

Integrating Artificial Intelligence and the Internet of Things in the Design of Responsive Smart Residential Environments

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Abstract:

Amid rapid digital transformation, interior design is undergoing a significant paradigm shift, driven by the rising influence of Artificial Intelligence (AI) and the Internet of Things (IoT) in shaping contemporary residential environments. Homes are no longer perceived as static spaces; rather, they are evolving into intelligent systems that interact with users' needs and adapt to their behaviors through real-time data analysis provided by smart sensors and digital assistants. These technologies now play a crucial role in regulating lighting, temperature, air quality, and even personalizing furniture layouts in alignment with diverse lifestyle patterns. Smart design is thus moving beyond conventional notions of visual or aesthetic comfort to incorporate interactivity, functional performance, and environmental awareness into the core structure of the design.

With growing global interest in enhancing quality of life and optimizing energy efficiency, there is an increasing need to explore the integration of AI and IoT in creating smart residential environments capable of anticipating and responding flexibly to user needs. Vision 2030 initiatives in countries like Saudi Arabia and Egypt explicitly promote the adoption of such technologies as part of broader strategies for digital transformation and sustainable urban development, underscoring the urgency of research in this area.

This study aims to analyze the dynamics of AI-IoT integration in the residential context, evaluating its impact on environmental performance, user comfort, and sustainable design outcomes. It also addresses the practical challenges associated with implementing these technologies in real-world settings.

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