Pacific Northwest
NATIONAL LABORATORY

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VOLTTRON™: A Tool for Improving Energy Efficiency in Buildings

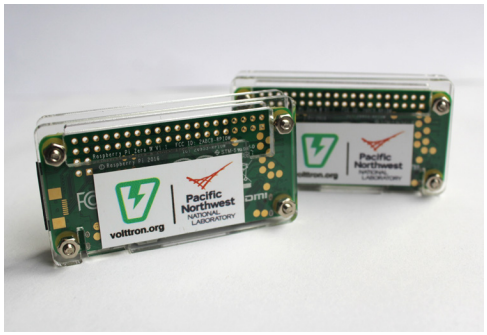
Buildings consume substantial amounts of energy to keep lights on, systems working and occupants comfortable. In the U.S., many buildings are designed to support efficiency features that reduce energy consumption for heating, ventilation and air conditioning (HVAC), lighting and other functions, yet these features often are not fully deployed. Experts believe that by addressing this deficiency, buildings can be made significantly more efficient without impacting functionality or occupant comfort.

One emerging solution is **VOLTTRON™**, a technology developed at the U.S. Department of Energy's Pacific Northwest National Laboratory. VOLTTRON™ provides four distinct advantages:

- **Cost-effectiveness**—It's an open source platform, free to users, and can be hosted on inexpensive computing resources
- **Scalability**—Deployable in one building or across a fleet of buildings, such as a school campus or a city
- **Interoperability**—Enables interaction/connection with various systems and subsystems, in and out of the energy sector.
- **Security** – Underpinned with a robust security foundation to combat today's cyber vulnerabilities and attacks.

A CLOSER LOOK

VOLTTRON™ is a software platform that provides enhanced deployment of supervisory control for the automation systems that manage heating, cooling, lights and other functions in buildings. VOLTTRON™ deploys applications, known as V-agents, that, via automation systems, gain access to HVAC and other data, identifying and diagnosing problems, such as erroneous temperature settings. The technology offers passive capabilities that report a problem, as well as active approaches that actually fix the problem. The ultimate result is improved system efficiency and reduced energy use.



VOLTTRON™ can be hosted on inexpensive computing resources.

"This technology offers opportunities to unlock more value from building devices and deliver services that benefit buildings, the power grid and energy markets."

Joe Hagerman, DOE Office of Energy Efficiency and Renewable Energy

U.S. DEPARTMENT OF
ENERGY

SUPPORTS EFFICIENT OPERATIONS IN BUILDINGS LARGE AND SMALL

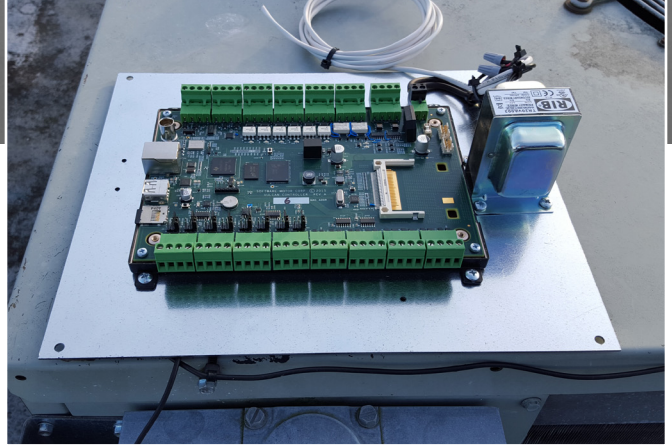
Buildings of more than 100,000 square feet typically employ automation systems; VOLTTRON™ can be seamlessly integrated, and supports commonly-used communications protocols that facilitate access to system data and initiation of control actions. For buildings without automation systems, VOLTTRON™ can operate as a controller, performing a number of services to enhance energy efficiency.

DESIGNED FOR DEVELOPERS

VOLTTRON™ not only uses V-agents to help identify building efficiency issues, but aids in their development, providing a host environment and core platform services that developers can use. The availability of such resources means that developers can spend more of their time designing energy-saving solutions.

To date, V-agents have been created for services such as:

- Automated proactive diagnostics
- Schedule detection
- Temperature set point identification
- On-off cycling detection
- Indication of abnormal power consumption



VOLTTRON™ technology has been deployed in a commercial controller for rooftop heating, air conditioning and ventilation units.

- Automated identification of re-tuning or retro-commissioning opportunities for systems, such as air handlers, economizers and hot water distribution systems.

MOVING TO MARKET

From its development in 2012, VOLTTRON™ technology moved rapidly to deployment, with regular releases of updated versions offering improved capabilities. DOE has supported development of the technology and its use in projects, viewing the innovation as a key component of buildings efficiency and emerging buildings-grid research. In addition to PNNL applying VOLTTRON™ capabilities in some of its own buildings, market penetration also is under way.

ABOUT PNNL

Interdisciplinary teams at Pacific Northwest National Laboratory address many of America's most pressing issues in energy, the environment and national security through advances in basic and applied science. Founded in 1965, PNNL employs more than 4,000 staff and has an annual budget of approximately $1 billion. It is managed by Battelle for the U.S. Department of Energy's Office of Science.

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To download VOLTTRON™, visit
https://github.com/VOLTTRON/volttron

Web site: ***Volttron.org***

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