**Research Statement**

Over the past ten years, my research interests have focused on the use of Virtual Reality (VR), Augmented Reality (AR), Extended Reality (XR), and Human Computer Interaction (HCI) in different areas such as education, anatomy, and virtual assembly. I have proposed different (AR/VR/XR/HCI) techniques in these areas and assessed their effects on users' learning enchantment, task accuracy, performance, and usability. My research work is mainly focused on the design and implementation of various natural, touchless, low-cost, multitasking, and more usable interaction techniques for AR and VR with the aim of achieving high performance, accuracy, and usability.

**Previous Work**

I have published research in different national and international conferences and reputed journals. During my MPhil studies, I published articles on the use of AR marker-based for natural interaction with virtual assembly environments and assessed the user task performance and accuracy [1-2] . Similarly, other research has been published on the use of different audio/visual cues for users' assistance during the assembly operation [3].

During my PhD study, I published multiple articles related to the use of AR markers and hand gestures for realistic interaction with different augmented and virtual reality environments. I have designed a new AR marker (and enhanced ARToolKit marker) and implemented it as a multitask interaction tool for interaction with AR and VR environments [4]. The interaction is based on the use of multiple embedded markers in a specialized manner. The proposed marker, like an interaction peripheral, works just like a touch pad, which can perform any type of interaction in a 3D VE. The proposed marker is not only used for interaction with Augmented Reality (AR), but also with Mixed Reality. Furthermore, I proposed a set of lightweight and multitasking hand gesture-based interaction techniques for VR environments [5-7]. These techniques utilized single and two fingertip-based hand gestures for interaction with VR environments. Similarly, I proposed gestural aids for efficient navigation and assembly tasks in VEs [8]. It performs two functions: it guides users through the VE and instructs them on how to perform the required action (gesture).I have also proposed a VR-based interactive writing board for teaching Urdu/Arabic at primary level education [9–10]. The proposed writing board allows multi-modal information visualization and interaction with 3D models in a realistic and natural manner. Interaction with it is done using distinct AR markers, multilayered markers, and hand gestures. Besides these, I collaborated with colleagues on different research projects, such as real-time gait-based gender identification [11], navigation aids in collaborative VEs [12], use of Artoolkit Markers for Indoor Navigation and Guidance [13], Thumb Inclination-Based interaction in VEs [14], and AR marker-based interaction in VEs [15].

**Current Work**

Currently, I am writing a research paper on the design of a more sophisticated AR marker (by extending the previously multilayered multitask AR marker) by embedding more markers inside the innermost marker and using it as a universal interaction tool for interaction with complex environments. Similarly, I am also working on the use of some other audio/visual aids in different combinations and to assess their effects on task performance, accuracy, and attention grabbing.

**Future Work**

In the future, I plan to use deep learning and human gait for surveillance and security systems. The system will be used for the identity and classification of humans based on gender, age, and physical training. It can also be used in other areas such gaming, social interaction, etc.

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