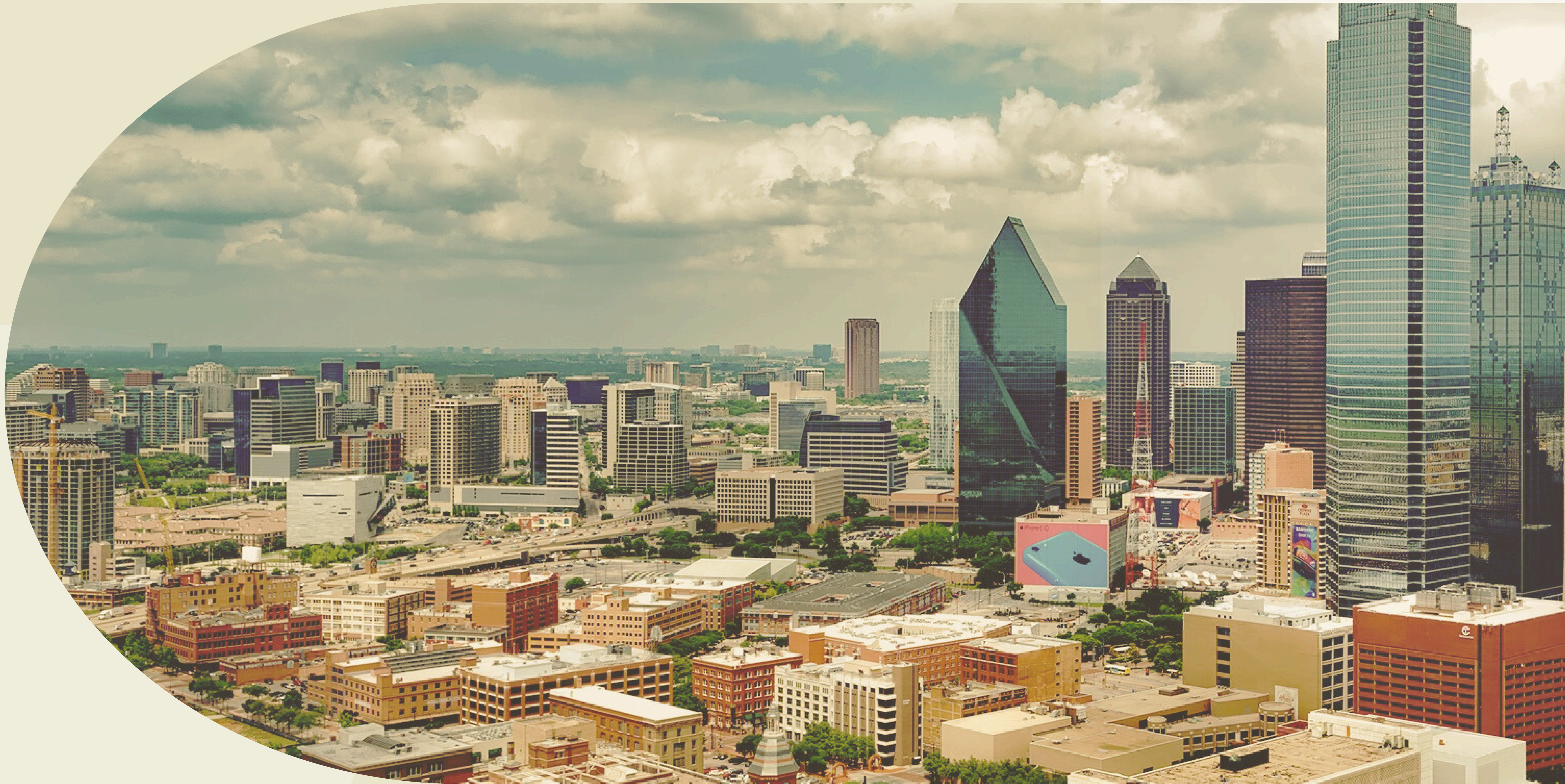
REIMAGINING URBAN SPACES



Urban Innovators

"Smart Cities, Efficient Systems."

Team

Members

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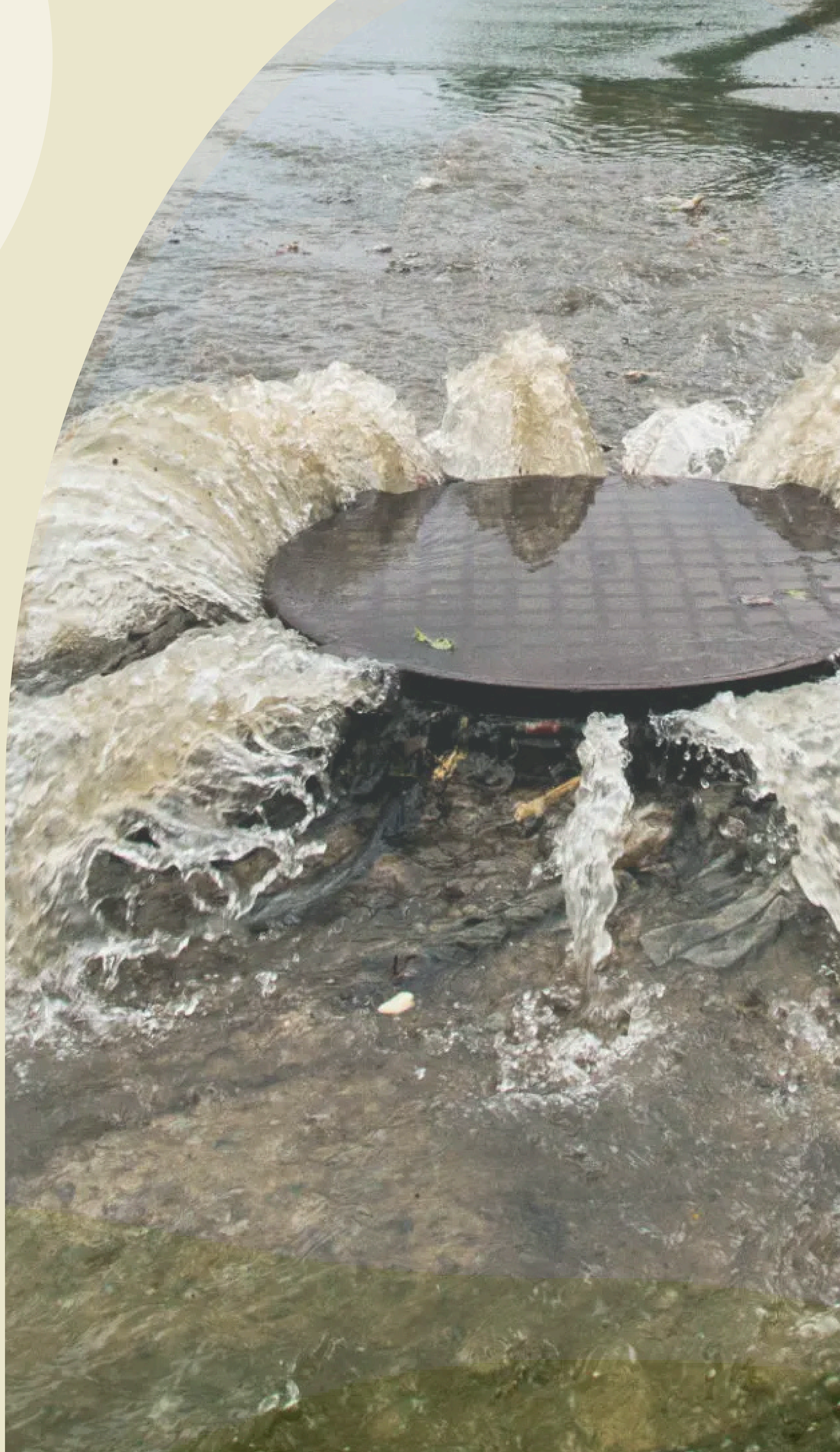
Problem Statement - 1

Unplanned urban areas are facing severe traffic congestion, which is significantly degrading mobility, increasing travel times, and leading to fuel inefficiency. The absence of a well-planned, efficient traffic management and diversion system further aggravates these issues, resulting in heightened **carbon emissions** and **unsustainable** urban transport.

Problem Statement - 2

Rapid urbanization, population growth, and **unplanned development** are overwhelming sewage systems, causing blockages, overflows, and environmental contamination. Reactive management approaches result in delays, inefficient resource use, and increased public health risks, due to the absence of a **proactive** and **predictive** model that is needed to forecast sewage load, optimize pump capacity, and prioritize services in vulnerable areas for **sustainable** and efficient waste management.



OUR SOLUTIONS

Traffic Management

A comprehensive analysis of traffic congestion using an **LSTM-**based prediction model, focusing on geographic and road width features to estimate **maximum vehicle capacity** and suggest **rerouting**. It predicts traffic congestion and adjusts vehicle counts based on road capacity, also performs rerouting where congestion **exceeds capacity**, evaluates the effect of rerouting through clustering **(K-Means)** before and after rerouting, and visualizes the results. The code also accounts for missing data and ensures capacity and rerouting predictions are handled appropriately. Overall, it offers a comprehensive approach to both traffic prediction and management through **rerouting**.

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Deployment in LinuxOne:

This code can be effectively leveraged using **IBM Z LinuxONE** servers (mainframes) by utilizing their robust processing power and scalability to handle large-scale traffic data analytics in **real-time**. **IBM Z LinuxONE's** capabilities in managing high transaction volumes and its ability to support **AI/ML** workloads make it ideal for running **LSTM** models for traffic prediction. By deploying this code on a **LinuxONE** server, organizations can process vast datasets, predict congestion, and reroute traffic dynamically across regions with minimal latency. Additionally, the inherent security, reliability, and encryption features of **IBM Z ensure** that sensitive traffic data is **protected**, while offering the scalability needed to accommodate growing data and model complexity.

Sewage System Optimization

Processing sewage management data to **predict** future sewage loads and assess various zone-specific factors such as flow rates, pump capacity, and power requirements for sewage pumping. A **RandomForestRegressor** model is trained to predict future sewage loads, with predictions adjusted and dates added. Incorporating **geographic data**, calculates slopes between zones, and marks low-lying areas. Estimating flow rates, pump capacities, and the power needed for sewage pumping. A **priority index** is calculated for each zone, categorizing them based on predicted sewage load and low-lying status, which is used to generate sewage management reports. With multiple visualizations such as the slope between zones, flow rates, and power requirements, alongside a detailed **textual report** for critical and other priority zones based on the **calculated priority index**.

Deployment in LinuxOne:

IBM's LinuxONE mainframe, leveraging its high-performance architecture and scalability, can efficiently run **data-intensive** workloads like the sewage management model described. With the ability to handle massive amounts of data and perform parallel processing, **LinuxONE** would accelerate the training of machine learning models, such as the **Random Forest Regressor** used here. By supporting seamless integration with Python-based analytics, the platform can handle complex **geospatial** and time-series analysis, ensuring high availability and security for critical infrastructure tasks like predicting sewage load, optimizing pump power, and managing priority zones based on **real-time data** processing.

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WOW FACTOR!

Traffic Model

Our system aims to reduce traffic congestion by smartly redirecting vehicles to less crowded routes, ensuring that **emergency services** like ambulances reach their destinations without delay. Beyond easing daily commutes, our solution prioritizes **life-saving journeys** and minimizes critical delays, fostering a safer and more **efficient urban environment**. With a focus on improving overall quality of life, we're building smarter cities where time, safety, and well-being come first.

WOW FACTOR!

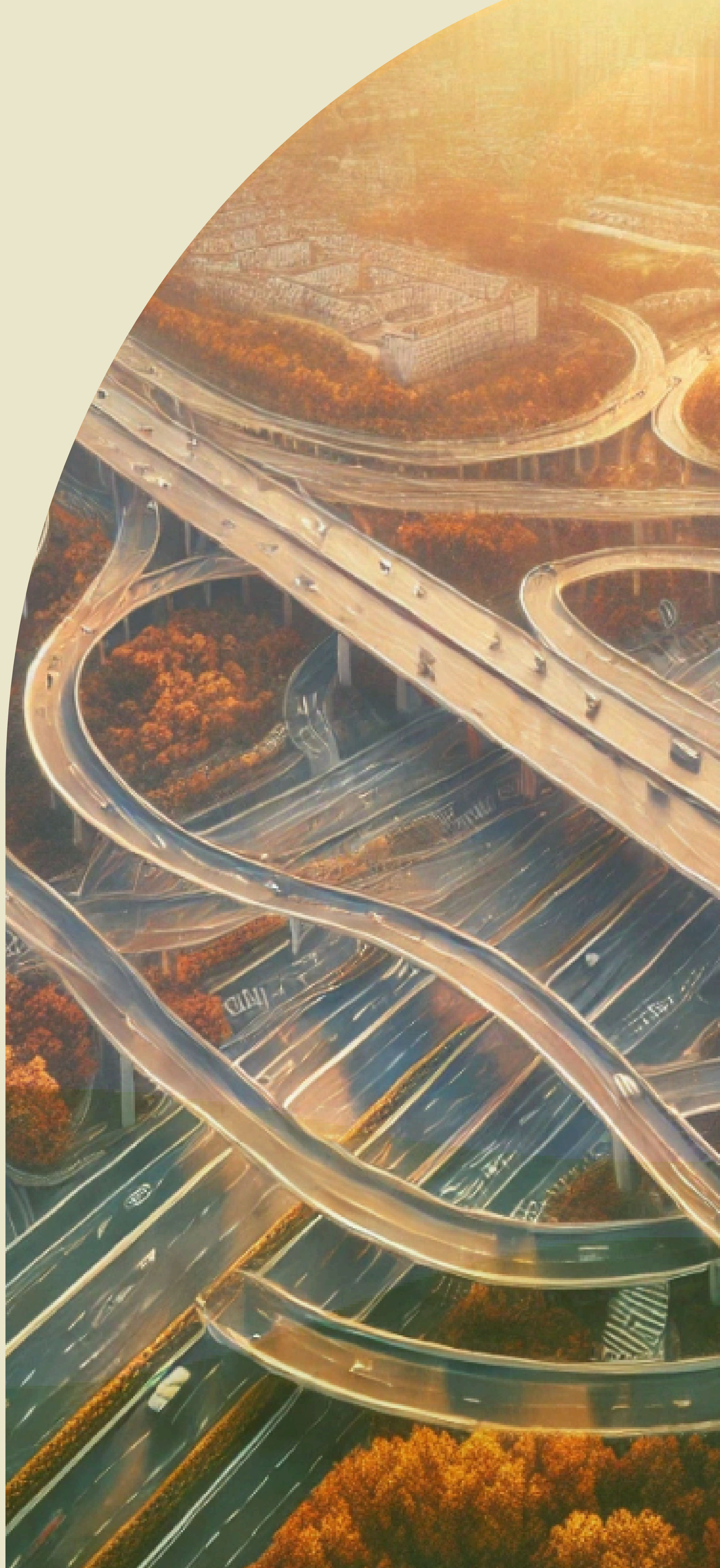
Sewage Model

Our cutting-edge solution aims to **reduce river pollution** and prevent hazardous sewage overflows, significantly decreasing the risk of **water-borne diseases**. By leveraging predictive analytics, our system anticipates sewage surges and efficiently manages the flow, ensuring that untreated waste doesn't enter rivers or community areas. This approach not only protects our precious water bodies but also promotes a **healthier environment** for all, turning clean water from a hope into a reality.

Future Enhancements:

Traffic model

This includes developing a **3D simulation** to improve traffic flow. This 3D model will **visualize the city's road network** in real-time, showing vehicle movements, congestion points, and traffic density using data from **IoT sensors**, **GPS**, and cameras. It allows for more **accurate simulations** of various traffic scenarios, enabling better decision-making for diverting vehicles to less congested routes. This model will **provide dynamic rerouting**, helping reduce congestion and ensuring that **emergency vehicles receive priority** routes for faster response times. City planners can use the 3D model to test changes, such as new road designs or traffic signal adjustments, before making real-world implementations. The result is a more efficient, **Data-driven approach** to managing traffic flow that **improves safety**, reduces delays, and supports better **urban planning.** This integration of 3D visualization with real-time data enables a smarter, more **responsive traffic management system**.



View our 3D model here

Future Enhancements:

Sewage model

The Future enhancements for the sewage management model use a **Large Language Model (LLM)** and **IoT sensors** for real-time, smart management. The LLM analyzes sensor data to **predict overflows**, alert low-lying areas, and **optimize routes for sewage trucks**, minimizing response times. A dashboard will provide real-time **insights for authorities**, while predictive analytics guide **proactive** maintenance. **IoT-enabled valves** will automatically adjust flows to balance sewage loads, preventing overflows. The system will also facilitate **communication with residents** for updates and queries, **increasing transparency**. These capabilities support better infrastructure planning and **environmental protection**, ensuring efficient and **sustainable** sewage management.

Summary

Key outcomes include:

- **Traffic Re-routing System:** Reduces congestion and **emissions** by suggesting alternate routes based on real-time data, improving travel efficiency.

- **Sewage Management System:** Predicts storage capacity, schedules waste removal, and ensures smooth sewage flow using mini underground pumping stations. This reduces maintenance costs and minimizes health risks.

Future enhancements involve integrating **IoT-enabled** sewage treatment and metro-ambulance services to further boost urban resilience and **sustainability**. Together, these solutions create smarter, more livable cities.