Using Smart Textiles in Customized Product Design Children's Drawings as Example

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Abstract. This is a project based analysis of interactive elements by using smart textiles as media. The effective design processes and methods of turning a concept into a real product in textiles industry are demonstrated. First children's' drawings were collected to analyzed the interaction performance expected on soft toys. Second, adapting suitable Smart Textile and the desirable electronic circuits which corresponding to the mode of the situational reaction as well as input and output context design. Finally, customized design process was established for the on-line smart textiles service.

Keywords: product design, work organization & agent modeling, e-fabric, customization.

1 Introduction

Characteristics of Smart Textiles are not only have the tactile of somatosensory, warm, soft, etc., but also provides the effects of light, temperature regulation, power storage, water, and other functions, and mean while preserving the fabric originally unique soft feature which can be braided, stitching, folding, extended class organic qualities, to replace chilled dangerous plastic products, more affinity exists in life. The research starts with children's drawings for soft toys. And base on the setting function of children's drawings to adapt customized modules and proper interactions modes that are suitable for Smart Textile corresponding to the situational reaction as well as input and output context design for the desirable electronic circuits. The establishment of an integrated modeling original design draft, electronic circuits, and smart textile design flow of customized products provide niche related industry to establish a smart fabric in the integrity of the program of customized products designed to integrate the use of technology model.

We also aimed at suggesting the systematized construction of the project management of Smart Textile applied in customized design process by practice cases to find how to improve the inconveniency that customers, material providers and designers confronted and help to integrate the electronic, information, fabric and consumer product.

The development of modes by smart textiles is according to the investigations of interaction concept from drawings, then design and develop the interaction IC boards. For the outlook we need to turn analog children's drawing into digital data by 2D computer drawing, 3D modeling, fabric material, making prototypes, and sewing.

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For the interaction, we need to decide the interactive scenarios corresponding to the behaviors, design electronic circuits and control program. Overall, a well-designed process integration management will be introduced. The use of digital printing and embroidery to accurately reproduce the original creative spirit. The establishment of this design research of customized textile goods providing benefit to establish a niche model in the relevant industry. Based on this, the purpose of the study is as follows:

(1) The establishment of the custom product design process of smart textile in order to understand their customers and designers coordination between each issues.
(2) Analysis of the interaction scenario from children's drawings to develop interaction modes of smart textiles.
(3) Apply textiles on soft toys developed from children's drawings, and dissemble performance of smart textiles.

2 Functional Application of Smart Textiles

2.1 Smart Textiles, E-Textiles

Multi-functional demands on textile fiber material instead of the end product, often reminiscent of smart textiles can be passed with light, sound, electricity, and other special functions with input and feedback fibers. Taiwan Textile Research Institute (hereinafter referred to as TTRI) is the legal entity belongs Ministry of Economic Affairs, has a strong R & D capabilities and resources, and is also a major source of functional fabrics scientific knowledge and education. The following table shows the smart textiles related nature and performance characteristics of their applications which Textile Research Institute published in 2011. (Table 1)

Table 1. Related Smart textiles technologies in TTRI (TTRI, 2011)

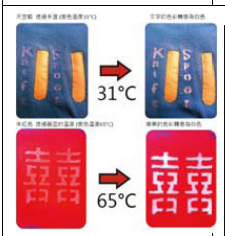
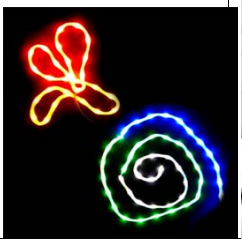
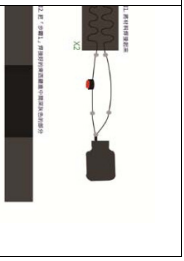
Energy	Sensor	Processing	Feedback
Development of Mobile Energy Textile Technology	Physiology Monitoring Textiles Development (health indicators: heart rate, respiratory rate and body temperature)	Application of Conductive Materials Processing Technology	Monitor(Mobile phone, Nursery Station)
		Development of Conductive Nano Silver Ink	LED Embedded and Photonic Textiles Technology
			Development of Electro-Thermal Textile

Smart fabrics with different definitions from functional fabrics generally defined as the detection of physiological signals or mood changes (Philips Design, SKIN probe project, 2006), and feedback information to enable the user to determine the response. Here are some examples of applications of smart textiles: "Bubelle Dress is composed of two layers. The inner layer features biometric sensors that analyze the wearer's emotions and show them in form of different colors projected onto the outer layer. The dress is the brainchild of researchers at Philips. It functions by analyzing physical

alterations linked with different feelings. For example, stress, arousal, or fear are linked with body temperature and sweat that change the colors of the dress. Thus, when a person is stressed the color of the dress becomes green and when the wearer is calm the dress turns green."

We seek to conduct applied research from analyzing interaction results from children's drawing within the smart fabrics included items such as fabrics covering sensing and feedback technologies. Study will present the results from research and development of the textile. The preliminary plan were from the previous experiences of the smart textile as following:

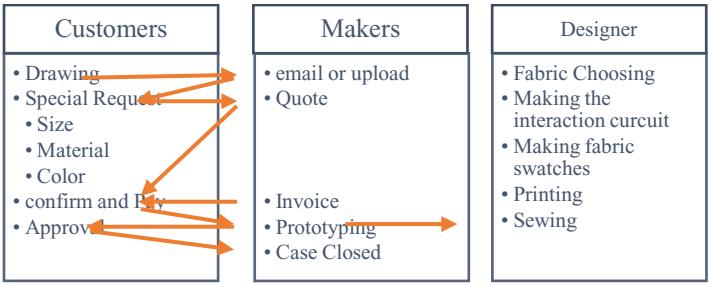
Table 2. Artifacts empowered by Smart textiles technologies. (Source: research result of smart-textile Lab hosted by Aqua Chuan-Yu Chen in Ming Chuan University).

Static electricity,	Light transmission	Conductive	
Sensatex: smart shirt	LED Embedded Yarns	Electro-thermal isolation fiber	electro-thermal Fabric
			

2.2 Customized On-line Service

Smart textiles' characteristics are different from ordinary fabric due to sensing and feedback function, but still with the softness and intimacy experience the plastic product can't achieve. Specific smart fabrics that can replace the hard circuit, plastic, or presented the light and temperature feedback.

Table 3. Related Smart textiles technologies in TTRI (TTRI, 2011)



With appropriate design process management to complete design ideas which can communicated to idea provider, and get expected performance of user behavior are important topics of this study. According to the aforementioned study flowchart of

table 2. The smart fabric design development process proposed in the preliminary design phase differences mode as Table 3 above.

3 The Design Process

3.1 Soft toys by E-textiles

The research started from questionnaires by asking children to draw their own soft toys and asking what are their expectations of these toys if they come alive. The expressions data were analyzed by four aspects: Physio, Socio, Psyco, and Ideo (Jordan, 2002). There are different forms in place for the different children's drawing. We found there are three types of interactions of intimacy: Touching, Hugging and Talking.

Fig. 1. Questionnaires analyzed for the parts of the soft toys and interaction scenarios

3.2 Development of Interaction Corresponding to the Scenario

With the interaction scenarios, three interactive scenarios corresponding to the behaviors are decided. 1) Touching and the soft toy will react by sound of heart beat and breathing frequency of lighting. 2) Hugging to activate the electro-thermo fiber to feel warm. 3) Talking to and the soft toys will reply back.

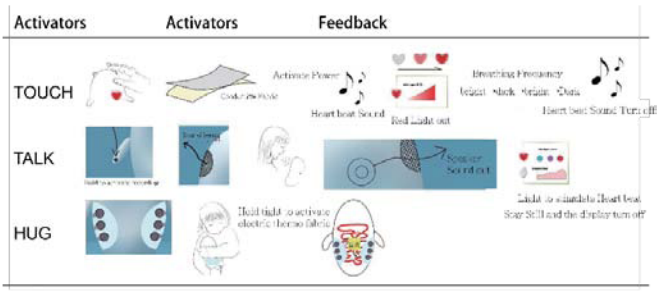


Fig. 2. Three patterns of intimacy

3.3 Applying Smart Textiles to Achieve the Interactions

We used conductive fabric with sensors, electro-thermo fiber, and LED Yarns to achieve the interaction modes. Two different electronic circuits and control program were made. The establishment of this design research of customized textile goods providing benefit to establish a niche model in the relevant industry.

Fig. 3. Two modes of intimacy. The electronic circuits and the smart textiles used.

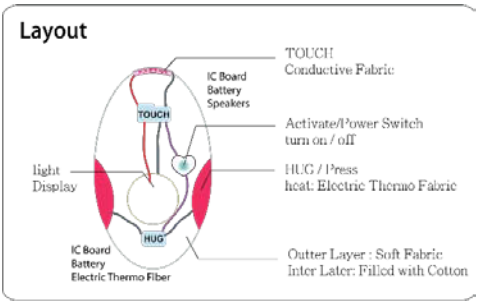


Fig. 4. The integration layout corresponding to the structure of soft toys from children's drawing

4 Summary and Discussion

From the child's drawing, we find the intimacy needs. And the application of smart textiles to presents the interactive results of children's expectation were studied. Currently we can show the interaction of temperature, heartbeat sound. For the next step, we will construct on-line site to collect more children's works and found innocent expectations that smart textiles could be used to develop intelligent interactive modules.

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