Chapter 4

Green Communication for Cognitive Cities

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ABSTRACT

To meet the explosive data rate requirements of future cognitive cities, mobile and wireless technologies are evolving at a very fast pace. With the faster adoption of bandwidth-hungry applications in our daily lives, the energy consumption in wireless networks has increased. Higher energy consumption has imposed some serious health concerns such as exposure to harmful radiation and increase in carbon dioxide emissions into the environment. To overcome the ecological and health issues and to meet the end user’s high data rate requirements for the successful deployment of the cognitive cities, the most important technology is green communication. Taking into consideration the importance of green communication technologies, this chapter presents an intense survey on energy-efficient technologies developed for green communication. Some key research challenges pertaining to the use and deployment of these technologies for green communication are discussed. In the end of this chapter, the worldwide standardization efforts for cognitive cities are also highlighted.

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INTRODUCTION

The most recent World Urbanization Prospects report has revealed that 55% of the world’s population is living in urban areas and it is expected to increase up to 70% by 2050. The factors responsible are: better education and job opportunities and great access to amenities like public transportation, sports, and cultural events etc. (Cisco, 2015). These advantages result in growth, and with growth comes strain on existing public services, infrastructure, resources and public safety. The basic need for urban public safety is also one of the biggest forces driving the adoption of “cognitive city” – the ultimate solution to the urban challenges through technological means. Thus, the term cognitive city refers to a city that collects, analyze and distribute information smartly by means of technologies (Yaqoob et. al, 2017). The foundation of such cities is a contemporary smart infrastructure made up of millions of devices/sensors connected through communication networks that collect and process data from these devices. This data is leveraged by various systems and platforms to make decisions or to initiate activities, and to address the needs of users via services and applications. Thus, cognitive city need the seamless Internet connectivity not only to the computers and smart devices carried by people, but also to the “things” with embedded sensors, actuators and networking capabilities to manage environmental, social, economic, and public health issues in future (Talari et. al, 2017). Cognitive city deployment is more than refining the old existing system technologically by simply adding electronic sensors, remote surveillance, and control to enhance existing city services (Wang, Huang, and Zou, 2016). Some of the major applications of cognitive cities have been enlisted in Table 1.

ROLE OF ICT IN COGNITIVE CITY

The information & communication technologies (ICT) plays a very vital role in cognitive cities in collecting and aggregating information and data from the field to improvise the city functionalities in terms of resources utilization, better services, and improved lifestyles, as illustrated in Fig. 1. The main key functions to achieve the goals and to maximize the performance of cognitive city are (ITU-T Focus Group, 2014):

- **Information Sharing and Knowledge Updation:** Even though, the conventional cities are well equipped to tackle emergency situations like natural disaster. However, the lack of information sharing outgrows the problem. It is anticipated that with immediate and accurate information
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