

Sensors Expo and Conference 2022

San Jose, California, USA
27-29 June 2022

ISBN: 979-8-3313-0063-0

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2022) by Questex Media Group, Inc.
All rights reserved.

Printed with permission by Curran Associates, Inc. (2024)

For permission requests, please contact Questex Media Group, Inc.
at the address below.

Questex Media Group, Inc.
275 Grove Street, Suite 2-130
Newton, Massachusetts 02466
USA

Phone: (617) 219-8300

info@questex.com

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

Pre-Conference Symposium 1: Sensors Converge with Energy Harvesting to Enable Ultra-Low Power IoT Deployments	1
<i>Brian Zahnstecher</i>	
From Low Power to No Batteries: Maximizing System Power Consumption of Bluetooth® Low Energy Sensor Nodes	8
<i>Tejashree Chaudhari</i>	
Wireless IoT for Condition Monitoring - Challenges for EH	22
<i>Ed Spence</i>	
Intelligent Power Management for Energy Harvesting Wireless Sensors	36
<i>N/A</i>	
Your Battery Died: Best Practices for Avoiding that in the Future	49
<i>Roldand De Graaf</i>	
Emerging Zero-Standby Solutions for Miscellaneous Electric Loads	57
<i>Daniel Gerber</i>	
Testing & Verification Strategies for ULP Systems.....	64
<i>N/A</i>	
Addressing System Integration Challenges in Energy Harvesting and Power Management for Wearables	74
<i>Marco Belcastro</i>	
Utilizing Sensor Data to Detect Health Indicators.....	87
<i>Michael W. Condry</i>	
Workshop: How to Easily Build a Smart Sensor using PICMG IoT.1 Specification	96
<i>Doug Sandy, David Sandy</i>	
Using Electronic Security to Protect Your Revolutionary Medical Products	105
<i>N/A</i>	
The Growing Role of Artificial Intelligence & Machine Learning in Medical Sensors	116
<i>N/A</i>	
Leading the Evolution of Business Wireless (Otherwise Known as Changing All the Rules)	122
<i>N/A</i>	
IoT Protocol Stacks: A Layered View.....	130
<i>Ammar Rayes</i>	
Case Study: New High-Performance Infrared LEDs Improve Accuracy and Efficiency in Sports Tracking Technology	143
<i>N/A</i>	
Growing the IoT from Billions to Trillions to Create the Supply Chains of the Future	149
<i>N/A</i>	

Wearables: Roadmap and Key Enablers	157
<i>Stan Farnsworth</i>	
Progress in Wearable, Printed, Gas Sensors for Bridging the Cost-Performance Gap in Medical, Environmental, Energy, and Space Applications	167
<i>Joseph R. Stetter, M. W. Findlay, D. Peaslee, E. F. Stetter, B. M. Muelendyk, V. Patel</i>	
The Mind. Unlocked.....	183
<i>Jamie Alders</i>	
MedTech E-Textile Development and Commercialization in Regulated Markets.....	192
<i>Pratyush Rai</i>	
Selection of Thin Flexible Batteries and Their Integration into Wearables and IoT Devices	205
<i>Konstantin Tikhonov</i>	
Reliable Wearable Gas Sensors for Ubiquitous Applications: Still a Fantasy Or 2022 Reality?.....	219
<i>Radislav A. Potyrailo</i>	
Sustainable and Scalable Printing of Nano and Microelectronics using Directed Assembly of Nanomaterials.....	232
<i>Anthony Childress, Ahmed Busnaina</i>	
Enabling End-to-End Specialized Healthcare: With Printed Electronics Sensing Technology	245
<i>Melanie Wendrikat</i>	
Charting the Opportunities for Sensor Integration in Smart Fabrics	256
<i>Michelle Farrington</i>	
The Future on the Farm is Now: The Technology Behind Autonomy.....	265
<i>Gaurav Bansal</i>	
Advanced Nanomaterial Embedded Cyber-Physical Platforms for Real-Time Monitoring of Water Challenges Related to Safety and Security	269
<i>Ashok Vaseashta</i>	
A Complete AI Insights Solution for Farmers	296
<i>N/A</i>	
A Path to Interoperability and Cybersecurity for IOT Sensors.....	302
<i>Ted Osinski</i>	
Smarter Buildings Are Critical to the Decarbonization of the Built Environment	312
<i>Dan Svejnar</i>	
Redefining a Sustainable Future Through Lidar.....	318
<i>Zohaib Mian</i>	
Case Study: Deployment of Sensors to Detect and Track Wildfires in CO	323
<i>Debra J. Deininger</i>	
Using PM Sensors to Measure Filtration Efficiency, a Key Health Metric for Commercial and Residential Buildings.....	332
<i>Nilli Martinez</i>	
MEMS Product Development: Process Risk Mitigation	349
<i>Carolyn D. White</i>	

SEMI MSIG Overview.....	357
<i>Michelle Bourke</i>	
Supply Chain Risk Report: The Semiconductor Shortage.....	378
<i>Bindiya Vakil</i>	
New Sensor Checklist: POLARIS a MEMS Fabrication Platform.....	384
<i>Robert MacDonald</i>	
Environmental Sensors Evolving to Everyone’s Daily Companion	394
<i>Thomas Block</i>	
Capacitive MEMS Technology for Low Power Pressure Sensing.....	408
<i>Calin Miclaus</i>	
Stealth Laser Dicing Process	417
<i>Rich Boardman</i>	
Leveraging SoC Concepts to Create a System-in-a-Sensor.....	427
<i>Tim Shotter</i>	
Motion Sensor Software Trends: From Pedometer to Machine Learning On-Chip	435
<i>Sahil Choudhary</i>	
The MEMS Speaker Era is Starting, Setting New Standards in Audio Integration.....	445
<i>N/A</i>	
Understanding the Safety Requirements for Sensors and Sensing Elements	453
<i>N/A</i>	
To Uphold the Sensor Market Growth, MEMS Are Getting More Brains	463
<i>Dimitrios Damianos</i>	
Importance of Testing.....	474
<i>N/A</i>	
Combining Different Sensors to Support HVAC Predictive Maintenance	485
<i>Steve Robbins</i>	
The Matter Standard: Raising the Bar for the Smart Home.....	495
<i>N/A</i>	
ML-Based Intrusion Detection that Won't Compromise Battery Life	503
<i>Tom Doyle</i>	
C-V2X: Tomorrows Smart City Connected Infrastructure is Today’s Reality in Peachtree Corners	512
<i>N/A</i>	
Debunking the Automotive Image Sensor Myths.....	520
<i>Sergey Velichko</i>	
The Smartest Choice for the Road Ahead: Safety Starts with Perception	524
<i>Chuck Gershman</i>	
The Age of Software Defined Sensors.....	533
<i>N/A</i>	

Automotive LiDAR – Lessons Learned	541
<i>Steffen Bartschat</i>	
Inertial Sensing in Autonomous Applications Lab vs Real Life Performance.....	546
<i>Pekka Kostianen</i>	
Sensors and Signal Processing for Autonomous Vehicles	554
<i>Shaminda Subasingha</i>	
Ultrasonic Sensors for Automotive Megatrend Applications	573
<i>Michael Wittman</i>	
Sensors Galore.....	577
<i>Jacopo Alaimo</i>	
The Art of Open Source Reimagines Intelligent Vehicles	580
<i>N/A</i>	
20% to 40% Switching and Dynamic Power Reduction using PowerGrid or Ground PowerPad Modification in Autonomous Electric Vehicle ICs	595
<i>Michael Hopkins</i>	
The Road to Mass Market Autonomy: What Sensors Will We Need and Why?	611
<i>Mark Fitzgerald</i>	
Connectivity for an Autonomous Future	625
<i>Donyel Jones-Williams</i>	
Unlocking ROI of Autonomous Fleets, Robotics and Drones with New Approaches to Flexible Wireless Charging Architecture.....	629
<i>Aya Kantor</i>	
A LoPIE Case Study: Augmented Awareness.....	638
<i>Anthony Dobaj</i>	
Personal Air Quality Monitoring using Embedded Artificial Intelligence	644
<i>Clayton Kostecky, Ravi Chillumula</i>	
Everything You Always Wanted to Know About Hardware Attacks (But Were Afraid to Ask).....	655
<i>Nicole Fern</i>	
Use Cases for Blockchain Technology at the Edge	667
<i>Mohammed Billoo</i>	
Position Imaging: New Use Cases for AI/ML.....	681
<i>N/A</i>	
Upscaling Large-Area Printed Sensors for Mass Market Application Needs.....	688
<i>Ashok Sridhar</i>	
Space Constrained Devices with Ultra-Low Power Consumption Budget Powered by the SIMO Architecture	698
<i>Gaurav Mital</i>	
Miniaturising Batteries for Industrial Monitoring	712
<i>Denis Pasero</i>	

Pre-Conference Symposium 1: BONUS Demo Session..... 720
N/A

Understanding the Opportunities and Challenges for Printed/Flexible/Stretchable and E-
Textile/Smart Fabric Sensors in Medtech and Wearables..... 724
Roger H. Grace

From Healthcare to Care for Health: The Workplace Vitality Hub as a Route Towards
Commercialization 757
Sywert H. Brongersma

Author Index