PROCEEDINGS OF SPIE

Virtual, Augmented, and Mixed Reality (XR) Technology for Multi-Domain Operations

Mark S. Dennison
Editor

27 April – 8 May 2020
Online Only, United States

Sponsored and Published by
SPIE

Volume 11426

Proceedings of SPIE 0277-786X, V. 11426

Virtual, Augmented, and Mixed Reality (XR) Technology for Multi-Domain Operations,
edited by Mark S. Dennison, Proc. of SPIE Vol. 11426, 1142601 · © 2020 SPIE
CCC code: 0277-786X/20/$21 · doi: 10.1117/12.2572756

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIEDigitalLibrary.org.

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings:
Author(s), "Title of Paper," in *Virtual, Augmented, and Mixed Reality (XR) Technology for Multi-Domain Operations*, edited by Mark S. Dennison Jr., Proceedings of SPIE Vol. 11426 (SPIE, Bellingham, WA, 2020) Seven-digit Article CID Number.

ISSN: 0277-786X
ISSN: 1996-756X (electronic)

ISBN: 9781510636293
ISBN: 9781510636309 (electronic)

Published by
SPIE
P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone +1 360 676 3290 (Pacific Time)· Fax +1 360 647 1445
SPIE.org

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

Publication of record for individual papers is online in the SPIE Digital Library.

SPIE. DIGITAL LIBRARY
SPIEDigitalLibrary.org

Paper Numbering: *Proceedings of SPIE* follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B … 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

Contents

ENABLING XR TECHNOLOGY II

11426 04 **Cooperative and location-independent terrain assessment for deployment planning using a 3D mixed reality environment** [11426-5]

11426 06 **Acquisition and management of field inspection data using augmented reality** [11426-7]

DECISION-MAKING IN XR I

11426 07 **Designing augmented reality visualizations for synchronized and time-dominant human-robot teaming** [11426-8]

11426 08 **Enhancing ground penetrating radar with augmented reality systems for underground utility management** [11426-9]

11426 09 **On the use of operations research for decision making with uncertainty for IoT devices in battlefield situations: simulations and outcomes** [11426-10]

11426 0A **Tools for enabling teaming during mission planning and rehearsal** [11426-11]

DECISION-MAKING IN XR II

11426 0C **Visualizations techniques for forensic training applications** [11426-13]

11426 0F **Physical object interaction in first responder mixed reality training** [11426-16]

HUMAN INFORMATION ITERATION IN XR I

11426 0G **A systematic literature review on dynamic cognitive augmentation through immersive reality: challenges and perspectives (Invited Paper)** [11426-17]

11426 0H **The impact of immersion level and virtual reality experience on outcomes from navigating in a virtual environment** [11426-18]

11426 0I **Divisive display augmented reality (ddAR) for real-world warfighter performance** [11426-19]

HUMAN INFORMATION INTERACTION IN XR II

11426 0J **Visuo-postural sensitivity to sinusoidal modulations of viewpoint in VR** [11426-20]

11426 0K **Visualizing dynamic and uncertain battlefield information: lessons from cognitive science** [11426-21]

11426 0L **Decision making with uncertainty in immersive systems** [11426-22]

JOINT SESSION WITH CONFERENCES 11413 AND 11426: AI/ML AND XR

11426 0M **Creating a mixed reality common operating picture across C2 echelons for human-autonomy teams** [11426-24]

11426 0N **Course of action modeling and visualization in augmented space** [11426-25]