Chapter 1
Ambient Intelligence: A Comprehensive Review and Insights Into Sensing Technologies

Michael Onyema Edeh
https://orcid.org/0000-0002-4067-3256
Coal City University, Nigeria & Saveetha School of Engineering, SIMATS, Chennai, India

Ramesh G.
Alva's Institute of Engineering and Technology, India

Karan Kumar
Alva's Institute of Engineering and Technology, India

Satyam Pawale
Alva's Institute of Engineering and Technology, India

Abdullah A.
Alva's Institute of Engineering and Technology, India

Shreyas J.
Manipal Institute of Technology Bengaluru/Manipal Academy of Higher Education, Manipal, India

ABSTRACT

This chapter examines the use of ambient intelligence (AmI) technologies to enhance autonomy and quality of life for those with cognitive decline, focusing on advancements in sensors. It proposes a framework to identify gaps and draws insights from applications such as ambient assistive living (AAL), human action recognition, and the industrial internet of things (IIoT). The study highlights technology's role in understanding occupant behavior, supporting services, and maintaining autonomy, addressing decentralized systems, blockchain, adaptive computing, and ethical concerns. The research stresses the need for further studies to ensure safe and effective sensor technology in real-world applications, emphasizing sensors' role in linking computational power with real-world scenarios.

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INTRODUCTION

Ambient Intelligence (AmI) is a technological breakthrough that uses intelligent technologies to communicate effortlessly with the environment, thus enhancing every aspect of the human experience. The discussion below searches into the vast terrain of ambient intelligence, stressing the incredible developments gained in sensing technologies in an era characterized by rapid improvements in sensing gadgets. Traditional methods of care create significant financial and emotional pressures on caregivers and healthcare professionals while they deal with the challenges posed by cognitive decline. To solve this, Ambient Assistive Living (AAL) technologies with cutting-edge components such as the Internet of Things (IoT) and Artificial Intelligence (AI) have evolved (Jain et al., 2023). These technologies offer not just to complement standard caring but also to enable intelligent learning inside the surrounding area. The assessment goes beyond healthcare, delving into areas as diverse as tourism, industrial operations, and human activity recognition. Sensing technology advancements are critical in a variety of applications, ranging from Multi-Criteria Recommender Systems in tourism destinations to ambient intelligence-assisted computing in Industrial IoT and the use of Bi-Convolutional Recurrent Neural Networks for human action recognition.

However, challenges and research gaps continue in this fast-growing subject, requiring careful evaluations of contributions from other fields. Usability, acceptability, ethical problems, and the necessity for human-in-the-loop interventions are underlined as key themes. A recommended conceptual framework describes future research alternatives in this area, to maximize the potential of sensing technologies in ambient intelligence systems. The review aims to provide valuable insights into the current state-of-the-art in Ambient Intelligence, envisioning a future where intelligent systems seamlessly coexist with human environments, enriching lives and fostering autonomy.

Shifting attention to serious games, a distinct genre that combines interactive technology with education, simulation, and training, has spurred R&D efforts. Recognizing the potential of serious games, international organizations use them as highly effective teaching and training supports in an array of fields. Shifting attention to serious games, a distinct genre that combines interactive technology with education, simulation, and training, has spurred R&D efforts. Recognizing the potential of serious games, international organizations use them as highly effective teaching and training supports in an array of fields. Ambient intelligence (AmI) is the system that makes judgments on the spot and regulates the actions of its environment by interacting with several actuators, sensors, and intelligent gadgets shown in Figure 1 (Teixeira et al., 2019) simplifies the overall structure of the transmission process by providing an overview of AmI Pub/Sub (messaging communication systems).