Immersive Learning Experience for Physical Exercises in Virtual Reality

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COVID-19 has restricted access to in-person healthcare services. Among those affected are patients requiring physical therapy. This project involved the creation of an immersive physical therapy experience in virtual reality (VR) using 3D image reconstruction methods. The reconstruction of the static background required photogrammetry software in order to capture multiple camera perspectives and to build spatial point clouds. A depth sensor was used to track and record the skeletal transformations as the exercises were performed. Using a skeletal animation (rigging) process, the joint movements were applied to a static human model of the therapist. This animated model was then combined with the static background to create an immersive experience. Using an Oculus Quest headset, the patient is able to visualize the exercises from different perspectives. Within the VR experience, 3D spatial annotations that describe proper techniques for each exercise are also displayed, thus preventing chances of injury. The patient interacts with an interface that allows controls such as play, pause, slow down, speed up, and move to a different exercise. In the future, this project could be advanced to a VR experience in which the patient and therapist may interact in real-time. In this model, the patients' exercise movements would be compared to the therapists' movement, and a mathematically calculated score would be generated to measure the accuracy of the patient's form.