Chapter 5
A Comprehensive Overview of IoT-Based Green Buildings:
Issues, Challenges, and Opportunities

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ABSTRACT

Green building defines the way buildings are designed, constructed, operated, and maintained in such a way that the negative impacts are reduced and eliminated. The green building ensures to impart the sustainability of a building environment for quality living of citizens. It is to be noted that, not only the structure of the building, but its entire life cycle—including designing, constructing, operating, maintaining, renovating, and demolishing—must ensure responsibility towards environmental and natural resources. However, there are numerous factors that influence the effect of green building. Further factors such as pollution control, air quality monitoring, adaptability to evolving environment, and materials used also need to be handled by the green building. Hence, this chapter focuses on exploring the various issues, challenges and opportunities of green building concepts. Further, this chapter addresses how IoT-based green building will assist in achieving the goal through other emerging technology such as cloud computing.

INTRODUCTION TO GREEN BUILDING

Buildings have a substantial impact on the environment in all the stages. Starting from their construction, occupancy, revamp, repurposing, and devastation, buildings uses energy, water, and raw materials, produce waste, and discharge potentially toxic atmospheric releases. Thus propagates the positive impacts on the natural surroundings and weather conditions to enhance the quality of life of the occupants of the building. The building industry is a significant energy-consuming sector in the industry. It consumes energy not only during the construction, but the whole of its life as well — the high consumption of energy

for everyday life like lighting, air-conditioning challenges the architects, civil engineers and constructors plan environment-friendly and resource-efficient constructions. These challenges have triggered the creation of green building aimed at mitigating the impact of buildings on the natural environment through sustainable design.

Green building is a real-world and mindful environment approach to building design. It consumes less water, generates less waste, conserves the right amount of energy, uses natural resources and provides a comfortable and healthier living environment for human beings. In the conventional way of constructing a building pay a very little attention towards the impact that has on the environment as they use a large amount of non-renewable and toxic materials for the construction. The green building considers the environment at every stage of its construction starting from design, implementation, operation and maintenance. The serious environmental problems, the constant demand for the improvement of the air quality encourages the rapid development of green buildings. Firstly, the efficient uses of non renewable resources like electricity, water and gas. To overcome this, Green Building promotes usage of alternate renewable energy source likes solar energy.

Several organizations, standards towards Green Building exist across the globe, namely World Green Building Council (WGBC), Indian Green Building Council (IGBC), Leadership in Energy and Environmental Design (LEED), US Green Building Council, British Building Research Establish Environment Assessment Method (BREEAM), Excellence in Design for Greater Efficiency (EDGE), Green Building Council of Australia (GBCA), Green Building Index (GBI) of Malaysian Government, ISO/TS 21931 2006, etc.. The major objectives of these organizations and standards are to facilitate sustainability, durability, economy and comfort through green building construction and maintenance.

In this aspect, Internet of Things (IoT) has proven to be an excellent opportunity to maintain and control buildings. According to ABI research report, the count of such IoT based opportunistic systems for Green Buildings is expected to grow over 64 million by 2021. The Green building along with IoT things will soon be evolved as connected everything that is belong to the buildings. And such connection will be supported by intercommunication of IoT things through Internet technology. The IoT based Green Building will ensure the enhancement of Quality of Occupant Life (QOL) in a green building environment. Some of the prominent areas where IoT can be implemented are cognitive modelling-based building maintenance and construction, air quality monitoring within building, energy usage monitoring, fire safety, security and surveillance, lighting system within given building, measuring and verification of inaccessible areas of the building using IoT systems. Hence, this chapter focuses on exploring the various issues, challenges and opportunities that are existing in present Green Building concepts. Further, this chapter address how the IoT based Green building will assist in achieving various goals of the Green Building.

The key contribution of this chapter are to:

- Introduce the concept of Green Building, its objectives, issues and challenges associated
- Need for IoT to achieve and overcome issues of Green Building.
- Discuss various IoT frameworks that are existing in literature for Green building.
- Address various Green Building Organizations Standards across international and national level.
- Real Time data collection through IoT systems from Green Building.
- Cognitive IoT approaches for maintenance of Green Building.
- IoT system based automated optimization, recommendation and replacement mechanisms for supply chain management of assets and equipments within a Green Building.

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