METROIND4.0&IoT

IEEE

2020 IEEE INTERNATIONAL WORKSHOP ON

Metrology for Industry 4.0 and IoT

JUNE 3-5, 2020

Virtual Conference

WORKSHOP PROGRAM

JUNE 3-5, 2020

For more information, visit the website
www.metroind4oiot.org

UNIVERSITÀ CAMPUS BIO-MEDICO DI ROMA

THE BIOROBOTICS INSTITUTE Sant'Anna

UNIVERSITÀ DEGLI STUDI DI BRESCIA

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Welcome Message

Welcome to the 3rd IEEE International Workshop on Metrology for Industry4.0 and IoT

On behalf of the Organizing Committee, we wish to welcome you to the *2020 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 technology advances that are commensurate with those of the first, second and third industrial revolutions. The speed, breadth, and depth of this revolution is forcing us to rethink how countries should develop, how organizations create value, and even what it means to be human.

The World Economy Forum 2019 (WEF), a symposium to discuss about the emerging trends of economy, technology, environment and health, discussed "Fourth Industrial Revolution"concluding that the revolution capabilities will create higher top and bottom line value through faster design, novel products, reduced risks and elimination of waste. The fourth Industrial Revolution will help countries and businesses to achieve sustainable growth.

COVID-19 is likely to accelerate aspects of the Fourth Industrial Revolution.

In some ways the advent of COVID-19 may accelerate changes already underway as part of the Fourth Industrial Revolution - as the relationship between businesses and their customers increasingly shifts to an always-connected model powered by digital communication. During the early part of the global outbreak, for example, the share price of video conferencing service Zoom more than doubled, as its number of users increased from 10 million to more than 200 million.

All these deep changes are possible also thanks to the recent developments in the field of metrology. Actually, the monitoring of remote physical phenomena and their control, require the 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.

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 test.

MetroInd4.0&IoT organization was a challenging task due to the large and increasing interest of our research and application areas and for the COVID-19 emergency. Efforts from several members of the MetroInd4.0&IoT community were required to shape the technical program and manage the operational aspects. In addition, it has been challenging to set up the online platform to maintain live the presentation, and we wish that our pilot initiative could pave the way towards innovations in the organization of future scientific events. We would like to take this opportunity to thank all and each of them. We also thank the public and private organizations that supported the meeting in different ways.

MetroInd4.0&IoT hosts three plenary lectures and 30 oral sessions designed to take advantage of a multidisciplinary approach to give a complete picture of the measurements applications and data treatments with the ultimate goal of increasing knowledge on the fourth industrial revolution. The sessions are divided in three tracks focused on "Key enabling measurement and instrumentation technologies", "Measurement methods for industry 4.0 and IoT", and "Biomedical, Healthcare, Wellness and Wearable sensors and instrumentation", as well as a fourth general track. Thanks to all the Technical Program Committee members and the reviewers who have contributed to make this outstanding program possible.

Despite of the COVID-19 outbreak in conjunction with the deadline of the submission, we received a record number of 160 abstracts from 33 countries all over the world.

The technical program encompasses several events and activities.

Moreover, we will also hold one of the three expected students challenges (the Wearable Devices Challenges) with more than 50 participants.

The keynote speeches will be held by experts in the field of metrology and industry with a common view on the ongoing industrial revolution: Domenico Formica, "Università Campus Bio-Medico di Roma", Italy, will talk about *Technologies 4.0 for biomedical applications in everyday life scenarios*; George Q. Huang, "The University of Hong Kong", will discuss about additional key enabling technologies *In search of breakthroughs in Industry 4.0 Manufacturing Systems*; Nunzio Abbate, STMicroelectronics, will illustrate novel trends *From Condition Monitoring to Predictive Maintenance: the role of Edge Processing*.

With the goal to provide a common ground for researches to share their findings about the metrology for industry of the future, the MetroInd4.0&IoT is based on 19 Special Sessions. The main reason is that a centralized research address definition is usually not suited for new research fields, while a spontaneous aggregation of well-focused themes is more effective. Therefore, several application-oriented Special Sessions have been organized. We wish to thank the organizers of these Special Sessions for their cooperation and support to the

conference organization. A careful attention was given to the link between Academia and Industry, with an Industrial Special Session.

Four awards will be assigned, including young researchers and woman in engineering.

The 3rd International Workshop on Metrology for Industry 4.0 and IoT is about to begin!

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MetroInd4.0&IoT 2020 Plenary Speakers

Plenary Wednesday, June 3, 2020

Technologies 4.0 for biomedical applications in everyday life scenarios

Domenico Formica
Università Campus Bio-Medico di Roma, Italy

ABSTRACT

The era of the fourth industrial revolution brings together robotics, digital mobile devices and services, wearable sensors and IoT systems, building a highly interconnected ecosystem often intimately coupled with human beings and their body. In this scenario, humans can be no longer considered as purely biological systems, but rather being part of an artificial-biological mixed complex. These integrated systems are nowadays essential to foster cutting edge research in a wide variety of fields, from basic science research, to medical and industrial applications, to consumers technologies.

Based on these considerations, this talk will present how wearable and IoT technologies are used to investigate basic mechanisms of motor neuroscience, to objectively assess brain pathologies, and to provide new tools to help people in everyday life learning.

Finally, exploiting the new technologies emerging from Industry 4.0, the talk will introduce a new class of robotic platforms for training children during the acquisition of new sensorimotor skills, through the use of robotics combined with wearable sensors, IoT, Augmented Reality, machine learning and man-machine interfaces, opening the field of Education 4.0.

SPEAKER BIO

Domenico Formica received the B.S., M.S. and Ph.D. degrees in biomedical engineering from the Università Campus Bio-Medico di Roma, Italy, in 2002, 2004, and 2008 respectively.

Since 2011 he is Assistant Professor of Bioengineering at Università Campus Bio-Medico di Roma, where in 2016 he co-founded the NEXT: Neurophysiology and Neuroengineering of Human-Technology Interaction research unit, a multidisciplinary research group with focus on the study of motor neuroscience in both healthy subjects and neurological patients.

His research interests lie at the intersection of robotics/mechatronics and neuroscience, and include the areas of mechatronic technologies for studying of human motor control, with particular attention to neurodevelopment, quantitative assessment of patients with neuromuscular disorders, and novel

robotic devices to improve motor learning. On these topics he published 45+ peer-reviewed journal papers, 50+ peer-reviewed international conference papers, and 4 book chapters.

He actively contributed to several important National and EU-funded projects, and in particular he has been awarded of two national grants for young researcher: the "FIRB - Futuro in Ricerca" early career grant for researchers under 32, by the Italian Ministry of Education, University and Research, and the "Ricerca Finalizzata / Giovani ricercatori" early career grant for researchers under 40, by the Italian Ministry of Health.

Currently, he is the European Coordinator of the H2020/ICT EU project CONBOTS (CONnected through roBOTS: physically coupling humans to boost handwriting and music learning).

Plenary Thursday, June 4, 2020

In search of breakthroughs in Industry 4.0 Manufacturing Systems

George Q. Huang
Chair Professor and Head of Department
Department of Industrial and Manufacturing Systems Engineering,
The University of Hong Kong

ABSTRACT

Industry 4.0 has been considered as the fourth industrial revolution. If it is a revolution, it mandates novel breakthroughs. This talk takes another dimension in addition to Automation Artificial Intelligence and Robotics (AIR dimension), which are considered as powerful weapons for this revolution. This dimension focuses on three novel breakthroughs to enable this revolution to come true.

The first breakthrough is "Finite element cyber-physical digitization." A factory is decomposed into finite elements (physical twins) of man, machine and material for most cost-effective creation of corresponding digital twins through industrial wearables. Physical and digital twins, called cyber-physical holons, and their interactions and interoperability are captured through cyber-physical visibility and traceability. This breakthrough significantly innovates a method for systematically digitizing Industry 4.0 factories.

The second novel breakthrough is "Theory of spatiotemporal Uncertainty Postponement (TUP)." Automation of some degree is essential in Industry 4.0 factories. It is well-known that automation is vulnerable to uncertainties and unforeseen disturbances including stochastic order arrivals and machine breakdowns. This is particularly serious when a relatively large "spatiotemporal window" is used, e.g. time horizons for production planning or scheduling across the entire shopfloor or production lines. This theory proposes to delay the consideration of uncertainties related to finite-element cyber-physical holons at the current spatiotemporal widow to the next widow. This ensures that decision models of the holons at the current spatiotemporal widow are deterministic and simple, and their dependencies with the next spatiotemporal widow are fully established by cyber-physical visibility & traceability analytics. The theory seeks to maximize the value and minimize the loss of postponing uncertainties.

The third breakthrough is "Spatiotemporal Analytics for Synchronization (SAS)." Production planning, scheduling and execution have been widely researched and solutions have been commercially available through enterprise resource planning (ERP) and manufacturing execution systems. However, underlining methods and theories suffer from uncertainties and NP-hardness, and they seldom use cyber-physical visibility and traceability of Industry 4.0 factories. Data-driven mechanisms would be investigated for cyber-physical synchronization, holonic synchronization and spatiotemporal synchronization. Not only punctuality but also simultaneity will be considered and built into decision models for cyber-physical factory planning, scheduling and execution.

Both dimensions complement with each other and together they govern what and how Industry 4.0 manufacturing systems are realized and operated.

SPEAKER BIO

Dr George Q. Huang is Chair Professor and Head of Department in Department of Industrial and Manufacturing Systems Engineering, The University of Hong Kong. He gained his BEng and PhD in Mechanical Engineering from Southeast University (China) and Cardiff University (UK) respectively. He has conducted research projects in the field of Physical Internet for Manufacturing, Logistics and Construction with substantial government and industrial grants exceeding HK$50M. He has published extensively including over three hundred refereed articles in journals and conferences in addition to ten monographs, edited reference books and conference proceedings. He is among "Top 1% Most Cited Scholar" in the relevant field. He serves as associate editors and editorial members for several international journals. He is a Chartered Engineer (CEng), a fellow of ASME, HKIE, IET and CILT, and member of IIE and HKLA.

Plenary Friday, June 5, 2020

From Condition Monitoring to Predictive Maintenance: the role of Edge Processing

Nunzio Abbate
Senior Director of the System Lab DU/SRA
STMicroelectronics

ABSTRACT

Condition-based Monitoring (CbM) and Predictive Maintenance (PM) are two maintenance strategies which aim at optimizing equipment efficiency and reducing service timing and costs during equipment lifecycle.

Condition Monitoring (CM) , in example in the industrial motors, is the monitoring of several parameters such as equipment vibration and temperature to identify potential issues such as misalignments or bearing failures.

Predictive maintenance (PdM) is a key component of smart industry that involves monitoring equipment during operation to detect early the warning signs of potential failures.

PdM is largely based on condition based monitoring (CbM) through the analysis of vibration, which is the most common method to detect imbalance, misalignment and other anomalies in machinery.

Traditional vibration sensing instruments are based on piezoelectric technology, but capacitive MEMS technology is gaining popularity in this field for various reasons involving flexibility and cost, and the fact that MEMS sensors are closing the gap to piezoelectric sensors in terms of bandwidth and dynamic range.

From designing smart sensor nodes and configuring embedded software running in sensor nodes (Edge) and the gateway, to developing software to be integrated in the Cloud or company Enterprise Resource Planning (ERP) system, Predictive Maintenance requires a variety of skills and competencies.

Machine Learning and Artificial Intelligence algorithms could be implemented too to ensure technical abnormalities are detected early and equipment uptime is maximized.

Both dimensions complement with each other and together they govern what and how Industry 4.0 manufacturing systems are realized and operated.

SPEAKER BIO

Nunzio Abbate is Senior Director of the System Lab DU/SRA in STMicroelectronics.

Abbate began his career in Alfa Romeo (FCA) as production engineer.

In STMicroelectronics since 1999, after a short time, he takes the lead of Product Engineering in Microcontrollers Division.

In 2005 he was appointed responsible for Automation, Robotics and Transportation solutions of System Lab Department, addressing System R&D on Industrial Automation.

In this role, he leads development of "turn-key system solutions" for Industrial Automation & eMobility, and coordinates Company programs on Electric Vehicles and Power Modules / Mechatronic & SiP products.

In 2013 he was appointed System LAB & SPG General Manager, contributing to the definition of products and the growth of ST's business in power technologies, mechatronic systems, RF modules, MEMS applications and devices as ST iNEMO™, STEVALs & "STM32 X-Nucleo" fast prototyping ecosystem.

He was accountable also for automated road-tolling, asset tracking, RF & "Predictive Maintenance" Businesses.

Abbate has also established close collaborations with WW R&D centers and activated co-design Partnership with ST Key Customers.

He held industrial patents in Europe and the United States and is co-author of several scientific publications on Robotics, Industrial Automation, Human-Machine Interaction and Automobile.

He was Chairman of the Manufacturing & Robotics Working Group of the European Platform on Smart Systems EPOSS and one delegate for Italy at World Micromachine Summit.

From 2019 he is a member of Board of Directors and Vice President of Italian MiSE "Competence Center" ARTES 4.0.

Nunzio Abbate was born in 1969 in Catania, where he graduated in Electronic Engineering in 1995.

MetroInd4.0&IoT 2020 Tracks and Special Sessions

TRACK 1- Key Enabling Measurement and Instrumentation Technologies

Special Session on Measurements and Virtual Measurements for Industry 4.0: Approaches and Solutions for Smart Manufacturing

Organized by: Giulio D'Emilia, *University of L'Aquila, Italy*, Antonella Gaspari, *University of L'Aquila, Italy*, Emanuela Natale, *University of L'Aquila, Italy*

Special Session on Cybersecurity Standards and Technologies for IoT and Industry 4.0 (Securitystandards)

Organized by: Alan Oliveira de Sá, *Admiral Wandenkolk Instruction Center, Brazil*, Lucila Maria de Souza Bento, *Inmetro, Brazil*

Special Session on Large-scale Traceability of Digital MEMS Sensor: Statistical Methods and in-line Control Systems

Organized by: Alessandro Schiavi, *INRIM, Italy*, Francesca Romana Pennecchi, *INRIM, Italy*, Andrea Prato, *INRIM, Italy*

Special Session on Advanced Measurement Systems for Safety and Security

Organized by: Enza Panzardi, *University of Siena, Italy*, Alessandro Pozzebon, *University of Siena, Italy* , Marco Mugnaini, *University of Siena, Italy*, Emilio Sardini, *University of Brescia, Italy*

Special Session on Sensors for Collaborative Robotics in Industry and Healthcare 4.0

Organized by: Luca Massari, *Scuola Superiore Sant'Anna, Italy*, Domenico Camboni, *University of Pisa, Italy*, Federico Bianchi, *Scuola Superiore Sant'Anna, Italy*

Special Session on The Industry 4.0 Paradigm for Energy Efficiency: Measurements, Techniques, Methodologies, Strategies and Requirements

Organized by: Fabio Leccese, *Roma Tre University, Italy*, Emanuele Piuzzi, *Sapienza University of Rome, Italy*, Luca Podestà, *Sapienza University of Rome, Italy*, Silvia Sangiovanni, *Sapienza University of Rome, Italy*

TRACK 2 - Measurement Methods for Industry 4.0 and IoT

Special Session on Electronic and Mechatronics in Industry

Organized by: Alessandro Massaro, *Dyrecta Lab srl, Italy*

Special Session on RF and Microwave Sensors and Sensor Interfaces

Organized by: Vincenzo Stornelli, *University of L'Aquila, Italy*, Giuseppe Ferri, *University of L'Aquila, Italy*

Special Session on Metrology for Data Interoperability in Industry 4.0

Organized by: Blair Hall, *Measurement Standards Laboratory, New Zealand*, Sascha Eichstädt, *Physikalisch-Technische Bundesanstal, Germany*

Special Session on Wireless Solutions for IoT Based Measurements over Wide Areas

Organized by: Emiliano Sisinni, *University of Brescia, Italy*, Diego Silva, *Federal University of Rio Grande do Norte*

Special Session on Industrial IoT Solutions for Measurement Applications

Organized by: Ivanovich Silva, *Federal University of Rio Grande do Norte,* Paolo Ferrari, *University of Brescia, Italy*

Special Session on Temperature and Vibration Measurements for Predictive Maintenance and Improved Reliability

Organized by: Marco Tarabini, *Politecnico di Milano*

Special Session on Gender-inspired Approaches to the Design of Innovative Measurement Systems and IoT Applications

Organized by: Paola Saccomandi, *Politecnico di Milano, Italy*, Cristina Emilia Costa, *Fondazione Bruno Kessler, Italy*, Monica La Mura, *University of Salerno, Italy*, Dajana Cassioli, *University of L'Aquila, Italy*

Special Session on Uncertainty Evaluation in Signal Processing for Industrial Applications

Organized by: Yuhui Luo, *National Physical Laboratory*, Liam Wright, *National Physical Laboratory*, Kavya Jagan, *National Physical Laboratory*

TRACK 3 - Biomedical, Healthcare, Wellness and Wearable Sensors and Instrumentation

Special Session on Physiological Sensors and Techniques for Monitoring Sport and Physical Activity

Organized by: Andrea Nicolò, *University of Rome "Foro Italico", Italy*, Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*

Special Session on Wearable Devices for Physiological Monitoring

Organized by: Soumyajyoti Maji, *Trinity College Dublin, Ireland*, Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*

Special Session on Fiber Optic Sensors for Industry and Healthcare 4.0

Organized by: Taesung Kim, *Sungkyunkwan University,* Daniele Tosi, *Nazarbayev University*, Emiliano Schena, *Università Campus Bio-Medico di Roma*

Special Session on Computational Sensing for IoT Industrial and Medical Applications

Organized by: Luca Vollero, *Università Campus Bio-Medico di Roma*, Samuel W. Oluwarotimi, *Shenzhen Institutes of Advanced Technology*

Special Session on Measurements and Sensors for Safety and Wellness of Workers

Organized by: Carla Fanizza, *DITSPIA, INAIL, Italy*, Maria Sabrina Sarto, *DIAEE, CNIS, Sapienza University of Rome, Italy*, Marco Di Rienzo, *IRCCS Fondazione Don Carlo Gnocchi, Italy*, Enzo Pasquale Scilingo, *University of Pisa, Italy*, Fabio Di Francesco, *University of Pisa, Italy*, Calogero Maria Oddo, *Scuola Superiore Sant'Anna, Pisa, Italy*, Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*

Papers submitted to Special Sessions that did not reach a minimum of three papers have been included in the General Sessions.

Conference Awards

Best Conference Paper Award

The Best Conference Paper Award is sponsored by **MDPI Sensors Journal**.

The award will consist of a certificate and a prize money amounting to 500 CHF.

Best Paper Presented by a Young Researcher

IEEE MetroInd4.0&IoT 2020 offers a **Best Paper Award to Young Researcher** who will present a paper during MetroInd4.0&IoT 2020.

The young researcher must be no more than 35 years old.

Best Paper Presented by a Woman

IEEE MetroInd4.0&IoT 2020 offers a **Best Paper Award for a paper authored and presented by a woman** during MetroInd4.0&IoT 2020.

Best Paper on "Sensors for Metrology and Industry 4.0"

The **IEEE Sensors Council Italy Chapter** recognizes distinguished papers submitted to MetroInd2020 through a presentation of an Award for the **Best Paper on "Sensors for Metrology and Industry 4.0"** accepted and presented to the Workshop.

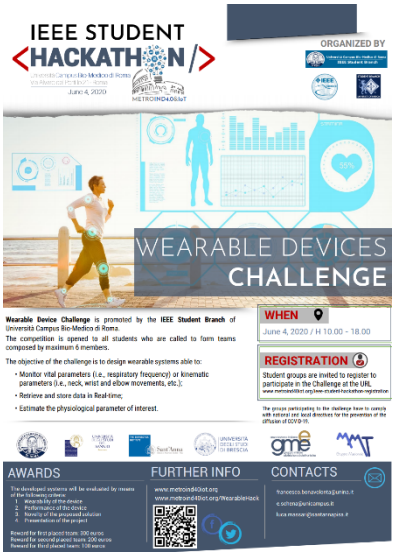
The Sensors Council Best Paper will be selected by a Committee of 5 members selected by the MetroInd2020 Award Chairs. The selection will be based on the technical quality and the review process of the initial full paper. The paper must be presented by an IEEE Student Member.

All winners will be notified during the Workshop by email and announced during the closing ceremony (June, 5). The awards winners will be also published on the MetroInd2020 website.

IEEE Student Hackathon

The **Instrumentation and Measurement (IM) Italy Chapter**, the **IEEE Sensor Council** and the **IEEE Student Branch** of Università Campus Bio-Medico di Roma, in cooperation with IEEE Student Branches of Naples and Brescia, are proud to announce the **MetroInd4.0&IoT 2020 IEEE Student Hackathon**, which will be held during the 2020 IEEE International Workshop on Metrology for Industry 4.0 & IoT (MetroInd4.0&IoT), Rome, Italy, June 3-5, 2020.

Wearable Devices Challenge



June 4, 2020

H 10:00 - 18:00

Wearable Device Challenge is promoted by the IEEE student branch of Università Campus Bio-Medico di Roma.

The competition is opened to all students who are called to form teams composed by maximum 6 members.

The objective of the challenge is to design wearable systems able to:

- Monitor vital parameters (i.e., respiratory frequency) or kinematic parameters (i.e., neck, wrist and elbow movements, etc.);
- Retrieve and store data in Real-time;
- Estimate the physiological parameter of interest

Patronages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Program Schedule - June 3, 2020

WEDNESDAY, JUNE 3, 2020			
09:15 - 09:30	**OPENING SESSION - WELCOME ADDRESSES**		
09:30 - 10:20	**INVITED TALK** - Domenico Formica, *Università Campus Bio-Medico di Roma, Italy* **Technologies 4.0 for biomedical applications in everyday life scenarios**		
	VIRTUAL HALL #1	VIRTUAL HALL #2	VIRTUAL HALL #3
10:30 - 11:50	**SESSION 1.1** Advanced Measurement Systems for Safety and Security PART I	**SESSION 2.1** Industrial IoT Solutions for Measurement Applications PART I	**SESSION 3.1** Physiological Sensors and Techniques for Monitoring Sport and Physical Activity - PART I
11:50 - 13:10	**SESSION 1.2** Measurements and Virtual Measurements for Industry 4.0: Approaches and Solutions for Smart Manufacturing PART I	**SESSION 2.2** Uncertainty Evaluation in Signal Processing for Industrial Applications PART I	**SESSION 3.2** Physiological Sensors and Techniques for Monitoring Sport and Physical Activity - PART II
14:30 - 16:10	**SESSION 1.3** Advanced Measurement Systems for Safety and Security PART II	**SESSION 2.3** Temperature and Vibration Measurements for Predictive Maintenance and Improved Reliability	**SESSION 3.3** Measurements and Sensors for Safety and Wellness of Workers
16:10 - 18:10	**SESSION 1.4** RF and Microwave Sensors and Sensor Interfaces	**SESSION 2.4** Industrial IoT Solutions for Measurement Applications PART II	**SESSION 3.4** Fiber Optic Sensors for Industry and Healthcare 4.0

Program Schedule - June 4, 2020

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Gender-inspired Approaches to the Design of Innovative Measurement Systems and IoT Applications</td><td>SESSION 3.5
Computational Sensing for IoT Industrial and Medical Applications
PART I</td><td rowspan="4">IEEE STUDENT HACKATHON

Wearable Devices Challenge</td></tr>
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Program Schedule - June 5, 2020

FRIDAY, JUNE 5, 2020			
09:00 - 09:50	**INVITED TALK** - Nunzio Abbate, *Senior Director of the System Lab DU/SRA in STMicroelectronics* **From Condition Monitoring to Predictive Maintenance: the role of Edge Processing**		
	VIRTUAL HALL #1	VIRTUAL HALL #2	VIRTUAL HALL #3
10:00 - 11:40	**SESSION 1.8** Large-scale Traceability of Digital MEMS Sensor: Statistical Methods and in-line Control Systems	**SESSSION 2.8** Electronic and Mechatronics in Industry	**SESSION 3.8** Computational Sensing for IoT Industrial and Medical Applications PART II
11:40 - 13:00	**SESSION 1.9** GENERAL SESSION PART III	**SESSION 2.9** Uncertainty Evaluation in Signal Processing for Industrial Applications PART II	**SESSION 3.9** GENERAL SESSION PART IV
14:30 - 16:10	**SESSION 1.10** The Industry 4.0 Paradigm for Energy Efficiency: Measurements, Techniques, Methodologies, Strategies and Requirements	**SESSION 2.10** Wireless Solutions for IoT Based Measurements over Wide Areas	**SESSION 3.10** Wearable Devices for Physiological Monitoring
16:30 - 17:00	**CLOSING AND AWARD CEREMONY**		

Technical Sessions - Wednesday, June 3

09:15 - 09:30
OPENING SESSION – WELCOME ADDRESSES
Room: Virtual Room #1

09:30 - 10:20
PLENARY SESSION
Room: Virtual Room #1
Chair: Emilio Sardini, *University of Brescia, Italy*

Technologies 4.0 for biomedical applications in everyday life scenarios
Domenico Formica, *Università Campus Bio-Medico di Roma, Italy*

10:30 - 11:50
SESSION 1.1
SPECIAL SESSION: Advanced Measurement Systems for Safety and Security – Part I
Room: Virtual Room #1
Chairs: Enza Panzardi, *University of Siena, Italy*
Marco Mugnaini, *University of Siena, Italy*

10:30 An Automatic Battery Recharge and Condition Monitoring System for Autonomous Drones
Tommaso Addabbo, *University of Siena, Italy*
Stefano De Muro, *Rete Ferroviaria Italiana S.p.A., Italy*
Giacomo Falaschi, *Rete Ferroviaria Italiana S.p.A., Italy*
Ada Fort, *University of Siena, Italy*
Elia Landi, *University of Siena, Italy*

Riccardo Moretti, *University of Siena, Italy*
Marco Mugnaini, *University of Siena, Italy*
Francesco Nicolelli, *University of Siena, Italy*
Lorenzo Parri, *University of Siena, Italy*
Marco Tani, *University of Siena, Italy*
Marco Tesei, *Rete Ferroviaria Italiana S.p.A., Italy*
Valerio Vignoli, *University of Siena, Italy*

10:50 A New Class of Chaotic Sources in Programmable Logic Devices

Tommaso Addabbo, *University of Siena, Italy*
Ada Fort, *University of Siena, Italy*
Riccardo Moretti, *University of Siena, Italy*
Marco Mugnaini, *University of Siena, Italy*
Hadis Takaloo, *University of Siena, Italy*
Valerio Vignoli, *University of Siena, Italy*

11:10 A Characterization System for Bearing Condition Monitoring Sensors, a Case Study with a Low Power Wireless Triaxial MEMS Based Sensor

Tommaso Addabbo, *University of Siena, Italy*
Ada Fort, *University of Siena, Italy*
Elia Landi, *University of Siena, Italy*
Riccardo Moretti, *University of Siena, Italy*
Marco Mugnaini, *University of Siena, Italy*
Lorenzo Parri, *University of Siena, Italy*
Valerio Vignoli, *University of Siena, Italy*

11:30 Design of a robotic platform for landmine detection based on Industry 4.0 paradigm with data sensors integration

Luca Bossi, *Università degli Studi di Firenze, Italy*
Pierluigi Falorni, *Università degli Studi di Firenze, Italy*
Gennadiy Pochanin, *National Academy of Sciences of Ukraine, Ukraine*
Timothy Bechtel, *Franklin and Marshall College, USA*
Jack Sinton, *Franklin and Marshall College, USA*
Fronefield Crawford, *Franklin and Marshall College, USA*
Tetiana Ogurtsova, *National Academy of Sciences of Ukraine, Ukraine*
Vadym Ruban, *National Academy of Sciences of Ukraine, Ukraine*
Lorenzo Capineri, *Università degli Studi di Firenze, Italy*

10:30 - 11:50
SESSION 2.1
SPECIAL SESSION: Industrial IoT Solutions for Measurement Applications - Part I
Room: Virtual Room #2
Chairs: Ivanovich Silva, *Federal University of Rio Grande do Norte, Brazil*
Paolo Ferrari, *University of Brescia, Italy*

10:30 Systems for an intelligent application of Automated Processes in industry: a case study from "PMI IoT Industry 4.0" project
Alessandro Massaro, *Dyrecta Lab srl, Italy*
Giuseppe Mastandrea, *Energy@Work, Italy*
Luigi D'Oriano, *Energy@Work, Italy*
Giuseppe Rocco Rana, *Energy@Work, Italy*
Nicola Savino, *Dyrecta Lab srl, Italy*
Angelo Galiano, *Dyrecta Lab srl, Italy*

10:50 Fault Classification Driven by Maintenance Management for Smart Maintenance Applications
Roberto Bodo, *Università degli Studi di Padova, Italy*
Matteo Bertocco, *Università degli Studi di Padova, Italy*
Alberto Bianchi, *Carel Industries SpA, Italy*

11:10 A Cloud-Oriented Measurement System for Radiological Investigation and Traceability of Stones
Massimiliano Donati, *University of Pisa, Italy*
Marco Marini, *University of Pisa, Italy*
Luca Fanucci, *University of Pisa, Italy*
Erica Fanchini, *CAEN S.p.A., Italy*
Massimo Morichi, *CAEN S.p.A., Italy*

11:30 An IoT condition monitoring system for resilience based on spectral analysis of vibration
Giovanni Bucci, *University of L'Aquila, Italy*
Andrea Fioravanti, *University of L'Aquila, Italy*
Fabrizio Ciancetta, *University of L'Aquila, Italy*
Alberto Prudenzi, *University of L'Aquila, Italy*
Edoardo Fiorucci, *University of L'Aquila, Italy*
Simone Mari, *University of L'Aquila, Italy*

10:30 - 11:50

SESSION 3.1

SPECIAL SESSION: Physiological Sensors and Techniques for Monitoring Sport and Physical Activity - Part I

Room: Virtual Room #3

Chairs: Andrea Nicolò, *University of Rome "Foro Italico", Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*

10:30 A wearable system for respiratory and pace monitoring in running activities: a feasibility study

Joshua Di Tocco, *Università Campus Bio-Medico di Roma, Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Luigi Raiano, *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*

10:50 Respiratory monitoring during cycling exercise: performance assessment of a smart t-shirt embedding fiber optic sensors

Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Andrea Nicolò, *University of Rome "Foro Italico", Italy*
Daniela Lo Presti, *Università Campus Bio-Medico di Roma, Italy*
Massimo Sacchetti, *University of Rome "Foro Italico", Italy*
Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*

11:10 Optoelectronic plethysmography derived breathing parameters can differ between athletes with and without a dysfunctional breathing pattern during exercise

Carol M.E. Smyth, *University of Kent, UK*
Samantha L. Winter, *University of Kent, UK*
John W. Dickinson, *University of Kent, UK*

11:30 Augmented Reality App to improve quality of life of people with cognitive and sensory disabilities

Mirko Rossi, *Sapienza University of Rome, Italy*
Giuseppe D'Avenio, *Istituto Superiore di Sanità, Italy*
Sandra Morelli, *Istituto Superiore di Sanità, Italy*
Mauro Grigioni, *Istituto Superiore di Sanità, Italy*

11:50 - 13:10

SESSION 1.2

SPECIAL SESSION: Measurements and Virtual Measurements for Industry 4.0: Approaches and Solutions for Smart Manufacturing – Part I

Room: Virtual Room #1

Chairs: Giulio D'Emilia, *University of L'Aquila, Italy*
Antonella Gaspari, *University of L'Aquila, Italy*
Emanuela Natale, *University of L'Aquila, Italy*

11:50 Use of internal sensors for the identification of wear conditions in automatic machines

Giulio D'Emilia, *University of L'Aquila, Italy*
Antonella Gaspari, *University of L'Aquila, Italy*
Emanuela Natale, *University of L'Aquila, Italy*
Giuliano Dionisi, *University of L'Aquila, Italy*

12:10 Comparative Cost and Benefit Analysis of TCal and Classical Calibration

Sasho Andonov, *Ss. Cyril and Methodius University, North Macedonia*
Marija Cundeva-Blajer, *Ss. Cyril and Methodius University, North Macedonia*

12:30 Prediction of the remaining useful life of mechatronic systems using internal sensors

Giulio D'Emilia, *University of L'Aquila, Italy*
Antonella Gaspari, *University of L'Aquila, Italy*
Daniele Lancione, *University of L'Aquila, Italy*
Emanuela Natale, *University of L'Aquila, Italy*

12:50 A Sensor System for Non-Destructive Monitoring of Food Ripening Processes

Alessandro Zompanti, *Campus Bio-Medico University of Rome, Italy*
Simone Grasso, *Campus Bio-Medico University of Rome, Italy*
Marco Santonico, *Campus Bio-Medico University of Rome, Italy*
Giorgio Pennazza, *Campus Bio-Medico University of Rome, Italy*

11:50 - 13:10

SESSION 2.2

SPECIAL SESSION: Uncertainty Evaluation in Signal Processing for Industrial Applications - Part I

Room: Virtual Room #2

Chairs: Yuhui Luo, *National Physical Laboratory, UK*
Liam Wright, *National Physical Laboratory, UK*
Kavya Jagan, *National Physical Laboratory, UK*

11:50 Uncertainty Evaluation for Metrologically Redundant Industrial Sensor Networks
Gertjan Kok, *Unit Flow VSL, the Netherlands*
Peter Harris, *National Physical Laboratory, United Kingdom*

12:10 A Bayesian approach to account for timing effects in industrial sensor networks
Kavya Jagan, *National Physical Laboratory, United Kingdom*
Liam Wright, *National Physical Laboratory, United Kingdom*
Peter Harris, *National Physical Laboratory, United Kingdom*

12:30 Uncertainty in Data Analysis for STRATH Testbed
Yuhui Luo, *National Physical Laboratory, United Kingdom*
Peter Harris, *National Physical Laboratory, United Kingdom*

12:50 Uncertainty of the Classification Result from a Linear Discriminant Analysis
Yuhui Luo, *National Physical Laboratory, United Kingdom*

11:50 - 13:10

SESSION 3.2

SPECIAL SESSION: Physiological Sensors and Techniques for Monitoring Sport and Physical Activity - Part II

Room: Virtual Room #3

Chairs: Andrea Nicolò, *University of Rome "Foro Italico", Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*

11:50 Wearable stretchable sensor based on conductive textile fabric for shoulder motion monitoring

Arianna Carnevale, *Università Campus Bio-Medico di Roma, Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Daniela Lo Presti, *Università Campus Bio-Medico di Roma, Italy*
Domenico Formica, *Università Campus Bio-Medico di Roma, Italy*
Umile Giuseppe Longo, *Università Campus Bio-Medico di Roma, Italy*
Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*
Vincenzo Denaro, *Università Campus Bio-Medico di Roma, Italy*

12:10 Performance assessment in clay pigeon shooting using machine vision for gaze detection

Massimiliano Micheli, *University of Brescia, Italy*
Stefano Massardi, *University of Brescia, Italy*
Stefano Morzenti, *Fabbrica d'Armi P. Beretta S.p.A.*
Simone Pasinetti, *University of Brescia, Italy*
Cristina Briamonte, *Sapienza University, Italy*
Matteo Lancini, *University of Brescia, Italy*

12:30 A preliminary approach for swimming performance analysis of FISDIR elite athletes with intellectual impairment using an inertial sensor

Teodorico Caporaso, *University of Naples Federico II, Italy*
Matthew Worsey, *Griffith University, Australia*
Hugo G. Espinosa, *Griffith University, Australia*
David V. Thiel, *Griffith University, Australia*
Angela Palomba, *University of Campania Luigi Vanvitelli, Italy*
Stanislao Grazioso, *University of Naples Federico II, Italy*
Dario Panariello, *University of Naples Federico II, Italy*
Giuseppe Di Gironimo, *University of Naples Federico II, Italy*
Antonio Lanzotti, *University of Naples Federico II, Italy*

12:50 Assessment of running training sessions using IMU sensors: evaluation of existing parameters and choice of new indicators

Emanuele Portuese, *Università Campus Bio-Medico di Roma, Italy*
Silvia Buscaglione, *Integris S.p.A, Italy*
Domenico Formica, *Università Campus Bio-Medico di Roma, Italy*
Davide Lanaro, *Integris S.p.A, Italy*

14:30 - 16:10

SESSION 1.3

SPECIAL SESSION: Advanced Measurement Systems for Safety and Security – Part II

Room: Virtual Room #1

Chairs: Alessandro Pozzebon, *University of Siena, Italy*
Marco Mugnaini, *University of Siena, Italy*

14:30 Sensors and Algorithm Evaluation for Tripwire Detection in the Landmine Detection 4.0 Project

Jonathon Sinton, *Franklin and Marshall College, USA*
Timothy D. Bechtel, *Franklin and Marshall College, USA*
Fronefield Crawford, *Franklin and Marshall College, USA*
Luca Bossi, *University of Florence, Italy*
Lorenzo Capineri, *University of Florence, Italy*
Pierluigi Falorni, *University of Florence, Italy*
Gabriella Sallai, *Franklin and Marshall College, USA*
Anastasia Kuske, *Franklin and Marshall College, USA*

14:50 Interoperability among Sub-GHz Technologies for Metallic Assets Tracking and Monitoring

Gabriele Di Renzone, *University of Siena, Italy*
Ada Fort, *University of Siena, Italy*
Marco Mugnaini, *University of Siena, Italy*
Stefano Parrino, *University of Siena, Italy*
Giacomo Peruzzi, *University of Siena, Italy*
Alessandro Pozzebon, *University of Siena, Italy*

15:10 Low-cost, robust gravimetric system for enhanced security of accesses to public places

Tommaso Addabbo, *University of Siena, Italy*
Ada Fort, *University of Siena, Italy*
Marco Mugnaini, *University of Siena, Italy*
Valerio Vignoli, *University of Siena, Italy*
Matteo Intravaia, *University of Siena, Italy*
Marco Tani, *University of Siena, Italy*
Stefano De Muro, *Rete Ferroviaria Italiana S.p.A., Italy*
Marco Tesei, *Rete Ferroviaria Italiana S.p.A., Italy*

15:30 Virtual Sensors: a Tool to Improve Reliability

Loredana Cristaldi, *Politecnico di Milano, Italy*
Alessandro Ferrero, *Politecnico di Milano, Italy*
Marco Macchi, *Politecnico di Milano, Italy*
Amirabbas Mehrafshan, *Politecnico di Milano, Italy*
Pasquale Arpaia, *University of Naples Federico II, Italy*

15:50 RADON Project: From Children's Game To Intelligent Personal Dosimeter

Alessandra Scarcelli, *Politecnico di Bari, Italy*
Roberta Borzone, *Politecnico di Bari, Italy*
Flavia Esposito, *Politecnico di Bari, Italy*
Patrizia Camassa, *Politecnico di Bari, Italy*
Michele Di Gioia, *Politecnico di Bari, Italy*
Cristoforo Marzocca, *Politecnico di Bari, Italy*
Maria Rizzi, *Politecnico di Bari, Italy*
Michele Terlizzi, *Politecnico di Bari, Italy*
Mario Ricci, *Softcode, Italy*
Alberto Amato, *Politecnico di Bari, Italy*
Antonella Giove, *Politecnico di Bari, Italy*
Rita Dario, AOU, *Policlinico Giovanni XXIII, Italy*
Marina Popolizio, *Politecnico di Bari, Italy*
Tiziano Politi, *Politecnico di Bari, Italy*
Vincenzo Di Lecce, *Politecnico di Bari, Italy*

14:30 - 15:50

SESSION 2.3

SPECIAL SESSION: Temperature and Vibration Measurements for Predictive Maintenance and Improved Reliability

Room: Virtual Room #2

Chair: Marco Tarabini, *Politecnico di Milano, Italy*

14:30 Sensor Nodes for Continuous Monitoring of Structures Through Accelerometric Measurements

Federico Zanelli, *Politecnico di Milano, Italy*
Marco Mauri, *Politecnico di Milano, Italy*
Francesco Castelli-Dezza, *Politecnico di Milano, Italy*

Maria Laura Bacci, *Politecnico di Milano, Italy*
Davide Tarsitano, *Politecnico di Milano, Italy*
Giorgio Diana, *Politecnico di Milano, Italy*

14:50 SAW Sensors Directly Integrated onto Industrial Metallic Parts for Manufacturing 4.0

Prince Mengue, *Université de Lorraine - CNRS, France*
Sami Hage-Ali, *Université de Lorraine - CNRS, France*
Omar Elmazria, *Université de Lorraine - CNRS, France*
Sergei Zhgoon, *National Research University "MPEI", Russia*

15:10 Prototyping and Metrological Characterization of a Data Acquisition and Processing System Based on Edge Computing

Giuseppe Lorenzini, *Politecnico di Milano, Italy*
Diego Scaccabarozzi, *Politecnico di Milano, Italy*
Fabio Conti, *One-Off Solution - Automation Software Services, Italy*
Manuel Roveri, *Politecnico di Milano, Italy*
Giovanni Raffaele Maria Parenti, *Politecnico di Milano, Italy*
Marco Tarabini, *Politecnico di Milano, Italy*

15:30 Online Fault Detection: a Smart Approach for Industry 4.0

Mariorosario Prist, *Università Politecnica delle Marche, Italy*
Andrea Monteriù, *Università Politecnica delle Marche, Italy*
Alessandro Freddi, *Università Politecnica delle Marche, Italy*
Paolo Cicconi, *Università Politecnica delle Marche, Italy*
Federico Giuggioloni, *Syncode S.c.ar.l., Italy*
Eduard Caizer, *Syncode S.c.ar.l., Italy*
Carlo Verdini, *Syncode S.c.ar.l., Italy*
Sauro Longhi, *Università Politecnica delle Marche, Italy*

14:30 - 15:50

SESSION 3.3

SPECIAL SESSION: Measurements and Sensors for Safety and Wellness of Workers

Room: Virtual Room #3

Chairs: Carla Fanizza, *DITSPIA, INAIL, Italy*
Maria Sabrina Sarto, *DIAEE, CNIS, Sapienza University of Rome, Italy*
Marco Di Rienzo, *IRCCS Fondazione Don Carlo Gnocchi, Italy*
Enzo Pasquale Scilingo, *University of Pisa, Italy*
Fabio Di Francesco, *University of Pisa, Italy*
Calogero Maria Oddo, *Scuola Superiore Sant'Anna, Pisa, Italy*
Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*

14:30 Ultrasound exposure in a workplace and a potential way to improve its measurement methodology

Michal Cieslak, *Physikalisch-Technische Bundesanstalt, Germany*
Christoph Kling, *Physikalisch-Technische Bundesanstalt, Germany*
Andrea Wolff, *Institut für Arbeitsschutz der Deutschen Gesetzlichen Unfallversicherung, Germany*

14:50 Multiphysics Modeling of a Wearable Sensor for Sweat Rate Measurements

Jorge Prada, *University of Pisa, Italy*
Federico Vivaldi, *University of Pisa, Italy*
Andrea Bonini, *University of Pisa, Italy*
Antonio Lanata, *University of Florence, Italy*
Emilio Franchi, *R.i.CO.srl, Italy*
Fabio Di Francesco, *University of Pisa, Italy*

15:10 A Test Bench to Assess Systems for Respiratory Monitoring of Workers

Martina Zaltieri, *Università Campus Bio-Medico di Roma, Italy*
Joshua Di Tocco, *Università Campus Bio-Medico di Roma, Italy*
Daniela Lo Presti, *Università Campus Bio-Medico di Roma, Italy*
Carlo Massaroni, *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*
Giacomo D'Alesio, *Scuola Superiore Sant'Anna, Italy*
Mariangela Filosa, *Scuola Superiore Sant'Anna, Italy*
Jessica D'Abbraccio, *Scuola Superiore Sant'Anna, Italy*

Ilaria Cesini, *Scuola Superiore Sant'Anna, Italy*
Luca Massari, *Scuola Superiore Sant'Anna, Italy*
Calogero Maria Oddo, *Scuola Superiore Sant'Anna, Italy*
Marco Di Rienzo, *IRCSS Fondazione Don Carlo Gnocchi, Italy*
Maurizio Ferrarin, *IRCSS Fondazione Don Carlo Gnocchi, Italy*
Michele Arturo Caponero, *ENEA Research Center of Frascati, Italy*
Maria Sabrina Sarto, *La Sapienza Università di Roma, Italy*

15:30 A New Smart-Fabric based Body Area Sensor Network for Work Risk Assessment

Antonio Lanata, *University of Florence, Italy*
Alberto Greco, *University of Pisa, Italy*
Stefano Di Modica, *University of Pisa, Italy*
Francesco Niccolini, *University of Pisa, Italy*
Federico Vivaldi, *University of Pisa, Italy*
Fabio Di Francesco, *University of Pisa, Italy*
Christian Tamantini, *Università Campus Bio-Medico di Roma, Italy*
Francesca Cordella, *Università Campus Bio-Medico di Roma, Italy*
Loredana Zollo, *Università Campus Bio-Medico di Roma, Italy*
Marco Di Rienzo, *IRCCS Fond. Don C. Gnocchi, Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*
Mariasabrina di Sarto, *Sapienza University of Rome, Italy*
Enzo Pasquale Scilingo, *University of Pisa, Italy*

16:10 - 18:10

SESSION 1.4

SPECIAL SESSION: RF and Microwave sensors and sensor interfaces

Room: Virtual Room #1

Chairs: Vincenzo Stornelli, *University of L'Aquila, Italy*
Giuseppe Ferri, *University of L'Aquila, Italy*

16:10 A Low Cost and Flexible Power Line Communication Sensory System for Home Automation

Mirco Muttillo, *University of L'Aquila, Italy*
Vittoriano Muttillo, *University of L'Aquila, Italy*
Luigi Pomante, *University of L'Aquila, Italy*
Leonardo Pantoli, *University of L'Aquila, Italy*

16:30 Towards the Design of Microcontroller Based Embedded Sensory systems with a Five-Parameter Single Diode Estimation Method for Photovoltaic Panels

Mirco Muttillo, *University of L'Aquila, Italy*
Vittoriano Muttillo, *University of L'Aquila, Italy*
Tullio de Rubeis, *University of L'Aquila, Italy*

16:50 RFID interface for compact pliable EMG wireless epidermal sensor

Carolina Miozzi, *University of Roma Tor Vergata, Italy*
Vito Errico, *University of Roma Tor Vergata, Italy*
Gaetano Marrocco, *University of Roma Tor Vergata, Italy*
Emanuele Gruppioni, *Centro Protesi Inail, Italy*
Giovanni Saggio, *University of Roma Tor Vergata, Italy*

17:10 Modular QMB sensors array for E-health applications

Alessandro Zompanti, *University Campus Bio-Medico di Roma, Italy*
Anna Sabatini, *University Campus Bio-Medico di Roma, Italy*
Valeria Cesarò, *University Campus Bio-Medico di Roma, Italy*
Simone Grasso, *University Campus Bio-Medico di Roma, Italy*
Giorgio Pennazza, *University Campus Bio-Medico di Roma, Italy*
Marco Santonico, *University Campus Bio-Medico di Roma, Italy*
Arnaldo D'Amico, *University of Roma Tor Vergata, Italy*

17:30 Empowering Blind People Mobility: a Millimeter- Wave Radar Cane

Emanuele Cardillo, *University of Messina, Italy*
Changzhi Li, *Texas Tech University, USA*
Alina Caddemi, *University of Messina, Italy*

17:50 Active Filter and RFID Based Identifier for Heartbeat Monitoring

Alfiero Leoni, *University of L'Aquila, Italy*
Iolanda Ulisse, *University of L'Aquila, Italy*

16:10 - 17:50

SESSION 2.4

SPECIAL SESSION: Industrial IoT Solutions for Measurement Applications – Part II

Room: Virtual Room #2

Chairs: Ivanovich Silva, *Federal University of Rio Grande do Norte, Brazil*
Paolo Ferrari, *University of Brescia, Italy*

16:10 Evaluation of the impact on industrial applications of NTP used by IoT devices

Paolo Ferrari, *University of Brescia, Italy*
Paolo Bellagente, *University of Brescia, Italy*
Alessandro Depari, *University of Brescia, Italy*
Alessandra Flammini, *University of Brescia, Italy*
Marco Pasetti, *University of Brescia, Italy*
Stefano Rinaldi, *University of Brescia, Italy*
Emiliano Sisinni, *University of Brescia, Italy*

16:30 Evaluating Human-Machine Translation with Attention Mechanisms for Industry 4.0 Environment SQL-Based Systems

Silvan Ferreira, *Federal University of Rio Grande do Norte (UFRN), Brazil*
Gustavo Leitão, *Federal University of Rio Grande do Norte (UFRN), Brazil*
Ivanovitch Silva, *Federal University of Rio Grande do Norte (UFRN), Brazil*
Allan Martins, *Federal University of Rio Grande do Norte (UFRN), Brazil*
Paolo Ferrari, *University of Brescia, Italy*

16:50 Introducing a cloud based architecture for the distributed analysis of Real-Time Ethernet traffic

Afonso Celso Turcato, *Federal Institute of São Paulo, Electrical and Computing, Brazil*
Andre Luis Dias, *Federal Institute of São Paulo, Electrical and Computing, Brazil*
Guilherme Serpa Sestito, *University of São Paulo, Brazil*
Rogério Flauzino, *University of São Paulo, Brazil*
Dennis Brandão, *University of São Paulo, Brazil*
Emiliano Sisinni, *University of Brescia, Italy*
Paolo Ferrari, *University of Brescia, Italy*

17:10 Development of an Energy Meter based on IoT

Wesley W. V. Souza, *Federal University of Rio Grande do Norte, Italy*
Mohamad S. A. Ali, *Federal University of Rio Grande do Norte, Italy*
Allyson F. M. Borges, *Federal University of Rio Grande do Norte, Italy*
Josiel P. P. Oliveira, *Federal University of Rio Grande do Norte, Italy*
Diego R. C. Silva, *Federal University of Rio Grande do Norte, Italy*
Marcelo B. Nogueira, *Federal University of Rio Grande do Norte, Italy*
Marconi C. Rodrigues, *Federal University of Rio Grande do Norte, Italy*

17:30 Microservice Orchestration for Process Control in Industry 4.0

Ricardo Pontarolli, *São Paulo State University (Unesp), Brazil*
Jeferson Bigheti, *National Service of Industrial Training (Senai), Brazil*
Michel Fernandes, *São Paulo State University (Unesp), Brazil*
Felipe Domingues, *São Paulo State University (Unesp), Brazil*
Sergio Luiz Risso, *National Service of Industrial Training (Senai), Brazil*
Eduardo P. Godoy, *São Paulo State University (Unesp), Brazil*

16:10 - 18:10
SESSION 3.4
SPECIAL SESSION: Fiber Optic Sensors for Industry and Healthcare 4.0
Room: Virtual Room #3
Chairs: Taesung Kim, *Sungkyunkwan University, Republic of South Korea*
Daniele Tosi, *Nazarbayev University, Kazakhstan*
Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*

16:10 Transformation matrices for 3D shape sensing with polyimide-coated multicore optical fiber

Davide Paloschi, *Politecnico di Milano, Italy*
Sanzhar Korganbayev, *Politecnico di Milano, Italy*
Kirill Bronnikov, *Novosibirsk State University, Russia*
Alexey Wolf, *Novosibirsk State University, Russia*
Alexander Dostovalov, *Novosibirsk State University, Russia*
Paola Saccomandi, *Politecnico di Milano, Italy*

16:30 Temperature Monitoring During Microwave Thermal Ablation of Ex Vivo Bovine Bone: a Pilot Test

Francesca De Tommasi, *Università Campus Bio-Medico di Roma, Italy*
Martina Zaltieri, *Università Campus Bio-Medico di Roma, Italy*
Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Eliodoro Faiella, *Università Campus Bio-Medico di Roma, Italy*
Rosario Francesco Grasso, *Università Campus Bio-Medico di Roma, Italy*
Bruno Beomonte Zobel, *Università Campus Bio-Medico di Roma, Italy*
Elena De Vita, *University of Naples Parthenope, Italy*
Agostino Iadicicco, *University of Naples Parthenope, Italy*
Stefania Campopiano, *University of Naples Parthenope, Italy*

16:50 Optical Fiber Biosensor Based on an Etched High-Scattering Fiber: Towards Reflector-Less Biosensors

Daniele Tosi, *Nazarbayev University, Kazakhstan*
Arman Aitkulov, *Nazarbayev University, Kazakhstan*
Carlo Molardi, *Nazarbayev University, Kazakhstan*
Marzhan Sypabekova, *National Laboratory Astana, Kazakhstan*
Wilfried Blanc, *Université Côte d'Azur, France*

17:10 Laser Beam Self-Focusing in Optical Fiber controlled through FBG integration

Lorenzo Dinia, *Sapienza University of Rome, Italy*
Fabrizio Frezza, *Sapienza University of Rome, Italy*

17:30 Towards temperature-controlled laser ablation based on fiber Bragg grating array temperature measurements

Sanzhar Korganbayev, *Politecnico di Milano, Italy*
Riccardo Pini, *Politecnico di Milano, Italy*
Annalisa Orrico, *Politecnico di Milano, Italy*
Alexey Wolf, *Institute of Automation and Electrometry SB RAS, Russia*
Alexander Dostovalov, *Institute of Automation and Electrometry SB RAS, Russia*
Paola Saccomandi, *Politecnico di Milano, Italy*

17:50 A wearable system for knee flexion/extension monitoring: design and assessment

Paolo Resta, *Università Campus Bio-Medico di Roma, Italy*
Daniela Lo Presti, *Università Campus Bio-Medico di Roma, Italy*
Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Domenico Formica, *Università Campus Bio-Medico di Roma, Italy*
Taesung Kim, *Sungkyunkwan University, Republic of South Korea*
Donjoo Shin, *Sungkyunkwan University, Republic of South Korea*

Technical Sessions - Thursday, June 4

09:00 - 09:50

PLENARY SESSION

Room: Virtual Room #1

Chair: Calogero Maria Oddo, *Scuola Superiore Sant'Anna, Pisa, Italy*

In search of breakthroughs in Industry 4.0 Manufacturing Systems

George Q. Huang, *The University of Hong Kong*

10:00 - 11:40

SESSION 1.5

SPECIAL SESSION: Measurements and virtual measurements for Industry 4.0: approaches and solutions for smart manufacturing - Part II

Room: Virtual Room #1

Chairs: Giulio D'Emilia, *University of L'Aquila, Italy*
Antonella Gaspari, *University of L'Aquila, Italy*
Emanuela Natale, *University of L'Aquila, Italy*

10:00 **A Smart Spindle Component concept as a standalone measurement system for Industry 4.0 Machine Tools**

Jeremi Wojcicki, *CNR STIIMA, Italy*
Giacomo Bianchi, *CNR STIIMA, Italy*

10:20 Compensation of Temperature Effects on an Automatic System for Diameter Measurement

Valerio Marcotuli, *Politecnico di Milano, Italy*
Stefano Marelli, *Politecnico di Milano, Italy*
Renato Casartelli, *Casartelli Antonio S.r.l., Italy*
Diego Scaccabarozzi, *Politecnico di Milano, Italy*
Bortolino Saggin, *Politecnico di Milano, Italy*
Marco Tarabini, *Politecnico di Milano, Italy*

10:40 A Vision-based Measurement System for Semi-finished Cylindrical Geometries

Valerio Marcotuli, *Politecnico di Milano, Italy*
Nitin Lal, *Politecnico di Milano, Italy*
Diego Scaccabarozzi, *Politecnico di Milano, Italy*
Marco Tarabini, *Politecnico di Milano, Italy*

11:00 A flexible method to detect the fault of components in an injection group of a diecasting machine

Luca Provezza, *University of Study of Brescia, Italy*
Alberto Marini, *Italpresse Gauss, Italy*
Giovanna Sansoni, *University of Study of Brescia, Italy*
Matteo Lancini, *University of Study of Brescia, Italy*

11:20 Assessment of the measurments contribution on composites thermoforming processes: a case study of an automotive component

Antonios G. Stamopoulos, *University of L'Aquila, Italy*
Pierfrancesco Spitilli, *University of L'Aquila, Italy*
Giulio D'Emilia, *University of L'Aquila, Italy*
Antonella Gaspari, *University of L'Aquila, Italy*
Emanuela Natale, *University of L'Aquila, Italy*
Antoniomaria Di Ilio, *University of L'Aquila, Italy*

10:00 - 11:40

SESSION 2.5

SPECIAL SESSION: Gender-inspired approaches to the design of innovative measurement systems and IoT applications

Room: Virtual Room #2

Chairs: Paola Saccomandi, *Politecnico di Milano, Italy*
Cristina Emilia Costa, *Fondazione Bruno Kessler, Italy*
Monica La Mura, *University of Salerno, Italy*
Dajana Cassioli, *University of L'Aquila, Italy*

10:00 A non-invasive system for epidural space detection: comparison with Compuflo®
Riccardo Sabbadini, *Università Campus Bio-Medico di Roma, Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Joshua Di Tocco, *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*
Alessia Mattei, *Università Campus Bio-Medico di Roma, Italy*
Rita Cataldo, *Università Campus Bio-Medico di Roma, Italy*
Francesca Gargano, *Università Campus Bio-Medico di Roma, Italy*
Massimiliano Carassiti, *Università Campus Bio-Medico di Roma, Italy*

10:20 Digital Signage by Real-Time Gender Recognition From Face Images
Antonio Greco, *University of Salerno, Italy*
Alessia Saggese, *University of Salerno, Italy*
Mario Vento, *University of Salerno, Italy*

10:40 VITAL-ECG : a de-bias algorithm embedded in a gender-immune device
Annunziata Paviglianiti, *Politecnico di Torino, Italy*
Eros Pasero, *Politecnico di Torino, Italy*

11:00 Human-Machine Interaction Personalization: a Review on Gender and Emotion Recognition Through Speech Analysis
Monica La Mura, *University of Salerno, Italy*
Patrizia Lamberti, *University of Salerno, Italy*

11:20 Is Really IoT Technology Gender Neutral?

Dajana Cassioli, *University of L'Aquila, Italy*
Antinisca Di Marco, *University of L'Aquila, Italy*
Tania Di Mascio, *University of L'Aquila, Italy*
Laura Tarantino, *University of L'Aquila, Italy*
Paola Inverardi, *University of L'Aquila, Italy*

10:00 - 11:40

SESSION 3.5

SPECIAL SESSION: Computational sensing for IoT industrial and medical applications - Part I

Room: Virtual Room #3

Chairs: Luca Vollero, *Università Campus Bio-Medico di Roma, Italy*
Samuel W. Oluwarotimi, *Shenzhen Institutes of Advanced Technology, China*

10:00 AWC C. elegans neuron: a biological sensor model

Martina Nicoletti, *Campus Bio-Medico University of Rome, Italy*
Alessandro Loppini, *Campus Bio-Medico University of Rome, Italy*
Letizia Chiodo, *Campus Bio-Medico University of Rome, Italy*
Viola Folli, *CLNS@Sapienza, Istituto Italiano di Tecnologia, Italy*
Giancarlo Ruocco, *CLNS@Sapienza, Istituto Italiano di Tecnologia, Italy*
Simonetta Filippi, *Campus Bio-Medico University of Rome, Italy*

10:20 Optical CO2 detectors for smart packaging of food in modified atmosphere

Simone Grasso, *Campus Bio-Medico University of Rome, Italy*
Alessandro Zompanti, *Campus Bio-Medico University of Rome, Italy*
Anna Sabatini, *Campus Bio-Medico University of Rome, Italy*
Ilaria Pazzaglia, *Campus Bio-Medico University of Rome, Italy*
Marco Santonico, *Campus Bio-Medico University of Rome, Italy*
Giorgio Pennazza, *Campus Bio-Medico University of Rome, Italy*

10:40 Chinese Sign Language Alphabet Recognition Based On Random Forest Algorithm

Simin Yuan, *Chinese Academy of Sciences, China*
Yuan Wang, *Chinese Academy of Sciences, China*
Xin Wang, *Chinese Academy of Sciences, China*
Hanjie Deng, *Chinese Academy of Sciences, China*

Shurui Sun, *Chinese Academy of Sciences, China*
Hui Wang, *Chinese Academy of Sciences, China*
Pingao Huang, *Chinese Academy of Sciences, China*
Guanglin Li, *Chinese Academy of Sciences, China*

11:00 The Effects of Electrode Locations on Silent Speech Recognition using High-density sEMG

Mingxing Zhu, *Chinese Academy of Sciences, China*
Xiaochen Wang, *Chinese Academy of Sciences, China*
Xin Wang, *Chinese Academy of Sciences, China*
Cheng Wang, *Chinese Academy of Sciences, China*
Zijian Yang, *Chinese Academy of Sciences, China*
Oluwarotimi Williams Samuel, *Chinese Academy of Sciences, China*
Shixiong Chen, *Chinese Academy of Sciences, China*
Guanglin Li, *Chinese Academy of Sciences, China*

11:20 A Pilot Study on Auditory Brainstem Response Evoked with Randomized Stimulation Rate

Xin Wang, *Chinese Academy of Sciences, China*
Mingxing Zhu, *Chinese Academy of Sciences, China*
Xiaochen Wang, *Chinese Academy of Sciences, China*
Shuting Liu, *Chinese Academy of Sciences, China*
Oluwarotimi Williams Samuel, *Chinese Academy of Sciences, China*
Wanzhang Yang, *Shenzhen Hospital of Southern Medical University, China*
Shixiong Chen, *Chinese Academy of Sciences, China*
Guanglin Li, *Chinese Academy of Sciences, China*

11:40 - 13:00
SESSION 1.6
SPECIAL SESSION: Sensors for Collaborative Robotics in Industry and Healthcare 4.0
Room: Virtual Room #1
Chairs: Luca Massari, *Scuola Superiore Sant'Anna, Italy*
Domenico Camboni, *University of Pisa, Italy*,
Federico Bianchi, *Scuola Superiore Sant'Anna, Italy*

11:40 Proof-of-Concept Millimeter-Wave Free-Space Nondestructive Testing Implemented on Collaborative Mobile Robots

Bilal Daass, *University of Lille, France*
Denis Pomorski, *Université des Sciences et Technologies de Lille, France*
Adem Rouibah, *University of Lille, France*
Kamel Haddadi, *University of Lille, France*

12:00 Interaction Force Computation Exploiting Environment Stiffness Estimation for Sensorless Robot Applications

Loris Roveda, *Istituto Dalle Molle di Studi sull'Intelligenza Artificiale, Switzerland*
Dario Piga, *SUPSI-IDSIA, Switzerland*

12:20 Tactile sensing with gesture-controlled collaborative robot

Francesca Sorgini, *Scuola Superiore Sant'Anna, Italy*
Giuseppe Airò Farulla, *Politecnico di Torino, Italy*
Nikola Lukic, *University of Belgrade, Serbia*
Ivan Danilov, *University of Belgrade, Serbia*
Loris Roveda, *Istituto Dalle Molle di Studi sull'Intelligenza Artificiale, Switzerland*
Milos Milivojevic, *University of Belgrade, Serbia*
Terrin Babu Pulikottil, *STIIMA CNR, Italy*
Maria Chiara Carrozza, *The BioRobotics Institute, Italy*
Paolo Prinetto, *Politecnico di Torino, Italy*
Tullio Tolio, *Politecnico di Milano, Italy*
Calogero Maria Oddo, *Scuola Superiore Sant'Anna, Italy*
Petar B. Petrovic, *University of Belgrade, Serbia*
Bozica Bojovic, *University of Belgrade, Serbia*

12:40 A Pneumatic Haptic Display for Collaborative Robotics applications

Debadrata Sarkar, *National Institute of Technology Durgapur, India*
Jessica D'Abbraccio, *Scuola Superiore Sant'Anna, Italy*
Domenico Camboni, *Scuola Superiore Sant'Anna, Italy*
Luca Massari, *Scuola Superiore Sant'Anna, Italy*
Aman Arora, *National Institute of Technology Durgapur, India*
Calogero Maria Oddo, *Scuola Superiore Sant'Anna, Italy*

11:40 - 13:00
SESSION 2.6
GENERAL SESSION – PART I
Room: Virtual Room #2
Chair: Francesco Lamonaca, *University of Sannio, Italy*

11:40 Speed detection of battery-free nodes based on RF Wireless Power Transfer
Roberto La Rosa, *STMicroelectronics, Italy*
Catherine Dehollain, *Ecole Polytechnique Federale de Lausanne, Switzerland*
Filippo Pellitteri, *University of Palermo, Italy*
Nicola Campagna, *University of Palermo, Italy*
Patrizia Livreri, *University of Palermo, Italy*

12:00 Novel Piezoelectric Sensor by Aerosol Jet Printing in Industry 4.0
Tiziano Fapanni, *University of Brescia, Italy*
Michela Borghetti, *University of Brescia, Italy*
Emilio Sardini, *University of Brescia, Italy*
Mauro Serpelloni, *University of Brescia, Italy*

12:20 3DOPE-DL: Accuracy Evaluation of a Deep Learning Framework for 3D Object Pose Estimation
Davide Maria Fabris, *Politecnico di Milano, Italy*
Remo Sala, *Politecnico di Milano, Italy*
Marco Tarabini, *Politecnico di Milano, Italy*

12:40 A Plain Low Threshold IoT Platform for Enabling New IoT Products from SMEs
Stefan Forsstrom, *Mid Sweden University, Sweden*
Ulf Jennehag, *Mid Sweden University, Sweden*
Xiao Guan, *Mid Sweden University, Sweden*

11:40 - 13:00
SESSION 3.6
GENERAL SESSION – PART II
Room: Virtual Room #3
Chair: Mauro Serpelloni, *University of Brescia, Italy*

11:40 Complex Event Processing on the Edge - Bringing Data Consolidation and Processing closer to Wireless Sensor Networks
David Merkl, *Frankfurt University of Applied Sciences, Germany*
Henry-Norbert Cocos, *Frankfurt University of Applied Sciences, Germany*

12:00 Low cost, low pass Prism filtering
Manus Henry, *University of Oxford, UK, South Ural State University, Russia*

12:20 Quality Assurance of Weld Seams Using Laser Triangulation Imaging and Deep Neural Networks
Andreas Spruck, *University of Erlangen-Nurnberg, Germany*
Jurgen Seiler, *University of Erlangen-Nurnberg, Germany*
Michael Roll, *Autotech Engineering Deutschland GmbH, Germany*
Thomas Dudziak, *Autotech Engineering Deutschland GmbH, Germany*
Jurgen Eckstein, *Autotech Engineering Deutschland GmbH, Germany*
Andre Kaup, *University of Erlangen-Nurnberg, Germany*

12:40 Test bench for the measurement of scissors' cutting torque
Marco Tarabini, *Politecnico di Milano, Italy*
D. Magnani, *Politecnico di Milano, Italy*
Hermes Giberti, *Università di Pavia, Italy*
G. Gianola, *Consorzio PREMAX, Italy*
Pietro Marzaroli, *Politecnico di Milano, Italy*
Stefano Marelli, *Politecnico di Milano, Italy*

14:20 - 16:40

SESSION 1.7

SPECIAL SESSION: Cybersecurity Standards and Technologies for IoT and Industry 4.0 (SecurityStandards)

Room: Virtual Room #1

Chairs: Alan Oliveira de Sá, *Admiral Wandenkolk Instruction Center, Brazil*
Lucila Maria de Souza Bento, *Inmetro, Brazil*

14:20 Development of security mechanisms for a remote sensing system based on opportunistic and mesh networks

Lucas S. dos Santos, *Federal University of Rio de Janeiro, Brazil*
Paulo R. M. Nascimento, *National Institute of Metrology, Brazil*
Lucila M. S. Bento, *National Institute of Metrology, Brazil*
Raphael C. S. Machado, *National Institute of Metrology, Brazil*
Claudio L. Amorim, *Federal University of Rio de Janeiro, Brazil*

14:40 Combining exposure indicators and predictive analytics for threats detection in real industrial IoT sensor networks

M. A. Brignoli, *Vitrociset – a Leonardo Company, Italy*
Silvio Mazzaro, *Vitrociset – a Leonardo Company, Italy*
G. Fortunato, *Vitrociset – a Leonardo Company, Italy*
A. Corà, *Vitrociset – a Leonardo Company, Italy*
W. Matta, *Vitrociset – a Leonardo Company, Italy*
S. P. Romano, *University of Naples Federico II, Italy*
B. Ruggiero, *University of Naples Federico II, Italy*
V. Coscia, *University of Naples Federico II, Italy*

15:00 Public-Key Infrastructure for Smart Meters using Blockchains

Wilson Melo Jr., *National Institute of Metrology, Brazil*
Raphael C. S. Machado, *National Institute of Metrology, Brazil*
Daniel Peters, *Physikalisch-Technische Bundesanstalt, Germany*
Mahbuba Moni, *Physikalisch-Technische Bundesanstalt, Germany*

15:20 A Digital Twins Approach to Smart Grid Security Testing and Standardization

Manolya Atalay, *Middle East Technical University Ankara, Turkey*

Pelin Angin, *Middle East Technical University Ankara, Turkey*

15:40 Proficiency Testing for Software Analysis and Cybersecurity Laboratories
Raphael Machado, *Inmetro, Brazil*
Wilson Melo Jr., *National Institute of Metrology, Brazil*
Lucila Bento, *National Institute of Metrology, Brazil*
Sergio Camara, *National Institute of Metrology, Brazil*
Vinicius da Hora, *Fluminense Federal University, Brazil*
Thais Barras, *National Institute of Metrology, Brazil*
Wladmir Chapetta, *National Institute of Metrology, Brazil*

16:00 Identification of Data Injection Attacks in Networked Control Systems with Varying Setpoint Condition
Alan O. de Sa, *Admiral Wandenkolk Instruction Center, Naval War College, Brazil*
Raphael C. S. Machado, *National Institute of Metrology, Fluminense Federal University, Brazil*

16:20 Security vulnerability in Internet of Things sensor networks protected by Advanced Encryption Standard
Pasquale Arpaia, *ARHEMLab, University of Naples Federico II, Italy*
Francesco Bonavolontà, *University of Naples Federico II, Italy*
Antonella Cioffi, *University of Naples Federico II, Italy*

13:00 - 15:20
SESSION 2.7
SPECIAL SESSION: Metrology for Data Interoperability in Industry 4.0
Room: Virtual Room #2
Chairs: Blair Hall, *Measurement Standards Laboratory, New Zealand*
Sascha Eichstädt, *Physikalisch-Technische Bundesanstal, Germany*

13:00 Software for calculation with physical quantities
Blair Hall, *Measurement Standards Laboratory of New Zealand, New Zealand*

13:20 Quantifying Metrological Redundancy in an Industry 4.0 Environment
Gertjan Kok, *VSL Dutch Metrology Institute, The Netherlands*
Peter Harris, *National Physical Laboratory, United Kingdom*

13:40 Semantic Information in Sensor Networks: How to Combine Existing Ontologies, Vocabularies and Data Schemes to Fit a Metrology Use Case

Maximilian Gruber, *Physikalisch-Technische Bundesanstalt, Germany*
Sascha Eichstädt, *Physikalisch-Technische Bundesanstalt, Germany*
Julia Neumann, *Physikalisch-Technische Bundesanstalt, Germany*
Adrian Paschke, *Free University Berlin, Germany*

14:00 Fundamental Physical Constants Ready for Machine Communication in a Digitalized World

Daniel Hutzschenreuter, *Physikalisch-Technische Bundesanstalt, Germany*
Henrike Weber, *Physikalisch-Technische Bundesanstalt, Germany*
Shanna Schönhals, *Physikalisch-Technische Bundesanstalt, Germany*
Shan Lin, *Physikalisch-Technische Bundesanstalt, Germany*
Frank Härtig, *Physikalisch-Technische Bundesanstalt, Germany*
Bojan Ačko, *University of Maribor, Slovenia*

14:20 A Measurement Information Infrastructure's Benefits for Industrial Metrology and IoT

Mark Kuster, *Consultant, USA*

14:40 Infrastructure for Digital Calibration Certificates

Clifford Brown, *National Physical Laboratory, UK*
Tommi Elo, *Aalto University, Finland*
Kristine Hovhannisyan, *Tallinn University of Technology, Estonia*
Daniel Hutzschenreuter, *Physikalisch-Technische Bundesanstalt, Germany*
Petri Kuosmanen, *Aalto University, Finland*
Olaf Maennel, *Tallinn University of Technology, Estonia*
Tuukka Mustapaa, *Aalto University, Finland*
Pekka Nikander, *Aalto University, Finland*
Thomas Wiedenhoefer, *Physikalisch-Technische Bundesanstalt, Germany*

15:00 A universal metadata model for metrological complex quantities

Vincenzo Paciello, *University of Salerno, Italy*
Laura De Santis, *University of Salerno, Italy*
Daniel Hutzschenreuter, *Physikalisch-Technische Bundesanstalt, Germany*
Ian Smith, *National Physical Laboratory, UK*

14:20 - 16:40

SESSION 3.7

SPECIAL SESSION: Physiological Sensors and Techniques for Monitoring Sport and Physical Activity – Part III

Room: Virtual Room #3

Chairs: Andrea Nicolò, *University of Rome "Foro Italico", Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*

14:20 Effect of Running Intensity on Leg Force Asymmetry and its Relationship to Internal Load Biomarkers

Filipe Sousa, *Federal University of Alagoas, Brazil*
Natalia Rodrigues, *Federal University of Alagoas, Brazil*
Fulvia Manchado-Gobatto, *University of Campinas, Brazil*
Claudio Gobatto, *University of Campinas, Brazil*

14:40 Validation of a novel wearable solution for measuring L5/S1 load during manual material handling tasks

Ilaria Conforti, *Sapienza University of Rome, Italy*
Ilaria Mileti, *Sapienza University of Rome, Italy*
Dario Panariello, *University of Naples Federico II, Italy*
Teodorico Caporaso, *University of Naples Federico II, Italy*
Stanislao Grazioso, *University of Naples Federico II, Italy*
Zaccaria Del Prete, *Sapienza University of Rome, Italy*
Antonio Lanzotti, *University of Naples Federico II, Italy*
Giuseppe Di Gironimo, *University of Naples Federico II, Italy*
Eduardo Palermo, *Sapienza University of Rome, Italy*

15:00 A Body Hydration Analysis System to improve running performance

Valerio Lapadula, *Università Campus Bio-Medico di Roma, Italy*
Anna Sabatini, *Università Campus Bio-Medico di Roma, Italy*
Alessandro Zompanti, *Università Campus Bio-Medico di Roma, Italy*
Silvia Buscaglione, *Integris S.p.A, Italy*
Davide Lanaro, *Integris S.p.A, Italy*
Mario Merone, *Università Campus Bio-Medico di Roma, Italy*

15:20 Comparison among different inertial-based algorithms for the automatic detection of temporal events in sprint tests: a preliminary study on elite athletes with intellectual impairment

Teodorico Caporaso, *University of Naples Federico II, Italy*
Angela Palomba, *University of Campania Luigi Vanvitelli, Italy*
Stanislao Grazioso, *University of Naples Federico II, Italy*
Alessia Megna, *University of Naples Federico II, Italy*
Dario Panariello, *University of Naples Federico II, Italy*
Diego Perez, *Don Orione Rehabilitation Center, Italy*
Piera Marchettoni, *FISDIR, Italy*
Giuseppe Di Gironimo, *University of Naples Federico II, Italy*
Antonio Lanzotti, *University of Naples Federico II, Italy*

15:40 Bluetooth Performance Evaluation based on Notify for Real-time Body-Area Sensor Networks

Olaf Reich, *Frankfurt University of Applied Sciences, UK*
Erik Hubner, *Frankfurt University of Applied Sciences, UK*
Bogdan Ghita, *Frankfurt University of Applied Sciences, University of Plymouth, UK*
Matthias Wagner, *Frankfurt University of Applied Sciences, UK*
Jorg Schafer, *Frankfurt University of Applied Sciences, UK*

16:00 Design and development of an instrumented glove for hand rehabilitation in children suffering from cerebral palsy: a digital manufacturing approach

Giorgia Cusimano, *Università Campus Bio-Medico di Roma, Italy*
Alessia Longo, *Università Campus Bio-Medico di Roma, Italy*
Alessio Uffreduzzi, *Università Campus Bio-Medico di Roma, Italy*
Marco Bravi, *Università Campus Bio-Medico di Roma, Italy*
Fabrizio Taffoni, *Università Campus Bio-Medico di Roma, Italy*

16:20 BEAT: Balance Evaluation Automated Testbed for the standardization of balance assessment in human wearing exoskeleton

Juri Taborri, *University of Tuscia, Italy*
Stefano Salvatori, *University Niccolò Cusano, Italy*
Giovanni Mariani, *University of Tuscia, Italy*
Stefano Rossi, *University of Tuscia, Italy*
Fabrizio Patanè, *University Niccolò Cusano, Italy*

17:00 - 18:00

IEEE STUDENT HACKATHON

Wearable Devices Challenge

Room: Virtual Room #4

Technical Sessions - Friday, June 5

09:00 - 09:50
PLENARY SESSION
Room: Virtual Room #1
Chair: Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*

From Condition Monitoring to Predictive Maintenance: the role of Edge Processing

Nunzio Abbate, *Senior Director of the System Lab DU/SRA in STMicroelectronics*

10:00 - 11:40
SESSION 1.8
SPECIAL SESSION: Large-scale traceability of digital MEMS sensor: statistical methods and in-line control systems
Room: Virtual Room #1
Chairs: Alessandro Schiavi, *INRIM, Italy*
Francesca Romana Pennecchi, *INRIM, Italy*
Andrea Prato, *INRIM, Italy*

10:00 **Traceablity Chain for Acoustic Sensors Based on the Direct Definition of the Acoustic Pascal by Optical Method**
Wan-Ho Cho, *Korea Research Institute of Standards and Science, Republic of Korea*
Triantafillos Koukoulas, *National Research Council Canada, Canada*

10:20 Assuring Measurement Traceability to ATE Systems for MEMS Temperature Sensors Testing and Calibration

Denis Smorgon, *INRIM - Istituto Nazionale di Ricerca Metrologica, Italy*
Vito C Fernicola, *INRIM - Istituto Nazionale di Ricerca Metrologica, Italy*
João Sousa, *IPQ, Portugal*
Luís Ribeiro, *IPQ, Portugal*
Enrico Tamburini, *SPEA spa, Italy*
Michele Catto, *SPEA spa, Italy*

10:40 A reliable sampling method to reduce large sets of measurements: a case study on the calibration of digital 3-axis MEMS accelerometers

Andrea Prato, *INRiM – National Institute of Metrological Research, Italy*
Alessandro Schiavi, *INRiM – National Institute of Metrological Research, Italy*
Fabrizio Mazzoleni, *INRiM – National Institute of Metrological Research, Italy*
Amara Touré, *Politecnico di Torino, Italy*
Gianfranco Genta, *Politecnico di Torino, Italy*
Maurizio Galetto, *Politecnico di Torino, Italy*

11:00 Calibration of digital 3-axis MEMS accelerometers: A double-blind «multi-bilateral» comparison

Alessandro Schiavi, *INRiM – National Institute of Metrological Research, Italy*
Andrea Prato, *INRiM – National Institute of Metrological Research, Italy*
Fabrizio Mazzoleni, *INRiM – National Institute of Metrological Research, Italy*
Giulio D'Emilia, *University of L'Aquila, Italy*
Antonella Gaspari, *University of L'Aquila, Italy*
Emanuela Natale, *University of L'Aquila, Italy*

11:20 Big Data management: A Vibration Monitoring point of view

Alessandro Paolo Daga, *Politecnico di Torino, Italy*
Alessandro Fasana, *Politecnico di Torino, Italy*
Luigi Garibaldi, *Politecnico di Torino, Italy*
Stefano Marchesiello, *Politecnico di Torino, Italy*

10:00 - 11:40

SESSION 2.8

SPECIAL SESSION: Electronic and Mechatronics in Industry

Room: Virtual Room #2

Chair: Alessandro Massaro, *Dyrecta Lab srl, Italy*

10:00 Infrared Thermography applied on Fresh Food Monitoring in Automated Alerting Systems

Alessandro Massaro, *Dyrecta Lab srl, Italy*
Antonio Panarese, *Dyrecta Lab srl, Italy*
Angelo Galiano, *Dyrecta Lab srl, Italy*

10:20 Infrared Thermography and Image Processing applied on Weldings Quality Monitoring

Alessandro Massaro, *Dyrecta Lab srl, Italy*
Antonio Panarese, *Dyrecta Lab srl, Italy*
Giovanni Dipierro, *Dyrecta Lab srl, Italy*
Emanuele Cannella, *Dyrecta Lab srl, Italy*
Angelo Galiano, *Dyrecta Lab srl, Italy*

10:40 Image Processing Segmentation applied on Defect Estimation in Production Processes

Alessandro Massaro, *Dyrecta Lab srl, Italy*
Antonio Panarese, *Dyrecta Lab srl, Italy*
Giovanni Dipierro, *Dyrecta Lab srl, Italy*
Emanuele Cannella, *Dyrecta Lab srl, Italy*
Angelo Galiano, *Dyrecta Lab srl, Italy*
Valeria Vitti, *Dyrecta Lab srl, Italy*

11:00 Production Optimization Monitoring System Implementing Artificial Intelligence and Big Data

Alessandro Massaro, *Dyrecta Lab srl, Italy*
Sergio Selicato, *Dyrecta Lab srl, Italy*
Roberto Miraglia, *Dyrecta Lab srl, Italy*
Antonio Panarese, *Dyrecta Lab srl, Italy*
Angelo Calicchio, *Dyrecta Lab srl, Italy*
Angelo Galiano, *Dyrecta Lab srl, Italy*

11:20 Low Cost IoT Sensor System for Real-time Remote Monitoring

Matteo D'Aloia, *MASVIS srl, Italy*
Annalisa Longo, *MASVIS srl, Italy*
Gianluca Guadagno, *MASVIS srl, Italy*
Mariano Pulpito, *MASVIS srl, Italy*
Paolo Fornarelli, *MASVIS srl, Italy*
Pietro Nicola Laera, *MASVIS srl, Italy*
Dario Manni, *MASVIS srl, Italy*
Maria Rizzi, *Politecnico di Bari, Italy*

10:00 - 11:40
SESSION 3.8
SPECIAL SESSION: Computational sensing for IoT industrial and medical applications Part II
Room: Virtual Room #3
Chairs: Luca Vollero, *Università Campus Bio-Medico di Roma, Italy*
Samuel W. Oluwarotimi, *Shenzhen Institutes of Advanced Technology, China*

10:00 The Performance Evaluation of SSVEP-BCI Actuated Wheelchair with Parameter Setting of Time-Window Length and Stimulation Layout

Jun Xie, *Xi'an Jiaotong University, China*
Xiaojun Wu, *Science and Technology on Electrooptic Control Laboratory, China*
Peng Fang, *Shenzhen Institutes of Advanced Technology, China*
Guanglin Li, *Shenzhen Institutes of Advanced Technology, China*
Guozhi Cao, *Xi'an Jiaotong University, China*
Tao Xue, *Xi'an Jiaotong University, China*

10:20 A New Approach for Hand Gesture Recognition Based on the Fusion of sEMG and Impedance Information

Yuan Wang, *Chinese Academy of Sciences, China*
Simin Yuan, *Chinese Academy of Sciences, China*
Pingao Huang, *Chinese Academy of Sciences, China*
Hui Wang, *Chinese Academy of Sciences, China*
Wenlong Yu, *Chinese Academy of Sciences, China*
Menglong Fu, *Chinese Academy of Sciences, China*
Xin Wang, *Chinese Academy of Sciences, China*
Oluwarotimi Williams Samuel, *Chinese Academy of Sciences, China*
Guanglin Li, *Chinese Academy of Sciences, China*

10:40 A Smart Solution for Proprioceptive Rehabilitation through M-IMU Sensors

Martina Lapresa, *Campus Bio-Medico University of Rome, Italy*
Christian Tamantini, *Campus Bio-Medico University of Rome, Italy*
Francesco Scotto di Luzio, *Campus Bio-Medico University of Rome, Italy*
Francesca Cordella, *Campus Bio-Medico University of Rome, Italy*
Marco Bravi, *Campus Bio-Medico University of Rome, Italy*
Sandra Miccinilli, *Campus Bio-Medico University of Rome, Italy*
Loredana Zollo, *Campus Bio-Medico University of Rome, Italy*

11:00 IoT Gateways for Industrial and Medical Applications: Architecture and Performance Assessment

Claudio Botta, *Everis*
Leonardo Pierangelini, *Università Campus Bio-Medico di Roma, Italy*
Luca Vollero, *Università Campus Bio-Medico di Roma, Italy*

11:20 Efficient Classification of Motor Imagery using Particle Swarm Optimization-based Neural Network for IoT Applications

Oluwagbenga Paul Idowu, *Chinese Academy of Sciences, China*
Oluwarotimi Williams Samuel, *Chinese Academy of Sciences, China*
Xiangxin Li, *Chinese Academy of Sciences, China*
Mojisola Grace Asogbon, *Chinese Academy of Sciences, China*
Peng Fang, *Chinese Academy of Sciences, China*
Guanglin Li, *Chinese Academy of Sciences, China*

11:40 - 13:00
SESSION 1.9
GENERAL SESSION - Part III
Room: Virtual Room #1
Chair: Luca De Vito, *University of Sannio, Italy*

11:40 Deploying Wifi, RF and BLE sensorsfor pervasive monitoring and control

Alberto Faro, *CPS Research Lab Deepsensing srl, Italy*
Daniela Giordano, *University of Catania, ISAFOM-CNR, Italy*
Mario Venticinque, *ISAFOM-CNR, Italy*

12:00 ISO/IEC 15189 Implementation in Microbiology Laboratory – General Concepts

Faris Hrvat, *International Burch University, Bosnia and Herzegovina*
Selma Cifric, *International Burch University, Bosnia and Herzegovina*
Amina Aleta, *International Burch University, Bosnia and Herzegovina*
Amra Dzuho, *International Burch University, Bosnia and Herzegovina*
Leja Gurbeta Pokvic, *International Burch University, Bosnia and Herzegovina*
Almir Badnjevic, *International Burch University, Bosnia and Herzegovina*

12:20 Informational Space and Messages Interaction Models for Smart Factory Concept

Maria Usova, *ITMO University, Russia*
Sergey Chuprov, *ITMO University, Russia*
Ilya Viksnin, *ITMO University, Russia*

12:40 SPIRIT - A Software Framework for the Efficient Setup of Industrial Inspection Robots

Daniele Evangelista, *University of Padua, Italy*
Marco Antonelli, *IT+Robotics srl, Padua, Italy*
Alberto Pretto, *IT+Robotics srl, Padua, Italy*
Christian Eitzinger, *PROFACTOR GmbH, Steyr-Gleink, Austria*
Michele Moro, *University of Padua, Italy*
Carlo Ferrari, *University of Padua, Italy*
Emanuele Menegatti, *University of Padua, Italy*

11:40 - 12:40

SESSION 2.9

SPECIAL SESSION: Uncertainty Evaluation in Signal Processing for Industrial Applications – Part II

Room: Virtual Room #2

Chairs: Yuhui Luo, *National Physical Laboratory, UK*
Liam Wright, *National Physical Laboratory, UK*
Kavya Jagan, *National Physical Laboratory, UK*

11:40 Bayesian Autoencoders for Drift Detection in Industrial Environments
Bang Xiang Yong, *University of Cambridge, United Kingdom*
Yasmin Fathy, *University of Cambridge, United Kingdom*
Alexandra Brintrup, *University of Cambridge, United Kingdom*

12:00 From dynamic measurement uncertainty to the Internet of Things and Industry 4.0
Sascha Eichstädt, *Physikalisch-Technische Bundesanstalt, Germany*

12:20 Stochastic approach for controllable measurement uncertainty in Industry 4.0 applications
Marjan Urekar, *University of Novi Sad, Serbia*

11:40 - 13:00
SESSION 3.9
GENERAL SESSION - Part IV
Room: Virtual Room #3
Chair: Sergio Rapuano, *University of Sannio, Italy*

11:40 Evaluation of the bounding box uncertainty of deeplearning object detection in HALCON software
Daniele Marchisotti, *Politecnico di Milano, Italy*
Vittorio Sala, *iMAGE S SPA, Italy*

12:00 Analysis of reproducibility and repeatability of a hand-held laser scanner for gap&flush measurement in car-assembly line
Alessia Baleani, *Università Politecnica delle Marche, Italy*
Paolo Castellini, *Università Politecnica delle Marche, Italy*
Paolo Chiariotti, *Università Politecnica delle Marche, Italy*
Nicola Paone, *Università Politecnica delle Marche, Italy*
Luca Violini, *Università Politecnica delle Marche, Italy*

12:20 IoT Indoor Localization with AI Technique
Matteo D'Aloia, *MASVIS srl, Italy*
Annalisa Longo, *MASVIS srl, Italy*
Gianluca Guadagno, *MASVIS srl, Italy*

Mariano Pulpito, *MASVIS srl, Italy*
Paolo Fornarelli, *MASVIS srl, Italy*
Pietro Nicola Laera, *MASVIS srl, Italy*
Dario Manni, *MASVIS srl, Italy*
Maria Rizzi, *Politecnico di Bari, Italy*

12:40 Robot Localisation using UHF-RFID Tags for Industrial IoT Applications
Farhad Shamsfakhr, *University of Trento, Italy*
Luigi Palopoli, *University of Trento, Italy*
Daniele Fontanelli, *University of Trento, Italy*
Andrea Motroni, *University of Pisa, Italy*
Alice Buffi, *University of Pisa, Italy*

14:30 - 16:10

SESSION 1.10

SPECIAL SESSION: The Industry 4.0 Paradigm for Energy Efficiency: Measurements, Techniques, Methodologies, Strategies and Requirements

Room: Virtual Room #1

Chairs: Fabio Leccese, *Roma Tre University, Italy*
Emanuele Piuzzi, *Sapienza University of Rome, Italy*
Luca Podestà, *Sapienza University of Rome, Italy*
Silvia Sangiovanni, *Sapienza University of Rome, Italy*

14:30 In-Line Quality Control in Semiconductors Production and Availability for Industry 4.0
Enrico Petritoli, *Università degli Studi "Roma Tre", Italy*
Fabio Leccese, *Università degli Studi "Roma Tre", Italy*
Giuseppe Schirripa Spagnolo, *Università degli Studi "Roma Tre", Italy*

14:50 An IoT Application for Industry 4.0: a New and Efficient Public Lighting Management Model
Mariagrazia Leccisi, *Università degli Studi "Roma Tre", Italy*
Fabio Leccese, *Università degli Studi "Roma Tre", Italy*
Fabio Moretti, *ENEA, Italy*
Laura Blaso, *ENEA, Italy*
Arianna Brutti, *ENEA, Italy*
Nicoletta Gozo, *ENEA, Italy*

15:10 Optical Wireless Communication and Li-Fi: a New Infrastructure for Wireless Communication in Saving Energy Era

Giuseppe Schirripa Spagnolo, *Università degli Studi "Roma Tre", Italy*
Lorenzo Cozzella, *Università degli Studi "Roma Tre", Italy*
Fabio Leccese, *Università degli Studi "Roma Tre", Italy*
Silvia Sangiovanni, *Sapienza Università di Roma, Italy*
Luca Podestà, *Sapienza Università di Roma, Italy*
Emanuele Piuzzi, *Sapienza Università di Roma, Italy*

15:30 Aspect ratio optimization of piezoceramic disks for maximizing electromechanical energy conversion in energy harvesting applications

Antonio Iula, *University of Basilicata, Italy*

15:50 Double Perovskite Oxide for Chemical Sensors

Fabio Zaza, *ENEA - Casaccia Reseach Centre, Italy*
Simone Bonanni, *University of Rome La Sapienza, Italy*
Emanuele Serra, *ENEA - Casaccia Reseach Centre, Italy*

14:30 - 15:50
SESSION 2.10
SPECIAL SESSION: Wireless solutions for IoT based measurements over wide areas
Room: Virtual Room #2
Chairs: Emiliano Sisinni, *University of Brescia, Italy*
Diego Silva, *Federal University of Rio Grande do Norte, Brazil*

14:30 A new LoRaWAN adaptive strategy for smart metering applications

Emiliano Sisinni, *University of Brescia, Italy*
Paolo Bellagente, *University of Brescia, Italy*
Alessandro Depari, *University of Brescia, Italy*
Paolo Ferrari, *University of Brescia, Italy*
Alessandra Flammini, *University of Brescia, Italy*
Silvia Marella, *University of Brescia, Italy*
Marco Pasetti, *University of Brescia, Italy*
Stefano Rinaldi, *University of Brescia, Italy*
Antonio Cagiano, *Acquedotto Pugliese S.p.A., Italy*

14:50 Performance Evaluation of an evolving data compression algorithm embedded into an OBD-II edge device

Gabriel Signoretti, *Federal University of Rio Grande do Norte, Brazil*
Marianne Silva, *Federal University of Rio Grande do Norte, Brazil*
Jordy Araujo, *Federal University of Rio Grande do Norte, Brazil*
Luiz Afonso Guedes, *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*

15:10 Proposal of a Hybrid LoRa Mesh / LoRaWAN Network

Nelson C Almeida, *São Paulo State University (Unesp), Brazil*
Rodrigo Rolle, *São Paulo State University (Unesp), Brazil*
Eduardo P Godoy, *São Paulo State University (Unesp), Brazil*
Paolo Ferrari, *University of Brescia, Italy*
Emiliano Sisinni, *University of Brescia, Italy*

15:30 Introducing a survey methodology for assessing LoRaWAN coverage in Smart Campus scenarios

Hudson B. M. Alves, *Federal University of Rio Grande do Norte, Brazil*
Vinicius S. S. Lima, *Federal University of Rio Grande do Norte, Brazil*
Diego Silva, *Federal University of Rio Grande do Norte, Brazil*
Marcelo Nogueira, *Federal University of Rio Grande do Norte, Brazil*
Marconi Rodrigues, *Federal University of Rio Grande do Norte, Brazil*
Rafael N Cunha, *Federal University of Rio Grande do Norte, Brazil*
Dhiego Fernandes Carvalho, *University of Brescia, Italy*
Emiliano Sisinni, *University of Brescia, Italy*
Paolo Ferrari, *University of Brescia, Italy*

14:30 - 16:20

SESSION 3.10

SPECIAL SESSION: Wearable Devices for Physiological Monitoring

Room: Virtual Room #3

Chairs: Soumyajyoti Maji, *Trinity College Dublin, Ireland*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*

14:30 An FBG-based Smart Wearable Device for Monitoring Seated Posture in Video Terminal Workers

Martina Zaltieri, *Università Campus Bio-Medico di Roma, Italy*
Daniela Lo Presti, *Università Campus Bio-Medico di Roma, Italy*
Carlo Massaroni, *Università Campus Bio-Medico di Roma, Italy*
Riccardo Sabbadini, *Università Campus Bio-Medico di Roma, Italy*
Emiliano Schena, *Università Campus Bio-Medico di Roma, Italy*
Marco Bravi, *Università Campus Bio-Medico di Roma, Italy*
Sandra Miccinilli, *Università Campus Bio-Medico di Roma, Italy*
Silvia Sterzi, *Università Campus Bio-Medico di Roma, Italy*
Domenico Formica, *Università Campus Bio-Medico di Roma, Italy*

14:50 Decisional Support System with Artificial Intelligence oriented on Health Prediction using a Wearable Device and Big Data

Alessandro Massaro, *Dyrecta Lab srl, Italy*
Giuseppe Ricci, *Dyrecta Lab srl, Italy*
Sergio Selicato, *Dyrecta Lab srl, Italy*
Sarah Raminelli, *Dyrecta Lab srl, Italy*
Angelo Galiano, *Dyrecta Lab srl, Italy*

15:10 Development of an In-Ear Photoplethysmography Wearable System

Andrea Pedrana, *University of Bergamo, Italy*
Daniele Comotti, *221e S.r.l., Italy*
Patrick Locatelli, *University of Bergamo, Italy*
Valerio Re, *University of Bergamo, Italy*
Gianluca Traversi, *University of Bergamo, Italy*

15:30 Contactless Heart Rate Monitoring Using A Standard RGB Camera

Soumyajyoti Maji, *Trinity College Dublin, Ireland*
Carlo Massaroni, *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*

15:50 Clean-Breathing: a Novel Sensor Fusion Algorithm Based on ICA to Remove Motion Artifacts from Breathing Signal

Luigi Raiano, *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*
Giovanni Di Pino, *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*

16:10 New Perspectives on Wearable Devices and Electronic Health Record Systems

Giacomo Assenza, *University Campus Bio-Medico, Italy*
Camilla Fioravanti, *University Campus Bio-Medico, Italy*
Simone Guarino, *University Campus Bio-Medico, Italy*
Valerio Petrassi, *University Campus Bio-Medico, Italy*

16:30 - 17:00
CLOSING AND AWARD CEREMONY
Room: Virtual Room #1