

Guest Editorial

Introduction to the Special Section on Immersive Virtual Reality Simulation for Vehicular Technology

IN THE last years, more and more research activities have focused on the application of Virtual Reality (VR) and related cutting-edge immersive technologies like Augmented Reality (AR) and Mixed Reality (MR) to vehicular systems for supporting the design of novel Human-Machine Interaction techniques, simulating the functioning of newly developed components, recreating hazardous test environments, establishing trust in Connected and Autonomous Vehicles (CAVs), etc.

The benefits brought by immersive environments for supporting simulations in the field of vehicular technology have already been recognized by many companies and academic institutions worldwide, as confirmed by the huge investments and a large number of publications. As we approach the time in which immersive simulations will become fundamental for a wide range of applications in the field of vehicular technology, the goal of this Special Section was to attract high-quality submissions reporting state-of-the-art research activities targeted to next-generation vehicles and related infrastructures.

The Special Section received 12 submissions, which were prescreened and reviewed by experts in the field. Four papers were ultimately accepted. In the paper titled “Strangers in a strange land: New experimental system for understanding driving culture using VR,” the authors present an experimental system and method to profile driving behavior and interaction using a multi-participant VR-based driving simulation environment, and use it to study how human driving differs across geographical locations which is key to make CAVs adapt to local norms. The authors of “Digital twins based VR simulation for accident prevention of intelligent vehicle” show how to ensure drivers’ and pedestrians’ life and property safety by means of a Traffic Accident (TA) prevention system based on digital twins and AI. The devised approach is evaluated in the context of a motor vehicle road TA-oriented video analysis system. In the paper “Perception of driving simulations: Can the Level of Detail of virtual scenarios affect the driver’s behavior and emotions?,” the authors investigate the possible correlations between Levels of Details (LOD) and driver’s experience in simulated driving scenarios. Finally, the authors of “MiRE, a Mixed Reality environment for testing of automated driving functions” present a MR environment that can be used to experiment with CAVs and test, e.g., their interaction with vulnerable road users.

These papers demonstrate how vibrant is the research in this field, and we believe they will contribute to making readers

aware of the areas which are worth further investigation. We thank the authors and the reviewers for their contribution to this Special Section. We are grateful to both the former and the current Editors-in-Chief for having allowed us to serve as Guest Editors and for their guidance throughout the process.

ALBERTO CANNAVÓ, *Guest Editor*

Department of Control and Computer Engineering
Politecnico di Torino
Torino 10129, Italy

FABRIZIO LAMBERTI, *Guest Editor*

Department of Control and Computer Engineering
Politecnico di Torino
Torino 10129, Italy

HIMANSHU THAPLIYAL, *Guest Editor*

Department of Electrical Engineering and Computer Science
The University of Tennessee
Knoxville, TN 37996, USA

RUCK THAWONMAS, *Guest Editor*

College of Information Science and Engineering
Ritsumeikan University
Shiga 525-8577, Japan



Alberto Cannavó (Member, IEEE) is currently an Assistant Professor with the Department of Control and Computer Engineering, Politecnico di Torino, Torino, Italy. His research interests include computer graphics and HMI. He is the Secretary of the IEEE CTSoc Technical Committee on Virtual Reality, Augmented Reality and Displays. He was the Chair for the homonymous track at IEEE ICCE 2022. He also was the Co-Organizer for the IEEE VR 2022 ReDiGiTS Workshop.



Fabrizio Lamberti (Senior Member, IEEE) is currently a Full Professor with the Department of Control and Computer Engineering, Politecnico di Torino, Torino, Italy, where he has the responsibility for the VR@POLITO hub. His research interests include computer graphics, HMI, and intelligent computing. He is an Associate Editor for IEEE TRANSACTIONS ON COMPUTERS, IEEE TRANSACTIONS ON LEARNING TECHNOLOGIES, IEEE TRANSACTIONS ON CONSUMER ELECTRONICS, *IEEE Consumer Electronics Magazine*, and *International Journal of Human-Computer Studies*.



Himanshu Thapliyal (Senior Member, IEEE) is currently an Associate Professor with the Department of Electrical Engineering and Computer Science, University of Tennessee, Knoxville, TN, USA. He is the Boards of SN Computer Science, *IEEE Consumer Electronics Magazine*, IEEE INTERNET OF THINGS JOURNAL, and *Microelectronics Journal*. His research interests include hardware security of IoT and vehicles, circuit design of emerging technologies like quantum computing, and smart healthcare.



Ruck Thawonmas (Senior Member, IEEE) is currently a Full Professor with the College of Information Science and Engineering, Ritsumeikan University, Kyoto, Japan, where he is leading the Intelligent Computer Entertainment Laboratory. He has authored or coauthored more than 250 peer-reviewed papers. His research interests include games for health and for humanity. He is the Chair of the IEEE CTSoc TC on Entertainment and Gaming and an Associate Editor for IEEE TRANSACTIONS ON GAMES and *Games for Health Journal*.