

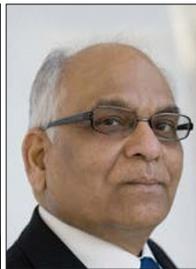
MULTI-SENSORY HUMAN BOND COMMUNICATION



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Information and communications technologies have progressed rapidly in this millennium for people to communicate and exchange information using multimedia including speech, text, image, and video, and the same mode of communication has extended to the Internet of Things (IoT) and machine-to-machine and machine-to-human communication. However, the ability to integrate the other three sensory features, namely, olfactory (smell), gustatory (taste), and tactile (touch) in information transfer and replication to deliver Star-Wars-like “being there” and “beyond being there” experience is still far from reality, and presents the next holy grail of immersive experiences, which we call human bond communication (HBC). HBC is a novel concept that incorporates all five sensory sources of information from sensing to digitization to transmission and replication at the receiver to allow more expressive, engaging, realistic, and holistic information transfer between humans, and in some cases between humans and machines (M2H) or IoT. Besides its utility in applications such as virtual reality, virtual presence, and gaming, the medical field could immensely benefit from such applications. New types of social networking applications could emerge based on HBC technology; present-day social platforms may undergo radical transformation.

This Feature Topic assembles three interesting articles that address different facets of HBC. A brief overview of each of the articles follows.

In the first article, “Human Bond Communications: Architectures, Challenges, and Possibilities,” Iftikhar *et al.* propose possible architectures for HBC with particular emphasis on healthcare. The article further covers the state of the art of sensors for HBC communication. The authors also describe a possible architecture for healthcare applications.

In the second article, “Human Bond Communication with Head-Mounted Displays: Scope, Challenges, Solutions, and Applications,” Hossan *et al.* discuss the applicability of head-mounted displays incorporating optical camera communications to advance HBC communication. The article provides specifications of several currently available HMDs, three IEEE standards, as well as OCC requirements and the applications of the technology to a variety of fields.

In the third article, “Communication through Breath: Aerosol Transmission,” Khalid *et al.* propose that exhaled breath, which, in the case of an infected patient, may contain certain pathogenic aerosol, can be used to retrieve valuable information about the health of the patient. The article discusses possible receivers that are commercially available and open issues of such a communications paradigm.

We hope that the readers will find the articles published in this Feature Topic interesting, leading to further research in multi-sensory HBC.

BIOGRAPHIES

SUDHIR DIXIT [LF] is a Senior Fellow and Evangelist at the Basic Internet Foundation in Oslo, Norway, and heads its U.S. operations. Recently, he also took on the role of International Evangelist of the Academy of Finland Flagship Programme, 6Genesis, led by the Centre for Wireless Communications, University of Oulu, Finland. From 2015 to 2017 he was the CEO and co-founder of a start-up, Skydoot, Inc. From 2009 to 2015, he was a distinguished chief technologist and CTO of Communications and Media Services for the Americas Region of Hewlett-Packard Enterprise Services in Palo Alto, California, and the director of Hewlett-Packard Labs India. Before joining HP, he held various leadership positions at BlackBerry, Nokia, NSN, and Verizon Communications. He has published over 200 papers, and edited, co-edited, or authored eight books. He has been a Technical Editor of *IEEE Communications Magazine*, and is presently a Board Member and Working Group Chair at the Wireless World Research Forum (WWRF). He is also on the Editorial Boards of *IEEE Spectrum* and Springer’s *Wireless Personal Communications Journal*. He is an active contributor to the IEEE Future Network Initiative and is on its Industry Outreach Board (IOB). In 2018, he was appointed a Distinguished Lecturer by the IEEE Communications Society for a two-year term. A Fellow of IET and IETE, he holds a Ph.D. from the University of Strathclyde, Glasgow, United Kingdom, and an M.B.A. from the Florida Institute of Technology, Melbourne.

SESHADRI MOHAN [LSM] is currently a professor in the Systems Engineering Department at the University of Arkansas at Little Rock, where, from August 2004 to June 2013, he served as the chair of the Department of Systems Engineering. Prior to his current position he served as the CTO of Converse. Besides these positions, his industry experience spans Telcordia (formerly Bellcore), Bell Laboratories, and Clarkson and Wayne State Universities. He has authored/coauthored over 140 publications as books, patents, and papers in refereed journals and conference proceedings. He co-authored the textbook *Source and Channel Coding: An Algorithmic Approach*. He holds 14 patents. He received the 2010 IEEE Region 5 Outstanding Engineering Educator Award. He holds a Ph.D. degree in electrical and computer engineering from McMaster University, Canada, a Master’s degree in electrical engineering from the Indian Institute of Technology, Kanpur, and a Bachelor’s degree in electronics and telecommunications from the University of Madras, India.

RAMJEE PRASAD [F] is a professor of Future Technologies for Business Ecosystem Innovation (FT4BI) in the Department of Business Development and Technology, Aarhus University, Herning, Denmark. He is the founder and president of the CTIF Global Capsule (CGC). He is also the founding Chairman of the Global ICT Standardisation Forum for India. He received the Ridderkorset af Dannebrogordenen (Knight of the Dannebrog) in 2010 from the Danish Queen for the internationalization of top-class telecommunication research and education. He has received several international awards. He is a Fellow of IET, IETE, and WWRF.

HIROSHI HARADA is a professor of the Graduate School of Informatics, Kyoto University. He joined the Communications Research Laboratory, Ministry of Posts and Communications, in 1995 (currently NICT). Since 1995, he has researched software defined radio (SDR), cognitive radio, dynamic spectrum access networking, smart utility networking (SUN), and broadband wireless access systems on VHF, TV white space, microwave, and millimeter-wave band. He has also joined many standardization committees and forums in the United States as well as in Japan, and has fulfilled important roles for them. He currently serves on the Board of Directors of SDR Forum, White Space Alliance, and Wi-SUN alliance, and also as Chair of the IEEE Dyspan Standards Committee (formerly, IEEE SCC41 and IEEE 1900) since 2009 and the Vice Chair of several IEEE Standards committees.