

## VGTC Virtual Reality Technical Achievement Award

## Kiyoshi Kiyokawa

The 2022 IEEE VGTC Virtual Reality Technical Achievement Award goes to Kiyoshi Kiyokawa of the Nara Institute of Science and Technology, in recognition of his pioneering research contributions in the development of advanced head mounted display systems, vision augmentation and assistive interfaces, immersive modeling, collaborative virtual and augmented reality, seamless transitional interfaces, and multimodal interfaces.



Kiyoshi Kiyokawa, Nara Institute of Science and Technology (NAIST) Award recipient 2022

Kiyoshi Kiyokawa is a Professor at the Nara Institute of Science and Technology (NAIST) where he has led the Cybernetics and Reality Engineering (CARE) Laboratory since 2017. From 2002 to 2017, he was an Associate Professor in the Cybermedia Center at Osaka University. Dr. Kiyokawa received the M.S. and Ph.D. degrees in information systems from NAIST in 1996 and 1998, under the supervision of Naokazu Yokoya and Haruo Takemura, respectively. He was a Research Fellow at the Japan Society for the Promotion of Science in 1998, and worked for the Communications Research Laboratory (currently the National Institute of Information and Communications Technology (NICT)) from 1999 to 2002. He was a visiting scholar at the Human Interface Technology laboratory at the University of Washington from 2001 to 2002.

Dr. Kiyokawa has received more than 30 scientific awards, including the Virtual Reality Society of Japan (VRSJ) Outstanding Contribution Award in 2006, and he became a VRSJ Fellow in 2019. He has given more than 100 keynote and invited talks, has published more than 70 journal papers and more than 300 conference and invited papers in the fields of virtual and augmented reality.

Dr. Kiyokawa developed the first occlusion-capable optical see-through head mounted display (OST-HMD), named ELMO, in 1999 using a 4f optical system with an LCD panel and two convex lenses to achieve per-pixel mutual occlusion between virtual and real objects, enabling a significant improvement in the color fidelity of augmented reality content. In 2000, he added a real-time range finder, and in 2002 eliminated parallax to further improve the system. His ELMO displays have been featured in many survey papers, textbooks, and encyclopedias on AR and display hardware including Springer's Handbook of Visual Display Technology.

Since then, Dr. Kiyokawa's contributions to the advancement of HMD systems have continued. In 2007 he developed a very wide field of view (FOV) OST-HMD using a hyperboloidal half mirror; its wearable version followed in 2011, enabling research investigating the impact of the expanded FOV on information noticeability from 2014 to 2018 with Ernst Kruijff.

Dr. Kiyokawa has supervised a number of PhD students on HMD-related themes, including Jason Orlosky in work on adaptive display technology (2015), Alexander Plopski in work on corneal-imaging OST-HMD calibration (2016, with Gudrun

Klinker), and Yan Zhang (2021, with Hong Hua) on achieving very wide FOV occlusion-capable OST-HMDs by using conical reflectors.

Dr. Kiyokawa's interests began to gradually shift from AR/VR to human augmentation and assistive interfaces after he compiled the VR Technology Roadmap for the VRSJ in 2013, which envisions a future in which XR technology can increase people's options for living and realize an inclusive society. Since then, he has frequently worked with Yuta Itoh on vision augmentation projects, including Laplacian Vision (2016). He also developed a strabismus correction system (2019) and smart sunglasses for photophobia (2021) with Xiaodan Hu.

Dr. Kiyokawa's earliest research was in immersive modeling and object manipulation techniques. His system VLEGO (1995-) was one of the first collaborative immersive modelers that supported bimanual interaction with geometric constraints. Its successor SeamlessDesign (1999) featured the first transitional interface for flexibly switching between VR and AR using an OST-HMD. In the early 2000s, Dr. Kiyokawa worked on a series of collaborative AR systems, including AR Pad (2001) with Mark Billinghurst; his research investigated the impact of display types, participant layout, etc. on usability, work efficiency, and interpersonal engagement. He has also made significant contributions to multimodal interfaces, including one of first systems to use drone-based midair haptics (2014), a walking sensation display with Yoshihiro Kuroda (2017), kinesthetic illusions with Daiki Hagimori and Shunsuke Yoshimoto (2018), and a GAN-based food-to-food translation system for taste modulation (2019) with Kizashi Nakano and Takuji Narumi.

## Award Information

The IEEE VGTC Virtual Reality Technical Achievement Award was established in 2005. It is given every year to recognize an individual for a seminal technical achievement in virtual and augmented reality. Nominations can be submitted either via direct email to [vgtc-vr-awards@vgtc.org](mailto:vgtc-vr-awards@vgtc.org) or via the VGTC website at <https://tc.computer.org/vgtc/awards/vr-award-nominations/>.