INTERNET OF THINGS - APPLICATIONS

The Internet of Things has many consumer applications besides the smart key ring. Among them are popular devices such as health wristbands, like the FitBit, that track the wearer's physical activity and sleep patterns. There are also smart thermostats that control heating and cooling in order to lower your energy bill. There are even smart light bulbs that can be remotely controlled or can control themselves based on the time, weather or if someone is in the room. While these consumer-facing products are becoming more and more prevalent, there are also a wealth of non-consumer products that are beginning to adapt to the Internet of Things.

Internet of Things Application: The Smart Grid

Nearly all of modern technology revolves around having constant access to electricity. This access has been provided to the public via the electric grid. While the current electric grid system works, there are many benefits to be gained by replacing it with a smarter and more connected version, appropriately named the Smart Grid.

The electric grid is tasked with taking power from power plants, delivering it to users and transforming it so it meets their needs. This is because the power needed by a large factory is much different than the power needed in a family's residence (Sclater, 2003). These users have different needs at different times and the grid operators must deliver power where it is needed.

It is possible to determine which parts of the grid are lacking power and which parts have excess power at a given point in time, but it takes time to adjust to meet these needs. For instance if power is lacking, then a generating station may need to come online to make up the difference. This takes time and costs money, so any method to make this process more efficient saves both power providers and consumers money. Currently many grid operators use statistical methods to predict future demands, but this is not a foolproof system (Hersent, 2012).

The Smart Grid will attempt to improve the electric grid by collecting current data instead of using statistics based on historical data. This will be accomplished in part by smart meters. Smart meters are internet-connected electric meters that will allow constant monitoring which can immediately be shared with power grid operators (Zhou, 2013). These meters can also track a single consumers

historical data, which can be shared with grid operators. By aggregating the data from all of their customers, grid operates will be able to make decisions based on their customers' current usage patterns, not statistical estimates.

Another benefit of the smart grid is that it can work with other Internet of Things devices to further amplify benefits. For example, a smart clothes dryer could be scheduled to run when demand on the grid is low. It could also communicate its expected power needs with the grid. This combination of constant monitoring and smart application awareness benefits both the grid operators and consumers (Hersent, 2012). Grid operators now have better information that allows them to make well-informed decisions and to potentially automate new aspects of grid management. Since smart appliances run at off-peak times, their owners will pay less for the electricity.

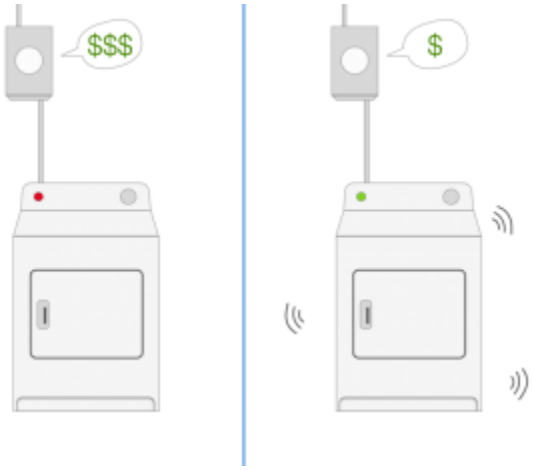

Figure 1

Internet and Smart Grid-Connected Clothes Dryer. Source: Stephen Panaro.

Electrical and Computer Engineers play an important part in advancing the smart grid. They will need to design, develop and test the new smart power meters. They must determine how they will communicate with the grid as well as what information is useful to track. Any smart appliances, like the clothes dryer, will need engineers to determine how they will communicate with the grid and what methods will be used to estimate their future power usage.

Internet of Things Application: Visible Light Communication

It is not uncommon to see smart light bulbs that can be controlled from a smartphone. They can dynamically change color and turn themselves on and off at scheduled times. However, there is another type of smart light bulb that solves a completely different problem.

Most wireless communication, including Bluetooth and WiFi, occurs in the radio frequency (RF) spectrum. Unfortunately transmission in the RF spectrum is limited due to regulation and interference (Lo, 2004). Since more and more devices have a need for wireless communication, especially with the rise of the Internet of Things, the RF spectrum is becoming crowded. One solution to this is to look into different spectrums for communication, such as the visible light spectrum. The technology that achieves this is known as Visible Light Communication (VLC).

VLC is the process of transmitting data by using visible light waves instead of the traditional radio waves (Lo, 2004). VLC is appealing because it is in an unregulated bandwidth, unlike RF, which makes adoption easier. VLC also has a potential 300 THz of bandwidth, allowing for multi-gigabit per second communications (Rajagopal, 2012).

VLC is a promising technology on its own, but implementing it in smart light bulbs is where real benefits will be found. Light bulbs already are used in many indoor spaces to provide light, but with the right technology they could be replaced by smart light bulbs. These bulbs would provide the same light but also wireless Internet connectivity (Kavehrad, 2010). This would result in less RF interference, less dedicated communications hardware and less wasted power.

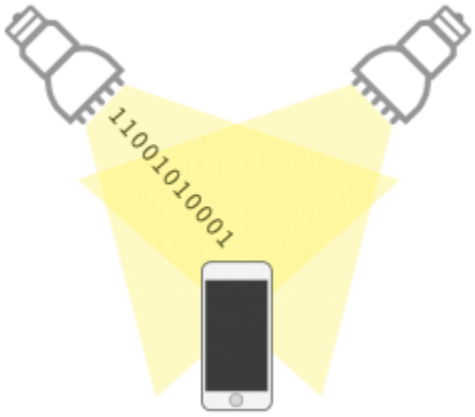

Figure 2

VLC Light Bulbs Provide Light and Data. Source: Stephen Panaro.

There are already a few installations of VLC light bulbs. Phillips installed smart light bulbs in a Dusseldorf grocery store and developed a smartphone application. When used together the application uses the lights to locate the user in a supermarket and helps them find products (LaMonica, 2014). While this is only one-way communication, it highlights the viability and simplicity of VLC light bulbs.

It will be the job of Electrical and Computer Engineers to further develop VLC light bulbs and find new applications for them. Additionally, there still remains significant research to do to establish a method of communicating from device to light bulb because VLC can't be used to communicate in both directions (Kavehrad, 2010).

Source : https://sites.tufts.edu/eeseniordesignhandbook/2015/internet-of-things/