# **Week 4 Report: Design Phase**

During the fourth week of the project, significant progress was made under the Design Phase, with primary efforts concentrated on establishing the technical blueprint and user interface foundation for the InsightNation platform. This week served as a critical juncture in translating the conceptual understanding of the platform into tangible structural and visual components. The focus areas included designing the system architecture, mapping the data flow, creating initial interface wireframes, and developing high-fidelity dashboard mock-ups.

**1. System Architecture Design**

The first major milestone was the definition of the InsightNation system architecture. A modular architecture was adopted to ensure scalability, maintainability, and efficient data processing. The system is structured into distinct components: data ingestion, preprocessing, machine learning analytics, visualization engine, and user interface.

* **Frontend**: Streamlit was selected for its rapid prototyping capabilities and interactive features.
* **Backend**: Python-based scripts and APIs will handle data preprocessing and ML model interaction.
* **Data Layer**: Pandas and SQL (for structured data storage if needed) were identified for handling datasets efficiently.
* **AI Layer**: Integration with Google Gemini API will power the insight generation and conversational features.
* **Visualization**: Plotly and Seaborn were chosen for generating dynamic and interactive charts.

This layered architecture will support seamless integration between components and ensure a robust pipeline from data ingestion to dashboard delivery.

**2. Designing the Data Flow**

The data flow design was undertaken to map how data will traverse through the system. A flowchart was created to represent each step from raw data input to insight generation:

* **Step 1**: Data collection from user-uploaded files (CSV).
* **Step 2**: Data cleaning and preprocessing pipeline (handling nulls, standardizing formats).
* **Step 3**: ML and NLP models perform sentiment analysis and pattern recognition.
* **Step 4**: Results are passed to the visualization module for display.
* **Step 5**: Gemini-powered AI summarizes results and provides recommendations.

Data pipelines were defined using a modular structure, making it easy to debug and scale as needed. Attention was given to ensure compatibility between intermediate outputs and final dashboard elements.

**3. Interface Wireframes**

Preliminary wireframes were sketched using tools like Balsamiq and Figma. These wireframes outlined the layout of the dashboard with sections for:

* Dataset upload and preview
* Filter options (by city, service type, sentiment)
* Charts and tables (for service satisfaction, demographics, suggestions)
* AI-generated insights section
* Navigation controls for switching views (e.g., transport, parks, libraries)

User-centric design principles were applied to ensure the interface remains intuitive and informative.

**4. Dashboard Mock-ups**

Based on the wireframes, interactive mock-ups were developed to simulate the final user experience. These mock-ups included sample data to represent key visuals such as:

* Bar charts for service satisfaction by age group
* Heatmaps showing city-wise sentiment scores
* Word clouds from suggestion text fields
* KPI indicators for user satisfaction trends

Mockups will serve as a design reference in the development phase and were shared with stakeholders for initial feedback.

**5. Iteration and Feedback**

Designs were reviewed internally and shared with key stakeholders. Constructive feedback highlighted the need for clearer filter placement and real-time update indicators for AI insights. The design was iterated based on this input to ensure alignment with user expectations and overall project goals.

**6. Documentation of Design Decisions**

All decisions made during the design phase were meticulously documented. Architecture diagrams, data flow maps, design justifications, and versioned mockups have been saved in the project documentation folder. These records will serve as vital references during implementation and future testing.

**Conclusion**:  
Week 4 marked a critical step forward in setting the visual and structural groundwork for InsightNation. The thoughtful design of system architecture, data pipelines, and dashboard interface ensures that future development phases will be streamlined and cohesive. Continued feedback and iteration will further refine the platform into a user-friendly, insights-driven tool for public service improvement.