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APPLICATION OF CONDUCTIVE TEXTILES

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ABSTRACT

Conductive textile is nowadays a very popular item in fashion as well as in functional garments. This paper is a review on the application part of use of conductive textiles. Its uses are as outer garments, in GPS, textile antenna for Bluetooth, in medical science, protective fabric against EMF shielding etc.

KEYWORDS: *PAN, FAN, RF, Interactive Electronic Textiles, Quantum Tunneling Composite, Fibrotronics*

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INTRODUCTION

In the field of electronic textiles conductive textile is the base of it. Conductive fabric has numerous applications in different field. Making textile conductive there are various ways, either to make self-conductive or by adding any conductive material to it. In our daily life importance of conductive textiles has been established a strong root. Not only as fashion but also it proves its effectiveness in different functional fields, out of which some important fields are explored in this literature.

Outer Garment

- Detection of external threats
- Provision of power supply
- Interconnections (data and power)
- Electronics and local processing
- Communications
- Alarms (light and sound)

GPS

- Standard GPS module integrated with power and communications bus. The GPS SMA connector links the GPS module (Antaris 4 positioning engine) with its active antenna

External Temperature Sensor

- External thermocouple sensor.

Flexible Battery

- Flexible Lithium polymer battery.

Textile Antenna + Transceiver for Bluetooth Transmission

- Low power consumption Bluetooth module integrated with Textile antenna. The Bluetooth device is connected to the Electronics box using an exclusive serial port and individually controlled power supply
- Application of electrically conductive textiles as electromagnetic shields in physiotherapy
- Electrically conductive nonwovens (stich bonded, needled) made fron these CF, differ from each other not only in production technology but also in electrical properties. Measuring the shielding effectiveness of these fabrics proved a possibility of their application as electromagnetic shields. Their practical application was presented for physiotherapy where short wave & micro wave diatherapy is used. Its property of attenuating electromagnetic fields in the form of textile shielding materials, it is used in the above field due to
- protective against high Textiles for clothing frequency EMF
- Less conductive textiles which carry away static charges from clothing or equipment (as often used in the semiconducting industry)
- Shielding curtains & wall covers for protecting rooms in special buildings (military, banks etc)
- The attenuation of the electric component EMF (E)ranges from the negligible upto almost 60dB & of the magnetic component(H) from 0dB to 4dB, depending on the textile type, different medical devices generating strong EMF with a dominant electric component are used in this range for therapeutic purposes.
- Actually conductive polymers are gaining more and more importance due to their advantages, but these polymers are still rather costly. They can be used in applications where flexibility, low weight and conductivity are required.

Textile Switches

- A number of companies now successfully supply fabric-based switches which can be integrated in clothing and which successfully survive washing.
- Generally speaking, textile materials made of organic polymers are perfect insulators. Due to weak electrical conductivity, electrical load is accumulated on the surface of organic polymers. Therefore, to prevent the accumulation of electrical load, to enhance the possibility of electrical load transfer and to obtain electromagnetic shielding effect, the textile materials are turned into electrically conductor by using different methods. Inherently conductive polymers are polyanyline, polyvinyl alcohol, polypyrole and polyamide 11 etc.
- Peratech focuses on wearable technology, for example it introduced the completely washable five- button keypad integrated into O'Neill's ski jackets.(Figure 11)
- QIO Systems set up high street consumer retail jackets and bags and sells textile components (Figure 1,4,12)
- Fibretronic manufacture textile based switches and keypads, fabric iPod controls, wearable sensor and lighting systems and other soft-format electronics

- Sefar produce Power matrix - a hybrid fabric consisting of polyester (PET) and copper monofilaments in warp and weft. The copper wires have a thin silver coating with a polymer varnish on top to serve as insulation. This enables the copper wires to be used to form a grid without electrical contact between the wires.
- CF is smart choice of engineers & designers in variety of areas viz. Aircraft, space smart clothing. EMI shielding etc as EMI braid, E-textile or smart textile, carbon mono tube E-textile, also known as electronic textiles or smart textiles are fabrics that enable computing digital computers & electronics to be embedded in them. Wearable technology is known as intelligent clothing or smart clothing. Electronic textiles do not strictly encompass wearable computing. It emphasizes on the seamless integration between the fabric & the electronic elements, such as cables, microcontrollers, sensors & actuators. The field of embedding advanced electronic components onto textile fibres is sometimes called

FIBROTRONICS

- Some advanced functions are: organic transistors: the first textile fibre transistor that is completely compatible with textile manufacturing & that contains no metal at all.
- Organic solar cell on fibers e- broidery means a fabricating electronic circuitry on wash & wears textile substrates.
- DC powered heating pads are perfect for near-body heating applications. They get warm to the touch but not too hot. Simply apply 5VDC to the wire leads and within minutes, the pad will begin to warm up. These heating pads are constructed using a mesh of Polyester filament and Micro Metal Conductive Fiber folded into a protective Polyimide Film (Figure 10)
- Lily pad button board gives the user a very discrete button without any sharp edges. Button closes when you push it and opens when you release (momentary push button). LilyPad is a wearable e-textile technology developed by Leah Buechley and cooperatively designed by Leah and Spark Fun. Each LilyPad was creatively designed to have large connecting pads to allow them to be sewn into clothing. Various input, output, power, and sensor boards are available. They're even washable!
- Wearable keypad (fig 13), flexible silicone keypad is all sealed up and ready to incorporate into your next wearable gadget. The button pad consists of five buttons: up, down, left, right and a center button emblazoned with the SparkFun flame. It even has a controllable red LED backlight! These would make great pads for controlling portable music players.
- Electronic textiles (e-textiles) are fabrics that have electronics and interconnections woven into them, with physical flexibility and size that cannot be achieved with existing electronic manufacturing techniques. Components and interconnections are intrinsic to the fabric and thus are less visible and not susceptible to becoming tangled together or snagged by the surroundings. An e-textile can be worn in everyday situations where currently available wearable computers would hinder the user. E-textiles can also more easily adapt to changes in the computational and sensing requirements of an application, a useful feature for power management and context awareness.
- Conductive thread is used in soft electronic circuits instead of using wire allowing electrical current [...]My Stabby Valentine is a simple no-sew textile Valentine with a surprise. Made with conductive fabric,

EMF SHIELDING & CONDUCTIVE FABRICS

Radio Screen

Nickel and Copper coated polyester mesh offers fairly good transparency and excellent corrosion resistance. Attenuation makes this the perfect choice for indoor window screens and shielding which requires air circulation. Flexible and light weight, cuts easily for custom sizing. Can be used indoors or out.

Project comprise of hybrid structures between both categories- advanced electronic components that are connected to a classical electronic device or component, e.g. touch buttons that are constructed completely in textile forms by using conducting textile weaves, which are then connected to devices such as music players or LEDs that are mounted on woven conducting fibre networks to form displays.

Smart textile products: pro-e-tex: electrical functions: electrical connectivity needs to be implemented in smart clothing (if only to reduce the no. of batteries employed) by integrating a wiring harness which should be fully integrated& therefore washable. Electrically conductive fibres woven or sewn into the clothing are achieving this. In addition controls & switches should be integrated enabling the wearer to modify the functions of clothing.

Textile switches: a no. Of companies now successfully supply fabric based switches which can be integrated in clothing & which successfully survive washing. Quantum tunneling composite (QTC) is a material from Peratech/ Qio-System company which becomes electrically conducting upon pressure in a manner which enables switches & sensors. They supply fabric switches for smart clothing. QTC comprised of a mixture of silicon & metal particles which become conducting on compression. It introduces washable 5 button keypad integrated into O'Neill's ski-jackets. They are licensee for high street consumer retail jackets & bags, wearable applications for military, industrial, sports etc. QTC sensor provides a flexible control interface for hi-vis garment, allowing the wearer to select which part of the garment to illuminate for optimum safety, playback button on sleeve to control music, mobile device without any contact with device. Ipod controls also produce. CFT needs a link active electronic element, together with a range of other functions as:

1) Power Supply, 2) Connection for Data, 3) Heating, 4) Block EMF, 5) Antistatic

Power matrix: a hybrid fabric consisting of polyester & copper monofilaments in warp & weft. The copper wires have a thin silver coating with a polymer varnish on top to serve as insulation. This enables the copper wires to be used to form a grid without electrical contact between the wires.

Noble biomaterials : use X-static – a silver surfaces textured with antistatic, antimicrobial & heat dissipation features & circuit X, which enables fabric circuits (picture from net)

Thermion: flexible heating material is a thin, conductive textile consisting of nickel coated carbon fibres formed into nonwoven fabric. It is manufactured using specialized paper making technology, precisely controlled to produce a fabric with the desired material weight, thickness & electrical resistivity.

Interactive Electronic Textile (IET) is developed for communication, entertainment, health & safety. E.g soft switch, integrated compact disc players, MP_3 players, electronic game panels, television remote control might be integrated into curtain. IETs have the potential to improve current healthcare practices for monitoring breathing, heart rate, stress levels & body temperature. The garment integrated fabric sensors to monitor & display pulse, blood pressure, time, distance, speed & calories. Textiles integrated with sensory devices driven by a global positioning system (GPS) can be

detecting a user's exact location anytime & in any weather. Textile keypads on a sleeve might be used to dial phone numbers, type pager messages & play music. Wireless technology: personal area network (PAN) enable electronic devices to exchange digital information, power & control signals within the user's personal space. PAN works by using the natural electrical conductivity of the human body to pass incredibly small amounts of current through the body. These current can transmit data. To overcome the hazards of radio frequency (RF), researchers are exploring options such as Fabric Area Network (FAN) to restrict the range of the RF fields to the surface of the textile. FAN uses wireless RF communication links, but the communication fields are restricted to the surface of a textile eliminating emission into the body.

Electronic textiles, also referred to as smart fabrics, are quite fashionable right now. Their close relationship with the field of computer wearable gives us many diverging research directions and possible definitions. On one end of the spectrum, there are pragmatic applications such as military research into interactive camouflage or textiles that can heal wounded soldiers. On the other end of the spectrum, work is being done by artists and designers in the area of reactive clothes: "second skins" that can adapt to the environment and to the individual. Fashion, health, and telecommunication industries are also pursuing the vision of clothing that can express aspects of people's personalities, needs, and desires or augment social dynamics through the use and display of aggregate social information. In my current production-based research, I develop enabling technology for electronic textiles based upon my theoretical evaluation of the historical and cultural modalities of textiles as they relate to future computational forms. My work involves the use of conductive yarns and fibers for power delivery, communication, and networking, as well as new materials for displays that use electronic ink, nitinol, and thermo-chromic pigments. The textiles are created using traditional textile manufacturing techniques: spinning conductive yarns, weaving, knitting, embroidering, sewing, and printing with inks.

CONCLUSIONS

Conductive textile is a new field in Technical Textiles. Textile is not only use as a simple garment or cover purpose but also it can be used to any trouble shooting purpose. In this article only the use of common conductive textiles is discussed. But there is a lot of scope to cater textile not as an integrated part of a metallic composites only, we can make fabric itself with an inherent conductive properly.

Figure 1 & Figure 2: LED As A Part of Fabric Fashion.

Figure 3 & Figure 4

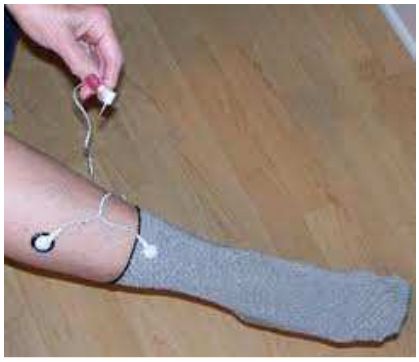

Figure 5 & Figure 6

Figure 7 & Figure 8

Figure 9

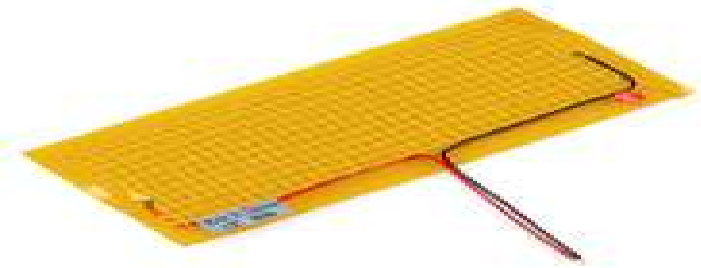

Figure 10

Figure 11

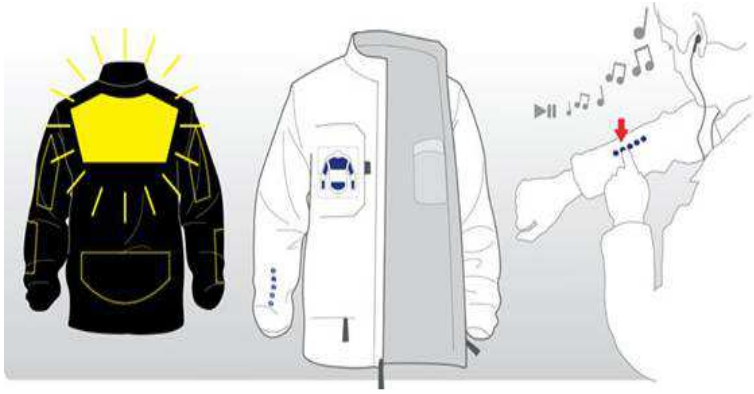

Figure 12

Figure 13

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