e-Bus Fleet, Battery & Charging Infra

Planning, Management & Optimization

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Digitalising EV Eco System
Technology for e-Bus Fleet for STU

- Managed e-Fleet of Buses
- Battery Safety Measures @ Design
- Training Needs Redressal
- Operational Safety
- Remote Management and Control
- Battery Safety Measures @ Usage
e-Fleet Management Platform for STUs

- **E-Bus Management**
  - Route Management: Route Optimization with Traffic economic zone
  - Vehicle Tracking, load updates, speed updates, Vehicle performance mgmt., maintenance scheduling

- **Driver Management**
  - Vehicle assignment to driver, Customer travel details, Route display, Battery Status & Nearest Swapping Station

- **Inventory Management**
  - Inventory updates customer bookings, live tracking of fleet, fleet schedule

- **Central Fleet Mgmt. Server**
  - Bus availability, Customer Authentication on boarding, Seat Layout, Dynamic price, Amenities, 24*7 booking support
  - Ticket booking, Arrival Schedule, Estimate pick up and drop time, cashless payments
  - Interface, grievance/complaints, Emergency Contact/Customer Service
  - Track Swapping batteries and Monitor battery performance
  - Vehicle & Battery Performance, all data

- **Customer App – E-Bus Ticket Reservation**
  - Customer App – E-Bus Ticket Reservation

- **Battery Swapping Station**
  - Battery Swapping Station

- **Dashboard & Analytics**
  - Dashboard & Analytics
The Bigger Threat

What Type of Battery?

How to manage life span?

How to manage temperatures?

Range Extension Options?

Design
Field Usage
Alerts and Notifications
Maintenance Schedules
Retirement
Reuse

BATTERIES
Battery safety: Designing Stage

- Right Cells
- Accurate SOC / SOH
- Protection
- BMS
- Mech. Design

- Chemistry
- Lifecycles
- Charge/dis rates
- Power, Range
- Operating conditions
- Size of battery

- Stability: vibration, shock / impacts, drops
- Determination / Management algorithms, Cell balancing, Optimization

- Over Current
- Over/Under Voltage
- Over/Under Temperature
- Short-Circuit
- Reverse battery/charger Connection
- Pre-Charge

- Optimal charging
- limiting the discharge
- Life cycle control and trade-offs

- Cooling requirement of pack
Battery Safety: While in Operations

- Utilization of Assets
- Vehicle Performance
- Batteries Performance and Safety Alerts
- Driving Behavior and Pattern
- Driver Efficiency
- Alerts on Faults/Errors in Assets
- Fleet Utilization Analysis
- Customer Feedback Analysis
Sample Analytics: Battery

Cell Voltage Imbalance during Charging

- More than 140mV for this battery
- Setting tolerable limits

Time Spent by batteries in different temperatures during charging

- Sensor 0 and Sensor 1 are faulty and are showing 119°C
- Sensor 3 is showing higher temperature consistently (~55°C)
- Some unusually low temperature (<18°C) for these batteries

Fault Recognition
Categories Subsystems

- Predict and Prevent Threats and accidents
- Compare Assets and bring out the best selection
- Aid in Planning and Re-planning of Infra / Network
- Recognise and layout training plans at all levels through data analytics
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