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Engineering Education with Mixed Reality (MR)

Nowadays, virtual reality (VR) is widely used in different applications such as healthcare, fashion, sports, education, commercial and entertainment, etc. Education and training is one of the leading area which is expected to grow to US\$2.2 billion in revenue by 2023. For the education and training in various disciplines, VR gives an opportunity to connect with learners and teachers in a novel and meaningful way. VR enables experiential learning by simulating virtual environments. It not only increases students' levels of engagement. Hands-on VR learning approaches can also contribute to increase cognitive and memory abilities. It is suggested that games, simulations, and virtual worlds in VR were effective in improving learning outcome gains of the students in higher education.

Mixed Reality (MR) is the most reason reality teahnology which emcompassing both virtual reality (VR) and augmented reality (AR). MR further enhances the effects of VR technology in teaching and education. It not only allows digital model combined with real world, but also enable users to interact with the digital content dynamically in real time. MR allows interaction and feedback from the students which is particularly important for enhancing experience in teaching and learning. The benefits of incorporating MR technology into educational experiences include better engagement and the opportunity for students to experience and better remember what they have learned.

Despite various approaches have been developed to help students in understanding engineering subjects with the aids of VR, not much work has been conducted to investigate the effects of MR in teaching engineering subjects in tertiary education. Therefore in this project, an MR application is proposed and developed for the teaching and learning of Enigneering subject in tertiary education. The application is developed on the HoloLens system. A practicable application has been designed that allows students to visualize the geometry of 3D objects, as well as the exploded diagrams of selected components. The students can command the system through the command manual, or signal the system through gazing, gesturing and voice to implement instructions. We have organized two MR workshops for the teachers and students in the university to

collect their feedbacks and comments. The teachers and students are allowed to experience and develop their MR application in the workshops. It was found that the MR application can help students in understanding the learning outcome of the engineering subject in university, the workshops can also enhance the skills of teachers in teaching university subjects with the support of MR. The outcomes and recommendations for future work of the proposed MR application are discussed and explained.