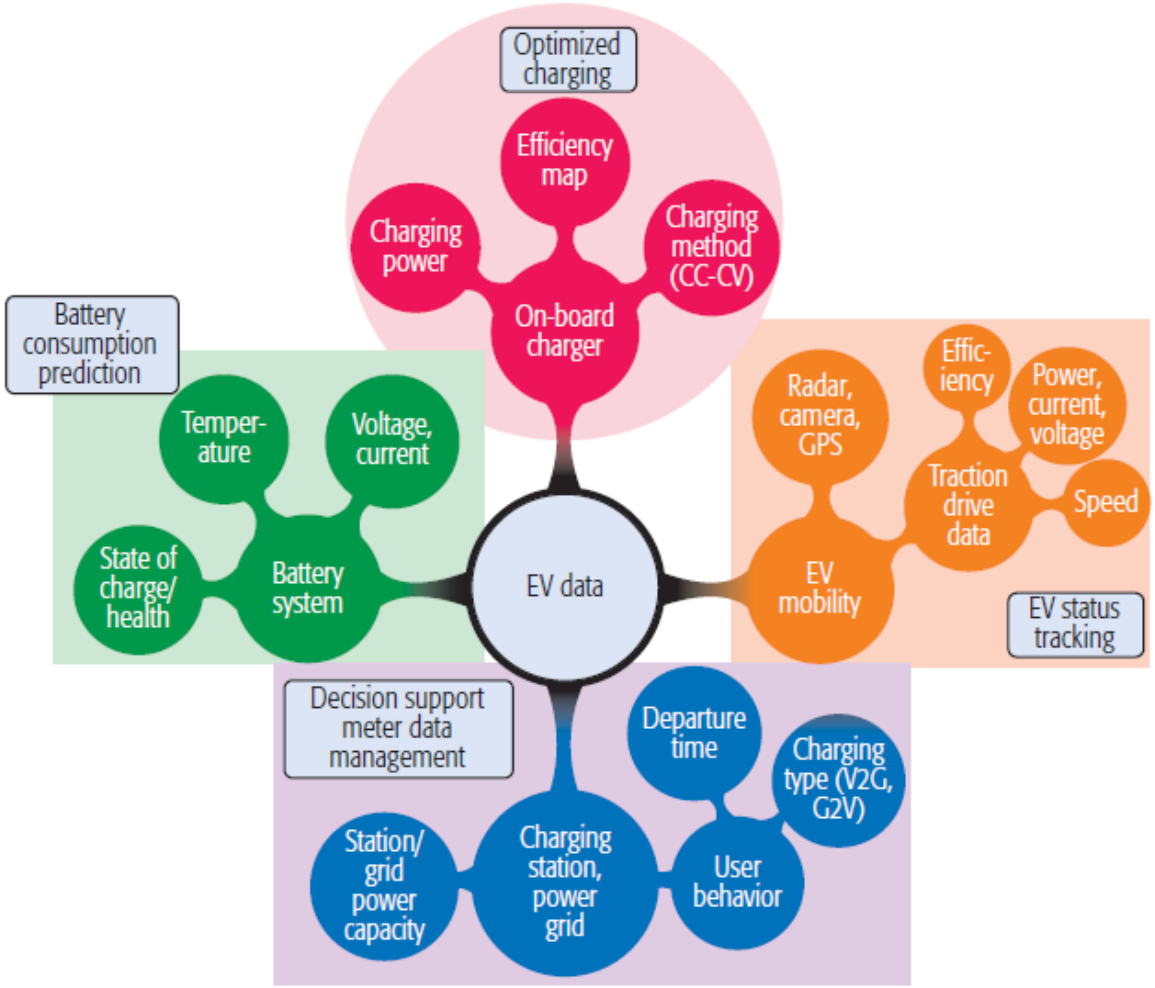


Performatica Webinar

Electric Vehicles - State of the Art & Emerging Strategies Industries

Followed by a Panel Discussion

Agenda

Subject	Speakers	Timeline
Introduction	Murthy Divakaruni	-
Advances in Battery Technology - use and impact of utility-scale battery installations	Krish Kommar	10 mins
Electric Vehicles - State of the Art & Emerging Strategies	Dr. Kaushik Rajashekara	35 mins
Panel Discussion, Q&A	John Baumgartner	30 mins
Key Takeaways	Murthy Divakaruni	-

Performatica - Introduction

Consulting+ Technology solutions **team from Fortune 500 and Tier I IT/ITES Firms**

Members from consulting, technology and operations provide an **all-inclusive perspective at an engagement level**

Design thinking and Change Management at the core of any proposed solution

Leveraging **low-code/no-code platforms for MVPs** as part of our engagements

What we do at Performatica

Management + Technology Consulting

Strategy | Operations | Technology | Alliances

Digital Leadership

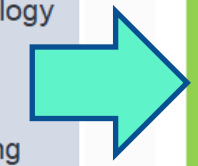
- "Systems level thinking" that is critical in delivering business performance metrics
- Deliver high value-added, fast, and cost-effective projects
- Technology COEs for technology acceptance and transfer, commercialization

Change Management

- Changes in Industry Dynamics *(e.g., M&As, alternative industries, sustainable goals)*
- Changes in Business Expectations *(e.g., remote operations, predictable and agile operations)*
- Changes in Technology Provisions *(e.g., faster, cheaper, reliable, automated and sustainable delivery)*

Design Led Transformation

- Specialists have experiential knowledge in multiple technology transformations in specific domains
- Integrated solutions leveraging engineering and advances in IT – led by design thinking
- Domain expertise in successfully applying these emerging technologies to solve business problems



Industry 4.0 → 5.0 ("New Normal")

- Real-Time Monitoring Dashboards, Decision Support/Expert Systems
- Remote Operations – Connected Factory Models
- RPA (Robotic Process Automation)
- Responsive Support
- Risk Controls (IoT Enabled Predictive Models)

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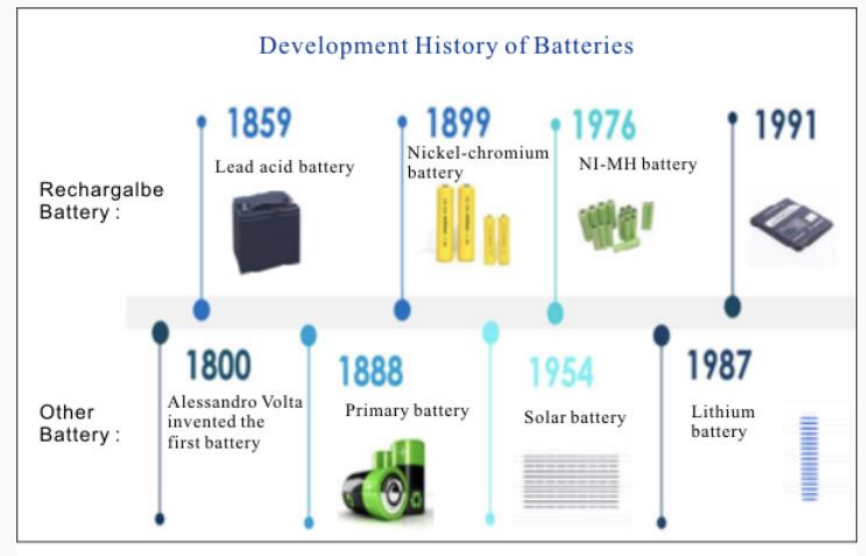
June 2021

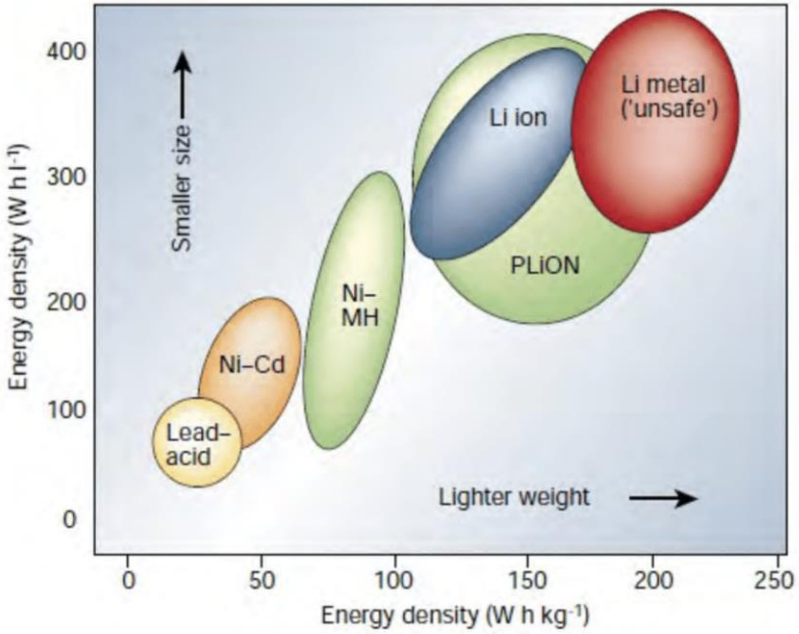
Advances in Battery Technology

Types of Battery technology

- Battery was first invented in 1800s and has been around for over 200 years
- Rapid advancements in Lithium-ion and significant cost reductions in the last 10 years brought in a Paradigm Shift in the state of battery technologies and its applications



Source: storagebattery.net



Source: Researchgate.net

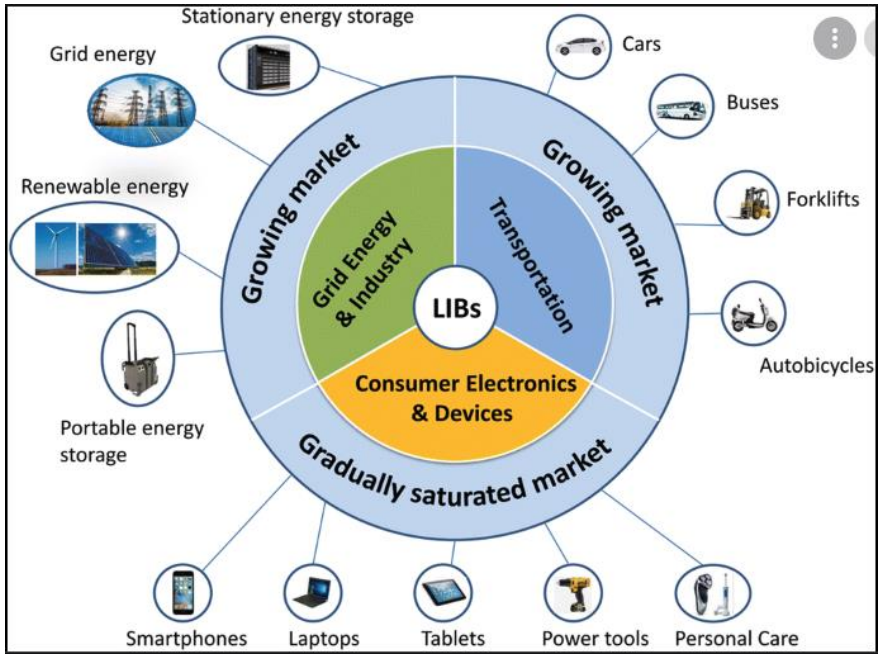
Uses of Lithium-Ion technology

Applications of Lithium-ion technology

Li-ion technology is being used across a spectrum of various industries:

- Consumer electronics
- Transportation
- Utility scale generation/Grid

Source: Alibaba.com



Source: link.springer.com

Lithium-Ion Chemistries & Applications

Lithium-ion technology now widely used in EV and Utility scale Battery Storage

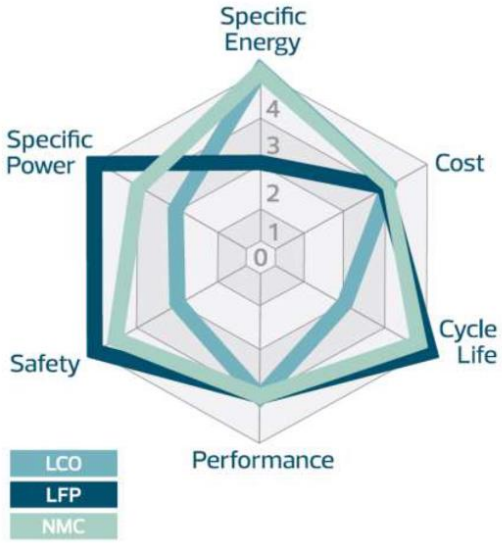
Li-ion chemistries:

Oxide-based:

LCO, NCA & NMC

LFPs:

Lithium-ion phosphate



Source: Incell Academy

Li-ion chemistries & its applications:

- NMCs - most widely used in EV cars & in Battery Storage Projects.
- NCAs also used in EV cars
- LFPs - used in EV buses & in Battery Storage Projects

Impact of battery technology on Utility industry

In the transition to a lower carbon system, battery storage is rapidly becoming a key component:

- Grid reliability/stability
- Utility grid infrastructure
- Flexible capacity is increasingly valued over intermittent or inflexible generation

Renewables Integration

- Match supply and demand
- Manage intermittency

Peaking Capacity

- Reliable zero emission power
- Near instantaneous ramp
- Modular design can locate near load

Wires Upgrades

- Bolster transmission or distribution capacity
- Can be cheaper than traditional utility solutions

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Electric Vehicles - State of the Art & Emerging Strategies

Kaushik Rajashekara

UNIVERSITY of HOUSTON
CULLEN COLLEGE of ENGINEERING

Outline

- Brief History of Electric Vehicles
- Electric vehicles
- Hybrid Vehicles
- Electric Vehicle Charging
- V2G Operation
- Challenges
- Future strategies

Adobe Acrobat Document

Agenda

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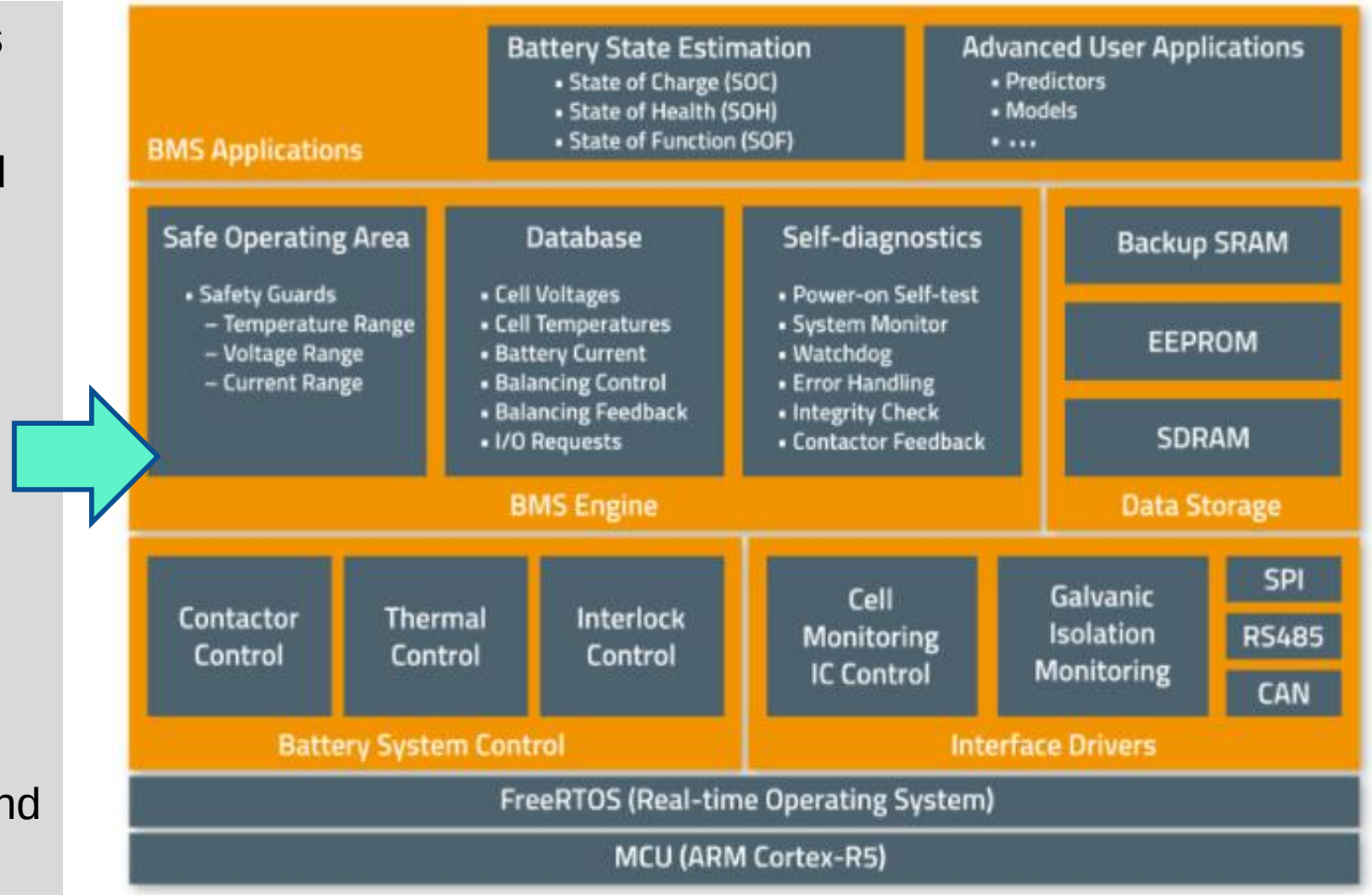
Panel Discussion

Key Takeaways

- EVs draw on a wide range of technologies, all of which are changing at a blistering pace.
- They will play a key role in meeting stringent sustainability goals, and the technologies are being applied across vehicle categories
- Moreover, they are increasing attractive to consumers and supported by many governments.
- Lastly, the effective integration of EV technologies with energy storage; AI, IOT, ML; and other advanced technologies holds the potential to radically transform the transportation and electric power industries with wide ranging secondary effects.
- We are on the cusp of a major worldwide technology adoption, and it is not too bold to note that EVs are likely to change society and the ways in which we live in many unforeseen ways.

Performatica's EV Consulting Services

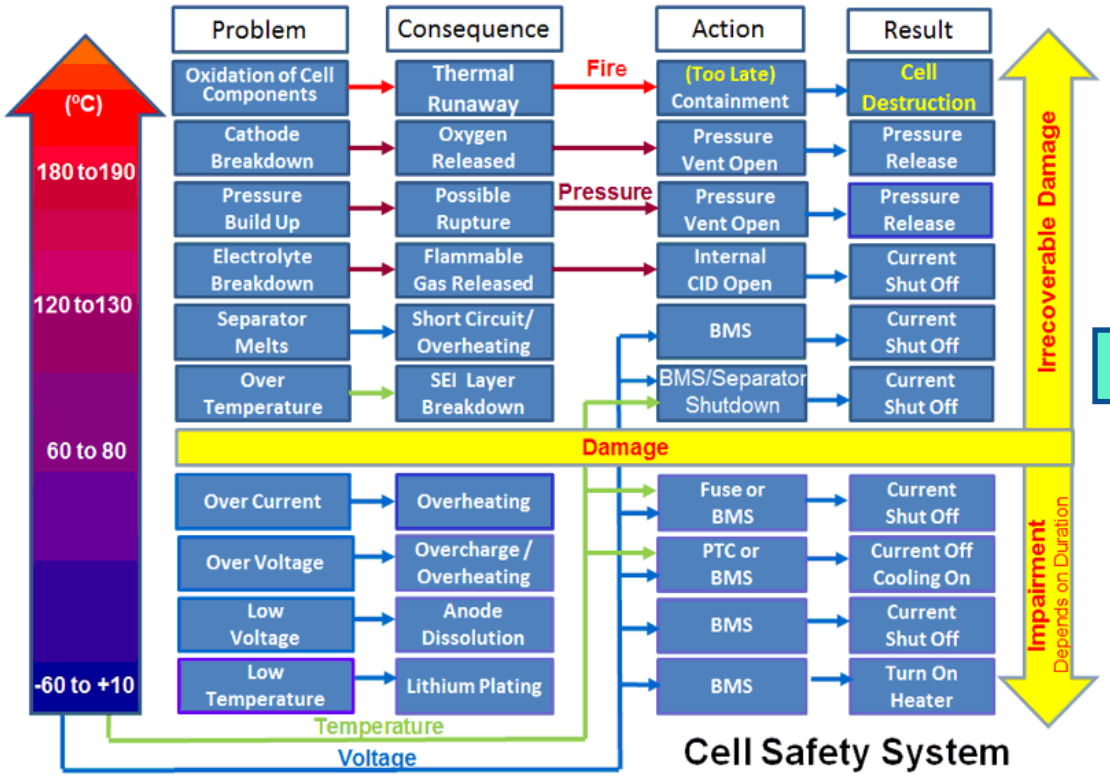
- Consulting in the field of battery systems and **failure analysis**
- POCs in the areas of **cybersecurity** and user management on BMS
- Partnership with Microsoft for data compliance, 24x7 delivery reliability and scaling requirements.
- Add-ons for modelling of battery cells (electric and thermal) for accurate state estimation algorithms (e.g., SOC, SOE, SOH, SOP)
- Prototyping of high-performance battery systems (e.g., for automotive, aviation and stationary applications)



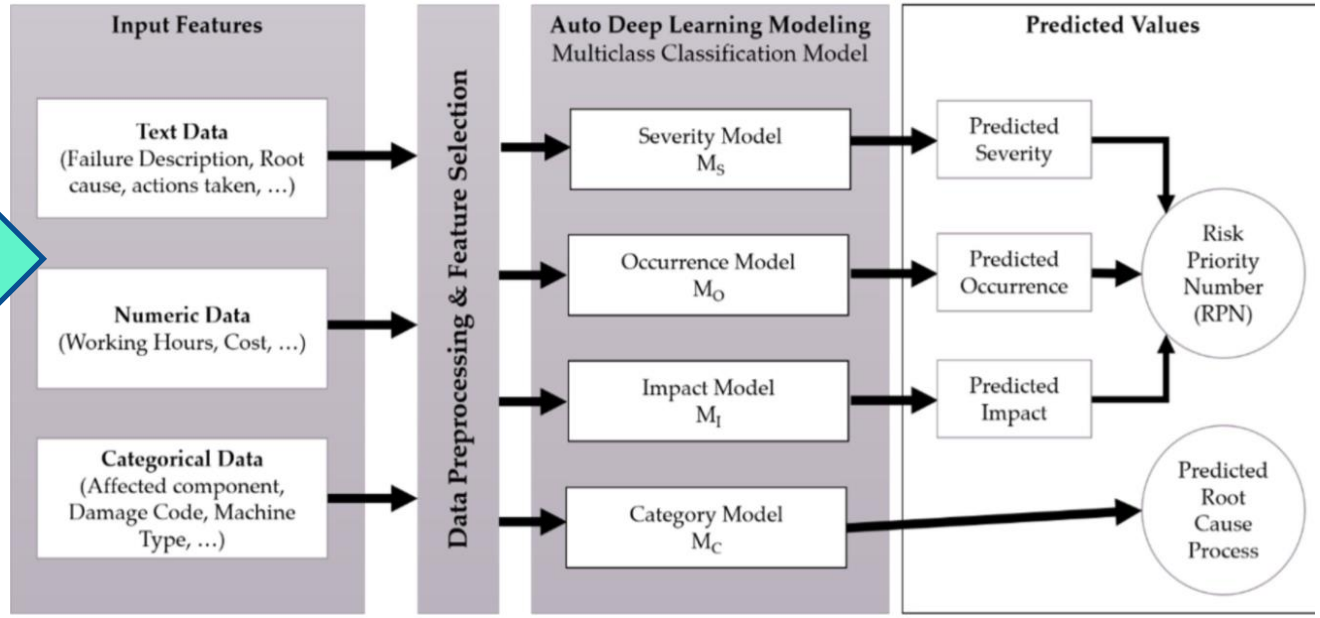
foxBMS – The Most Advanced Open Source BMS Platform

Performatica's EV Consulting Services

BMS Failure Scope and Consequences



Enhancing FMEA (Failure Mode and Effects Analysis) using AI/ML for EV's BMS Failure Prediction



Performatica's Industry Solutions on "Responsible AI/ML"

1. Prediction of OEE (*Overall Equipment Effectiveness*) from MTConnect & Operators
2. AI enabled grid insights to forecast short- and long-term loads and variances

Manufacturing & Utilities
Performance Metrics/Grid Insights

Energy
E&P Operations/ Pipelines

1. Pipeline Integrity Analysis
2. Asset's Performance Prediction from Process Historians
3. Production Decline Analysis

1. Outliers/Anomalies & Pattern Detection in Medical Images
2. Prediction of ADRs (*Adverse Drug Reactions*)

Healthcare
Medical Imaging/ Clinical Trials/ Insurance Claims

Sustainability
Electric Vehicles, Renewable Plants

1. Prediction of EV's BMS(Battery Management System) Performance
2. Prediction of Energy Efficiency and Production Variance

Thank you

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https://performatica.net/