Chapter 42
Energy Harvesting Methods for Internet of Things

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ABSTRACT

Internet of Things (IoT) has becoming a central theme in current technology trend whereby objects, people or even animals and plants can exchange information over the Internet. IoT can be referred as a network of interconnected devices such as wearables, sensors and implantables, that has the ability to sense, interact and make collective decisions autonomously. In short, IoT enables a full spectrum of machine-to-machine communications equipped with distributed data collection capabilities and connected through the cloud to facilitate centralized data analysis. Despite its great potential, the reliability of IoT devices is impeded with limited energy supply if these devices were to deploy particularly in energy-scarced locations or where no human intervention is possible. The best possible deployment of IoT technology is directed to cater for unattended situations like structural or environmental health monitoring. This opens up a new research area in IoT energy efficiency domain. A possible alternative to address such energy constraint is to look into re-generating power of IoT devices or more precisely known as energy harvesting or energy scavenging. This chapter presents the review of various energy harvesting mechanisms, current application of energy harvesting in IoT domain and its future design challenges.

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INTRODUCTION

Internet of Things is gradually increasing the unity of people and things around us bringing a new trend towards "ambient intelligence". Ambient Intelligence takes into account of sensitive and adaptive electronic environment by responding to the needs of the things around (Aarts, & Wichert, 2009). According to Marcelo (2014), there are six fundamental building blocks that constitute the components of the Internet of Things:

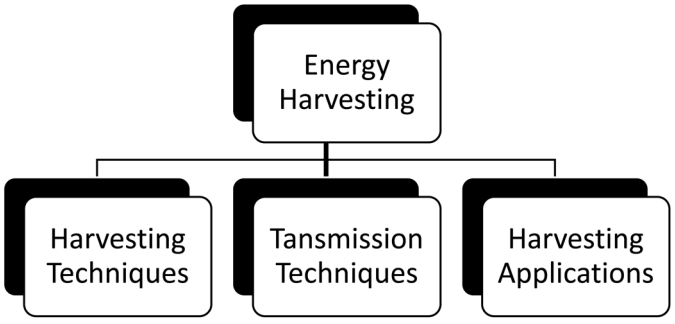
- **Sensors:** For tracking and measuring activity.
- **Connectivity:** Internet or cloud infrastructure.
- **Processors:** Contain some computing power.
- **Energy Efficiency:** Difficult for access to charge and replace battery.
- **Cost-Effectiveness:** Easily available.
- **Quality and Reliability:** Need to operate in harsh environments for longer period.
- **Security:** Need to relay sensitive information.

Energy efficiency in IoT domain has becoming one of the key challenges for researchers as such devices are expensive to maintain especially being deployed in inaccessible locations where replenishment of energy is almost impossible. Since these devices should be designed to operate unattended for very long duration, constant energy supply should be taken as a major design consideration and thus, energy harvesting comes into place.

Energy harvesting is a process of scavenging or hunting energy from the environment such as solar, wind or other sources like body heat, foot strike or vibration and converting it into electricity. The harvesting rate determines the performance of wireless network and may typically increase or extend the lifetime indefinitely. This chapter aims at presenting several mechanisms and methods involved in energy harvesting in wireless and sensor network as they are becoming the prominent features for IoT. Various techniques of energy harvesting, including assessing the variety sources of energy, methods of wireless energy transfer and possible application scenarios will be discussed as shown in figure .1.

To the best of our knowledge, there is little survey conducted on the application areas of energy harvesting in IoT domain. Although there have been a number of excellent literature reviews surrounding energy harvesting for wireless sensor network (Hande et al., 2007; Alippi & Galperti, 2008; Eu et al., 2009; Tan et al., 2009; Simjee & Chou, 2008; Liu et al., 2006; Kumar et al., 2008; Mainwaring et al,.

Figure 1. Energy harvesting domains



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