Chapter 7
Internet of Things for Green Building Management: A Survey

Muhammad Waqas Nadeem
Department of Computer Science, Lahore Garrison University, Lahore, Pakistan

Hock Guan Goh
Faculty of Information and Communication Technology (FICT), Universiti Tunku Abdul Rahman, Malaysia

Mudassar Hussain
Department of Computer Science, Lahore Garrison University, Lahore, Pakistan

Vasaki a/p Ponnusamy
Faculty of Information and Communication Technology (FICT), Universiti of Tunku Abdul Rahman, Malaysia

Muzammil Hussain
School of Systems and Technology, University of Management and Technology, Pakistan

Muhammad Adnan Khan
Department of Computer Science, Lahore Garrison University, Lahore, Pakistan, Pakistan

ABSTRACT

The expansion and development of advanced technology by mankind have a great substantial impact on the natural environment. The buildings consume a large number of natural resources during their construction, design, and operation process. Due to the manipulation of natural resources by the buildings on a large scale, there is a need of better-designed buildings for effective and efficient use of resources. The concept of "green buildings" is an innovative solution for the aforementioned issues and promotes eco-friendly activities. Internet of things (IoT) transforms the idea of green building into real. Considering a large number of IoT applications, the objective of this chapter is to survey the major IoT concepts for green building management. The survey is conducted by summarizing a large number of scientific contributions to the field (i.e., internet of things for green buildings) and presented in this study. This chapter also describes the open research challenges for future work in this emergent area.

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INTRODUCTION

The Internet of Things (IoT) is entering the daily operations into an automatic manner of several applications and industries such as but not limited to smart homes, smart buildings, green buildings smart grids, smart cities, e-health, physical security, FinTech, asset management, logistics, etc. IoT technologies and devices provide new types of services to improve daily life. Similarly, this new technology recently developed other new types of technologies such as Cloud Computing(Armbrust et al., 2010; Mell & Grance, 2011), Big Data (Chen, Mao, & Liu, 2014), FinTech (Mehrban et al., 2020) and Energy Monitoring (Al-Turjman, Altrjman, Din, & Paul, 2019; Fulk et al., 2019; Gray, 2020; L. Han & Wanhui, 2019; Hu et al., 2019; Kowalska-Pyzalska & Byrka, 2019; Middei et al., 2019; Yang, Chen, Liu, Liu, & Chang, 2020). The concept of the smart city is emerging in several continents, where enhanced infrastructure monitoring, street lighting controls, physical security, surveillance, and public safety, meter reading, gunshot detection, and transportation analysis and optimization systems are being deployed on a city-wide scale. The concept of green buildings is related to cost-effective at user-level that begins from IoT based applications and devices (Ghosh & Ghosh, 2020; Jain, Goel, Rekhi, & Alzubi, 2020).

Buildings have a great impact on the environment in various stages. Starting from their construction, revamp, occupancy, devastation, and repurposing, buildings use raw materials, water, and energy, and produce waste, and release toxic atmospheric constituents. Thus propagates impose positive impacts on the natural environment, surroundings, and weather conditions to improve the quality of life of the residents of the buildings. The building industry consumes energy significantly. The buildings do not consume energy at construction time, but also consume high energy during whole life as well for daily life activities such as air-conditioning and lighting. This is a challenging task for civil engineers, architects, and constructors to plan resource-efficient and environment-friendly constructions. These challenges are triggered by the creation of green buildings that main goal to reduce the impact of buildings on the natural environment through sustainable design. The design of green buildings is mindful and real-world for the environment. Because green buildings generate less waste, consume less water, conserves the precise amount of energy, and use natural resources to provide a healthier and comfortable living environment to human beings. In normal construction, the method pays very little attention to the impact of toxic and non-renewable materials that are used for the construction of the building. The green buildings consider the sustainability of the environment at every stage starting from design, implementation, operation, and maintenance. The serious environmental issues and problems, the demand for the improvement of air quality constantly increase that encourages the development of green buildings at a rapid level. Firstly, to make efficient use of non-renewable resources like water, gas, and energy. To overcome this problem, the green building promotes the concept of alternate renewable energy resources such as solar energy. Several organizations, standardize the concept on green buildings at the global level, namely Green Buildings Index (GBI) of Malaysian Government, World Green Building Council (WGBC), British Building Research Establish Environment Assessment Method (BREEAM), US Green Building Council, etc. The main objectives of these standards and organizations are to facilitate durability, sustainability, economy, and comfort through the development and maintenance of green buildings. The IoT technologies perform excellently to control and maintain buildings. According to the research report of ABI, the IoT based devices and systems for green buildings is expected to grow over 64 million by 2021. The concept of green buildings with IoT evolved as connected to everything soon that present in the context of the building. Internet technologies are used for the intercommunication for IoT devices. The IoT based green buildings make sure the improvement in the Quality of Occupant Life (QOL) in the green building