Smart Fabrics In Various Fields

Karthik M[1], Mr. Prashanth K[2]

[1]*PG Student, Master of Computer Applications, RV College of Engineering, Karnataka,India*
[2]*Assistant Professor, Master of Computer Applications, RV College of Engineering, Karnataka,India*

Abstract— **In light of the advances in computer technology, particularly in the field of wireless technology and worldwide networking, the vision of wearable Computers rose. We as of now utilize a ton of compact electronic gadgets like mobile phones, notebooks etc. The subsequent stage in portable figuring could be to create truly wearable computers that are integrated into our daily clothing and always serve as our assistant. In this context the idea of Smart fabric cloths guarantees greater user-friendliness, user empowerment, and more efficient services support. The smart fabrics used in many fields such as Health care, fashion, military etc Smart fabric materials are adaptive, The innovation woven into the smart fabric textures will have the option to see ecological changes and react accordingly depending on the programming or type of technology being used.**

Keywords—Smart fabrics, E-textiles, Interactive Textile

Introduction

Smart Fabrics are fabrics that have electronics, actuators, sensors, data processing, power units and interconnections woven into them. Components and interconnections are a part of the fabric and along these lines are significantly less noticeable and, more importantly, to getting tangled together or caught by the surroundings. Consequently, smart fabric materials can be worn in everyday situations where currently available wearable computers would hinder the user. E-textiles additionally have flexibility in adapting to changes in the computational and sensing requirements of an application.

Smart fabrics are used in many fields such as Health care, military/defense, Fashion or Entertainment, Sports etc. Smart fabric cloths are durable. Same cloths can be used in all the climates, depending on the body temperature it will react accordingly, smart fabric cloths has the sensors, it will detect the body temperature and send these data to the micro controllers, micro controllers give the signal to the electronic device which is woven into smart fabrics, and it will react accordingly, during hot summer it will give the cool feelings, during winter it will warm our body.

Similarly In military and defense field Smart fabric cloths worn in the critical situation, it has the GPS, sensors to track the soldiers, these materials will protect from the bullet, using GPS soldiers can easily find where they are. In health-care smart fabric cloths is used to detect heath

The Smart Fabric cloths are growing at a rapid pace in the health-care, Sports, Fashion and entertainment etc. It is predicted in the future that the Smart Fabric will greatly change our lives.

In this paper the Author discuss about smart fabrics in the field of boo-medical engineering and also discuss some of the signals which can be measured using smart textiles and how this technology is applied[1].

In this paper the current progress is being discussed in creating universal smart textile device which would solve this problem and accelerate the development of smart wearable electronics[2].

Smart Fabrics and Interactive Textile (SFIT) based systems are designed to integrate sensors, actuators, computers and a power source into textiles, all of which are part of an interactive communication network[3].

In this paper, The addition of hydrophobic treatments to antibacterial fabric was concerned and estimated in the form of multi functional medical textiles[4].

In this paper, smart clothes look for a balance among fashion, engineering, interaction, user experience, security, design and science to reinvent technologies that can anticipate needs and desires[5].

Implementation and Design

The devices for building Smart cloths include sensors, connecting wires and adapter. Artificial Intelligence are also implemented in smart fabric cloths which makes these cloths smart. Power supply has also be provided for these to work.
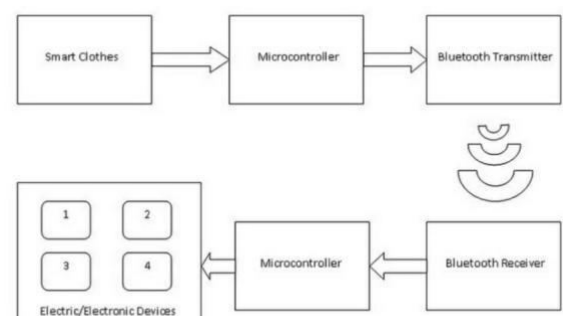

Fig 1: Block Diagram of Implementation of Smart fabric cloths

Fig 1 shows the block diagram of smart fabric cloths, Smart Fabric cloth have electronics and interconnections woven into them. Components and interconnections are a part of the fabric and thus are much less visible. Sensors sense the body behaviors and transmits the data to micro-controllers and micro controllers transmits the data to electronic devices through blue-tooth, based on the data, electronic device will reacts.

Applications

The Smart fabrics has a broad application in the medical field, Military and defense, fashion and entertainment, Sports fields. They are used from tracking minute information such as calories burnt, glucose level, Blood pressure, detecting the location, bullet proof jackets, give warning message during the critical situation and protect body.

Health care – Smart fabric cloths embedded with wireless network and sensors can be used to continuous Monitoring of ECG, respiration, EMG, and physical activity. Wearable sensitized garment that measures human heart beat and respiration using a three lead ECG shirt. The conductive fiber and sensors are fully integrated in the garment.

Fig 2: shirt for measuring rehabilitation

Devices implementation	Sensing components	Signals	Applications
Woven or knitted conductive yarn/ rubber/ ink electrodes	Fabric sensors	Electrocardiogram	Cardiopulmonary
Woven or knitted conductive yarn/ rubber electrodes	Fabric sensors	Electromyography	Neural rehabilitation
Woven or knitted conductive yarn/ rubber electrodes	Impedance pneumographic sensors	Respiration	Cardiopulmonary
Textile fibers or small-sized strips based on conductive yarn	Inductive plethysmograhic sensors	Respiration	Cardiopulmonary
Textile fibers or small-sized strips based on conductive yarn/ carbon filled rubber/ electro active polymer	Piezoresistive sensors	Respiration	Cardiopulmonary
EAP based textile fibers or small-sized strips	Piezoresistive sensors	Movement and posture	Neural rehabilitation
EAP based textile fibers or small-sized strips	Piezoelectric sensors	Carotid pulse, radial artery pulse, heart apex pulse, and sound	Cardiopulmonary
Optical fibers	Optical fibers	Pulse oxygen	Cardiopulmonary
EAP based textile fibers or small-sized strips	Thermoelectric sensors	Skin tempreture	Neural rehabilitation
Woven or knitted conductive yarn/ rubber/ & optical fibers	Fabric sensors	Cuffless blood pressure	Cardiopulmonary

Fig 3: E-textile sensors in health monitoring

The above figure 2 shows the man who wearing the smart fabric shirt which measures the rehabilitation. And the figure 3 shows various devices and sensors which is used in smart fabric cloths in health care.

Fig 4: Smart fabrics for entertainment & fashion

The above figure 4 shows the smart fabric cloths in fashion and entertainment, we can change the color of the cloths whenever we want. This fabric embedded with fiber optics, lights and sensors.

Military/Defense – In extreme conditions and risky situation, these smart fabric cloths will give the protection, and it also has wireless devices which will alert the soldiers in some critical conditions. Smart fabric bullet proof jacket will protect the body from bullets.

Fashion and Entertainment - Club wear that reacts to movement, heat and light. They include clothing with panels which illuminate when the dancer moves, or clothing containing fiber optics woven and designed into the fabric.
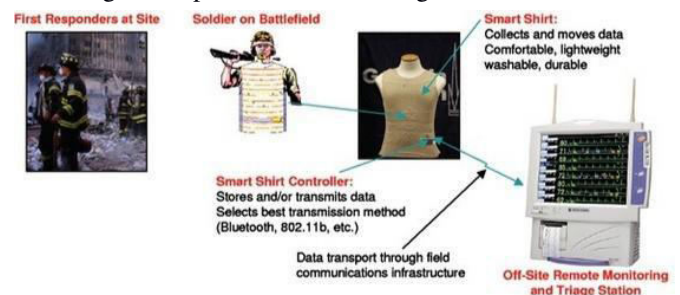

Fig 5: Smart fabric cloths in military and Defense

Sportswear – Smart fabric cloths has a broad application in the sports field. They are used from tracking minute information such as calories burnt, number of steps moved, calculate how many kilometers an athlete run, monitor heart rate and blood pressure during gym workout or morning jogging. And it also can be able to analyze information and based on the information it will give the feedback on performance. Based on the play mood of the athlete it will automatically playing performance enhancing music.

Fig 5: Smart fabric Sportswear

Smart fabric cloths in other fields – GPS enabled smart fabric shoes which allowing mountain rescue services to track the user. In Ski jackets to help the wearer find in the event. Cyclist uses the smart fabric gloves which has heaters and LED emitting light, so that cyclist can able to see in the dark. Modern contemporary cars have control panels that enable air-bags, heated seats which is the application of smart fabrics.

Conclusion

Smart fabric clothing promises more user friendliness, user empowerment and more efficient in supporting services. Electronic textiles or smart textiles describe the convergence of electronics and textiles into fabrics capable of sensing, computing, communicating and acting. Since many different electronic systems can be connected to any clothing. Wearable system is more flexible and depending on the environmental changes and individual preferences the consumer can alter his look. The Smart Fabric cloths are growing at a rapid pace in the health-care, Sports, Fashion and entertainment etc. It is predicted in the future that the Smart Fabric will greatly change our lives.

REFERENCES

[1]. S. Coyle, D. Diamond, "Medical Application of Smart Textiles", Multidisciplinary Know-How for Smart-Textiles Developers, 2013

[2]. Krisjanis nesenbergs, Leo Selavo, "Smart textiles for wearable sensor networks", 2015 IEEE International Symposium on Medical Measurements and Applications (MeMeA) Proceedings, ISBN:978-1-4799-6477-2.

[3]. Rita Paradiso, "Smart Fabrics and Interactive Textile: State of the Art and Future Challenges", 2013.

[4]. Taun-Anh Nguyen, "Multi functional Smart Textiles: Influences of Hydrophobic Additional Finishes on Antimicrobial Treated Cotton Fabric", 2018 4th International Conference on Green Technology and Sustainable Development (GTSD), 23-24 Nov. 2018, ISBN: 978-1-5386-5126-1.

[5]. Tiago M. Fernandez-carames, Paula Fraga-lamas, "Towards The Internet of Smart Clothing: A Review on IoT Wearables and Garments for Creating Intelligent Connected E-Textiles", 31 October 2018.

[6]. Media Lab., MIT, Cambridge, MA, USA, First International Symposium on Wearable Computers, ISBN: 0-8186-8192-6.

[7]. A Lymberis, R. Paradiso, "2008 30th Annual International Conference of the IEEE Engineering in Medicine and Biology Society", ISSN: 2162-2321

[8]. Javad Foroughi , Teodor Mitew, Philip Ogunbona, "IEEE Consumer Electronics Magazine",22 September 2016, ISSN: 2162-2256

[9]. Sam Lemey ,Sam Agneessens , Hendrik Rogier, "IEEE Microwave Magazine", 03 August 2018,ISSN: 1557-9581.

[10]. K. M. B. Jansen, "Smart textiles: how electronics merge into our clothing", 2019 20th International Conference on Thermal, Mechanical and Multi-Physics Simulation and Experiments in Microelectronics and Microsystems (EuroSimE), ISBN:978-1-5386-8040-7.