

Chapter 7

A Smart Recyclable Waste Collection System Based on IoT and an Application

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ABSTRACT

Waste management is the method developed to eliminate the negative effects of waste to the environment and human health. The study focuses on the subject vehicle routing. The purpose of this study is to minimize the distance of route for the vehicles which pick up recyclable items collected in containers. For this purpose, a decision support system is proposed based on the internet of things. This is to ensure that the vehicles are routed to filled containers only thanks to the data obtained from sensors. In the chapter, a municipality's recyclable waste container location information was collected and resolved. As a result of the study, the route costs developed by IoT application and the costs incurred in conventional locating results were compared. Finally, the issues that can be improved in relation to the problem have been evaluated.

INTRODUCTION

In recent years, technology has developed rapidly. Objects and concepts such as sensors, connectivity, autonomous system, and connectedness have become a part of our daily life. The smart connected objects are products with traditionally different

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functionality and technological infrastructure. Smart connected products can be expressed as structures consisting of physical and smart systems. Smart systems consist of three main parts. Physical components are mechanical and electrical components, smart components are sensors, microprocessors, data storage, controls, software, integrated operating system and digital user interface and connectivity components are antennas, protocols, and so on (Porter & Heppelman, 2014). It is possible to use smart connected products, which it is defined as basic, for monitoring, control, optimization and autonomous in all areas. The monitoring, control, optimization and autonomy skills can be achieved according to the order given. For example, monitoring, control and optimization for autonomy must be provided (Porter & Heppelman, 2014). The monitoring refers to observe external environment of products through sensors and external data sources. Monitoring allows following operations, conditions, performance of products. This ability provides notice about the changing environment conditions. Control can be called a control algorithm for the product. The object controls its surroundings, properties. Optimization means trying to optimize itself by processing the observed data. Thanks to the available data, the system learns and checks the situation with the help of monitoring and tries to optimize. Autonomy is the ability to act in accordance with its own judgment by bringing together the capabilities of monitoring, control and optimization. So far, basic information about smart objects has been presented briefly. The increase of smart objects and the desire to communicate with each other reveal the concept of 'Internet of Things (IoT)'. The concept of IoT, which have become a widespread interest and a field of study has increased in recent years. It takes place as a revolution in many sources. It appeared as a radio frequency-based system by Kevin Ashton in 1999. IoT can be defined as a communication protocol within a network of identifiable objects.

Although the internet technology of objects is based on many years ago, its name has been in our daily life for many years. There are different applications in fields such as production monitoring, smart cities, agriculture, environmental control, smart building systems, security, supply chain management. It will be useful to show some applications related to the applications made here.

- Thanks to the objects developed for the patient in the field of health, the patient's breathing, position, heart rate, amount of oxygen in his / her blood can be measured in real time and transferred to the computer.
- Built-in smart thermostats allow the user to observe the temperature of the air without going home and adjust the temperature remotely via the system.
- Information about the product, its needs, and the stage in which it is in the supply chain, covering all the rings of the chain, can be reached.

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