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Eleksen

Getting switched on to wearable electronics

Research has proved that first impressions count. People judge one another by their clothes, their hair, even their hands and in modern society we are also judged on... our gadgets. Anyone who's anyone these days is conscious of having the latest mobile phone, the most recent notebook computer and the trendiest MP3 player as this is how people are judged nowadays. But as technology advances to make our lives easier, one thing that becomes more complicated is how to carry all of these electronics around with us comfortably. And, how do we ensure that these labour saving devices that we can no longer live without remain fully charged at all times? This is where developers saw a gap in the market which has led to a whole new generation of apparel, wearable electronics or soft products.

Few would disagree that the concept of wearable electronics is a positive step for the consumer and the apparel industry. The wearer can enjoy the benefits of being constantly 'plugged in' to the technology they have become reliant upon without being laden down with numerous gadgets, and apparel manufacturers have the opportunity to add extra value to their products. All very good in theory, but wearable electronics is far from a simple matter of incorporating a battery into a jacket. However, after years of research and development, several firms have succeeded in producing reliable, useful wearable electronics that fulfil a market demand.

Fashion leads to functionality

The iPod is an important little device, as more than anything else it has driven the fashionable use of modern electronics and the need to find

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some way to manage not just a mobile phone, but also all the other 'must have' electronic gadgetry of modern life. Drive along the Charles River in Boston, or any similar location in almost any major world city and you will see joggers with iPods attached to their upper arms or belts as they exercise, oblivious of the world around them.

With phase change materials to balance temperature, silver to kill off those unwanted bacteria, and lotus leaf biomimicry to self clean our clothing, smart materials have been getting steadily smarter. At the same time radio chips, like RFID tags that transmit data contained in them, have been added to clothing to provide readable washing instructions or included in Swatch watches to serve as ski passes.

So, it is not surprising that the pressure is on to get electronics into garments. Wearable electronics can lead us into many definitions, with companies such as Polar, Suunto, Casio and Timex all involved in providing huge amounts of information on the wrist. Polar has an interest in transmission and has taken one step further with the incorporation of its heart pulse monitor and transmitter in a sports bra. Suunto and others now also offer electronic pods which attach to the laces of footwear to transmit data on movement. For Suunto this has been developed to allow a trainer to monitor a team's performance from a distance.

Helly Hansen has also added electronics to its jackets – one for sailors provides emergency lighting high on the sleeve, and another for hang gliders gives wind speed indication.

But the excitement of the last few years has been to define 'wearable electronics' as items even more integrated into the garments and even the fibres of the garments themselves.

Consider what Hans-Jürgen Hübner, CEO of the innovative Swiss Schoeller Textil AG said at a conference in October 2003.

'In addition to innovations based on nanotechnology or biotechnology, developments in the electronic sector will also have an important influence on the textile industry. The 'wearable electronics', or, in other words, 'communicating jackets' are no longer a Utopian concept, but very realistic and on the way to becoming available for the market. Through the link between nanotechnology, information technology and electronics, clothing will become a means of informing, communicating and entertaining.

"Achievements resulting from the interlinking include work wear integrated identification systems permitting access to restricted business sites or luminous safety zones and emerging company slogans; clothing that could monitor and regulate blood pressure or heart rate on a daily basis; bio or microchips could register the temperature of the body to control the heat supply; and finally in fashion, change the colour and the look of the fabric by a simple press of a button."

Some of these things were already happening, with Philips and Levis combining a few years ago to market a jacket with an integrated mobile phone and MP3 player, built-in. The earphones were built-in via the hood. The difficulty with this system was to find a wiring system which was robust enough to handle cleaning, and it is in this area that new advances are now being made. Motorola and Burton have their Bluetooth Snowboarding Jacket where the boarder can switch from phone to iPod on the snow and O'Neill also has a Bluetooth MP3 snowboarding jacket.

Last year Nyx of Los Angeles introduced a jacket with an illuminated display on the back which runs off batteries and can be changed using a PDA.

Military advances

Activity in Iraq and Afghanistan is part of the push for development, as in a joined up world of communications US and other soldiers are carrying unacceptable weights, sometimes close to their own body weights, when out in the streets. This includes items such as body armour, weaponry, and water. Yet an increasing amount of the weight is represented by new electronic gadgets each requiring extensive batteries. So if these could be combined into the soldiers'



Spyder's limited edition ski jacket with Elekson's sensor technology

Elekson

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Sensing a change in the market

UK-based company Eleksen is one such company to have succeeded in this sector and has collaborated with well-known names such as O'Neill and Spyder to produce innovative products.

Eleksen has developed its own patented sensor technology to create durable, pliable and discreet control interfaces. Based on ElekTex multi-layer fabric technology that can determine X,Y, and Z coordinates, it is made from 100% fabric conductive ribbons that eliminate the need for wires.

The sensor is constructed from multiple fabric layers with the connectivity created through fabric ribbons, which means that it offers the advantages of an electro-mechanical sensor in a lightweight, soft form. It can be intergrated into the assembly of any existing product as it can easily be glued or stapled into place. Furthermore, unlike less advanced soft electronic products, it is also very durable, withstanding puncture, washing and temperature tests. It is also very sensitive, which has allowed Eleksen to reduce the size of the sensor without reducing its efficiency. And maybe one of the most important factors is that it can be washed, a hurdle that in the past proved to be a problem that was far from easy to overcome for developers of this type of technology.

If that were not enough, Eleksens sensor is also breathable, and semi-transparent so that it can be back lit and configurable with software.

garments, and some supportive power source be provided, further potential growth in weight to be carried could be contained.

At the same time if a viable portable power system could be introduced this could be applied to providing some form of temperature control, most likely for creating a cooler micro-climate for a soldier in a hot climate. This would also help many non-military users who have to work outside but still wear heavy protective clothing.

So getting the electronic technology into the clothes holds great potential, in streetwear, military, sports and industrial usage.

Some of this is made possible by advances in what is described by Ian Pearson, the BT futurologist as organic electronics. These are effectively conducting and semi-conducting plastics which can survive machine washing. Writing in the Journal of The Communications Network, he says: "Thin flexible displays are becoming available already, and we will undoubtedly see them built into clothing with increasing frequency. This will be both for body adornment and functional uses. A wide range of electronic devices can already be built into clothes and this will increase. New fabrics are already being developed to provide power generation, using solar power, electromagnetic, thermal and mechanical means."

Keeping in contact

Communications in the field is also a vital area for the military in the field and wearable electronics could prove important in this sector. In regions such as the Middle East, solar energy is abundant and with wearable technology that is powered by solar panels, these garments could in fact become valuable military equipment.

Putting theory into practice

This is all very impressive so far, but many new developments soon become obsolete before they are truly launched, unless at least one big name brand picks up on the new technology. In the case of Eleksen, this looks unlikely to happen as two big name brands have already recognised the potential for this technology and have developed products incorporating Eleksens sensors, which have added to the genuine functionality of the garments.

Spyder has launched a limited edition ski jacket with an intergrated iPod using Eleksens technology with fabric controls woven into the sleeve, allowing the wearer to play, pause, and skip tracks by simply touching their arm. This is not a simple gimmick as skiiers cannot easily remove clothing and need to protect electronic equipment from the elements. By using Eleksens soft technology, Spyder has intergrated the latest technology without compromising any of the functionality that it offers in its garments. The jacket offers electronic functions combined with all of the performance properties such as stretch fabric with a Dermaizan-MP waterproof membrane, X-static silver fibre insulation, and Spylon water repellent coating with Spyder Heat technology that captures and retains the wearers body heat.

Earlier this year, ONeill Europe unveiled the H2 series of snow-wear wearable electronics, which includes a second generation entertainment jacket incorporating an MP3 player with a blutooth module stationed in the chest pocket and a microphone in the collar to allow the wearer to make Çhands free calls from their mobile. The range also features what is claimed to be the worlds first intergrated solar backpack which incorporates two flexible solar panels and a Bluetooth module. In optimum light conditions, the backpacks solar panels not only recharge the users iPod, mobile phone and Bluetooth module via a USB recharging system, it is actually intelligent enough to calculate which appliance is most in need of extra power and allocate it accordingly.

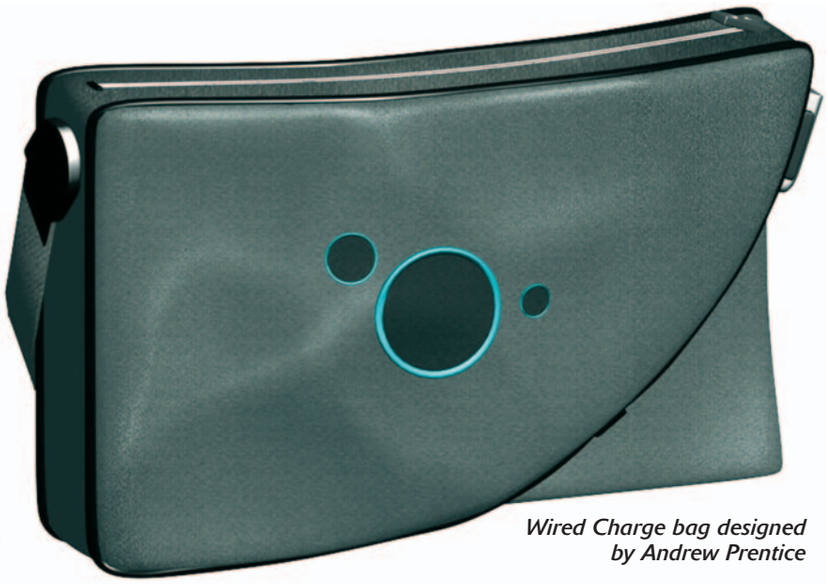
A microphone is built in to the left shoulder strap and a headphone is incorporated into the chest pocket to allow hands-free calling, which automatically interupts the MP3 transmission, pausing the music until the call is over. As it functions with Bluetooth technology, it also allows for voice recognition dialling, leaving the wearers hands free at all times to concentrate totally on the task in hand, i.e. skiing.

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A learning curve

As this is a new area of technology, it is not surprising that wearable electronics is a hot topic on university campuses around the world and more and more students are leaning towards courses in intelligent textiles and wearable electronics.

And when you consider the fact that, according to research carried out by market research company VDC, this sector is set to generate $0.5 billion by 2008, there is a definite need for more research in this field. But far from being restricted to theoretical discussions on the subject, students are already developing new wearable electronics that are marketable products. One example of this is the Wired Charge bag, an electrical recharging bag, designed by Andrew Prentice, a student in Product Design at Nottingham Trent University, UK. The bag recharges personal electronic devices such as mobile phones, digital cameras, ipods, and other portable players.



Wired Charge bag designed by Andrew Prentice

Designed using induction charging technology that allows a safe electrical charge to pass from a charging wall into the battery unit of each device, the Wired Charge bag removes the need for different charge adapters and allows the user to charge up to three items at the same time. The unit is waterproofed using three-layer Gore-Tex and features the latest technology such as Elumin8 electroluminescent lighting with electro conductive ink that allows the user to see when items are charged.

Taiwan-based company, Solar Focus Technology, has developed a number of solar powered wearable items – in varying sizes ranging from purses to rucksacks – that can recharge electrical items using triple junction solar cards and the latest lithium battery technology. This has applications across the board, from the man in the street who wishes to charge his mobile phone, to a soldier on a reconnaissance trip in the Afghan mountains. These solar products have proved so successful that, Atomtech Engineering Co., which developed this technology, decided to spin this sector off to create Solar Focus Technology as an independent company.

Another area where Pearson sees growth is in Haptics technology. This is the 'technology of enabling the remote sensation of touch' and he expects it will soon become available as part of clothing. A variety of electro-responsive materials exists already, albeit sometimes in primitive forms and he expects these to 'progress quickly into routine fabric technologies'. Included in this are things like muscles, wires and shape memory alloys. His argument moves towards a merging of form and function, in that new materials and micro-size electronics allows designers to add a myriad of functions without interfering with the look, or form, of the garment.

This is already seen as we move form pods attached to shoes to monitor sports participants to the VivoMetrics LifeShirt. The LifeShirt System is the first non-invasive, continuous ambulatory monitoring system that can collect data on pulmonary, cardiac, and other physiologic data, and correlate them over time.

The System gathers data during the subject's daily routine, providing pharmaceutical and academic researchers a continuous "movie" of the subject's health in real-life situations (work, school, exercise, sleep), rather than the "snapshot" generated during a typical clinic visit. The LifeShirt System collects, analyses and reports on the subject's pulmonary cardiac and posture data. It also correlates data collected by optional peripheral devices that measure blood pressure, blood oxygen saturation, EEG, EOG, periodic leg movement, core body temperature, skin temperature, and end tidal CO_2. It is reportedly already being used in over 1,000 hospitals world wide.

Malden Mills with its Polartec fabric has done outstanding work with the US military in providing a battlefield capability of this sort via a base layer garment which provides remote physiological monitoring of soldiers in combat. During this programme Malden Mills has worked with Foster-Miller, Exponent, and Eastern Carolina University. United States Congress has approved $21 million for Polartec garments for the US military in the 2005 Defence Spending Bill and this included a $1.5 million grant for Combat Casualty Care to continue to design these electronic textiles for the US military to monitor and transmit soldiers' pulse, blood pressure, body

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temperature, and location back to military medics responsible for their well being in the field. 'The Combat Casualty Care program will save lives by enabling medics to quickly evaluate a situation and focus their efforts on the soldiers who need it most' according to the Malden Mills press release.

What goes where in all this is indicated in a diagram from Ian Pearson's presentation at a recent textile conference that shows which types of function are most likely to be found in the various layer levels above the skin. Indeed he argues that as technology continues to miniaturise and improve we will be able to carry all our photos and our music within our clothes, making items such as the iPod redundant, other than as a fashion statement. Such 'tokens indicating the personality of the wearer' he expects to see becoming more important, such as the bands people are now wearing to show support for the fight against cancer or empathy with Aids sufferers.

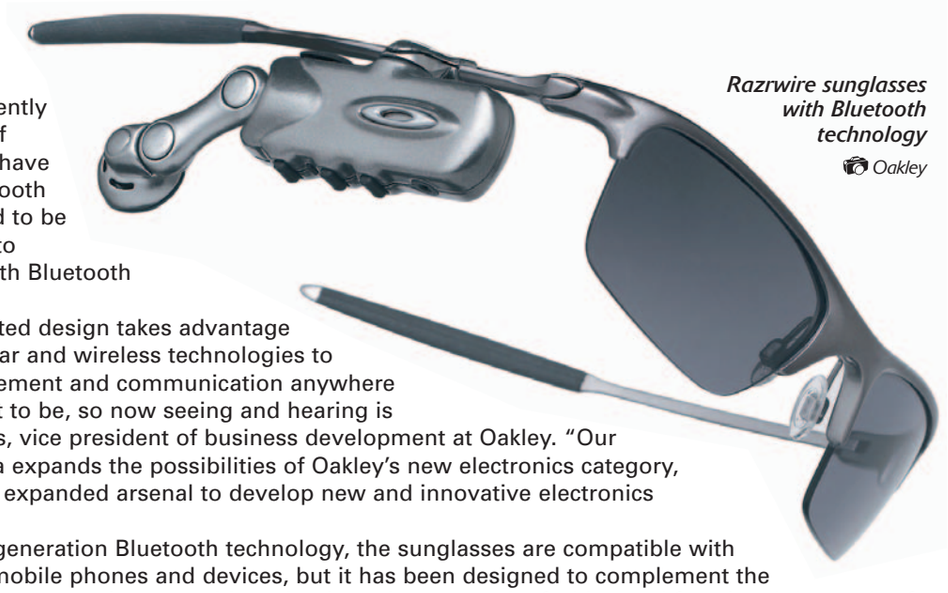
This all leads us inevitably into the area of ubiquitous computing and the theory expounded by Resnick which handles computing with everyday objects, things to think with or things that think. In this initiative the idea is shifting away from virtual objects on computer screens and focusing instead on physical things, embedding computational capabilities into everyday objects such as active name tags, toys, or within a garment, that the user can almost imperceptibility carry with himself. Here the basic idea is that when a user with, for example, a smart ring enters into a smart networked room, the ring can primitively communicate with certain access points of the room. On the other hand, the goal is not simply to create neat gadgets or time saving conveniences. Rather the goal is to create thinking things that change not only what we do, but how we think, what we think about, and who we think with.

At the next level of this computing philosophy we hit right at wearable computing. In this philosophy the main idea is that the user wears a computing system which forms an interface between the user and a ubiquitous environment. In this alternative the information flow between the user and the environment is much higher than in the two cases described earlier. Also the applications can be more complicated and the utilisation of for example the internet is more common.

The future for computing is mobile. For this it has to be wireless, light, find access to better systems of power supply, and capable of being seamlessly joined up with other electronic equipment that has become part of everyday life. Great strides have been made, and the consumer's appetite has certainly been whetted for the wearable electronic future.

Acknowledgement: Parts of this feature have been developed from A Brief Survey of Ubiquitous Computing by Marja Haapasaari and Lauri Sydnheimo of Tampere University, Finland.

Oakley and Motorola make a spectacle of technology



Razrwire sunglasses with Bluetooth technology

Oakley

Wireless solutions company Motorola and renowned sunglasses designer Oakley have recently collaborated in the area of wearable electronics and have developed Razrwire Bluetooth eyewear, which is claimed to be the world's first eyewear to combine Oakley optics with Bluetooth wireless technology.

"Razrwires fully integrated design takes advantage of the world's best eyewear and wireless technologies to give freedom of life, movement and communication anywhere and everywhere you want to be, so now seeing and hearing is believing," said Cos Lykos, vice president of business development at Oakley. "Our partnership with Motorola expands the possibilities of Oakley's new electronics category, offering our engineers an expanded arsenal to develop new and innovative electronics products."

Using Motorola's third generation Bluetooth technology, the sunglasses are compatible with most Bluetooth-enabled mobile phones and devices, but it has been designed to complement the overall look of the sunglasses, creating wearable technology that meets the fashion and functional demands of today's consumer.

The controls include two volume buttons and a single button used to handle incoming and outgoing calls and allows the wearer to carry on phone conversations while up to 30 feet away from their compatible Bluetooth-enabled phone.