Chapter 9
IoT-Based Green Building: Towards an Energy-Efficient Future

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ABSTRACT

Among the various domains of IoT, one domain that is highly emerging in recent years is the application of IoT in green buildings. With the advent of IoT, the concept of green buildings has taken an even broader perspective. Incorporating intelligence into the current building management systems could revolutionize the buildings in terms of energy efficiency. The chapter explores some sound benefits of integrating IoT into a green building. It offers insight into the various technologies used in green construction, followed by some IoT-based architectures. Some machine learning algorithms that can be used to boost the efficiency of IoT devices are also discussed. Finally, the chapter dives into the future of IoT-enabled green buildings, and explores the challenges in achieving zero-energy buildings, while addressing the questions it raises. It focuses on how a green building, together with the internet of things, may lead to zero-energy buildings, thus carving our path towards a secure and energy-efficient future.

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INTRODUCTION

Minimizing the massive energy consumption in the industrial and residential sector is a big challenge worldwide. Increasing the energy demand patterns of cities are one of the major challenges that the globe has encountered in recent years. This ever-increasing demand for energy, when coupled with the limited energy resources, constitutes the energy problems which have to be resolved as soon as possible, in order to prevent the expected extinction of energy resources in the near future.

When we dig deeper into finding the causes of such enormous energy demand of cities, it is found that buildings, particularly, are the biggest electricity consumers, accounting for more than 60% of the total global energy consumption. In other words, buildings are solely responsible for more than 60% energy consumption, which is a lot to consider (Tushar et al., 2018).

The life cycle of a building, in general, comprises 3 phases: construction, operation, and deconstruction. Each phase is responsible for hurting the environment in one or the other way. For instance, the factories that produce the materials used in the construction of a building produce damaging CO_2 emissions; according to the US Green Building Council (USGBC), buildings are the biggest energy consumers, accounting for around 41% of the world's energy use; the destruction of buildings (in the interest of renovation) also contribute to a large amount of hazardous waste.

Recent years have seen a tremendous growth in the number of buildings being built, and consequently their disastrous effects on the environment. Thus, having a sustainable and efficient building is more of a necessity today than anything else.

What Is a Green Building?

The United States Environmental Protection Agency (U.S. EPA) defines green building as *"the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort. Green building is also known as a sustainable or high-performance building"*.

The most widely accepted and pronounced benefit green homes have on the environment is, without a doubt, energy efficiency. Other benefits include, but are not limited to, massive reduction in carbon emissions, improved indoor air quality, reduction in waste sent to landfills, and protection of natural resources, as the green construction involves the use of renewable and biodegradable resources. Moreover, green building doesn't just have an outstanding result on the environment. It is also advantageous to the occupants of the buildings.

However, certain barriers or obstacles are present for green buildings, such as higher inceptive costs, lack of incentives and political assist, absence of public awareness, and the perception that green is for the high end sector only, as per the Dodge Data and Analytics 2016 (Jadhav, 2016).

But, the construction of a green building should be looked upon as an investment. An investment that will save money (in the future), and at the same time preserve the environment and prevent depletion of natural resources. That is a win-win situation for everyone.