A study of smart textiles in fashion and clothing

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Abstract: This report covers different projects, research as well as commercial projects, within smart textiles and clothing, with a certain focus on European activities. Each project is categorized as EU-project, University project not funded by EU and commercial projects. All information is based on literature studies, inquires from the Baltic Fashion Partners and search for projects in project databases. The collected material shows that there are research initiative on both European and national levels. In these projects there has been a focus on medical applications and applications concentrated on enabling technologies. Despite an extensive research effort in several projects for over 10 years there are only few smart textile products on the market. In earlier investigations technical and production aspects are explained as barriers for the commercialisation of smart textiles. Fashion is rarely mentioned as a potential area for smart textiles. However, in this report it is most of the companies that are found are deals with fashion. The companies are certainly small and several authors dismiss the potential in their applications as more or less uninteresting.

Keywords: EU-Project, Commercial Project, European Apparels, Baltic Fashion Partners.

1. INTRODUCTION

Textiles of today are materials with applications in almost all our activities, we wear clothes all the time and we are surrounded with textiles in almost all our environments. The integration of multifunctional values in such a common material has become a special area of interest in recent years. Fibres yarns, fabric and other structures with added-value functionality have been developed for a range of applications [Lam Po Tang, Stylos]. Textile materials and techniques have become an important platform for high-tech innovations. Smart Textile represents the next generation of textiles anticipated for use in several fashion, furnishing and technical textile applications. The vision of Smart Textile is to create textile products that interact by combining smart materials and integrated computing power into textile applications.
This report aims to provide an overview of projects combining smart textiles and clothing as a basis for further discussions on how smart textiles could be introduced in fashion. The overview covers different projects, research as well as commercial projects, within smart textiles and clothing, with a certain focus on European activities. Each project is categorized as either EU-project, University project not funded by EU and commercial projects.

2. BACKGROUND

Smart textiles are based on research, which has its foundation in different research disciplines; textile design and technology, chemistry, physics, material science and computer science and technology. Significant for this research is the interdisciplinary approach and the interaction between basic research and design activities. Smart textiles are possible thanks to the three following developments. The first is the introduction of new type of textile fibres and structures for example conductive materials. Smart textiles are based on research, which has its foundation in different research disciplines; textile design and technology, chemistry, physics, material science and computer science and technology. Significant for this research is the interdisciplinary approach and the interaction between basic research and design activities. Smart textiles are possible thanks to the three following developments. The first is the introduction of new type of textile fibres and structures for example conductive materials. The third is different kind of wireless technologies enabling the technology to be wearable and at the same time communicating with other devices such as computers or mobile phones. Smart textiles were introduced in early 1990s, strongly influenced by military research and wearable technology in general.

2.1. SENSOR MATERIALS AND STRUCTURES

The basis of a sensor is that it transforms one type of signal into another type of signal. There are different materials and structures that have the capacity of transforming signals. A thermal sensor for examples, detects thermal change. Other examples are stimuli-responsive hydrogels that swell in response to a thermal change or humidity sensors that measure absolute or relative humidity. Pressure sensors convert pressure to an electrical signal and strain sensors convert strain into an electrical signal. Chemical sensors are a series of sensors that detect presence and concentration of chemicals.

2.2. ACTUATOR MATERIALS AND STRUCTURES

Actuators respond to a signal and cause things to change colour, release substances, change shape and others. Chromic materials, which are widely used in smart textile applications, as colour change material, change their optical properties due to stimuli like temperature, light, chemical, mechanical stress etc. [Addington,Schoedek]. Stimuli-
responsive hydrogel is a three-dimensional polymer network that responds to stimuli such as pH, electric field or temperature changes. The response is swelling and they are also able to release chemicals when required [Lam Po Tang, Stylos].

2.3. CONDUCTIVE MATERIALS

Besides sensors and actuators there is a group of materials that conducts electricity, these are the conductors. They are usually not categorised as sensors or actuators but, due to their conductive properties, they are useful in smart applications. As pathways to transferring data information but they are also important components in the creation of sensors and actuators. Metals, like silver and copper are the most conductive materials [Harling].

2.4. ELECTRONICS

In terms of intelligence, the smart system will require a central processing unit that will carry out data to the different sensors and decide action on the basis of the results [Worden]. The processing unit consists of hardware and software where the software causes unique dynamic behaviour in real time. The traditional package of computing material is a computer that allows data processing as well as communication. The processing unit is a complex structure of electronic circuitry that executes stored program instructions. Included in this structure are; integrated circuits, secondary storages, power supply and communications technologies [Tao2].

3. EU-PROJECTS IN SMART TEXTILES AND CLOTHING

A number of EU-projects in smart textiles have been supported the last decades. Most of the supported projects are within the health monitoring area. Another type of projects at EU-level develop enabling technologies for smart textiles, for example stretchable electronics, integration of electronics in textiles, technologies that are necessary for the development of smart textiles applications.

4. HEALTH MONITORING FOR MEDICAL ASSISTANCE

Health monitoring is a general concern for patients requiring continuous medical assistance and treatment. In order to increase mobility for such patients a huge effort has been pursued for the development of wearable systems for the monitoring of physiological parameters such as respiration, cardiac activity or temperature of the body. Smart textiles play a growing role in these developments since they are well suited for wear ability and wash ability that ensures the comfort for the user.
4.1. WEALTHY

The Wealthy project [Wealthy] was one of the first EU-projects aiming to set up comfortable health monitoring system based on textile sensors, advanced signal processing techniques and modern telecommunication systems. The focus areas were cardiac patients during rehabilitation but also to assist professional workers to consider physical and physiological stress and environmental and professional health risks. In this project two types of sensors were developed for the integration in garments. The first sensor was a lycra based fabric coated with carbon black and rubber for the recording of breathing rate.

4.2. MY HEART

My Heart project [My Heart] is a continuation of the Wealthy project and the aim was to gain knowledge on health status of a large group of people by continuous monitor vital signs using flexible and wearable systems. The results from the monitoring were used to make diagnosis and to detect trends in order to support the citizens to avoid cardiovascular risk factors and help to avoid heart attack and other acute events. For this purpose a set of textile based sensor system were used.

4.3. BIOTEX

The Biotex project [Biotex] can be seen as an extension of the Wealthy and My Heart project with an overall goal to create a garment that monitors biochemical parameters of the wearer. Instead of using conductive materials constructed as sensors a new type of sensors, such as chemical and biosensors were integrated in textile structures. The sensing system consists of patches including textile sensors targeted to measure different body fluids such as blood and sweat was developed and finally integrated in a garment.

5. CONCLUSION

Smart textile represents the next generation of textiles affiliated in both research and commercial activities. The aim with this report is to give an overview of different research and commercial activities for further discussions on how smart textiles could be introduced in fashion. As this report tells, there has already been an introduction of smart textiles in
fashion, however the efforts of introducing smart textiles in other clothing areas are still dominating the research activities. The difference in the clothing area between health care and work wear application and fashion is the type of application.

REFERENCES

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