EVALUATION OF CYBER SECURITY ASPECTS IN SMART TEXTILES APPLICATIONS

Prof. Manuela Bräuning[1],
Tobias Scheible[2] **(M. Eng.)**
[1] *Albstadt-Sigmaringen University, faculty engineering, textile and clothing technology and management*
[2] *Albstadt-Sigmaringen University, faculty computer sciences, it-security and digital forensics*
braeuning@hs-albsig.de

ABSTRACT

The SEKT project systematically investigates the cyber security of electronic communication systems and their integration within smart textile products. The main aims are the scientific investigation of cyber security of smart textile products, the transfer of existing security concepts as well as the development of secure innovative prototypes. Based on the knowledge gained, recommendations for further action will be derived and potential courses for the cross-sectoral knowledge transfer will be developed. An interdisciplinary team of scientists and companies from the fields of textile and clothing technology as well as information technology is facing up to this challenge.

Key Words: SMART TEXTILES, E-TEXTILES. CYBER SECURITY, IT SECURITY, SMART DEMONSTRATORS

1. INTRODUCTION

From automated communication with a washing machine to intelligent theft protection and vital sign monitoring – technology in textiles can make products smarter. In recent decades, the field of technical textiles has gained ground and is opening up to a wide variety of industries with product innovations; here Germany is regarded as an innovation engine and world market leader. [1, p. 4] [2] From underwear, interior design and lightweight construction facilitating e-mobility, to the rotors of wind power peripheries supporting the energy revolution – textiles make an important contribution in our lives and, despite everything, are often used as hidden components. Facilitated by the Internet of things (IoT), textiles can evolve with integrated electronic components, triggering the next revolution in textile and clothing technology. These textile products can be summarized under the term of Smart Textiles.

1.1. Smart Textiles

Although the development of Smart Textiles has been going on for decades, its use in everyday life is still in its infancy and there are numerous definitions with different focuses. In the following, Smart Textiles are defined as textile products that interact with their surroundings and thus actively support their users. The following graphic shows the subdivision into Intelligent Textiles, so-called I-textiles and Smart Textiles with integrated electronic components, so-called E-textiles. In essence, the area of Smart Textiles is not clearly defined and there are linguistic differences between interpretations. However, a general division into I-textiles (intelligent textiles) and E-textiles (electronic textiles) is possible. For this research work we concentrate exclusively on the field of E-textiles and divide this field into the integration levels adapted, integrated and modified. The basis for all variants is functional and technical textiles.

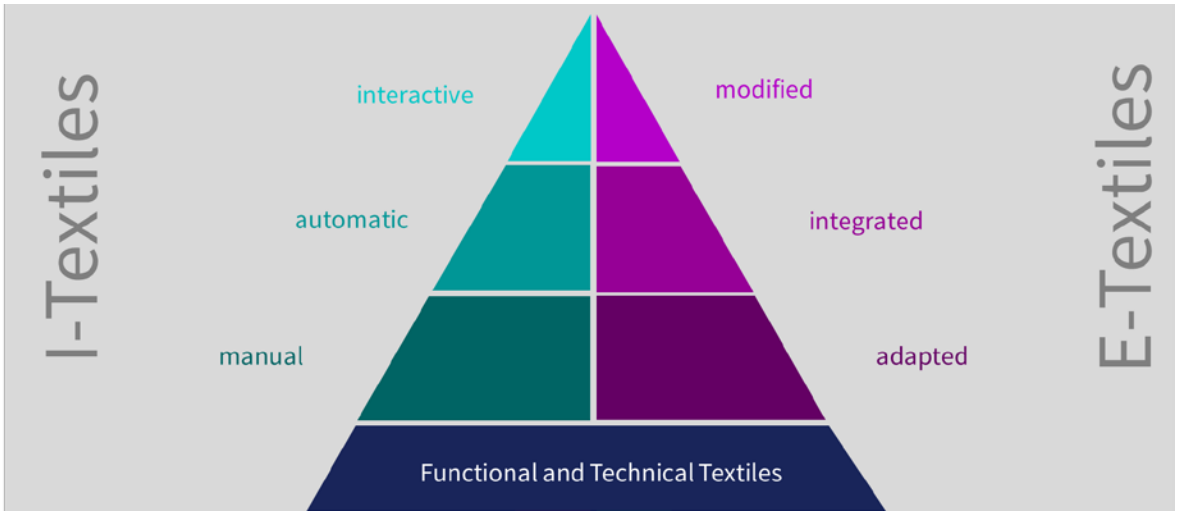

Figure 1: Definition of Smart Textiles

For this research work, we concentrate exclusively on the field of E-textiles and divide this field into the integration stages adapted, integrated and modified.

The Smart Textiles market is a relatively young and agile area, making it difficult to obtain reliable data and forecasts of the market volume. The FashionTech-Smart Textiles report of the Centre for European Economic Research (ZEW) provides data for Germany, the USA and worldwide market volume. Among other things, secondary studies and official statistics were evaluated for the year 2017. At present, a large part of the turnover is still allocated to the supply sector of Smart Textiles, i.e. the sale of conductive yarns, electronic sensors and actuators, etc. In addition, promising forecasts were made for 2022 and 2030. It is expected that the global market volume will have increased thirtyfold by 2030.

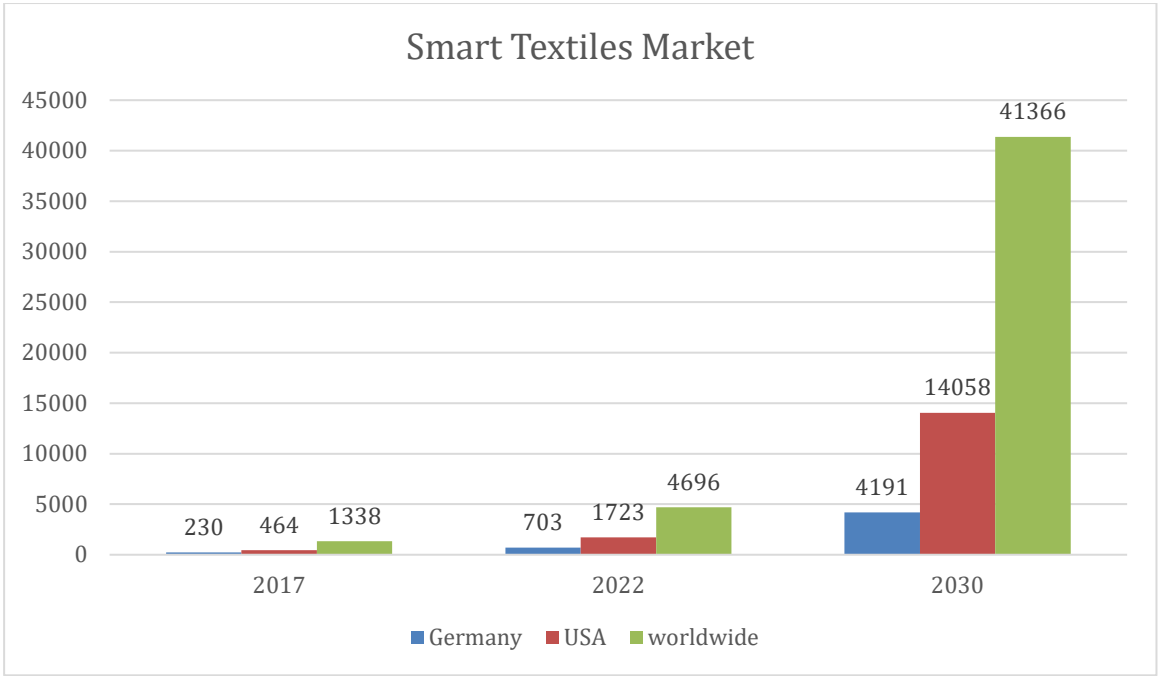

Figure 2: Smart Textiles Market Volume [3, pp. 3-7]

According to the study, the largest increases in Smart Textiles will be expected in the medical, industrial, military and fashion sectors. [3, pp. 3-7] Megatrends such as connectivity, new work, health and individualization will also contribute to this growth [4].

1.2. IT Security

The digitalization of our high-tech world has become a key technology of the future in the last 20 years, mainly due to the development of the Internet. Consequently, IT security has become an important topic due to Web 2.0, social media platforms and the increasing exchange of data, e.g. audio and video data within personal communication networks.
This is precisely why the research area of IT security is a topic full of tensions. Whilst there is cutting-edge research that surfaces fascinating and forward-looking projects, there are also products with a large number of security gaps brought onto the market that may be exploited by attackers without major effort. The report „The situation of IT security in Germany 2018" by the German Federal Office for Information Security (BSI) states that the threat situation for IT attacks has intensified and the focus of attacks has broadened considerably. The areas of Smart Home and IoT, for example, are now also among the targets for attacks alongside traditional computer systems.

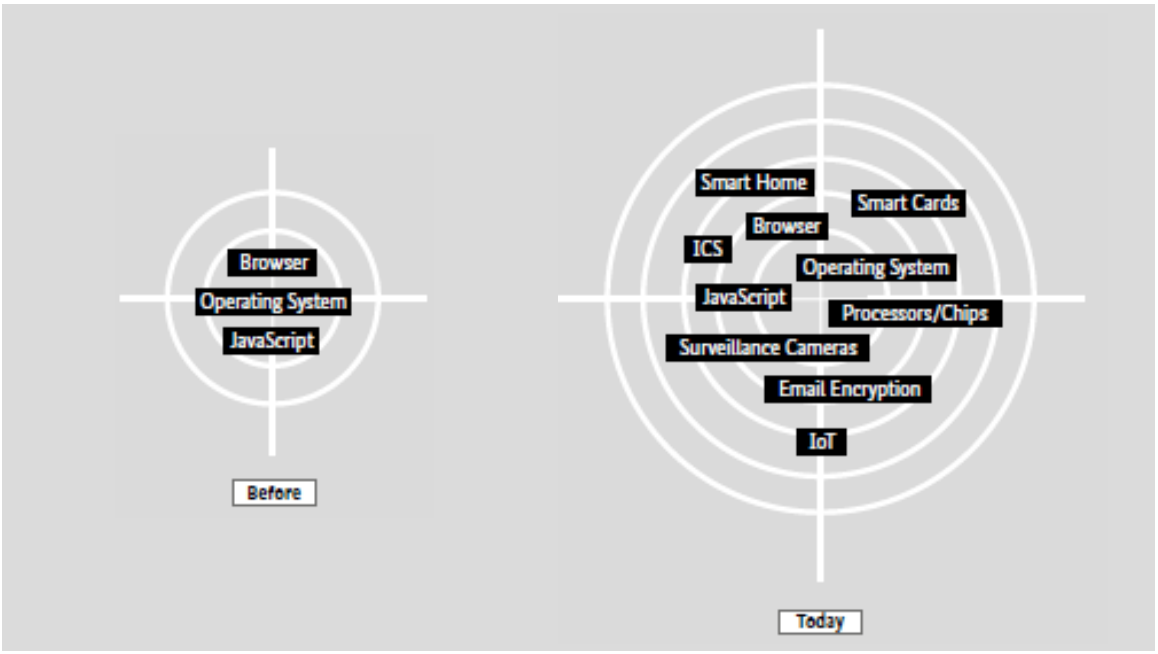

Figure 3: Focus of attacks broadening [5, p. 50]

IT security as a whole should be seen as an open topic, since computer systems in the meantime can be found in all industries. Due to the topics Industry 4.0 and the IoT, IT security will penetrate almost all areas of life in the future. Since Smart Textiles belong to the Internet of Things, they are also a potential target for attackers, yet IT security in this area has not been investigated.

In principle, the knowledge for the development of secure products is available in Germany, as many products could be implemented more securely simply by observing the basic IT protection of the BSI. However, this requires cooperation between different specialist disciplines, as interdisciplinarity is a clear success factor here.

Aiming to take up this approach is the interdisciplinary research project SEKT. Within the project the Faculties of Engineering and Computer Science at the Albstadt-Sigmaringen University of Applied Sciences will link the fields of textile and clothing technology and IT security intensively. The SEKT project systematically investigates the integration and IT security of electronic communication systems in smart textile products and resulting in the development of practical security concepts and smart demonstrators.

2. The project SEKT

The core objective is therefore the scientific investigation of the area of IT security of smart textile products and the transfer of existing security concepts as well as the development of secure, innovative prototypes. This challenge is to be met by an interdisciplinary team of scientists and companies from the fields of textile and clothing technology and IT security between December 2018 and November 2021. In addition to three professors a team of three employees and 12 project partners – ranging from Start-Ups to associations and large corporations – will be involved.
The project is divided into the following five work packages:
1. analysis of current system solutions
2. Investigation of specific systems
3. adaptation of practice-relevant safety concepts
4. development of smart demonstrators
5. knowledge and technology transfer

The individual project phases are described below.

2.1. Work package 1: Analysis of current system solutions

The first step, which we are currently in, consists of research on readily available commercial Smart Textiles systems. Research in this area will then be expanded to include further techniques that will become available in the future. This information will be used as a basis for a survey. To guarantee that the survey is representative, care is taken to ensure that as many target groups as possible are represented in sufficient numbers. Together with the project partners, the survey will be tested and optimized in terms of user-friendliness.
The project partners thus play a central role in carrying out the survey. In addition to directly approaching the identified target groups, the survey is distributed and advertised via the partners, in particular via the network partners. In addition, further networks will be contacted to further increase the outreach of the survey.
The information gained is subsequently analyzed and evaluated. For this purpose, a first overview is created, and coherent clusters are formed. The free text questions are evaluated, and new insights gained are systematically structured.
The first work package will conclude with the publication of the study on the dissemination and integration of electronic communication systems in textile and clothing products. The aim of this work package is thus to identify the technologies used in Smart Textiles for industrial purposes validating the practical orientation of the research project.

2.2. Work package 2: Investigation of specific systems

The second work package is informed by the survey, wherein a number of products available on the open market will be selected and examined together with the cooperation partners. This includes the integration of the electronic components into the textile products, and the examination of the security concepts used. The first step consists of the investigation of textile integration and aims to derive a classification for the degree of integration. At the same time,

security and penetration tests are carried out. The selected techniques are examined for their compliance with security standards. Firstly, the most frequent failures and secondly the most serious security gaps are documented. Finally, the critical fields of action will be identified by evaluating the security tests, which will be further investigated in the next work packages.

2.3. Work package 3: Adaption of practice-relevant safety concepts

In the third work package, the previously defined fields of action are taken up and systematically analyzed. Established security and data protection concepts are transferred and modified if necessary, resulting in a novel security concept. Which in turn then serves as the basis for further development using practical prototypical Smart Textiles. By testing the security concept on different Smart Textiles the applicability of the functional principle will be illustrated.

2.4. Work package 4: Development and production of smart demonstrators

The aim of this work package is to transform the knowledge gained into practice. The demonstrators should be as representative as possible for the different fields of application and implement the requirements collected in the previous packages in specific and tangible demonstrators. Together with the project partners a selection of three demonstrators will be made to be designed, developed and manufactured. They will then be evaluated at the end of this phase with regard to the previously defined requirement profile and their practical implementation.

2.5. Work package: 5 Knowledge and technology transfer

The final work package aims is to prepare the results for ensuring knowledge and technology transfer by means of a compendium and a teaching module in the blended learning process in order to support the process of lifelong learning. For this purpose, the newly collected knowledge will be prepared in a way that it can be used directly for the development and improvement of new Smart Textiles and at the same time educate the general public to raise awareness through the publication of guidelines and other documents.

3. CONCLUSIONS

IT security is no longer to be regarded as an independent area exclusive to IT, but as the base for all future developments with the task to transfer the existing know-how to other fields. The textile industry is and remains an innovative industry, which has dedicated itself to progress across all industries – especially in the area of Smart Textiles – and is therefore predestined for an interdisciplinary model project, which is currently being implemented with SEKT.

4. ACKNOWLEDGEMENT

The German Federal Ministry of Education and Research (BMBF) promotes interdisciplinary research and development projects in the disciplines of engineering, natural sciences and economics, where universities of applied sciences cooperate with partners from business and science. The ongoing research project SEKT (funding code FKZ:13FH180PX6) has the first team of researchers that focuses on the Evaluation of Cyber Security of Electronic Communication Systems in Smart Textile Products. The project started in December 2018 and will last until November 2021. The project team works together with well-known brands with a background in textiles and clothing in different fields such as fashion, sports, military or medical applications and cooperates with different partners from the informatics. In addition, the group cooperates with various associations and the universities of Ellwangen-Nürnberg and

Hamburg – so in total there is a consortium of 12 partners involved. Finally, the project SEKT gets approx. 500.000 Euro financial support by the FHprofUnt2016 initiative.

5. Bibliography

Since 2013 Manuela Bräuning is professor for textile and clothing technology and management in the Faculty of Engineering at the Albstadt-Sigmaringen University of Applied Sciences. She teaches different topics from the idea conception, trough developing to the manufacturing of textile products. Moreover, she has several research topics, namely innovative clothing systems and wearing comfort. Before leading the SEKT project as project coordinator, she conducted the BMBF funded research project RespothermTex that handled the topic of thermosresponsive polymers in smart clothing systems

Since 2012 Tobias Scheible is a scientific assistant at the Albstadt-Sigmaringen University of Applied Sciences in the Faculty of Computer Science. There he first worked as a module developer in the Open Competence Center for Cyber Security research project and developed study content in the areas of cloud computing and internet technologies. He then became involved as an author and e-tutor in the part-time master's degree course Digital Forensics and conducted practical courses on information security and IT forensics in the bachelor's degree course IT security. He is currently successfully applying his knowledge in the research project SEKT.

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