



SMART WEARABLES-AN INNOVATIVE TREND IN TEXTILE INDUSTRY

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Abstract:

In the beginning, man can wear clothes for modesty and protect him against the harmful things and weather, later it is developed for some sort of attire and as part of social display of exposing their status, style, gender and culture. Follows that, today's fashion world can attain greater transition and development which can fulfil its fashion purpose and step forward into the technology as smart wearable textiles. Smart textiles can observe, react, and adopt themselves to the external factors which can supports well with human brain for knowledge, reasoning and kinetogenic capacity. It represents the future generation of textiles are expected for use in several fashion, embellish and technical textile applicants. The version of smart textile is to produce textile materials interact by merging smart textiles and integrated computing power into textile products. Wearable technology is mainly concentrated on fastest growing sectors of health, education, fashion and entertainment. This article represents the components, materials and methods of smart fabrics, especially its recent trends and developments.

Keywords: smart fabrics, wearable technology, health, fashion, trends and development.

Introduction:

Today's textiles are not only used for the fashion purpose, used for various purpose it almost surrounded in all our environment and activities. ^[4] The integration of multifunctional values in such a usual textile material has become a special area of interest in recent years. These wearable technologies have exhibited during last decade of years notable advances in terms of miniaturisation, seamless integration, functionality, comfort, data processing and communication. ^[5] Fibres, yarns, fabrics and many other materials which have added functionalities have been created for a wide field of applicants.

These smart fabrics have incorporated electronics and interconnections woven into them, resulting in a physical flexibility that is not achievable with other electronic manufacturing methods. Interconnections and components are intrinsic to the fabric they are invisible and less susceptible of getting twisted by the surrounding objects. ^[1]

Smart fabrics integrated a greater level of intelligence and can be divided into three subdivisions, passive textiles, active smart textiles and very smart textiles. The main components included in smart wearable textiles are sensor, actuator and controlling unit. These technological developments have enabled electronics to become tinier are more powerful to increase portability and comfort. ^[3]

Components of smart fabrics:

Sensor materials and structure: Activity of a sensor is to convert one form of signal into another form of signal. There are variety of materials and structures that have the capacity of transforming signals. They are thermal sensor, humidity sensors, Pressure sensors, Chemical sensors and Biosensors is a sensing device that contains

biological elements which is the primary sensing element. These sensors can absorb and react to the state of form they needed.^[4]

Actuator materials and structures: Actuators are the substance that react to a signal and make things to change colour, release substances, change shape and others. Chromic materials, are widely used in smart textile products as colour changing material, which can change their optical properties due to provocation like temperature, light, chemical, mechanical stress etc. stimuli-responsive hydrogel, Electroluminescence materials, Light emitting diodes are some other forms of actuators used in smart textile applicants.^[4]

Conductive materials: Another type is conductive materials. These are the group of materials that can conduct electricity and are implemented in smart textile applications. These are used to transferring data information and also used as important components in the creation of sensors and actuators. Metals like silver and copper are the most conductive materials. Fibres like Carbon and silicone are blended and used to create high conductivity. Conductive polymers are organic materials that have ability to transform electricity.^[4]

Types of smart textiles:

Smart textiles can be categorized into four types based on their properties.

1. Passive smart materials: These are the material which can only observe the environmental conditions or provocation.
2. Active smart material: These are the materials which can both observe and react to the surroundings or provocation.
3. Very smart materials: These are materials that are able to perform triple functions, there are sensors which can receive, react to the signals and adapt the changes like shape, size, colour or act pursuant to the given purpose.
4. Materials with the even higher level of intelligence: Develop artificial intelligence to the computers that are partially achieved in the current research of human beings. This may be achieved with R&D in the field of electronics and textiles.^[6]

Materials and methods:

- Fabrication techniques: Implementing electronic circuitry into textiles can be achieved in various methods, this is based on the selection of the substrate to be used. Some of the methods are
 1. The use of conductive adhesive to bond components to substrate.
 2. Direct soldering of surface-mount electronic components onto metallic organza.
 3. Direct couching of thread-frame of a component into a circuit and
 4. Components can also be “stapled” into a conductive stitched switch
- Implementing smartness into apparels: The microprocessors and sensors could be implemented into the yarn directly and it would not obstruct with normal fabrication of apparel. This method is based on encapsulated area.
- Flexible circuit substrates: There are several ways of fabrication of circuits on flexible substrates depends on the metallization of flexible polymer substrate that can resist the high temperatures of conventional soldering process. It is to be ensured that whenever a substrate is used for designing a circuitry, great precaution must be taken and the overall mechanical stress of the application will be avoided to increase the lifetime of the product.
- Electrically Active Textiles: Various natural textile materials exhibit properties that indicate their usefulness in designing electronic circuitry. There are a lot of combinations of natural and manmade fibres, combined with metallic fibres or conductive polymer fibres.
- Metallic silk organza: Metallic silk organza has its origin in India. Wrap of the fabric made of parallel silk threads. Weft of fabric is woven with a metal foil helix coated with a silk thread via the wrap. The metallic thread is created like cloth-core telephone wire, and is highly conductive. The fibre core of the silk can resist high temperatures and it also has high firmness which makes it feasible for the yarn to be embroidered using an industrial machine. In addition, circuits created using this technique possesses several degrees of flexibility, when compared to single degree of flexibility that conventional substrates can give.
- Conductive fabrics: There are several ways to produce electrically conductive fabrics, a technique is to implement the conductive yarns directly into a textile structure for instance via weaving. However the implementation of conductive yarns in a textile structure is difficult and rarely a uniform process

as the electrically conductive fabric has to be delicate or comfortable to wear rather than rigid and hard.^[1] These yarns are manufactured using textile production techniques. They are made from a precursor polymer, the precursor is first spun into filaments and after spinning, the polymer fibres are then heated to force non-carbon atoms. Electron's flow of directions in the fabric depending on the thread in woven fabrics, the current flows of the filament direction is same for woven and different for knitted fabrics.^[2]

Applications:

Smart wearable technologies are rapid growing in main sectors of health, education, fashion and entertainment.

Health: The application of smart textiles in health care sectors are in wide range. These are organized to monitor things like biometrics used in athletes, dieters and physicians observing patient's vital signs.^[7] Using wearable devices for the automatic monitoring of mental health behaviour is a feasible approach for monitoring a person's health conditions. Fabric sensors can apply for baby monitors and smart shirts or biometric smart wear to record heart rate, footsteps electrocardiogram, electromyography and electroencephalography sensing, shape sensitive fabrics can sense movement and can derive muscle fitness. These devices are become increasingly important in the field of medical sciences.^[3]

Entertainment: Smart wearable textiles such as miniature cameras can easily be worn on a garment while being controlled via mobile app. This development is largely due to the availability of better touch screens and high resolution cameras. Wearable electronics can record a player's physiological performance and data accuracy of time in sports. T-shirt with built-in camera can record to allowed the fans to experience the action in real speed with exact dimension of the game and perspective of the player. These data are also used to check physical and mental health of the athletes and their movement speed in an exact manner.^[3]

Education: In the field of education, many wearable devices have been developed to enhance the teaching and learning experiences. Usage of Wearable technologies is greater in the education field like documenting the activities of students, regulate teachers' protocols with a subjective view and alert students working in laboratories to hazardous conditions. Most interesting aspect of smart wearable technology in this field is to increasing productivity. These could help students and educator to communicate through networks and keep track of things better.^[3]

Fashion: In this fashion field, smart fabrics is used to incorporate unique aesthetics into their creations. Characteristics such as the colour, size or shape of the garments can be changed using smart fabrics. Smart fabrics in materials can allow user to communicate with environment and data through integrated sensors or lead wires with wearable devices through fabrics.^[7] Not only for communication but for a fashion trend smart textiles are wisely used like light emitting textiles like glowing skirts and shoes are finding their way onto the tradeshows which suggest a future trend in a wearable computing garment.^[4]

Future trends and development:

Some interesting products of the advancements in smart fabrics that may soon be well available in the market in the nearest future are discussed.

Light up fabrics: The light up fabric is a product that is coming to replace candles and reflectors. The fabric is developed using ultra-thin optical fibres, which is woven directly onto the synthetic fibres. These light up fabrics are perfect for a decor line in special occasions and also need in future designs for party wears, sneakers, workout gears etc.

Temperature regulating fabrics: Temperature regulating fabric is capable of regulating body temperature due to the embedded heat management technology. The fabric can be used for a wide range of applications such as body armour, beddings, curtains, footwear, cushions and apparels. This makes it an advanced technology in upcoming days.

Drug releasing material: The carefully designed fabric is capable of releasing antiretroviral drugs, it is known as medicated electro-spun fabric, which is invented to prevent from contracting HIV. The material similar to silk and added tropical drugs are used as fibres that would dissolves if it is exposed to moisture, thereby releasing portion of its integrated retroviral drugs quickly than tropical rings or gels.

Moisturizing textiles: Advancements in the field of smart textiles are implemented in applying moisturizers and body lotions too. The Juvetex Rejuvenating is a special fabric is designed with a permanent skin moisturizing ability. It gives us a revolutionary method of hydrating without applying chemicals are creams.^[1]

Conclusion:

Smart textile represents the future generation of textiles Affiliated in both research & commercial activities and there have been immense increase in customer's interests in the products. This article is report to give an overview of a methods and materials of smart wearable textiles with its wide range and focusing on its developments in various sectors. Though smart textiles can be subjected with new technologies and developments, we need more focus on research and commercial activities to reduce the technological barriers and need of new applications with advanced techniques which are easily accessible and affordable to the customers.

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