Augmented and virtual reality applications for approachable anatomy education

Patrik Samuel Ondreička, Lucia Sochorová, Tomáš Socha
University of Žilina
Faculty of Management and Informatics
Univerzitná 8215/1, 010 26 Žilina
ondreicka4@stud.uniza.sk, sochorova2@stud.uniza.sk, socha2@stud.uniza.sk

Abstract. *Since the rise in popularity and accessibility of both virtual reality (VR) and augmented reality (AR) technologies, they have been widely utilized in training and education across various fields. These technologies enable the creation of immersive tools that, alongside traditional approaches like textbooks and educational software, make learning more effective and engaging for both students and the general public. To demonstrate the capabilities of these approaches, we propose two computer applications - one for each technology. The virtual reality application, developed in Unreal Engine 5, allows users to interact with a 3D model of the human body. The model used in the application includes over 900 separate body parts. As part of the project, a pipeline backed by large language models (LLMs) was used to generate summaries for each body part, sourced from openly available references. These summaries provide descriptions for each body part within the application. Meanwhile, to illustrate the potential of augmented reality, an application utilizing Google MediaPipe and Unity was made. The application addresses practical challenges related to processing the output of the machine learning model, transforming detected hand landmarks into the 3D scene, and calculating anatomically meaningful bone rotations, including bone reconstruction in cases where anchoring points were missing. These steps had to account for camera image transformations to keep the virtual bones aligned with the user's hand. Together, both applications showcase how VR and AR technologies can be used to create interactive anatomy learning tools that combine detailed 3D visualization with real-time user interaction.*

Keywords. Virtual Reality, Augmented Reality, Anatomy Learning, Unity, Unreal Engine, MediaPipe

Acknowledgments

We would like to thank doc. Ing. Miroslav Kvaššay, PhD. for supervising the work. We would also like to acknowledge Ing. Maroš Gorný, whose diploma thesis provided a foundation for the development and further adaptation of the augmented reality application.

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