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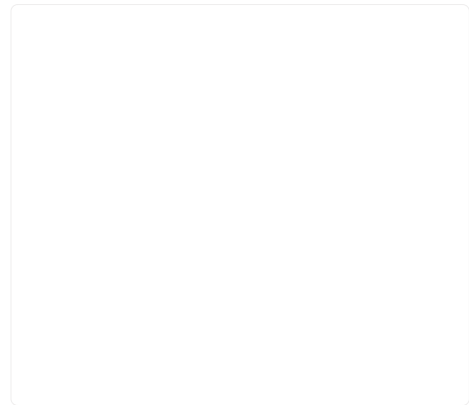
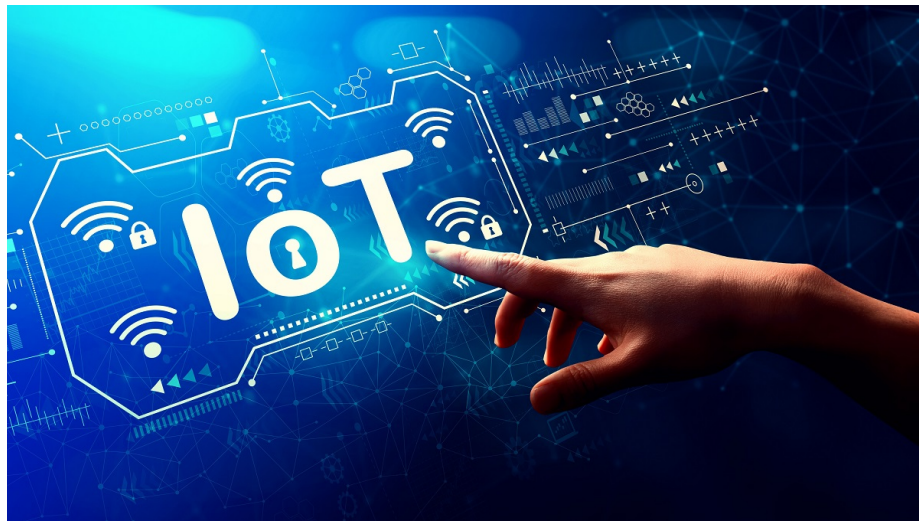
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Removing Batteries From the Internet of Things



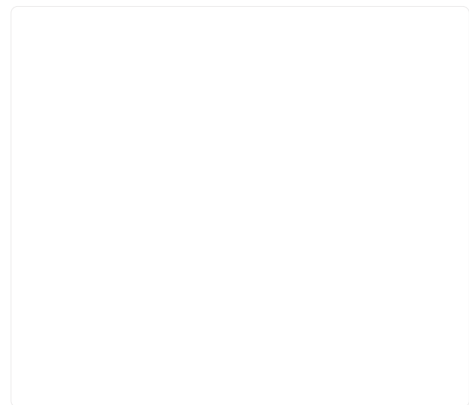
By [Gemma Alexander](#)

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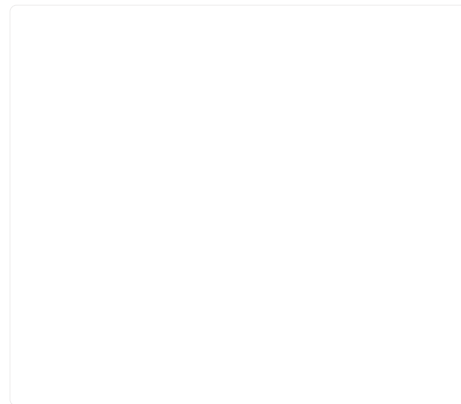
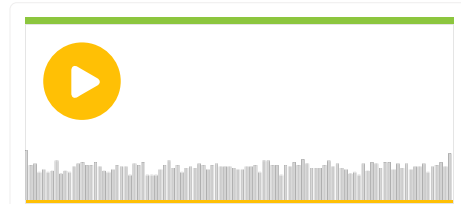
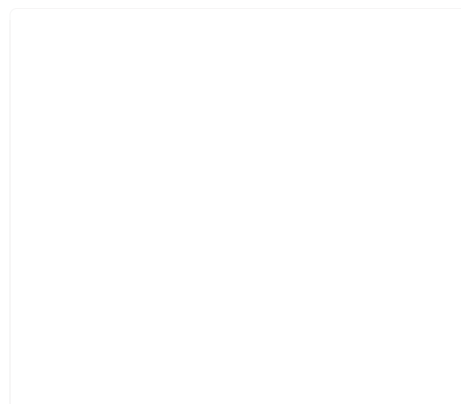
battery-free.

The Internet of Things

Most simply, the term "[internet of things](#)," often shortened to IoT, refers to objects that are connected to the internet. By now everyone is used to internet-connected computers and electronic devices like tablets and cell phones. The internet of things expands that connection to include all kinds of household items from televisions to [toasters](#). Many of these products seem like solutions in search of a problem or even a cynical grab for your personal information. (Is it really helpful to start your clothes dryer using a phone app when you still have to manually switch over the clothes?) But smart devices can make your life easier and even greener. [Smart thermostats](#) and [smart window shades](#) can reduce heating and cooling costs, even when you aren't home. [Smart gardening products](#) can help you save hundreds of gallons of water in your garden.

The Problem With Batteries

But all of these items have potential environmental downsides, too. They have all of the recycling challenges of [stealth electronics](#). And they do draw power, often even when they are not in use. All those new sensors and portable devices also means a proliferation of batteries. [Rechargeable batteries](#) are better than disposable ones, but both [rechargeable](#) and [single-use](#) batteries can be hard to dispose of responsibly. Disposal is only one of the [serious drawbacks to batteries](#). Batteries of all kinds contain toxic and corrosive materials that are dangerous at every stage of life. [Mining and processing](#) these materials requires huge quantities of water and pollutes water, soil, and air.



stop if it is removed for a few minutes.)

Now electronics designers are using more sophisticated methods to power a host of sensors and other devices. Ultra-low-power [integrated circuits](#) that harvest energy from sources like indoor light and vibrations to generate data are already being used in industrial applications. These circuits never turn off, require basically no maintenance, and can last over 20 years. Data collection is a major focus of the internet of things. Consumer devices that incorporate these circuits could draw less power and last longer (because the sensors don't wear out).

A Battery-Free Internet of Things

The circuits currently in use require minuscule amounts of energy, but many innovators are working to develop energy-harvesting devices that — either alone or in combination with such circuits — can power more than just sensors. [Various projects](#) are exploring energy sources such as radio waves, temperature differentials, vibrations, ambient light, and even [Wi-Fi backscatter](#).

Researchers at Northwestern designed a Nintendo Game Boy powered by game-play and sunlight. It uses energy generated by tiny magnets and tightly wound coils every time a user presses a button. Researchers at the University of Washington are working to develop battery-free cell phones. The environmental benefit of cell phones whose useful life is limited by materials rather than the lifespan of rechargeable batteries is immediately obvious.

Battery-Free Barriers

As radio and backscatter-harvesting devices become more common, regulatory concerns will develop. Questions over who holds the data will need to be addressed. But currently



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[E-Waste: What Happens When We Fail To Recycle Electronics](#)



By [Gemma Alexander](#)

Gemma Alexander has an M.S. in urban horticulture and a backyard filled with native plants. After working in a genetics laboratory and at a landfill, she now writes about the environment, the arts and family. See more of her writing [here](#).

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