

Experience Smell-Enhanced VR via Wearable Olfactory Display

Zhe Zou and Takamichi Nakamoto

Information and Communications Engineering, Institute of Science Tokyo, Tokyo, Japan
nakamoto.t.ab@m.titech.ac.jp

While visual, auditory, and haptic technologies are well-established in virtual reality (VR), integrating flexible olfaction remains a critical frontier for achieving true multisensory immersion. To advance this field, as illustrated in Fig 1, we built upon our previous eight-channel architecture and advanced miniaturization designs to develop a highly compact, next-generation wearable olfactory display (WOD) [1]. The high-density odor channels integrated into this system deliver liquid odorants with nanoliter-level precision, ensuring ultra-precise intensity control. When combined with dedicated odor generation and airflow units, the prototype successfully achieves broad scent diversity and a prompt scent response [2].

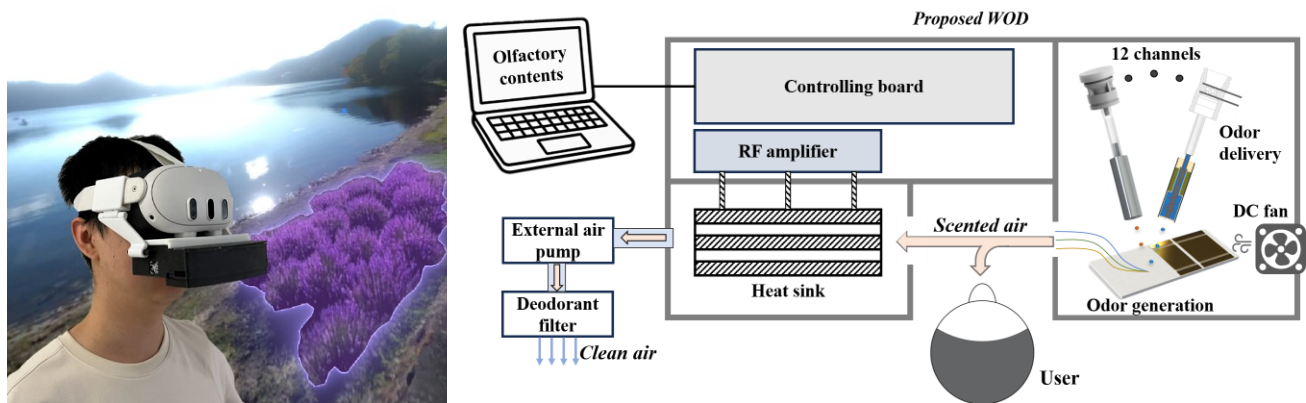


Fig 1. Diagram of proposed WOD and the potential smell-enhanced VR application.

The workshop demonstration features an interactive VR application designed to validate the real-time performance and practical usability of our proposed WOD. Attendees will wear a standard VR headset integrated with this WOD to experience a seamless, multisensory virtual environment. As users explore, the system instantly synchronizes visual, auditory, and olfactory stimuli in response to their real-time interactions. Through interactive sensory association and scent-matching tasks, participants will directly experience the system's high-fidelity performance, rapid scent-switching capabilities, and precise intensity control with low residual odor interference.

References

- [1]. Zou, Z., Nakamoto, T., Wu, H. H., Cheng, K., Lee, S., & Hasegawa, S. (2026). Development of an Eight-channel Wearable Olfactory Display for Virtual Reality. *IEEE Sensors Journal*.
- [2]. Zou, Z., Prasetyawan, D., Wu, H. H., Cheng, K., Lee, S., & Nakamoto, T. (2024). Demo of the Extended Wearable Olfactory Display for Multisensory VR Experience. In *ICAT-EGVE (Posters & Demos)*.