE 2025
Team ID	LTVIP2025TMID31378
Project Name	Sustainable Smart City
Maximum Marks	4 Marks

Brainstorm & Idea Prioritization:

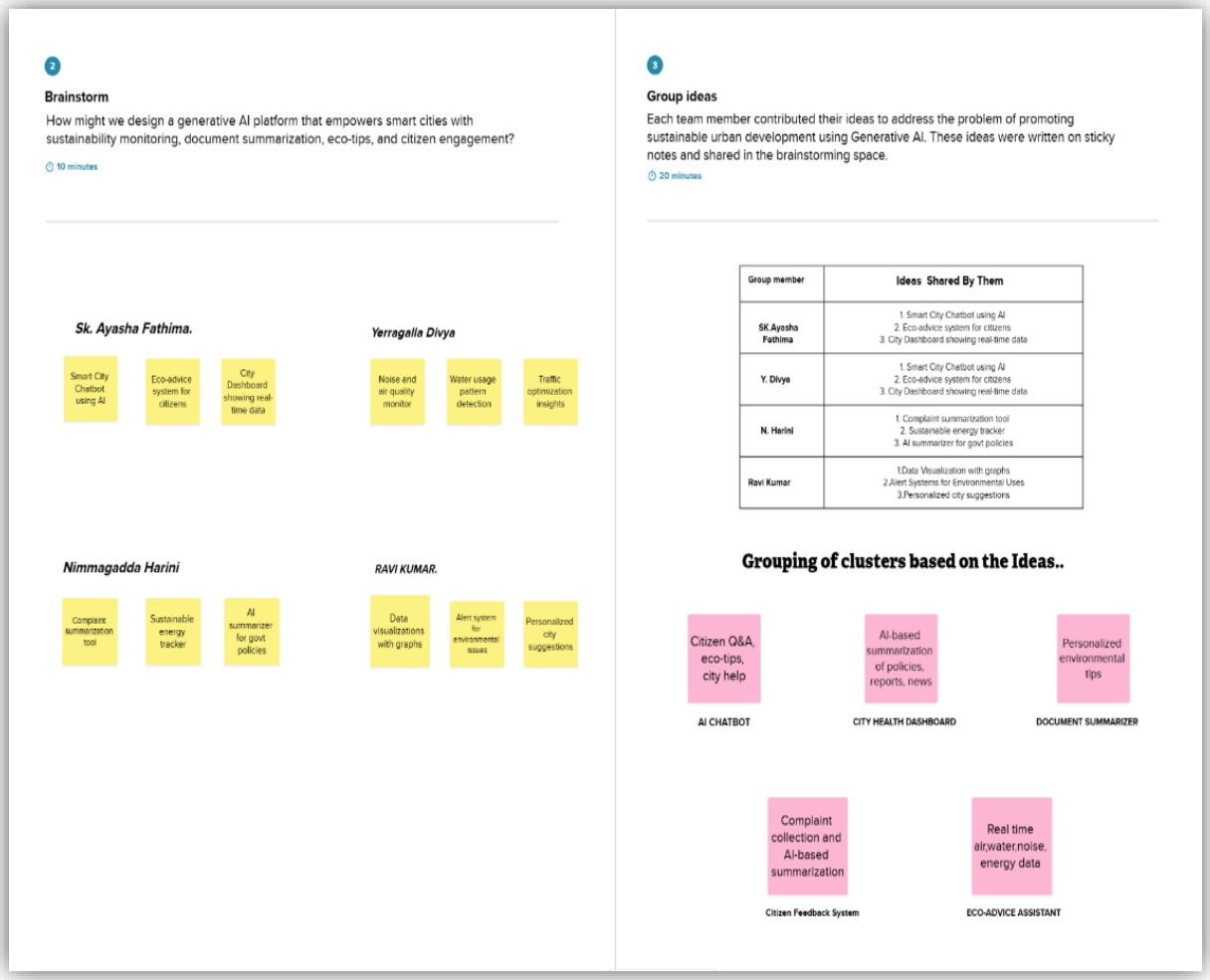
Brainstorming allowed our team to openly explore the pressing issues around smart city sustainability. We focused on building a solution that leverages Generative AI to improve urban planning, citizen engagement, and eco-conscious living.

During the session, we prioritized impactful and feasible ideas over just volume. Everyone contributed their ideas, from AI tools to real-world applications like dashboards and feedback systems. This led us to develop Sustainable Smart City, a one-stop platform integrating real-time city data, document summarization, eco-advice, and chatbot assistance for queries of people in the city. We used this process to creatively think beyond standard approaches and identify a unique blend of AI + sustainability for Smart cities.

STEP-1: Team Gathering, Collaboration and Select the Problem Statement



Step-2: Brainstorm, Idea Listing and Grouping



2

Brainstorm

How might we design a generative AI platform that empowers smart cities with sustainability monitoring, document summarization, eco-tips, and citizen engagement?

10 minutes

Sk. Ayasha Fathima.

Smart City Chatbot using AI

Eco-advice system for citizens

City Dashboard showing real-time data

Yerragalla Divya

Noise and air quality monitor

Water usage pattern detection

Traffic optimization insights

Nimmagadda Harini

Complaint summarization tool

Sustainable energy tracker

AI summarizer for govt policies

RAVI KUMAR.

Data visualizations with graphs

Alert system for environmental issues

Personalized city suggestions

3

Group ideas

Each team member contributed their ideas to address the problem of promoting sustainable urban development using Generative AI. These ideas were written on sticky notes and shared in the brainstorming space.

20 minutes

Group member	Ideas Shared By Them
SK.Ayesha Fathima	1. Smart City Chatbot using AI 2. Eco-advice system for citizens 3. City Dashboard showing real-time data
Y. Divya	1. Smart City Chatbot using AI 2. Eco-advice system for citizens 3. City Dashboard showing real-time data
N. Harini	1. Complaint summarization tool 2. Sustainable energy tracker 3. AI summarizer for govt policies
Ravi Kumar	1.Data Visualization with graphs 2.Alert Systems for Environmental Uses 3.Personalized city suggestions

Grouping of clusters based on the Ideas..

Citizen Q&A, eco-tips, city help

AI CHATBOT

AI-based summarization of policies, reports, news

CITY HEALTH DASHBOARD

Personalized environmental tips

DOCUMENT SUMMARIZER

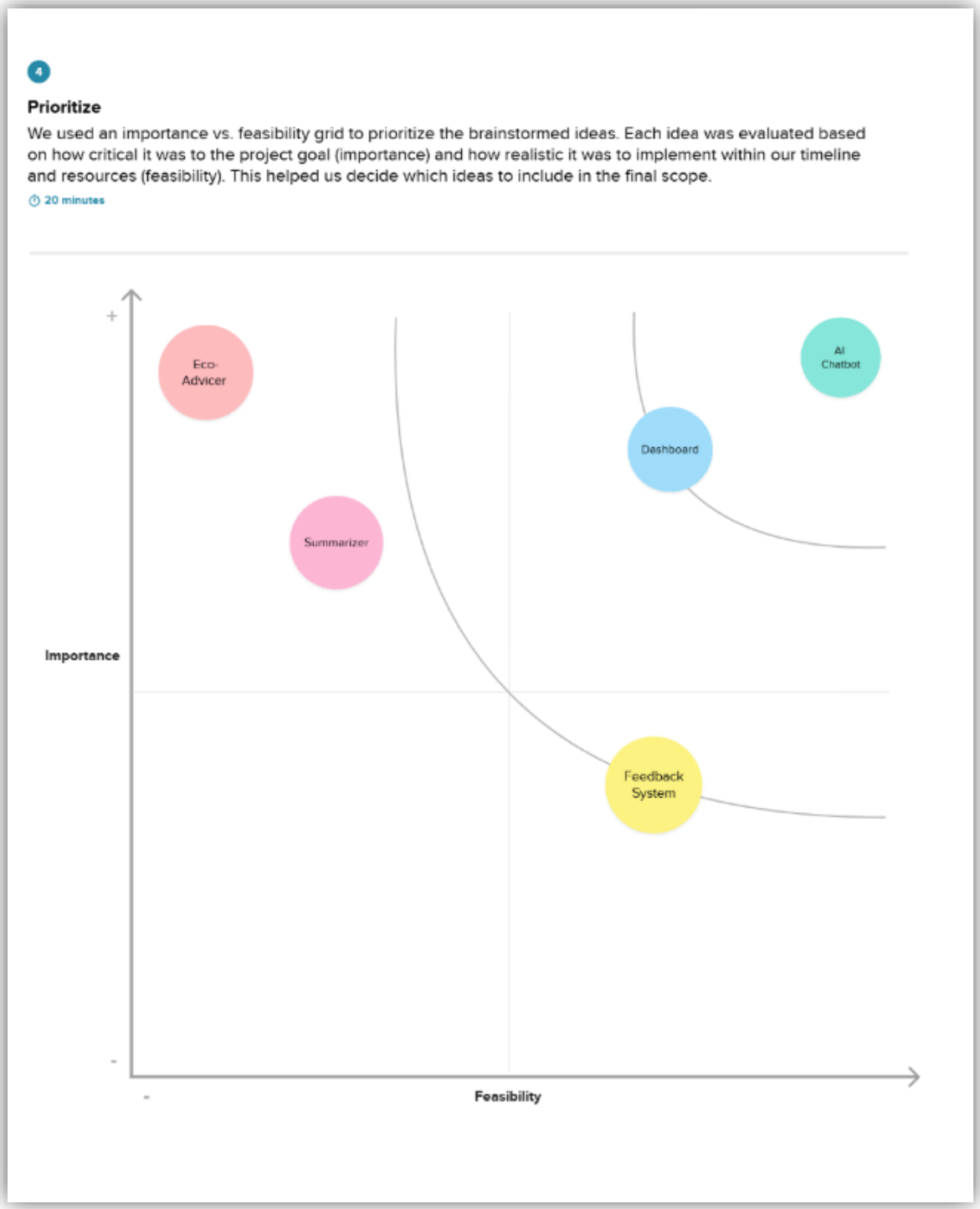
Complaint collection and AI-based summarization

Citizen Feedback System

Real time air,water,noise, energy data

ECO-ADVICE ASSISTANT

Step-3: Idea Prioritization



Define the Problem Statements

Date	25 JUNE 2025
Team ID	LTVIP2025TMID31378
Project Name	Sustainable Smart City Assistant
Maximum Marks	2 Marks

Customer Problem Statement:

I am a citizen.

I'm trying to access sustainability insights, eco tips, forecasts, and policy summaries.

But I don't have a smart, AI-powered assistant to help me make informed, timely decisions.

Because most city systems are disconnected, manual, and hard to understand.

Which makes me feel frustrated, unsupported, and worried about the city's future.

A well-articulated customer problem statement allows you and your team to find the ideal solution for the challenges your customers face. Throughout the process, you'll also be able to empathize with your customers, which helps you better understand how they perceive your product or service.

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	a city planner or civic administrator.	monitor urban KPIs like water usage, air quality, and energy consumption.	I don't have a centralized AI system to forecast trends or summarize data.	current systems are manual, slow, and not integrated.	overwhelmed and under-equipped to make smart decisions.
PS-2	a citizen interested in sustainability.	get eco tips and submit feedback to my city.	there's no interactive tool that listens or guides me.	existing platforms are not AI-powered or user-friendly.	ignored and disconnected from city sustainability efforts.

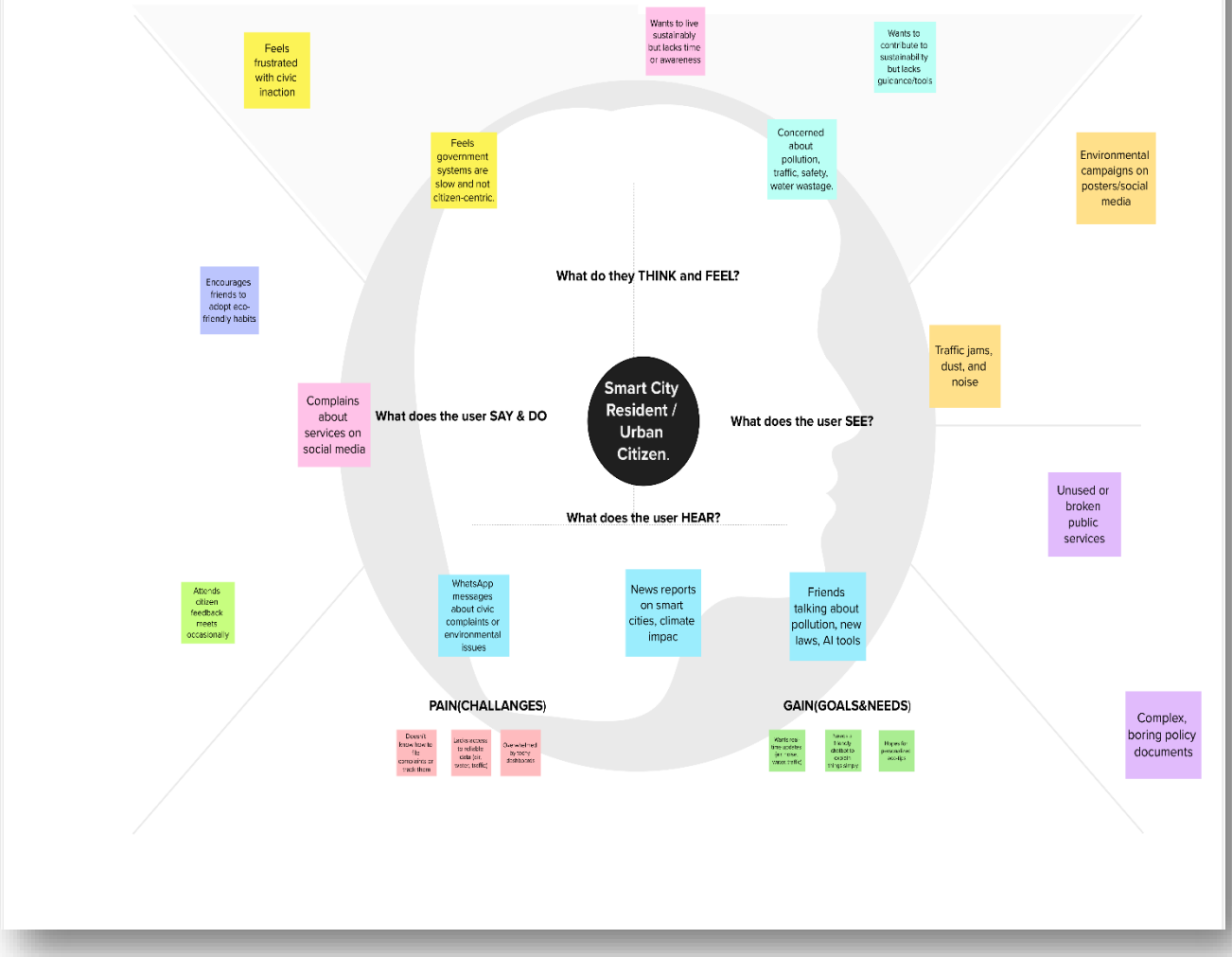
Empathize & Discover

Date	25 JUNE 2025
Team ID	LTVIP2025TMID31378
Project Name	Sustainable Smart City
Maximum Marks	4 Marks

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviors, needs, feelings, and attitudes.

It is a useful tool to help teams better understand their users — in our case, **urban citizens** living in smart cities. Creating an effective AI solution requires deeply understanding the real problems faced by these individuals, and how they experience their environment on a daily basis.

The process of creating the empathy map helped our team step into the shoes of a city resident. We reflected on their challenges, motivations, and goals — especially related to sustainability, civic engagement, and access to real-time city information. This activity helped shape **Sustainable Smart City** to be more human-centered, meaningful, and impactful.


Feels frustrated with civic inaction
Wants to live sustainably but lacks time or awareness
Wants to contribute to sustainabil by but lacks guidance/tools
Feels government systems are slow and not citizen-centric.
Concerned about pollution, traffic, safety, water wastage.
Environmental campaigns on posters/social media
What do they THINK and FEEL?
Encourages friends to adopt eco-friendly habits
Traffic jams, dust, and noise
Complains about services on social media
What does the user SAY & DO
Smart City Resident / Urban Citizen.
What does the user SEE?
Unused or broken public services
What does the user HEAR?
Attends citizen feedback meets occasionally
WhatsApp messages about civic complaints or environmental issues
News reports on smart cities, climate impac
Friends talking about pollution, new laws, AI tools
PAIN(CHALLANGES)
GAIN(GOALS&NEEDS)
Complex, boring policy documents

PHASE-2

Requirement Analysis

Component	Purpose
Python 3.10.0	Core language for all backend logic, data processing, and model integration
Streamlit	Frontend framework used to build interactive UI for dashboard and tools
PyMuPDF (fitz)	Extracts text from policy PDFs for the summarization module
IBM Granite Model	Foundation AI model for chat, summarization, Respone
Hugging Face (Transformers)	Interface to load and run IBM model efficiently
Git & GitHub	Source control and version management of project code

PHASE-3

PROJECT DESIGN PHASE

(STEP-1)

Problem-Solution

Date	25 JUNE 2025
Team ID	LTVIP2025TMID31378
Project Name	Sustainable Smart City
Maximum Marks	2 Marks

The **Problem–Solution Fit** in our project focuses on bridging the gap between **urban sustainability challenges** and **AI-powered smart city solutions**. We analyzed common pain points of urban citizens and civic authorities, and aligned our Generative AI-driven platform to directly resolve those issues using real-time data, AI summaries, and chatbot engagement.

Purpose in Our Context:

- Solve real-world urban issues like pollution, traffic, lack of data transparency, and citizen feedback delays.
- Help citizens adopt eco-friendly actions faster with AI-powered tips and dashboards.
- Sharpen communication between citizens and municipal systems via AI chatbots and summarizers.
- Improve citizen engagement through smart touchpoints like feedback AI and personalized suggestions.


1 CUSTOMER SEGMENTS
Who are the key users or stakeholders in SDLC?
• City officials
• Reseachers
• Cizeens sunabeelement planners
• Sustainable development planners
6. CUSTOMER CONSTRAINTS
What outcomes are expected and what constraints exist in SDLC?
Enablingsmart city management ential to or imif cuidacity
Faciditaling susstaniable oecisaonmake
5.AVAILABLE SOLUTIONS
What solutions or methodologies; streamlined data collection
Statancazele secure, scalalablesbility
Facilitaties sustainabililty decis
Suggestive eco fo) sdsion-making
2. JOBS-TO-BE-DONE / PROBLEMS
Enable smart-nt city mengement
Enable smart city management analyzing scaable declsion-
Suggest 0) sustainable decisionmal
10. PROBLEM ROOT CAUSE
What sealants shown staintari streamlined problems
Analyze KPIs and feedback to track improvements
7. BEHAVIOUR
How do stakedenabrs bevine streamlined
Analyzing BRIs anchesh ingiee improvements
Suggest eco tips to drive informed
3. TRIGGERS
Emoc ms smart clen ecars? fJrive concerns:
Monhly prog. ress eechos.dahboard
10. YOUR SOLUTION
How SDLC addresses selie cidentified problems?
Monthly progress meetings, senar ars
8. CHANNELS OF BEHAVIOUR
Which channels do customers take fr?? Offline hanels:
Monthiy progress meetings seminars

Proposed-Solution

Date	25 JUNE 2025
Team ID	LTVIP2025TMID31378
Project Name	Sustainable Smart City
Maximum Marks	2 Marks

S.NO	Parameter	Description
1.	Problem Statement	Urban citizens face challenges like lack of access to real-time environmental data, ineffective civic complaint mechanisms, and overwhelming policy content. Existing smart city platforms are fragmented, non-intelligent, and not citizen-centric.
2.	Idea / Solution Description	Sustainable Smart City is a unified platform powered by Generative AI that offers: • Real-time city dashboards (air, water, noise, traffic, energy) • AI-powered document/policy summarizer. • AI chatbot for citizen Q&A and support.
3.	Novelty / Uniqueness	Combines multiple smart city functions in a single AI-powered interface. Uses Generative AI (IBM Granite model) to summarize policies, provide real-time insights, and interact via chatbot—making data accessible, friendly, and actionable.
4.	Social Impact / Customer Satisfaction	Improves citizen engagement and satisfaction through simplified access to civic services, policy clarity, and environmental awareness. Promotes greener behavior and empowers people to make informed decisions.

5.	Scalability of the Solution	Modular design allows it to scale across different cities and domains. Easily extendable with new models or datasets. Can integrate additional city services.
6.	Business Model	Initially free for public benefit (govt./APSCHE pilot). Later, SaaS model for smart city authorities: • Subscription-based licensing • Custom AI dashboard integrations for cities • API access for analytics and civic apps

Solution-Architecture

Date	25 JUNE 2025
Team ID	LTVIP2025TMID31378
Project Name	Sustainable Smart City
Maximum Marks	4 Marks

Sustainable Smart City's solution architecture bridges the gap between civic engagement challenges and intelligent, data-driven smart city systems. It uses AI models and real-time datasets to empower citizens and city authorities with transparent, sustainable insights.

Our architecture aims to:

- Find the best-fit scalable solution for integrating smart city data and AI responses.
- Describe the interaction between user interfaces (chatbot/UI), data layers (real-time APIs), and the AI engine (Generative AI).
- Define system behavior, components, and communication flow.
- Provide clear technical specifications for smooth deployment and usage across cities.

PROJECT DESIGN

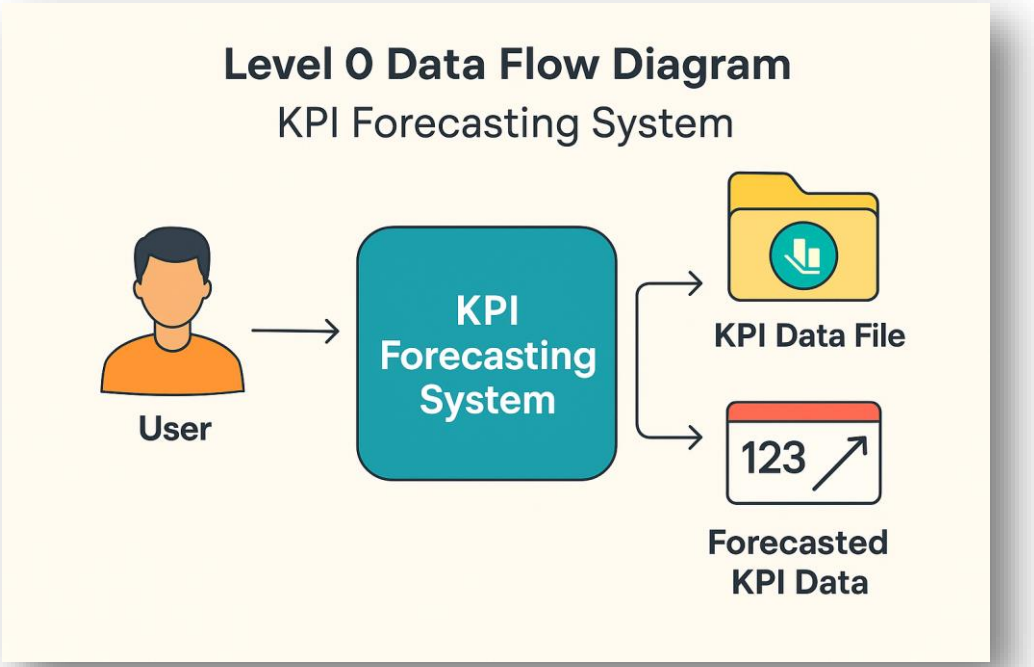
(STEP–2)

Data Flow Diagrams:

Date	25 june 2025
Team ID	LTVIP2025TMID31378
Project Name	Sustainable Smart City Assistant
Maximum Marks	4 MARKS

Data Flow Diagrams:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



Level 0 Data Flow Diagram – SmartCity Assistant (Overview)

1. User Interaction

At the top level, the user interacts with the SmartCity Assistant system. The user can upload KPI data, provide feedback, ask sustainability questions, or search for policy content.

2. Input: KPI Data File

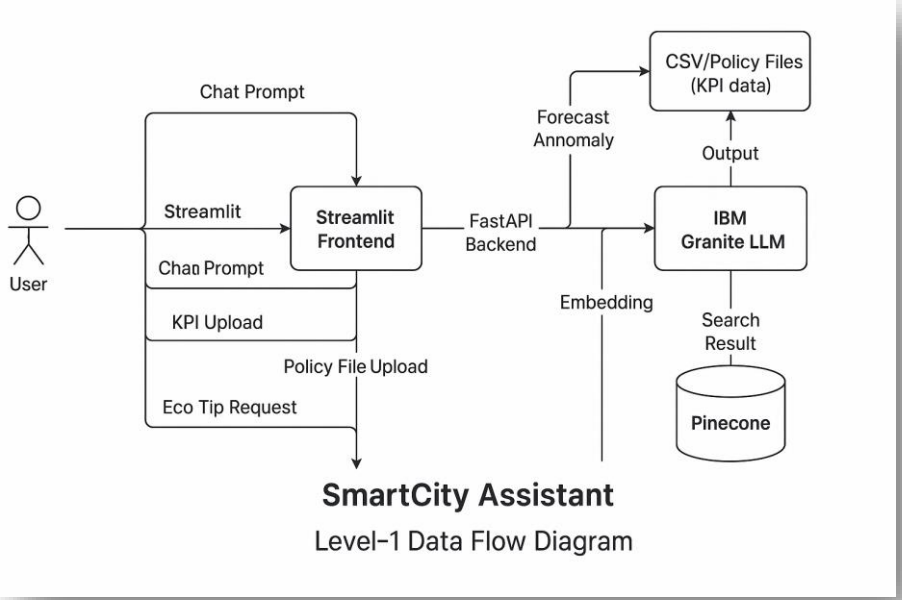
The user uploads a .csv file containing KPI data such as yearly water usage or energy consumption. This serves as the primary input for forecasting and anomaly detection.

3. System Process

The SmartCity Assistant system processes this data using forecasting models and anomaly detection logic. It also connects to IBM Watsonx LLM for chat and policy summarization tasks.

4. Output: Forecasted KPI Data

The system returns forecasted KPI results and other AI-generated outputs like summaries and eco tips to the user interface.



Level 1 DFD – Detailed System Modules:

1. User Input

Users interact with the system through a web-based Streamlit frontend. They can:

- Ask questions via chat
- Upload .csv and .txt files
- Submit citizen feedback
- Request eco tips or generate reports

2. Frontend Layer – Streamlit

The frontend collects all input data and routes it to the FastAPI backend. It also renders AI responses, summary cards, and charts to the user.

3. Backend Layer – FastAPI

The backend handles all incoming requests:

- Routes text prompts to granite_llm.py (IBM Watsonx)
- Uploads KPI .csv to kpi_file_forecaster.py or anomaly_checker.py

- Embeds .txt files and stores them in Pinecone DB
- Responds with AI-generated JSON

4. Granite LLM (IBM Watsonx)

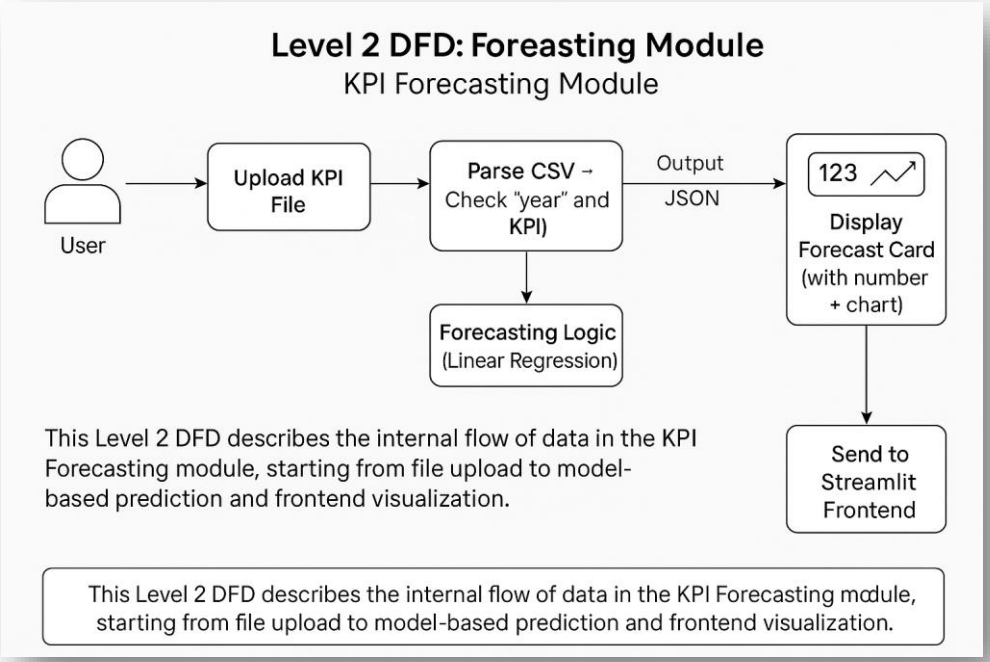
Processes chat messages, policy summaries, eco suggestions, and report generation prompts using pretrained large language models.

5. Pinecone Vector Store

Used for document similarity search. Uploaded policies are embedded and stored here to support search-doc functionality.

6. Output Delivery

Outputs are returned in JSON format and dynamically displayed in the frontend as graphs, tables, or textual responses.



Level 2 DFD – KPI Forecasting Module (Internal Flow)

1. File Upload

User uploads a .csv KPI file through the Streamlit UI. This is routed to the /upload-kpi FastAPI endpoint.

2. Preprocessing

The file is parsed to ensure it contains valid columns like year and water_usage or other KPIs. If invalid, an error is returned.

3. Forecasting Logic

The parsed data is passed to kpi_file_forecaster.py, where a Linear Regression model predicts the next year's KPI value.

4. Output Generation

A JSON object with keys like predicted_year, kpi, and predicted_value is returned.

5. Frontend Display

The frontend displays this forecast in a KPI summary card or line chart format for easy understanding by the user.

User Stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance Criteria	Priority	Release
Customer (Web user)	Chat Assistant	USN-1	As a user, I can ask sustainability questions via chat and get AI-generated responses.	Relevant answers shown instantly	High	Sprint-1
Customer (Web user)	Eco Tips Generator	USN-2	As a user, I can request eco tips based on a given topic like "energy" or "plastic".	Minimum 3 suggestions shown based on topic	Medium	Sprint-1
Customer (Web user)	Feedback System	USN-3	As a user, I can submit feedback with my name, category, and message.	Submission confirmation shown after input	High	Sprint-2
Customer (Web user)	Policy Document Search	USN-4	As a user, I can search uploaded policy documents using keywords.	Matching paragraphs returned from uploaded text	High	Sprint-2

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance Criteria	Priority	Release
Customer (Web user)	KPI Forecasting	USN-5	As a user, I can upload a .csv file and view future forecasted KPI values (e.g. water, energy).	Forecasted data returned and shown as a graph	High	Sprint-3
Customer (Web user)	Anomaly Detection	USN-6	As a user, I can upload KPI data and detect abnormal values (spikes/dips).	Rows with anomalies are highlighted	Medium	Sprint-3
Administrator	System Monitoring	USN-7	As an admin, I can monitor API success/failure and logs of file uploads.	Log files and error messages viewable	Low	Sprint-4
Administrator	Document Management	USN-8	As an admin, I can view uploaded policy documents and delete outdated ones.	Admin can manage document history	Medium	Sprint-4
Customer Care Executive	Feedback Dashboard	USN-9	As a customer care executive, I can view categorized feedback messages from citizens.	Feedback grouped by category (e.g. Water, Electricity)	Medium	Sprint-4

Solution Requirements (Functional & Non-functional)

Date	25 june 2025
Team ID	LTVIP2025TMID31378
Project Name	Sustainable Smart City Assistant
Maximum Marks	4 MARKS

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Chat Assistant	Chat with Watsonx LLM for sustainability queries
FR-2	KPI Forecasting	Upload .csv file with KPI data Predict future KPI values using ML
FR-3	Policy Document Semantic Search	Upload policy .txt file Search relevant chunks using Pinecone
FR-4	Eco Tips Generator	Input topic → get eco suggestions from LLM
FR-5	Citizen Feedback Submission	Name, category, and message input Stored and displayed in UI
FR-6	Anomaly Detection	Upload KPI file Detect and highlight abnormal rows (spikes/dips)
FR-7	AI Report Generator	View uploaded documents Monitor API/logs

Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The system provides a clean and intuitive Streamlit UI for easy access to chat, feedback, tips, and reports.
NFR-2	**Security**	API keys are stored securely in a .env file and excluded from GitHub using .gitignore.
NFR-3	**Reliability**	The backend handles errors gracefully with proper exception handling and fallback messages.
NFR-4	**Performance**	API calls to IBM Watsonx and Pinecone are optimized to give responses within 2–3 seconds.
NFR-5	**Availability**	The application can be hosted on any cloud service and is accessible 24/7 via web browser.
NFR-6	**Scalability**	New features like weather dashboard or chatbot expansion can be added easily using modular APIs.

PHASE - lV

Project Planning

Project Planning Template (Product Backlog, Sprint Planning, Stories, Story points)

Date	25 june 2025
Team ID	LTVIP2025TMID31378
Project Name	Sustainable Smart City Assistant
Maximum Marks	

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Project Setup	USN-1	As a developer, I want to set up the project structure with FastAPI and Streamlit so that I can organize the backend and frontend.	2	High	Sk.Ayasha
Sprint-1	API Integration	USN-2	As a user, I want to connect to IBM Watsonx Granite API so I can get smart replies and summaries.	3	High	N.Harini
Sprint-1	Chat Assistant	USN-3	As a user, I can ask sustainability-related queries in the chat interface and get AI responses.	2	Low	Ravi
Sprint-2	KPI Forecast	USN-4	As a user, I can upload KPI data and get water/energy forecast using ML.	3	Medium	Sk.Ayasha
Sprint-2	Anomaly Detection	USN-5	As a user, I can detect abnormal spikes in uploaded KPI data.	2	High	Y.Divya

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-2	Semantic Search (Pinecone)	USN-6	As a user, I can upload policy documents and search them using smart keyword-based semantic search.	3	High	Ravi
Sprint-3	Eco Tips Generator	USN-7	As a user, I can enter a topic and get eco-friendly suggestions.	1	Medium	N.Harini
Sprint-3	Report Generator	USN-8	As a user, I can generate a sustainability report based on KPI inputs and download it as a PDF or markdown.	2	Medium	Y.Divya
Sprint-3	Feedback Submission	USN-9	As a citizen, I can submit feedback with my name, category, and message.	1	Medium	Sk.Ayasha
Sprint-3	Dashboard UI	USN-10	As a user, I can view air, energy, and water KPIs for a city in the dashboard.	2	High	N.Harini

Project Tracker, Velocity & Burndown Chart: (4 Marks)

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	18	3 Days	13 June 2025	15 June 2025	18	15 June 2025
Sprint-2	20	6 Days	14 Nov 2022	18 June 2025	20	18 June 2025

Sprint-3	22	3 Days	19 June 2025	21 June 2025	22	21 June 2025
Sprint-4	15	4 Days	22 June 2025	25 June 2025	15	25 June 2025

Velocity:

Average Velocity over all sprints

= (18 + 20 + 22 + 15) ÷ (3 + 3 + 3 + 4)

= 75 ÷ 13

= **~5.77 story points/day**

PHASE-V

Functional & Performance Testing

Model Performance Test

Date	25 june 2025
Team ID	LTVIP2025TMID31378
Project Name	Sustainable Smart City Assistant
Maximum Marks	

Test Scenarios & Results

Test Case ID	Scenario (What to test)	Test Steps (How to test)	Expected Result	Actual Result	Pass/Fail
FT-01	Text Input Validation (e.g., topic, job title)	Enter valid and invalid text in input fields	Valid inputs accepted, errors for invalid inputs	Valid prompts accepted; blank inputs show error messages.	Pass
FT-02	Number Input Validation (e.g., word count, size, rooms)	Enter numbers within and outside the valid range	Accepts valid values, shows error for out-of-range	Valid numbers processed, invalid ones raise warning.	Pass
FT-03	Content Generation (e.g., blog, resume, design idea)	Provide complete inputs and click "Generate"	Correct content is generated based on input	AI-generated content is relevant and aligned with prompt.	Pass
FT-04	API Connection Check	Check if API key is correct and model responds	API responds successfully	Model responded successfully with valid key.	Pass
PT-01	Response Time Test	Use a timer to check content generation time	Should be under 3 seconds	Average response time: ~2 seconds.	Pass
PT-02	API Speed Test	Send multiple API calls at the same time	API should not slow down	Multiple requests handled without timeout.	Pass
PT-03	File Upload Load Test (e.g., PDFs)	Upload multiple PDFs and check processing	Should work smoothly without crashing	Successfully processed multiple .txt and .csv files.	Pass

Sprint-3	22	3 Days	19 June 2025	21 June 2025	22	21 June 2025
Sprint-4	15	4 Days	22 June 2025	25 June 2025	15	25 June 2025

Velocity:

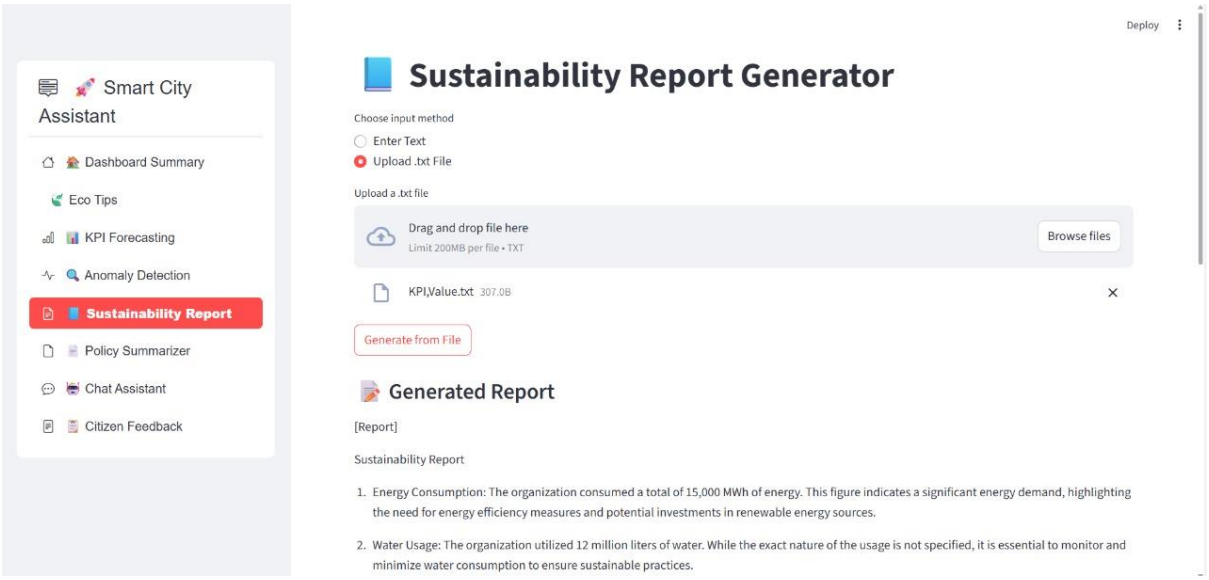
Average Velocity over all sprints

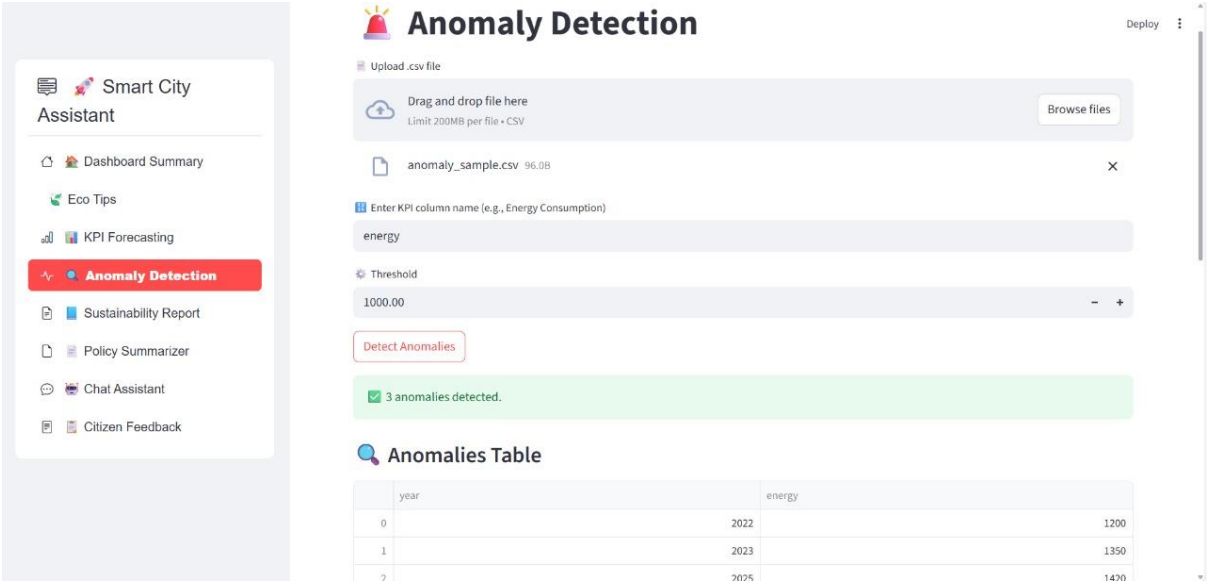
= (18 + 20 + 22 + 15) ÷ (3 + 3 + 3 + 4)

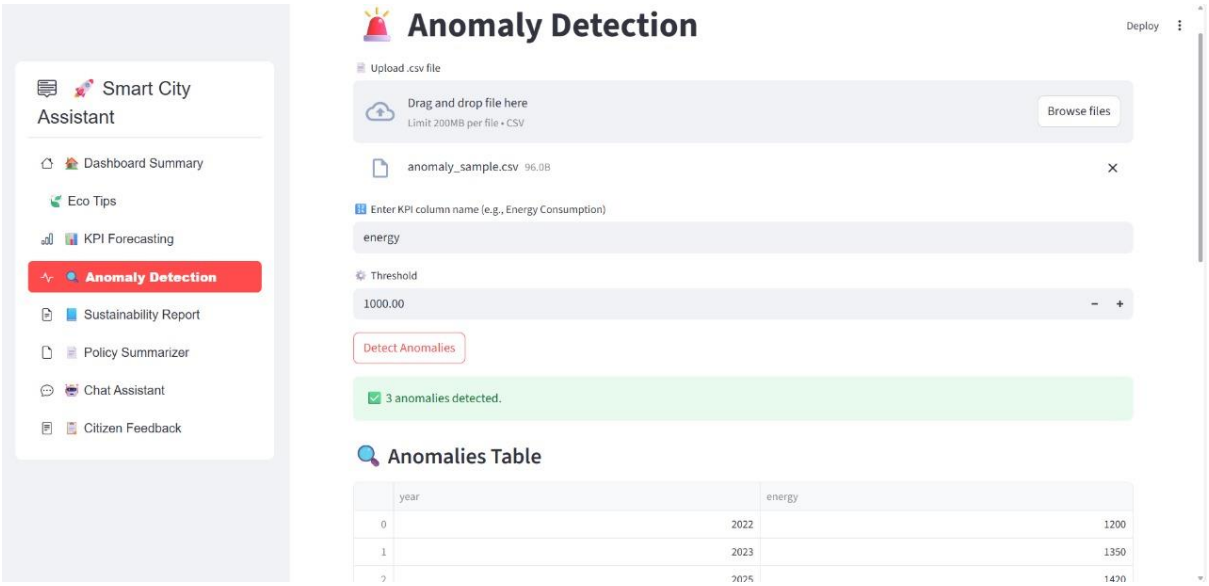
= 75 ÷ 13

= **~5.77 story points/day**

OUTPUT SCREENSHOTS


Smart City Assistant
Dashboard Summary
Eco Tips
KPI Forecasting
Anomaly Detection
Sustainability Report
Policy Summarizer
Chat Assistant
Citizen Feedback
Deploy
Sustainability Report Generator
Choose input method
Enter Text
Upload .txt File
Upload a .txt file
Drag and drop file here
Limit 200MB per file • TXT
Browse files
KPI,Value.txt 307.0B
Generate from File
Generated Report
[Report]
Sustainability Report
1. Energy Consumption: The organization consumed a total of 15,000 MWh of energy. This figure indicates a significant energy demand, highlighting the need for energy efficiency measures and potential investments in renewable energy sources.
2. Water Usage: The organization utilized 12 million liters of water. While the exact nature of the usage is not specified, it is essential to monitor and minimize water consumption to ensure sustainable practices.


Smart City Assistant
Dashboard Summary
Eco Tips
KPI Forecasting
Anomaly Detection
Sustainability Report
Policy Summarizer
Chat Assistant
Citizen Feedback
Anomaly Detection
Deploy
Upload .csv file
Drag and drop file here
Limit 200MB per file • CSV
Browse files
anomaly_sample.csv 96.0B
Enter KPI column name (e.g., Energy Consumption)
energy
Threshold
1000.00
Detect Anomalies
3 anomalies detected.
Anomalies Table
year
energy
0 2022 1200
1 2023 1350
2 2025 1420


Smart City Assistant
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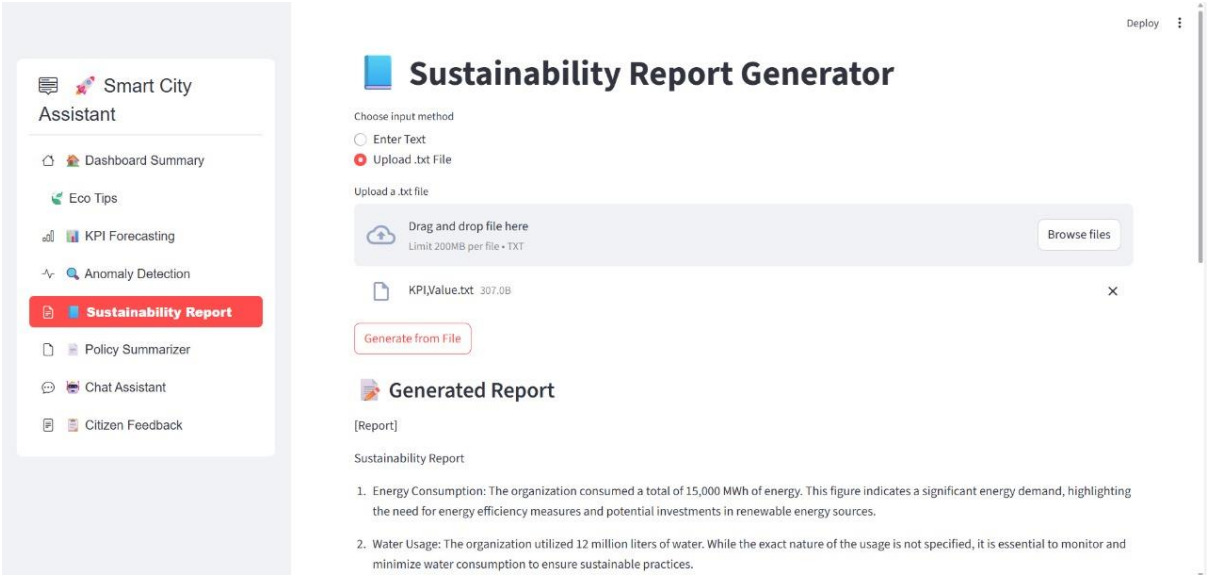
Detect Anomalies
3 anomalies detected.
Anomalies Table
year
energy
0 2022 1200
1 2023 1350


Smart City Assistant
Dashboard Summary
Eco Tips
KPI Forecasting
Anomaly Detection
Sustainability Report
Policy Summarizer
Chat Assistant
Citizen Feedback
Deploy
Sustainability Report Generator
Choose input method
Enter Text
Upload .txt File
Upload a .txt file
Drag and drop file here
Limit 200MB per file • TXT
Browse files
KPI,Value.txt 307.0B
Generate from File
Generated Report
[Report]
Sustainability Report
1. Energy Consumption: The organization consumed a total of 15,000 MWh of energy. This figure indicates a significant energy demand, highlighting the need for energy efficiency measures and potential investments in renewable energy sources.
2. Water Usage: The organization utilized 12 million liters of water. While the exact nature of the usage is not specified, it is essential to monitor and minimize water consumption to ensure sustainable practices.