



EV.ENGINEER

INTELLIGENCE. SAFETY. SECURITY.



TRUSTED INTELLIGENCE FOR
MISSION-CRITICAL ENERGY SYSTEMS



Ashwini Sudarshana

EV.ENGINEER™ - Team

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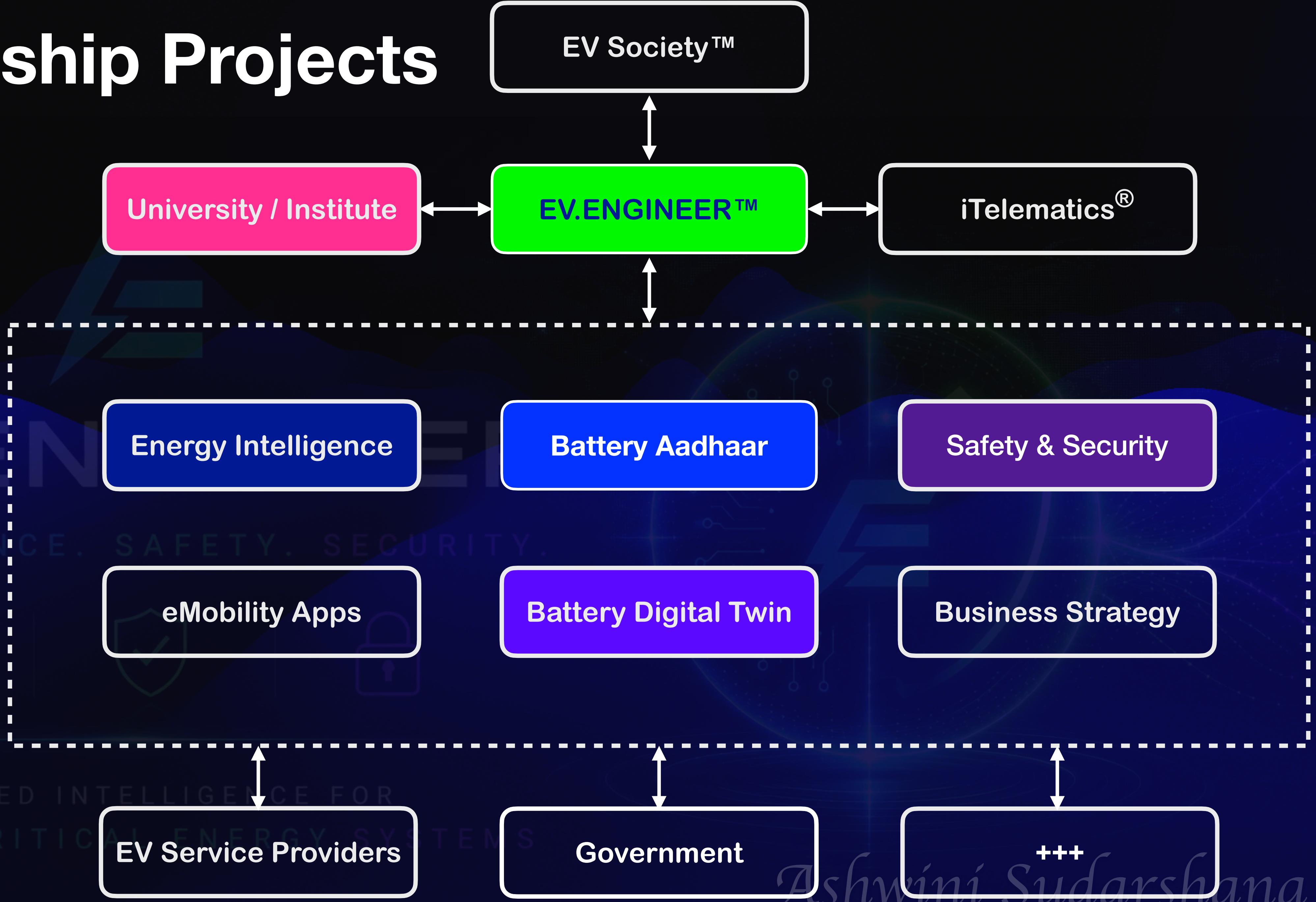
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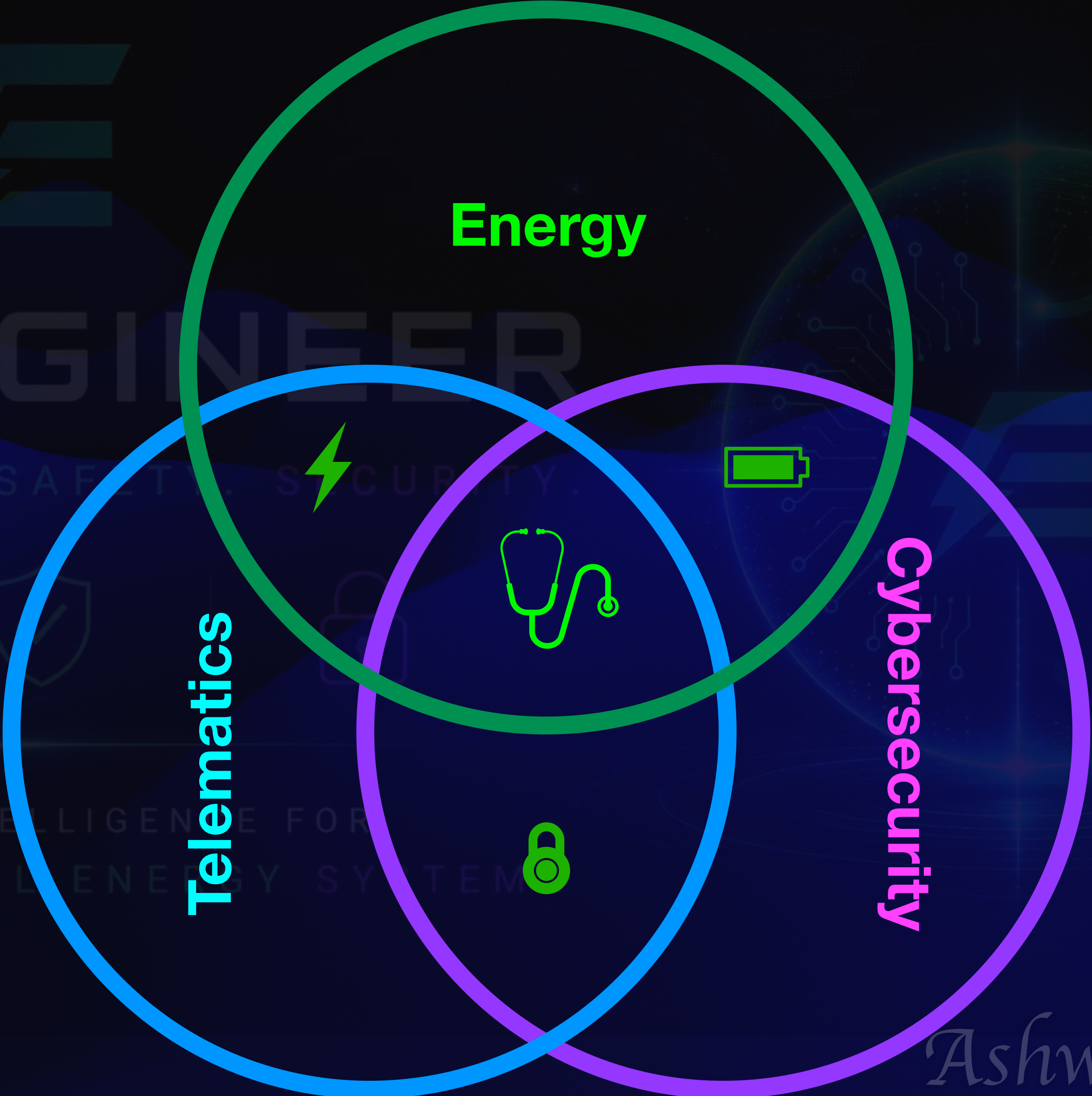
EV Society™, Bangalore, India

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EV Internship Projects



Energy Intelligence



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Battery Pack Aadhaar System

- A simulation-first platform that **creates Battery Pack Aadhaar digital identities, generates BPAN + QR payloads, and simulates battery health/safety behaviour (SoH, status transitions, incidents) using PyBaMM, producing lifecycle event logs aligned to the guideline's BDD model.**



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Tech Stack

- Java, Python, PyBaMM (simulation)
- **FastAPI (Python)** backend (API + BDD event writer)
- **PostgreSQL** (battery identity + BDD event timeline)
- **Redis + Queue** (async simulation jobs)
- **QR scan/generate libs** in Flutter
- Flutter (Frontend), Offline local DB in Flutter
- Auth (Firebase/Auth0), S3 storage, Sentry, Kubernetes, analytics DB
- Antigravity IDE, AWS, Google Cloud Platform, Figma (UX design)

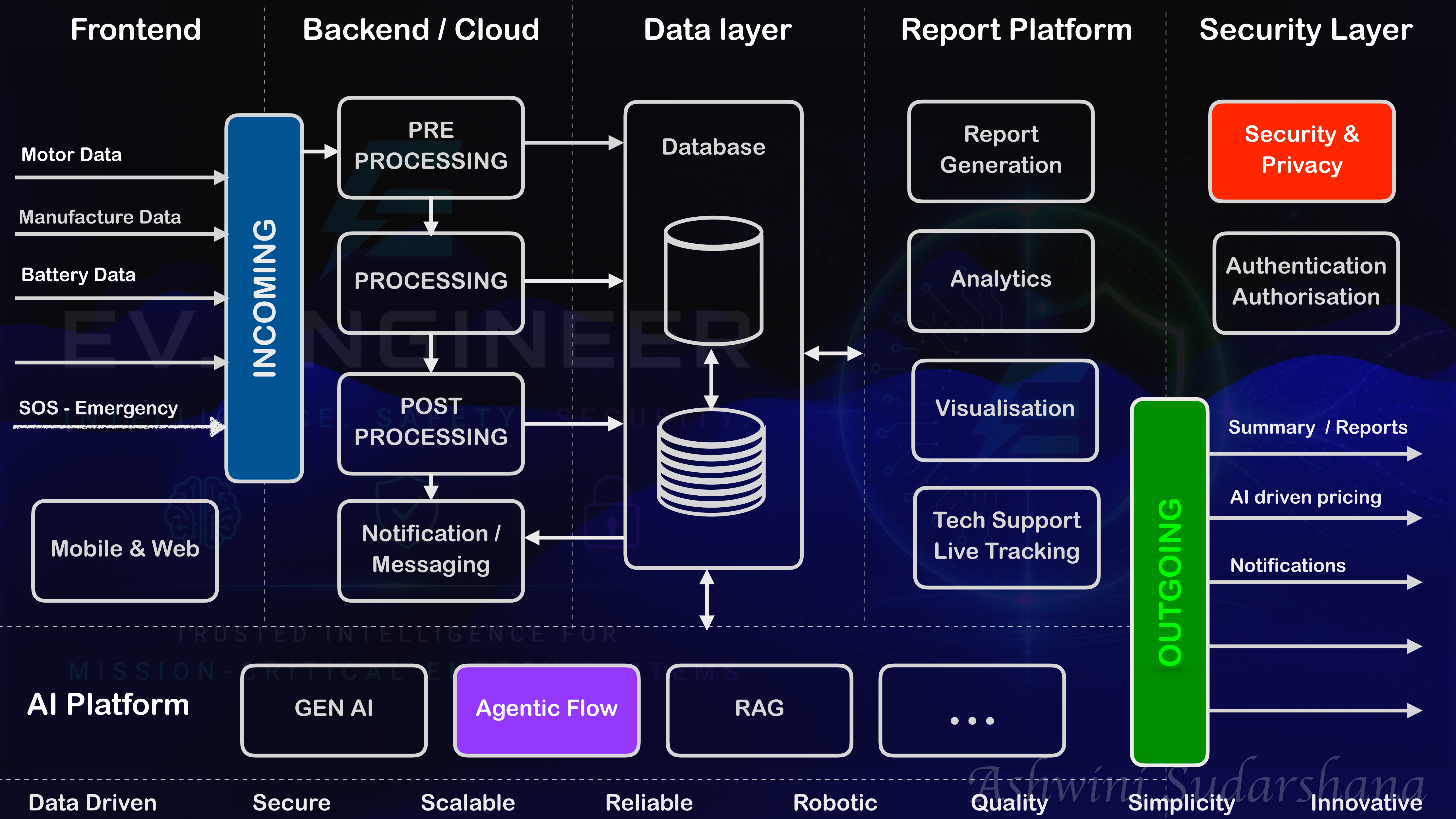
Energy Intelligence

Availability

Accessibility

Affordability

Maintainability



POC vs Product v.1

POC

LLM	Gemma 3:4b via Ollama (local)
Tool selection	Prompt-based JSON extraction
Agent count	5 overlapping agents
Knowledge base	7-line doc + keyword match
Data source	Static CSVs
Per-vehicle data	Global fleet-wide only
Anomaly model	Retrained every call
Caching	None
Testing	Print-based scripts
Drift detection	Simple σ comparison

PRODUCT v.1

Claude API (Haiku for speed, Sonnet for quality)
Native Claude tool use
1 orchestrator + 5 specialists
Chunked docs + vector embeddings (ChromaDB)
Timescale DB with real-time ingestion
Per-vehicle driving/charging history
Trained once, persisted
@st.cache_resource + model serving layer
pytest with assertions and fixtures
KS test / PSI

Data drift occurs when your model's input data distribution changes over time, leading to performance degradation. Choosing the right detection method depends on your data type and what you want to measure.

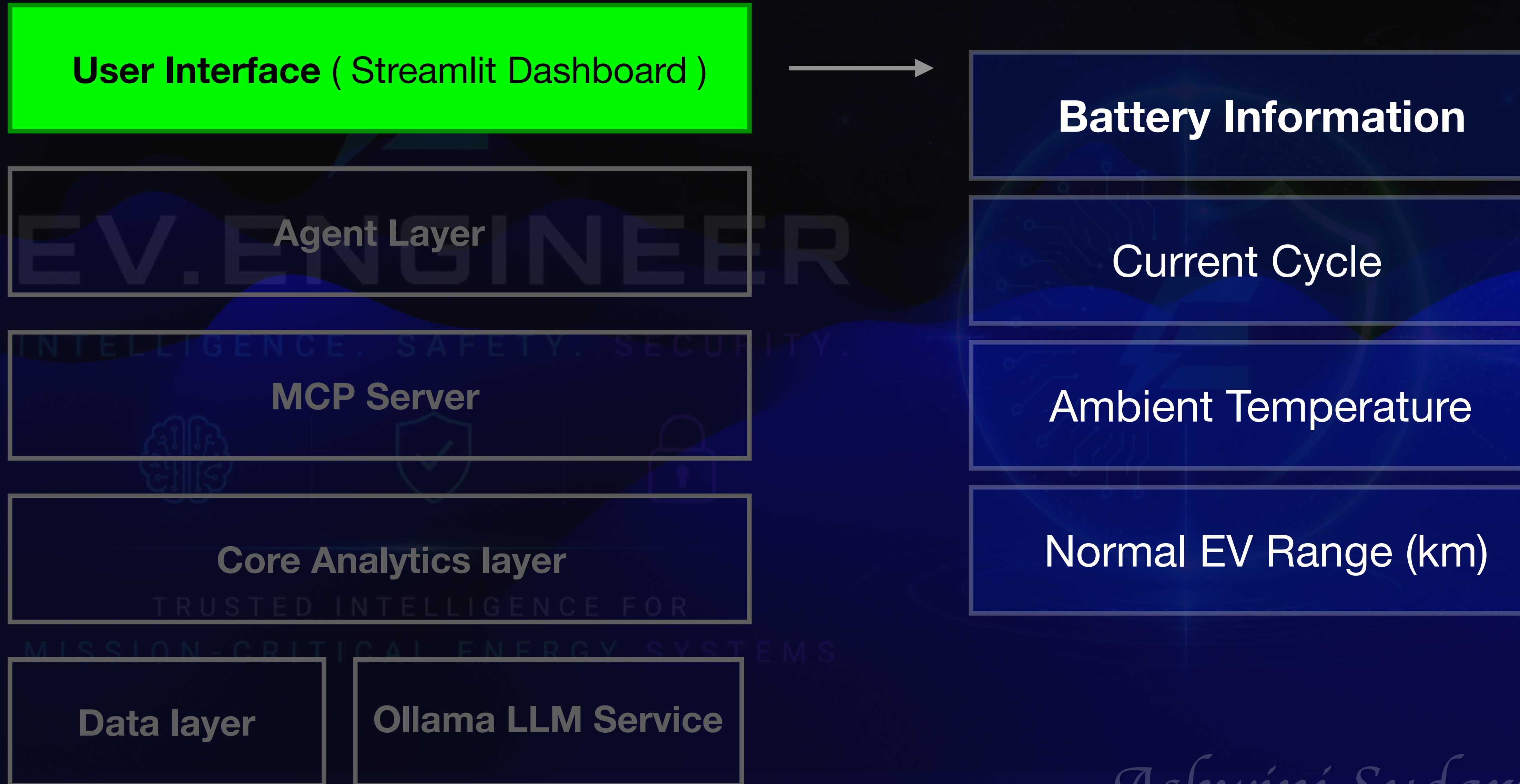
Assumptions | Limitations

- **Data is static and fleet-global** — not per-vehicle, not real-time
- **Knowledge base is a stub** — needs proper RAG
- **Five redundant agent implementations** — only one is production-relevant
- **No Streamlit caching** — every interaction reloads ML models
- **LLM dependency on local Ollama** — creates fragile runtime requirement
- **Anomaly model retrains on every call**

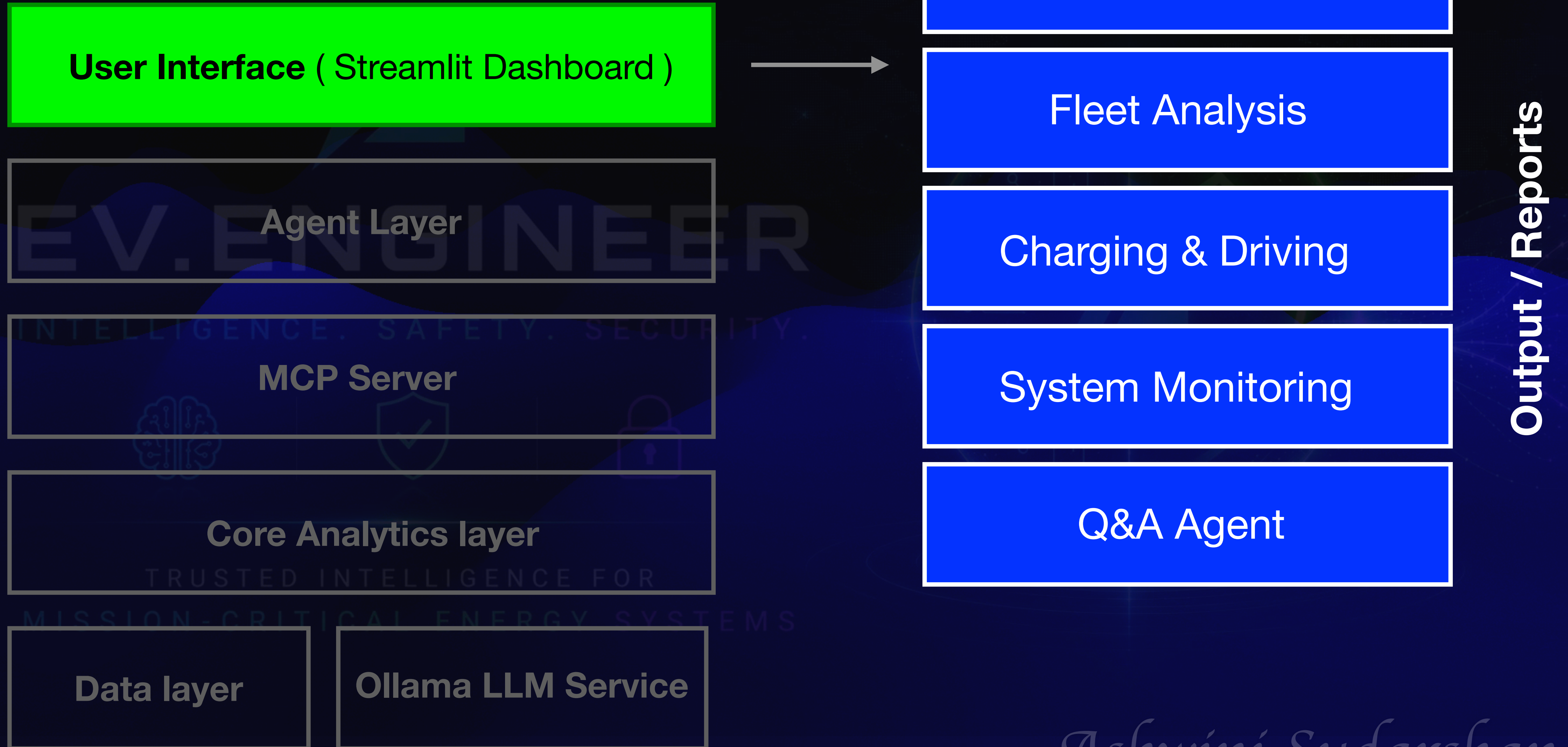
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High Level Architecture



High Level Architecture



High Level Architecture

User Interface (Streamlit Dashboard)

Agent Layer

MCP Server

Core Analytics layer

Data layer

Ollama LLM Service

Battery Digital Twin

Predicted SOH RUL to 80% SOH
Estimated Range Health Status

Battery Health Score
Digital Twin Timeline
Simulation Table / Graph - SOH, Range

Model: gemma3:4b

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High Level Architecture

Fleet Analysis

User Interface (Streamlit Dashboard)

Agent Layer

MCP Server

Core Analytics layer

Data layer

Ollama LLM Service

Fleet average SOH

Worst Battery

Best Battery

Fleet SOH Distribution

Top 20 Healthy Batteries

Top 20 Risky Batteries

Fleet temperature distribution

Fleet anomaly detection

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High Level Architecture

User Interface (Streamlit Dashboard)

Agent Layer

MCP Server

Core Analytics layer

Data layer

Ollama LLM Service

Charging Intelligence

Avg charging duration

Avg SOC Increase

Avg Charging Risk Score

Fast Charging Usage

Charging Risk Distribution

High Level Architecture

User Interface (Streamlit Dashboard)

Agent Layer

MCP Server

Core Analytics layer

Data layer

Ollama LLM Service

Driving Intelligence

Driving Style

Average Speed

Driving Score

Average Power

Predictive Maintenance

- Maintenance Priority
- Overall score
- Recommended actions

High Level Architecture

User Interface (Streamlit Dashboard)

Agent Layer

MCP Server

Core Analytics layer

Data layer

Ollama LLM Service

System Monitoring

System status

Fleet Status

Critical Batteries

Fleet average SOH

Data drift monitoring

Fleet health overview

Fleet SOH distribution

Top 20 critical batteries

Top 20 healthy batteries

System Warnings

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High Level Architecture

User Interface (Streamlit Dashboard)

Agent Layer

MCP Server

Core Analytics layer

Data layer

Ollama LLM Service

Discovery MCP Agent

LLM Digital Twin Agent

MCP Tool Agent

Tool calling Agent

Digital Twin Agent | No LLM

High Level Architecture

User Interface (Streamlit Dashboard)

Agent Layer

MCP Server

Core Analytics layer

Data layer

Ollama LLM Service

Predict SOH

Estimate RUL

Generate Summary

Generate Charging Summary

Get charging risk distribution

Get high risk charging sessions

Get driving energy summary

Get driving score

Get driving style

Compare batteries - Risk vs Healthy score

Check system health, son drift

High Level Architecture

User Interface (Streamlit Dashboard)

Agent Layer

MCP Server

Core Analytics layer

Data layer

Ollama LLM Service

Random forest - SOH / RUL / Range / Timeline

Charging Analyser - Risk analysis

Driving Analyser - Telemetry (speed/power)

Fleet anomaly detector

Data drift detector

Twin Report - Aggregates Battery / Charging / Driving

Predictive Maintenance Engine

System Monitoring Engine

Battery Knowledge Base

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High Level Architecture

User Interface (Streamlit Dashboard)

Agent Layer

MCP Server

Core Analytics layer

Data layer

Ollama LLM Service

Trained Random Forest (SOH predictor)

LabelEncoder for battery IDs

Static snapshot of 20 batteries

Driving telemetry (EV)

Per-session charging risk

Pre-aggregated charging stats

Pre-aggregated risk distribution

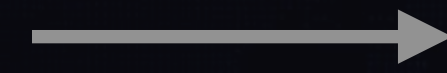
Knowledge Base

Battery Degradation

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New v.1 -> Solution / Architecture

REAL-TIME DATA INGESTION



MQTT / OBD-II API

DIGITAL TWIN STATE LAYER

Telemetry Broker

MCP TOOL SERVER (FastMCP)

TimescaleDB

MULTI-AGENT ORCHESTRATION

TimescaleDB is a high-performance, open-source time-series and event database built as an extension to PostgreSQL. It allows developers to store and analyze massive volumes of time-based data (IoT, finance, server logs) while maintaining full ACID compliance and standard SQL capabilities

DASHBOARD / API LAYER

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New v.1 -> Solution / Architecture

REAL-TIME DATA INGESTION

DIGITAL TWIN STATE LAYER

MCP TOOL SERVER (FastMCP)

MULTI-AGENT ORCHESTRATION

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DASHBOARD / API LAYER

Per-vehicle SOH snapshots

Charging sessions

Driving sessions

Battery Physics Engine

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New v.1 -> Solution / Architecture

REAL-TIME DATA INGESTION

DIGITAL TWIN STATE LAYER

MCP TOOL SERVER (FastMCP)

MULTI-AGENT ORCHESTRATION

DASHBOARD / API LAYER

Battery tools

Fleet tools

Charging tools

Driving tools

Anomaly tools

Drift tools

Maintenance tools

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New v.1 -> Solution / Architecture

REAL-TIME DATA INGESTION

DIGITAL TWIN STATE LAYER

MCP TOOL SERVER (FastMCP)

MULTI-AGENT ORCHESTRATION

DASHBOARD / API LAYER

Orchestrator Agent

- Battery Analyst Agent
- Fleet Analyst Agent
- Charging Expert Agent
- Maintenance Planner Agent
- Report Writer Agent

RAG Knowledge Retriever

(ChromaDB + sentence-transformers)

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New v.1 -> Solution / Architecture

REAL-TIME DATA INGESTION

DIGITAL TWIN STATE LAYER

MCP TOOL SERVER (FastMCP)

MULTI-AGENT ORCHESTRATION

DASHBOARD / API LAYER

Streamlit Dashboard

FastAPI REST endpoints for external consumers

Alert / Notification service (email / WhatsApp)

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Thank you

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iTelematics[®] Software Private Limited, Bengaluru, India

EV Society[™], Bengaluru, India

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