# Smart Data-driven Battery Management Systems for E-mobility using Digital-twinning, Machine Learning, and New IoT Techniques

## SPEAKERS

**Akash Samanta**
*Doctoral Research Scholar*

**Sheldon Williamson**
*Professor*

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## About Us:

ITEC is aimed at helping the industry in the transition from conventional vehicles to advanced electrified vehicles. The conference is focused on components, systems, standards, and grid interface technologies, related to efficient power conversion for all types of electrified transportation, including electric vehicles, hybrid electric vehicles, and plug-in hybrid electric vehicles (EVs, HEVs, and PHEVs) as well as heavy-duty, rail, and off-road vehicles and airplanes and ships.

**Contact Us:**
https://itec-conf.com/
info@itec-conf.com

## SUMMARY

Despite Lithium-ion batteries (LIBs) being widely accepted for automotive applications, it is noticed that the frequent incident of fire in electric vehicles (EVs) is primarily due to ineffective battery management systems (BMS). In addition, range anxiety and reliability aspects are also a bottleneck for the wide adoption of EVs. The internal characteristics of LIBs are highly nonlinear and extremely sensitive to operating and environmental parameters. Therefore, an intelligent safety framework and smart BMS are extremely essential to ensure safe, reliable, and longer battery life.

## ABSTRACT

The reliable operation of BMS requires detailed information on the voltage, current, temperature, and aging profile of each cell. Moreover, important battery states like the state of charge, health, and remaining useful life cannot be directly measured with physical sensors. Therefore, intelligent state estimation techniques such as artificial intelligence (AI), machine learning (ML), and deep learning (DL)-based techniques will be discussed in this short course.

Now, as high-resolution data is the backbone of any data-driven technique, collecting and processing high-resolution data needs the internet of things for accessing advanced platforms such as cloud computing and data storage. All these aspects will be discussed with examples in this short course. Furthermore, the application of microcomputers and new-gen computing platforms, such as edge-computing and fog-computing will also be discussed.

Recently, with the introduction of fast charging, the issues of range anxiety and the long charging times have been somewhat minimized. However, there has been a high risk of thermal runaway and other safety issues due to this. To ensure effective BMS operation, superfast data acquisition, processing, control, and accurate state estimation are of utmost importance. Here, a recently patented digital-twin-based battery safety framework powered by DL will be introduced.

Finally, recent R&D issues, challenges, and case studies of existing BMS methods and thermal management systems will be explained.