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A Comprehensive Review on Augmented and Virtual Reality Technologies in Forensic Science: Technology Overview, Applications, and Challenges

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Abstract

Forensic science plays a crucial role in the criminal justice system by analyzing evidence collected from a crime scene. Accurate evidence forms the foundation for a fair legal system. Most on-site records in traditional crime scene investigations rely on photographs and manual sketches, which can overwhelm the jury in a court setting. In need of a more objective, precise, and comprehensive solution for crime scene documentation, 3D reconstruction of crime scenes for various purposes such as learning and teaching, courtroom representation, evidence annotations, and visualization has been trending in forensic science. Integrated 3D scanning platforms could be used to obtain evidence from the crime scene and these data can be visualized in 3D with VR headsets which allow respective personals to move through the crime scene and explore different perspectives. This data can also be preserved and transmitted easily when needed. This study reviews the technology used, applications of Virtual Reality and Augmented Reality in forensic science, and the challenges they face in using it. Key challenges such as medical conditions, cost, data security, and data accuracy are discussed and future research development areas such as scalability and storage management of crime scene multimedia data, implementing low-cost high precision solutions, use of blockchain-based techniques for secure file sharing and adoption of immersive technology has been suggested. Important reliable academic database sources were investigated as potential data sources, including Scopus and Google Scholar, which index publications and conferences supported by organizations like IEEE, ACM, Elsevier, and SpringerLink.

Keywords: *Virtual environments, Crime scene, 3D scanning, 3D reconstruction, Immersive technology*