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Merging Artificial Intelligence With the Internet of Things

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Chapter 11

AIoT in Environmental Sustainability

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ABSTRACT

To address the majority of environmental sustainability issues, like transportation, energy, water management, and biodiversity, artificial intelligence (AI) has grown in importance. The primary focus areas in energy are area neural networks, expert systems, fuzzy logic models, and pattern recognition. This chapter assesses how the use of AI could improve the environment by reducing the effects of agriculture, climate change, water resources, weather forecasting, ocean health, and disaster resilience. The impact of AI on the environment and its sustainable applications are examined in this chapter using qualitative analysis. With an emphasis on AI's role in advancing environmental sustainability, the chapter's main goal is to identify applications of AI for environmentally friendly practices. It can help stakeholders understand international initiatives to improve environmental sustainability by utilizing AI.

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INTRODUCTION

Due to the global environmental issues of the 21st century, artificial intelligence (AI) has emerged as a crucial field of study essential to addressing many of the current environmental sustainability challenges (Prank, 2021). John McCarthy first defined AI in 1956 as the science and engineering of building intelligent machines. Essentially, AI is a branch of computer science that leverages prior knowledge to solve environmental problems more effectively. Artificial intelligence (AI) has therefore addressed the many limitations of human thought in the current digital era, opening a new field where intelligent machines with artificial brains are designed to coexist with human brains (Jha et al., 2019). Our knowledge of and capacity to manage the ecosystem could be significantly enhanced by the application of AI in environmental sustainability. While machine learning algorithms can be used in water science to forecast discharge and water levels and improve quality, AI-enabled technologies, such as drones and motion-sensing cameras, can be used to gather and analyze huge amounts of biodiversity data. Furthermore, the integration of machine learning, blockchain technology, and the Internet of Things can enhance urban water management. By anticipating and lessening the effects of natural disasters like earthquakes, hurricanes, and floods, AI can also be utilized to decrease the risk of disasters. AI can also lessen the environmental impact and increase the agricultural sector's resource efficiency. As AI applications continue to advance, it is crucial to think carefully about the moral ramifications of applying AI to environmental sustainability and make sure the technology is applied responsibly and openly. Although there are many different aspects to environmental sustainability, many common environmental issues can be readily resolved by igniting public interest, thanks to the development of artificial intelligence (AI). Sustainable agriculture, environmental asset conservation, pollution and waste management, pollution treatment, and monitoring are the four (4) primary areas into which the domains of artificial intelligence (AI) and environmental sustainability can be broadly separated (Nishant et al., 2020; Callicot & Mumford, 1998). Importantly, most of the current regional and global environmental troubles are addressed by AI in areas like water, transportation, energy, and biodiversity, though many of these areas have influenced every category and are always evolving. AI has been used in real-world applications in transportation and biodiversity in numerous developed countries. For example, preventing pollution in the ocean, conserving wildlife to boost biodiversity, and employing AI-powered autonomous garbage collection trucks to pick up electronic waste. In current times, artificial intelligence (AI) has gained a lot of attention. Advances in other cutting-edge technologies, like virtual reality, big data, the Internet of Things (IoT), and cloud computing, have made important progress in AI possible. AI has the potential to transform environmental sustainability in

addition to its economic and social advantages. Given the volume and complexity of interactions that occur within an ecosystem, scientists argue that understanding how the ecosystem works is one of the main barriers to environmental sustainability. The human mind or traditional statistical methods can't analyze the vast amount of data that is available. To manage these complexities and make prompt decisions in uncertain and volatile situations, AI can assist in the analysis and creation of models from the huge amounts of data that sensors can gather.

Sustainable AI refers to artificial intelligence (AI) systems that follow moral business practices. There are practical solutions, even though many of the AI systems in use today are harmful to the environment. Experienced AI model developers and users are aware that training AI models is a time-consuming and energy-intensive process that inevitably produces emissions and air pollution (Nishant et al., 2020). AI models need to be made more effective to use less energy when being trained. An AI system's power consumption should be minimized by optimizing each component. By doing this, companies can create new approaches to AI modeling and optimization that lessen the negative environmental effects of their AI systems. A key component of sustainable AI is minimizing the detrimental effects of AI on the environment while simultaneously emphasizing the application of AI and machine learning as instruments to promote sustainable development across a range of sectors (Table 1). This entails using AI and ML to help businesses operate sustainably so that the achievements of the present do not endanger the future. In addition to reducing the adverse environmental effects of AI, sustainable AI highlights machine learning as an instrument to promote sustainable development across a variety of industries. To ensure that the accomplishments of today do not jeopardize the future, we must leverage AI and ML to assist organizations in operating sustainably. The foundation of sustainable AI is two key ideas. Above all, we must ensure that AI is environmentally friendly and sustainable. The second is using AI as a tool to promote sustainable development and decrease the harmful environmental effects of various industries. By focusing on both aspects of sustainable AI, we can cover the mode for a future that is more ecologically conscious and sustainable (Tariq, 2025).

Table 1. Generative AI market growth and adaptation trends

Consumer data	Timeline	Growth rate
Businesses using generative AI for synthetic customer data	2023vs 2026	Less than 5% to 75%
Industry/function specific/gene AI model	2023vs 2027	Approximately 1% to over 50%
Energy-conserving gene AI implementations	By 2028	30%