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Extended Abstract
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Nanotechnology-2020: Smart Textiles for Personalized Health Care- Jun Chen, University of California, US.

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Statement of the issue: There is nothing more personal than healthcare. Health care must move from its current reactive and disease-centric system to a personalized, predictive, preventative and participatory model with a focus on disease prevention and health promotion. As the world marches into the era of Internet of Things (IoT) and 5G wireless, technology renovation enables industry to offer a more individually tailored approach to healthcare with more successful health outcomes, higher quality and lower costs. However, empowering the utility of IoT enabled technology in personalized health care is still significantly challenged by the shortage of cost-effective and wearable biomedical devices to continuously provide real-time, patient-generated health data. Textiles have been concomitant and playing a vital role in the long history of human civilization. In this talk, I will introduce our current research on nanotechnology enabled smart textiles for biomedical monitoring and personalized diagnosis, textile for therapy, and textile power generation as an energy solution for the future wearable medical devices.

The role of the body, the degree of personalization, and the prototyping process provide opportunities for ultra-personalization within these new types of embodied STSs. We present an overview of commercially available STSs based on these three elements. We then analyse three STSs that we have developed in the context of well-being.
We advocate that within the exemplified STSs the service interface is strongly connected to the bodily senses of the people using the service. This connection is further specified with three notions of ultra-personalization: personalization through the material properties, the design of the garment, and the programming of the interactions with the wearer.

Applications of smart textiles for medicine and healthcare Application In vitro In vivo Surgery Bandages Wound-care Sutures Soft-tissues Orthopaedic implants Cardiovascular implants Hygiene Uniform for medical personal Hospital textiles - Drug-release systems Smart bandages and plasters - Bio-monitoring Cardiovascular and haemodynamic activity Neural activity Muscle activity and kinematics Respiratory activity Thermoregulation - Therapy and wellness Electrical stimulation therapy Physiotherapy Auxiliary systems Active thermoregulation systems - Traditionally medical textiles find applications in surgery and hygiene.

Textile Sensors in Smart Textiles for Healthcare

As it has been mentioned above, textile sensors for physiological assessment and therapy purposes vary in their functions and applications, materials and technology solutions, and integration level into textiles. According to their general working principles, those can be physical, biochemical and optical transducers. Further, those can be divided into several categories according to their integration level into textile structure. This is mostly defined by the chosen technology approach. According to the literature review, four general sensor structure categories were defined: − fibre-based, when a sensor is a single yarn; − textile-structured, when all compounds of a transducer are textile materials; − textile-based, when textiles are a substrate or another non-sensitive, but inseparable compound of a transducer; − textile-integrated, when textiles carry the function of a carrier. Above that, textile sensors can be characterized by their functions, measurement

Textile sensors for kinematic analysis

Besides registration of physiological parameters, textile materials can assist in kinematic analysis, monitoring of body motion and positioning. These criteria are significant in rehabilitation and assessment of skeletal system during therapy treatment and diagnostics with application of optical fibres, piezoelectric materials and elastomers

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Humidity sensors

Humidity is a crucial criterion in many philological and biological processes, and can significantly influence human's health. Initially moisture can be referred as absolute humidity that indicates the actual amount of vapour. Relative humidity (RH) implies the percentage of the vapour amount in the air at prescribed temperature that is compared to the amount of vapour, which could hold in the air by this temperature.

Sensors for pH level estimation

The pH level is one the important indicators in assessment of biochemical processes in physiology and is regulated by acid-base homeostasis. The pH level is a crucial parameter in assessment of wound healing processes and in sweat monitoring. Modern textile and engineering technologies offer several scenarios to develop such a sensor that ensures continuous pH monitoring in real-time. Despite the variety of developments, there are found several key scenarios for sensor implementation described in the literature

Conclusions

Smart textiles find variety of applications and possess sensing and actuating functions that can be efficiently used in medicine, engineering and fashion. Smart textiles for the former use are one of the RURAL ENVIRONMENT. EDUCATION. PERSONALITY Jelgava, 7 – 8.02 2014. 158 most important niches in the R&D sphere due to the socially-economic and technological drivers. Such textiles offer advanced solutions for smart clothing and textiles for sensing and actuating, protective wear, ambient assisted living, hospitals and surgery. Those have potentials to support healing processes, improve safety, comfort and living of patients ensuring their mobility in a friendly way.

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