Chapter 11
The Convergence of Artificial Intelligence and the Internet of Things for Next-Generation Smart Systems

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ABSTRACT

The convergence of Artificial Intelligence and the Internet of Things has paved the way for the development of smart environments that are efficient, adaptive and

DOI: 10.4018/979-8-3373-4455-3.ch011

sustainable. While IoT enables vast networks of interconnected sensors, device and actuators to capture real-time data, AI provides the intelligence needed to process, analyze and act upon this information. Together, they transform reactive systems into proactive, context-aware ecosystems capable of decision-making and automation. This chapter presents a comprehensive framework for integrating AI with IoT, highlighting its architecture, component and applicability across domains such as smart cities, healthcare, agriculture, transportation and industrial automation. The framework emphasizes enabling technologies including edge, fog, and cloud computing, communication protocols and open platforms like FIWARE, which collectively support scalability, interoperability and real-time analytics.

INTRODUCTION

The technological progress of Internet of Things (IoT) and Artificial Intelligence (AI) has created a total revolution in contemporary technological advancement. The first IoT idea required linking physical devices to internet protocols which allowed them to transfer and receive information. The first applications operated at a basic level to track and control operations. The growth of IoT networks brought forth three main technological solutions which included smart homes and connected health systems and industrial automation systems. AI experienced a transformation from basic rule-based systems and expert programs into complex machine learning and deep learning models which recognized patterns and made predictions and autonomous decisions. AI provided the intelligence to process real-time data that IoT delivered in vast quantities. AI and IoT joined forces to establish modern adaptable systems which will remain relevant in the future. These technologies enable both connected systems and environments which adapt while learning from their operations. The integration between AI and IoT enables cities to operate efficiently and produces wearable devices that track health data instantly thus reshaping modern living. AI-powered IoT stands at the innovation forefront to lead the world toward a more intelligent and sustainable future.

The Internet of Things and Machine learning have fundamentally altered our interactions with the environment and data utilization. The Internet of Things (IoT) is a network including interconnected devices, sensors, and actuators that gather data. Artificial intelligence (AI) refers to a collection of advancement that allows machines to replicate the abilities of humans. Technologies such as computer vision and machine learning, natural language processing exemplify this category. Nonetheless, the endeavor of deriving substantive insights from this enormous volume of data is far more arduous (Nagaraj, 2023). Help from AI in such a scenario with AI algorithms and techniques, which are derived from the data generated by Internet