Chapter 10
Application of Augmented Reality in Manufacturing

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ABSTRACT

AR is a distinctive interface between humans and machines that overlays virtual information generated by computers onto a practical application environment. In the past few years, it has been discovered that AR has the potential to be used in various fields, such as military training, maintenance, assembly, product design, and other production processes. AR is now playing a key role in overcoming the problems of integrating technology to speed up Industry 4.0. It enables workers to convert from mass production to mass customization. AR technology is gaining popularity because of the ease with which it can be implemented in the production and wide accessibility of hardware devices, including smartphones and tablets, that are capable of supporting it. This chapter provides a comprehensive evaluation of the latest AR applications and advancements in the manufacturing industry. Efforts are also made to understand the major challenges in AR applications and the scope for overcoming them in the future.

1. INTRODUCTION

Augmented reality (AR) is a revolutionary technology that has the potential to revolutionise the manufacturing industry (Arena et al., 2022). Through the process of superimposing digital data onto the actual environment, AR enhances the way manufacturers design, assemble, operate, and maintain their products and processes. The incorporation of virtual aspects into the physical world opens up new possibilities for improving productivity, worker safety, decision-making, and overall operational efficiency in manufacturing. The manufacturing industry is constantly seeking innovative ways to enhance efficiency, reduce costs, and improve quality. Traditional manufacturing processes often involve complex machinery, intricate assembly procedures, and intricate maintenance tasks. AR addresses these issues by delivering

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real-time, interactive, and contextually pertinent information to employees, empowering them to carry out tasks with improved precision, efficiency, and safety. Consequently, research in AR technologies is experiencing a surge in interest. As illustrated in Figures 1 and 2, we can observe the evolution of AR and VR technology research from 2000 to 2023 in terms of research publications. Figure 1(a, b) displays the quantity of publications and presents the data on the types of documents spanning the years 2000 to 2023, revealing a notable exponential growth in the number of publications, particularly in the past decade. Meanwhile, Figure 2(c, d) presents data on the research areas, and the countries which are leading in the AR research.

Despite the more pronounced advancements in AR over the past two decades, it's important to recognize that the development and application of AR technologies have a longer history than is commonly acknowledged (Eswaran & Bahubalendruni, 2022). Morton Heiling developed the Sensorama Simulator in the late 1950s, offering 3D stereo images with sensory enhancements like vibrations, wind, and scents (Schmalstieg & Höllerer, 2017).

Figure 1. (a) The quantity of publications and (b) the types of documents from 2000 to 2023
Source: Scopus (2023)