Smart Wearables & Fashion 4.0 Congress (SWFC)

27 October 2022

Programme

(GMT = Greenwich Mean Time, BST = British Summer Time)

Session 1 -- 08:30 - 10:00 GMT / 9:30 - 11:00 BST	
Starts – Germany 10:30 / India 14:00 / Bangladesh 14:30 / China 16:30 / New Zealand 21:30	
Chair - Dr. Abu Sadat Muhammad Sayem, Manchester Metropolitan University, UK	
P1	***The evolution of adaptive clothing,*** Tania Allan Ross, School of Fashion, Otago Polytechnic, New Zealand
P2	***IoT-enabled Smart Clothing,*** Nishtha Srivastava, Department of Textile Design, National Institute of Fashion Technology, Patna, India
P3	**Keynote - *Smart wearables in neurological rehabilitation*,** Professor Deepti Gupta, Indian Institute of Technology – Delhi

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Session 2 -- 10:10-11:40 GMT / 11:10-12:40 BST	
Starts - New York & Toronto 06:10 / Germany 12:10 / India 15:40 / Bangladesh 16:10 / China 18:10	
Chair – Professor Deepti Gupta, Indian Institute of Technology – Delhi	
P1	***Development of Multifunctional Inks for Additive Manufacturing Process to Directly Print Sensors on the Garments,*** Dr. Hasan Shahriar, Senior Scientist, Diversey, USA
P2	***Piezoresistive smart-textile for soft and flexible electronics,*** Dr. Gaffar Hossain, Head, Institute of V-Trion GmbH Textile Research, Austria
P3	***Reliable Futuristic Wearable Electronic Textiles; Challenges and Opportunities,*** Mohammad Shak Sadi, Kaunas University of Technology, Lithuania

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Session 3 -- 13:30-15:30 GMT / 14:30-16:30 BST	
Starts - New York & Toronto 09:30 / Germany 15:30 / India 19:00 / Bangladesh 19:30 / China 22:30	
Chair - Dr. Abu Sadat Muhammad Sayem, Manchester Metropolitan University, UK	
P1	**Keynote - *Smart Textile Wearables for Healthcare,*** Dr. Kunal Mankodiya, Associate Professor, Biomedical Engineering and Director, Wearable Biosensing Lab, University of Rhode Island, USA
P2	**Keynote - Making the Computer Invisible: Smart Wearable in Cloud Computing and Healthcare applications,** Dr. Ragib Hasan, Associate Professor, Department of Computer Science, Founder, Secure and Trustworthy Computing Lab, The University of Alabama at Birmingham, USA
P3	**Keynote - *Exploring cobot technologies and agile tooling to aid creative garment making within Industry 5.0,*** Professor Susan Postlethwaite, Manchester Metropolitan University, UK
P4	***Digital Simulation of E-Textile Systems for Fashion 4.0,*** Caitlin G. Knowles, North Carolina State University, USA

Abstracts

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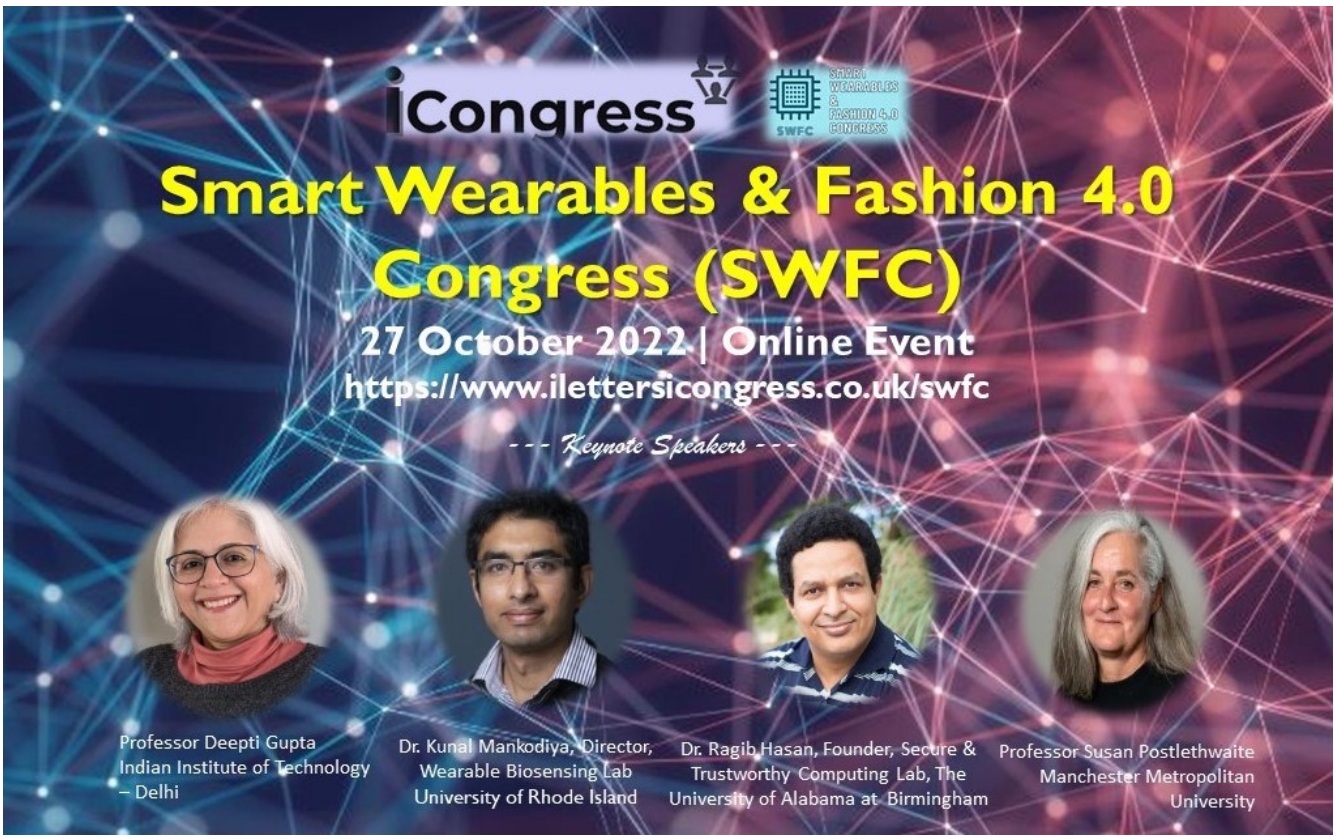

The evolution of adaptive clothing

Tania Allan Ross
School of Fashion, Otago Polytechnic, New Zealand

A review of the progression of adaptive clothing is conducted through appraisal of published materials from 2012 to 2022. The chapters making up this field of the fashion industry are identified and examined for the decade reviewed. Forming an up-to-date commentary of the design, commercialization, wear-ability and functions of adaptive clothing. Of particular interested within the review is the unpacking of how the designers and producers of adaptive clothing choose to interact with and include the end users, especially within their design processes, to address both functional and aesthetic clothing needs of their target market.

IoT-enabled Smart Clothing

Nishtha Srivastava and Pintu Pandit
National Institute of Fashion Technology, Patna, India

The sensors embedded into the clothing and the Internet of things (IoT) make data monitoring, collection, sharing and decision-making very efficient, productive and valuable. The synergy has contributed to adapting to the transient fashion and improving people's lifestyles across the age and professions. IoT-based bright clothing balances the functionality driven by enabling technology such as Artificial intelligence (AI) and Augmented Reality (AR) with the style and versatility of fashion. The creation of conductive yarn and the seamless integration of sensors into textiles are made possible by the fast-moving convergence of materials and electronics. The potential of intelligent fabrics predicts a new era in retail, healthcare, sports, and defence that can exchange information with digital tabs or smartphones to process physiological data like temperature, heart rate, oxygen level, respiration, stress, hormone levels, and locomotion. Smart wearables integrated with microelectronics can predict wants and desires and aim to seek a balance among engineering, fashion, comfort, design, science, and cybersecurity. The paper discusses the integration of sensors with textile, IoT technology, developments, opportunities and challenges in diverse, innovative clothing applications.

Development of Multifunctional Inks for Additive Manufacturing Process to Directly Print Sensors on the Garments

Hasan Shahariar
Diversey, USA

This work presents a unique approach to embedding sensors directly in the garments through the additive printing process. Wearable ECG sensors were printed on the polyester strap of the garment (underwear) in a layer-by-layer fashion. A particle-free silver salt ink was inkjet printed as a conductive silver-based layer to conformally coat polyester fiber, then a direct-write printing approach was taken to print an ionically conductive elastomeric sensor layer, and an insulating encapsulating layer on top of the conductive base layer. Finally, the inks were cured with the illumination of UV light. The sensor was evaluated to monitor the ECG signal of the wearer in different conditions. This technology solves the manufacturing complexity of the integrating electronic sensor on the textile platform.

Piezoresistive smart-textile for soft and flexible electronics

Gaffar Hossain
V-Trion GmbH Textile Research, Austria

Production of smart-textile sensor for wearable and nonwearable is always a challenge. This work deals with the manufacturing model of piezoresistive textile sensor and their application in different aspects e.g.; shelvescan for retail shelves inventory management record, sensor gloves for understanding of sign language, active floormat mat to recognize actions involved with human and the floor surface and smart-cushion for wheelchair to recognize sitting posture. Thus, a pressure sensitive textile semiconductor has been developed for above diversified application. All relevant factors of the piezoresistive textile such as coating uniformity, stability, repeatability, sensistivity, resistant variation, hysteresis have been characterized. Finally, the smart textile has been used for sandwich structure sensor development and demonstrate its effectiveness visualizing wirelessly via smartphone

Reliable Futuristic Wearable Electronic Textiles; Challenges and Opportunities

Mohammad Shak Sadi and Eglė Kumpikaitė
Department of Production Engineering, Faculty of Mechanical Engineering and Design,
Kaunas University of Technology, Lithuania

Electronic textiles (E-textiles) are the traditional textiles of different hierarchies embedded with functional nanomaterials to be utilized in different areas inspired by the Internet of Things (IoT) to improve all aspects of wearer life by replacing traditional bulky, rigid, and uncomfortable wearable electronics. The wearable e-textile utilizes different action-driven signals in measurable quantities with exciting possibilities in versatile areas along with personalized algorithms. Flexible electronic textiles are of great interest due to their ease of use, comfort, and compatibility at the user level. It is obvious that remarkable advances have been achieved in all possible aspects, from material selection to end-user-reliant, durable e-textile product design in recent years. Researchers have explored different architectural textile assemblies with numerous innovative fabrication techniques, along with various performance enhancement strategies toward highly durable and washable wearable e-textiles. However, challenges related to stability, repeatability, durability, washability, scalability, and other process-induced flaws limit the manufacture and commercialization of reliable high-end wearable electronic textile products. Therefore, for the e-textiles device to be commercially successful beyond the laboratory, future research should be focused more on the challenging issues and research gaps to design multipurpose reusable wearable electronic clothing as casual wear at the customer level.

[Keynote]

Smart Textile Wearables for Healthcare

Kunal Mankodiya
University of Rhode Island, USA

For thousands of years, textiles and clothes have been a part of human life. What if they can also be a part of healthcare? In the keynote talk, Dr. Mankodiya will demonstrate key innovations in smart textile wearables that can change healthcare monitoring and delivery in clinical and daily life environments. The ecosystem of smart textile design is complex and demands careful orchestration of multiple domains, especially when the end products are targeted for healthcare and medicine. Dr. Mankodiya will also discuss the ongoing challenges in smart textiles and potential ways to overcome them.

[Keynote]

Making the Computer Invisible: Smart Wearable in Cloud Computing and Healthcare applications

Dr. Ragib Hasan
Department of Computer Science, The University of Alabama at Birmingham, USA

Since the early days of computing, we are used to assuming that computers are distinct devices that we use to solve problems. However, improvements in electronics and technology has allowed us to make computers very small or pack many computers in a very small area. We posit that in the future, such improvements will ultimately lead to the disappearance of computers as separate devices, as they will be blended into our clothing and other everyday wearable items. This in turn will lead to many new applications and possibilities, from making a wearable cloud with applications in disaster management and first response, to the field of healthcare. In this talk, we show examples of this using a wearable cloud jacket, wearable hospital gown, and a smart bracelet.

[Keynote]

Exploring cobot technologies and agile tooling to aid creative garment making within Industry 5.0

Susan Postlethwaite

Manchester Fashion Institute, Manchester Metropolitan University, UK

Engineering innovation in the fashion sector has come from high volume, low-value production, where repetitive and highly automated tasks are undertaken by machines with minders/operators 'feeding' textiles and components to the machine. From a human perspective this work, whilst a long way from the image of manufacturing still held by the public as largely handmade, is very rapid, repetitive, and dull. The deskilling of the workforce is clear. Either this or labour practices verge on modern day slavery with workers underpaid and exploited in dangerous conditions. Design skills also risk becoming redundant in the drive to make unsustainably large volumes of clothing. Fully automated systems can be seen to be driving the simplicity of garment shape and construction and data-driven high-volume production means manufacturers are happy to supply consumers with more of what they already own. Economies of scale will eventually mean fewer choices for consumers. Conversely, the development of disruptive technologies like 3D weave and knit for micro-production and zero waste manufacture will mean close cooperation between designers, engineers, yarn producers, textile technologists and consumers, which could revolutionise garment production and on-demand manufacturing. New, small scale, agile tools are needed to support and facilitate a new, more ethical culture in garment manufacturing that focuses on upskilling workforces, designing new cobot technologies with the ambition for more meaningful and satisfying work.

Digital Simulation of E-Textile Systems for Fashion 4.0

Caitlin G. Knowles, Amanda C. Mills and Jesse S. Jur
North Carolina State University, USA

New design and manufacturing strategies are available to explore and develop in an increasingly digital world following the birth of the Fourth Industrial Revolution. Electronic textiles (e-textiles) for health monitoring are the perfect case-study product as they combine multiple industries (e.g., apparel, electronics, health) and are a data-driven, digital, connected platform synonymous with the defining features of Industry 4.0. E-Textiles have incredible potential to revolutionize the wearable technology space due to benefits such as their practical form factor and distributed sensor network capability. However, key design and manufacturing challenges including electronic integration strategies and scalable production methods are holding back the potential growth. New technologies such as 3D garment simulation gave emerged in recent years, but their use in performance-predictive design is underexplored. This presentation will highlight four case studies in how 3D garment simulation can be used in the conceptualization, prediction, production, and communication of e-textile products. Specifically, we will discuss screen printed interconnect simulations, contact pressure prediction for improved ECG signal quality, rapid kirigami and auxetic structure prediction, and AR/VR applications for communicating the tangibility of textiles in a virtual space.