

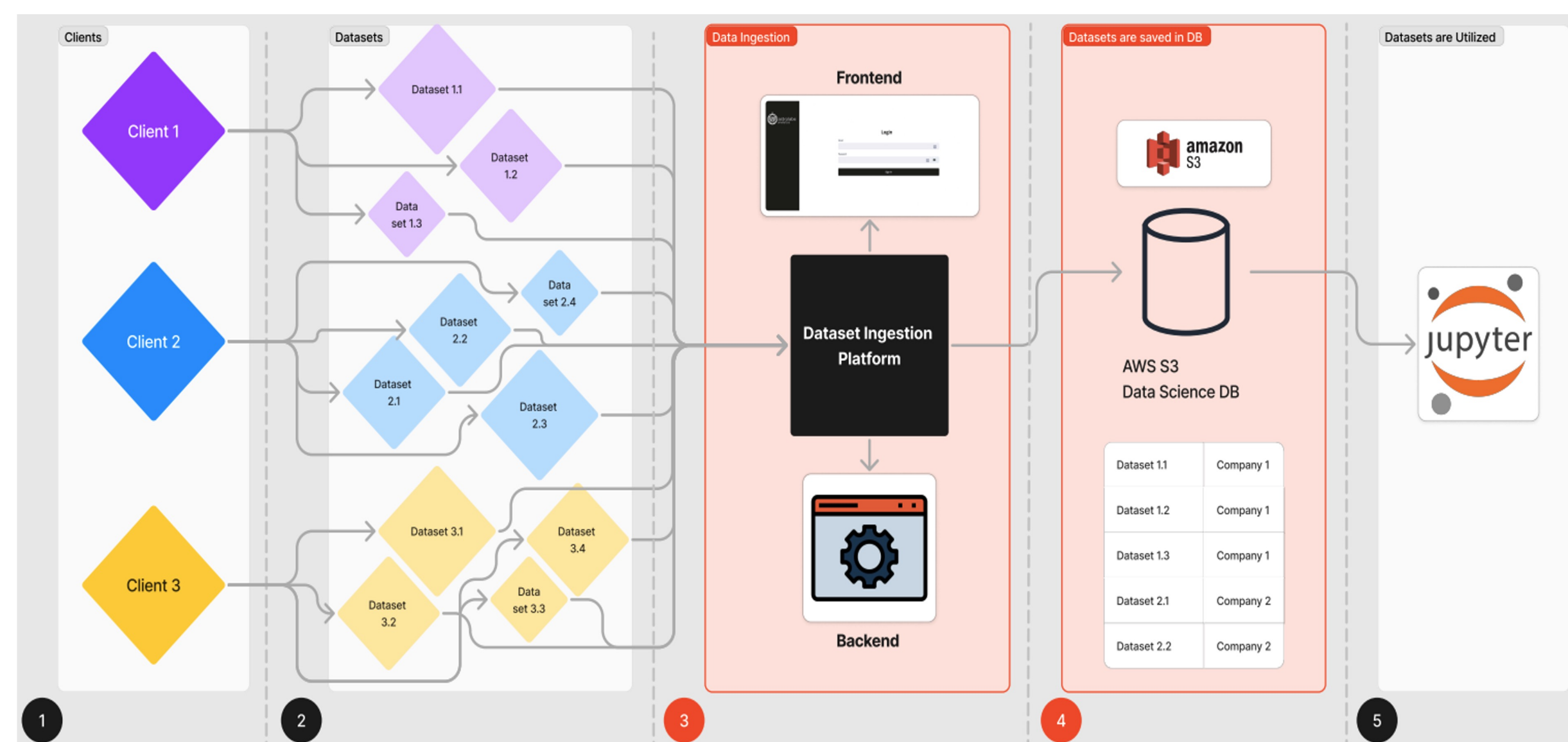


A Cloud-Based Multimodal Data Ingestion Platform for Time Series, Cycling, and Open-Circuit Battery Data

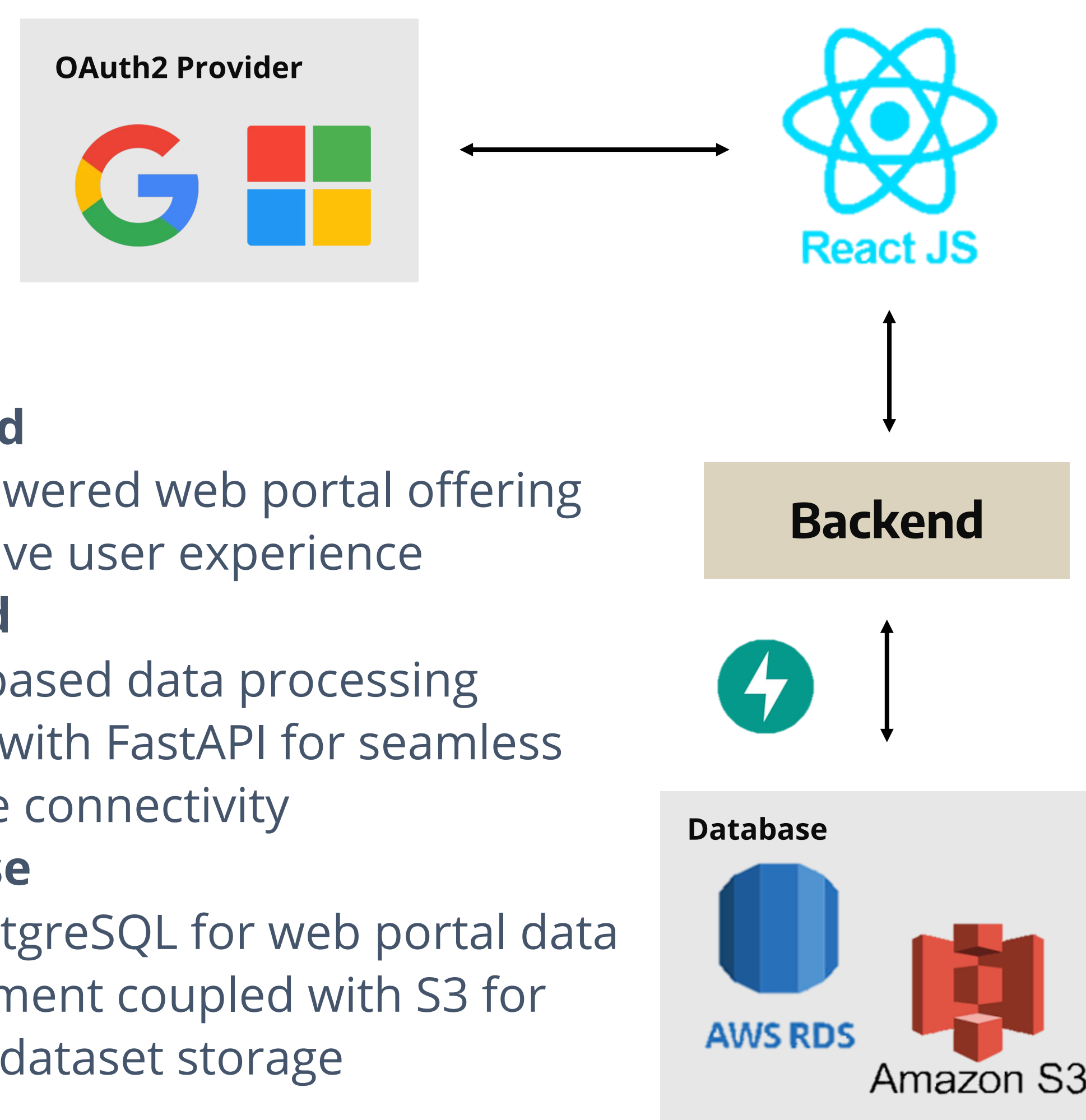


Problem and Objective

Battery technology companies struggle with inconsistent, inefficient data from multiple sources. Our web-based portal standardizes battery data through an intuitive interface and powerful backend, enabling seamless upload, processing, and insight extraction.

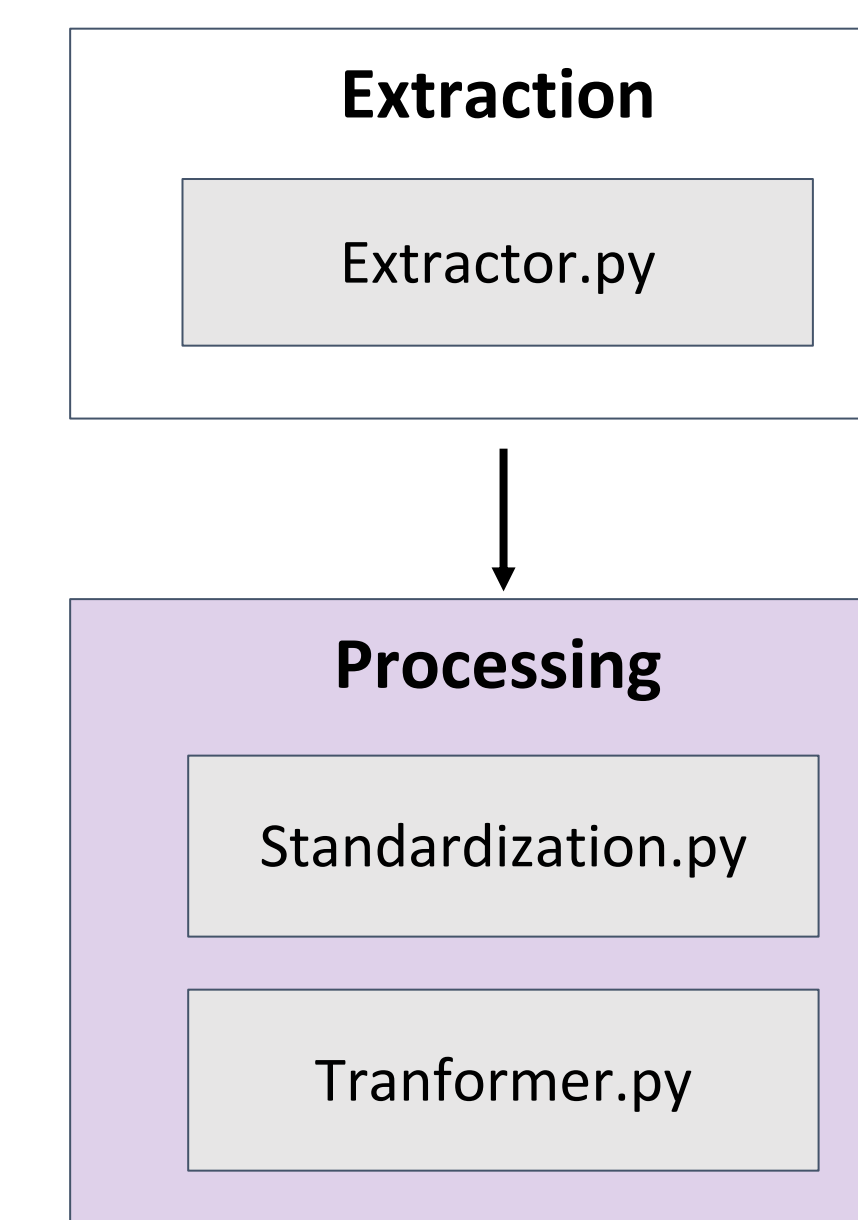


Architecture and Requirements



Component Design

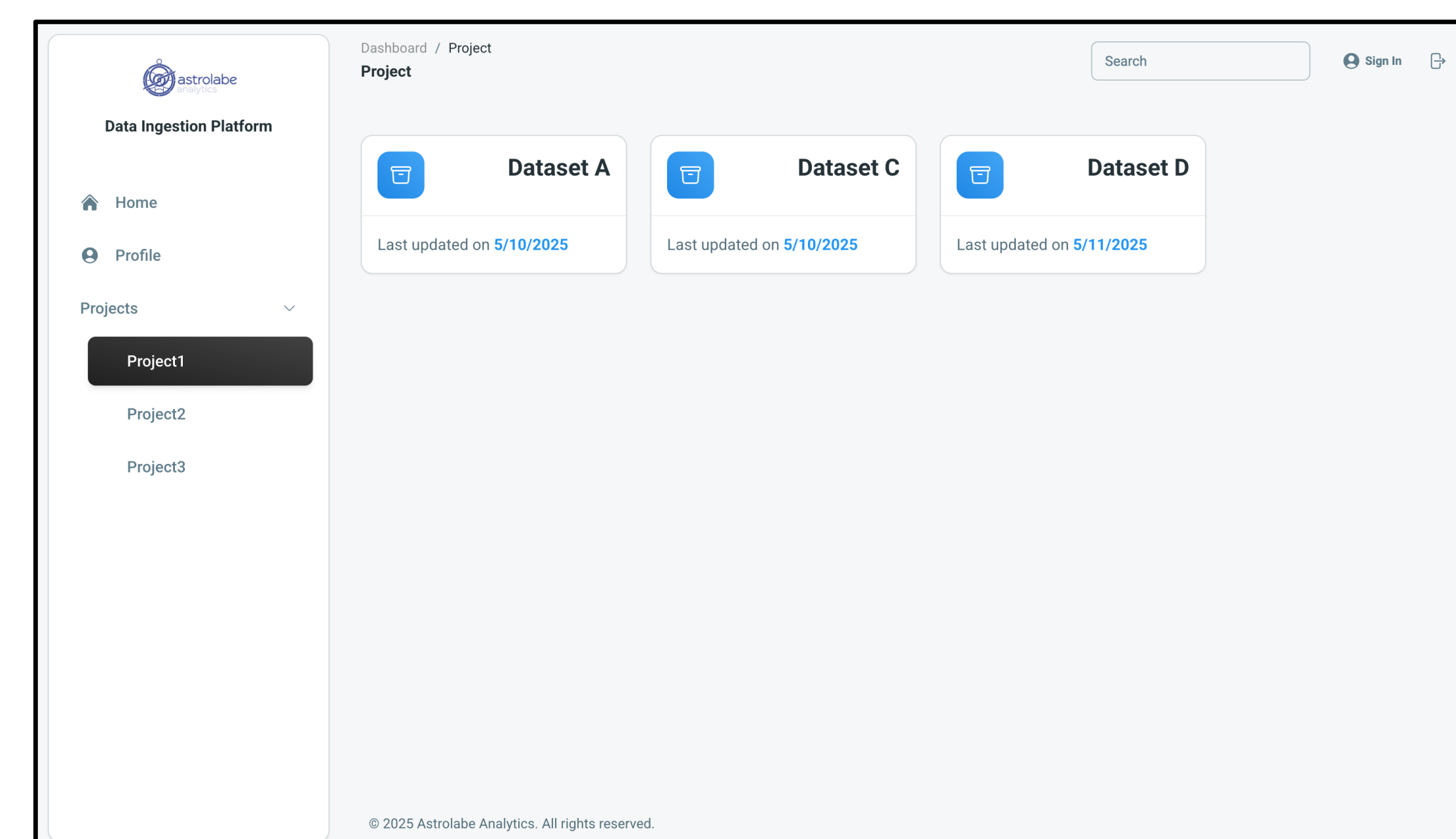
Extractor.py – Unifies CSV, Excel, JSON, and MAT files into a single DataFrame for processing.
standardization.py – Standardizes units, handles missing data, and renames columns using fuzzy matching.
Transformer.py – Enhances data with time-series features, cycle segmentation, and custom transformations.
Visualizer.py – Creates high-quality cycling plots using Seaborn and Matplotlib for analysis and reporting.



User Interface

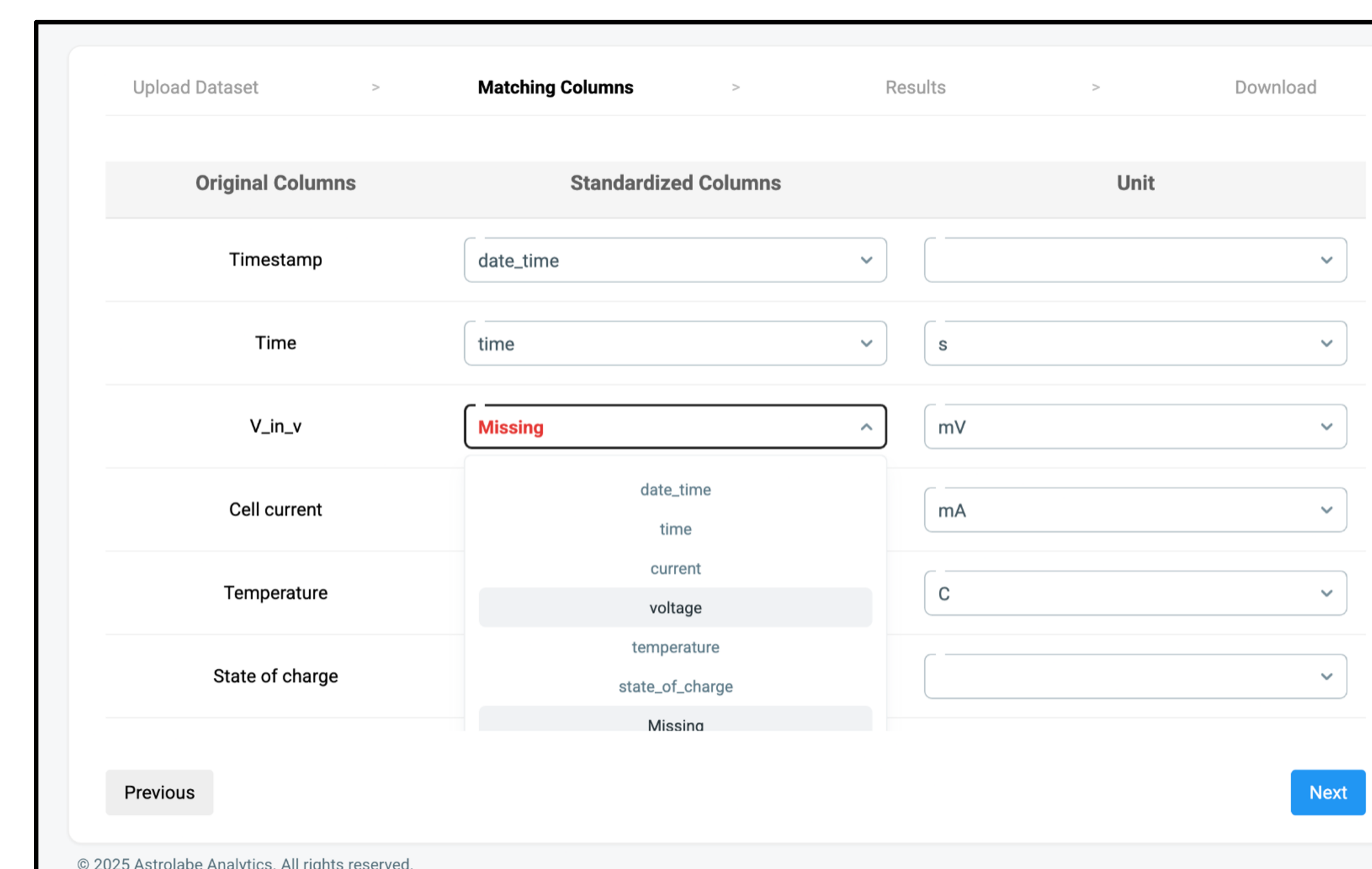
User-Friendly

A clean dashboard with quick access to projects, profiles, and instant dataset search.



Matching Table

A visual interface that streamlines data integration by combining automated column mapping with intuitive customization for flexibility and efficiency.



Standardization of Columns

Input Data set (type: Pandas Dataframe)

	Time	Current	Voltage	Capacity	Energy	SOC	SOE
0	1	-3450.1	4.1152	0.000000	0.000000	0.000000	0.000000
1	2	-3450.8	4.1052	0.958583	3.938639	0.041710	0.047859

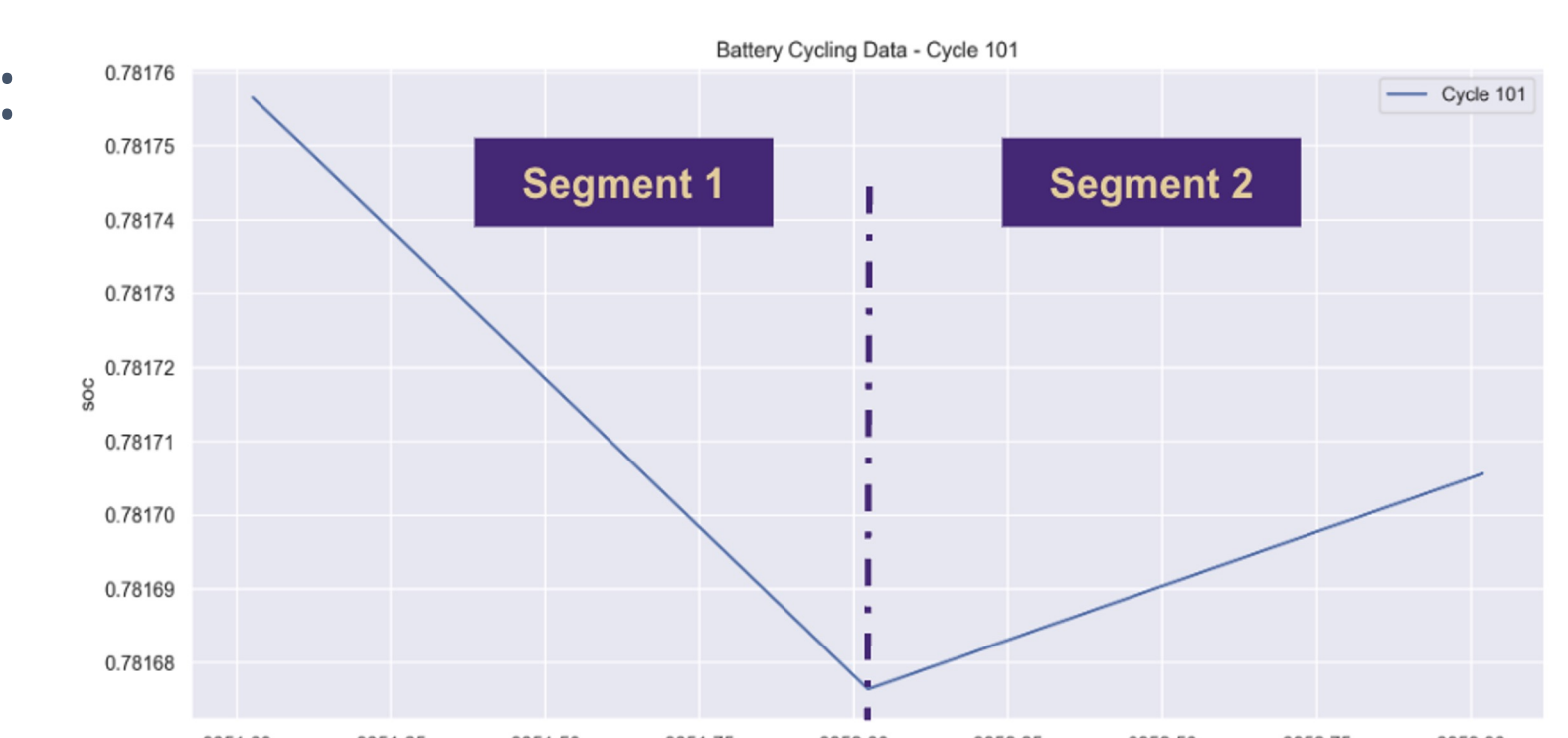
Output Data set (type: Pandas Dataframe)

	time (s)	Current(a)	Voltage(v)	discharge capacity(Ah)	discharge_energy(Wh)	state_of_charge
0	1	-3450.1	4.1152	0.000000	0.000000	0.000000
1	2	-3450.8	4.1052	0.958583	3.938639	0.041710

Validated Results & Key Features

✓ Clean Output Visualization:

Cycle 101 State of Charge plot shows a distinct V-shape, confirming that our preprocessing effectively preserved meaningful transitions and removed noise.



✓ **Automated Column Mapping:** Smart mapping with user prompts for consistent schema across formats (CSV, Excel, JSON, MAT).

✓ **Time-Series Segmentation:** Efficiently identifies charging, discharging, and idle cycles for targeted analysis.

✓ **High-Quality Plotting:** Ready-to-use visualizations for reports using Seaborn/Matplotlib.

✓ **Scalable AWS Storage:** Backed by S3 and PostgreSQL for secure, expandable data handling.

Future Work

- **EC2 Deployment:** We plan to host the platform on Amazon EC2 for public accessibility and real-time use.
- **Battery Usage Prediction:** ML models integrated to predict battery health, usage trends, and remaining life.
- **Cross-Domain Application:** The pipeline will be adapted for other fields like EV telemetry or solar monitoring, using custom schema mappings.