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SMART TEXTILES

Smart textiles have been called e-textiles or intelligent textiles, electro active textiles, wearable electronics, and textronic depending on the approach. Smart textiles need to be designed to exhibit physical properties similar to those of traditional textiles such as bendable, stretchable, and washable while keeping good electrical conductivity. Nowadays the concept of wearable textiles becomes more practical regarding comfort, light weight, breathability, and especially to care and maintenance. For Smart textile two important aspects of the human body must be considered: body size and human motion that both will affect the sensor placement on the garment as well as its relative position with human body [2].

Smart textiles are defined as textiles that can sense and react to environmental conditions or stimuli, from mechanical, thermal, magnetic, chemical, electrical, or other sources. They are able to sense and respond to external conditions (stimuli) in a predetermined way. Other examples of smart textiles include fabrics capable of releasing medication or moisturizer in to the skin, fabrics that help control the vibration of muscles during athletic activities and materials that regulate body temperature. There are also simpler, aesthetic applications for smart textiles, including those that can change color, light up in patterns or potentially display pictures and video [1].

The materials of our surroundings are being “intellectualized”. These materials can interact, communicate and sense. Polymeric or carbon coated threads Conductive yarn, conductive rubber, and conductive ink have been developed into sensors or used as an interconnection substrate. Conductive yarns and fibers are made by mixing pure metallic or natural fibers with conductive materials. Pure metallic yarns can be made of composite stainless steel or fine continuous conductive metal-alloy

combination of fibers with conductive materials can be completed by the methods namely: Fibers filled with conductive material (e.g., carbon -or metallic particles) [1].

There are a number of commercial fibers today that include metallic fibers mixed with textile fibers to form conducting fibers that can be woven or sewn. One of the most important issue of E-textiles is that the fibers should be made so that it can washable as the clothes should be washed when it is dirty and the electrical components in it should be a insulator at the time of washing. A new class of electronic materials that are more suitable for e-textiles is the class of organic electronics materials, because they can be conducting, semiconducting, and designed as inks and plastics [3].

Smart textiles can be made by incorporating smart materials, conductive polymers, encapsulated phase change materials, shape memory polymers and materials and other electronic sensors and communication equipments. These materials interact – according to their designed feature with the stimuli in their environment. All smart materials involve an energy transfer from the stimuli to response given out by the material. They are integrated and complex materials. They have the ability do some sort of processing, analyzing and responding. Even they can adapt to the environment. Textile to behave smartly it must have a sensor, an actuator (for active smart textiles) and a controlling unit (for very smart textiles). These components may be fiber optics, phase change materials, shape memory materials, thermo chromic dyes, miniaturized electronic items etc. These components form an integrated part of the textile structure and can be incorporated into the substrate at any of the level namely: fiber spinning level; yarn/fabric formation level; finishing level [1].

The development of wearable monitoring systems is already having an effect on healthcare in the form of "Telemedicine". Wearable devices allow physiological signals to be continuously monitored during normal daily activities. This can overcome the problem of infrequent clinical visits that can only provide a brief window into the physiological status of the patient. Examples are: wireless-enabled garment with embedded textile sensors for simultaneous acquisition and continuous Monitoring of ECG, respiration, EMG, and physical activity. The "smart cloth" embeds a strain fabric

sensor based on piezo resistive yarns and fabric electrodes realized with metal based yarns. Sensitized vest including fully woven textile sensors for ECG and respiratory frequency detection and a Portable electronic board for motion assessment, signal pre-processing, and bluetooth connection for data transmission [1].

For example, there is a shirt is equipped with motion sensors; it can provide feedback about the wearer's movements or postures. Such information is helpful in rehabilitation or sport applications, where it is important that certain movements are executed correctly. The life shirt system is a comfortable garment that can be worn under normal uniform and it can automatically and continuously monitor over 40 physical signs such as respiratory rate, ventilation, swallow counts, arterial pulse wave, and heart rate. [1]

There is a concept created by Younghui Kim and Milena Iossifova, which uses the sound/noise level of the environment to create active color patterns on clothing or bags. These cool garments interact with ambient sounds and show the levels on the garment. The microphone and processor converts the sound levels into light via LEDS and EL wire. Sound Activated Textiles may have safety purposes [1].

Thus, textiles are changing day by day and this hybridisation of textiles with other branches of science is really a breakthrough. It has shifted the consumer values – instead of looking for the finest natural material, people look at the engineered beauty, innovative design and intelligent aspect of product. If smart textiles are affordable I think they will be accepted by the user as part of his everyday life.

REFERENCES

1. Smart Textiles and Nano-Technology [Electronic resource].-Electronic data. Mode of access: https://www.researchgate.net/publication/279847961_Smart_Textiles_and_Nano-Technology_A_General_Overview

2. Smart-Textile [Electronic resource].-Electronic data. Mode of access: https://www.slideshare.net/ritusolanki9212/smart-textile-51686042

3. New Possibilities in Textile Engineering [Electronic resource].-Electronic data. Mode of access: https://www.researchgate.net/publication/286459263_Smart_Textiles-New_Possibilities_in_Textile_Engineering