


Chapter 14


Case Study 1: Applications of AI and IoT- Based Smart Cities

G. Muthupandi

 <http://orcid.org/0009-0002-8822-0157>

Chennai Institute of Technology, India

K. Jayakumar

 <http://orcid.org/0009-0000-2849-5445>

Chennai Institute of Technology, India

G. Karthiyayini

Mangayarkarasi College of Engineering, India

ABSTRACT

Artificial Intelligence (AI) and the Internet of Things (IoT) are significantly changing the nature of cities due to the integration of technologies; this has created new life in cities turning them into smart, interconnected ecosystems. With increasing urban population size and the sustainability of living being a question under spotlight, AI and IoT technologies play a critical role in solving problems of traffic congestion, energy efficiency, waste management, safety, health, and the management of water. This chapter addresses the history of smart cities describing the potential of AI and Internet of Things to collect data in real time, make predictions and execute decisions to achieve greater efficiency and livability of urban environments. It presents real-life case studies, along with actual outcomes and achievements presented in the cities of Singapore, Barcelona, and Amsterdam, which demonstrate such concrete values as preserving carbon & better-developed public services. Future trends and the role of 5G, edge computing and blockchain curves are also explored in the chapter.

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1. INTRODUCTION

1.1 The Urban Challenge and the Rise of Smart Cities

Urbanization is reshaping the world that we are today living in; where predominant centers of human activities in the 21st century are the urban centers. United Nations (2018) predicts that the current world population residing in residential cities of the world is over 55 percent of the total world population which is approximately 4.2 billion and it is increasing at a high rate and is projected to reach 68 percent by 2050, or 2.5 billion additional residents, most of whom are occupying Africa and Asia. The high rates of urban development lead to an increment in the urbanization disadvantages such as the high traffic, environmental pollution, lack of resources and over-crowded public facilities. Among others, owing to congested traffic in cities, economies lose billions of dollars per annum, which, in the case of United States, resulted in productivity and fuel costs worth 81 billion dollars in 2022 alone.

The environmental issue is rather acute, as well, which is why, according to the World Health Organization (2023), 4.2 million individuals succumb to premature death annually because of the air pollution in the city. Lack of resources available in urban areas such as scarcity of water in Cape Town and the lack of supply of energy in the growing mega cities also compromises urban sustainability. The idea of smart cities has materialized as the remedial answer to these problems. Smart cities adapt urban systems with digital technologies to support quality of life, optimize its systems and sustain the environment. Smart cities operate on a dynamic level to regulate infrastructure and services through interconnected devices, data analytics, and automation differently than in traditional cities.

1.2 The Role of AI and IoT in Urban Transformation

Out of all technologies, the cornerstones of the smart city ecosystem are AI and IoT, which allow moving toward a proactive management of urban environment. The Internet of Things is a system of interconnected things connected devices, sensors, cameras, smart meters, and connected infrastructure and collect real-time data on the movement across the urban systems. As an example, traffic cameras connected to the internet keep track of car traffic, smart meters monitor the amount of energy used in the house, and environmental sensors can count air pollution and noise.

AI boosts IoT by analyzing this information into patterns, trend predictions, and even automated decision-making. The raw data can be leveraged using machine learning, computer vision, and predictive analytics to turn the data into actual viable insights using AI. With regard to transportation, AI is used to analyze IoT in order to set optimal times that the traffic signals should change, alleviating traffic up to

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