Big Data Analysis for Spatial Intelligence

Introduction:

This project entailed developing a data analysis platform that delivers spatial intelligence through advanced algorithms and interactive analytics tools. The goal is to generate analytics pertaining to city, place, and audience. The solution enables exploring population dynamics, mobility patterns, dwell times, and audience demographics. It provides powerful evidence-based insights for urban design, investment, and engagement strategies.

The ecosystem comprises of modules such as **Site Designer Studio** for custom study creation, **Big Query on Demand** for scalable compute pipelines, and **GeoData Studio** for data exploration and visualization. Together they enable organizations to generate tailored datasets, run spatial models at scale, and derive actionable intelligence to inform decision-making.

Client Details:

Name: Confidential | **Industry:** Real Estate, Software | **Location:** Australia

Technologies:

- **Technology:** Ruby on Rails, Next.js, MongoDB, TypeScript, Redux Toolkit
- **IDE:** Visual Studio
- **Third-party Libraries:** Stripe, OpenAI, Amazon AWS
- **Packaging:** Yarn

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Project Description:

The project delivers a comprehensive suite of data products and tools to analyze and measure place performance over time. These data products include:

- **Population and Activity** – Understand total demand hours and person counts at any location.
- **Mobility Networks** – Track usage of streets, bike paths, railways, and footpaths.
- **Distributed Dwell Times** – Identify how long and where people exhibit specific behaviors.
- **Catchment and User Mix** – Reveal visitor origins and activity timelines.
- **Same Day Mobility** – Analyze routes taken before and after visiting a site.
- **Audience & Geodemographic** – Profile visitors by demographics, interests, and behaviors.
- **Origin-Destination Data** – Measure flows between zones (up to 50,000 per model).
- **Journey Data & Travel Times** – Model journeys and estimate travel times across networks.

The solution enables project stakeholders to create custom studies, run large-scale jobs, and explore results through an intuitive visual interface.

Key Modules & Features:

1. Site Designer Studio (Primary Contribution)

- Draw or import geofenced project boundaries.
- Select relevant algorithms and specify analysis parameters (date ranges, filters).
- Upload GIS datasets for tailored spatial analysis.
- Generate project cost estimates and control spend with query-based billing.
- Role-based access for job approvals and budget management.
- Sync results directly to secure company project drives.

Impact: This module served as the foundation for custom client studies. Our main contribution was enhancing boundary operations, data import/export, and filtering workflows to ensure seamless integration with GeoData Studio.

2. Real-time Chat model using OpenAI

- Train the OpenAI model using the chart data of the Geo locations.
- Add a chat window in the map page to fetch the real-time data about the selected location.
- Results generated with an accuracy of about 90%.

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3. Big Query Jobs on Demand

- Auto-provisioned scalable supercomputers for data-intensive jobs.
- Ultra-efficient compute pipelines leveraging IaC and distributed infrastructure.
- Results generated in minutes, optimized for cost and scale.

4. GeoData Studio

- Interactive dashboards to explore spatial intelligence data.
- Multi-year and multilayer analysis of population, mobility, and audience trends.
- Custom data visualization modules for intuitive exploration.
- Easy export for integration with third-party GIS tools.

Engagement Model:

- Acted as an integrated partner in client projects—supporting research, testing, and strategy phases.
- Delivered place-based success measures, economic indicators, and persona-driven design inputs.
- Ensured compliance with privacy standards (GDPR, Australian Privacy Principles) while leveraging de-identified data sources.

Project Impact:

- Provided actionable insights into community dynamics, enabling evidence-based design and investment strategies.
- Helped client measure impact over time with dashboards that track activity, economic performance, and persona shifts.
- Empowered stakeholders with on-demand big data processing, reducing costs and speeding up decision-making.
- Strengthened cross-disciplinary collaboration by making data accessible to urban planners, designers, and executives.

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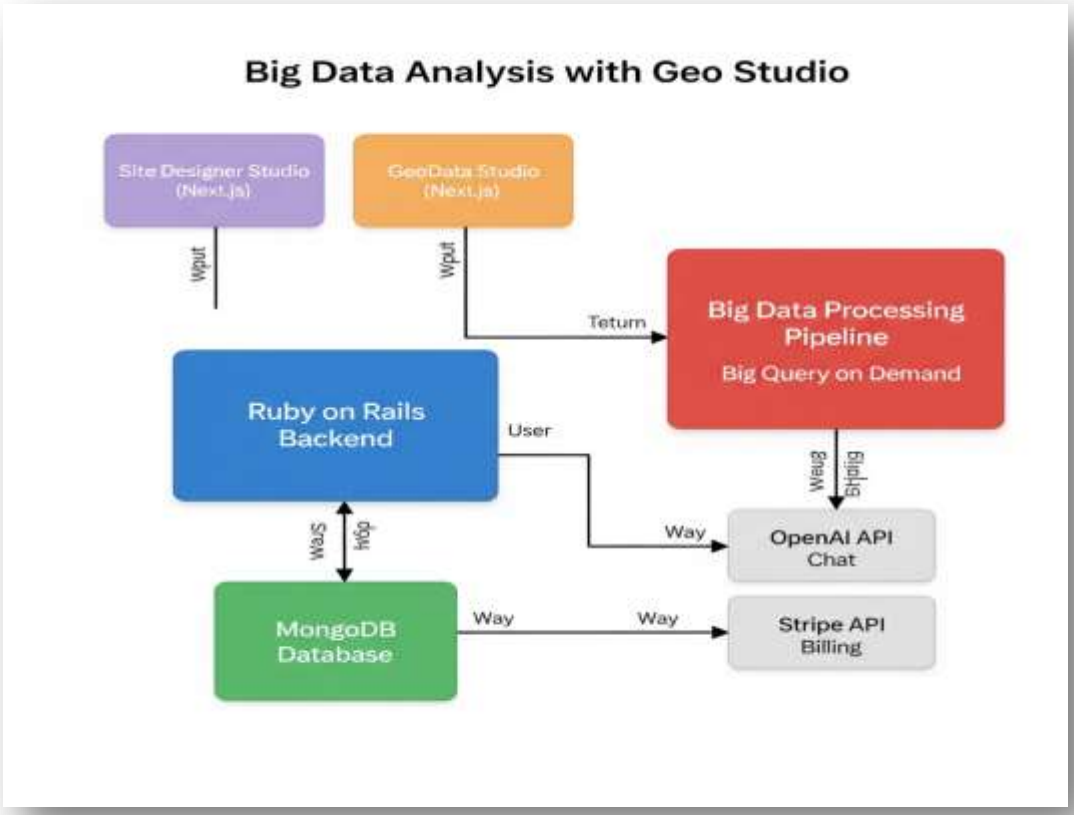
Architecture Diagram:



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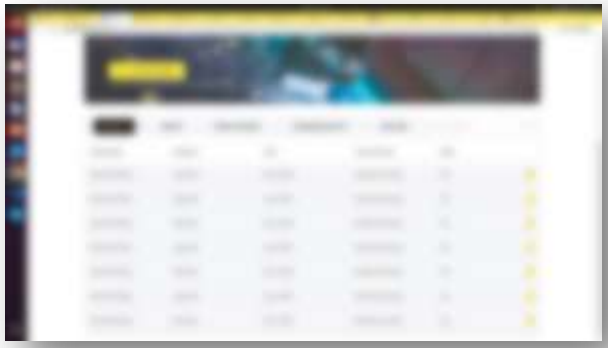
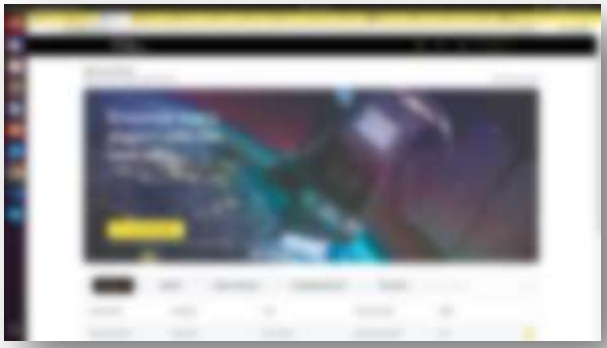
Screenshots:

Home Page

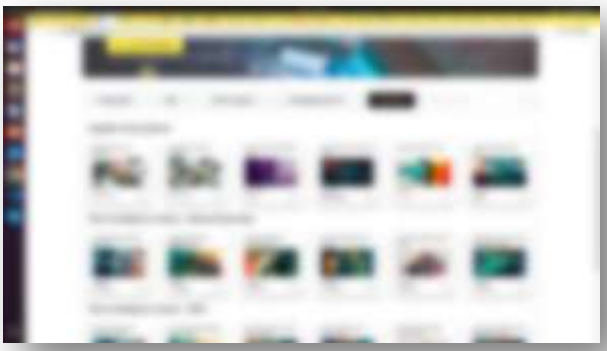


Site Designer List Page

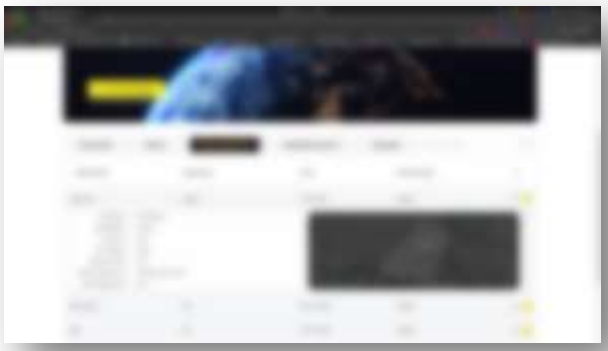


Users List

Data Lakes



Boundary



Boundary Options

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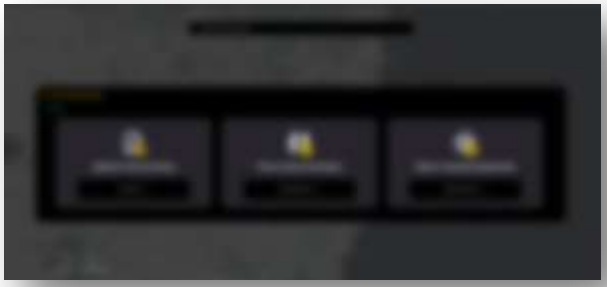
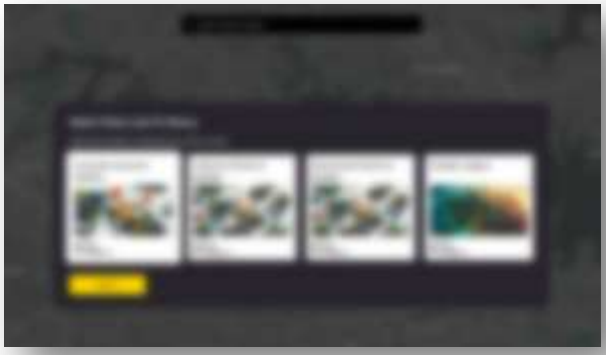
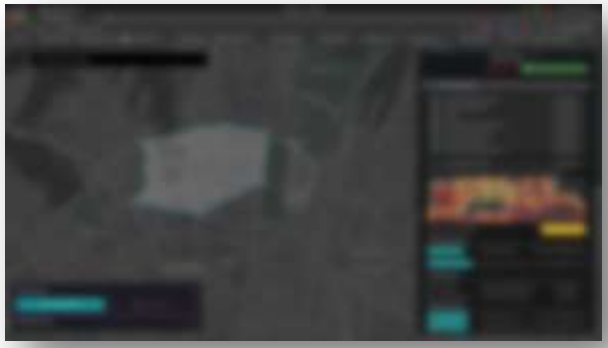
Selecting Boundary



Selecting Data Lake

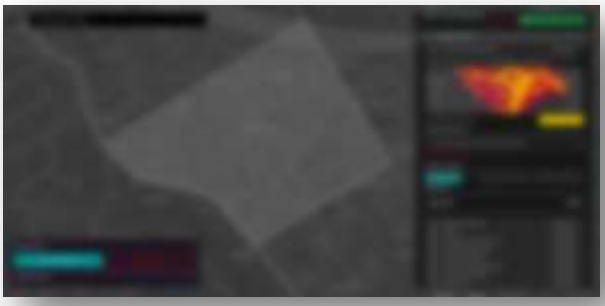


Drawing Boundary



Adding Model Layer

H3 Layer



Multiple H3 layers

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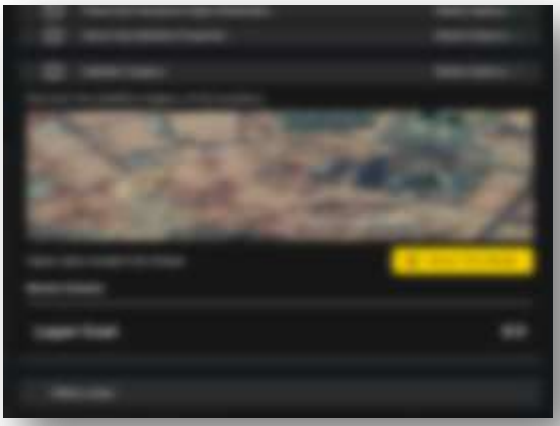
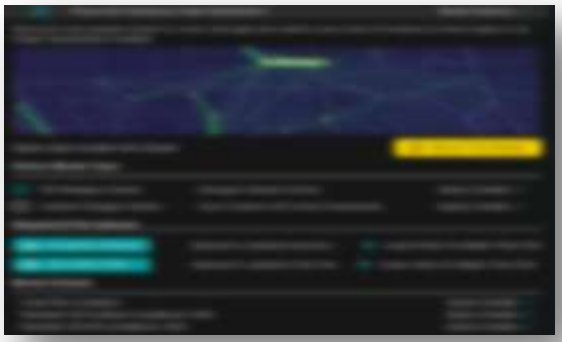
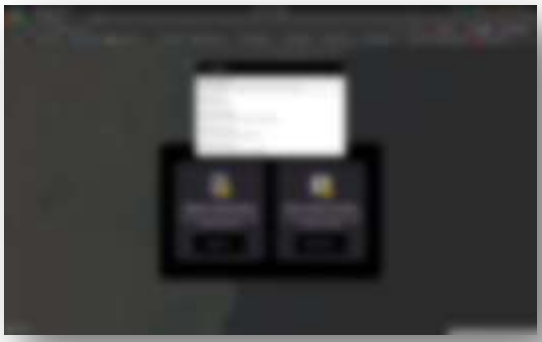


Zone Layers

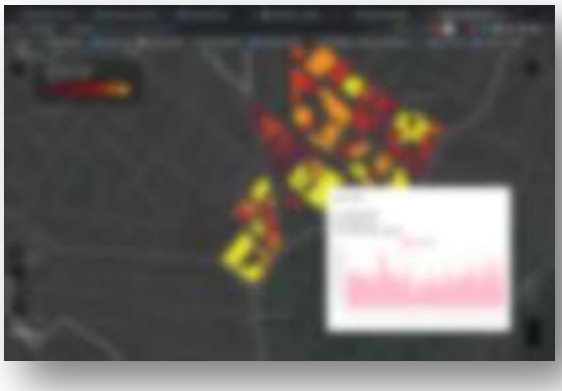
Location Search



Location Chart



Layer Chart



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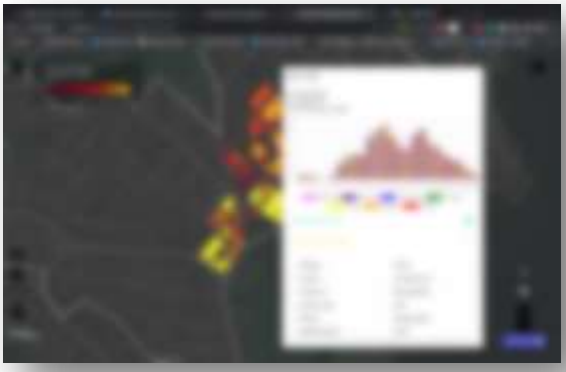
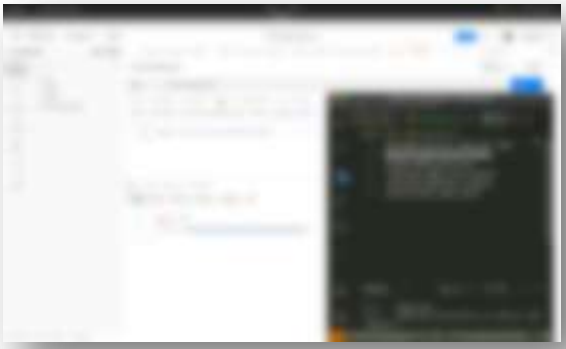
Multi-layer Chart



Project saving

OpenAI Training



OpenAI Training