Smart Homes: Connectivity and Self-Sustainability

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Situation

"A smart city begins with a smart home."
- AUS Professor Abdulrahman Al Ali (ELE)

A smart home is a sustainable home that applies advanced systems to provide sophisticated control over the building's functions.

The use of computer hardware and software as well as Information Technology to control, monitor, and optimize household appliances and systems.

Figure 1: Smart Home Technology Impacts [1]

Problems

Energy

According to Natural Resources Defense Council (NRDC) [2]:

- $19 billion a year is wasted by inactive 'idle load' electronics
- 23 percent of power consumption in an average American household

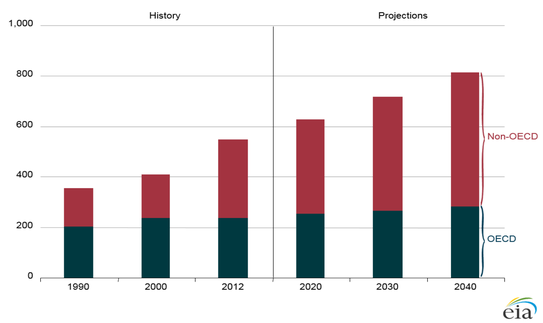

Figure 2: Home Idle Load: Device Energy Waste [3]

Sustainability

- Modern homes are dependent on electricity from external sources and are part of the climate change problem

Security

- Most modern homes are often not monitored by cameras and sensors, cannot detect any security patterns, and do not have the technology to take action in case of emergency

Solutions

Energy Saving Approach

- The zero net waste house produces energy as much as it consumes
- "The goal is to reinvent the home—to build a sustainable, affordable house that uses readily available technology to negate its imprint on the environment and to promote the health and comfort of its inhabitants." [4]

Security Approach

- A modern fingerprinting algorithm has been developed which allows user verification for accessing the house remotely

Comfort and Practicality

- SELSA (Sustainable Energy Efficient Low Power Smart Home Application)
- Controls the home system remotely
- Cuts off appliances when idle
- Home devices are connected through a grid

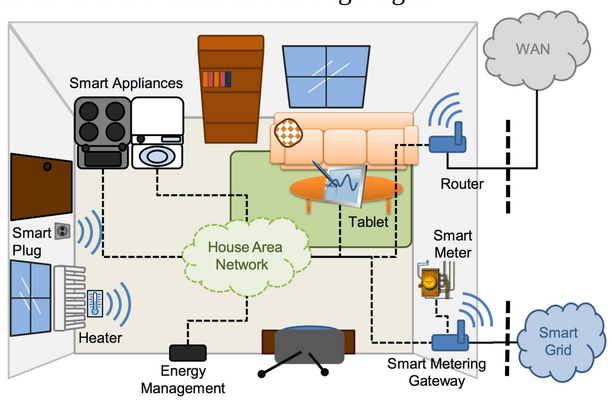

Figure 3: Energy-efficiency in Wireless Sensor Networks [4]

Evaluation

Retrofit

- In terms of wiring and design, clashes with traditional houses, therefore more houses must be built to suit the circumstances

Availability

- Smart homes could be limited until customer feedback, government incentives, and technological innovation push to implementing more smart homes

Reliability

- A smart home can be increased in reliability by customer feedback and thorough testing. But if an error occurs, repair costs will be high, therefore reducing potential reliability

Cost

- Energy consumption must be utilized through decreasing energy consumption by cutting off electrical supply and waste to unused appliances

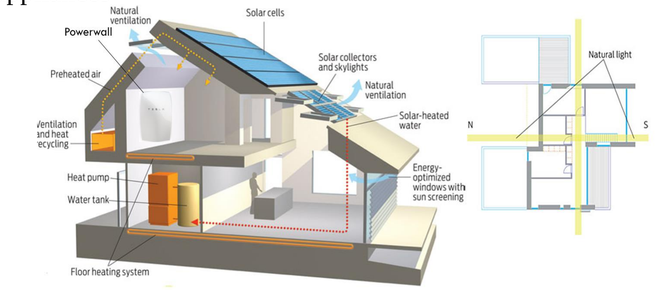

Figure 4: Denmark's Net-Zero-Energy Home [5]

References

[1] J. Eiting, "Smart Home Technologies: Changing the Face of Vacation Rental Management", Kigo, 2016.
[2] P. Delforge, "Home Idle Load: Devices Wasting Huge Amounts of Electricity When Not in Active Use", NRDC, 2015.
[3] "International Energy Outlook 2016-World energy demand and economc outlook - Energy Information Administration", Eia.gov, 2016.
[4] J. Wilke and C. Haas, "Energy-efficiency of concast communication in Wireless Sensor Networks," Wireless On-demand Network Systems and Services (WONS), 2013 10th Annual Conference on, Banff, AB, 2013, pp. 34-38.
[5] E. Hansen, "Denmark's Net-Zero-Energy Home", IEEE Spectrum: Technology, Engineering, and Science News, 2010.