

Smart Clothing

Technology and Applications



Edited by **Gilsoo Cho**



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Smart Clothing

Technology and Applications

Human Factors and Ergonomics

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Contents

| | |
|--|-----|
| Preface..... | vii |
| About the Editor..... | ix |
| List of Contributors..... | xi |
| | |
| Chapter 1 Review and Reappraisal of Smart Clothing | 1 |
| <i>Gilsoo Cho, Seungsin Lee, and Jayoung Cho</i> | |
| | |
| Chapter 2 Designing Technology for Smart Clothing | 37 |
| <i>Joohyeon Lee, Hyun-Seung Cho, Young-Jin Lee, and Ha-Kyung Cho</i> | |
| | |
| Chapter 3 Standardization for Smart Clothing Technology | 59 |
| <i>Yong Gu Ji and Kwangil Lee</i> | |
| | |
| Chapter 4 Electro-Textile Interfaces: Textile-Based Sensors and Actuators | 89 |
| <i>Kee Sam Jeong and Sun K. Yoo</i> | |
| | |
| Chapter 5 Integration of Plastic Optical Fiber into Textile Structures | 115 |
| <i>Moo Sung Lee, Eun Ju Park, and Min-Sun Kim</i> | |
| | |
| Chapter 6 Hardware and Software Architectures for Electronic Textiles | 135 |
| <i>Mark T. Jones and Thomas L. Martin</i> | |
| | |
| Chapter 7 Humanistic Needs as Seeds in Smart Clothing | 153 |
| <i>Sébastien Duval, Christian Hoareau, and Hiromichi Hashizume</i> | |
| | |
| Chapter 8 Shape Memory Material..... | 189 |
| <i>Chang Gi Cho</i> | |
| | |
| Chapter 9 Methods of Evaluation for Wearable Computing..... | 229 |
| <i>Daniel Ashbrook, Kent Lyons, James Clawson, and Thad Starner</i> | |

| | | |
|--------------------|--|-----|
| Chapter 10 | Fundamentals of and Requirements for Solar Cells and Photovoltaic Textiles | 249 |
| | <i>Jong-Hyeok Jeon and Gilsoo Cho</i> | |
| Index | | 267 |

Preface

The set of chapters contained here offers a unique global view for three reasons. First, they evoke the whole design cycle of smart clothes. Second, they cover applications for both the general public and professionals. Third, they dig into human aspects as well as technological aspects.

This book begins with a review and reappraisal of smart clothing by Gilsoo Cho et al., who provide a global overview by summarizing the international state of the art, identifying challenges, and evoking potential benefits of smart clothing from technological and human perspectives. Readers can thus get up to date, visualize trends, and glimpse the future.

In Chapter 2, Joohyeon Lee et al. discuss the design of technologies for smart clothing, establishing the need for methods significantly differing from traditional ones, presenting a whole theoretical design process, and providing concrete examples. Readers can relate to real cases thanks to arguments based on MP3-player jackets, photonic clothing, and bio-monitoring clothing, systems that manufacturers already commercialize though problems are by no means all solved.

In the following chapter, Yong Gu Ji and Kwangil Lee complement the discussion on design processes with a twin discussion on standardization, thus covering a critical aspect of the production and dissemination of smart clothes worldwide. They evoke trends, methods, and strategies worldwide, and detail the cases of South Korea, which is their country as well as the world leader for the production of smart clothing. Readers should value the broad scope of the information provided as well as the separate coverage of clothing and electronics.

Chapters 4 and 5 conjointly offer a view of typical enhancing components for smart clothing. Kee Sam Jeong and Sun K. Yoo present electro-textile interfaces, sensors, and actuators, and then Moo Sung Lee et al. present optical fibers. Thanks to them, the readers should understand the difficulties in choosing materials and designs that simultaneously provide targeted functions, allow a viable and elegant integration into textile and apparel, and maintain the comfort and usability of the final smart clothing in everyday life or for specific activities. As a by-product of their writing, the authors demonstrate the importance of multidisciplinary collaborations.

Reliably and efficiently exploiting combinations of components will often require particular software and hardware architectures, which will differ greatly from those existing for standard computers and multi-function cellular phones. Accordingly, Mark T. Jones and Thomas L. Martin discuss in their chapter the properties of e-textiles and propose dedicated architectures that are fault-tolerant, power-aware, and concurrently support numerous components. Although of low importance for simple cases, these aspects appear critical for complex smart clothes, and can influence their whole design.

Focusing on potential wearers, Sébastien Duval et al. explore in Chapter 7 original foundations for a global future in which smart clothes gratify human needs and match human diversity. This unique approach is theoretical and practical, clarifying trends in ubiquitous computing, testing hypotheses based on humanistic psychology

in the Occident and Orient, and arguing for usefulness from birth to old age. As a result the authors propose a vision based on five key principles. Readers may consider the remarkable importance of this initiative: both meaningful starting points and clear methods are lacking to achieve projects of significant societal value, and public support remains uncertain.

In Chapter 8, Chang Gi Cho offers a deep view of shape memory materials, which possess great potential for future applications related to comfort, health, and survival, as well as aesthetics and fun, but have so far rarely been embedded into smart clothes. Readers may greatly benefit from the coverage of core aspects of shape memory materials, of a series of materials potentially very useful to design smart clothing, and of the numerous references.

In the following chapter, Daniel Ashbrook et al. sketch methods of evaluation, completing the reflections on the development cycle of smart clothes. Armed with significant first-hand experience with wearable computers, the authors provide a unique perspective. However, due to the breadth of the scope and uniqueness of their work, they could only outline the spirit in which to carry out evaluations, describe methods, and let readers be creative according to the intended wearers and smart clothes at hand. In any case, the readers should greatly benefit from this coherent approach, complementary methods, and results based on daily life as well as laboratory experiments.

Finally, Jong-Hyeok Jeon and Gilsoo Cho face the thorniest obstacle for the viability of smart clothes: the provision of energy. As a solution, they envisage creating photovoltaic textiles, textiles that absorb solar energy to transfer it as electricity to the active components. The authors first introduce the basics of solar cells, then identify milestones for the realization of photovoltaic textiles, and finally compare methods for the production of photovoltaic yarns. Readers will note that this visionary approach requires much research and development, and that success is not guaranteed. However, this first proposal may help evaluate the feasibility of the project and clarify difficulties.

I would like to thank all authors for their willingness to accept my invitation to share their pioneering efforts in this field with the readers, and for their time to prepare book chapters with their own thoughts and knowledge. Most of the authors were in the National Research Group of Technology Developments of Smart Clothing for Everyday Life sponsored by the Ministry of Knowledge Economy, Korea. I especially thank Professors Tom Martin and Mark Jones at Virginia Tech and Thad Starner at Georgia Tech for their wonderful contribution for this book. Special thanks go to Drs. Sébastien Duval and Jong-Hyeok Jeon for their participation. I am indebted to the outstanding assistance provided by all reviewers of the manuscripts. Their careful reviews and editorial suggestions improved the scientific rigor and clarity of communication in the book's chapters. I also express my gratitude to Jin Young Choi, a researcher of the smart clothing research group, for her endless devotion.

I deeply appreciate Professor Gavriel Salvendy for allowing me to edit this book in the Human Factors Book Series. Finally, I want to express my special gratitude to CRC Press for publishing this book.

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About the Editor

Dr. Gilsoo Cho has been a professor in the Department of Clothing and Textiles at Yonsei University, Seoul, Korea, since 1984. She earned her B.S. and M.S. in clothing and textiles at Seoul National University in 1978 and 1980, respectively, and her Ph.D. in clothing and textiles at Virginia Tech in 1984.

Professor Cho currently focuses her research on the development of smart textiles and clothing. She is one of the Korean pioneers in the field. She successfully mentored 20 masters students and 7 doctoral students on diverse aspects of textile and apparel science, and has published approximately 90 articles during the last 10 years. In addition, she led various research projects, notably a 5-year project for the “technological development of smart-wear for future daily life” funded by the Korean Ministry of Knowledge Economics until 2009. She has worked with scholars from several leading universities worldwide as well as partners from Korean industrial companies.

Professor Cho has been a member of the Human Factors and Ergonomics Society since 2005, and has served on the editorial board of *Fibers and Polymers* since 2000 and is currently serving as an associate editor of the journal. She has obtained 10 patents covering topics as diverse as switches in fabrics, simulations for fabric sounds, and photovoltaic yarns. She has appeared in *Marquis Who's Who* both in science and business since 2003. She was recognized as one of the top 100 scientists in 2005 by the International Biographical Center, and received an award from the Korean Federation of Science and Technology Societies in the same year.

More information about Dr. Cho is available online at:

<http://web.yonsei.ac.kr/gscho/eng/index.htm>.