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How Smart Homes Can Deliver Sustainability as a Service

Smart-home services have the potential to impact households in a profound way.

Within just three years, it's estimated that as many as five billion people and 50 billion devices could be connected. While those numbers alone are impressive, it's the potential of that connectivity to improve many aspects of our lives (including the health of our planet) that's truly eye-opening.

Many discussions surrounding the smart home focus on benefits that can be realized by the people living in them. But a truly smart, connected home—one that can independently assess and respond to real-time requirements for power, water, heating, and similar resources—is able to promote sustainability. In addition, it can avoid serious damage to the home by independently identifying waste and avoiding spillage.

The introduction of highly power-efficient chips that support multiple communications protocols—e.g., IEEE 802.15.4, ZigBee 3.0, Thread, and Bluetooth Low Energy (BLE)—is rapidly driving advances in smart-home networking.

But in order to realize the environmental benefits of smart-home technology, we must first understand what a smart home really is (not just a collection of connected devices) and have insight into what consumers want from a smart home (services).

1. These are the types of events and behavior patterns that a smart home will track and learn from to recognize what is going on in the home.

WHAT IS A SMART HOME?

Too often, the words "smart" and "connected" are used interchangeably when discussing the devices that power the Internet of Things (IoT). But they are not the same. Many of today's devices are essentially internet-enabled remote controls that require human action to be turned on and off.

The term "smart" implies intelligence with decision-making capabilities. A smart device and application can analyze incoming data and make a decision to control or activate a device without human intervention.

In the context of the home, "smart" refers to a network of sensors in the house that measures and monitors the environment. The network senses who is in the home, where they are in the home, and what the "normal" activity is in the home at that particular day and time.

By using intelligence and information that the system has learned about the residents, it makes decisions about whether to lock doors and windows; turn on or off the heater, air conditioner, lights or entertainment systems; activate the security system; and more *(Fig. 1)*.

For example, if a family was streaming a movie on a hot summer night, a smart-home system would turn off the lights and turn down the A/C in the empty parts of the home. In addition, if power-consuming devices are on but not in use, such as a computer or gaming console, the system turns those off as well.

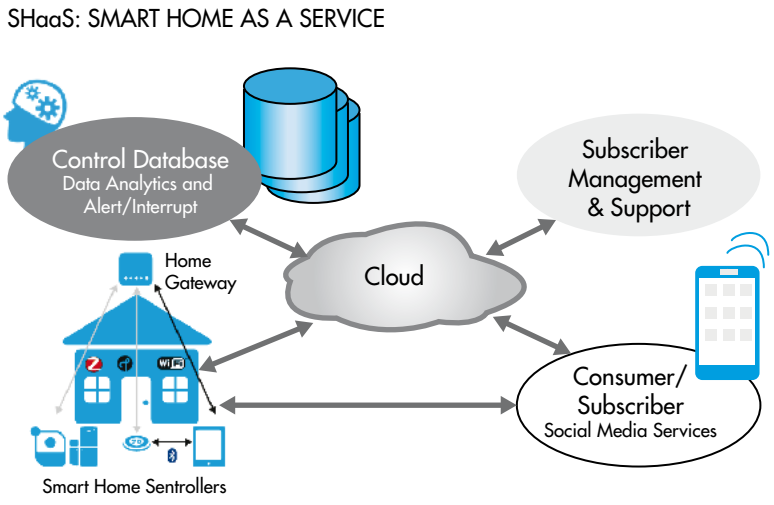
After the family goes to bed, the system can then turn off the A/C or heating in the unused areas and keep it on only in the areas where people are sleeping. Since many people prefer cooler temperatures for sleeping, the system could be smart enough to slowly reduce the temperature at night and then raise it again in the morning. It could further reduce energy consumption by anticipating the falling outside temperature during the night.

The network learns from the people who live in the home to make predictions about future behaviors. It knows the number of household members, how rooms are used and when, bedtimes, who works from home and where, who gets up early, etc. Patterns are absorbed by the system and used to enhance comfort and convenience settings. These settings are also cost-saving and have the potential to significantly reduce energy consumption.

This type of sophisticated smart-home network requires specific capabilities:

1. It must connect to and communicate with other smart or connected devices in the home.
2. It must be intelligent, recognize what goes on in the home, and learn what is normal.
3. Residents must be able to manage functions with a single integrated application on a smartphone or other web-connected device.

Smart devices are essential to what consumers really want—namely, services. A 2016 study showed that consumers are not interested in simply having a bunch of connected devices that remotely control various things in the home. They desire services, and having these services without the hassle of investigating, purchasing, installing, and maintaining a system of disparate connected devices. In short, consumers want a smart home as a service.



2. A Smart Home as a Service (SHaaS) system consists of multiple services that leverage input from sensors.

WHAT IS SHAAS?

Smart Home as a Service (SHaaS) is a collection of services that analyzes input from the smart home's sensors, learns how the family lives and how the home is used, and can make intelligent decisions to make homes more comfortable, safe, and energy-efficient *(Fig. 2)*.

Instead of a consumer having to decide which hardware and software options or which wireless technology to implement in their home, they can simply leave it up to the providers of services they already use (e.g., internet access, security, and entertainment).

By opting for SHaaS, consumers don't have to be technologically savvy or care about the underlying wireless technology. Having one provider responsible for installation, setup, and management of the network makes it much faster to implement services, add new services, and ensure that controls and user interfaces are unified.

This is how the four basic components of a SHaaS work together:

1. A network of sensors in the home provides a general indication of when and where movement occurs in the home and whether the home is secure, what the environmental conditions are, and whether there are any issues (a leak, for example).
2. The information derived from these sensors is wirelessly collected by a local hub (gateway, set-top box, etc.) and securely transmitted to an intelligent cloud service that collects and analyzes the data, and sends alerts to family members when it detects changes.
3. A central management app enables the consumer to manage the network via a smartphone or any web-connected device in a single user interface.

3. The SHaaS acts as a butler in the home, using a network of sentrollers and cloud intelligence to create an environment that benefits those who live in it—and also helps to support the health of our planet.

4. The service provider is able to easily handle customer support, billing, and subscriber management, as well as software and service upgrades and changes.

HOW CAN THE SHAAS REDUCE ENVIRONMENTAL IMPACTS?

It's easy to see how a SHaaS can increase efficiency, safety, and comfort within the home and help its occupants better manage and live their lives. But SHaaS benefits reach well beyond the walls of the home, helping to reduce the use of our planet's natural resources and our carbon footprint *(Fig. 3)*.

Water. Water conservation is one such example. Most everyone has experienced a leaking water heater. If the leak is not immediately detected, the water heater continues to run, inefficiently heating and wasting water, causing costly damage in the home, and resulting in high energy and water bills.

One fix is to install a leak detector that sends an alarm when the tank fails. But by taking that a step further and connecting that leak detector sensor to a smart-home network—one that includes actuators and controls on the power and water sources—the smart home can alert the home owner and control the power and water systems that feed it.

This same scenario applies to frozen water pipes. If the network notices that water is moving in the pipes with no one home, it can send a notice to the homeowner and turn off the water at the main valve. In daily applications, the smart home would recognize that water is flowing when no one is home, talk to the water meter, and turn off the flow.

Power. Power use is another area where the SHaaS delivers environmental benefits. A green smart home would monitor how and when power is consumed and manage power in the home based on that data. For example, the home would make sure A/C and heating systems are not in use until someone is home, and would automatically open and close window shades or curtains to adjust for the sun and the season.

The home's power-storage system can be charged during the day via solar panels on the roof, or at night when power is less expensive. That way, the home's power-hungry appliances can use "cheap" stored electricity instead of drawing from the grid during expensive rate times. These systems are already in use in industrial applications and will soon be moving to home use.

The smart-home power system can learn which devices are the worst power consumers when not in use and simply disconnect them. If the home network recognizes that the family is away on vacation, it can disconnect all devices that consume standby power.

People. A smart home can have environmental benefits in subtle ways, as well. Families with an older parent who lives alone can use the smart-home network to maintain awareness of their daily well-being without having to drive or take the bus across town, reducing CO2 emissions.

An effective smart home makes its people smarter, too. When people are educated about how much appliances are actually costing in power, they are more likely to turn off the appliances when not in use and to be more conscientious in their use of energy.

HOME SENSORS AND ANALYTICS SUPPORT SUSTAINABILITY

On April 22, countries around the world will mark Earth Day. Our ideas about the role of home connectivity in environmental stewardship have been transformed since the first celebration of this event in 1970.

New technology, composed of sensors and analytics, is empowering smart-home solutions that learn from the people who live there. These systems use this knowledge to make predictions about future behaviors and take actions that enhance comfort and convenience, save money, and reduce environmental impacts. Smart Home as a Service enables consumers to practice sustainability and help ensure a cleaner future simply by exerting greater control over the way resources are used in their homes.