HOLOTWIN Workshop Programme

Venue	Technical University of Sofia, Bulgaria in hybrid mode
Dates	22-23.11.2021 **Starting 13:00 CET (+ 1 Hour Sofia, Bulgaria)**

Meeting link WEBEX: shorturl.at/bgALP

22.11.2021		Moderator: Prof. Vladimir Poulkov
Time table CET	**Topic**	**Speaker**
13:00 – 13:15	Welcoming speech	Project Partners
13:15 – 13:45	Mixed reality technologies in surgery	Vladimir Ivanov, Sergey Strelkov, Peter the Great Saint Petersburg Polytechnic University, Russia
13:45 – 14:15	AI-aided ultra-low latency wireless communication for XR	Kwang-Cheng Chen College of Engineering University of South Florida, USA
14:15-14:30	Coffee break	
14:30 – 15:00	Frame Synchronization for Multi Source Holographic Teleportation Applications	Sweta Anmulwar, 5G/6G Innovation centers, Institute for communication Systems, University of Surrey, UK
15:00 – 15:30	5G edge computing for remote production/rendering of holographic teleportation content	Ning Wang, 5G/6G Innovation centers, Institute for communication Systems, University of Surrey, UK
15:30 – 16:00	Human Augmentation Technology	Mariofanna Milanova, Computer Science Department at the University of Arkansas at Little Rock, USA
16:00 – 16:30	TBC	Sudhir Dixit, University of Oulu, Finland

HOLOTWIN

Venue   Technical University of Sofia, Bulgaria in hybrid mode

Date   23.11.2021   **Starting 10:00 CET (+ 1 Hour Sofia, Bulgaria)**

Meeting link WEBEX: shorturl.at/bgALP

23.11.2021		Moderator: Assoc. Prof. Agata Manolova
Time table CET	**Topic**	**Speaker**
9:50 – 10:00	Opening	Moderator
10:00 – 10:30	Description and comparison of complex shapes using a specific shape index and Reeb graphs	Florian Beguet, PhD Jean-Luc Mari LIS (Computer Science and Systems Laboratory), G-Mod (Geometric Modeling team), Aix-Marseille Université, France
10:30 – 11:00	Immersive Collaborative Connectivity through Holographic Telepresence Systems	Albena Mihovska, Department of Business Development and Technology, Aarhus University
11:00 – 11:30	HOLOTWIN Knowledge Transfer	Prevedourou Didoe, Hellenic American University, Greece
11:30 – 12:00	Implementation Requirements and System Architecture for Mixed Reality Telepresence Application Scenarios	Krasimir Tochev, Faculty of Telecommunications, Technical University of Sofia
12:30 – 13:00	"Green Multi Business Models" How to measure Green Business Models and Green Business Model Innovation?	Peter Lingdren, Department of Business Development and Technology, Aarhus University
13:00	Closing Session	**Vladimir Poulkov, Technical University of Sofia**

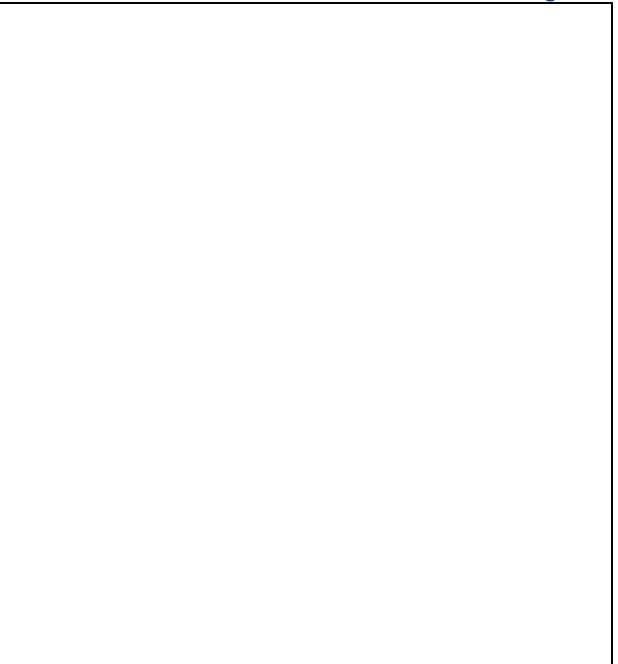| Speakers	Abstract
Vladimir Ivanov, Sergey Strelkov Peter the Great Saint Petersburg Polytechnic University, Russia	**Mixed reality technologies in surgery** The paper considers the possibilities, prospects and drawbacks of the mixed reality (MR) technology application using mixed reality smart glasses Microsoft Hololens 2 on the example of 3 clinical cases: 2 median neck and 1 branchial cyst excision. In each case, we applied a unique approach of hologram positioning in space based on the use of mixed reality markers. Moreover, we developed the solutions in such a way as to streamline the MR-technology surgeries with no significant labor costs of preoperative planning and patient positioning.
Kwang-Cheng Chen has been a Professor at the Department of Electrical Engineering, University of South Florida, since 2016. From 1987 to 2016, Dr. Chen worked with SSE, Communications Satellite Corp., IBM Thomas J. Watson Research Center, National Tsing Hua University, HP Labs., and National Taiwan University in mobile communications and networks. He visited TU Delft (1998), Aalborg University (2008), Sungkyunkwan University (2013), and Massachusetts Institute of Technology (2012-2013, 2015-2016). He founded a wireless IC design company in 2001, which was acquired by MediaTek Inc. in 2004. He has been actively involving in the organization of various IEEE conferences and serving editorships with a few IEEE journals, together with various IEEE volunteer services to the IEEE, Communications Society, Vehicular Technology Society, and Signal Processing Society, such as founding the Technical Committee on Social Networks in the IEEE Communications Society. Dr. Chen also has contributed essential technology to various	**AI-aided ultra-low latency wireless communication for XR** Metaverse is expected to further advance digital society as a new technological frontier. AR/VR or XR serves a unique tool to realize metaverse. To facilitate XR and human/digital-twin interactions in the metaverse, ultra-low latency wireless communications emerge as one critical technology. We propose proactive open-loop communication in the small virtual cell network architecture, which enables minimal-latency wireless communications and enhances energy efficiency. Machine learning enabling anticipatory mobility management and radio resource management, together with multi-user detection, is proposed so that minimal latency can be reliably disruptively achieved to support various scenarios of XR and metaverse.

international standards, namely IEEE 802 wireless LANs, Bluetooth, LTE and LTE-A, 5G-NR, and ITU-T FG ML5G. He has authored and co-authored over 300 IEEE publications, 4 books published by Wiley and River (most recently, Artificial Intelligence in Wireless Robotics, 2020), and more than 24 granted US patents. Dr. Chen is an IEEE Fellow and has received a number of awards including 2011 IEEE COMSOC WTC Recognition Award, 2014 IEEE Jack Neubauer Memorial Award, 2014 IEEE COMSOC AP Outstanding Paper Award. Dr. Chen's current research interests include wireless networks, quantum computing and communications, artificial intelligence and machine learning, social networks and data analytics, IoT/CPS, and cybersecurity.	
Sweta Anmulwar is a PhD researcher working on Frame Synchronisation for Multi-source Holographic Teleportation Applications at University of Surrey. Sweta has an experience in Computer Networking, Software development and wireless communication. She is a key member in design and development of various software development projects like SDN Online Lab, Smart city, Traffic Generators and was actively involved in setting up of a test-bed for wireless mesh networks. She has delivered expert lectures on Software Defined Networking at various institutes. She has conducted various tutorials on SDN at IEEE conferences and faculty development programme on "SDN and OpenFlow".	**Frame Synchronisation for Multi Source Holographic Teleportation Applications** Live holographic teleportation is an emerging media application that allows Internet users to communicate with each other in a fully immersive manner. One distinct feature of such an application is the capability of simultaneously teleporting multiple objects from different network locations to the receiver's field of view, mimicking the effect of group-based communications in a common physical space. In this case, teleportation frames from individual sources need to be stringently synchronized in order to assure user Quality of Experiences (QoE) in terms of avoiding the perception of motion misalignment at the receiver side. In this talk, we carry out systematic performance evaluations on how different Internet path conditions may affect the teleportation frame synchronization performances. Based on this, we present a lightweight, edge-computing based scheme that is able to achieve controllable frame synchronization operations for multi-source based teleportation applications at the Internet scale.

	Ning Wang received his B.Eng degree in computing from Changchun University of Science and Technology, China in 1996 and M.Eng degree in electronic engineering from Nanyang Technological University, Singapore in 2000 respectively. He obtained his Ph.D degree in electronic engineering from the Centre for Communication Systems Research (CCSR, currently known as the Institute of Communication Systems - ICS), University of Surrey, UK in 2004.	**5G edge computing for remote production/rendering of holographic teleportation content**
	Mariofanna Milanova is a Professor of the Computer Science Department at the University of Arkansas at Little Rock since 2001. She received a M.Sc. in Expert Systems and Artificial Intelligence and Ph.D. in Engineering and Computer Science from the Technical University, Sofia, Bulgaria. Dr. Milanova conducted post-doctoral research in visual perception at the University of Paderborn, Germany. Dr. Milanova has extensive academic experience at various academic and research organizations worldwide. Dr. Milanova is IEEE Senior Member, Fulbright U.S. Scholar, and NVIDIA Deep Learning Institute University, Ambassador. Dr. Milanova's work is supported by NSF, NIH, DARPA, DoD, Homeland Security, NATO, Nokia Bell Lab, NJ, USA and NOKIA, Finland. She has published more than 120 publications, over 53 journal papers, 35 book chapters, and numerous conference papers and has 2 patents.	**Human Augmentation Technology** Human augmentation is an interdisciplinary field that addresses methods, technologies and their applications for enhancing sensing, action and/or cognitive abilities of a human. This is achieved through sensing and actuation technologies, fusion and fission of information, and artificial intelligence (AI) methods.

Sudhir Dixit is currently a Senior Fellow and Evangelist of Basic Internet at the Basic Internet Foundation in Norway and heads its San Francisco office. He has over 30 years of experience in computer networking and telecommunications, and related fields. From 2015 to 2017 he was the CEO and Co-Founder of a start-up, Skydoot, Inc, in the cloud-based and collaboration space. From December 2013 to April 2015, he was a Distinguished Chief Technologist and CTO of the Communications and Media Services for the Americas Region of Hewlett-Packard Enterprise Services in Palo Alto, CA, and prior to this he was the Director of Hewlett-Packard Labs India from September 2009. Prior to joining HP Labs Palo Alto, Dixit held a joint appointment with the Centre for Internet Excellence (CiE) and the Centre for Wireless Communications (CWC) at the University of Oulu, Finland. From 1996 to 2008, he held various positions with leading companies, such as with BlackBerry as Senior Director, with Nokia and Nokia Siemens Networks in the United States as Senior Research Manager, Nokia Research Fellow, Head of Nokia Research Centre (Boston), and Head of Network Technology (USA). From 1987 to 1996, he was at NYNEX Science and Technology and GTE Laboratories (both now Verizon Communications) as a Staff Director and Principal Research Scientist.	TBC
Florian Beguet, PhD student LIS (Computer Science and Systems Laboratory), G-Mod (Geometric Modeling team), Aix-Marseille Université, France	**Description and comparison of complex shapes using a specific shape index and Reeb graphs** We present the development of a 3D shape description approach for the analysis and the comparison of triangulated models. This approach is based on the computation of a shape index Reeb graph that characterizes in

a compact way both the geometry and the topology of the object, relying on the differential analysis of the input mesh. The shape index is used as a curvature function to guarantee the invariance to scaling and remeshing of the graph. Since curvature-based functions generate noisy Reeb graphs, a graph filtering operator based on the geometric properties of the surface is proposed. It aims at removing the nodes that represent a surface ratio lower than a defined threshold. To analyze specific regions of the surface, the graph is split into several subgraphs using a spectral partitioning algorithm. This step allows to obtain a more complete semantic description of the shape compared to traditional Reeb graphs built from geodesic or height functions. The comparison of regions of two different surfaces described by a subgraph is then performed by finding the pairs of subgraphs that minimize a custom graph editing distance.

Albena Mihovska is a Senior Academic Research professional, currently an Associate Professor at the Dept of Business Development and Technology (BTECH), at Aarhus University, Herning, Denmark. She is leading the 6G Knowledge Research Lab at the CTIF Global Capsule(CGC) research group at BTECH and a Technical Manager of several EU-funded projects in the area of Beyond 5G networks coordinated by Aarhus University.

Immersive Collaborative Connectivity through Holographic Telepresence Systems
Wireless communications combined with advances in artificial intelligence (AI), sensing technologies, imaging, massive scale machine-to-machine (M2M) communications, augmented reality (AR), cross-reality (XR), wearable displays, deep analytics, and so forth, are driving the emergence of a new era of communication-namely in a combined physical and virtual world. In the light of the recent pandemic, remote collaboration revealed its importance as the backbone of modern business and kept the so important human communication and interaction at a satisfactory level. With the advancement of technology, remote interactions become more and more part of our everyday living. The talk will explore the possibilities arising from this trend, as well as the main challenges.

Prevedourou Didoe holds a Master's degree in Computer Science and Electrical Engineering from Northwestern University, Evanston, Illinois, USA. Didoe is currently the Director of Innovation in ICT at the Hellenic American University and College. She is mainly responsible for the organization and coordination of funded research and innovation management activities. She also serves as the Vice President of Innovation and Research at the CTiF Global Capsule (CGC), a global, collaborative, non-profit organization for cross-/inter-disciplinary research, education, and innovation. Didoe has extensive working experience in both academic and corporate environments. During 2014-2020, she served as the Managing Director of AIT, a private non-profit research organization, and before that, for twelve years, as AIT's Research Director mainly responsible for the administration and organization of AIT's research activity, including fund raising, research collaborations and partnership formulations, as well as protection, dissemination and commercialization of AIT's intellectual capital. During 1991 – 2001, Didoe served in various research and managerial positions at INTRACOM S.A., the biggest Hellenic Telecommunications Industry. She was also INTRACOM's representative at the European Telecommunications Standards Institute (ETSI), and a representative of the Greek Industrial Confederation at the Telecommunications Working Group of the Union of Industrial and Employers' Confederations in Europe (BUSINESSEUROPE). Didoe has worked as

HOLOTWIN Knowledge Transfer

Knowledge Transfer (KT) is a key mechanism for dissemination of research results and access to knowledge and expertise, and an important vehicle for the valorization of research for social and economic benefit. Research results are at the core of Knowledge Transfer, which is a process involving seven stages. The presentation provides a holistic view of the Knowledge Transfer process from research to impact, and describes the seven stages of the process. It identifies barriers and possible ways to surpass them. Finally, HOLOTWIN Knowledge Transfer is presented against indicators that have been introduced to enable measuring and tracking of the KT process.

research scientist in numerous EU and nationally funded research projects, also in the roles of project coordinator and technical manager, as well as in industrial projects, covering diverse thematic areas in ICT and innovation management. Her research interests are in ICT and its applications in healthcare-wellness, the environment, education, and culture.

Krasimir Tonchev a senior researcher leading scientific and research activities at the "Teleinfrastructure Lab", Faculty of Telecommunications, Technical University of Sofia, Bulgaria. His research interests include, on the theoretical side, large scale Kernel Machines, modeling of dynamical behavior, Bayesian modeling, and on the application side, 2D and 3D facial analysis for soft biometrics, affective computing and general scene understanding from video. He has lead and coordinated many national and international scientific projects in the field of signal analysis, computer vision, reliable face and emotion recognition, and ambient assisting living systems. He also participated in innovative commercial product development including embedded vision and image processing with a large scale volume production. He has published many scientific papers in the field of facial analysis and general human behavior understanding. He is an IEEE member.

Implementation Requirements and System Architecture for Mixed Reality Telepresence Application Scenario
With the advance of technology, human-to-human real life-like communication became more and more realistic. Cheap and easy to install 3D sensors, virtual and mixed reality Head-Mounted Displays (HMD) are paving the way to affordable and real life-like communication. However, the current development in this direction is still infant and the lack of standards and recommendations are one of the main issues towards off the shelf systems. Considering a specific case study based on a controlled environment, we define the requirements for Mixed Reality Telepresence System (MRTS), propose the system architecture in terms of hardware and software and provide implementation details for each of the MRTS components.

Peter Lindgren holds a full Professorship in Multi Business Model Development and

"Green Multi Business Models"
How to measure Green Business Models and Green Business Model Innovation?

Technology Innovation at Aarhus University, Denmark - and is Vice President of CTIF Global Capsule (CGC). He is Director of CTIF Global Capsule/MBIT Research Centre at Aarhus University – Business Development and Technology - and is member of Research Committee at Aarhus University, BSS. He has researched and worked with network based high-speed innovation since 2000. He has been heading of Studies for Master in Engineering Business Development and Technology at Aarhus University from 2014 - 2016 and member of the management group at Aarhus University BTECH 2014 - 2018. He has been researcher at: Politechnico di Milano in Italy (2002/03); Stanford University, USA (2010/11); University Tor Vergata, Italy (2016/2017); and has in the period 2007 - 2011 been the founder and Centre Manager of International Centre for Innovation www.ici.aau.dk at Aalborg University; founder of the MBIT research group and lab http://btech.au.dk/forsk ning/mbit/ and is cofounder of CTIF Global Capsule www.ctifglobalcapsule.org He has worked as researcher in many different multi business model and technology innovations projects, and knowledge networks among others: E100 http://www.entovation.com/kleadmap/ ; Stanford University project Peace Innovation Lab http://captlogy.stanford.edu/projects/peace-innovation.html ;The Nordic Women in business project www.womeninbusiness.dk/ ; The Centre for TeleInFrastruktur (CTIF), FP7 project about "multi business model innovation in the clouds" www.Neffics.eu ; EU projects www.Biogas2020.se ; Central

Project, Motor5G, Recombine and Greenbizz. He is cofounder of five startup businesses amongst others www.thebeebusiness.com the www.thedigibusiness.com and the www.vdmbee.com He is author to several articles and books about business model innovation in networks and Emerging Business Models. He has an entrepreneurial and interdisciplinary approach to research. His research interests are multi business model and technology innovation in interdisciplinary networks, multi business model typologies, sensing-, persuasive- and virtual- business models. He has been serving as quest editor and reviewer for many highly respected journals and conferences.	
Vladimir Poulkov has received the M.Sc. and Ph.D. degrees from the Technical University of Sofia (TUS), Sofia, Bulgaria. He has more than 30 years of teaching, research, and industrial experience in the field of telecommunications, managed numerous industrial, engineering, R&D and educational projects. He has been Vice Chairman of the General Assembly of the European Telecommunications Standardization Institute. Currently he is Head of the "Teleinfrastructure" R&D laboratory at TUS; Chairman of the "Cluster for Digital Transformation and Innovation", Bulgaria; Chairman of the Board of the "Research and Development and Innovation Consortium" at Sofia Tech Park, Bulgaria. He is Fellow of	**Moderator**

the European Alliance for Innovation and Senior IEEE Member.	
Agata Manolova is associate professor with the Faculty of Telecommunications at the Technical University of Sofia (TU-Sofia), Bulgaria and the head of the research laboratory "Electronic systems for visual information" and Vice-Dean Education of the Faculty. Her domains of interest are machine learning, pattern recognition, computer vision, image and video processing, biometrics, neural networks, augmented and virtual reality. She has received her PhD from Universite de Grenoble, France. She is laureate of Fulbright scholarship and an IEEE member.	**Moderator**