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Linking the Internet of Things:

HitchHike Prototype

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Stanford and MIT researchers are proposing a unique two-way radio called HitchHike [1]. This is an energy-efficient backscatter radio that essentially holds its own WiFi infrastructure. The significance of this device is held in its ability to “link” to the Internet of Things. IoT envisions a word in which all these devices work in harmony efficiently. Sensor-gathered information is only meaningful if infrastructure analyzes it in real-time. This dime-size device would theoretically assist in this huge prognostic development. Theoretically, the Hitchhike combats this problem quite effectively. In the presence of WiFi signals, it data streams from a source and decodes it such that it can reflect the same data onto another WiFi channel. This is a simple concept that allows for effectively transmitting bouncing data.

While having many pros as a potentially revolutionary device, the prototype has a simple and clever design. As mentioned before, the device bounces onto waves generated by surrounding routing devices. HitchHike receives a transmission stream and a data stream, and a uses a frequency shifter to create a backscatter stream. For example, consider a HitchHike receiving data from a standard smartphone [2]. The smartphone transmits an 802.11b packet to the first HitchHike. The HitchHike tag receives the WiFi packet, frequency shifts it to another channel, modulates its information and then reflects the signal as backscatter into the AP of the HitchHike. Using XOR logic, the HitchHike decodes the backscatter data and reflects it as a WiFi packet. As demonstrated, HitchHike efficiently handles incoming data streams. Data in the HitchHike tag only changes if the streaming bit results in the code word being altered. One potential problem would be the interference of of radios between the original and new datastream of the Hitchhike devices. To approach this issue, the devices uses a frequency shifter to shift the current signal to another WiFi channel, almost powerlessly. This is quite a feat that continues to show the “power” of the device. Surrounding the world with HitchHike devices definitely opens the door for widespread communication and empowering the Internet of Things.

Creating such a device had been unreachable before because it would involve high energy. As the Stanford article describes, another favorable trait about this device is its energy efficiency. [1] Self-sufficient, the device is described as being able to survive for at least a decade with a small battery. The system even has the potential to self-energize, harvesting energy from electromagnetic energy of surrounding radio waves. Never versions of the HitchHike devices may use miniature solar panels. While almost too good to be true, the device offers an entrance to an energy efficient world in technology. Especially since WiFi currently consumes battery power quickly, this energy saving would improve peoples lives and the quality of data sharing. With a range of up to 50 meters, the bit is able tot transmit 300 kilobits per second. Considering that this speed is faster than the fastest dial-up modem, this is quite extraordinary. IoT becomes more reachable with such an energy-saving device. The simplicity would likely contribute to cheapness of the device, quickly building the Internet of Things.

The article demonstrates a simple experiment in which HitchHike detects the results of a heart-rate [3]. Hitchhike takes in ECG signals while reflecting the signals onto a laptop. The laptop decodes the reflected signals, displaying the ECG signals in real-time. As shown in the video, the decoding happens very quickly, indicating the power of the HitchHike device and its potential to be used outside the Internet of Things. As shown, the device would be useful in Mobile Health.

The efficiency of the device is already contributing to its potential in being applied large-scale in the future. Only presented at a conference earlier in November, the device holds promise in its ability to incorporate wireless devices within the next three to five years. There is hope that a class of these devices will be planted all around the world, entering a revolutionary Internet of Things. Connecting these HitchHike devices could increase efficiency for cloud-based applications. Some of these applications involve “enabling intelligence” among machinery. Non-WiFi dependent machines could become smart bridges, smart cars, and eventually smart cities. Implanting these building blocks, “portable WiFi” devices, throughout the glove would essentially help that entire place begin to construct.

Bibliography

[1] Zhang, P., Bharadia, D., Joshi, K., & Katti, S. (2016, November 14). HitchHike: Practical Backscatter Using Commodity WiFi [Abstract]. *ACM,* 0-13. Retrieved from http://web.stanford.edu/~pyzhang/papers/sensys16\_back\_comm.pdf

[2] Myers, A. (2016). Miniature WiFi device developed supplies missing link for the Internet of Things | Stanford News. Retrieved from http://news.stanford.edu/2016/11/16/miniature-wifi-device-developed-supplies-missing-link-internet-things/

[3] Zhang, P. (2016, November 14). HitchHike: Practical Backscatter using Commodity WiFi. Retrieved from https://www.youtube.com/watch?v=r6Lh5ftg3C8&feature=youtu.be