Chapter 1
Human–Machine Interaction in the Metaverse:
A Comprehensive Review and Proposed Framework

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ABSTRACT

The rise of the metaverse, a virtual shared space where users interact collectively, has generated significant interest in examining the dynamics of human-machine interaction within this digital environment. This study presents an extensive overview of current research on human-machine interaction (HMI) in the metaverse, encompassing a variety of technologies, methodologies, and consequences. By drawing upon a diverse array of academic references, this study delves into the fundamental

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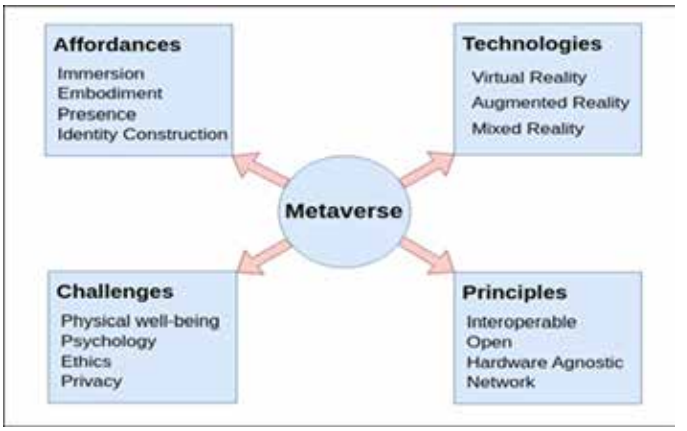
aspects of HMI in the metaverse, such as gesture and motion tracking, voice recognition, virtual and augmented reality interfaces, haptic feedback, brain-computer interfaces, avatars, personalization, and collaborative engagement. Furthermore, this study addresses the obstacles and possibilities linked to HMI in the metaverse and provides a framework for swift integration of HMI in the metaverse.

INTRODUCTION

In the past few years, the idea of the metaverse has evolved from a mere concept in science fiction to a concrete virtual reality. This evolution has been driven by rapid technological advancements, opening the potential for a virtual shared space where users can engage with digital environments, objects, and other users in real-time. Central to this new digital landscape is the intricate dynamic between humans and machines, influencing how we experience, explore, and engage with virtual worlds. Recognizing and comprehending this intricate relationship is crucial for harnessing the complete capabilities of the metaverse and crafting immersive, interactive, and significant experiences for users globally. Metaverse is not a new concept, Figure 1 has presented its dimensions.

Figure 1. Dimensions of metaverse



Mystakidis (2022)

Affordance theory, advanced technologies, and robust design principles are fundamental to the metaverse's development. Affordance ensures intuitive and natural user interactions with virtual environments. Key technologies like Virtual Reality, Augmented Reality and high-speed connectivity enable immersive, secure, and