

Lithium innovation and beyond

FLASH DATA CENTRE 4.0, MACHINE LEARNING AND IMPROVED LITHIUM BATTERY PERFORMANCE ARE JUST SOME OF THE RECENT ADVANCEMENTS FROM FLASH BATTERY

▶ We're living in the era of the Internet of Things, where communication is digital, intelligent and interconnected and the boundaries between the physical and the virtual are becoming ever more blurred. Speed, connection and big data analysis are words that rule our everyday lives and monitoring devices are now crucial to provide insight into consumer habits, and offer high-tech, cutting-edge solutions.

There would be no technological innovation without the commitment and far-sightedness of real people. Innovators transform problems into challenges and challenges into opportunities. "Everyone knew it was impossible until a fool who didn't know came along and did it," said Albert Einstein. Flash Battery started out in a garage 10 years ago. Since then, it has turned innovation into its strength and made the technology of its lithium batteries for industrial machinery and vehicles accessible, wherever they are in the world, with a few clicks.

Flash Data Centre, the Italian company's proprietary remote-control software, was among the 41 finalists to the prestigious international Bauma Innovation Award 2022 for the best industrial projects in the area of research and innovation. How exactly did this software push the boundaries of traditional remote monitoring systems? We spoke with Marco Righi, CEO and founder of Flash Battery, to find out.

You presented Flash Data Centre 4.0 at Bauma in Munich. What is it exactly and how does it work?

Flash Data Centre is a remote-control software designed to monitor, on a daily basis, how each lithium battery we've ever sold is being used, regardless of where it is in the world. Its most important feature is the fact that it automatically controls the data in real time; in other words, 24 hours a day, seven days a week, the software controls and analyses the battery operation data received and sends it out to both the customer and the Flash Battery technical assistance department. It is a powerful self-diagnostics and predictive maintenance system that helps stop misleading



CEO Marco Righi (RIGHT) and CTO Alan Pastorelli, who together started Flash Battery 10 years ago

reports and anomalies before they gain traction and prevent faults.

Flash Data Centre 4.0 release is also integrated into a virtual environment with containerised architecture, harnessing the power of latest-generation artificial intelligence and machine learning technologies to ensure the interconnection of the over 15,000 Flash Battery systems currently operating in 54 countries across the world. The system learns from the data analysed and improves battery performance. And our customers have the possibility to perform advanced analyses of the big data coming from their battery systems in real time.

This translates into in-depth insight of how the industrial machinery and vehicles

that install Flash Battery brand batteries are being used (actual charging/discharging time, days of use, average consumption, temperatures reached, etc.). In addition, the new graphic interface is designed to offer a simpler and even more intuitive and interactive navigation experience.

What kind of data does Flash Data Centre actually analyse and what are the benefits of having this information monitored automatically?

Flash Data Centre analyses every parameter having to do with the battery's operation, the most important of which is the battery's SOH (state of health), to get an accurate picture of the condition of every single battery out there

in the market. Other parameters taken into account include voltage, current, temperature, and analysis of charge/discharge times, standing watch over the peaks and lows reached during these activities.

What are the benefits of this?

Let's consider that a lithium battery can be used in a wide variety of contexts and in many different ways, which all affect its longevity. Knowing ahead of time where and how to act to extend its life cycle or improve its performance is a great advantage. Ever since 2012, we have produced batteries for many very different contexts and which have been subject to an ample mix of stresses. Take, for example, the automated logistics sector, where AGVs and LGVs operate non-stop 24 hours a day in industrial plants with a temperature range of -30°C to +45°C. Thanks to predictive analysis, it is possible to know how users are using the batteries and how long these will last and behave in the future. This is undoubtedly a great added value for us and the customer, who receives accurate planning of replacements and valuable recommendations for correcting and perfecting the performance of their machinery, which, of course, increases productivity.

Are there other added values your customers appreciate?

The advantages of predictive analysis are quite a few. A typical customer that chooses Flash Battery doesn't install just one battery on its industrial machine or vehicle. We are dealing with complete systems where computer technology, IoT and artificial intelligence have become real allies in ensuring the application stays reliable over time.

For example, implementing the remote control function right at the prototype stage helps to size the vehicle more accurately. Data from the prototype helps us to understand if the battery should deliver more or less energy or build in specific performance-enhancing characteristics.

Let's also consider the fact that our customers are usually not the end-users of the electrified vehicles. Flash Battery brand

RIGHT: A Flash Battery lithium battery pack solution

BELOW: Flash Battery's extensive portfolio can be customised according to client requirements



batteries are installed on machines and vehicles that our customers sell all over the world so, it becomes clear that having real time data on their operation is the fast-track way to assess if the end-user is using the application correctly (for example, if it is exposing the vehicle to repeated full discharges or out-of-range temperatures). Let's use a road sweeper as an example: through constant data control we can analyse how the battery is performing in that specific usage context, its charge/discharge profile, its limitations, and how the end-user is employing it. With this information at hand, our customer can evaluate actual use and implement improvements to their fleets going forward, and we can create increasingly more specific and higher-performance batteries.

Lastly, Flash Data Centre, with its machine learning-driven automatic data control, allows for advanced planning of extraordinary maintenance work. This avoids unnecessary and expensive machine downtime and lets customers manage the end-of-life of the systems independently, meaning they can sustainably plan the replacement of end-of-life batteries in entire fleets and, as a result, optimise and reduce the cost of disposal and make the process of re-using components more efficient.

Could you explain in layman's terms what is machine learning?

Machine learning is a subset of artificial intelligence that creates systems with the ability to learn and improve performance through the data analysed. In our case, the concept starts from the complex nature of the battery. We are

working with devices that have especially complex chemistry so machine learning enables us to extract from the battery a clear and accurate description of how it is behaving. Our added value lies in the fact that we have collected a huge amount of data on the operation of our batteries.

The first Flash Data Centre was already in place in 2013 and today we work with an astounding 180 million logs or nearly 100,000 logs a day. Machine learning thrives on data so this is what sets us apart from the competition. In fact, it analyses data using statistical theories and harnesses the computing power of computers to implement every statistical technique. With the large amount of data we are providing, the battery behaviour information extracted is incredibly precise. We can practically recreate a digital twin for each battery and use it for simulations, especially at the design stage, and for formulating and testing behaviour hypotheses for next-generation batteries still in the making.

Innovation is in a constant state of becoming. How are you moving towards the future?

Today, Flash Data Centre 4.0 can output a very accurate SOH analysis that helps us in our research into increasingly higher-performance and smarter new-generation batteries with ad hoc features for the needs and use of every kind of industrial application.

Its evolution going forward will go hand in hand with the amount of data it will be provided with. We are talking about an intelligent system that is constantly learning, storing and processing. As new data arrives, the system processes and analyses the data; it is always studying and adapting to new data. The amount of data we are collecting compared to the past is increasing at a faster and faster rate; today, we are analysing up to 4,000 sensors per battery, and the trend is growing. We are therefore well on our way to building a very sound infrastructure that can continuously process huge amounts of data, interpret trends, variations and anomalies, and reproduce realistic usage scenarios we can use to develop smarter and smarter lithium batteries. **ivt**



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