






HOW CAN IOT SOLUTIONS HELP LI-ION BATTERY MANUFACTURERS IMPROVE SERVICE EFFICIENCIES



GUIDE

EXECUTIVE SUMMARY

Enhancing service capabilities is paramount to staying future-ready and competitive. IoT-connected batteries enable lithium-ion manufacturers to capture real-time data to enhance their service capabilities and foster service innovation.

Undoubtedly, the internet of things (IoT) significantly impacts almost every industry out there. And when it comes to batteries, the potential applications are practically endless. So how can IoT solutions help battery manufacturers improve service efficiencies? By enabling smart monitoring of battery performance and health, IoT solutions can help identify and address issues early, saving money and time in the process. In this e-book, we'll look at critical enablers for IoT-connected batteries and explore how they can help improve service efficiencies for lithium-ion battery manufacturers.

CHALLENGES FACED BY LI-ION BATTERY MANUFACTURERS

Li-ion batteries are used in a wide range of applications, and their service life spans vary drastically. The challenges to maintaining them can be significant for manufacturers, particularly when it comes to keeping an accurate record of the health of each battery.

Similarly, complicated challenges arise since some devices have more problems than others with certain types (or even models) of batteries. These situations require manufacturers to either keep track of all relevant information or rely on anecdotal evidence gathered from customers who voluntarily contact them directly. Either way, this process is time-consuming as well as costly because not every customer may be willing/able to provide feedback due to various reasons such as lack of knowledge or misunderstanding about product specifications.

▶ Achieving intended outcomes from a battery

Manufacturers of Li-ion batteries need help understanding how their products perform in real-world applications. Failure to get such information can lead to underperformance, and it can be costly for both customers and manufacturers.

Li-ion batteries are light, compact, and can be recharged many times with little noticeable degradation in performance. However, to be able to work as expected, they need to be operated in ideal environments which need to be monitored for anomalies.

▶ Improving servicing practices and goals

Manufacturers need to keep up with the latest technology, but servicing it is a difficult process plagued with errors and inconsistencies. Therefore, manufacturers need to ensure they have the information they need before they begin servicing their batteries.

Errors and inconsistencies often plague battery servicing due to the unavailability of data. Therefore, manufacturers must ensure they have the necessary information before servicing their batteries.

For e.g. Lack of information such as the health, age, and charging cycles of a battery is a major hindrance to ensuring the safety and reliability of batteries. Consequently, relevant information can help manufacturers optimize servicing processes.

▶ Enhancing durability

Battery manufacturers face a critical challenge when it comes to battery durability. Most manufacturers offer warranty coverage on batteries, so the development process presents engineering challenges. In addition, batteries must be continuously monitored to avoid uncertainties, improve efficiency, and enable better service.

The problem is that many battery systems are challenging to monitor. There are several reasons for this, including:

- The nature of the product (batteries have high resistance and capacitance compared to other devices)
- The environment in which it operates (batteries operate at extreme temperatures)
- The complexity of the system (it can be difficult to isolate individual components for analysis)

- The lack of information about the system (the battery may be too far away from a monitoring station)
- Safety concerns (it's difficult to access batteries in operation)
- Lack of time and resources (many other issues are competing for engineers' attention)
- The need for remote management (batteries can be located in remote areas)
- The need for real-time information (failure of a battery could lead to harm or even loss of life)

▶ Compliance

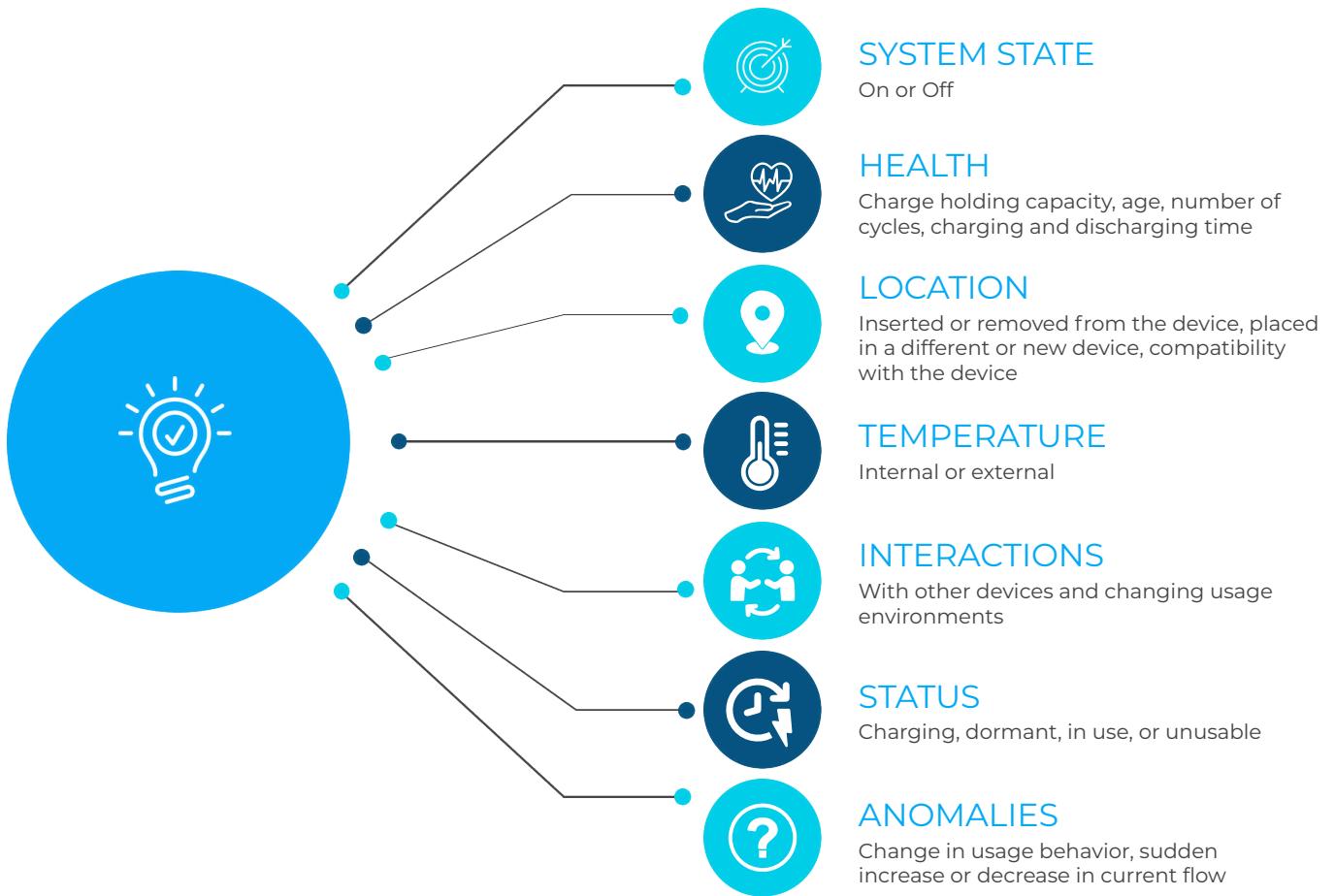
Creating a safe, secure, and environmentally responsible environment is a top priority for many modern businesses. In the case of lithium-ion batteries, those who fail to meet these goals may face significant penalties. Li-ion battery manufacturers must comply with strict regulations such as **IEC 62133, UN/DOT 38.3, IEC 62619, UL 1642, and UL 2580** related to the handling and disposal of hazardous materials as well as the safety standards of the devices that will use them.

A key consideration here is monitoring the batteries to ensure they are used as intended and per the manufacturer's directions. In the event that liability arises for manufacturers, they need access to data that can confirm if the batteries were (or were not) used in accordance with guidelines.

UNDERSTANDING THE NEED FOR CONNECTED BATTERIES

To understand how IoT devices can help improve service efficiency, it's helpful first to understand what they do. The information gathered helps us better understand how batteries work and when they need attention.

Here is some information that IoT devices can offer manufacturers that are relevant to improving service efficiencies:



HOW IOT SOLUTIONS CAN OVERCOME CHALLENGES AND IMPROVE SERVICE EFFICIENCIES FOR LI-ION BATTERY MANUFACTURERS

▶ Real-time battery data helps visibility

Capturing real-time usage data is critical to effective maintenance and service for the battery manufacturer and the operator. Typically, the battery management systems on board (BMS) of most Li-ion battery packs ensure that the battery pack is operating efficiently.

For example, a BMS can help ensure the battery is charged in the right temperature range. However, the information collected by a BMS is local to the battery or device to which the battery is connected.

IoT allows this information to be scaled and share the data with both the manufacturer and the operator in real-time. While the manufacturer requires such data to understand the performance of the battery pack over time, the operators can leverage the data to react or make adjustments to the environment to maintain battery health.

▶ Enables off-site analytics

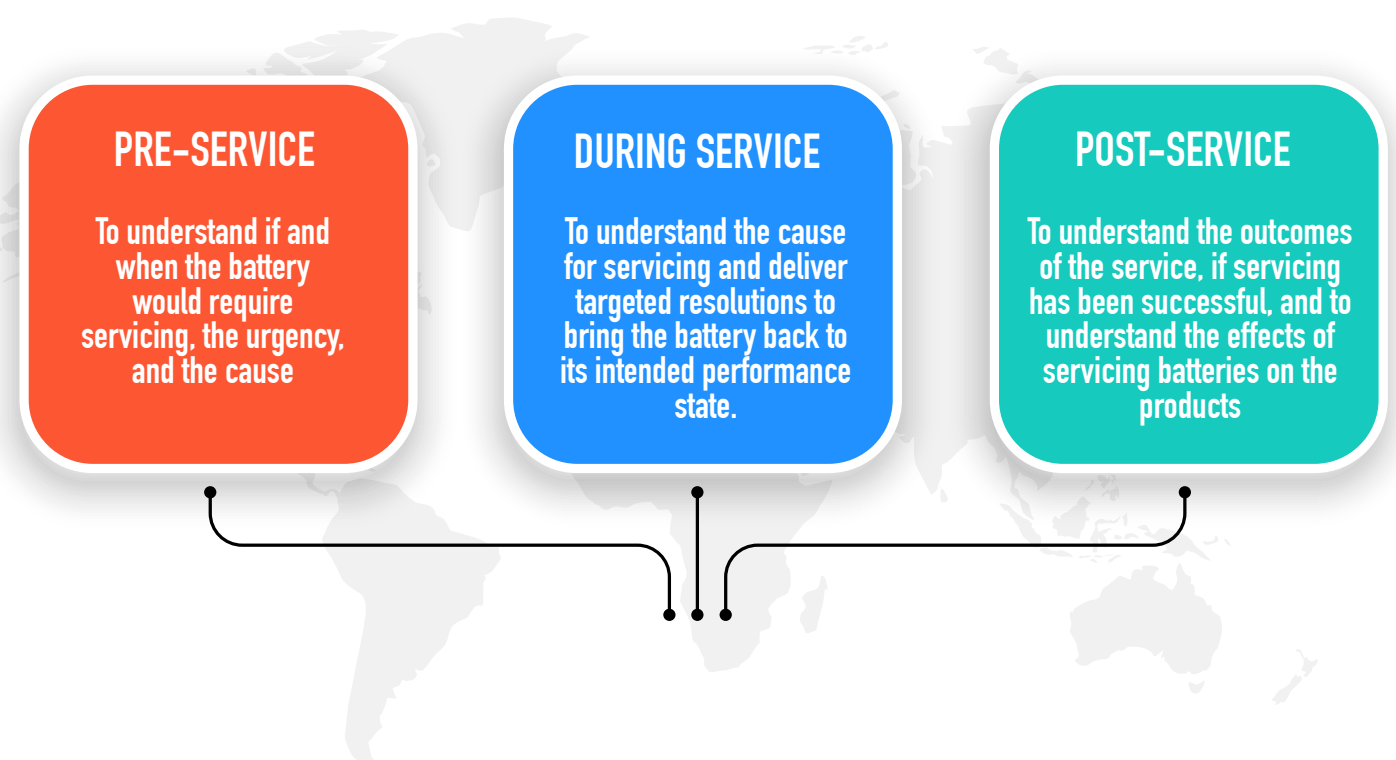
Manufacturers can monitor the battery's health remotely to reduce costs and improve efficiency with off-site analytics. This is especially true for lithium-ion batteries, which are often used in high-value equipment and systems that must be kept running continuously. Monitoring these devices remotely allows manufacturers to detect problems early and fix them before they become serious.

IoT solutions also prove highly useful for manufacturers who don't have access to the site due to geographical limitations or other factors like cost. The ability of a manufacturer to understand how its products are being used and when they need servicing will allow them to more effectively allocate their service staff, resulting in greater efficiency and lower costs.

▶ Improves decision-making

With the help of IoT, Li-ion battery manufacturers can receive information about their batteries in real-time and make informed decisions. It will help improve service efficiencies and cut costs.

As manufacturers receive a real-time data stream from batteries, they can get accurate information on issues arising with the product. Coupled with historical data on the health and usage of the batteries, manufacturers take the right steps to ensure optimal performance—which can both be pre-service and during the servicing process.



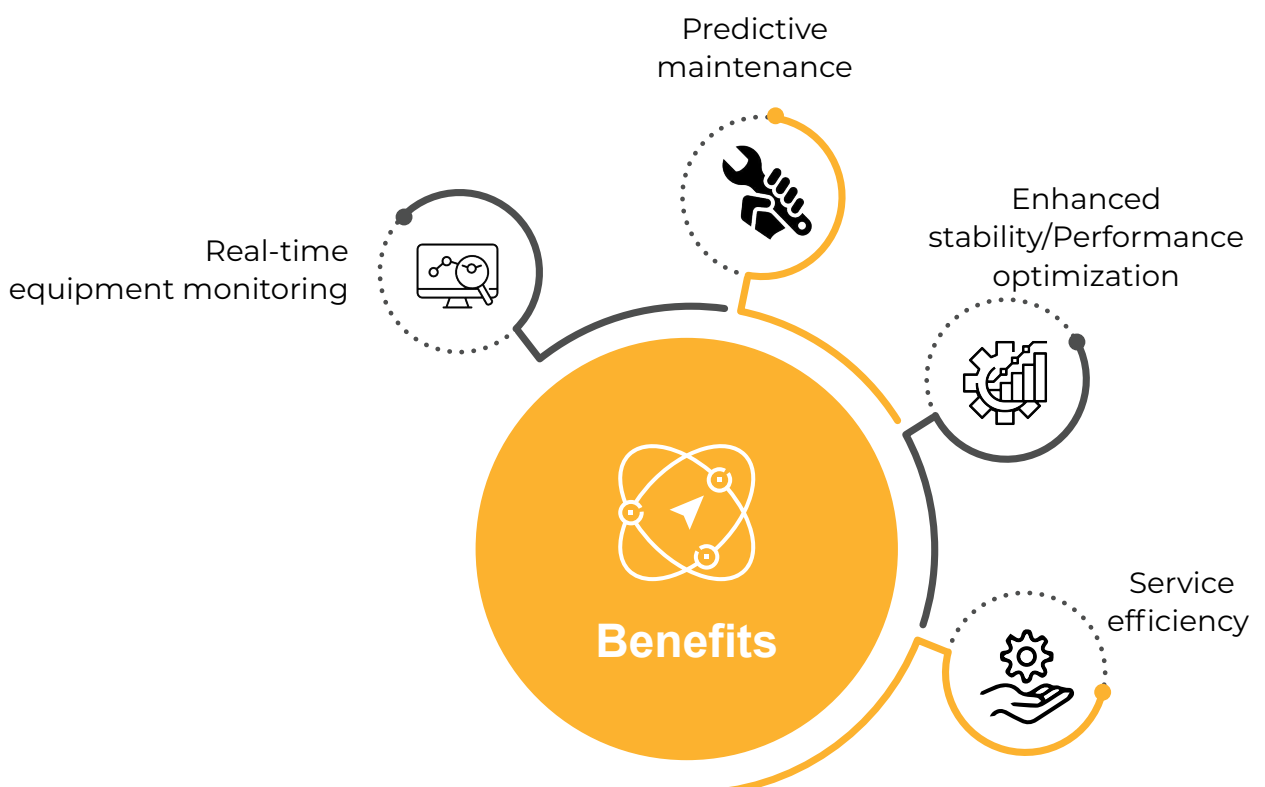
UNLOCKING ADDITIONAL REVENUE

Consider the case of rechargeable battery-powered equipment. For example, the electrification of material handling increases the use of rechargeable battery-powered equipment such as mobile computer carts, material handling fleets, and wheelchairs. This presents OEMs with unique opportunities to innovate and provide improved customer experiences.

IoT enables OEMs to monitor equipment, replace parts, and provide additional services to their customers, increasing their revenue.

For a user, the experience can be significantly enhanced by IoT-connected products. Users can receive both action-oriented and analytical real-time product information, like battery charging status, service scheduling etc.

- **For manufacturers :** IoT enables OEMs to monitor equipment, replace parts, and provide additional services to their customers, increasing their revenue.
- **For end-users :** The experience can be significantly enhanced by IoT-connected products. Users can receive both action-oriented and analytical real-time product information, like battery charging status and service schedule.



IOT-CONNECTED BATTERIES ARCHITECTURE

▶ Gathering and Storing data

Real-time or near real-time data is critical to monitor batteries and is one of the primary infrastructures that need to be in place. Most lithium-ion battery systems are manufactured with a Battery Management System, and the design of the BMS needs to ensure that there is some connectivity to get the data the BMS already monitors. This is typically done by ensuring that the BMS has either WiFi, Cellular, or in some cases, a serial/USB-type interface that can then be connected to a wireless connectivity solution.

The software on the BMS is then engineered to regularly push the data through the wireless connection to a cloud-based or a local database.

Using a cloud-based system presents some obvious advantages in scale, security, access to software development workflows and also analytics engines that are available from the cloud providers.

One of the most important aspects of connectivity is the provisioning of the fleet of batteries. Take, for example, a BMS connected through WiFi on a customer's premise, provisioning deals with the challenges of programming the battery/BMS so that it actually connects to different WiFi access points with different parameters. So, in addition to storing data, a robust device management system that allows provisioning the devices and uploading software to the devices ensures that the BMS is up to date and can be easily deployed in the field. This has the added advantage of the system keeping secure. Think Tesla software updates vs other cars.

▶ Analyzing data

Data analysis involves visualizing the data received from multiple sources and generating insights and reports to support decision-making. Manufacturers can use it for a variety of purposes, including:

- Analyzing trends over time to predict future performance and determine areas for improvement.

- Identifying opportunities to increase revenue or cut costs.
- Value add services to their customer, for e.g. customer engagement by providing customers with the information they need.
- Monitoring business performance and comparing it to industry standards.
- Identifying opportunities for growth.

▶ Data as a platform

Once the data is stored and analyzed, the application of the data can be tailored to the use cases that are relevant to the usage and operation of the battery.

- Alerts can be provided to operators managing their equipment.
- Fleet usage analysis can be conducted.
- Charge cycles can be optimized.
- Manufacturers can be alerted to problems in performance, and they can replace service batteries without an explicit custom request.
- Manufacturers can expand revenue by providing additional services to their customers and operators through the data platform.

For example: Monitoring battery charging is essential for lithium-ion batteries to work at their peak efficiency. The charging temperatures must be carefully controlled, and a real-time system alerting the operations fleet can ensure that batteries are charged and operated at optimal temperatures or countermeasures taken.

CONCLUSION

The data provided by IoT solutions offer potent insights into the behavior of batteries. In the past, battery manufacturers could not obtain accurate information on how devices used their batteries, preventing them from anticipating issues, delivering targeted resolutions, and identifying unrevealed problems. With the advent of IoT, information from each device can be accessed by manufacturers remotely, and complex algorithms and communications protocols can be developed to understand how the batteries are performing. IoT solutions provide precise, real-time information on battery usage that helps manufacturers better predict when battery replacement services are required and how long each device will continue to operate before needing a new battery. This not only helps ensure safer products but also reduces downtime and costs associated with service calls, ultimately translating into better service efficiencies.

WE HELP ACCELERATE YOUR IOT!



Altiux Innovations is a software & product engineering services organization focused on helping you accelerate development of your IoT solutions and products. We provide specialized engineering services across the entire IoT development cycle from consulting, device engineering, cloud and mobility application development, data analytics, and support & maintenance.

Altiux has developed an IoT Toolkit - BoxPwr™. BoxPwr is a production ready suite of software frameworks for sensor nodes & actuators, communication gateways, Edge computing & Cloud connectivity that helps accelerate IoT product & solution development.

At Altiux, we offer multiple models for commercial engagement that can be tailored to meet your specific needs.

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