Sensor100

The International Bio-sensor and Chemo-sensor Network

The Lifetouch Sensor
© Isansys Lifecare

Newsletter
September 2013

Contents

Cover Image:
The Lifetouch Sensor by Isansys Lifecare - see Page 5

www.sensor100.com

From the editor...

I suppose there are several (many?) ways of ranking universities, and I recall when I was at the Sloan School they would wheel out their top statisticians to "prove" the flaws in any B-School ranking they didn't like. The QS World University ranking for 2013 has come up with an interesting finding: among the top ten universities, four are in the UK. After MIT and Harvard, they rank Cambridge, UCL, Imperial and Oxford in 3rd, 4th, 5th and 6th place. Far from being surprised, I am delighted by this order, being a graduate of two of these eminent institutions (MIT and Imperial).

My reason for remarking on this is that Fortune Magazine International edition this month ran a feature article on the problems facing the new (ex Harvard) Dean of the Said Business School at Oxford in getting the university to buy-in to an entrepreneurship program. (As an aside, Fortune noted that Cambridge is also less than a world leader in spin-offs.)

So the paradox is that the UK has four of the worlds top ten universities, but still is reluctant to endorse entrepreneurship. A deep seated cultural effect that is possibly slowly changing, but not fast enough to keep up with the world.

A couple of personal items. Suzanne and I celebrated our fortieth wedding anniversary this month. And I was just reminded by the Sloan School that my thirty-fifth re-union happens next year. Suddenly, I feel quite old.

Kind regards

Michael

michael@sensor100.com

mHealth - Myth or Reality?

"*The whole sensor field is going to explode. It's a little all over the place right now, but with the arc of time it will become clearer.*"

- Tim Cook, CEO, Apple, 2013

Sensor100 looks at the status of mHealth

The idea of monitoring people remotely using wearable or at-home sensors with wireless transmission of data is an appealing idea. What used to be called telemedicine is now increasingly called mHealth. There seem to be at least four target markets:

- The elderly, who can be monitored at home at lower cost
- The chronic sick, e.g. asthma or diabetics
- Sportspeople and athelets
- The worried well, who want to improve their health by e.g. losing weight, stopping smoking, sleeping better or reducing stress

New smart phone related apps which address one or more of these target audiences seem to appear almost daily - see **MobiHealth News.** For example, there are 229 dermatology-focused medical apps in the Apple, Android, Blackberry, Nokia Windows app stores, according to a study recently published in the Journal of the American Medical Association Dermatology.

Sensor100 has from time to time reported sensor based mHealth products - Proteus Digital Health, Asthmapolis (now Propeller-Healthcare), Avery Dennis Metria™. Clearly staying on top of this rapidly emerging technology is near impossible, but we will watch and as Tim Cook says wait for it to become clearer. Meanwhile, here are two healthcare applications which are in real everday use.

Isansys Lifecare Limited

Isansys, a provider of complete real-time physiological patient data services and systems, announced the general availability of its CE-marked **Patient Status Engine™** – the world's first plug-and-play continuous wireless vital signs monitoring system complete with clinical apps that can be customised for individual needs.

Intended for hospital use, the PSE continuously collects multiple vital sign data, and incorporates the Isansys LifeTouch cardiac monitor – a lightweight and unobtrusive smart patch that collects data directly from the patient and analyses every heartbeat to provide continuous heart rate, respiration rate and heart rate variability. With a wireless pulse oximeter and blood pressure monitor, a patient's physiology is automatically uploaded as a series of secure digital files to a patient record and may be accessed by computer, tablet or smart phone. You can watch a **video overview** of the end-to-end PSE system.

Connected Cardiac Care

Connected Cardiac Care is a home tele-monitoring and education program for patients with Heart Failure (HF) who are at risk for hospitalization, operated by Partners International in Boston, US.

Each morning, using provided technology, patients take their blood pressure, pulse, oxygen levels, and weight. They then answer symptom questions on the touch-screen computer, and send the data to Partners HealthCare at Home. A nurse reviews the data and appropriate intervention is taken when readings are outside established parameters.

For over 5 years, Connected Cardiac Care has been effective in keeping patients healthy at home, and out of the hospital with a 48% decrease in re-hospitalizations after enrollment in the program.

Sensors in Medicine 2014

Linking Academic Clinical and Commercial Worlds

25 & 26 March
London

Venue: Royal Geographic Society, South Kensington, London

Registration now Open

REGISTER NOW!

Call for Papers - Oral and Poster Presentations

Wearable, Implantable, Wireless Sensors
Innovation Technology
Breath Analaysis
Emerging Sensor Companies

Submit an Abstract Deadline - 31 December 2013

Exhibition

Spaces available
Special discount for sensor SMEs who exhibit and present

Contact Sensor100 for more information

Registration includes:
Admission to all sessions and exhibition
Book of Abstracts
Refreshments and two lunches
Reception featuring the Conference Cocktail

Sensors in Medicine 2014 is organised by **Sensor100**

www.sensor100.com

Coming Events

Health 2.0 Seventh Annual Fall Conference

29 September - 2 October, Santa Clara CA, USA
The Nokia Sensing X Challenge awards will be presented on
2nd October - $525k grand prize and up to five $120k awards

224th Electrochemical Society Meeting

27 October - 1 November, San Francisco, CA USA

6th International Workshop on Surface Modification for Chemical and Biochemical Sensing

8 - 12 November, Łochów, Poland

On-Line and At-Line Analytical Technologies in the Industrial Biotechnology Sector

Thursday 14 November 2013, 09.30 - 16.45, London
Organised by SCI's Separation Science & Technology Group

Medical Devices Summit Europe

11-12 November, Dublin, Ireland

NanoBioTech - Montreux

18 - 20 November, Montreux, CH

5th International Workshop on Intelligent Environments Supporting Healthcare and Well-being (WISHWell'13)

3 December, Dublin Ireland

2013 4th International Conference on Nanotechnology and Biosensors

20 - 21 December, Paris France

Call for Papers

EUROPT(R)ODE XII Conference on Optical Chemical Sensors and Biosensors

13 - 16 April 2014, Athens Greece
Abstract Submission Deadline November 18, 2013

Sensor100

Technical Articles Required

Sensor100 is inviting submission of articles describing sensor technology. The articles will initially be published in this eNewsletter, and eventually collected together as an eBook.

Try your hand at technical writing - describe a sensor technology (acoustic, electrochemical, optical, magnetic or something else) in a short ilustrated article.

Publication at editor's discretion. Preference will be given to articles submitted by post-graduate students/post-docs. Up to 5 authors of accepted articles submitted before 28 February 2014 will be offered a free place at Sensors in Medicine 2014.

For further information see:
Sensor Technology Project

BIOSENSORS 2014

27-30 May 2014 • Melbourne, Australia

Submit abstracts by 22 Nov 2013

24th Anniversary World Congress on Biosensors

Congress Committee

CHAIR: Prof Anthony P F Turner Linköping University, Sweden

Committee

Prof Loïc J. Blum France
Prof Man Bock Gu Korea
Dr Frances Ligler USA
Prof Arben Merkoci Spain
Prof Koji Sode Japan
Prof Xian-En Zhang China

Speakers

Prof Frank Caruso University of Melbourne, Australia
Prof Andrew de Mello ETH Zurich, Switzerland
Prof J. Justin Gooding University of New South Wales, Australia
Prof Wolfgang Knoll Austrian Institute of Technology, Austria
Prof Tanya Monro University of Adelaide, Australia
Prof Joseph Wang University of California, San Diego, USA

Topics Include

• Bioelectronics • Commercial biosensors, manufacturing and markets • DNA chips, nucleic acid sensors and aptasensors • Enzyme-based biosensors • Immunosensors • Lab-on-a-chip • Microfluidics and immobilisation technology • Nanobiosensors, nanomaterials & nanoanalytical systems • Natural & synthetic receptors • Organism- and whole cell-based biosensors • Printed biosensors and microfabrication • Proteomics, single-cell analysis and cancer-cell detection • Signal transduction technology • Theranostics & implantable sensors

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www.biosensors-congress.elsevier.com

Who's Who in Sensors...

Sensor100 talks to **Chris Van Hoof**, who is on the organising committee for Sensors in Medicine 2014

CV Snapshot	
Current Position	Director, Body Area Networks & Program Director of Wearable Healthcare, imec, BE Professor University of Leuven
Former Postions	Director Integrated Systems Department
Education	PhD Electrical Engineering, KULeuven (1992)
Publications	Over 500 publications and over 50 invited talks / keynotes
Research Interests	Wearable Healthcare, System Integration, wireless sensors
Web site	www.imec.be, www.imec-nl.nl

S100: *Chris, you are the first engineer we have interviewed, congratulations! We have profiled* ***imec*** *in Sensor100 before, but tell us about it. Is it a government sponsored contract research organisation?*

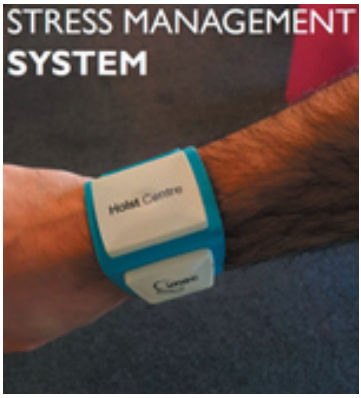
CVH: imec is an independent nanoelectronics research center with headquarters in Belgium and offices in the Netherlands, Taiwan, India, China, Japan and the United States. Our R&D focuses on creating industry-relevant solutions for our worldwide industrial partners and customers in the fields of ICT, healthcare and energy. Our staff of over 2000 people includes more than 650 industrial residents and guest researchers. Last year imec's revenue (P&L) totalled 320 million euro. Approximately 15% of our budget is government funding (Imec Belgium and imec Netherlands are supported by the Flemish and the Dutch government) and this has supported the continuous growth of imec over the last 29 years to a high-tech knowledge centre.

S100: *At Sensors in Medicine 2013, everyone was intrigued by your work on wearable sensors. How is that going? Are there near term commercial applications?*

CVH: Currently six of our customers are working on production of our wearable system solutions. The most fascinating part of this is that it is an even mix of large integrated device manufacturers and small/medium-size companies in Europe, Asia and the United States.

S100: *Thinking about wearable sensors, sports medicine has bought in, but do you think home healthcare and consumer markets will really take off? Or is that wishful thinking?*

CVH: Consumers are definitely not waiting for just another gadget. Once wearable sensors provide true value to the user, the consumer market will take off. Think of a health assistant that knows a lot about your actual health status and provides accurate individual coaching towards a healthier life and towards disease prevention, now that is a very appealing proposition.



imec prototype wearable sensor

S100: *Exactly what is a Body Area Network?*

CVH: It's a set of companion devices linked to your smartphone whereby each device senses electrophysiological parameters, extracts actionable data from it and relays them to a smartphone. These companion devices can take the form of a patch, a wristband, a headset, shoes, glasses or even contact lenses.

Continued...

S100: *You have done many interesting things at imec. What are you particularly proud of?*

CVH: I am really proud of having been able to assemble a world-class multi-disciplinary R&D team that has taken our initial ideas from the drawing board into reality, and brought them to such level of maturity that industry is now producing several of them.

S100: *And you are also a full professor at Leuven University. It sounds like you have a very busy life. Do you teach and have a research group there?*

CVH: Yes, I teach two courses and have several doctoral students at the university. I find teaching very rewarding and the university link enables to start long-term research that can become a future direction for imec.

S100: *We always ask this difficult question, but where do you think sensor technology in life sciences will be in say 5-10 years?*

CVH: I am convinced that it will be just as disruptive as the smartphone has been, and that we all will be wearing one or other health assistant in 5-10 years from now.

S100: *I'm not sure if you have the time, but any interests outside of work?*

CVH: On my (many) intercontinental travels, I make it a habit of being very active on the plane by working, reading professional literature (about strategy or sales predominantly) and reading worldwide fiction. Aside from that, I tremendously enjoy wave surfing which I do a couple of weeks each and every year.

S100: *Favourite book, movie, music?*

CVH: Nearly every book from John Irving could be a favourite. In terms of non-fiction it's got to be "real leaders don't do powerpoint". I enjoy most movies of Quentin Tarantino, the music of the French contemporary musician Yann Tiersen.

S100: *Thanks for your time Chris. We are looking forward to seeing you again at Sensors in Medicine 2014*

[Chris answered our questions while waiitng for a plane at Vienna airport]

Phononic Array Sensors

Contributed by:
Dr. Julien Reboud
Division of Biomedical Engineering, University of Glasgow

In recent years highly sensitive devices capable of detecting specific molecules in bodily fluids as a basis for disease diagnosis have been developed. However, the extreme performances of this new generation of sensors, seen in model solutions, tend to break down when used with real clinical samples such as saliva, blood or sputum. The complex and heterogeneous matrices often require systems to purify the samples prior to sensing. These are often either expensive or bulky, or require expert handling skills not available in a decentralised setting. There is a need for a range of diagnostic tests which can be used outside the clinical laboratory at point-of-care sensors or in the home, as pregnancy tests and glucose monitors are used today.

Professor Jon Cooper's group at the University of Glasgow is exploring how to meet this challenge using the mechanical energy carried by sound, by integrating all sample preparation steps together with sensing on a low-cost disposable device. The aim is to produce low-power hand-held diagnostics where many 100s of tests can be run from the power contained from within a single charge cycle of a mobile phone.

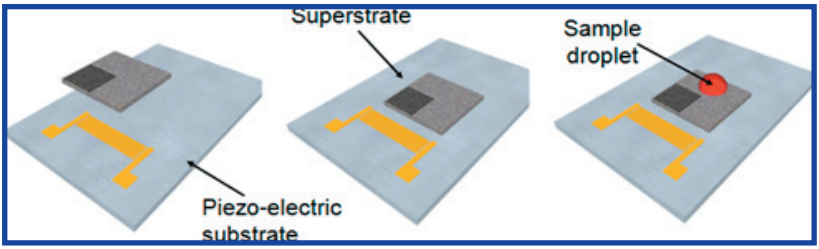
Technology

The new techniques rely upon the complex interactions between sound waves, microstructured surfaces and liquids. The sound waves are generated by Surface Acoustic Wave (SAW) devices, already in use in sensor devices. SAW devices function through the interaction between applied dynamic voltages and a piezoelectric chip, which converts the electric excitation into mechanical deformations.

The voltage induces a mechanical ripple in the uppermost layer of the piezoelectric wafer that propagates across the surface of the device, producing an acoustic wave. Cooper's group have coupled this wave into a thin disposable plastic, silicon or glass chip structure, called a superstrate – which literally sits on top of the expensive piezoelectric wafer and can be readily disposed of after use.

In phononic array sensors the superstrate is modified with microstructures that scatter or reflect the wave as it propagates . The phononic arrays, which can be considered as "acoustic holograms", shape the acoustic wave into more complex forms, which, in turn, changes the way the fluid is manipulated on the chip.

Different phononic arrays create different acoustic fields that can be used to perform different functions. For example, energy from the acoustic wave can not only be focused to heat the fluid sample, as might be needed by PCR, but at the correct frequency the liquid will nebulise, creating a fine dispersion of droplets in the air which has application for drug delivery.



Holograms made with other dimensions, materials or patterns result in sample movement, splitting, or recombination. If there are particles in a fluid, these will be subject to different forces depending upon their size, mechanical properties and the frequency of the acoustic wave. At one frequency, a particular cell type will "feel" the pressure wave and be moved by it, whilst different cells with different mechanical properties will not – providing a method for cell separation.

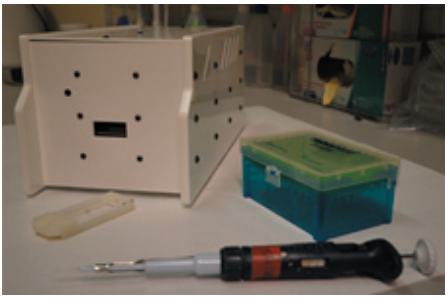
Continued...

Applications

It is possible to create a "tool-box" of different fluidic functions, each of which requires a different phononic structure. It is then possible to overlay these holograms, such that a single device will show different functions at different frequencies. Just as in electronics, where different components are combined to create a circuit, so the same is true for this new technology, where different phononic arrays are combined to produce diagnostic systems.

The technology opens the way for new types of hand-held, medical diagnostic devices. We have already demonstrated the use of the technology to perform a diagnostic test for malaria in whole blood. The infected blood cells are broken open by shear flows induced by the acoustic waves, and release the genetic material of the pathogen. The DNA is amplified through acoustic heating on the same device, using a different frequency. In this particular application, the amplification is detected optically using a LED and a photodetector.

This new, battery-operated, technology could replace the large instruments and microscopes, currently used for diagnosis of infectious diseases in rural communities throughout the Developing World. The applications could not only include those associated with human healthcare, e.g. identification of emerging strains of drug resistant malaria, but could also provide veterinary applications.



Prototype System

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   PNAS, 2012, 109 (38) 15162-15167
3. R Wilson, J Reboud, Y Bourquin, SL. Neale, Y Zhang and JM. Cooper,
   Phononic crystal structures for acoustically driven microfluidic manipulations
   Lab Chip, 2011, 11, 323
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   Surface acoustic wave biosensors: a review
   Anal Bioanal Chem (2008) 391:1509–1519

Dr Reboud was awarded the Royal Academy of Engineering ERA Foundation Entrepreneurship Award in 2013 to translate phononic arrays into a DNA based sensory technology

For more information, contact:
julien.reboud@glasgow.ac.uk

Company News...

MEMS Market Biosensors and Nanosensors 2013 analysis in new research report at **ReportsnReports.com.** This report provides an overview of the global market for microelectromechanical systems (MEMS), which consist of sensing devices that integrate mechanical elements, sensors, actuators, and electronics on a common silicon substrate, and typically have dimensions in the 1-micron to 100-micron range; as well as biosensors and nanosensors. **Read more...**

OptiEnz Sensors, LLC has been awarded a National Science Foundation Phase I Small Business Innovation Research (SBIR) grant to further develop sensors for direct continuous measurement of one of the world's most widespread water contaminants, trichloroethene (TCE), which was widely used as an industrial degreaser and as a dry cleaning solvent for decades. About 34% of US drinking water sources are estimated to contain TCE, and 75% of EPA National Priority List hazardous waste sites and Superfund sites have TCE pollution. **Read more...**

Sphere Medical Holding plc report Pelorus 1500 study at Great Ormond Street Hospital for Children

Sphere Medical, a leading developer of innovative monitoring and diagnostic products for the critical care setting, announced the completion of a study at Great Ormond Street Hospital for Children ("GOSH") to evaluate the use of the Company's Pelorus 1500 analyser to monitor accurately propofol levels during paediatric spinal surgery on anaesthetised children.

The Aptamer Discovery Company Base Pair Biotechnologies have published their **September Newsletter.**
In an effort to allow researchers to demonstrate aptamer success in their own laboratories, Base Pair Biotechnologies is offering a few of their more validated aptamers at a promotional rate of $100 for 100ug of biotinylated PBP-2a (MRSA), p24 (HIV), and/or Fibronectin aptamers for a limited time.

booz&Co. have published: **Fit for Growth* in Medtech**
Medtech companies must take the right strategic approach to managing costs while investing in capabilities and growth initiatives, via a Fit for Growth* transformation. This entails three specific priorities: (1) investing in differentiating capabilities and growth initiatives; (2) transforming the cost structure; and (3) reorganizing for sustainability.

Singapore company manufactures Oxford Chilli Tester to redefine heat

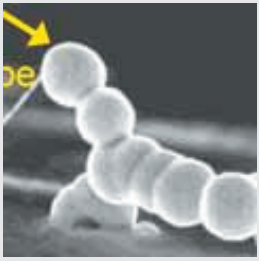
A chilli sensor developed at the University of Oxford is to be manufactured by Singapore spin-out, **Bio-X (S) Pte. Ltd.** to bring standardisation for heat in the food industry. The sensor was developed in the Oxford electrochemistry labs of Prof Richard Compton. The sensor measures the levels of capsaicinoids, chemicals in chillies that gives the characteristic 'heat'. There are plans to develop other sensors for garlic, turmeric, onion and pepper.

Google Launches Healthcare Company

Larry Page, chief executive, unveiled the venture, called Calico, with a characteristically ambitious and vague claim that "with some longer term, moonshot thinking around healthcare and biotechnology, I believe we can improve millions of lives".

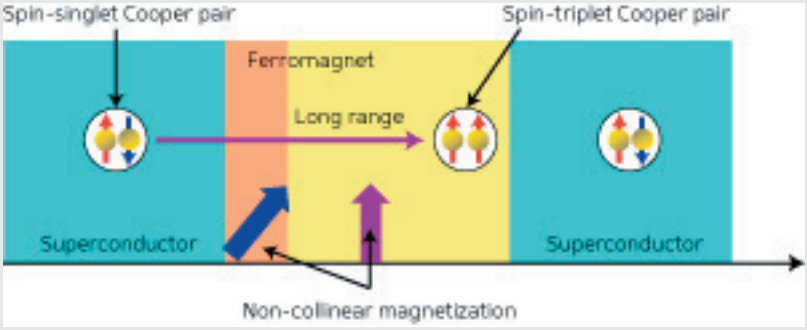
Technology News...

Nanoparticle biosensor for noninvasive glucose sensing



Jonathan C. Claussen at the Naval Research Laboratory/George Mason University Washington reported that multilayered graphene petal nanosheets enhanced with platinum nanoparticles and enzyme glucose oxidase can monitor the wide range of glucose concentrations found in saliva, tears, blood, and urine.

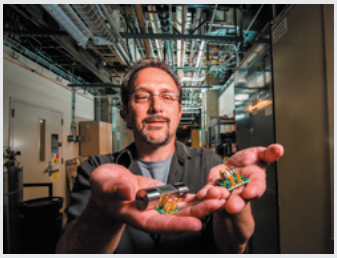
A theoretical device could bring practical spintronics closer to reality reported by RIKEN RESEARCH.



Spin currents in superconductor–ferromagnet multilayers. Sandwiched between two superconductors, spin-triplet Cooper pairs formed by two electrons can be sustained in the ferromagnet and carry spin currents over relatively long distances.

Sandia Labs researching new detectors for chemical, biological threats

Sandia National Laboratories scientists are thinking small, building on decades of sensor work to invent tiny detectors that can sniff out everything from explosives and biotoxins to smuggled humans. In the late 1990s, Sandia developed a simple-to-use handheld chemical detector for the military, the MicroChemLab. Ever since, Sandia has improved such microfluidics- and microelectromechanical (MEMS) systems-based instruments that identify chemicals based on gas chromatography, or GC, and resonator-style instruments such as surface acoustic wave (SAW) detectors. Now, new detectors are needed that can find compounds such as carbon dioxide, chemical signals unique to humans or the volatile signatures of pathogens and diseases in livestock and humans. The prototype of the new detector, a miniature pulsed-discharge ionization detector, or mini-PDID, is about 1 inch by 1 inch by 2 inches, can be coupled with commercially produced micro-GCs and can run for nine hours on a charge of helium.



Sandia National Laboratories researcher Ron Manginell displays new miniature pulsed-discharge ionization detectors, or mini-PDIDs, he is developing along with Sandia colleagues. The tiny detectors have broadened the scope of chemical targets for Sandia's microanalytical detection technology to toxic industrial chemicals, biological volatiles, greenhouse gases and more. (Photo by Randy Montoya)

Colorimetric microbial biosensor detects odor of sepsis-causing bacteria

The new device can identify bacteria in blood samples in 24 hours according to James R. Carey, PhD, of National University of Kaohsiung in Taiwan, the Republic of China.

New Publications...

Biosensors for medical applications

Edited by S Higson, Cranfield University, UK

Woodhead Publishing Series in Biomaterials
No. 45
ISBN 1 84569 935 1
ISBN-13: 978 1 84569 935 2
August 2012
360 pages 234 x 156mm hardback
£135.00 / US$230.00 / €160.00

Implantable sensor systems for medical applications

Edited by A Inmann, Andreas Inmann Consulting, USA and D Hodgins, European Technology for Business Limited, UK

Woodhead Publishing Series in Biomaterials
No. 52
ISBN 1 84569 987 4
ISBN-13: 978 1 84569 987 1
January 2013
544 pages 234 x 156mm hardback
£165.00 / US$280.00 / €200.00

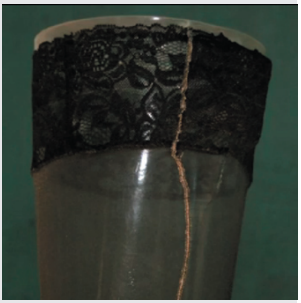
The Last Word

[In which we bring you the more unusual, controversial or off-topic sensor stories of the month]

'World's sexiest knee brace' on show

Wearable computing often foregoes sexiness in the pursuit of technological advancement.

But one project from the Wearable Technology Lab at the University of Minnesota seeks to make a statement on the need to make sure such technologies make the user look and feel good.



The team has created a stocking with a sensor woven into the fabric. It can alert the wearer if they are moving in the wrong way by creating a buzz at the top of the stocking if a leg is bent beyond a certain angle.

At the International Symposium on Wearable Computers in Zurich, team director **Lucy Dunne** told the BBC about how the knee brace works.

[Click image to play video]

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