

## Scientists propose better battery system for smart home use

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Smart homes need smart batteries. Current systems overuse power, which can shorten the life of batteries and the devices they power. Future batteries may get an intelligence boost to mitigate the problem.

A collaborative research team based in Beijing, China, has proposed a novel programming solution to optimize <u>power consumption</u> in batteries. The scientists, from the Institute of Automation, the Chinese Academy of Sciences, and the School of Automation and Electrical Engineering at the University of Science and Technology Beijing, published their results in *IEEE/CAA Journal of Automatica Sinica (JAS)*, a joint publication of the IEEE and the Chinese Association of Automation.

"In smart <u>home</u> energy management systems, the intelligent optimal control of [the] <u>battery</u> is a key technology for saving power consumption," Prof. Qinglai Wei of the Chinese Academy of Sciences wrote in the paper.

To develop a system in which batteries can learn and optimize their power consumption, Wei and his team turned to adaptive dynamic programming. This method breaks down one big problem—how best to use batteries in <u>smart home systems</u>—into smaller problems. The answer to each small problem contributes to the answer to the big problem, and, as the circumstances change, the system can examine all the small answers to see if and how the big answer adapts.

Wei and his team are the first to use this method while also considering



the physical charging and discharging constraints of the battery. The algorithm learns which inputs, such as the demand for power from a device, lead to which outputs, such as providing power. By continually questioning the link between input and output, the algorithm learns more about the best times to charge and to discharge to limit power consumed from the grid. To extend battery life, every iteration of learning is constrained by the understanding that the battery can only charge and discharge to certain limits. Anything more, and the battery could experience excessive wear.

"The battery [makes] decisions to meet the demand of the home load according to the real-time electricity rate," Wei wrote, noting that the objective of optimal control is to find the ideal balance for each battery state (charging, discharging, and idle) within the battery's constraints, while still minimizing the <u>power</u> needed from the grid.

To further extend the lifetime of batteries in <u>smart home</u> systems, Wei and his team will next examine how the damage caused by frequently switching between charging and discharging modes may be avoided.

**More information:** Qinglai Wei et al, Optimal constrained selflearning battery sequential management in microgrid via adaptive dynamic programming, *IEEE/CAA Journal of Automatica Sinica* (2017). DOI: 10.1109/JAS.2016.7510262

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