Smart AC Plugs

How much power is every device you own using, right now?

Today, there's no way for you to know, because almost no appliances or tools are designed with power-usage monitoring, much less any sort of remote automation. In order for energy monitoring to increase energy conservation significantly, it has to be embedded in everything we plug into AC power at home and the office. But it's not available in anything sold at Costco, Home Depot, or Office Depot, so it has not yet reached the tipping point.

IOTA's vision is to make it simple to integrate Internet connectivity into any object that uses AC or battery power. We want to allow everything you make to become an intelligent networked device. The key to this is integrating everything needed to pull this off in as few components as possible, and making sure they work together perfectly.

Scenario A—no smart plugs

Your electric utility just installed a smart meter, which saves them money by not having to pay meter readers to drive around reading tiny numbers on millions of meters. And they gave you a login to a website where you can track your daily power usage, which has made you realize you're using too much, but it can't tell you which things are using the most energy.

Scenario B—add external meters to a few key appliances

Dissatisfied with the dumb data from the smart meter, you go to BestBuy.com and order three power-usage meters, at $40 each. These meters don't talk over the Internet, however, so you need another device—but neither of the two the product description lists can be found on the site, so you go visit another website that has one model for $99, and the other for over $300—and neither product describes whether or not the included software will display power usage from these meters. And at $40 a pop, you aren't about to buy one for every AC-powered thing you own. You might never save enough electricity to recoup that expense.

This—sadly—is today's state-of-the-art for retail products aimed at the consumer. The few Best Buy stores with home automation sections and trained salespeople are a little better, but not much. None of the microwaves, ovens, or other appliances the stores sell can talk to any of the home automation technology just a few aisles away.

Scenario C—IOTA-Powered Smart Plug

Fast-forward a year, and you're moving out of a tiny apartment and into a large house, so you have occasion to buy a bunch of new appliances. You drive to Best Buy and discover that just about every appliance—over 90% of the AC-powered devices they sell—have stickers saying they transmit power usage over whatever Internet system your house has—HomePlug over the AC wiring, Wi-Fi, etc.

Now, you can use a smart phone, TV, laptop, or desktop computer to see where the power hogs in your home are, and adjust your electricity usage until both you and your pocketbook are happy.

This rapid adoption will be possible because of how easy it is to make devices part of the Internet of Things using the IOTA architecture.

What's in a Smart Plug?

The reliability and integration of the IOTA CPU make it ideally suited for this task. The bare minimum number of components required to make the vision in Scenario C happen are these:

- IOTA Microcontroller
- AC current sensor
- Temperature sensor
- Shunt-tripped circuit-breaker or GFCI module
- Power-Line Communications network chip
- Wi-Fi network module

For some small appliances such as curling irons, you might delete the Wi-Fi radio module to keep costs down, but with the circuit breaker interfaced with IOTA, you can make it easy for the owner to disconnect it from their smart phone as soon as they start worrying.

The hardest part of this integration will be designing the circuit assembly to support being molded into the AC plug. IOTA's architecture frees the product designers from the standard computer systems integration nightmare, so they can concentrate on creating an amazing product that will just work.

The temperature and power usage sensors each connect to two of IOTA's dozen-plus general-purpose input/output (GPIO) pins, while the power line carrier and Wi-Fi modules connect to two other sets of GPIO pins designated for networking.

Once all these parts are connected electrically, the product developer simply has to write the code that will read the sensors and format the data that will be turned into IP packets by the IOTA OS and sent out over whichever type of network the Smart Plug can access.

Ubiquity requires simplicity

The power of this concept is that it puts all the needed sensors and intelligence inside the AC plug, which can be UL-certified as a component and then integrated into just about any device, appliance, or even simple cord sets without requiring additional certification.

With the simple integration described here, you really could see Internet-enabled energy-usage reporting on nearly every AC-powered device within just a couple of years.

IOTA Benefits

All-In-One Platform
Spend more time innovating and less integrating

Built-in Networking
IPv6 Stack, MAC, SPI, and RMII interface with nearly any PHY

Reprogrammable
Upgrade data reporting formats, RF duty cycle, and other behavior in the field

IOTA
COMPUTING