E-Textiles Network

Welcome to E-Textiles 2020

2nd International Conference on the Challenges, Opportunities, Innovations and Applications in Electronics Textiles

E-Textiles 2020: International Conference on the Challenges, Opportunities, Innovations and Applications in Electronic Textiles is the second conference to be held by the E-Textiles Network. E-Textiles 2020 will discuss the exciting innovations and challenges in the rapidly emerging field of e-textiles. Topics include textile power supplies, textile sensors and actuators, manufacturing and materials and applications of e-textiles.

The conference includes eight invited speakers, including two keynote speakers from both academia and industry. There will also be the opportunity to view poster presentations, with a best student prize. Conference Proceedings will be published in MDPI Proceedings.

We would like to say thank you to our conference partner Women in Wearables, and to our Technical Programme Committee.

We hope you enjoy the Conference and gain new insights. Finally, don't forget to follow the conference on Twitter #etextiles2020

- *The E-Textiles Network Steering Board*

Keynote and Invited Speakers

Dr Jesse Jur – *Keynote Speaker*

Professor of Textile Engineering, NC State University's Wilson College of Textiles

Designing for E-Textile System Success:

Innovation in electronic textiles (e-textile) is challenged by a multitude of issues, including a lack of use case understanding, low cost manufacturing strategies, and standards testing. This presentation explores the root causes of the e-textile innovation challenges as it relates to the product system that they are designed toward and explores strategies to resolve these issues. Specifically, e-textiles materials will be reviewed with respect to system level impact, in which considerations of the performance of the textile and the electronics are mutually beneficial to another.   Furthermore, textile design strategies for reducing the complexity of the wearable garment designs will be examined. Finally an outlook to the future will be previewed, including recent progress toward comfort management and self-powered garment-based wearables for remote wellness.

Cath Rogan – *Keynote Speaker*

Director – Smart Garment People

E-textiles – What next?:

I have been developing performance clothing and textiles for almost 30 years and since 2006, this has included e-textiles. During that time, a global financial crisis and several major trends and technologies have changed our world dramatically. As we head into another era of global uncertainty, I'll review the impact of previous changes on the evolution of e-textiles and highlight some key emerging trends and technologies that could have an equally significant influence on the next generation of e-textile products and services.

Keynote and Invited Speakers

Professor George Stylios

Professor of Textiles, Heriot Watt University

A Novel Exempt from Motion Artefact Wearable Vest for Continuous Well-being Monitoring:

Reducing motion artefact is challenging in ECG signalling because the spectrum of motion artefact overlaps with the ECG signal. We have studied and compared the performance of the FIR filter, IIR filter, moving average filter, moving median filter, wavelet transform, empirical mode decomposition, and adaptive filter for reducing motion artefact. We found that the adaptive filter using the impedance pneumography signal as the reference input signal performs better than other denoise methods and can effectively reduce the motion artefact in the ECG signal. The well-being device is capable of measuring ECG, respiration, motion and temperature and it is based on low energy, size and weight and on dry hybrid textile electrodes. The optimum textile electrodes are made of silver-plated nylon conductive knitted fabric (MedTexTM P-130) and silver-plated nylon conductive thread 234/34-4ply, according to electrode skin impedance trials. We have finally shown how to purposely design bra vests by an integrated design concept, that eliminates any body movement artefact and without any need of hard wiring for signal fidelity and wearing comfort.

Dr Jacob Skinner

CEO, Thrive Wearables

Using Technology Enabled Textiles in Real World Wearable Products:

Wearable technology was once 'a Fitbit'. It's now many things to many people, with diverse applications across medical, health, sports, industrial and other near human environments. However, people are not flat, rigid things and so plastic, metal and traditional electronics form factors are limited. With frequent need to develop products with flexible and adaptable form factors, we must turn to textiles and soft goods techniques to make wearables more human appropriate. What does it take to integrate electronics and textile supply chains? How do you make a prototype scaleable to mass production? In this talk Dr Skinner will talk about some of the challenges in doing this, using real world examples.

Keynote and Invited Speakers

Professor Tilak Dias

Professor of Knitting, Nottingham Trent University

E-Textiles & Wearables – Weaving the Future into What You Wear:

Today the demand for wearable devices is growing. To continue to meet this demand engineers, designers and commercial pioneers are conceptualising new applications. Textiles have a major role to play in this strategically important area and offer many advantages over traditional materials such as support for technologically advanced products, flexibility, softness, and high-strength-to-weight ratios. The highly developed mass production techniques that characterise the global textile industry facilitate the path for the development of new products and their cost-effective manufacture for many applications. This presentation investigates how modern textile technologies can be used to create wearable textiles of added value. Integrating sensors and active devices directly into the textile structure of clothing will mean the design becomes an aesthetic point of interest rather than an unattractive add-on and allow washability.

Professor Zijian Zheng

Professor, Institute of Textile and Clothing (ITC), The Hong Kong Polytechnic University

Fiber-based Wearable Energy Storage Devices:

Wearable energy storage devices are indispensable corner stones for future wearable electronics. Current energy storage technologies are based on materials and devices that are rigid, bulky, and heavy, making them difficult to wear. On the other hand, fibers are flexible and lightweight materials that can be assembled into different textiles and have been worn by human beings thousands of years. Different from conventional two-dimensional thin films and foils, the three-dimensional fibre and textile structures not only provide superior wearing ability, but also much larger surface areas. This talk will introduce how our research group makes use of the attributes of fibres for high-performance wearable energy storage devices. We will demonstrate the strategies and discuss the perspectives to modify fibers and textiles for making wearable capacitors and batteries with excellent mechanical durability, electrochemical stability, and high energy/power density.

Keynote and Invited Speakers

Dr Nazmul Karim

Associate Professor for Novel Print Process and Materials, The University of West of England, Bristol

Multifunctional Graphene-based Wearable E-textiles:

Wearable electronics is becoming increasingly very popular since such technology makes life safer, healthier and more comfortable. Among them, smart wearable textiles have been going through significant evolutions in recent years, through the innovation of wearable electronics, and due to their miniaturization and the wireless revolution. This has resulted in personalized wearable garments that can interface with the human body and continuously monitor, collect, and communicate various physiological parameters such as temperature, humidity, heart rate, and activity monitoring. Such a platform would potentially provide a solution to the overburdened healthcare system resulting from a rapidly growing aging society, as well as maintaining and encouraging healthy and independent living for all, irrelevant of time and location. However, current technologies for wearable garments are associated with a number of challenges that other electronic technologies do not face, such as the complex and time-consuming manufacturing process of e-textiles and the use of expensive, non-biodegradable, and unstable metallic conductive materials. Graphene-based textiles have shown promise for next generation wearable electronics applications due to its advantages over metal-based technology. We developed simple, scalable and cost-effective way of manufacturing graphene-based textiles at commercial production rates of ~150 m/min for fabrics and (~1000 kg/h) for electro-conductive textile yarns. The graphene textiles thus produced are washable, flexible and bendable. We then demonstrate a potential application of our graphene-based electronics textiles for multifunctional and high-performance wearable electronics applications. We believe our scalable production method of producing graphene-based wearable e-textiles is an important step toward moving from R&D-based e-textiles to actual real-world applications.

Miguel Ridao

CEO, Sensing Tex

Sensing Health, Sensing Mats and Smart Textiles for Preventive Care of Bedridden and Low Mobility Patients:

The presentation will introduce Sensing Health, a continuous monitoring Product and Service across the Care continuum from home to Hospitals that provides early detection to help lower risk and improve Bedridden and Low mobility patient care while reducing costs. The Products have been developed thanks to the eTextiles technology of stretchable circuits and Sensing Mat and Sensing Wear Platforms from Sensing Tex and the latest technology to analyse the raw data based on machine learning and AI. The products are systems developed for body pressure mapping to recognize body movement, postural analysis and Bio signals in bedding, seating applications in a non-invasive way. Although the platform allows to connect and integrate other sensors. The conference will describe the different sensors and how they are textile printed and built in the same manufacturing process, the architecture of the whole system and how fully printed eTextiles can be implemented in Large Area non-invasive sensors. Application of machine learning to Raw data of the textile sensors will be also explored.

Conference Programme

Day 1: Tuesday 3ʳᵈ November 2020

Time	Title	Session/ Chair
9.15	Welcome	
9.25	Cath Rogan (Smart Garment People) – *Keynote Speaker* *E-Textiles – What's Next?*	1 Prof. Steve Beeby
10.00	Mahmoud Wagih (University of Southampton) *Powering E-Textiles Using a Single Thread Radio Frequency Energy Harvesting Rectenna*	
10.15	Kamil Garbacz (Fraunhofer IZM) *TPL toolkit for rapid prototyping*	
10.30	Q&A Session (Session 1)	
10.45	Coffee Break	
11.00	Miguel Ridao (SensingTex)– *Invited Speaker* *Sensing Health, Sensing Mats and Smart Textiles for Preventive Care of Bedridden and Low Mobility Patients*	2 Dr Debra Carr
11.30	Tianchen Shen (Kings College London) *Identification of Design Parameters for a Spacer Fabric Pressure Mapping Sensor*	
11.45	Christian Dalsgaard *A Global Alliance for Smart Textile; advancing the emerging industry in a challenging time.*	
12.00	Q&A Session (Session 2)	
12.15	Lunch	
13.15	Prof. Tilak Dias (Nottingham Trent University)- *Invited Speaker* *E-Textiles & Wearables – Weaving the Future into What You Wear*	3 Dr Theo Hughes-Riley
13.45	Ramona Nolden (Hochschule Niederrhein University of Applied Sciences) *Smart glove with integrated, textile, Arduino-controlled bending sensor, textile data conductors and biofeedback using LED-FSDs and the embroidery technology*	

Conference Programme

Day 1 continued

14.00	Granch Berhe Tseghai (Ghent University) *PEDOT:PSS/PDMS-Coated Cotton Fabric for Strain and Moisture Sensor*	
14.15	Q&A Session (Session 3)	
14.30	Coffee Break	
14.45	Dr Jacob Skinner (Thrive Wearables)- *Invited Speaker* *Using Technology Enabled Textiles in Real World Wearable Products*	**4 Barbara Shepherd**
15.15	Giorgia Petri (Berlin University of the Arts) *Measuring Pleated Knitted Sensors*	
15.30	Meijing Liu (University of Southampton) *Fully printed wearable electrode textile for electrotherapy application*	
15.45	Q&A Session (Session 4)	
16.00	End	

Conference Programme

Day 2: Wednesday 4th November 2020

Time	Title	Session/ Chair
9.20	Welcome	
9.30	Professor Zijian Zheng (The Hong Kong Polytechnic University) - *Invited Speaker* *Fiber-based Wearable Energy Storage Devices*	**5** **Dr Kai Yang**
10.00	Sandra Gellner (Hochschule Niederrhein University of Applied Sciences) *Textile-based battery using a biodegradable gel-electrolyte*	
10.15	Dr Sheng Yong (University of Southampton) *Flexible supercapacitor fabricated on a polyester-cotton textile*	
10.30	Q&A Session (Session 5)	
10.45	Coffee Break	
11.00	Professor George Stylios (Heriot Watt University) - *Invited Speaker* *A Novel Exempt from Motion Artefact Wearable Vest for Continuous Well-being Monitoring*	**6** **Dr Yang Wei**
11.30	David Court (University of Southampton) *Development of a printed e-textile for the measurement of muscle activation via EMG for the purpose of gesture control*	
11.45	Benji Fenech-Salerno (Imperial College London) *Inkjet printing 2D materials for wearable and e-textile biosensing applications*	
12.00	Dr Arash M. Shahidi (Nottingham Trent University) *Investigation of the physical and electrical properties of knitted electrodes when subjected to multiaxial compression and abrasion testing*	
12.15	Q&A Session (Session 6)	
12.30	Lunch	
13.25	Dr Jesse Jur (North Carolina State University) - *Keynote Speaker* *Designing for E-Textile System Success*	**7** **Dr Russel Torah**
14.00	Dr Sasikumar Arumugam (University of Southampton) *Visible and Ultraviolet Light Emitting Electrochemical Cells realised on Textile*	

Conference Programme

Day 2 continued

14.15	Barbro Scholz (University of Applied Science, Hamburg) *Light as a Material of E-textile Composites*	
14.30	Q&A Session (Session 7)	
14.45	Coffee Break	
15.00	Dr Nazmul Karim (The University of West of England, Bristol) - *Invited Speaker* *Multifunctional Graphene-based Wearable E-textiles*	**8 Prof. Steve Beeby**
15.30	Poster Session A: Dr Kristel Fobelets (Imperial College London) - *Wireless Power Transfer with Knitted Coils* Yixuan Sun (University of Southampton) - *Simulations on 2-coil and 4-coil Magnetic Resonance of wearable WPT systems* Dr Berit Greinke (Berlin University of the Arts) - *Pleating Electronic Textiles for Sensing Structures* Q&A Session (Poster Session A)	
16.00	Poster Session B: Tom Greig (University of Southampton) - *Investigation of nozzle height control to improve reliability of dispenser printing for e-textiles* *Sutthima Sriprasertsuk (University of Surrey) - Reduced Graphene Oxide Fibre Electrodes for Drug Sensing* Jessica Saunders (London College of Fashion) - *Do e-textiles for fashion require specific legislation and developmental guidelines in order to avoid harmful waste?* Q&A Session (Poster Session B)	
16.30	End	