Chapter 52
Applications of Big Data and Green IoT-Enabling Technologies for Smart Cities

Onur Dogan
https://orcid.org/0000-0003-3543-4012
Istanbul Technical University, Turkey

Omer Faruk Gurcan
Istanbul Technical University, Turkey

ABSTRACT

In recent years, enormous amounts of digital data have been generated. In parallel, data collection, storage, and analysis technologies have developed. Recently, there has been an increasing trend of people moving towards urban areas. By 2030 more than 60% of the world's population will live in an urban environment. Urban areas are big data resource because they include millions of citizens, technological devices, and vehicles which generate data continuously. Besides, rapid urbanization brings many challenges, such as environmental pollution, traffic congestion, health problems, energy management, etc. Some policies for countries are required to cope with urbanization problems. One of these policies is to build smart cities. Smart cities integrate information and communication technology and various physical devices connected to the network (the internet of things or IoT) to both improve the quality of government services and citizen welfare. This chapter presents a literature review of big data, smart cities, IoT, green-IoT concepts, using technology and methods, and applications worldwide.

INTRODUCTION

Data increases at exponential growth rate year after year. Advances in several technologies such as communications, sensors and mobile devices have enabled data collection (Yakoob et al., 2016). In the 2012 World Economic Forum, it is reported that big data has become an economic resource, which has a significance to gold and currency (Alharthi et al., 2017). Jeanne Ross from MIT (cited in Akoka et al.,

DOI: 10.4018/978-1-6684-3662-2.ch052

2017) suggests the SMACIT factors (Social media, Mobile systems, Analytics, Cloud and Internet of Things) that have critical parts of digital transformation. This classification has the goal of focusing on the link of SMACIT and Big Data (Akoka et al., 2017). With advances in IoT technology, interconnection of different networked embedded tools, such as sensors, cameras and home appliances associated with Internet (Jaradat et al., 2015; Zanella et al., 2014). Internet of Things (IoT) provides new services and facilitates human life considerably in different areas of life such as healthcare, transportation and emergency (Zanella et al., 2014; Rathore et al., 2016).

More than 53.86% of the population in the world was living in cities as of 2015. On the other hand, Turkey has an urban population of 73.40%. Cities go on to grow and a prediction declares that 70% of the people will live in urban areas by 2050 (URL 11). The growth increases management and complexity problems for authorities in many areas such as waste management, supply of energy, traffic management, healthcare environment, education and safety. With the increasing population, tremendous devices contact with each other. Significant increase in device variety, volume of data and sensor technologies have offered opportunities to build smart cities for countries (Rathore et al., 2016; Holler et al., 2014; Joshi et al., 2016; Souza et al., 2016). According to Doran et al. (2013) sensors are useful to determine what is happening, on the other hand, they are not successful to occur information about why and how. Cities have been equipped with many strategies to become smart and easy-to-manage.

The Smart City was a concept firstly introduced in the "Strategic Energy Technology Plan" (URL 12). In the plan smart city is defined as "…a city that makes a conscious effort to innovatively employ information and communication technologies (ICT) to support a more inclusive, diverse and sustainable urban environment…" (Rosati & Conti, 2016). According to Pike Research on Smart Cities, the smart city market is estimated at hundreds of billion dollars by 2020 (URL 13). The basic goal of the smart cities is solving common public problems for people (Consoli et al., 2017). Urban big data is a significant resource for smart city development projects. It is a huge amount of data collected from the subjects and objects including people, companies and other urban facilities (Pan et al., 2016). Smart city applications can be made on transportation systems, education, healthcare, energy management etc. with private companies and urban administration cooperation. Smart city applications offer both improved delivery of services to citizens and reduced environmental impact (Holler et al., 2014).

SMART CITY

Urban area has higher population than the rural area in the worldwide since 2008 and it is predicted that increase in population will not only go on but also be strengthened (United Nations, 2012). The fact means that there will be many difficulties for economies in cities with respect to efficiently use of resources and sustainability in the near future (Angelidou, 2015). High ratio of urbanization brings some problems related to health, traffic management, education, energy management, pollution and waste management. Table 1 presents implementation areas related to mentioned problems. These problems require to develop new strategies about the environment design. The digital developments have made easy cities and policy makers to recognize the relationship between technology benefits and urbanization. As a response, various conceptualizations have been introduced such as digital cities, wired cities, cyber cities, real-time city, techno cities, WIKI cities and networked cities. Although there are variety of city descriptions, the smart city concept has become most recognized among practitioners and urban researchers (Steenbruggen et al., 2015).