Chapter 6

Leveraging Internet of Things to Revolutionize Waste Management

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ABSTRACT

A continuously growing population and their migration to urban centers consequently leads to waste expansion. The rapidly increasing quantities of waste generated in the cities affect way of human life, environment and planet. Hence, the necessity for smarter, safer, and greener places have never been more urgent. The novel technologies, Internet of Things (IoT) particularly, holds the potential to better manage waste and recycling. The IoT-driven waste management systems positively influence achieving the vision of smart green cities. This article analyzes the role of smart and safe IoT-powered waste management system, highlights its benefits, and possibilities of implementation and evaluation. It is expected that the IoT-based waste management system will deal successfully with an increasing amount of diverse types of waste and through the realization of a smart green city vision will resolve numerous problems related to human health and environmental contamination.

INTRODUCTION

The worldwide human population continuously grows and according to numerous estimates, it will reach 9 billion people by 2050, with 70% of the population living in cities (OECD, 2012). As more people means more waste, the urban residential areas will generate large amounts of diverse types of waste than other areas of residency. In

other words, with a rising number of people the expansion of waste and its harmful effects on human health and environment have never been more noticeable. It is anticipated that the entire mass of waste generated globally will rise by about 50% over the following few years and that it will hit 2.3 billion tons by the end of 2025 (Future Market Insight, 2017; Martin, 2014). Hoornweg et al. (2013) estimate that by 2100 the growing global urban population will be producing three times as much waste as it does today (exceed 11 million tonnes per day). OECD (The Organization for Economic Co-operation and Development) countries are responsible for almost half of the world's waste, while Africa and South Asia regions produce the least waste (Hoornweg & Bhada-Tata, 2012). Irrespective of the waste type (organic, papers, plastic, glass, metal, e-waste, mixed) and their source (e.g., residential and commercial buildings, industry, hospitals, transport, etc.), waste represent a serious problem of modern society. The smart management of waste is something that must be successfully realized in order to create smart, green and sustainable city. Hence, the realization of smart, safe, green and sustainable urban center demands accomplishing one of the most unglamorous but essential tasks – the collection, transportation, disposal or recycling, and monitoring of waste (Maksimovic, 2017a). The proper waste management should reduce the waste production, ensure waste disposal properly, recycle and reuse disposed products and therefore protect the environment, improve people's safety and increase efficiency. European Commission in its Waste Framework Directive 2008/98/EC defines a goal to be achieved by the end of this decade - 50% of waste produced by households and similar origins must be prepared for reuse and recycling. The ongoing efforts toward waste prevention, waste treatment and other waste management tasks are proofs that the society is becoming aware of the problem and that the efficient managing of materials produced through diverse peoples' activities is essential to avoid their harmful effects over human health and the environment (Waste Management Resources, 2009). In the traditional approaches, there is no information about the waste bins status and collection routes are pre-scheduled. This means that waste collection is blind and not optimized as it uses static routes – the collection route includes collecting waste from bins that are overflowing with garbage, but at the same time includes the bins that are less than half-full. On this way there are many unnecessary operational and environmental costs, what makes these traditional approaches not efficient. On the other side, the recent intensive technology advancements, the establishment of Internet of Things (IoT) concept particularly, contribute to smarter, faster and more efficient management of waste. The IoT-powered waste management system poses information regarding waste bins status and according to them create optimized collection routes what significantly reduce costs and improve citizens' satisfaction. Some positive examples how smart city technology utilization can help in dealing with increasing volume of waste are (Novoseltseva, 2017):

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