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METAVERSE-DRIVEN VIRTUAL REALITY SIMULATIONS FOR ENABLING MICROGRAVITY RESEARCH FOR STUDENTS

Abstract

Accessing microgravity conditions aboard the International Space Station (ISS) is a perennial challenge impeding the practical learning and experimentation opportunities for students. Despite the increasing availability of space education via the internet, the prohibitive logistical constraints and extreme environmental factors continue to limit direct access to the ISS and its crucial experimental settings. This paper introduces a pioneering technological solution harnessing Virtual Reality (VR) and Metaverse technologies to meticulously replicate the ISS environment, thereby offering an unprecedented platform for simulating diverse experiments conducted in microgravity. Our proposed platform is designed as an intricately detailed replica of the ISS infrastructure, enabling the emulation of a spectrum of ISS experiments such as Fluid Flow in microgravity, Space Agriculture, and Manufacturing. The integration of VR and Metaverse technologies plays a pivotal role in rendering an immersive, high-fidelity simulated environment that mirrors the conditions within the ISS. This innovative platform serves as an accessible, controlled, and practical learning space, democratizing access to the otherwise restricted realm of space experimentation. Through this simulated environment, students gain unparalleled access to conduct experiments, interact with simulated microgravity environments, and acquire insights previously limited to space-bound endeavors. The significance of this platform lies in its capacity to democratize space education and research, offering a transformative educational experience by providing accurate data and simulations for experiments performed on the ISS. By bridging the gap between theory and practical application, this platform fosters a deeper understanding of microgravity-related phenomena and encourages novel innovations in various scientific domains. In essence, this VR and Metaverse-based platform represent a groundbreaking leap toward enabling comprehensive, hands-on space education and experimentation, transcending the constraints of physical access to microgravity environments. It serves as a gateway for primary and secondary students to engage in complex experiments, thereby empowering the next generation of space scientists and innovators.