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Protecting Yourself with RFID

Embracing the benefits of wireless tracking technology.

By William Lumpkins

RADIO-FREQUENCY IDENTIFICATION (RFID)—AN OLDER TECHNOLOGY that was first used for spying by the Komitet Gosudarstvennoy Nezhopasnosti (KGB), the main security agency of the Soviet Union until 1991, and the U.S. National Security Agency (NSA), the U.S. internal security agency, during the early days of the Cold War—is

now being used worldwide in an attempt to track valuables and personal assets for your safety. Both the KGB and NSA needed a technology that could be used to “listen” to conversations and only repeat them when a specialized field frequency was generated nearby. Both groups, depending on who you ask, came up with a similar idea: to design an antenna that converts the specified field into electrical energy, like a coiled piece of wire generates a charge when moved through a magnetic field, and then connect it to something that would record the information for later playback. Both groups had years of fun trying to out-listen the other group. Eventually, scientists from both sides left their low-paying jobs with the government and took their ideas to a venue where they could make some real money—the consumer marketplace.

WHAT IS RFID IN THE CONSUMER SPACE?

RFID is remote/self-powered asset-tracking technology (see Figure 1). RFID uses an antenna with an F_{co} of the resonance field that generates a charge to a microprocessor that sends encrypted bits of data back and forth to the reader or field generator. Together, the microprocessor, antenna, and encryption protocol are called an RFID tag. It is used to monitor important assets like shipping containers, high-value items that are prone to theft, and even vehicles. The great thing is that this technology uses radio-frequency waves like frequency-modulated radio waves, similar to what you would listen to on your car radio. These waves travel invisibly through glass and the



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Digital Object Identifier 10.1109/MCE.2015.2393009
Date of publication: 15 April 2015

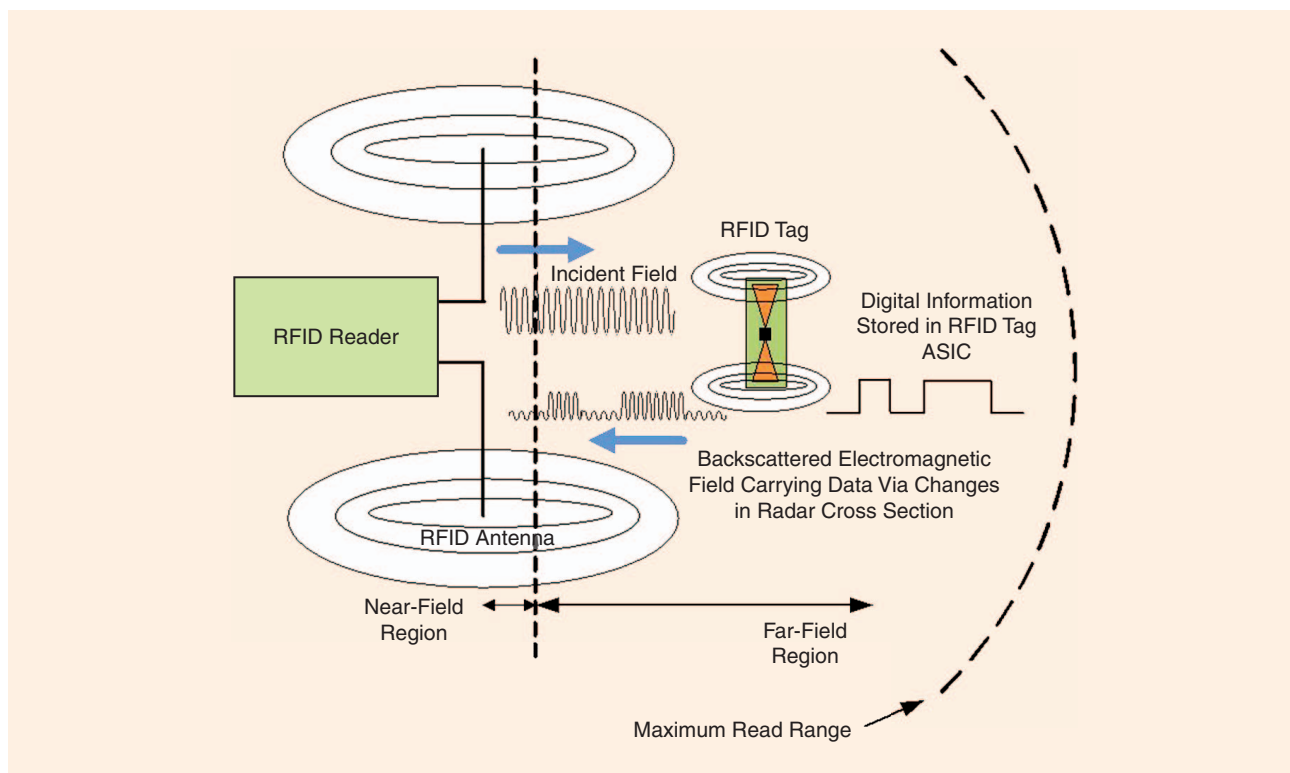


FIGURE 1. RFID systems, comprising tags and a reader, can be used to track objects for a variety of applications, including asset protection, market research, and payment systems.

air, though they have trouble penetrating thick clothing or walls. The number one use of RFID tags in North America is toll tags for vehicles. Cars do not need to stop at a toll booth; they just pass through, and their accounts are debited directly.

RFID tags are easy to hide. They can be inserted into software game packages, book bindings, and printed on boxes, and, as determined by some advanced university research work, they have even been embedded in clothing, though the cost factor tends to be prohibitively high. As you may know, most of the latest credit and loyalty cards have embedded RFID technology, including Apple Pay, Google Wallet, American Express, and some new Visa and MasterCards. Most hotels now use RFID for enhanced security to safeguard guests from pesky thieves.

As most RFID tags get their power from RFID field generators or readers, they do not need batteries. With no parts to wear out, they can transmit secure asset-location information

virtually indefinitely. As an added benefit, RFID readers can be hidden; there are many plans at a multitude of retailers to embed them in floors, doorways, ceiling tiles, and store shelves. The biggest issue is the cost of the readers or field generators; this is why they tend to be limited to handheld readers or placed only at store entrances/exits. The tags can cost as little as US\$0.05 in multimillion units of volume, but the readers tend to cost about US\$800 for a handheld unit and more than US\$2,000 for a store entrance unit. Retail logistics departments try to justify the costs with the reduction in overall theft and the amount of time saved by allowing sales associates to quickly check inventory by waving the reader in an aisle verses checking every single item individually.

The largest expense is the back-office software needed to track all of the RFID asset tags and its incorporation into the inventory-management software. These systems tend to be made by companies like SAP and cost in the range of US\$300,000–500,000. Marketing departments would love to develop software to track the movement of the product once it leaves the store, but there is no way to do so, as most RFID tags use a proprietary encryption protocol, and different readers cannot read them.

I could envision a future where all RFID tags use a similar system, but although I like the fantasy of intercorporate cooperation, it is not likely to happen anytime soon. That is why there is a current industry push for another old idea made into a new marketing buzzword—the Internet of Things (IoT). The premise of the IoT is that more items will be able to connect to

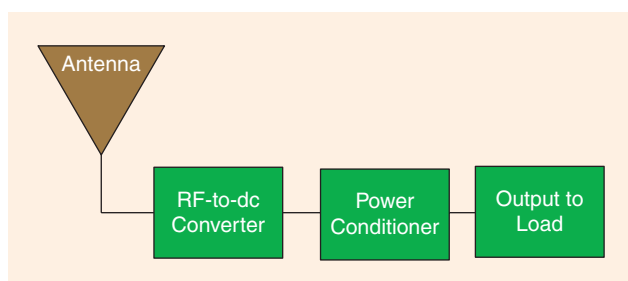


FIGURE 2. A block diagram of RFID energy harvesting.

the Internet and the Cloud for ultimate connectivity with enhanced security, which will enable us to find lost children, ensure that thieves do not abscond with our property, and that our lives are made easier and safer [1].

An exciting new aspect of this old technology is the reinvigorated interest in renewable energy. Nikola Tesla first experimented with the idea of wireless power in the late 19th century, and this trend is now re-emerging. As we know, an RFID tag gets its energy from radio waves, so why not take the unused energy of all those pesky Wi-Fi hotspots that lurk in every creak and crevice of our modern lives? From Starbucks to the hospital to the local elementary school, Wi-Fi is everywhere. As Wi-Fi operates at 2.4 GHz, all we need are antennas that have an F_{co} at 2.4 GHz and RFID tags can reuse the extra radio waves and recharge devices like cell phones, tablets, and toys [2], as shown in Figure 2.

SCANNING FOR RFID ADVANCES

This exciting old technology that is finally making it into the mainstream is changing rapidly. Over the past two years, I have had the honor of being the chair of the IEEE Committee on RFID (CRFID). The CRFID is composed of ten IEEE technical Societies that focus on different aspects of technology. These ten Societies are the IEEE Antennas and Propagation Society; IEEE Circuits and Systems Society; IEEE Communications Society; IEEE Consumer Electronics Society; IEEE Engineering in Medicine and Biology Society; IEEE Intelligent Transportation Systems Society; IEEE Microwave Theory and Techniques Society; IEEE Solid-State Circuits Society; IEEE Systems, Man, and Cybernetics Society; and IEEE Vehicular Technology Society.

The CRFID holds two major conferences every year with RFID Journal Live!, where scientists, researchers, students, industry professionals, and technologists gather to discuss issues and share research. Our next upcoming conferences are 15–17 April 2015 at the San Diego Convention Center in California (<http://2015.ieee-rfid.org/>) and 16–18 September 2015 in Tokyo, Japan (<http://2015.ieee-rfid-ta.org/>). We welcome all interested parties to attend and join in the future of RFID. The CRFID also has an online newsletter as well as a virtual journal (<http://www.ieee-rfid.org/ieee-rfid-virtual-journal/>).

Dr. Larry, Zhang, editor-in-chief of the Virtual Journal on RFID, says:

The Virtual Journal on RFID brings together in one place the best work in RFID technology, systems, and applications. For each quarterly issue, the distinguished associate editors of the virtual journal, representing a diverse group of IEEE Societies, highlight the best work available in the field from across the IEEE journal and conference publications. These high-impact, peer-reviewed publications provide the highest-quality information available about this rapidly evolving field. The editorial content focuses on timely topics and draws together emerging research and commercial trends to provide a comprehensive perspective on RFID and its emerging impact on society.



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HOW DO I ENABLE MYSELF WITH RFID?

It is not easy to get the newest RFID products, nor is it easy to get them to interoperate. The good news is that we have been trying to engage all interested parties in the early stages while there is still time to encourage businesses to put these awesome ideas into practice. Here's what you can do:

- ▼ Educate yourself about RFID. Continue reading *IEEE Consumer Electronics Magazine* and sign up to receive the free RFID newsletter (<http://www.ieee-rfid.org/>).
- ▼ Ask stores if they are using RFID and if they have wireless charging stations. If they don't have it, mention that RFID is the way of the future and energy harvesting is the way toward a greener planet.
- ▼ Finally, help us spread the word about the benefits of RFID and energy harvesting. Share this article with friends, coworkers, and loved ones. If we work together and let stores know we won't tolerate not having free wireless power, and that wireless power leads to a greener planet, they'll have to honor our collective buying power. We consumers have more control than we realize since stores depend on our shopping dollars. Give your financial support to retailers that put customers first! Support RFID and wireless power! RFID technology helps us work toward a better tomorrow.

Comments and suggestions are always welcome. The views expressed in this piece are mine and do not represent an official policy or stance of the IEEE.

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