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Short Communication

Impact of Wireless Sensors with Radio Frequency Identification

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ABSTRACT

The study presents an assessment of battery-free Radio Frequency Identification (RFID) based wireless sensors, which have been popular in recent years. RFID technology is evolving into wireless sensors. Furthermore, the study discuss the many components of these battery-free RFID-based wireless sensors, as well as the five basic topologies that turn a simple RFID chip into a battery-free wireless sensor and current implementations of these topologies. The read range is critical in battery-free wireless sensors. As a result, we'll go through how each sensor component affects the read range and how each architecture uses these components to maximise read range, complexity, and/or cost and also address possible future directions that might aid in the advancement of RFID-based wireless sensor technologies.

Keywords: Battery-less; IoT; Radio frequency identification; Sensor; Zero-power

ABOUT THE STUDY

Wireless sensors are becoming increasingly popular in the household and industrial sectors, where they are utilized for a wide range of applications from temperature and humidity monitoring to product quality assessment. Wireless technology allows for non-contact, noninvasive sensing, which is one of the key benefits of adopting it. This capability not only removes the need for long connections for data transmission, but it also prevents the spread of germs and provides comfort to users. To fully utilize the possibilities of wireless sensors and automated processes, the next generation of wireless communication, 5G, and the growing Industry 4.0 seeks to include them on a vast scale, resulting in a significant increase in research on wireless sensors [1-3].

Radio Frequency Identification (RFID) has been frequently utilised to identify and track objects over the past two decades [4]. This technology required a long time to become inexpensive and dependable in a wide range of applications. To combat theft, the system was first designed to replace bar codes and Electronic Article Surveillance (EAS). Later, RFID's application horizon widened, and it was used in a variety of applications, including inventory tracking in a warehouse for supply management, automated toll collection without the need to stop, and automatic door unlocking when entering parking garages or building premises [5].

RFID's uses are continually developing as time passes on, and RFID-based sensors are one of the most intriguing. Initially, RFID technology was developed solely for the purpose of object identification. By 2004, the technology has begun to include sensing capabilities. Although it is simple to extend the chip's capabilities beyond identification to sensing, the design must ensure that the extension does not compromise the performance of an RFID tag. As a result, such an addition should generate enough power to run the RFID chip and the sensing element without significantly reducing the RFID tag's read range. Active, semi-passive, and passive RFID tags are the three types of RFID tags available.

An active RFID tag has its own power supply and a transmitter for communication, whereas a semi-passive RFID tag has its own power source but no transmitter and instead communicates using a backscattering mechanism. A passive RFID chip, on the other hand, which is frequently the cheapest, has no internal power source and no transmitter, and hence relies on the reader's electromagnetic field to power its circuitry and backscatter the received signal. To create an RFID sensor, a sensing element can be inserted into any of the aforementioned categories.

Active or semi-passive technology requires a power supply, making the wireless sensor big and expensive, whereas passive technology is far less expensive, but adding sensing elements is difficult owing to the restricted power and flexibility available.

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As a result, passive technology must be carefully designed to address these issues. RFID is currently a widely utilized technology for tracking and inventory management services, and it is subject to a number of design requirements as a result. However, because wireless sensors, particularly RFID-based sensors, are still a relatively new technology, they may be referred to by multiple names in the community. Passive wireless sensors, in particular, are frequently referred to as battery-free, self-powered, or even zero-power.

Battery-less because RFID-based wireless sensors are small, inexpensive, and long-lasting, they have sparked a lot of interest. The ones that operate at Ultra-High Frequency (UHF) are of particular interest since they provide a good balance of size and read range. Chip-less sensors, chip-based antenna resonance modifying sensors, multi-port chip-based sensors, digitally integrated sensors, and chip-based ambient energy-harvesting sensors are some of the concepts that have been presented in the past.

CONCLUSIONS

A thorough examination of battery-free RFID-based wireless sensors was carried out. The antenna, rectifier, digital circuit, and sensing element, among other components of an RFID sensor, were all thoroughly covered. Different topologies utilizing the components in various ways were examined. The detect range of a battery-free RFID-based wireless sensor was seen to be affected by how the limited power was used and how the components were arranged. The use of humidity, flood, force, and temperature sensors in real-world applications was explored. Chip-based topologies are said to have the best read range and dense deployment capabilities.

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