# **Week 3 Report: System Architecture & Design**

The third week of the **InsightNation – Government Data Analytics Platform for Citizen Opinion and Public Service Enhancement** project marked a critical continuation of the Design Phase, with a strong emphasis on **technical structuring and visual interface planning**. Building upon the foundational planning and high-level design work done in Week 2, the focus this week was on detailed architectural design, refined data flow planning, and dashboard visualization prototyping. These components are essential to ensure a smooth transition from design to development in the subsequent phases.

**1. Defining the System Architecture**

The week began with the formal definition of the **system architecture** for the platform. The overall design was conceptualized to support the core data analytics workflow: data ingestion, preprocessing, analysis, visualization, and insight generation. Major components identified include:

* **Data Sources:** Feedback data collected from CSV files representing public opinions, survey results, and citizen complaints.
* **Data Storage Layer:** Local storage in the development phase using pandas-compatible structures, with an option to scale to cloud databases later.
* **Processing Engine:** A pipeline using Python libraries such as pandas for preprocessing, SpaCy for NLP, and scikit-learn for ML tasks.
* **AI Insight Layer:** Google’s Gemini API for generating strategic narratives and policy recommendations from analytical outputs.
* **Visualization Layer:** Streamlit-based front-end for building interactive dashboards and data displays.

All components were arranged modularly, ensuring scalability and ease of maintenance. The architecture also accounted for role-based access in future releases and included security protocols such as data anonymization and controlled API interactions.

**2. Planning the Data Flow**

After outlining the architecture, attention turned to mapping the **data flow** across the system. This step involved detailing how data would traverse from raw input to meaningful output. The flow was structured into distinct stages:

1. **Ingestion:** CSV upload and validation via the user interface.
2. **Preprocessing:** Cleaning, handling missing values, and standardizing formats.
3. **Text Processing:** NLP pipeline for sentiment and topic modeling using SpaCy.
4. **ML Pipeline:** Application of classification or regression models depending on the feedback data characteristics.
5. **Visualization and Insights:** Final output displayed on dashboards and enhanced with Gemini-generated narratives.

This flow ensured that every record entering the system would be processed methodically, with data privacy and integrity maintained at each step.

**3. Creating Interface Wireframes**

With the backend flow established, the team moved on to designing **wireframes** of the dashboard interface. The goal was to create an intuitive and functional layout that caters to public administrators and decision-makers. Initial wireframes included:

* Data Upload Panel
* Dropdown Filters (by city, age group, service category, etc.)
* Sentiment Summary Section
* Issue Trend Charts
* Gemini AI Recommendation Box

These sketches were created using Figma and presented to the internal team for feedback. The design focused on usability, accessibility, and clarity of insights for non-technical users.

**4. Developing Dashboard Mock-ups**

Following the wireframes, high-fidelity **dashboard mockups** were created. These included sample visualizations such as:

* Bar charts for service satisfaction breakdowns
* Line graphs showing changes in public sentiment over time
* Pie charts categorizing major public grievances
* Tables with top keywords extracted via NLP
* Text sections for Gemini’s strategic advice summaries

Color palettes were selected to maintain visual consistency, with accessibility for colour-blind users considered. Mock-ups closely mirrored the intended final product and served as a prototype for the frontend implementation in later phases.

**5. Collaboration and Feedback**

Frequent collaboration occurred this week between the design, analytics, and technical teams. Regular meetings were held to review designs, critique user experience flows, and discuss improvements. Constructive feedback from academic mentors and peers led to refinements in chart placement, filter logic, and overall dashboard structure. Stakeholders emphasized the importance of simplicity and actionability of insights, prompting the inclusion of summary boxes and tooltips.

**6. Documentation**

To close out the week, all activities were thoroughly **documented**. A design specification document was prepared, containing:

* Finalized architecture diagrams
* Annotated data flow charts
* Versioned wireframes and mockups
* Description of interface components and visualization logic

This documentation package will serve as a vital reference for developers and stakeholders as implementation begins.