

# Large growth in smart textiles providing sensing, energy harvesting and communication and military wearables

The past few years have seen the introduction of a number of wearable technologies, from fitness trackers to smart watches but with the increasing use of smart textiles, wearables are set to become 'disappearables' as the devices merge with textiles, according to a new report from Cientifica. Unlike today's 'wearables' tomorrow's devices will be fully integrated into the the garment through the use of conductive fibres, multilayer 3D printed structures and two dimensional materials such as graphene

Smart fabric is a traditional fabric with added interactive functionality such as power generation or storage, sensing, radio frequency functioning, human interface elements and/or assistive technology. With the help of nano-materials, nano-biotechnology, and nano-electronics, electronic components such as actuators, control units, and sensors, are embedded into smart textiles. Smart textiles have applications in medical, sports, personal protective equipment, geo-protection, military, and aerospace sectors, where sensing and monitoring are already used and would only be made more efficient if integrated with textiles.

Many countries are now investigating the application of various electronic devices integrated into textiles for

military use. The special programme “Soldiers of the Future” was launched by the United States in the 1990s and investigated the benefits of smart textiles for soldiers. Two different training and education initiatives have been sponsored by North Atlantic Treaty Organization (NATO) on the application of advanced textiles for civil protection and defence

Constant technological innovations in this market have led to an added range of functionalities and capabilities to smart textiles used in the military sector. Smart textiles are being integrated with adaptive insulation property to enhance warmth in military clothing, sleeping bags, and blankets. Also, manufacturers are developing smart textiles that have the potential for physiological and locational monitoring and energy harvesting.

## **Innovative material for soft sensor could bring new tactile tech**

Purdue University researchers have developed a new type of soft and stretchable sensor, called iSoft, which has a wide range of functionality and is unique because it doesn't need wiring or electronics within the material, said Karthik Ramani, a professor of mechanical engineering at the university and director of the C Design Lab.

Such flexible and wearable sensors are being developed to measure and track body motion, a task made more complex by the human anatomy's numerous potential contortions. For a wearable sensor to work properly, it must be able to deform accordingly. Unlike some soft sensors developed previously, iSoft can handle continuous contact and also can be easily modified for custom purposes after manufacture. “By

continuous, we mean moving on the surface and also pressing all the time such as drawing with a pen, which is difficult to achieve,” Ramani said.

The technology features an electrical impedance tomography – or EIT – technique to estimate changes of resistance distribution on the sensor caused by fingertip contact. The system also uses an algorithm the team developed called a dynamic baseline update for EIT that compensates for “rebound elasticity,” which normally causes a signal delay while the elastomer returns to its original shape. These baseline updates are triggered by fingertip contact and movement detections.

The sensor is a thin, rubbery sheet with electrodes around the periphery. It harnesses a material called carbon-filled silicone rubber, a non-toxic piezoresistive material that has been widely explored in research for various types of low-cost sensors.

“However, the limitations in interactions have been mainly due to a rebound elasticity of the material, which causes a slow-recovery of the sensing signals after material deformations,” Ramani said.

## **Military smart textiles**

Technavio’s market research analyst predicts the global smart textiles market in the military sector to grow at a CAGR of close to 10% between 2016 and 2020. The active smart textiles segment dominated the market and accounted for the highest market share in 2015. These second-generation smart textiles accommodate sensors that can sense the external environmental changes and actuators, which act in accordance to the stimuli sensed.

Active smart textiles have the shape memory property and are chameleonic, water-resistant, vapor permeable and absorbing, and heat storage and thermos regulated fabrics. The camouflage technique that these textiles offer has prompted several countries to focus on the R&D of fiber optics, thermal sensitive materials, photosensitive materials, conductive polymers, and chemical-responsive fabrics.

The Americas dominated the global market and occupied the maximum market share during 2015. The security requirements of the Americas are rising considerably with the increasing threats from various militant groups along with territorial disputes. Such security concerns have prompted countries like the US, Canada, Mexico, and other Latin American nations to increase their focus on offering the soldiers wearables equipped with electronic devices to boost their situational awareness. The need for protective clothing for the troops and the measures adopted to equip them with enhanced high-tech products will further contribute to the growth of the market in the Americas.

Leading vendors in the military textile market are -BAE Systems , Midé Technology, Ohmatext, TenCate, W.L Gore & Associates. Other prominent vendors in the smart textiles market in the military sector include Advanced Fabric Technologies, BeBop Sensors, Directa Plus, DuPont, Intelligent Textiles, and Outlast Technologies.

## **Smart Textiles Market worth 7.7 Billion USD by 2023**

Transparency Market Research, projects the global smart textiles market to take a leap at a CAGR of 30.8% during the

period between 2015 and 2023, to stand at a valuation of US\$7730 mln by 2023. The report segments the global smart textiles market into military and defense, healthcare, automotive, entertainment, sports and fitness, and others including architecture and fashion. As per the study, a majority of the revenue in the global smart textiles for wearable technology comes from its military and safety applications followed by home and architectural applications. The military and defense sector accounted for 28.7% of the market in 2014.

On the basis of function the global smart textiles market can be categorized into sensing, energy harvesting, luminescent, thermoelectricity, and others. Textile sensors form a huge and significant sub-segment of smart textiles. This is because sensing ability is the most essential characteristic of any smart textile product. The application in the sports and fitness sector is expected to exhibit high growth during the forecast period. There is also a considerable demand for the smart textile market in architecture. Non-wearable smart textiles can be found in the architecture and design sector.

The driving factors for the growth of this market include the uptrend in wearable electronics industry, growing popularity of smart gadgets with advanced features, miniaturization of electronic components, and a rapid growth of low-cost smart wireless sensor networks.

However, the growth in this market is expected to be restrained by high cost of production of smart textiles and compatibility issues. The slow rate of adoption and the lack of exhaustive standards and regulations are the major restraining factors for the growth of the smart textiles market.

Among the geographies Europe dominated the market in 2015 followed by North America. Asia Pacific region is expected to grow at the highest CAGR over the forecast period. Major players in the smart textiles market are Google Inc. (U.S.), Intelligent Clothing Ltd. (U.K.), International Fashion Machines, Inc. (U.S.), Interactive Wear AG (Germany), Schoeller Textiles AG (Switzerland), Textronics, Inc. (U.S.), Vista Medical Ltd. (Canada), Textronics, Inc. (U.S.), Gentherm Incorporated (U.S.), and Sensoria Inc. (U.S.).

## **References and Resources also include:**

- <http://www.marketsandmarkets.com/PressReleases/smart-textiles.asp>
- <http://www.technavio.com/report/global-defense-global-smart-textiles-market-military-2016-2020>
- <http://www.purdue.edu/newsroom/releases/2017/04/innovative-material-for-soft-sensor-could-bring-new-tactile-tech.html>