Battery LLM - TIMELINES & ROADMAP

1. Battery LLM - Battery description integration with Pricing affecting factors & training feature params using SmolAgent and other LLMs
2. Battery LLM - pricing determination as per health state and condition of battery
3. Battery LLM reutilisation - reutilisation with other devices as per battery state

Additional Factors Affecting Battery Pricing Structure

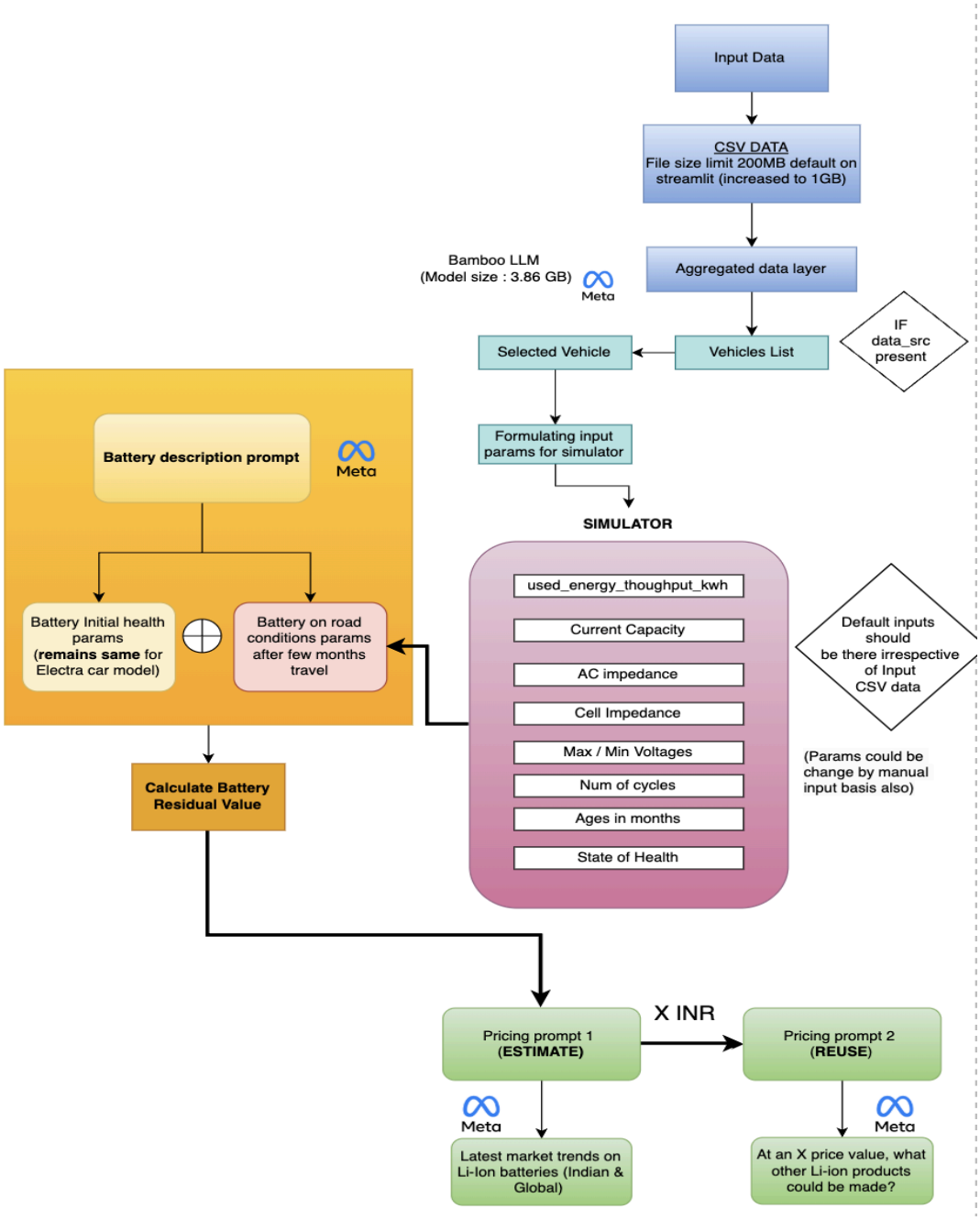
1. **Environmental Conditions**: Temperature variations can significantly impact battery health and performance.
2. **Charging Infrastructure**: Availability and type of charging stations (fast vs. slow charging) can influence usability.
3. **Battery Age and Cycle Life**: The number of charge cycles affects the remaining useful life (RUL) of the battery.
4. **Market Trends**: Fluctuations in lithium prices and technological advancements can affect overall pricing.
5. **Vehicle Usage Patterns**: Daily mileage, driving conditions (urban vs. highway), and idle time should be considered.

How GenAI can benefit in Battery pricing in comparison with traditional ML models?

- Generative AI can develop **dynamic pricing models** that adjust prices based on real-time market conditions, vehicle on road usage conditions, competitor pricing, and customer demand. This ensures optimal pricing strategies that maximize profitability.
    - Real-time Dynamic Pricing Analysis
    - Adaptive Learning & Market Intelligence:: Studying and feeding Latest market trends where traditional ML methods requires regular retraining with new data. GenAI can continuously learn from new scenarios and adapt to market changes through few-shot learning.
    - Synthetic data generation:
        - Factor in environmental conditions and usage patterns

        - Consider geographic and route-specific degradation factors
    - Complex Pattern Recognition: Traditional ML methods are limited to statistical patterns in historical data whereas GenAI can identify subtle correlations between various factors like:
        - Driving behavior and battery degradation
        - Environmental conditions and performance impact
        - Charging patterns and cell deterioration
    - Scenario generation - GenAI excels at creating diverse scenarios based on historical data. This enables manufacturers to simulate various market conditions and consumer responses, allowing them to adjust pricing strategies proactively rather than reactively.
    - Multi-dimensional Valuation Parameters:
        - Battery health prediction - SoH estimation, Temperature excursions, Max/Min Voltage, Num of cycles, Battery Capacity degradation and Age of vehicle.
    - CSV Analyzer -
        - GenAI would be able to perform data analysis and extract vehicle on road usage stats without hardcoding values, to understand columns from tabular data and generate pricing insights.
        - Process vehicle telemetry data (voltage, current, temperature patterns)
        - Analyze charging-discharging cycles and patterns

- **Technical Flow:**


Input Data
CSV DATA
File size limit 200MB default on streamlit (increased to 1GB)
Aggregated data layer
Bamboo LLM
(Model size : 3.86 GB)
Meta
Vehicles List
IF data_src present
Selected Vehicle
Formulating input params for simulator
SIMULATOR
Battery description prompt
Meta
Battery Initial health params (remains same for Electra car model)
Battery on road conditions params after few months travel
used_energy_thoughput_kwh
Current Capacity
AC impedance
Cell Impedance
Max / Min Voltages
Num of cycles
Ages in months
State of Health
Default inputs should be there irrespective of Input CSV data
(Params could be change by manual input basis also)
Calculate Battery Residual Value
X INR
Pricing prompt 1 (ESTIMATE)
Pricing prompt 2 (REUSE)
Meta
Meta
Latest market trends on Li-Ion batteries (Indian & Global)
At an X price value, what other Li-ion products could be made?

•

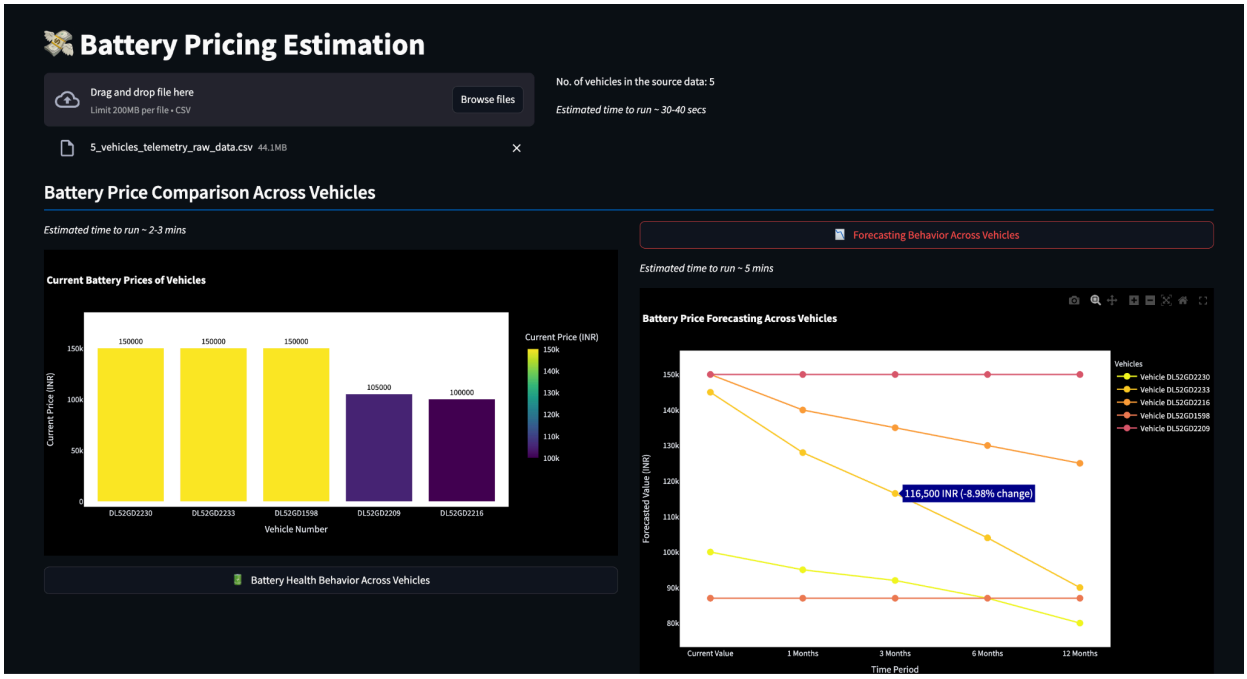
I recommend using the Mistral model for this analysis because:

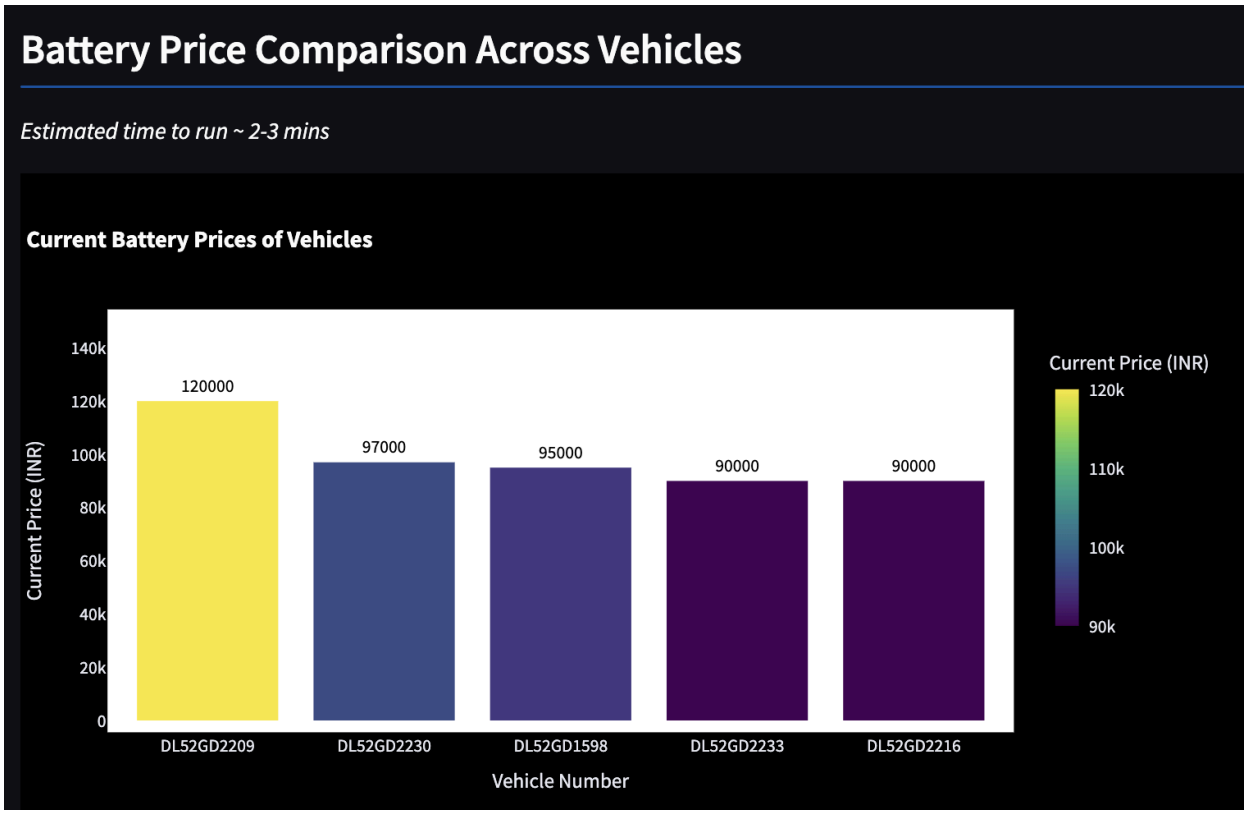
1. It has better performance on technical data analysis compared to base LLaMA2
2. It can handle structured data like battery statistics more effectively
3. It provides more consistent and detailed technical analyses
4. It has better understanding of numerical relationships and technical specifications

References:

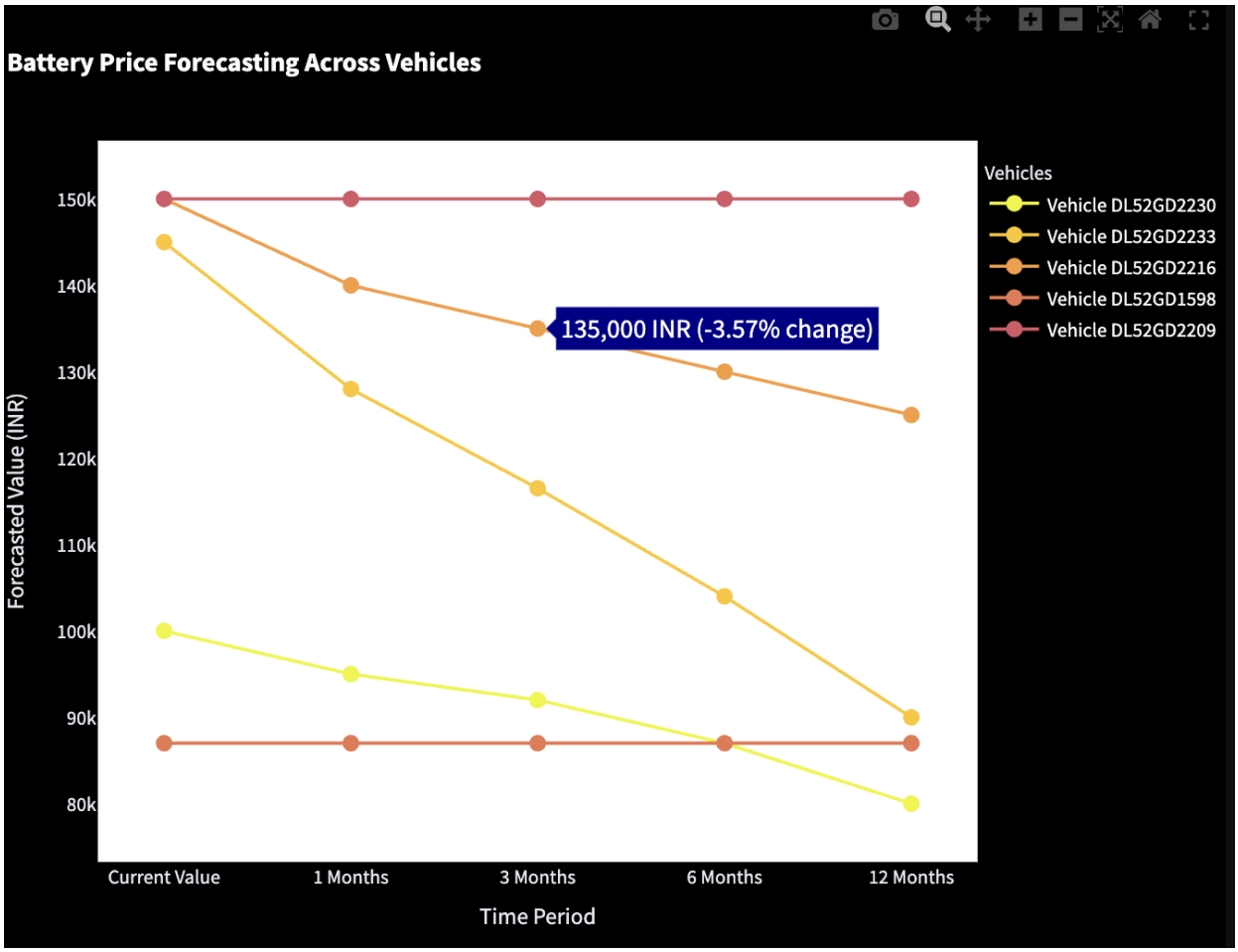
- Complete Guide to EV Batteries in India: Pricing, Top Manufacturers & Future Trends (2024)
- https://lohum.com/scrap-battery-price-calculator/

BATTERY LLM PRICING INDICATOR - STREAMLIT APP DETAILS:



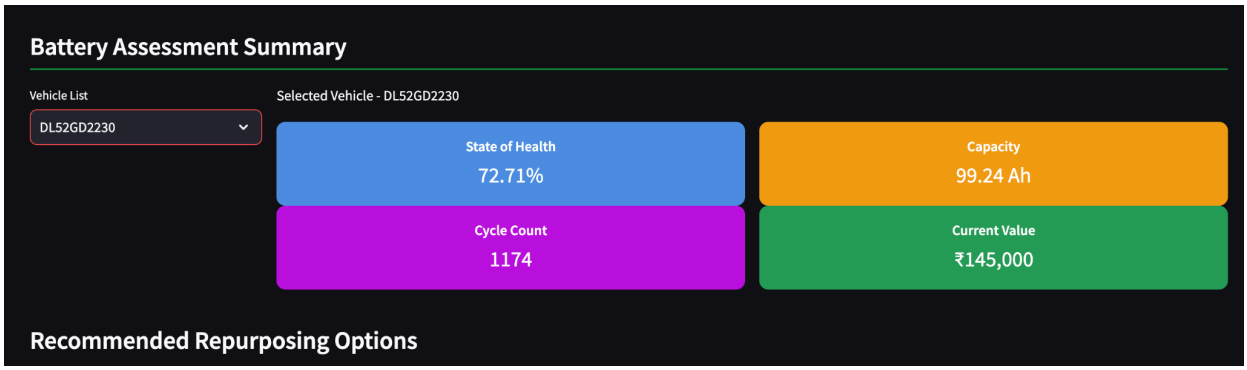


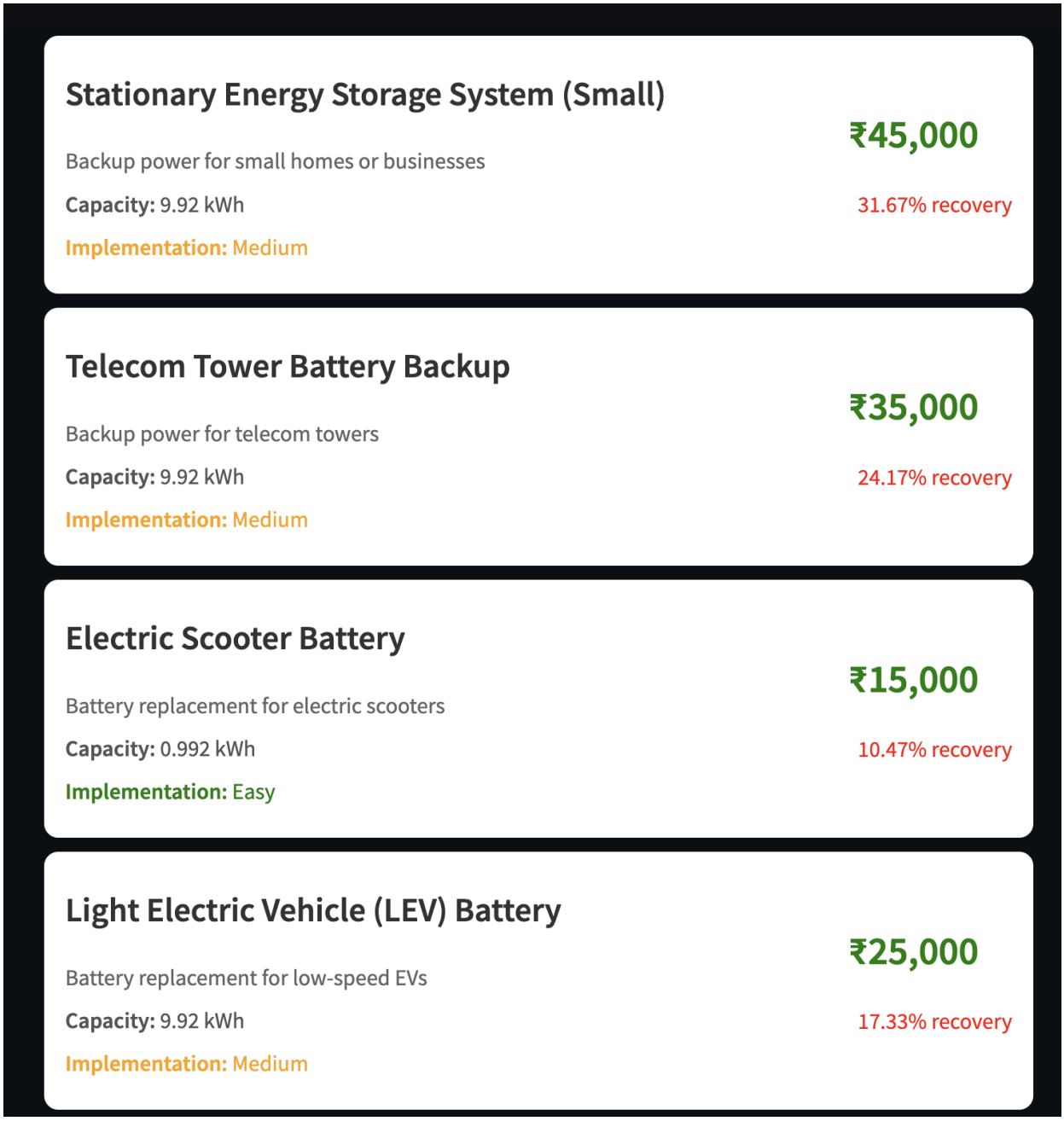
Price Forecasting upto 12 months behavior based on on-road vehicle usage for a battery:



Battery Reutilisation Products (Top 5) features:

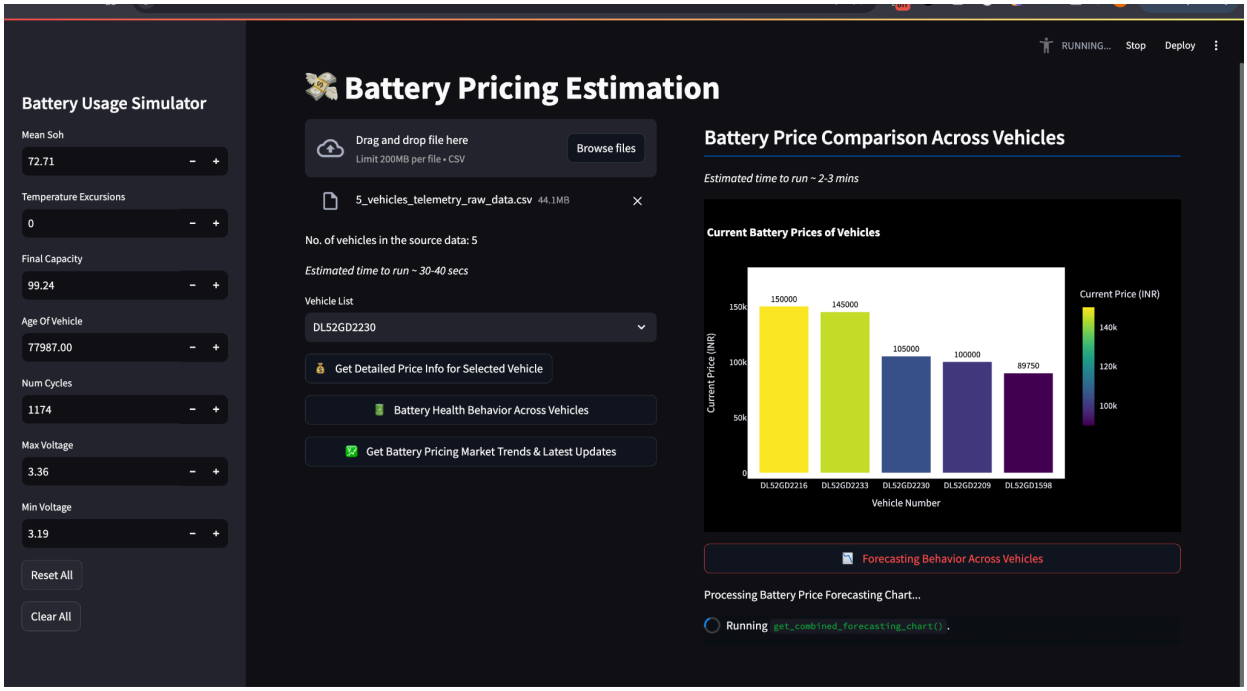
1. Product Name & Description
2. Capacity required by the product
3. Implementation Level
4. Marked Demand
5. Recovery Value in INR
6. Recovery %

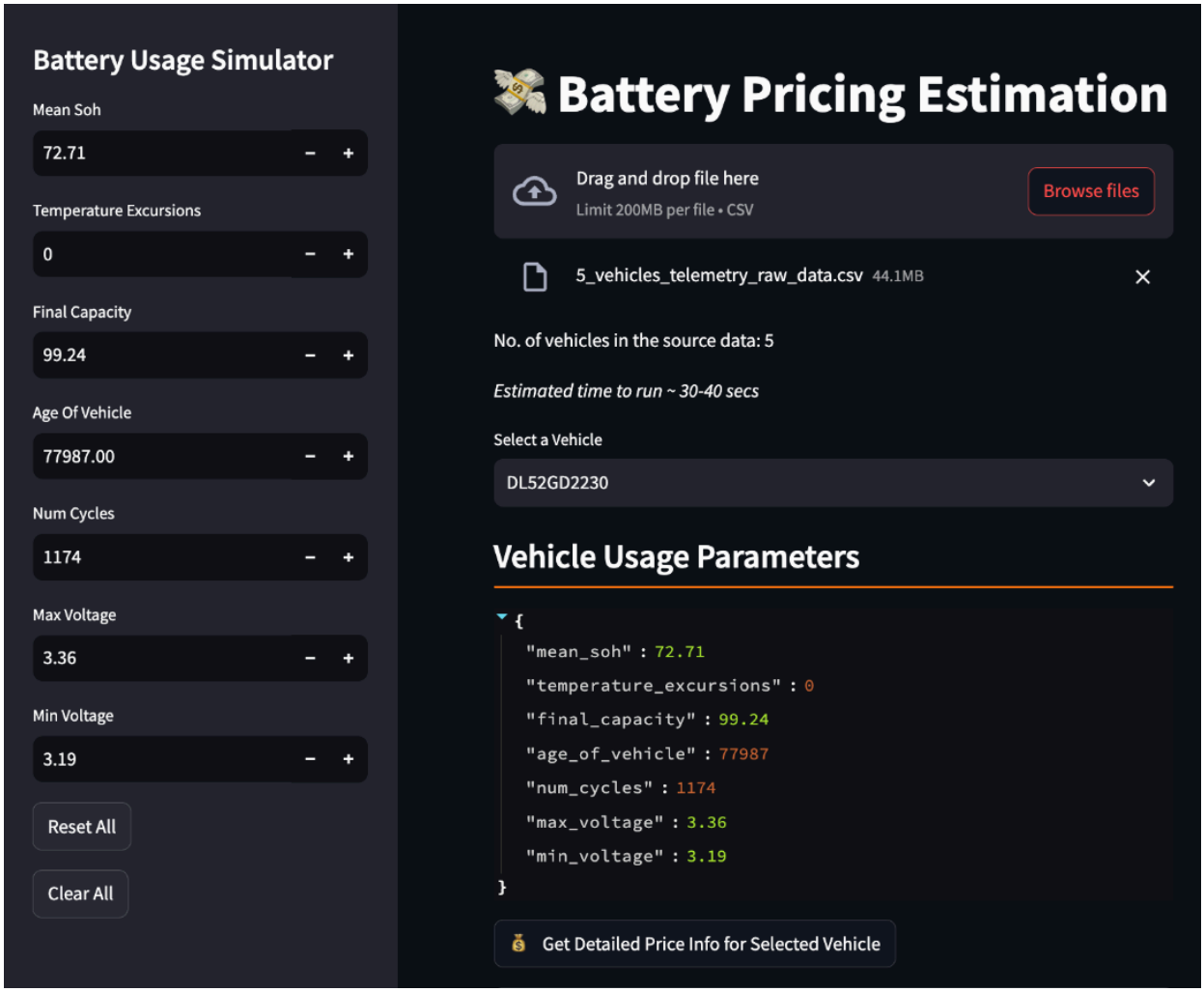




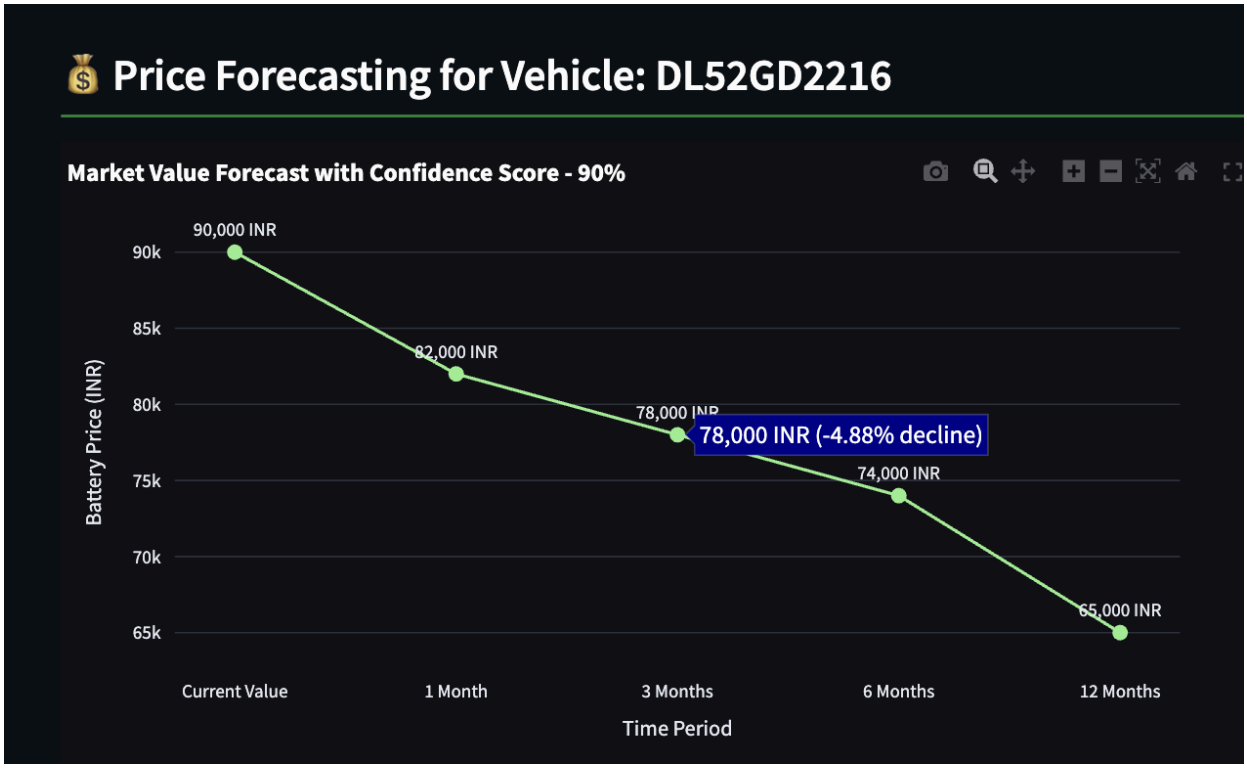
In Depth Technical View & Features:

Detailed Price Info for selected vehicle, dynamic multi-parameters simulation could also be tested :


RUNNING...
Stop
Deploy
Battery Usage Simulator
Mean Soh
72.71
Temperature Excursions
0
Final Capacity
99.24
Age Of Vehicle
77987.00
Num Cycles
1174
Max Voltage
3.36
Min Voltage
3.19
Reset All
Clear All
Battery Pricing Estimation
Drag and drop file here
Limit 200MB per file • CSV
Browse files
5_vehicles_telemetry_raw_data.csv 44.1MB
No. of vehicles in the source data: 5
Estimated time to run ~ 30-40 secs
Vehicle List
DL52GD2230
Get Detailed Price Info for Selected Vehicle
Battery Health Behavior Across Vehicles
Get Battery Pricing Market Trends & Latest Updates
Battery Price Comparison Across Vehicles
Estimated time to run ~ 2-3 mins
Current Battery Prices of Vehicles
Current Price (INR)
150k
100k
50k
0
150000
145000
105000
100000
89750
DL52GD2216
DL52GD2233
DL52GD2230
DL52GD2209
DL52GD1598
Vehicle Number
Current Price (INR)
140k
120k
100k
Forecasting Behavior Across Vehicles
Processing Battery Price Forecasting Chart...
Running get_combined_forecasting_chart()


Battery Usage Simulator
Mean Soh
72.71
Temperature Excursions
0
Final Capacity
99.24
Age Of Vehicle
77987.00
Num Cycles
1174
Max Voltage
3.36
Min Voltage
3.19
Reset All
Clear All
Battery Pricing Estimation
Drag and drop file here
Limit 200MB per file • CSV
Browse files
5_vehicles_telemetry_raw_data.csv 44.1MB
No. of vehicles in the source data: 5
Estimated time to run ~ 30-40 secs
Select a Vehicle
DL52GD2230
Vehicle Usage Parameters
{
"mean_soh" : 72.71
"temperature_excursions" : 0
"final_capacity" : 99.24
"age_of_vehicle" : 77987
"num_cycles" : 1174
"max_voltage" : 3.36
"min_voltage" : 3.19
}
Get Detailed Price Info for Selected Vehicle

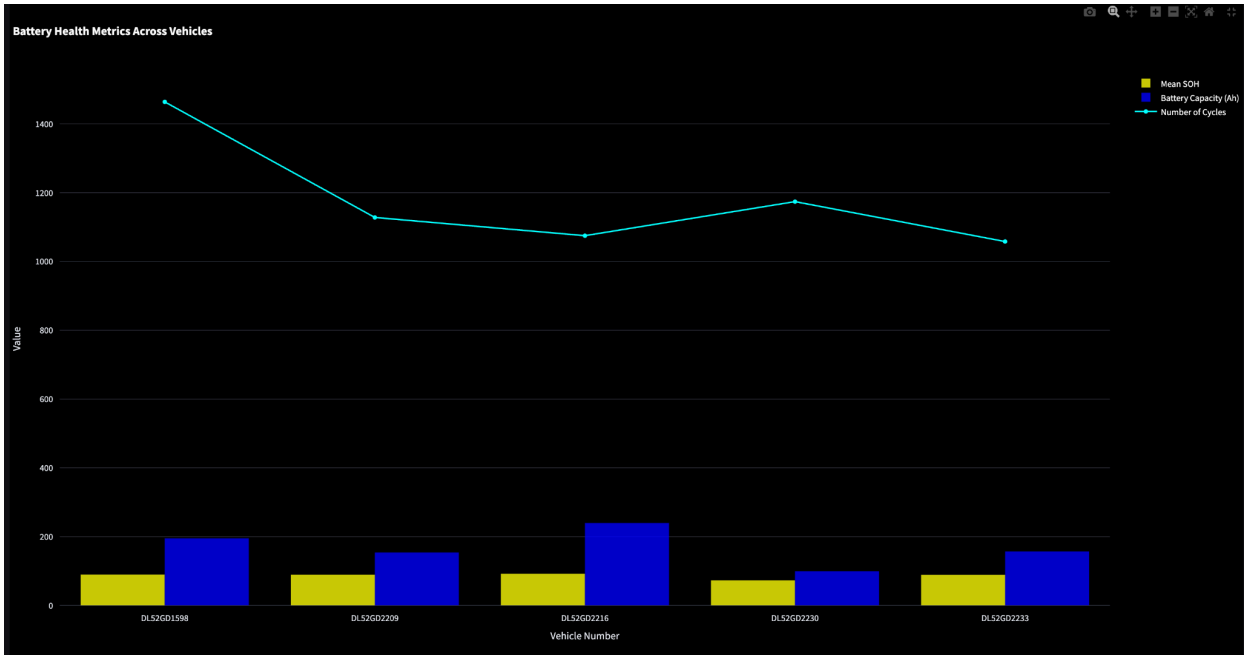
💰 Price Forecasting for Vehicle: DL52GD2216



👩🏻‍💻 Price Anlaysis Full Report Generated!

Battery Pack Valuation Report

Metric	Current Value (INR)	Adjustment (%)	Final Value (INR)
Base Value	120,000	-	120,000
Technical Health Impact			
Safety Rating Adjustment	N/A	-25	-30,000
Thermal Management	N/A	-10	-12,000
Protection Systems	N/A	-10	-12,000
Usage Impact			
Battery Residual Value	80,000	-15	68,000
Temperature Exposure	N/A	-15	-12,000
State of Health (SOH)	N/A	-6	-7,200
Age of Battery	N/A	-5	-6,000
Final Capacity	N/A	-30	-36,000
Maintenance Quality	N/A	0	0
Market Factors			
Insurance Risk	N/A	-10	-12,000
Regional Climate	N/A	-5	-6,000
Support Infrastructure	N/A	0	0
Total Adjustment			-124,200
Final Value (Adjusted)	120,000	N/A	95,800



NEXT STEPS :

- LLM [REALTIME NOT LOCAL] & ACCURACY - Confidence metrics
- REALTIME INDUSTRY ANALYSIS
- Running time optimisations