

The Fourth Workshop on Multiple Input Modalities and Sensations for VR/AR Interactions (MIMSVAI)

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ABSTRACT

Rapid technological advancements are expanding the scope of virtual reality and augmented reality (VR/AR) applications; however, users must contend with a lack of sensory feedback and limitations on input modalities by which to interact with their environment. Gaining an intuitive understanding of any VR/AR application requires the complete immersion of users in the virtual environment, which can only be achieved through the adoption of realistic sensory feedback mechanisms. This workshop brings together researchers in UbiComp and VR/AR to investigate alternative input modalities and sensory feedback systems with the aim of developing coherent and engaging VR/AR experiences mirroring real-world interactions.

CCS CONCEPTS

• **Human-centered computing** → **Ubiquitous and mobile computing systems and tools.**

KEYWORDS

Virtual reality, Augmented reality, Mixed reality, Extended reality, Multiple sensory modalities, Multi-sensations, Mixed reality, Realism, User friendliness

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1 OBJECTIVE

Recent technological advances in Virtual Reality (VR) and Augmented Reality (AR) are fueling enthusiasm for these applications [7]; however, efforts to enhance the user experience and facilitate interactions with these systems are currently constricted by a lack of innovative input modalities. There is also a pressing need for methods by which to achieve the seamless integration of multiple realistic sensations, which is crucial to the realism and immersivity of VR/AR experiences [2]. Numerous research groups are exploring methods to enhance the coherence between input modalities and sensations in order to deliver a more captivating VR/AR experience.

Full immersion in a virtual reality (VR) or augmented reality (AR) environment requires the integration of multiple realistic sensations, while effective system interactions require an unobtrusive interface and intuitive input modalities. Recent technological advances have no doubt improved the user experience; however, system developers are constantly striving to enhance the realism of VR/AR applications through the incorporation of sophisticated visual systems [3], haptic feedback [9], auditory cues [4], and olfactory sensations [6]. Developers are also exploring diverse input modalities, including gaze monitoring [5], voice commands [8], and gesture recognition [10] to ensure seamless interactions between the user and VR/AR environment. Nonetheless, numerous challenges will have to be overcome before these systems rival the realism and immersivity of the physical world.

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The Multiple Input Modalities and Sensations for VR/AR Interactions (MIMSVAI 2024) workshop is a one-day gathering of researchers in ubiquitous computing (UbiComp) and VR/AR aimed at catalyzing research momentum in efforts to enhance the immersivity of VR/AR experiences and facilitate computer-user interactions. The event is scheduled for October 5-6, 2024 in Melbourne, Australia. Attendees who would like to participate in the workshop will be required to register for the UbiComp/ISWC 2024 main conference. The workshop aims to catalyze research momentum in the UbiComp community by inviting paper submissions focused on designing input modalities and sensory feedback mechanisms to enhance the immersive nature of VR/AR experiences and facilitate computer-user interactions. Accepted papers will be presented in dedicated sessions, followed by discussions mediated by session chairs to distill motivated ideas and findings. Additionally, expert talks on VR/AR interactions will be featured in the morning. This year, we introduce afternoon discussion sessions to encourage workshop attendees to engage in productive brainstorming, generating potential challenges and ideas for more immersive VR/AR experiences. The workshop will conclude with closing remarks and the presentation of the Best Paper Award to recognize and encourage excellence in research, accompanied by a certificate for the awardee.

2 RELEVANT AND TIMELY

UbiComp refers to the integration of computing into one's daily life and physical surroundings through the use of mobile and wearable computing devices, whereas VR immerses users in computer-generated virtual environments, and AR overlays a virtual world over the real world. While UbiComp involves wearable computing devices in the real world, VR immerses users in computer-generated virtual environments, and AR overlays a virtual world onto the real world. However, technological advancements have blurred these distinctions, as UbiComp components enabling interactions in the physical world can also support interactions in virtual worlds using VR/AR devices. This workshop provides a platform for researchers in UbiComp and VR/AR to exchange ideas on designing input modalities and sensory feedback mechanisms for enhancing VR/AR interactions.

Nonetheless, a convergence of technological advances and interdisciplinary collaborations have largely blurred these distinctions, as all of these efforts are meant to facilitate human-computer interactions. UbiComp devices that permit interactions in the physical world are increasingly being used to support interactions in the virtual world and vice versa. This workshop will serve as a platform for the exchange of ideas among researchers in UbiComp and VR/AR focusing on the development of input modalities and sensory feedback mechanisms.

3 TOPICS

Our primary objective in hosting this event is to foster dialogue and collaborations among experts in UbiComp and VR/AR with a focus on five key themes: (1) Facilitating user-computer interactions through the use of enhanced input modalities; (2) Enhancing the authenticity of virtual worlds through the application of sensory feedback; (3) Pioneering new devices and infrastructure; (4)



Figure 1: Keynote speech presented in MIMSVAI 2023.

Identifying novel application scenarios; and (5) Broadening design processes, platforms, and tools for immersive VR/AR interactions. The five key themes are detailed in the following:

- **Advancing Input Modalities.** In developing input systems for the detection of user actions and interpretation of user intentions, researchers may seek to refine existing methods or develop entirely new models.
- **Enhancing Realism through Sensory Feedback.** The creation of an immersive virtual experience depends on the ability to mimic real-world interactions. Feedback mechanisms can enhance awareness of these interactions at the conscious as well as sub-conscious levels.
- **Developing Innovative Devices and Infrastructure.** Advances in VR/AR and infrastructure can only proceed as a series of technological innovations surpassing the limitations of current-generation technology. Researchers must lead the way in pioneering new solutions to develop innovative VR/AR devices or platforms.
- **Identifying Novel Application Scenarios** VR/AR has expanded from gaming into healthcare and education; however, the potential of this technology has yet to be fully realized. Further advances in this field will require visionaries with the ability to re-imagine everything we think we know.
- **Broadening design processes, platform/tools, and libraries.** There is a pressing need for methods to predict user and meet evolving user requirements. It will also be necessary to adapt existing platforms/tools (e.g., Unity/Unreal Engine) and libraries (e.g., Android ARCore, Apple ARKit) to accommodate new VR/AR applications.

Note that we also encourage submissions dealing with other pertinent areas of investigation.

4 WORKSHOP STRUCTURE

The MIMSVAI 2024 workshop will be a one-day, in-person event building on the momentum of last year's event (see Figs. 1 and 2). The agenda will include interactive activities, keynote speeches, and presentations by participants (see Table 1). After expert talks



Figure 2: Photo of attendees from MIMSVAI 2023.

on VR/AR interactions in the morning, papers will be presented in dedicated sessions with Q&A mediated by session chairs. We will also be introducing an open afternoon brainstorming session addressing current challenges and novel approaches to achieving a more immersive VR/AR experience. The workshop will conclude with closing remarks and the presentation of a certificate to the authors of the Best Paper.

Table 1: Workshop Schedule

Workshop Schedule	
9:00-9:10 am	Opening
9:10am-10:20am	Keynote Talk I: 50 + 20min
10:20am-10:30am	Coffee Break
10:30am-11:10am	Paper Session I: 2 × (15 + 5)min
11:10am-11:20am	Coffee Break
11:20am-12:00pm	Paper Session II: 2 × (15 + 5)min
12:00pm-2:00pm	Lunch Break
2:00pm-2:40pm	Paper Session III: 2 × (15 + 5)min
2:40pm-2:50pm	Coffee Break
2:50pm-3:50pm	Discussion Session I: 60min
3:50pm-4:00pm	Coffee Break
4:00pm-5:00pm	Discussion Session II: 60min
5:00pm-5:10pm	Closing & Best Paper Award Ceremony

A call for papers has been distributed across various research communities, including UbiComp, HCI, VR/AR applications, haptic and tactile interfaces, and multi-sensory perception. Manuscripts should adhere to a maximum length of 5 pages (4 pages for content and 1 page for references), in accordance with the ACM sigconf template [1]. Submissions will undergo review by at least two Program Committee members and organization staff. Evaluation criteria include novelty, quality, and relevance. Note that organizers anticipate a substantial number of submissions due to explosive growth in the burgeoning VR/AR community. We will therefore be accepting only four papers for presentation to ensure presentations of

the highest caliber. Successful submissions will be featured in the UbiComp/ISWC Adjunct Proceedings, which will be published in the ACM Digital Library.

5 EXPECTED OUTCOMES

It is expected that the workshop will draw at least 20 participants in the field of VR/AR technology. The aim is for this workshop to contribute to an enriched comprehension of current cutting-edge methodologies and emerging developments in the field.

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A APPENDIX: CALL FOR PAPERS

A surge in the popularity of VR/AR technology has given rise to a plethora of applications to captivate new users; however, further advances in VR/AR realism will require the integration of novel input modalities and multiple realistic sensations. This workshop will provide a platform to facilitate collaborations among researchers in UbiComp and VR/AR fields in exploring novel approaches to making this vision a reality.

Submitted papers may encompass, but are not restricted to the following topics:

- 2D/3D and volumetric display and projection technology

- Immersive analytics and visualization
- Modeling and simulation
- Multimodal capturing and reconstruction
- Scene description and management issues
- Storytelling
- Tracking and sensing
- Audio interfaces, sound rendering, spatialized audio, auditory perception, and psychoacoustics
- Embodied agents, virtual humans, and self-avatars
- Haptic and tactile interfaces, wearable haptics, passive haptics, pseudo haptics, and other touch-based user interfaces
- Mediated and diminished reality
- Multimodal input and output
- Multisensory rendering, registration, and synchronization
- Perception and cognition
- Presence, body ownership, and agency
- Teleoperation and telepresence
- 3D user interaction
- 3D user interface metaphors
- Collaborative interactions
- Ethical issues
- Human factors and ergonomics
- Input devices
- Locomotion and navigation
- Multimodal/cross-modal interaction and perception
- Non-fatiguing 3D user interfaces
- Non-visual interfaces (such as olfactory)
- Touch, tangible, and gesture interfaces
- Usage research, evaluation methods, and empirical studies
- Domain-specific VR/AR/MR/XR applications.

- Design processes, platforms/tools, or libraries used to incorporate input modalities or sensations for VR/AR interactions or study their use.
- The use of AI and Large Language Models in VR/AR/MR/XR applications

Important Dates

Paper submission: June 7, 2024

Paper notification: June 28, 2024

Camera-ready: July 26, 2024

Workshop: October 5-6, 2024

Best Paper Award

The Best Paper Award will be conferred upon the most outstanding paper presented at the MIMSVAI 2024 workshop, in recognition and encouragement of excellence in research. The recipient will be presented with a certificate during the workshop.

Workshop Organizer

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Yi-Chao Chen, Shanghai Jiao Tong University

Liwei Chan, National Yang Ming Chiao Tung University

Min-Chun Hu, National Tsing Hua University

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