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The Smart Glove Workshop

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A Glove for Seamless Computer Interaction – Understand the WINSPECT

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Abstract. As the mouse is the standard user interface for graphical desktop computer applications and the glove has beside joysticks and other immersive interaction devices gained some popularity in several virtual reality applications, the glove seems to be the preferred human computer interface (HCI) for wearable computing. In this paper the concept of the WINSPECT is presented and put into the context of advanced wearable computing applications.

1 Introduction and state-of-the-art

Gloves are a piece of clothing and a part of fashion. However, the origin of gloves is a protective purpose: In ancient Egypt, Greece and Rome mittens were used by farmers and gardeners in the form of little sacks from fur or cloth. The Romans also wore thin finger stalls during meals. It is an invention of the Persians and Germans of the Bronze Age to produce mitten gloves from sheep wool. In the 8th century gloves became a sign for rule and jurisdiction and others were only allowed to wear mitten.

From the 16th century on gloves became common and a part of fashion until about 1950 when gloves lost this meaning for fashion and their use was reduced to the protection against cold and injury. Negative aspects of gloves are that at room temperature wearing those causes sweating and gloves in general hinder fine motor skills.

With the upcoming use of wearable computing this might change: gloves may again become a part of fashion as in some sports or a protective interaction device for the information overload in the professional working environment as for consumer use.

One of the challenges gloves for computer interactions have to master is the integration of electronics and textiles. There exist some examples (see fig. 1) for the appropriate integration e.g. in sports like gloves with integrated heating for snowboarding or gloves with integrated lightning for bikers or the perfect golf glove with an integrated pressure sensor and a beeper for feedback in case of to high pressure. All those gloves are not designed for computer interaction but have some well integrated electronic parts and for the purpose a perfect textile design; they are all consumer products of a reasonable price (up to 150 €).

(a) (b) (c)

Figure 1: “stupid” sporting gloves with (a) heating (b) lightning (c) pressure sensor and beeper

There exist as well some examples for “intelligent” virtual reality gloves designed for complex computer interaction. Those commercially available US produced gloves from Immersion[1] and 5DT[2] are equipped with five to 22 sensors (see fig.2). They are designed for virtual grasping and able to detect exact finger motion. The gloves from Immersion are also delivered with actuators for feed-back and those from 5DT are also available as a pair. The standard interface is a RS232. For the 5DT gloves exists a version with a Bluetooth® interface but the interface and the battery, which allow more then 8 hours operation without changing the batteries. Interface and power supply are not integrated into the gloves but a belt (see fig. 2). The price range for those gloves is between 1.500 and 7.500 US$ including drivers. Those gloves are made of Lycra® in one size fits most.

- Above 5 and 14 sensor gloves from 5DT with Bluetooth® interface
- Left 22 sensor CyberGlove® and CyberTouch™ from Immersion

Fig. 2 “intelligent” virtual reality interaction gloves from Immersion and 5DT

[1] http://www.immersion.com/3d/products/cyber_glove.php

[2] http://www.5dt.com/hardware.html#glove

Another approach for the integration of electronics into textiles is the "Wanted" phone by Berglin[3].

2 Devices for computer interaction in wearable computing

Classical wearable computing is based six components (see fig. 3 left): a core wearable computing unit (CWCU), a communication subsystem to interact with the working environment (CS), input and output devices (ID & OD), general peripherals (GP) like servers, databases, number cruncher and sensor subsystems (SS), which are mandatory for the necessary context detection in wearable computing. It is more or less a desktop computer where the rack (CWCU+CS) is reduced in size as far as possible, the monitor is replaced by a head mounted or wrist mounted device (OD) and as Input device (ID) one-hand keyboards like the twiddler[4] connected by cable to the CWCU are used. The wireless computing unit (CWCU +CS) gives in this approach access to the general peripherals based e.g. on wireless LAN technology. Sensor subsystems are usually understood as sensors somewhere applied to the body and connected via wires to the CWCU.

More advanced 3rd generation wearable computing systems use an on body network and try to go beyond the desktop paradigm (see fig. 3 right). Here the system is reduced to four components with wireless communication, three of them as wearable devices. The sensor subsystem and the input device can be integrated.

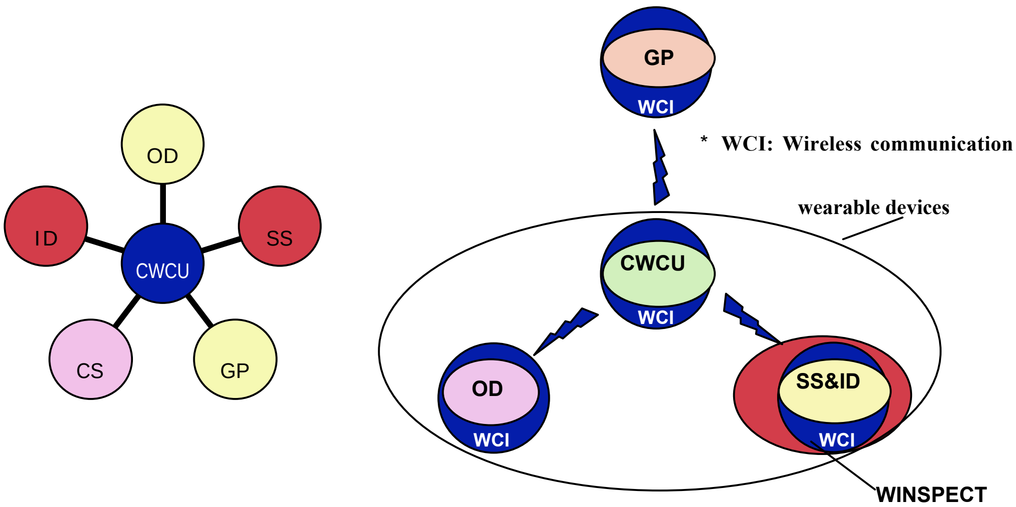

Fig. 3: classical wearable computing architecture (left) and on body wearable computing network (right)

[3] http://www.cs.chalmers.se/idc/publication/pdf/berglin_wanted.pdf
[4] http://www.handykey.com/

To achieve a user friendly and wearable sensor subsystem it seems to be quite natural that the device has to base on wireless communication; thus the device itself could be put on and off like clothing.

3 Components of the wireless WINSPECT

To achieve an implementation of a wireless sensor subsystem the following components have to be managed in an integrative manner: textile as liner, wiring for interfacing the sensors (binary, analog, digital) with the sensor signal processor, a communication interface like Bluetooth ® and the energy supply. Possible sensors are given in fig. 4. Here it becomes obvious that with such a glove much more information especially on the context of the user can be achieved.

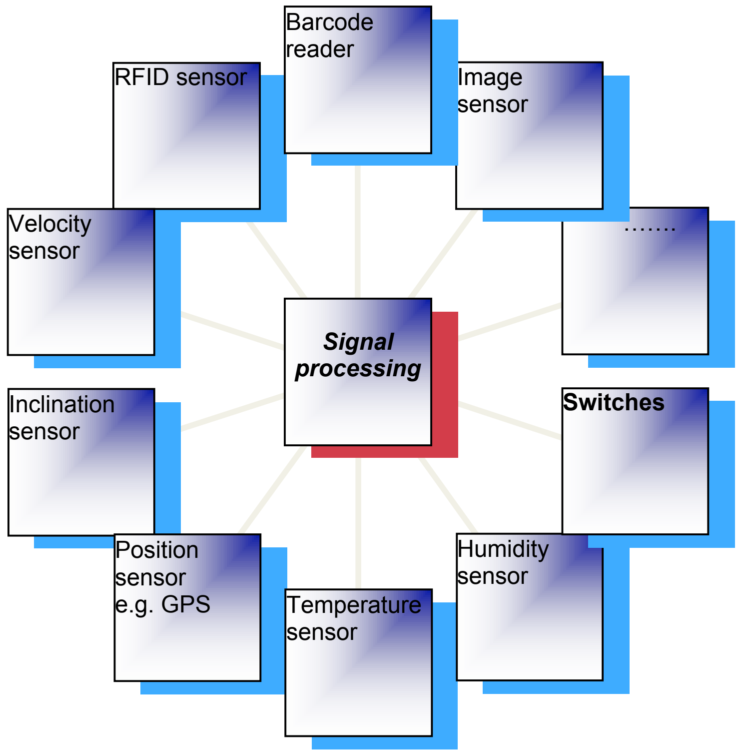

Fig. 4: Possible sensors for wearable computing, e.g. on the wireless WINSPECT

The WINSPECT is a well documented device for wearable computing maintenance applications[5]. But the device was not wireless connected to a wearable computer, which is crucial as explained above for increased user acceptance. The glove was used for applications like seamless selection of displayed items in menues or used as pointing device in computer graphics.

The implementation presented here is based on a three layer glove, an inner layer of a hygiene glove from cotton (user specific) the sensor glove from lattice lining where the electronics are on leatherette and hook and loop fasteners are used as fixtures. The third and outer glove is an application specific working glove (see fig. 5).

Fig. 5 wireless WINSPECT

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5 http://csdl2.computer.org/persagen/DLAbsToc.jsp?resourcePath=/dl/proceedings/&toc=comp/proceedings/iswc/2001/1318/00/1318toc.xml&DOI=10.1109/ISWC.2001.962124

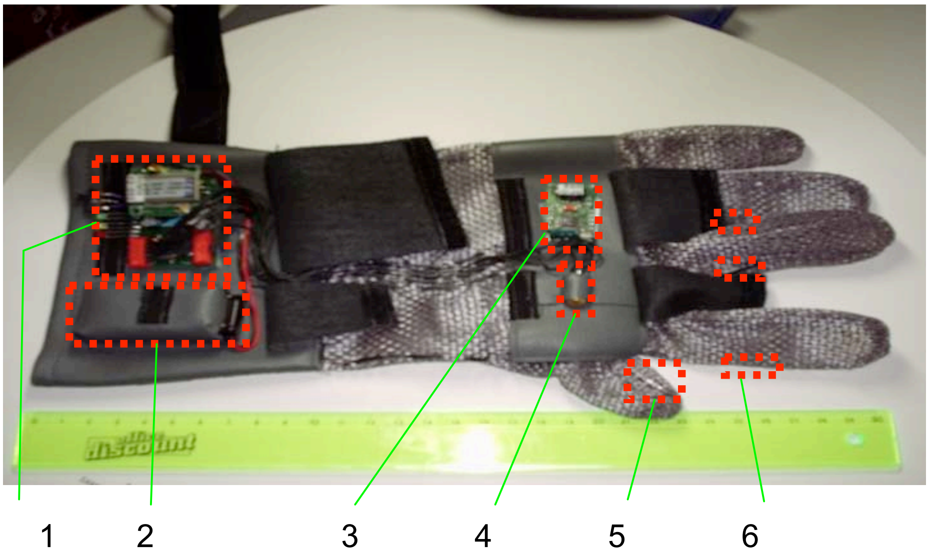

Fig. 6 electronic components of wireless WINSPECT

The following electronic components (see fig. 6) are integrated in the device (1) an electronic module including a Bluetooth® interface (55 x 32 x 15 mm_), (2) an accumulator (9V block), (3) a RFID scanner (37 x 10 x 18 mm_), (4) an inclination sensor (18 mm, Ø 7 mm), (5) a magnet (20 mm, Ø 4 mm), and (6) three Reed-switches (10 x 3 x 3 mm_)[6].

4 Outlook and needs of improvement

The wireless WINSPECT meets the important criterion of wireless communication already quite well. However are the Bluetooth® interface as well as the RFID reader quite energy consuming. Actually on times with the used batteries of approximately one hour can be achieved.

This implementation of the WINSPECT is compared to previous designs a real improvement.

However, there is still some work necessary to improve some aspects:

First of all is this the energy supply. There is a need for flexible boards. Chips without housing would as well as using SMD technology an advance towards an industrial use. The integration of sensors and wires into the textiles seems to be a necessary additional enhancement as well as the used textile material proved to be not optimal. A fingertip free version would also be a benefit.

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[6] * http://www.lichen-int.ebigchina.com/sdp/355735/4/pl-1675186.html

Institut für Integriertes Design
an der Hochschule für Künste Bremen
Institute of Integrated Design
at HfK University of Arts Bremen

Smart Gloves
Dreaming the Future

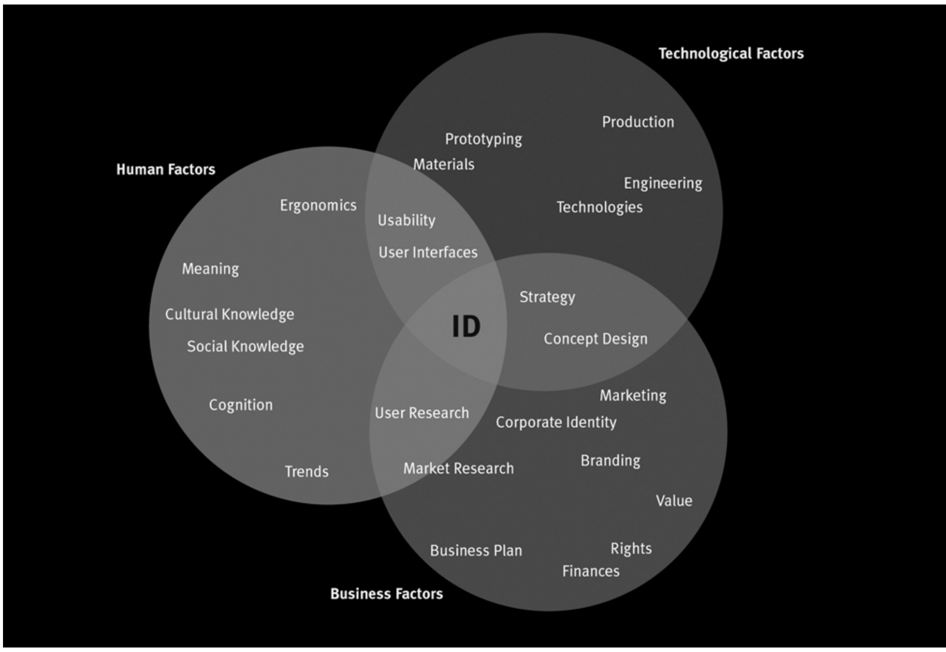
The i/i/d Institute of Integrated Design develops on behalf of companies and organisations user-oriented innovations and design solutions to improve their competitiveness and success of products. The i/i/d is a multidisciplinary centre for research and development. Designers, artists, scientists, architects and engineers work together on innovative design solutions. The institute was founded in 1998 when its director, Detlef Rahe, was appointed a professor for 3-di. Design at the University of the Arts Bremen (HfK). The i/i/d has a cooperation agreement with the HfK and is a company within Steinbeis Group, Steinbeis GmbH & Co. KG for technology transfer. The institute is based in an old warehouse called 'Speicher XI' in the harbour quarter.

Integrated design supports on the one hand the interdisciplinary collaboration of different design disciplines (as communication design, industrial design, architectural design or strategic design) and coordinates on the other hand the management and synchronization of all design activities with processes of research, development and innovations – all with strong user-focus from the early start of projects.

Main activities of the i/i/d are research, development and optimization of the man-made environment and the intensifying of relations between user and product.

Structure:
The i/i/d has six departments, called 'studios':
- management+planning: planning/ management of creative and innovation processes
- products+system: product design and industrial design, system design, robotics
- interior+exterior: architecture for exhibitions and shops, interior and workplace design, guidance systems
- information+communication: brand development and corporate design communication und PR, interface design
- animation+visualization: interpretations of complex processes/structures, graphic, diagrams, charts
- education+organisation: customer retention, events, workshops, trainings for problems solving and creativity methods

Most of the projects are carried out in cooperation of different studios.



Integrated Design

The ultimate ambition:
'User-oriented Innovation by Integrated Design'.

Integrated Design:
- Intensifying the relationship between user and product.
- Increasing of demand, desire and acceptance of new products and services.
- Integrated Design links the sender's (companies) with the recipient's (customers) interests and creates business. In each phase of an innovation.

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Main factors for the relation between user and artifact:

- Senses/Aethetics: form/shape, optics, haptic, sound
- Ergonomics: handling, measurements/sizes, body measurements, cognitive ergonomics (interfaces)
- Image/Status: semantics, meaning for users, defining own social status, increasing the self-respect
- Accessability: easy use, simple access, self-explanatory, easy handling
- Usability: useful, satisfying human needs

Advantages of Integrated Design:

- Customer- and user-oriented innovation
- Combination of creativity, imagination and method based planning
- Reduction of time for development
- Improved marketability

Clients:
The clients of the institute are long ranged, from small companies to huge enterprises. The i/i/d also has some cooperations with institutes at universities working together in various research projects.

Projects:
In the past 7 years the i/i/d has handled more than 100 projects. One main focus is mobile technologies/mobile solutions/mobile communication.

CyberCompanion – augmented reality device

:// CyberCompanion:
CyberCompanion is a communication set, which Astrium together with i/i/d specially designed for working in the aerospace. Based on augmented-reality technologies, it enables astronauts to perform tasks or experiments swiftly, securely and much more efficient. Astronauts are empowered by receiving 2D or 3D data in addition to the view of the real environment. Thus, the actions they are performing are supported. CyberCompanion consists of two units worn on the body and specially designed to consider the working environment in space: first, a head-mounted device with an integrated colour display, camera, position sensors, earphones and microphone; second, a carrier unit holding the computer, the power pack and the radio. In 2002 CyberCompanion received the iF Product Design Award and was presented within the European Design Selection in the Louvre, Paris.

Smart Gloves
Dreaming the Future

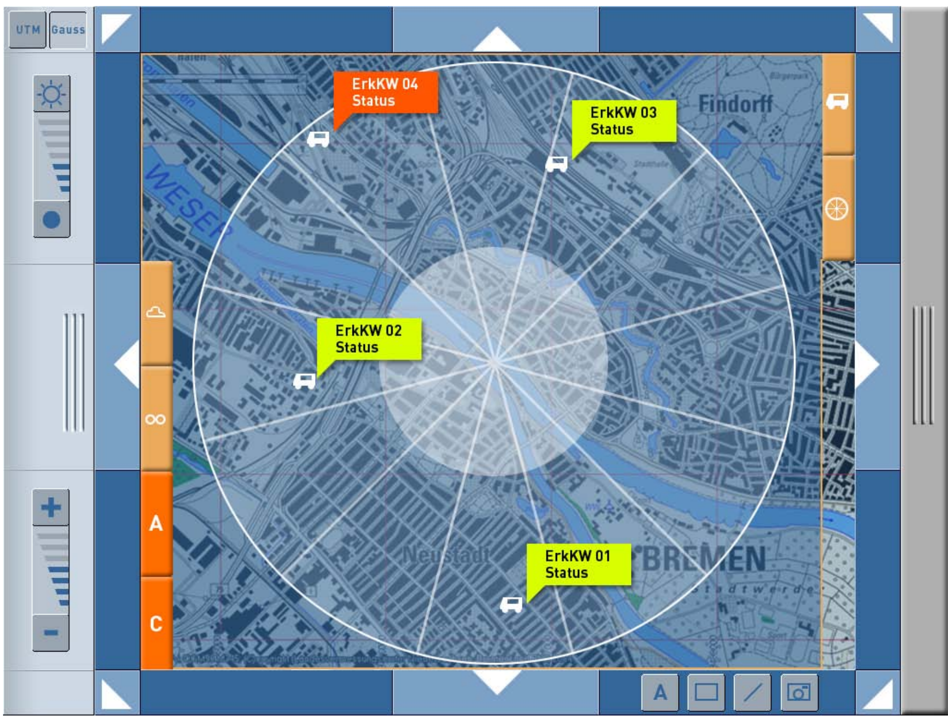
:// TEREBES – Wearable, extended reality system for welding processes:
Based on the same technology as the CyberCompanion, this device will reform welding processes. With the new welding helmet the welder is able to watch the process without damaging his eyes. The helmet has an integrated camera recording the actual process and displaying it at the same time within the glasses. The welder also gets additional information needed to analyze data. Therefore the costly checking of weld seams will probably belong to the past soon. At the moment the welding helmet is tested at the Luerssen shipyard in Bremen.

TEREBES – welding helmet

:// Post Press Company – user-centred operations interface for a cutting machine:
Cutting machines are controlled by interfaces. As cutting processes are complex and dangerous and the staff changes quite often, the principle and the handling of the machines has to be easy to understand and adapt. The concept is based on clear differentiations in colour, well-defined icons and traceable procedures. The interface won the iF design award and is nominated for the German Bundespreis Design.

:// Mobile Future – Future scenarios for mobile solutions:
By order of the Bremer Innovation Agency (BIA) the i/i/d developed several future scenarios for mobile solutions. The result is a storyboard showing life in Bremen in 2010. The story shows various different mobile solutions covering different categories such as school/learning, medicine, tourism, entertainment etc.

:// Civil Protection – Interior and Interface Design for emergency vehicles:
In case of terror attacks, chemical or severe traffic accidents the fire brigade sends out units to carry out measurements of the air or leaked out liquids. A leading unit directs the investigation units and analyses the measurements. Together with the Institute of Automation (IAT), the i/i/d is working on a research project developing a concept for the leading units. Tasks of the i/i/d are the interior design of the leading unit and the interface for the evaluation-software.



Interface design for evaluation software

Institut für Integriertes Design
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Institute of Integrated Design
at HfK University of Arts Bremen

Smart Gloves
Dreaming the Future

My glove:
Thesis of the workshop:
‘Smart gloves may expand the scope of gloves beyond protection and fashion. Smart gloves are novel human-computer interaction devices that can be both high-end and easy-to-use.’
Smart gloves are trendsetting and promising wearable computing devices.
Future scenarios have to be investigated and developed for defining smart gloves applications.

Some exemplary scenarios:
- 3-d-modelling: forming something virtually with your hands covered with gloves, seeing it through special virtual-reality glasses/on screens and getting the data on PC
- 3-d-measuring: taking measurements/scanning with your hands (f.e. on building sites)
- Learning to conduct: practicing virtually without orchestra, hearing the result via a programme on PC
- Sign-language-translator: translating sign language into word documents
- Measuring surfaces: getting measurements of surfaces (material, coverage, layers etc.)
- Virtual teacher: practicing an instrument without the instrument, listening to the results via a programme on PC
- Virtual keyboard: typing documents without a keyboard
- Optimizing movements: practicing and optimizing exercises/movements
- Touching virtual 3-d-projections: feeling virtual 3-d-projections


3-d-modelling

The i/i/d can supply the following contributions to the development of future smart gloves applications (within a research project f.e.):


3-d-measuring

- Research in novel human-computer interaction devices
- Development of future scenarios
- Investigation and defining of target groups/milieus
- Design planning and management of the creative innovation process
- Design of products, the glove and integration of electronics
- Support with the smart glove prototyping/design models
- Overall Interface design


Learning to conduct


sign-language-translator

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Position Paper

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Lösungsmittel Produkt- und Industriedesign GmbH
URBAN TOOL | “frischware” Design und Handels GmbH

The *Lösungsmittel Produkt- und Industriedesign GmbH* (product and industrial design) has been developing and researching in the field of wearable products for more than 4 years. Next to products such as the washable music players from “sound2wear” and the holsters from “URBAN TOOL”, the company is developing wearable products for “Xybermind” und “Reebok”. Two years ago the company started working on research and is financed by public funds.

URBAN TOOL | “frischware” Design und Handels GmbH (design and trading company) operates since June 2004 and distributes and brings innovative products to market, especially in the field of wearable electronic and emotional electronic devices.

Mag. Sabrina Tanner and Dipl. Des. Anja Herwig lead the two companies and conduct the research work.

Both companies are performing together with Moondial Inc. as “FLYING LEAP” focused on research and development of marketable wearable products.

We think further steps with smart gloves are requiring substantial thoughts in the following issues:

Environment:

The surrounding environment of wearable products is made up of 2 totally opposite industries. On one hand there is the fashion/textile industry with its requirements and on the other hand is the IT and electronic industry with its total opposite views. Both sides have its rules and ways to develop innovations.

Wearables products have to fit into both segments and if you are aiming a serial manufactured product, which would be very appropriate for smart gloves products, it is very important to reflect the environments for production and development and bring these requirements into the product concept and product design at an very early stage.

Product development:

Wearables worn on the arms and hands have to be designed very sensible because hands are peoples most tactile and qualified tools. The product design for such products starts right at the conceptual target of the product. Many social, psychological, ergonomic and human related parameters have to be incorporated. The success or failure of a smart glove product goes hand in hand with a smart product development which is able to build up a new and capable product design for such new products.

Product design and development for wearables demands substantial and interdisciplinary skills and has to incorporate right at the beginning the view for serial production and market positioning.

Market strategy:

The best product and the smartest solution miss the market if it is not developed according to the requirements of potential sales channels and market segments. Therefore appropriate analyses of future markets and sales channels are essential. Current distribution channels are made for conventional products. They are well organised and have potential to work well for these products. If a product doesn't fit to normal categories, and wearables especially don't, it will be really difficult to bring the product on the market. It is an illusion to establish new channels; therefore a recommended strategy is to build up existing channels with intermediate products and follow with more complex solutions.

Position Paper on Smart Gloves:
Smart Glove Statement regarding Skin, Body and Touch.

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Skin is our largest organ. It contains nerve endings, which provides the sense of touch. It communicates emotional, physical states and communicates through hormonal signals. The conductivity of skin is a sensitive indicator for stress.

The motives to develop a smart glove can be improved performance, health and survival. Biotextiles will play an important role for human well-being. Tomorrow's clothes could administer medication to the body, have a healing effect, measure blood pressure or temperature, and communicate with the physician.

Smart gloves clothes cauld save lives and simplify cost-intensive medical monitoring.

We try to make clothing fabrics that have the extensional qualities of our skin and clothes are said to be our second skin.

Touch can offer inspiration for our glove design. Touch is our most neglected sense. We are always touching something and being touched in return, but we seldom think about it. Scientists know less about the workings of touch than about our other senses.

Touch can produce delightful sensations or uncomfortable reactions. The right touch can make us feel secure, happy, loved.

Social taboos and new technologies often seem to get in the way of human contact. Many of our ordinary interactions with the world make poor use of our sense of touch.

A smart glove could engage us more playfully with the touch senses. To explore unexpected materials, reinvent how we use objects and technologies in order to produce more satisfying encounters and to promote richer human relationships.

New technology could be space around objects to support issues of self-definition or expression.

The research approach at the Swedish School of Textile is based on combining practice based design research with experimental engineering science in a series of experiments interlinked through given product applications.

Examples of product applications is a toy project called Spookies where the integration of technology in a soft textile toy has been explored. By using a colour change print combined with a knitted fabric integrated with a layer of conductive yarn feedback can be

Medical applications such as EKG, EMG and respiration rate is an other area where THS collaborate with Umeå university, Swedish National institute for Working life and Chalmers University of technology. The third project is a glove project called Wanted, which is a glove that is wirelessly connected to the mobile phone, which makes it possible to make and receive calls through the glove. Besides the applications the research is concerned on how the different textile structures in weave, knit and finishing for example affects the electronic properties in a conductive surface.

The Wanted project is focused o gloves and has resulted in two types of prototypes and a third prototype concept has been developed. The project has been tested on several people and the response has been positive. The first prototype was tested and the response was positive. It has been easy for users to understand the products and to understand its purpose.

The first prototype of Wanted was focused on the act of communication. Receiving and making calls through the glove. An interesting challenge in this prototype was to avoid the interaction model from the mobile phone. Instead of using buttons and display Wanted uses hand gestures and voice. A phone call is made by activation, phoning by voice recognition, speaking and ending the call by deactivating the function. The headphone and microphone are placed inside the hand and the activation part on the thumb.

In prototype number two a knitted textile system has been integrated. The system transmits signals between the components and allows the user to move the technology from one glove to another. The glove consists of a knitted textile system that transmits sound between the different components. The system also allows the user to move technology from one glove to another.

A future proposal for this product is to extend the project and to use further gestures in the interaction with the user.

To communication two more concepts using mobile technology in different ways, could be added, information and an open function

1. Communication, make call, receive call, increase/decrease sound
2. Information, get certain information like weather, navigation
3. Open function, different services to the system you log on to. It is called identification and it can work like a fingerprint, giving access to ski-lifts or avalanche warnings, for example. This identification could also be used as support for working teams.

The concept is designed in a three finger glove where the interaction takes place mainly by voice and hand gestures. The basis for hand gesture is a textile structure sensitive to stretch.

Wanted 1

Wanted 2 New prototypes

Wanted 2 Textile databus

Wanted 3 Gestures using stretch sensing materials

CONDUCTIVE, SENSORIAL AND LUMINESCENT FEATURES IN TEXTILE STRUCTURES

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ABSTRACT

The TITV - The Institute for Special Textiles and Flexible Materials - is a German textile research institute. Our special capabilities are:

- thread materials / threads with a high level of conductivity and textile properties
- special thread constructions (fancy yarns, braiding)
- possibilities to produce fabrics with these material (weaving, warp knitting, embroidery)
- textile circuitries based on woven structures
- coating technology
- textile test laboratory.

Furthermore the institute has experiences in the area of medical textiles:

- monitoring of bodily functions
- 3 dimensional fabrics with defined pressure elastic behavior and thermoregulation
- textile switches based on matrix structures.

In this paper the current stand of technique and actual developments will be presented. Also examples of conductive structures and their processing possibilities are shown. Textile conductor busses and carrier of ICs show the possibilities of textile micro-structuring. Another field of application of conductive structures is the use in a textile-based keypad or matrices.
The galvanic modification improves the electrical properties of the textile structures. Through special coatings luminous / luminescent textiles can be produced.

INTRODUCTION

The TITV – The Institute for Special Textiles and Flexible Materials – is a German research institute. Since its foundation in 1992 the TITV (Textile Research Institute Thuringia Vogtland) with 50 employees has its focus as a close-to-business establishment in special technologies.
On one side, microsystems techniques and their integration into flexible textile structures play an important role in our current activities, on the other side we combine textile technologies and new materials to develop special items characterized by flexibility and low weight.
Here are the current fields of activities:

- Textile Microsystems Technique
- Textile Structures for Medicine, Biotechnology and Bionics
- Coating / Surface Modification
- General Textile Technology.

The research groups of the TITV are joined in networks to handle technology-comprehensive research projects. Another basis is the interdisciplinary integration of other research institutes and small and medium businesses. This includes medics, medical technicians and specialists for micro-systems and electronic systems.

PROCESSING CONDUCTIVE MATERIALS

The research of the TITV to integrate microelectronics into textiles had already begun in the middle of the 1990’s. 1997, a multi-layer textile structure with a network of conductive threads with defined section points and connection points was developed./1/ Common wires were used which were made textile processible through special thread constructions. Narrow fabrics served as carrier for electronic units, transferring information and energy. /2-4/ Figure 1 show a circuit layout, the textile substrate, the assembling of the chip and the complete circuit. This conductive textile structure is the basis for several applications. Figure 2 shows high flexible connectors and bus systems. Another example for this is a textile EEG electrode.

DEVELOPMENT OF CONDUCTIVE THREAD MATERIALS

Further developments of the TITV contain the improvement of processing features of the conductive materials and the increase of conductivity itself. The development of Elitex®-threads allows the manufacturing of innovative products or functional components. Elitex®-threads are galvanic modified silvered threads made of polyamide. The base material (Shieldex® Yarn), made by Statex Company, Bremen, is provided in different finenesses and has a certain value of conductivity. The resistance depends on the silver layer and goes from 400 Ohm up to 1,5 kOhm per meter. Through an extra galvanic after-treatment process, additional silver is coated on the thread. Depending on the amount of additional silver, the conductivity of the material increases. High electro-plated threads have a resistance of 20 to 40 Ohm per meter. The textile properties of these materials are still given and can be compared with multi filament yarns made of polyester or polyamide. Shedding, twining and enwinding can even increase conductivity and occurs in dependency from the application. So threads with a resistance of 2 Ohm per meter were processed with the above mentioned base material.

APPLICATIONS

Elitex® threads and PES multifilament yarns are the basis for developments of the TITV, like the textile switch, woven transponder antennas, luminescent textiles and textile bus structures.

Textile Transponder Antenna

To optimize the processes in logistics, several micro units are used, like the RFID-tags or the transponder. A disadvantage is that they can only be read out over short distances which is not enough for many applications. The scientists of the TITV developed a textile transponder antenna integrated into a label. This transponder antenna is flexible and washable and has a good reading range. The label can be affixed permanently on textiles and provides the common visual marking too.

Figure 4 shows the single steps of development. Textile processes like weaving, knitting and embroidery are used for pre-structuring. There are 2 kinds of manufacturing. First, common material (Shieldex®) is galvanic after-treated. The advantage is a solidification of existing weaves. The second possibility is the use of Elitex®-threads. For solidification, special weaves were developed. Both versions were tested. The more favorable solution was the second one.

The woven transponder antenna consists of a three-layer fabric. The lower layer provides conductive threads in weft direction. The middle layer is for isolation. The upper layer provides conductive threads in warp direction. A special weave connects the threads right on the desired contact points. It was also investigated to manufacture the antenna by embroidery. The advantage is a permanent circuit path without any contact points. But to lead the circuit path through the reel to contact the chip caused problems. The Fraunhofer Institut für Zuverlässigkeit (IZM) Berlin helped us with these investigations. /6-8/

The latest version of the woven transponder antenna is a three-layer fabric too. Lower and upper layer are for isolation, conductive materials cross themselves in the middle layer. If a contact point is not desired, the respective warp thread is taken in the upper layer, while the weft thread is taken in the lower layer. The middle layer now is for isolating. With this layout, no contact problems occur.

Luminescent Textiles

Woven double comb structures are the basis for luminescent textile structures (see Figure 6). On both sides of the structure an electrode is woven in with the help of conductive materials. Alternating implemented weft threads are contacted by weaves on the respective side. Then an electroluminescence paste is coated.

This can be realised by screen printing too. With high-frequency voltages the paste is activated to light. /6,8,9/

This textile structure can be a basis for LEDs too. Figure 7 shows a conductive fabric with contacted LEDs. Through the properties of the Elitex®-threads (multi filament yarn) the surface can be embroidered without taking the conductivity out.

Textile Bus Structures and Switches

Parallel adjustment of Elitex®-threads provides the manufacturing of textile bus structures. Data transfer rates up to 20 MBit per second are possible. These flexible bus structures are unbeatable with their textile haptics. With very good forming properties they can be used in places where usual cables are difficult to reach. And with attention to a permanent bending load, textile bus structures are durable over a long period.
Textile bus structures can be used to realize a textile switch or a textile keyboard.
Figure 7 shows the integration of the components in a car's seat. Used items like

- Double Comb Structure with LED
- Textile Flexible Display
- Textile Bus Structures and
- Textile Switch

fulfill their function.

SMART GLOVE

One application was the development of some components for a "smart glove" with the possibility to integrate electronic functions. The TITV has developed internal textile components like textile switches, conductive textile connections and the textile layout. The interfaces between cables and threads as well as between textiles and electronics were realised (see Figure 8).

SUMMARY

The developed Elitex®-threads from the TITV can provide the basis for new applications of textiles. The interdisciplinary cooperation of chemists, physicians, electronic technicians and „textilers“ creates innovative products with new features and functions. These products have chances in the growing economic sector of technical textiles. /10,11/

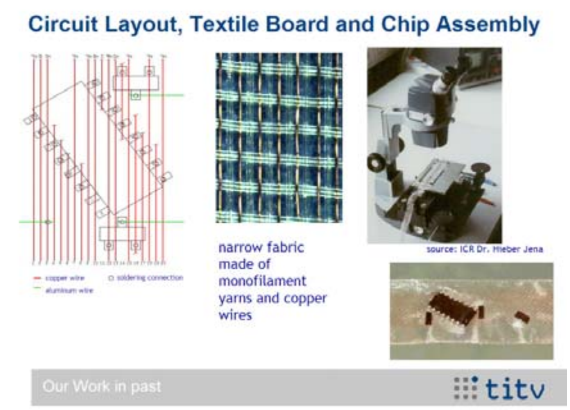

Figure 1: Circuit Layout

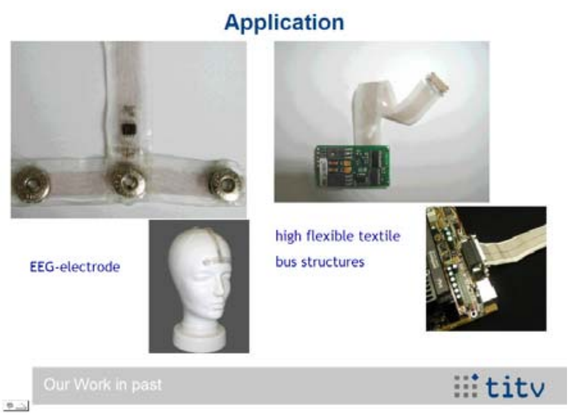

Figure 2: Application

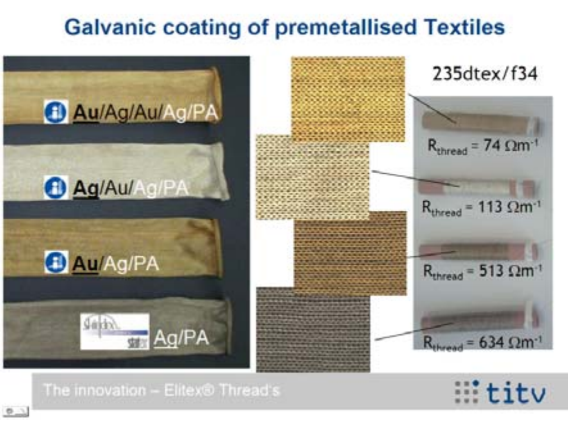

Figure 3: Elitex® Threads

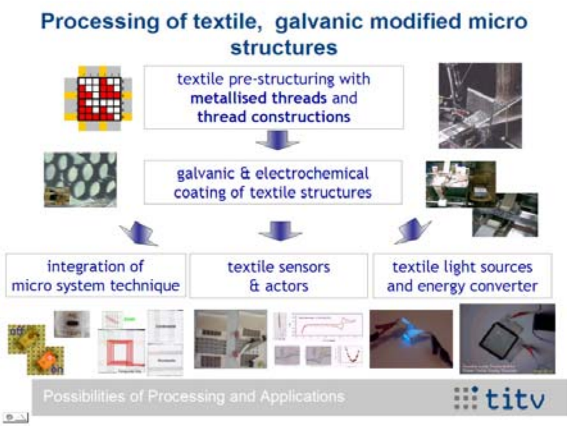

Figure 4: Textile Structuring / Application

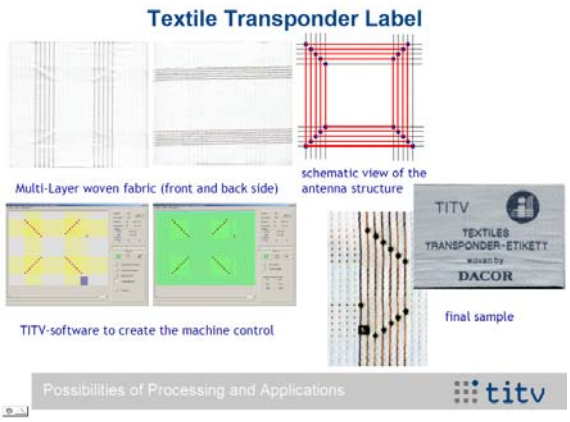

Figure 5: Transponder Antenna

Figure 6: Luminescent Textiles

Figure 7: Application

Figure 8: Application

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