UNIVERSITÀ DI TRENTO

◆IEEE

2022 IEEE INTERNATIONAL WORKSHOP ON

Metrology for Industry 4.0 & IoT

UNIVERSITY OF TRENTO, ITALY / JUNE 7-9, 2022

WORKSHOP PROGRAM

For further information, visit the website
www.metroind40iot.org

ATHENA
BUSINESS AND TECHNOLOGY CONSULTING

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Welcome Message from the General Chairs and Technical Program Chairs

On behalf of the Organizing Committee, we wish to welcome you to the 2022 IEEE International Workshop on Metrology for Industry 4.0 and IoT - MetroInd4.0&IoT.

The Fourth Industrial Revolution represents a fundamental change in the way we live, work, and relate to one another. It is a new chapter in human development, enabled by technological advances that are commensurate with those of the first, second, and third industrial revolutions. The speed, breadth, and depth of this revolution are forcing us to rethink how countries should develop, how organizations create value, and even what it means to be human.

All these deep changes are also possible thanks to the recent developments in the field of metrology. Actually, the monitoring and the control of remote physical phenomena require development of new sensors, acquisition techniques, data analysis, new architecture of data acquisition systems, and so on MetroInd4 0 &IoT aims to discuss the contributions both of the metrology for the development of Industry 4 0 and IoT and the new opportunities offered by Industry 4 0 and IoT for the development of new measurement methods and instruments.

Since the first edition, MetroInd4.0&IoT represents an international meeting place in the world of research in the field of Metrology for Industry 4 0 and the Internet of Things involving national and international institutions and academia in a discussion on the state of the art concerning issues that require a joint approach by experts of measurement instrumentation and industrial testing, typically professional engineers, and experts in innovation metrology, typically academic. MetroInd4.0&IoT wants to federate stakeholders active in developing instrumentation and measurement methods for Industry 4.0 and IoT, with new technologies for metrology-assisted production, component measurement, sensors and associated signal conditioning, and calibration methods for electronic tests.

The first edition of MetroInd4.0&IoT was hosted by the University of Brescia, Italy in 2018, then the second edition was organized in Naples and hosted by the University of Naples Federico II. Then two years of emergency of COVID-19 outbreak forced the editions 2020 and 2021

expected in Rome, and organized with the precious help of University Campus Bio-Medico di Roma, to be held online. 2022 starts finally with a coming back to the normality!

This year our expectation of hosting you all in Trentino-Alto Adige and its world-famous Dolomites has been realized! The programme is arranged to offer the possibility of visiting Trentino-Alto Adige before, during and after the workshop!

The 2022 IEEE International Workshop on Metrology for Industry 4.0 and IoT is hosted in Trento, Italy. The organization is coordinated by the University of Trento, the University Campus Bio-Medico di Roma, and the University of Brescia, together with the invaluable contribution of the University of Sannio.

MetroInd4.0&IoT Technical Program consists of 80 oral presentations scheduled over three days. Presentations are organized in a General Session and 18 Special Sessions. Special Sessions aim to create a focus on specific topics, where researchers can make knowledge, familiarize, exchange ideas, and build cooperation.

The received extended abstracts were submitted to a peer-review process. Relevance, quality, significance, and novelty of the scientific contribution were the main attributes for acceptance and publication in the Proceedings. The Proceedings are going to be submitted for publication in the IEEEXplore Digital Library. We would like to thank all the reviewers who actively contributed to the selection and quality improvement of the presented works.

Technically extended versions of presented papers can be submitted to the Special Issues of MDPI Sensors Journal.

MetroInd4.0&IoT 2022 is honored to have experts in robotics and Industry 4.0 as Invited Speakers.

- Prof. Nanshu Lu, from The University of Texas at Austin, will present the first day "Soft Electronics for Digitizing Human Body and Human-Centered Robotics."
- Prof. Claudio Castellini, from FAU Erlangen-Nürnberg, Germany, will present "If I can do it, you can do it! Interactive learning as the key to reliable intent detection" on June 8.
- Prof. Nikola Djuric, University of Novi Sad, Republic of Serbia, will give a talk on "The Sensors Network for EMF Monitoring as Public Protection Tool", on the last day of the workshop.

We are grateful to the Invited Speakers for joining the Workshop.

To recognize the most outstanding paper presented at the annual *2022 IEEE International Workshop on Metrology for Industry 4.0 and IoT*, the Best Conference Paper Award sponsored by Sensors Journal will be assigned. Other awards will be assigned to the Best Paper presented by a Young Researcher, and to the Best Paper Presented by a Woman, this last sponsored by IEEE Women in Engineering, to recognize the full engagement of women in all aspects of the Metrology in Industry 4.0 and IoT.

We sincerely want to thank all the sponsors and the patronages who made this event possible.

The *2022 IEEE International Workshop on Metrology for Industry 4.0 and IoT* is about to begin. Metrologists, Industrial ICT engineers and IoT designers enjoy the Workshop!

June 2022

Davide Brunelli, University of Trento, Italy
Pasquale Daponte, University of Sannio, Italy
Emiliano Schena, Università Campus Bio-Medico di Roma, Italy
MetroInd4.0&IoT 2022 General Chairs

Mauro Serpelloni, University of Brescia, Italy
Kasim Sinan Yildirim, University of Trento, Italy
MetroInd4.0&IoT 2022 Technical Program Chairs

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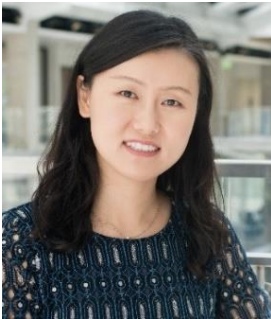Maurizio Valle, *Università di Genova, Italy*
Bert van der Linden, *ATS Applied Tech Systems B.V., The Netherland*
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Krzysztof Kozłowski, *Poznan University of Technology, Poland*

IEEE MetroInd 4.0 & IoT 2022 Plenary Speakers

Plenary - Tuesday, June 7, 2022 - H 14:50 CEST

Soft Electronics for Digitizing Human Body and Human-Centered Robotics

Nanshu Lu
The University of Texas at Austin, USA

ABSTRACT

Industry 4.0, a.k.a. the cyber-physical systems, point to a future where humans will be more like robots (i.e., digital, computational, connected to the internet, etc.) whereas robots will be more like humans (i.e., soft, human-mimetic actuation and sensation, artificial intelligence, etc.). This talk will introduce my research on the design, fabrication, bio-integration and functionality of soft electronics based on inorganic but high-performance functional materials such as metals, silicon, carbon nanotubes (CNT), and graphene. In particular, epidermal electronics, a.k.a. electronic tattoos (e-tattoos), represent a class of noninvasive stretchable circuits, sensors, and stimulators that are ultrathin, ultrasoft and skin-conformable. My group has invented a dry and freeform "cut-solder-paste" method for the rapid prototyping of multimodal, wireless, or very large area e-tattoos that are also high-performance and long-term wearable. The e-tattoos can be applied for physiological sensing as well as human body digitization for human-robot interaction. While e-tattoos are to be worn by human, e-skins are to be worn by robots. Recently, we have engineered an e-skin based on barely electrically conductive porous nanocomposite laminated with an ultrathin insulating layer. The hybrid piezoresistive and piezocapacitive responses of this novel e-skin have enabled unprecedented pressure sensitivity at large pressures. It therefore could be applied for sensing very subtle surface pulse waves from the temporal artery even under the pressure of a VR headset. A stretchable version of it could be much more sensitive to out-of-plane pressure than in-plane strain, and hence can be mounted on an inflatable soft robotic finger for performing diverse tasks. A perspective on future opportunities and challenges in this field will be offered at the end of the webinar.

SPEAKER BIO

 Dr. Nanshu Lu is currently Temple Foundation Endowed Associate Professor at the University of Texas at Austin. She received her B.Eng. from Tsinghua University, Beijing, Ph.D. from Harvard University, and then Beckman Postdoctoral Fellowship at UIUC. Her research concerns the mechanics, materials, manufacture, and human / robot integration of soft electronics. She has been named 35 innovators under 35 by MIT Technology Review (TR 35) and iCANX/ACS Nano Inaugural Rising Star. She has received US NSF CAREER

Award, US ONR and AFOSR Young Investigator Awards, 3M non-tenured faculty award, and the ASME Thomas J.R. Hughes Young Investigator Award. She has been selected as one of the five great innovators on campus and five world-changing women at the University of Texas at Austin. She is a highly cited researcher identified by Web of Science.

Plenary - Wednesday, June 8, 2022 - H 09:00 CEST

If I can do it, you can do it! Interactive learning as the key to reliable intent detection

Claudio Castellini
FAU Erlangen-Nürnberg, Germany

ABSTRACT

Intent detection is a quintessential part of human-machine interaction and proves to be especially hard in rehabilitation and assistive robotics – decades of research in signal processing, machine learning and mechatronics still fail to produce a dexterous, flexible, and reliable HMI for prostheses and exoskeletons. In this talk I'll sketch the state of the art in the field, try and highlight a few pitfalls and possible ways ahead, and illustrate what I consider to be the main path to success: interactive (human and machine-) learning, leading to tight coupling, optimal control, and embodiment of robotic artefacts.

SPEAKER BIO

I am a researcher in medical robotics, focussing on rehabilitation and assistive robotics, human-machine interfaces and interaction and applied machine learning. In 1998 I obtained a degree in Electronic (Biomedical) Engineering from the University of Genoa, then in 2005 a Ph.D. in Artificial Intelligence (Mathematical Logic) from the School of Informatics of the University of Edinburgh. I then turned my attention to robotics for the disabled and spent 4.5 years as a post-doctoral fellow at the Advanced Robotics Laboratory of the University of Genoa. In 2009 I landed at the German Aerospace Centre where, as of now, I am a team leader and senior researcher at the Institute of Robotics and Mechatronics.
In 2021 I have been appointed full professor at the Chair of Medical Robotics at the University of Erlangen-Nuremberg. As of now, I have (co)authored short of 120 scientific papers, I am involved in a few research projects and I have served, or am currently serving, for some international editorial boards and committees.

IEEE MetroInd 4.0 & IoT 2022 Tutorial

Thursday, June 9, 2022 - H 09:00 CEST

The Sensors Network for EMF Monitoring as Public Protection Tool

Nikola Djuric
University of Novi Sad, Republic of Serbia

ABSTRACT

The electromagnetic field (EMF) become an inevitable element of surrounding environment, regarding an extensive technological development of wireless communication, which uses EMF for data transfer. Almost each telecommunication service uses its own EMF sources, generating considerable level of artificial EMF in surrounding, in addition to the natural ones. Therefore, in last two decades, the considerable efforts are devoted to investigation of EMF influence/exposure on a living organism and consequent prevention of dangerous EMF levels in environment.

The modern EMF investigation approach suggest continuous and long-term EMF monitoring, initiating development of several progressive monitoring systems. This Keynote Speech will present concept and technical details of the state-of-the-art continuous EMF investigation using wireless sensors network (WSN).

The acquisition, processing and dissemination of monitoring results will be discussed, offering experience in development of the Serbian EMF RATEL monitoring network, as the newest system of this kind. Also, the open metrology issues in such monitoring networks will be discussed, opening new research opportunities for young researchers in metrology community.

Finally, the systems for continuous EMF monitoring are intended to become useful and user-friendly tool for the general population, interested on daily EMF levels, as well as for decision makers and regulatory agencies, which are in charge for regulation and protection of environment from possible harmful level of EMF radiation.

SPEAKER BIO

Professor **Nikola Djuric** received his Ph.D. degree in Telecommunication and Signal Processing from the Faculty of Technical Sciences, University of Novi Sad (FTN-UNS). Currently, his research is focused on computational and applied electromagnetics, particularly on systems for electromagnetic field monitoring. Professor Djuric is Head of the Chair of Theoretical Electrical Engineering and Head of Laboratory for Electromagnetic Compatibility at FTN-UNS, as well as leader of the research team that has been

specialized in environmental EMF measurement and monitoring for EMF compliance testing and estimation and simulation of the whole-body exposure to EMF.

In the last four years, professor Djuric has been a Project Coordinator of several nationally funded projects, regarding continuous broadband EMF monitoring and EMF exposure assessment. He was also the MC Member and Serbian Coordinator for the EU COST BM1309 Action – "European network for innovative uses of EMFs in biomedical applications (EMF-MED)".

Professor Djuric is a Member of Technical Committee of the Accreditation Body of the Republic of Serbia (ATS), then the ATS Commission for the Accreditation of Laboratories for EMF Compliance Testing and the ATS Commission for the Adaptation of Legislative Acts. Additionally, he is an IEEE Member and author of more than 100 journal and conference articles.

IEEE MetroInd 4.0 & IoT 2022 Venue

The IEEE MetroInd 4.0 & IoT 2022 will be held at the **Povo Scientific Campus - University of Trento**.

Address: Via Sommarive, 5
Povo - Trento

The University's headquarters in the suburb of Povo is home to the Department of Engineering and Computer Science, the Department of Industrial Engineering and the CIBIO Research Centre.
It is made up of two interlinked blocks of buildings, has a surface area of approximately 20,000m^2 across teaching rooms, teaching laboratories and research laboratories along with spaces for collective study and recreation, offices, a canteen, a library and a car park.

https://goo.gl/maps/FcL7ad3xQ2jVXzXS6

Download here the
Travel Support: Trento City – Conference Venue

https://www.metroind40iot.org/files/TravelSupportMetroind40iot2022.pdf

IEEE MetroInd 4.0 & IoT 2022 Social Events

WELCOME PARTY

Tuesday, June 7, 2022
19:30 - 21:30

The IEEE MetroInd 4.0 & IoT 2022 Welcome Party will be held at **Castello del Buonconsiglio**.
Address: Via Bernardo Clesio, 5 – Trento

GALA DINNER

Wednesday, June 8, 2022
20:00 – 23:00

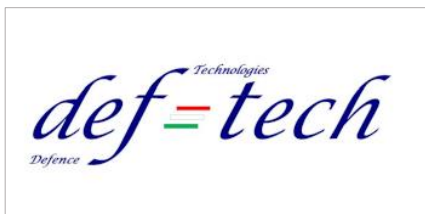The IEEE MetroInd 4.0 & IoT 2022 Gala Dinner will be held at **Forsterbräu Trento**
Address: Via Paolo Oss-Mazzurana, 38 - Trento

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Program Schedule - Tuesday June 7

TUESDAY - JUNE 7, 2022		
09:00 - 09:30	Opening Ceremony - Welcome Addresses Room B107	
	Room B107	*Room B109*
09:30 - 11:10	**Session 1.1** Special Session #01 - Non-contact and Vision-based measurements for metal production industry	**Session 1.2** Special Session #05 - User-Driven approaches to the design of inclusive and Gender-Aware innovative measurement and IoT systems
11:10 - 11:40	Coffee Break	
11:40 - 13:00	**Session 2.1** Special Session #04 - Wearable devices and Industry 4.0: Are they able to enhance the well-being, safety and productivity of workers?	**Session 2.2** Special Session #06 Part 1 - AI-Enhanced sensing for industrial and medical IoT applications
13:00 - 14:45	Lunch	
14:50 - 15:50	**Keynote Speaker** Nanshu Lu, The University of Texas at Austin *Soft Electronics for Digitizing Human Body and Human-Centered Robotics* Room B107	
15:50 - 16:20	Coffee Break	
	Room B107	*Room B109*
16:20 - 18:00	**Session 3.1** Special Session #15 - The frontiers of sensing: Quantum & biosensors	**Session 3.2** Special Session #06 Part 2 - AI-Enhanced sensing for industrial and medical IoT applications
19:30 - 21:30	Welcome Party - Castello Buonconsiglio	

Program Schedule - Wednesday June 8

WEDNESDAY - JUNE 8, 2022		
09:00 - 9:45	**Keynote Speaker** Claudio Castellini, FAU Erlangen-Nürnberg, Germany *If I can do it, you can do it! Interactive learning as the key to reliable intent detection* Room B107	
9:45 - 10:00	Emerging Technologies: MAR (Multipurpose Amphibious Rover) by SeTeL group Room B107	
	Room B107	*Room A209*
10:00 - 11:00	**Session 4.1** Special Session #13 Part 1 - Measurements for the Electric power industry	**Session 4.2** Special Session #16 Part 1 - Tracking and positioning for Industry 4.0
11:00 - 11:30	Coffee Break	
11:30 - 12:30	**Session 5.1** Special Session #13 Part 2 - Measurements for the Electric power industry	**Session 5.2** Special Session #16 Part 1 - Tracking and positioning for Industry 4.0
12:30 - 14:30	Lunch	
	Room B107	*Room B109*
14:30 - 15:50	**Session 6.1** Micro-Electro-Mechanical Systems (MEMS) in Industrial IoT	**Session 6.2** Special Session #18 - Printed Sensors for Industrial and Medical IoT: Innovation and Challenges
15:50 - 16:20	Coffee Break	
16:20 - 18:00	**Session 7.1** Special Session #14 Part 1 - Wearable sensors and devices for unobtrusive human activities and physiological monitoring	**Session 7.2** Special Session #12 - Cybersecurity standards and technologies for IoT and industry 4.0 (SECURITYSTANDARDS)
20:00 - 23:00	Gala Dinner	

Program Schedule - Thursday June 9

THURSDAY - JUNE 9, 2022		
09:00 - 09:40	**Tutorial** Nikola Djuric, University of Novi Sad, Republic of Serbia *The Sensors Network for EMF Monitoring as Public Protection Tool* Room B107	
	Room B107	*Room B108*
09:40 - 11:00	**Session 8.1** Special Session #14 Part 2 - Wearable sensors and devices for unobtrusive human activities and physiological monitoring	**Session 8.2** Special Session #02 - Reliable wireless solutions for IoT and Industrial IoT
11:00 - 11:30	Coffee Break	
11:30 - 12:30	**Session 9.1** Special Session #07 - Smart Systems based on Fiber Optic sensors for Industry 4.0	**Session 9.2** Special Session #08 - Measurements and Virtual Measurements for Industry 4.0: Approaches and solutions for smart manufacturing
12:30 - 14:30	Lunch	
	Room B107	*Room B108*
14:30 - 15:50	**Session 10.1** Emerging Techniques for measuring and detecting anomalies in Industrial and Medical IoT	**Session 10.2** General Session
15:50 - 16:20	Closing and Award Ceremony Room B107	

Technical Sessions - Tuesday, June 7

08:30 - 16:00
REGISTRATION
Room: Povo Scientific Campus - University of Trento

09:00 - 09:30 CEST
OPENING SESSION - WELCOME ADDRESSES
Room: Room B107 - Povo Scientific Campus

09:30 - 11:10 CEST
SESSION 1.1
Special Session - Non-contact and Vision-based measurements for metal production industry
Room: Room B107 - Povo Scientific Campus
Chair: Marco Tarabini, *Politecnico di Milano, Italy*

09:30   **Automated Vision Inspection of Critical Steel Components based on Signal Analysis Extracted form Images**
Paolo Brambilla, Politecnico di Milano, Italy
Paolo Cattaneo, Growermetal S.p.A., Italy
Andrea Fumagalli, Growermetal S.p.A., Italy
Paolo Chiariotti, Politecnico di Milano, Italy
Marco Tarabini, Politecnico di Milano, Italy

09:50   **Metrology of a Monocular Vision System for Markers Localization and Tracking**
Giada Luppino, Politecnico di Milano, Italy
Lisa Bosisio, Politecnico di Milano, Italy
Chiara Conese, Politecnico di Milano, Italy
Davide Maria Fabris, Politecnico di Milano, Italy
Marco Tarabini, Politecnico di Milano, Italy

10:10   **Identification of Aluminothermic Reaction Through Vision System and Flame Recognition**
Fabio Conti, Politecnico di Milano, Italy
Yuvan Sathya Ravi, Politecnico di Milano, Italy
Maurizio Colombo, One-Off Solution - Automation Software Services, Italy
Paolo Fasoli, Politecnico di Milano, Italy
Andrea Mazzoleni, One-Off Innovation, Italy
Marco Tarabini, Politecnico di Milano, Italy

10:30   **Surface roughness measurements of turned parts through a vision-based measurement system: uncertainty analysis and performance comparison with state-of-the-art instruments**
Alessia Baleani, Università Politecnica delle Marche, Italy
Nicola Paone, Università Politecnica delle Marche, Italy
Jona Gladines, University of Antwerp, Belgium
Steve Vanlanduit, University of Antwerp, Belgium

10:50   **Design of a scanning system for the identification of beam profile of immersion ultrasonic probes**
Carol Sergenti, Politecnico di Milano, University of Pavia, IMG Utrasuoni SRL, Italy
Hermes Giberti, University of Pavia, Italy
Marco Tarabini, Politecnico di Milano, Italy
Francesco Balatti, IMG Utrasuoni SRL, Italy
Emanuele Gaddi, IMG Utrasuoni SRL, Italy
Massimo Carminati, IMG Utrasuoni SRL, Italy

09:30 - 11:10 CEST
SESSION 1.2
Special Session - User-Driven approaches to the design of inclusive and Gender-Aware innovative measurement and IoT systems
Room: Room B109 - Povo Scientific Campus
Chairs: Sara Coppola, *Institute of Applied Science and Intelligent Systems - CNR, Italy*
Monica La Mura, *University of Salerno, Italy*
Cristina Ponti, *Roma Tre University, Italy*
Paola Saccomandi, *Politecnico di Milano, Italy*

09:30   **The "Great Beauty" of Diversity: Smart Totems to Promote Gender Uniqueness**
Tania Di Mascio, University of L'Aquila, Italy
Sara Peretti, University of L'Aquila, Italy
Federica Caruso, University of L'Aquila, Italy
Dajana Cassioli, University of L'Aquila, Italy

09:50   **Smart Seat With Real-Time Asymmetrical Sitting Alert**
Patrizia Lamberti, University of Salerno, Italy
Monica La Mura, University of Salerno, Italy
Marco De Gregorio, University of Salerno, Italy
Vincenzo Tucci, University of Salerno, Italy
Luigi Egiziano, University of Salerno, Italy

10:10   **Polymeric microneedles: design of a biomedical patch**
Sara Coppola, Institute of Applied Sciences and Intelligent Systems, CNR, Italy
Danila del Giudice, University of Naples Federico II, Italy
Vincenzo Ferraro, University of Naples Federico II, Italy
Veronica Vespini, Institute of Applied Sciences and Intelligent Systems, CNR, Italy
Simonetta Grilli, Institute of Applied Sciences and Intelligent Systems, CNR, Italy
Pier Luca Maffettone, University of Naples Federico II, Italy

10:30   **Analysis on the plié and grand plié in classical ballet with magneto-inertial measurement units**
Davide Paloschi, Politecnico di Milano, Italy
Mario Cigada, Politecnico di Milano, Italy
Stefania Ballone, Teatro alla Scala di Milano, Italy
Omar De Bartolomeo, Gruppo Italiano Danza e Medicina, Italy
Alfredo Cigada, Politecnico di Milano, Italy
Paola Saccomandi, Politecnico di Milano, Italy

10:50   **On Anatomical Human Models for Evaluation of Exposure to Electromagnetic Fields**
Cristina Ponti, 'Roma Tre' University, Italy
Giuseppe Schettini, 'Roma Tre' University, Italy

11:10 - 11:40
COFFEE BREAK
Room: Povo Scientific Campus - University of Trento

11:40 - 13:00 CEST
SESSION 2.1
Special Session - Wearable devices and Industry 4.0: Are they able to enhance the well-being, safety and productivity of workers?
Room: Room B107 - Povo Scientific Campus
Chair: Gloria Cosoli, *Università Politecnica delle Marche, Italy*

11:40 **Thermal discomfort in the workplace: measurement through the combined use of wearable sensors and machine learning algorithms**
Silvia Angela Mansi, Università degli studi di eCampus, Italy
Gloria Cosoli, Università Politecnica delle Marche, Italy
Anna Laura Pisello, Università di Perugia, Italy
Ilaria Pigliautile, Università di Perugia, Italy
Gian Marco Revel, Università Politecnica delle Marche, Italy
Marco Arnesano, Università degli studi di eCampus, Italy

12:00 **Estimation of human core temperature from heart rate: a preliminary study for application in occupational field**
Tiziana Falcone, INAIL, Italy
Simona Del Ferraro, INAIL, Italy
Vincenzo Molinaro, INAIL, Italy
Loredana Zollo, Campus Bio-Medico University of Rome, Italy
Paolo Lenzuni, INAIL, Italy

12:20 **Uncertainty of heart rate variability measured through a wearable device during office activities**
Nicole Morresi, Università Politecnica delle Marche, Italy
Sara Casaccia, Università Politecnica delle Marche, Italy
Gian Marco Revel, Università Politecnica delle Marche, Italy

12:40 **RT-PROFASY: Enhancing the Well-being, Safety and Productivity of Workers by Exploiting Wearable Sensors and Artificial Intelligence**
Massimiliano Donati, University of Pisa, Italy
Martina Olivelli, University of Pisa, Italy
Romano Giovannini, Digital Building srl, Italy
Luca Fanucci, University of Pisa, Italy

11:40 - 13:00 CEST
SESSION 2.2
Special Session - AI-Enhanced sensing for industrial and medical IoT applications – PART I
Room: Room B109 - Povo Scientific Campus
Chairs: Luca Vollero, *Università Campus Bio-Medico di Roma*
Samuel Oluwarotimi, *Shenzhen Institute of Advanced Technology, China*

11:40 **Performance Evaluation of HD-sEMG Electrode Configurations on Myoelectric Based Pattern Recognition System: High-Level Amputees**
Yazan Ali Jarrah, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China

Mojisola Grace Asogbon, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China

Oluwarotimi Williams Samuel, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China

Ejay Nsugbe, Nsugbe Research Labs, United Kingdom

Shixiong Chen, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China

Guanglin Li, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China

12:00 Analyzing the Impact of Varied Window Hyper-parameters on Deep CNN for sEMG based Motion Intent Classification

Frank Kulwa, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China

Oluwarotimi Williams Samuel, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China

Mojisola Grace Asogbon, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China

Olumide Olayinka Obe, Federal University of Technology, Nigeria

Guanglin Li, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China

12:20 Framework for IoT ecosystems based on distributed ledger technologies and decentralized identifiers

Giordano Pescetelli, Università Campus Bio-Medico di Roma, Italy

Lorenzo Petrosino, Università Campus Bio-Medico di Roma, Italy

Stefano Della Valle, Teleconsys S.p.A., Italy

Giulia Rongao, Teleconsys S.p.A., Italy

Mario Merone, Università Campus Bio-Medico di Roma, Italy

Luca Vollero, Università Campus Bio-Medico di Roma, Italy

12:40 Intelligence Combiner: A Combination of Deep Learning and Handcrafted Features for an Adolescent Psychosis Prediction using EEG Signals

Ejay Nsugbe, Nsugbe Research Labs, United Kingdom

Oluwarotimi Williams Samuel, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China

Mojisola Grace Asogbon, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China

Guanglin Li, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China

13:00 - 14:45
LUNCH
Room: Mensa POVO-0 - Povo Scientific Campus - University of Trento

14:50 - 15:50 CEST
PLENARY SESSION
Room: Room B107 - Povo Scientific Campus
Chair: Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*

Soft Electronics for Digitizing Human Body and Human-Centered Robotics

Nanshu Lu, *The University of Texas at Austin, USA*

15:50 - 16:20
COFFEE BREAK
Room: Povo Scientific Campus - University of Trento

16:20 - 18:00 CEST
SESSION 3.1
Special Session - The frontiers of sensing: Quantum & biosensors
Room: Room B107 - Povo Scientific Campus
Chair: Alessandro Loppini, *Università Campus Bio-Medico di Roma, Italy*

16:20   **A Brownian computational approach for supporting the design of nanopore-based biosensors**
Mauro Chinappi, Università di Roma Tor Vergata, Italy
Giovanni Di Muccio, Università di Roma Tor Vergata, Italy
Cristiano Giordani, Universidad de Antioquia, Colombia
Fabio Cecconi, Istituto Sistemi Complessi - CNR, Italy
Blasco Morozzo della Rocca, Università di Roma Tor Vergata, Italy

16:40   **Imaging corrosion under insulation with a mechanically-translatable atomic magnetometer**
Benjamin Maddox, University College London, UK
Yuval Cohen, University College London, UK
Ferruccio Renzoni, University College London, UK

17:00   **Multiscale Modeling of Ion Channels Electrophysiology: from Atomistic Description to Whole-Cell Models**
Nicole Luchetti, Campus Bio-Medico University, Italy
Letizia Chiodo, Campus Bio-Medico University, Italy
Alessandro Loppini, Campus Bio-Medico University, Italy
Simonetta Filippi, Campus Bio-Medico University, Italy

17:20 **Optimal quantum control of a spin qubit in diamond for biosensing**
Santiago Hernandez-Gomez, Università degli Studi di Firenze, Italy
Federico Balducci, Istituto Nazionale di Fisica Nucleare, Italy
Paola Cappellaro, Massachusetts Institute of Technology, USA
Antonello Scardicchio, Istituto Nazionale di Fisica Nucleare, Italy
Nicole Fabbri, CNR-INO, LENS

17:40 **Monitoring cells local temperature variation using nitrogen-vacancy (NV) centers in nanodiamonds**
Giulia Petrini, INRiM, University of Torino, Italy
Giulia Tomagra, University of Torino, Italy
Ettore Bernardi, INRiM, Italy
Ekaterina Moreva, INRiM, Italy
Paolo Traina, INRiM, Italy
Andrea Marcantoni, University of Torino, Italy
Federico Picollo, University of Torino, INFN, Italy
Paolo Olivero, University of Torino, INFN, Italy
Klaudia Kvakova, Institute of Organic Chemistry and Biochemistry, Czech Republic
Petr Cigler, Institute of Organic Chemistry and Biochemistry, Czech Republic
Ivo Pietro Degiovanni, INRiM, INFN, Italy
Valentina Carabelli, University of Torino, Italy
Marco Genovese, INRiM, INFN, Italy

16:20 - 18:00 CEST
SESSION 3.2
Special Session - AI-Enhanced sensing for industrial and medical IoT applications – PART II
Room: Room B109 - Povo Scientific Campus
Chairs: Luca Vollero, *Università Campus Bio-Medico di Roma*
Samuel Oluwarotimi*, Shenzhen Institute of Advanced Technology, China*

16:20 **Online detection of floating microplastics in liquids**
Anna Sabatini, Università Campus Bio-Medico di Roma, Italy
Eleonora Nicolai, University of Rome Tor Vergata, Italy
Luca Vollero, Università Campus Bio-Medico di Roma, Italy

16:40 **On the Application of Parsimonious Models for Surgical Anesthesia Depth Prediction using EEG Recordings**
Ejay Nsugbe, Nsugbe Research Labs, United Kingdom
Mojisola Grace Asogbon, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China
Oluwarotimi Williams Samuel, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China
Guanglin Li, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China

17:00   **Smart sock-based machine learning models development for phlebopathic patient screening**
Emanuele D'Angelantonio, University of Rome "Foro Italico", Italy
Leandro Lucangeli, University of Rome "Foro Italico", Italy
Valentina Camomilla, University of Rome "Foro Italico", Italy
Antonio Pallotti, "San Raffaele" University of Rome, Italy

17:20   **Reduced complexity on micro-controller learning of ECG anomalies**
Danilo Pietro Pau, STMicroelectronics, Italy
Norhen Abdennadher, STMicroelectronics, Italy

17:40   **Electric current classification with tiny machine learning for home appliances**
Danilo Pietro Pau, STMicroelectronics, Italy
Randriatsimiovalaza Dimbiniaina Marc, STMicroelectronics - University of Trento, Italy
Davide Denaro, STMicroelectronics, Italy

19:30 - 21:30
WELCOME PARTY
Museo Castello del Buonconsiglio - Trento

Technical Sessions - Wednesday, June 8

08:30 - 16:00
REGISTRATION
Room: Povo Scientific Campus - University of Trento

09:00 - 09:45 CEST
PLENARY SESSION
Room: Room B107 - Povo Scientific Campus
Chair: Davide Brunelli, *University of Trento, Italy*

If I can do it, you can do it!
Interactive learning as the key to reliable intent detection

Claudio Castellini, *FAU Erlangen-Nürnberg, Germany*

09:45 - 10:00 CEST
Room: Room B107 - Povo Scientific Campus
Chair: Davide Brunelli, *University of Trento, Italy*

Emerging Technologies: MAR (Multipurpose Amphibious Rover)

Se.Te.L group

10:00 - 11:00 CEST
SESSION 4.1
Special Session - Measurements for the Electric power industry - PART I
Room: Room B107 - Povo Scientific Campus
Chairs: Erick F. Alves, *Norwegian University of Science and Technology, Norway*
David Macii, *University of Trento, Italy*
Elisabetta Tedeschi, *University of Trento, Italy*

10:00 **An open-hardware implementation for GPS synchronized waveform measurements**
Eduardo Viciana, Zred Comunicaciones y Automatizacion SL, Spain
Alfredo Alcayde, University of Almeria, Spain
Francisco M. Arrabal-Campos, University of Almeria, Spain
Raul Ba˜nos, University of Almeria, Spain
Francisco Manzano-Agugliaro, University of Almeria, Spain
Francisco G. Montoya, University of Almeria, Spain

10:20 **VESPQ: Visual Event System for Power Quality**
Francisco G. Montoya, University of Almeria, Spain
Francisco M. Arrabal-Campos, University of Almeria, Spain
Jorge Ventura Gil, University of Almeria, Spain
Alfredo Alcayde, University of Almeria, Spain
Viktor Isanbaev, University of Almeria, Spain
Elisabetta Tedeschi, University of Trento, Italy
Thomas A. Cooke, Electric Power Research Institute, USA
Jason JohnsElectric Power Research Institute, USA
Eduardo Viciana, Zred Comunicaciones y Automatizacion SL, Spain

10:40 **The Effects of LED Lamps Emissions on PLC: a Preliminary Study in a Realistic Scenario**
Giovanni Bucci, University of L'Aquila, Italy
Fabrizio Ciancetta, University of L'Aquila, Italy
Andrea Fioravanti, University of L'Aquila, Italy
Edoardo Fiorucci, University of L'Aquila, Italy
Carmine Landi, University of Campania "Luigi Vanvitelli", Italy
Mario Luiso, University of Campania "Luigi Vanvitelli", Italy
Simone Mari, University of L'Aquila, Italy
Andrea Silvestri, University of L'Aquila, Italy

10:00 - 11:00 CEST
SESSION 4.2
Special Session - Tracking and positioning for Industry 4.0 - PART I
Room: Room B209 - Povo Scientific Campus
Chair: Daniele Fontanelli, *University of Trento, Italy*

10:00 **A Calibration Method for Antenna Delay Estimation and Anchor Self-Localization in UWB Systems**
Marco Piavanini, Politecnico di Milano, Italy
Luca Barbieri, Politecnico di Milano, Italy
Mattia Brambilla, Politecnico di Milano, Italy
Mattia Cerutti, Politecnico di Milano, Italy
Simone Ercoli, Tracking 4 Fun S.r.l., Italy

Andrea Agili, Tracking 4 Fun S.r.l., Italy
Monica Nicoli, Politecnico di Milano, Italy

10:20 **RFID SAR-based Localization for Worker Safety: a Monte Carlo Analysis for Measurement Uncertainty Evaluation**
Gabriele Bandini, University of Pisa, Italy
Alice Buffi, University of Pisa, Italy
Mirko Marracci, University of Pisa, Italy
Bernardo Tellini, University of Pisa, Italy
Luciano Di Donato, INAIL, Italy
Marco Pirozzi, INAIL, Italy
Laura Tommasini, INAIL, Italy
Alessandra Ferraro, INAIL, Italy

10:40 **Algorithms for Enhanced Indoor Positioning and Tracking based on a 60-GHz Radar Platform**
Farhad Shamsfakhr, University of Trento, Italy
Michele Corrà, TRETEC S.r.l., Italy
Alessandro Ferrari, VNG Ingegneria, Italy
David Macii, University of Trento, Italy
Luigi Palopoli, Universita` di Trento, Italy
Daniele Fontanelli, University of Trento, Italy

11:00 - 11:30
COFFEE BREAK
Room: Povo Scientific Campus - University of Trento

11:30 - 12:30 CEST
SESSION 5.1
Special Session - Measurements for the Electric power industry - PART II
Room: Room B107 - Povo Scientific Campus
Chairs: Erick F. Alves, *Norwegian University of Science and Technology, Norway*
David Macii, *University of Trento, Italy*
Elisabetta Tedeschi, *University of Trento, Italy*

11:30 **Battery Thermal Dissipation Characterization with External Coating Comparison**
Alessandro Torrisi, University of Trento, Italy
Franco Tabarelli, University of Trento, Italy
Davide Brunelli, University of Trento, Italy

11:50   **Reliability Prediction of an innovative Power Quality Meter**
Gabriele Patrizi, University of Florence, Italy
Alessandro Bartolini, University of Florence, Italy
Carlos Iturrino Garcia, University of Florence, Italy
Cristiano Del Rio, University of Florence, Italy
Lorenzo Ciani, University of Florence, Italy
Marcantonio Catelani, University of Florence, Italy
Francesco Grasso, University of Florence, Italy

12:10   **ANN-Based Stealth Attack to Battery Energy Storage Systems by Using a Low-Cost Device**
Alan Oliveira de Sá, Universidade de Lisboa, Portugal
Lucila Maria de Souza Bento, State University of Rio de Janeiro, Brazil
Mariana Luiza Flavio, Physikalisch-Technische Bundesanstalt, Germany
Marco Pasetti, University of Brescia, Italy
Paolo Ferrari, University of Brescia, Italy
Emiliano Sisinni, University of Brescia, Italy

11:30 - 12:30 CEST
SESSION 5.2
Special Session - Tracking and positioning for Industry 4.0 - PART II
Room: Room B209 - Povo Scientific Campus
Chair: Daniele Fontanelli, *University of Trento, Italy*

11:30   **Cost-effective bistatic radar with ultrawide-band radio**
Maria Doglioni, University of Trento, Italy
Luca Santoro, University of Trento, Italy
Matteo Nardello, University of Trento, Italy
Daniele Fontanelli, University of Trento, Italy
Davide Brunelli, University of Trento, Italy

11:50   **Stride Reconstruction Through Frequent Location Updates and Step Detection**
Fabian Holzke, University of Rostock, Germany
Frank Golatowski, University of Rostock, Germany
Dirk Timmermann, University of Rostock, Germany

12:10   **Metrological comparison of DL techniques for bin picking applications**
Vittorio Sala, iMAGES s.p.a, Italy
Andrea Mannella, iMAGES s.p.a, Italy

12:30 - 14:30
LUNCH
Room: Mensa POVO-0 - Povo Scientific Campus - University of Trento

14:30 - 15:50 CEST
SESSION 6.1
Micro-Electro-Mechanical Systems (MEMS) in Industrial IoT
Room: Room B107 - Povo Scientific Campus
Chairs: Andrea Prato, *INRiM - National Institute of Metrological Research, Italy*
            Alessandro Schiavi*, INRiM – National Institute of Metrological Research, Italy*

14:30   **Mixture distribution modelling of the sensitivities of a digital 3-axis MEMS accelerometers large batch**
Andrea Prato, INRiM – National Institute of Metrological Research, Italy
Francesca R. Pennecchi, INRiM – National Institute of Metrological Research, Italy
Gianfranco Genta, Politecnico di Torino, Italy
Alessandro Schiavi, INRiM – National Institute of Metrological Research, Italy

14:50   **Calibration of a multicomponent MEMS sensor for vibration monitoring of rolling bearings: broad-band and amplitude traceability up to 20 kHz**
Alessandro Schiavi, INRiM – National Institute of Metrological Research, Italy
Ada Fort, University of Siena, Italy
Elia Landi, University of Siena, Italy
Marco Mugnaini, University of Siena, Italy
Valerio Vignoli, University of Siena, Italy
Andrea Prato, INRiM – National Institute of Metrological Research, Italy
Fabrizio Mazzoleni, INRiM – National Institute of Metrological Research, Italy
Michele Murgia, Politecnico di Torino, Italy

15:10   **Time and Frequency Domain Assessment of Low-Power MEMS Accelerometers for Structural Health Monitoring**
Emanuele Parisi, University of Bologna, Italy
Amirhossein Moallemi, University of Bologna, Italy
Francesco Barchi, University of Bologna, Italy
Andrea Bartolini, University of Bologna, Italy
Davide Brunelli, University of Bologna, Italy
Nicola Buratti, University of Bologna, Italy
Andrea Acquaviva, University of Bologna, Italy

15:30 **MEMS based on Chitosan – Tetrasulfonated Copper Phthalocyanine Composite for Detection of Ethanol Vapor in Air**

Carlo Trigona, University of Catania, Italy
Tianqi Lu, Technische Universität Chemnitz, Germany
Malak Talbi, Technische Universität Chemnitz, Germany
Salvatore Baglio, University of Catania, Italy
Ammar Al-Hamry, Technische Universität Chemnitz, Germany
Clara Garcia-Martinez, Universidade Federal do Paraná, Brazil
Olfa Kanoun, Technische Universität Chemnitz, Germany

14:30 - 15:50 CEST
SESSION 6.2
Special Session - Printed Sensors for Industrial and Medical IoT: Innovation and Challenges
Room: Room B109 - Povo Scientific Campus
Chair: Bruno Andò, *University of Catania, Italy*
Michela Borghetti, *University of Brescia, Italy*

14:30 **Uncertainty Sources in Aerosol Jet Printed and Flexible Electrochemical Sensors**

Tiziano Fapanni, University of Brescia, Italy
Mauro Serpelloni, University of Brescia, Italy
Emilio Sardini, University of Brescia, Italy

14:50 **Design and characterization of a smart fabric sensor to recognize human intention for robotic applications**

Giovanni Mariani, University of Tuscia, Italy
Juri Taborri, University of Tuscia, Italy
Ilaria Mileti, University of Niccolò Cusano, Italy
Giacomo Bagordo, University of Tuscia, Italy
Eduardo Palermo, University of Sapienza, Italy
Fabrizio Patanè, University of Niccolò Cusano, Italy
Stefano Rossi, University of Tuscia, Italy

15:10 **Investigation on a Inkjet printed sensor for ammonia detection in liquid media**

Bruno Andò, University of Catania, Italy
Salvatore Baglio, University of Catania, Italy
Salvatore Castorina, University of Catania, Italy
Salvatore Graziani, University of Catania, Italy
Marthala Guru Bhaskar Reddy, University of Catania, Italy
Salvatore Petralia, University of Catania, Italy
Maria Anna Messina, University-Polyclinic of Catania, Italy
Ludovica Maugeri, University-Polyclinic of Catania, Italy

Giovanni Neri, University of Messina, Italy
Angelo Ferlazzo, University of Messina, Italy

15:30 **Preliminary study on printed microelectrode array by Aerosol Jet Printing technology**
Ileana Armando, University of Brescia, Italy
Michela Borghetti, University of Brescia, Italy
Emilio Sardini, University of Brescia, Italy
Mauro Serpelloni, University of Brescia, Italy

15:50 - 16:20
COFFEE BREAK
Room: Povo Scientific Campus - University of Trento

16:20 - 18:00 CEST
SESSION 7.1
Special Session - Wearable sensors and devices for unobtrusive human activities and physiological monitoring - PART I
Room: Room B107 - Povo Scientific Campus
Chair: Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*

16:20 **Feasibility assessment of a piezoresistive sensor based on graphene nanoplatelets for respiratory monitoring**
Joshua Di Tocco, Università Campus Bio-Medico di Roma, Italy
Carlo Massaroni, Università Campus Bio-Medico di Roma, Italy
Emiliano Schena, Università Campus Bio-Medico di Roma, Italy
Fabrizio Marra, Sapienza University of Rome, Italy
Alessio Tamburrano, Sapienza University of Rome, Italy
Serena Minutillo, Sapienza University of Rome, Italy
Maria Sabrina Sarto, Sapienza University of Rome, Italy

16:40 **Simple low-power demodulator for the measurement of basal and physiological changes of electrical bioimpedance**
Ernesto Serrano-Finetti, Universitat Politècnica de Catalunya, Spain
Gemma Hornero, Universitat Politècnica de Catalunya, Spain
Oscar Casas, Universitat Politècnica de Catalunya, Spain

17:00   **A Wearable System for Detecting Lumbar Hyperlordosis in Ballet Dancers: Design, Development and Feasibility Assessment**

Mariangela Pinnelli, Università Campus Bio-Medico of Roma, Italy
Martina Pulcinelli, Università Campus Bio-Medico of Roma, Italy
Arianna Carnevale, Università Campus Bio-Medico of Roma, Italy
Joshua Di Tocco, Università Campus Bio-Medico of Roma, Italy
Carlo Massaroni, Università Campus Bio-Medico of Roma, Italy
Emiliano Schena, Università Campus Bio-Medico of Roma, Italy
Umile G Longo, Università Campus Bio-Medico of Roma, Italy
Vincenzo Denaro, Università Campus Bio-Medico of Roma, Italy

17:20   **SISTINE 2.0: Sensorized Socks for Postural Telemonitoring**

Leandro Lucangeli, University of Rome "Foro Italico", Italy
Emanuele D'Angelantonio, University of Rome "Foro Italico", Italy
Valentina Camomilla, University of Rome "Foro Italico", Italy
Antonio Pallotti, University of Rome "San Raffaele", Italy

17:40   **Wearable Device for Plant Growth Monitoring: a Pilot Study**

Joshua Di Tocco, Università Campus Bio-Medico of Roma, Italy
Daniela Lo Presti, Università Campus Bio-Medico of Roma, Italy
Carlo Massaroni, Università Campus Bio-Medico of Roma, Italy
Stefano Cinti, University of Naples Federico II, Italy
Sara Cimini, Università Campus Bio-Medico of Roma, Italy
Laura De Gara, Università Campus Bio-Medico of Roma, Italy
Emiliano Schena, Università Campus Bio-Medico of Roma, Italy

16:20 - 18:00 CEST
SESSION 7.2
Special Session #12 - Cybersecurity standards and technologies for IoT and industry 4.0 (SECURITYSTANDARDS)
Room: Room B109 - Povo Scientific Campus
Chairs: Alan Oliveira, *University of Lisbon, Portugal*
         Lucila Bento, *State University of Rio de Janeiro, Brazil*

16:20   **Data Acquisition and extraction on mobile devices – A Review**

Alessandro Monteiro da Costa, Fluminense Federal University, Brazil
Alan Oliveira de Sá, Universidade de Lisboa, Portugal
Raphael C. S. Machado, Inmetro and UFF, Brazil

16:40   **Cyber-Physical Risks identification on Industry 4.0: A Methodology Proposal**

Maria Fernanda O. Santos, National Institute of Metrology, Quality, and Technology, Brazil
Wilson S. Melo Jr, National Institute of Metrology, Quality, and Technology, Brazil
Raphael Machado, Inmetro and UFF, Brazil

17:00 Software Watermark Scheme
  Lucila M. S. Bento, UERJ, Brazil
  Raphael C. S. Machado, Inmetro and UFF, Brazil
  Felipe S. Sim˜oes, Universidade Federal Fluminense, Brazil

17:20 Evasion Techniques for VM-based Black-Box Software Analysis
  Bruno Leite, Inmetro, Brazil
  Alan Oliveira de Sá, Universidade de Lisboa, Portugal
  Raphael Machado, Inmetro and UFF, Brazil

17:40 Sensors for detection of cyber threats on industrial environment using a high interaction ICS/SCADA Honeynet
  Maxli Campos, Universidade Federal Fluminense, Brazil
  Elson Gomes, Itaipu Technological Park Foundation Brazil, Brazil
  Raphael Machado, Inmetro and UFF, Brazil

20:00 - 23:00
GALA DINNER
Forsterbräu Trento - Via Paolo Oss-Mazzurana, 38, Trento

08:30 - 15:00
REGISTRATION
Room: Povo Scientific Campus - University of Trento

09:00 - 09:40 CEST
TUTORIAL SESSION
Room: Room B107 - Povo Scientific Campus
Chair: Mauro Serpelloni, *University of Brescia, Italy*

The Sensors Network for EMF Monitoring as Public Protection Tool

Nikola Djuric, *University of Novi Sad, Republic of Serbia*

09:40 - 11:00 CEST
SESSION 8.1
Special Session - Wearable sensors and devices for unobtrusive human activities and physiological monitoring - PART II
Room: Room B107 - Povo Scientific Campus
Chair: Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*

09:40 **Heart Rate And Heart Rate Variability Indexes Estimated By Mechanical Signals From A Skin-Interfaced IMU**
Carlo Massaroni, Università Campus Bio-Medico di Roma, Italy
Chiara Romano, Università Campus Bio-Medico di Roma, Italy
Francesca De Tommasi, Università Campus Bio-Medico di Roma, Italy
Milena B. Čukić, Complutense University of Madrid, Spain
Massimiliano Carassiti, Università Campus Bio-Medico di Roma, Italy
Domenico Formica, Università Campus Bio-Medico di Roma, Italy
Emiliano Schena, Università Campus Bio-Medico di Roma, Italy

10:00   **Heart Rate Monitoring With Smartphone Built-In Frontal Digital Camera**
Nunzia Molinaro, Università Campus Bio-Medico di Roma, Italy
Emiliano Schena, Università Campus Bio-Medico di Roma, Italy
Sergio Silvestri, Università Campus Bio-Medico di Roma, Italy
Carlo Massaroni, Università Campus Bio-Medico di Roma, Italy

10:20   **Open-MBIC: an Open-Source Android Library for Multiple Simultaneous Bluetooth Low Energy Connections**
Silvia Zampato, University of Padova, Italy
Carlo Alberto Bernardini, University of Padova, Italy
Zimi Sawacha, University of Padova, Italy
Michele Rossi, University of Padova, Italy

10:40   **Machine learning algorithms for the activity monitoring of elders by home sensor network**
Nicole Morresi, Università Politecnica delle Marche, Italy
Sara Casaccia, Università Politecnica delle Marche, Italy
Lorenzo Scalise, Università Politecnica delle Marche, Italy
Gian Marco Revel, Università Politecnica delle Marche, Italy

09:40 - 11:00 CEST
SESSION 10.2
Special Session - Reliable wireless solutions for IoT and Industrial IoT
Room: Room B108 - Povo Scientific Campus
Chair: Paolo Ferrari, *University of Brescia, Italy*

09:40   **The Underestimated Influence of Air Quality - Implementing a Homogenous Network Structure for an IoT-Based Data Acquisition and Analysis System**
David Merkl, *Frankfurt University of Applied Sciences, Germany*
Markus Krauße, *Frankfurt University of Applied Sciences, Germany*
Matthias F. Wagner, *Frankfurt University of Applied Sciences, Germany*

10:00   **Simulating scalability of a transparent LoRaWAN enhancement for emergency communication**
Paolo Ferrari, *University of Brescia, Italy*
Emiliano Sisinni, *University of Brescia, Italy*
Paolo Bellagente, *University of Brescia, Italy*
Alessandro Depari, *University of Brescia, Italy*
Dhiego Fernandes Carvalho, *University of Brescia, Italy*
Alessandra Flammini, *University of Brescia, Italy*
Marco Pasetti, *University of Brescia, Italy*
Stefano Rinaldi, *University of Brescia, Italy*

10:20 **Smart Measurement Systems Exploiting Adaptive LoRaWAN Under Power Consumption Constraints: a RL Approach**
Tommaso Fedullo, University of Padova, University of Modena and Reggio Emilia, Italy
Alberto Morato, CNR-IEIIT, Italy
Federico Tramarin, University of Modena and Reggio Emilia, Italy
Paolo Ferrari, University of Brescia, Italy
Emiliano Sisinni, University of Brescia, Italy

10:40 **Ultra-Wideband for Distance Measurement and Positioning in Functional Safety Applications**
Giovanni Peserico, University of Padova, Italy
Tommaso Fedullo, University of Padova, University of Modena and Reggio Emilia, Italy
Alberto Morato, CNR-IEIIT, Italy
Federico Tramarin, University of Modena and Reggio Emilia, Italy
Stefano Vitturi, CNR-IEIIT, Italy

11:00 - 11:30
COFFEE BREAK
Room: Povo Scientific Campus - University of Trento

11:30 - 12:30 CEST
SESSION 9.1
Special Session - Smart Systems based on Fiber Optic sensors for Industry 4.0
Room: Room B107 - Povo Scientific Campus
Chair: Daniela Lo Presti, *Università Campus Bio-Medico di Roma, Italy*
         Cátia Leitão, *University of Aveiro, Portugal*

11:30 **3D Printed Wearable FBG based Devices: A Proof of Concept for Heart Rate Monitoring**
Cátia Tavares, University of Aveiro, Portugal
Cátia Leitão, University of Aveiro, Portugal
Daniela Lo Presti, Università Campus Bio-Medico di Roma, Italy
Emiliano Schena, Università Campus Bio-Medico di Roma, Italy
M. Fátima Domingues, University of Aveiro, Portugal
Nélia Alberto, University of Aveiro, Portugal
Hugo Plácido da Silva, University of Lisbon, PLUX - Wireless Biosignals, Portugal
Paulo Antunes, University of Aveiro, Portugal

11:50 **Fiber optic plant wearable sensors for growth and microclimate monitoring**
Daniela Lo Presti, Università Campus Bio-Medico di Roma, Italy
Joshua Di Tocco, Università Campus Bio-Medico di Roma, Italy
Carlo Massaroni, Università Campus Bio-Medico di Roma, Italy
Sara Cimini, Università Campus Bio-Medico di Roma, Italy
Stefano Cinti, Univesity of Naples Federico II, Italy
Rosaria D'Amato, ENEA, Italy
Michele A. Caponero, ENEA, Italy
Laura De Gara, Università Campus Bio-Medico di Roma, Italy
Emiliano Schena, Università Campus Bio-Medico di Roma, Italy

12:10 **Wearable Systems Based on Fiber Bragg Grating Sensors for Respiratory monitoring: Design, Fabrication, Open Challenges, and Future Directions**
Daniela Lo Presti, Università Campus Bio-Medico di Roma, Italy
Joshua Di Tocco, Università Campus Bio-Medico di Roma, Italy
Carlo Massaroni, Università Campus Bio-Medico di Roma, Italy
Emiliano Schena, Università Campus Bio-Medico di Roma, Italy
Domenico Formica, Università Campus Bio-Medico di Roma, Italy

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11:30 - 12:30 CEST
SESSION 9.2
Special Session - Measurements and Virtual Measurements for Industry 4.0: Approaches and solutions for smart manufacturing
Room: Room B108 - Povo Scientific Campus
Chair: Antonella Gaspari, *Polytechnic of Bari, Italy*
Emanuela Natale, *University of L'Aquila, Italy*

11:30 **Automated inspection of composite components: comparison between methods**
Giulio D'Emilia, University of L'Aquila, Italy
Luciano Chiominto, University of L'Aquila, Italy
Laura Fabbiano, Polytechnic of Bari, Italy
Antonella Gaspari, Polytechnic of Bari, Italy
Emanuela Natale, University of L'Aquila, Italy

11:50 **Increase the accuracy in direct 3D-Printing of mathematical patterns for smart manufacturing**
Francesca Bertacchini, University of Calabria, Italy
Eleonora Bilotta, University of Calabria, Italy
Francesco Demarco, University of Calabria, Italy
Pietro Pantano, University of Calabria, Italy
Carmelo Scuro, University of Calabria, Italy

12:10 **Integration and Digitalization of a TIR Measurement System for Roll Manufacturing Industry**
Dung T. Nguyen, Youngstown State University, USA
Kenneth Diogo, Youngstown State University, USA
Farzad Ahmadi, Youngstown State University, USA

12:30 - 14:30
LUNCH
Room: Mensa POVO-0 - Povo Scientific Campus - University of Trento

14:30 - 15:50 CEST
SESSION 10.1
Emerging Techniques for measuring and detecting anomalies in Industrial and Medical IoT
Room: Room B107 - Povo Scientific Campus
Chair: Francesco Scardulla, *University of Palermo, Italy*

14:30 **A TinyML approach to non-repudiable anomaly detection in extreme industrial environments**
Mattia Antonini, Fondazione Bruno Kessler, Trento, Italy
Miguel Pincheira, Fondazione Bruno Kessler, Trento, Italy
Massimo Vecchio, Fondazione Bruno Kessler, Trento, Italy
Fabio Antonelli, Fondazione Bruno Kessler, Trento, Italy

14:50 **Data-driven leak detection and localization using LPWAN and Deep Learning**
Rodrigo P. Rolle, Sao Paulo State University, Brazil
Lucas N. Monteiro, Sao Paulo State University, Brazil
Lucas R. Tomazini, Sao Paulo State University, Brazil
Eduardo P. Godoy, Sao Paulo State University, Brazil

15:10 **A data-stream TinyML compression algorithm for vehicular applications: a case study**
Marianne Silva, Federal University of Rio Grande do Norte, Brazil
Gabriel Signoretti, Federal University of Rio Grande do Norte, Brazil
Thommas Flores, Federal University of Rio Grande do Norte, Brazil
Pedro Andrade, Federal University of Rio Grande do Norte, Brazil
Jordao Silva, Federal University of Rio Grande do Norte, Brazil
Ivanovitch Silva, Federal University of Rio Grande do Norte, Brazil
Emiliano Sisinni, University of Brescia, Italy
Paolo Ferrari, University of Brescia, Italy

15:50 **Blood pressure acquisitions with a prototypal PPGbased device**
Francesco Scardulla, University of Palermo, Italy
Nicola Montinaro, University of Palermo, Italy
Leonardo D'Acquisto, University of Palermo, Italy

14:30 - 15:50 CEST
SESSION 8.2
General Session
Room: Room B108 - Povo Scientific Campus
Chair: Matteo Nardello, *University of Trento, Italy*

14:30 **Continuous EMF Monitoring as an Emergency and Disaster Detection Tool**
Nikola Djuric, University of Novi Sad, Serbia
Dragan Kljajic, University of Novi Sad, Serbia
Vidak Otasevic, Regulatory Agency for Electronic Communications and Postal Services, Serbia
Snezana Djuric, University of Novi Sad, Serbia

14:50 **Complex impedance measurement front-end based on an on/off lock-in amplifier**
Ernesto Serrano-Finetti, Universitat Politècnica de Catalunya, Spain
Gemma Hornero, Universitat Politècnica de Catalunya, Spain
Oscar Casas, Universitat Politècnica de Catalunya, Spain

15:10 **Deployment of a LoRa-based Network and Web Monitoring Application for a Smart Farm**
Mohamed Saban, ETSE School of Engineering, Spain
Otman Aghzout, ENSA School of Engineering, Morocco
Alfredo Rosado-Munoz, ETSE School of Engineering, Spain

15:30 **Design of a novel PWV-Varying Arterial Simulator for biomedical applications: a preliminary study**
Fabio Fuiano, Roma Tre University, Italy
Andrea Scorza, Roma Tre University, Italy
Salvatore Andrea Sciuto, Roma Tre University, Italy

15:50 - 16:20 CEST
CLOSING AND AWARD CEREMONY
Room: Room B107 - Povo Scientific Campus