KEYNOTE TALK
Tuesday, October 22, 2024 at 1:30 pm

Perceptual Focus Issues in Augmented Reality

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Abstract: In an Optical See-through (OST) Augmented Reality (AR) system, virtual information is conveyed via the optics of the AR head-mounted display (HMD) and can appear at varying distances from the user. Sometimes, it's necessary for users to combine information from these diverse distances by shifting both visual attention and focus. For example, imagine a surgeon using an OST AR display during surgery. To perform the surgery, the surgeon needs to look at a flat panel display to gather patient information that is far away while also viewing virtual information (e.g., information regarding the surgery guidance) that is optically closer. Thus, the surgeon needs to adjust both the eye's focus depth and visual attention to synthesize the information, which may lead to oversight of crucial data and unexpected mistakes. This challenge is relevant beyond surgery, encompassing other fields such as military operations, maintenance, and industry. The initial segment of the talk will cover two perceptual aspects of OST AR: (1) context switching—where users shift their visual and cognitive attention between real and virtual information and (2) focus distance switching—where users must accommodate (change the shape of the eye's lens) to see, in sharp focus, information at a new distance. Perceptual focus distance switching can occur in two forms: continuous and perpetual focus depth switching. To counteract the drawbacks of continuous focus depth switching, the talk will discuss a focus correction algorithm built on perceptual image processing principles, introducing a new font for AR systems. We termed this "*SharpView font*," which looks sharper than standard fonts when seen out-of-focus. Lastly, the talk will discuss the behavior of the human visual system with changes in perceptual depth in the real world and AR with eye tracking as a potential solution to the perpetual focus depth switching.

Speaker Bio-Sketch: Dr. Mohammed Safayet Arefin is an Assistant Professor in the Department of Computer Science at Colorado State University (CSU). Before joining CSU, Dr. Arefin was a Postdoctoral Fellow at the DEVCOM US Army Research Laboratory West (ARL West). Dr. Arefin achieved his Ph.D. and MS in Computer Science from Mississippi State University, USA. His research has been broad-based, centering on the topics of augmented reality, applied and visual perception, perceptual imaging, virtual reality, eye tracking, and human-computer interaction. Dr. Arefin won the 'Certificate of Commendation' from the SES Executive Deputy to the Commanding General of the US Army Futures Command and the 'Director's Commendation Award' in recognition of outstanding research achievement. For the seventh consecutive term, Dr. Arefin has served as a Publication Co-chair in the IEEE Virtual Reality (VR) and IEEE International Symposium on Mixed and Augmented Reality (ISMAR) conference committees. In addition, Dr. Arefin is co-founder and co-organizer of the Workshop on Replication in Extended Reality (WoRXR).