LIBERTY

RTR Conference 2023

Lightweight Battery System for Extended Range at Improved Safety

LIBERTY has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 963522.
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Presentation Outline

LIBERTY Project Intro

Goals

Facts & Figures

WP structure

EU perspective

Some of our key innovations

Immersion Cooling

Active Safety System

BMS

SOX algorithms

Battery Passport

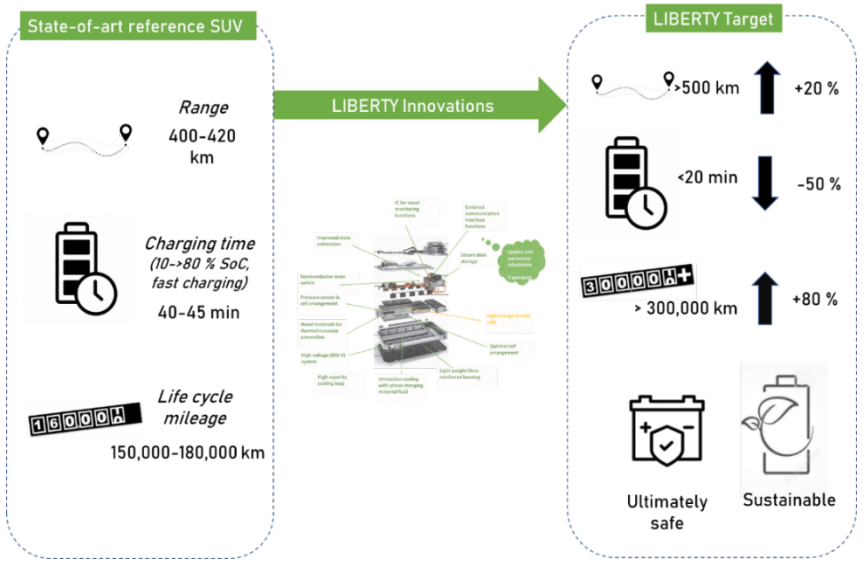
COLLABAT cluster

Cluster Introduction

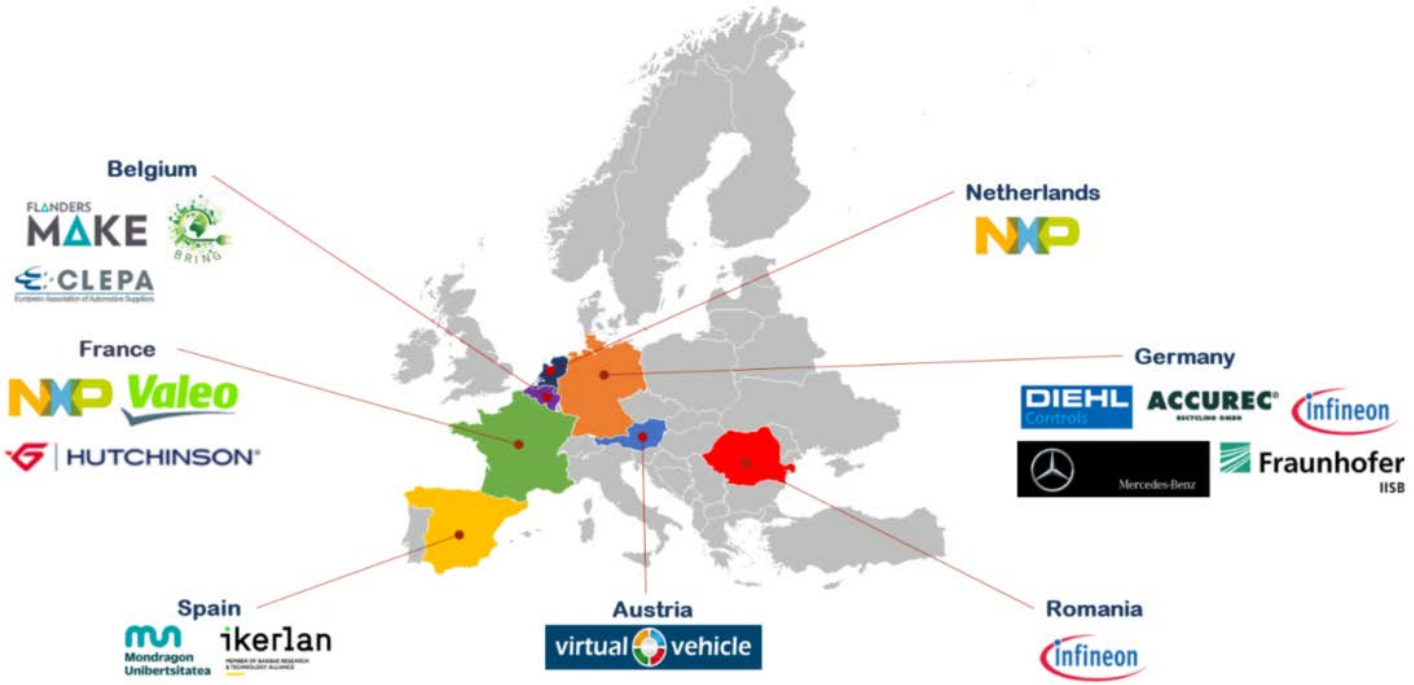
Project Overview

- Lightweight Battery System for Extended Range at Improved Safety
  - Objective 1: To achieve a range of 500 km on a fully charged battery pack
  - Objective 2: To achieve a short charging time
  - Objective 3: To achieve an ultimately safe battery system
  - Objective 4: To achieve a long battery lifetime
  - Objective 5: To achieve sustainability over the battery pack entire life cycle

Parameter	Benchmark: EQC 2019	Target: LIBERTY EQC
Battery system capacity [kWh]	80	96
Battery system weight based on 80 kWh battery capacity [kg]	650	520
Max. charging power [kW]	110	350
Charging window 10-80% SoC [min]	40	18
Range (WLTP) [km]	417	500
Battery life (no. of cycles to 80% DoD)	500	1000
Mileage [km]	160,000	>300,000



Facts & Figures



- 16 Partners from 7 countries
- Coordinator: IKERLAN
- Start date: January 2021
- Duration: 42 months
- Budget: 10M

WP Structure – V Design Methodology

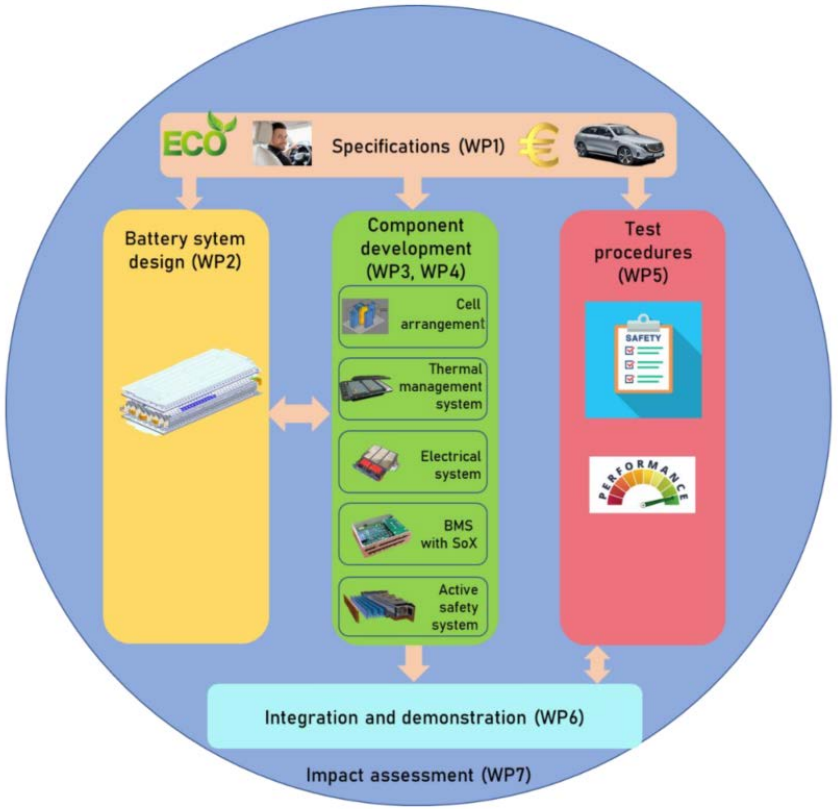
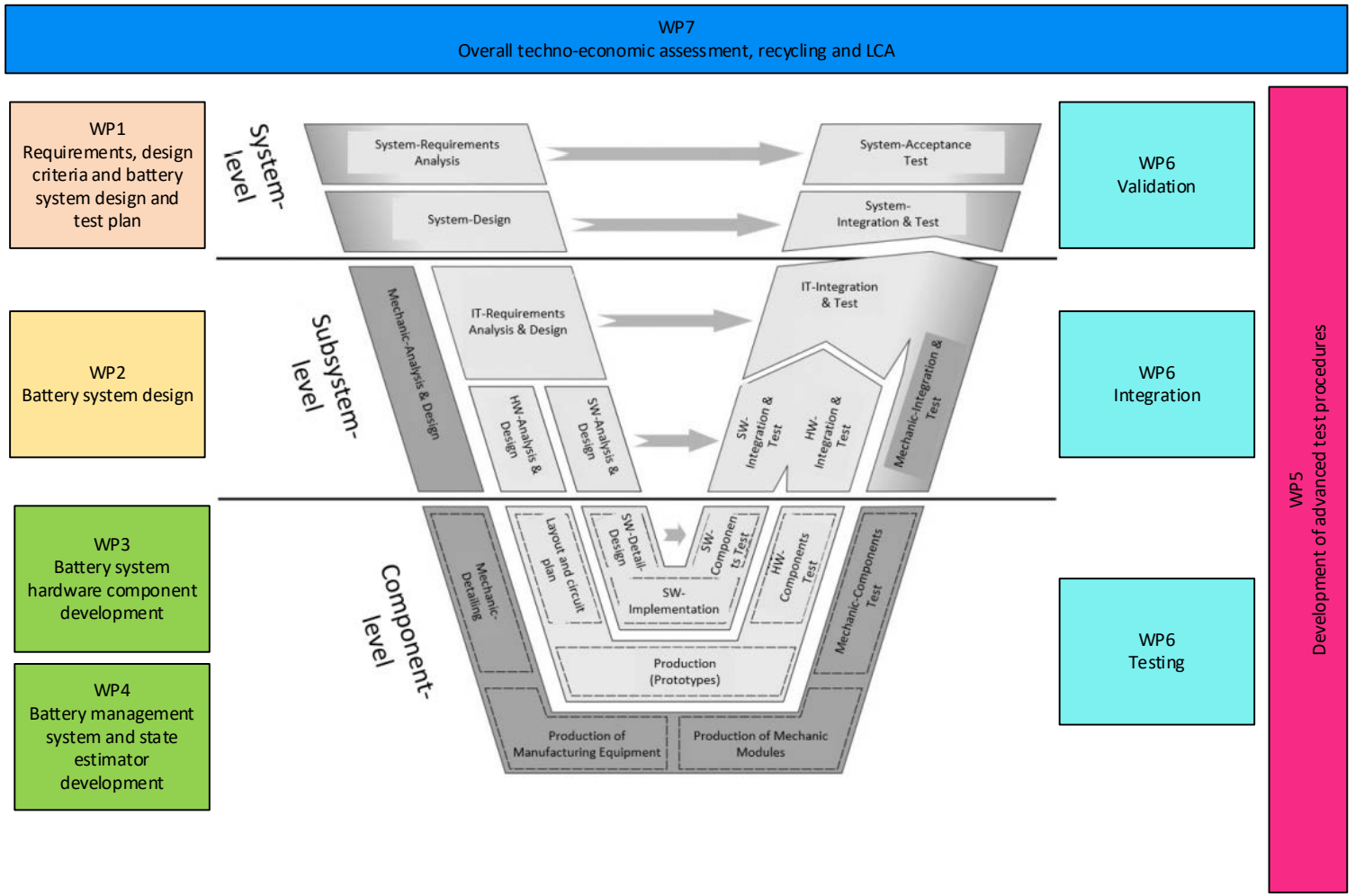


Figure 1-3 Overall approach and methodology of the work plan



V-model by Bender 2005, translated from Bender (2005) –
"V-MODELS FOR INTERDISCIPLINARY SYSTEMS ENGINEERING", I. Graessler, J. Hentze and T. Bruckmann

EU perspective – Horizon 2020 Framework

- LC-BAT-10-2020
  - Design of advanced battery packs
    - Lightweighting
    - Crashworthiness
    - Electrical and thermal requirements
  - Sustainable dismantling and recycling of battery pack/modules
  - Flexible advanced battery management systems
  - Remote maintenance and troubleshooting
  - High voltage systems compatible with high-power ultra-fast charging
  - Future performance-related test procedures
  - Development and qualification of future safety related test procedures
  - Integration into an existing vehicle

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LIBERTY – Key Innovations

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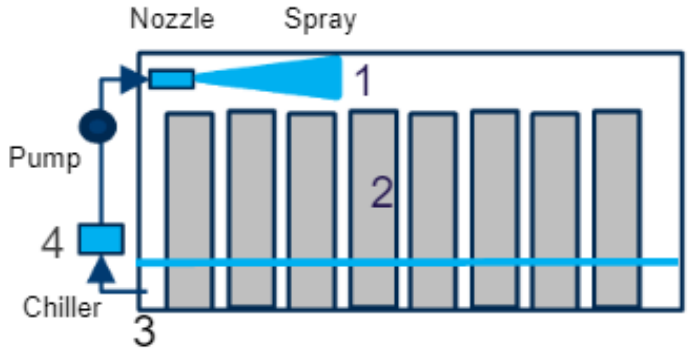
- O2: To achieve a short charging time
- O3: To achieve an ultimately safe battery system
- O4: To achieve a long battery lifetime
- O5: To achieve sustainability over the battery pack entire life cycle

Immersion Cooling based TMS

Conceptual Drawing



1- Dielectric liquid is sprayed on the battery surfaces

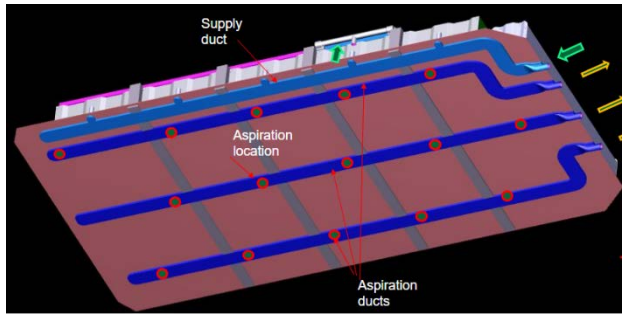
2- Liquid run off over the cells

3-The liquid is sucked by the pump

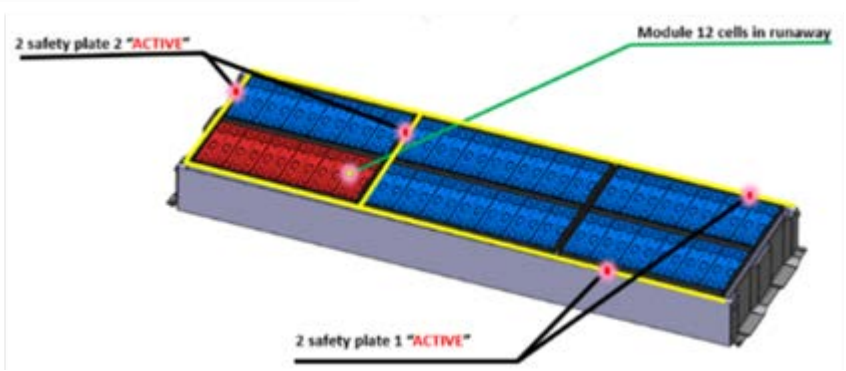
4-Liquid is cooled through a chiller to start a new cycle

- Monophasic partial immersion
- Nozzles in the upper part to be integrated with the casing
- Collection of the liquid in the down part to drive the fluid to pump and chiller
- Chiller will evacuate heat to vehicle system

Testing and Integration

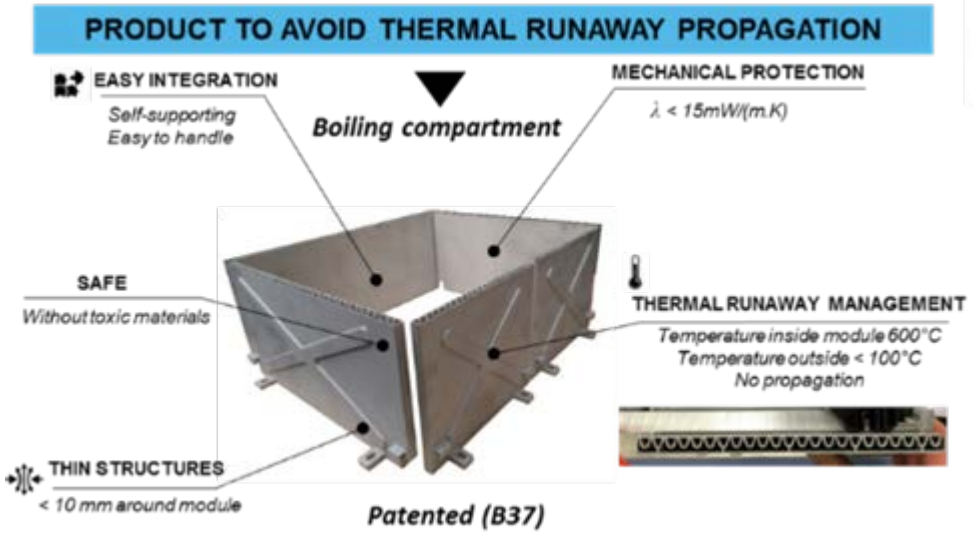


Active Safety System



- Encapsulation of group of cells to prevent TR propagation.
- Active: 2-phase fluid > boils in case of TR.
- Passive: Fire retardant material – minimize active use system

ACTIVE



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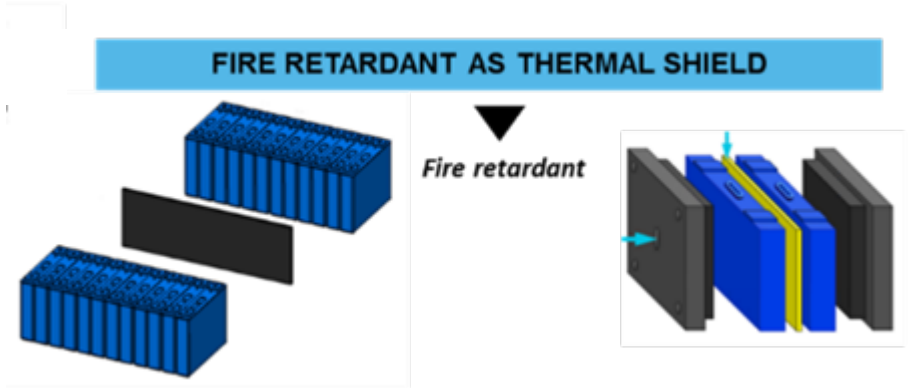


PASSIVE

Battery Management System & HV electric system

- Bus bar design integrating BMS slaves.
- Impact of fluid for immersion cooling. Tailored solution
- Maximising energy density.
- Based on foxBMS2 open-source BMS.

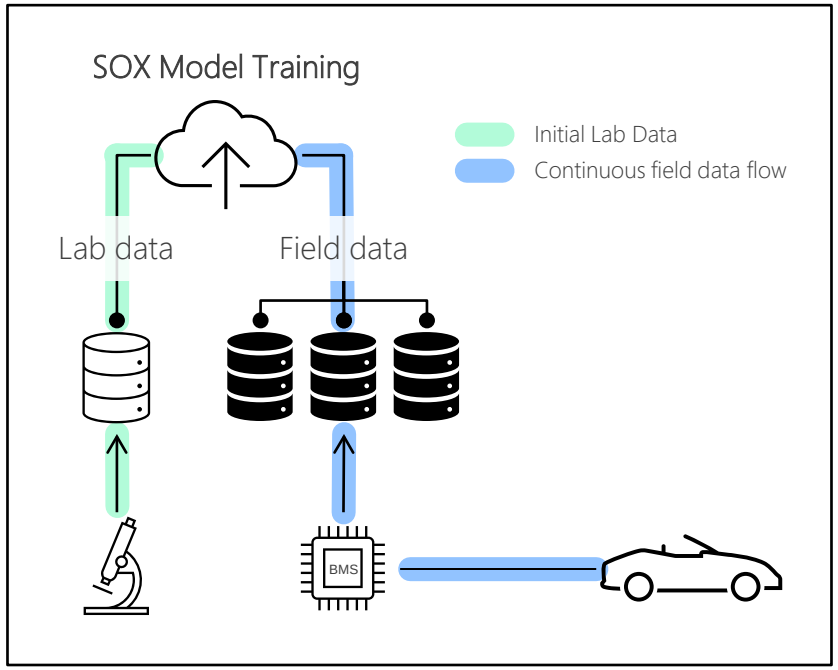
SOX Estimation Algorithms

Main Requirements:

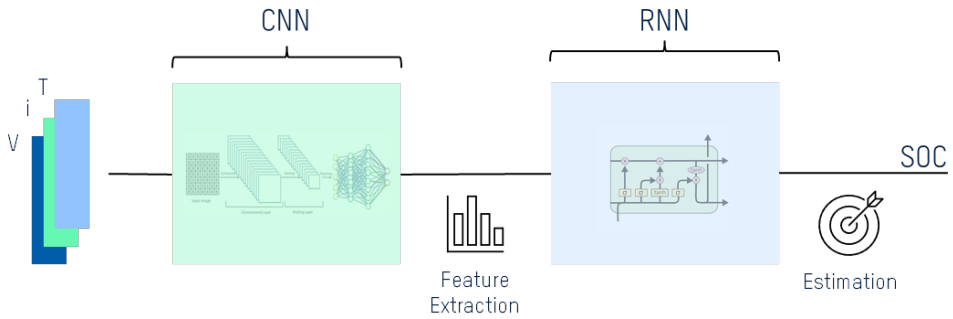
- Quick model development phase
- Reduced experimental burden

Our solution: Data-driven modelling techniques

- We take advantage of in-field operation data for SoX estimation modelling.



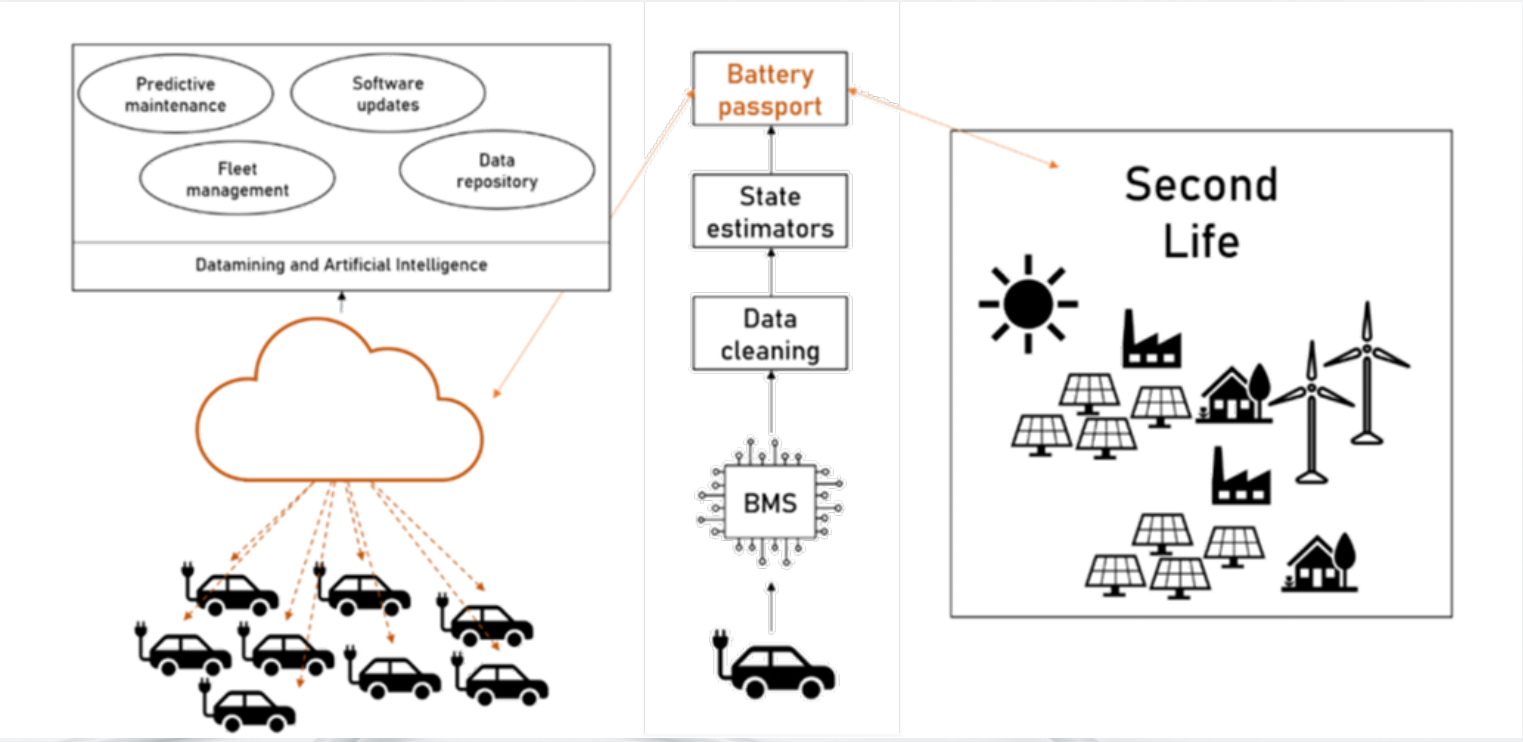
SOC estimation algorithm structure:



Outstanding Benefits:

- Increased accuracy and reliability as new data becomes available.
- Improved performance at unobserved conditions.
- Experimental burden can be significantly reduced.

Battery Passport Concept



- Real-Time battery data processed and stored
- Advanced services
- Enabling a simpler transition to 2nd Life.

Next steps

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COLLABAT Cluster

- LC-BAT-10-2020 projects joint Cluster: COLLABAT
  - ALBATROSS
  - LIBERTY
  - HELIOS
  - MARBEL

- 4 main subclusters defined:
  - Sub – A: Sustainability
  - Sub – B: Testing
  - Sub – C: BMS
  - Sub – D: Modelling

- LinkedIn page published soon!
- Upcoming Events, workshops, whitepapers, etc.

Stay tunned!

Thank you very much!

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www.libertyproject.eu

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FOR EXTENDED RANGE AT IMPROVED SAFETY

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