

E-textiles and smart fabrics

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Knit. Wearable technology. Purl. Conductive yarns. Knit. Sensing fabrics. Purl.



Frances Joseph holds a piece of knitted fabric that includes a flexible sensor of metallic yarn.

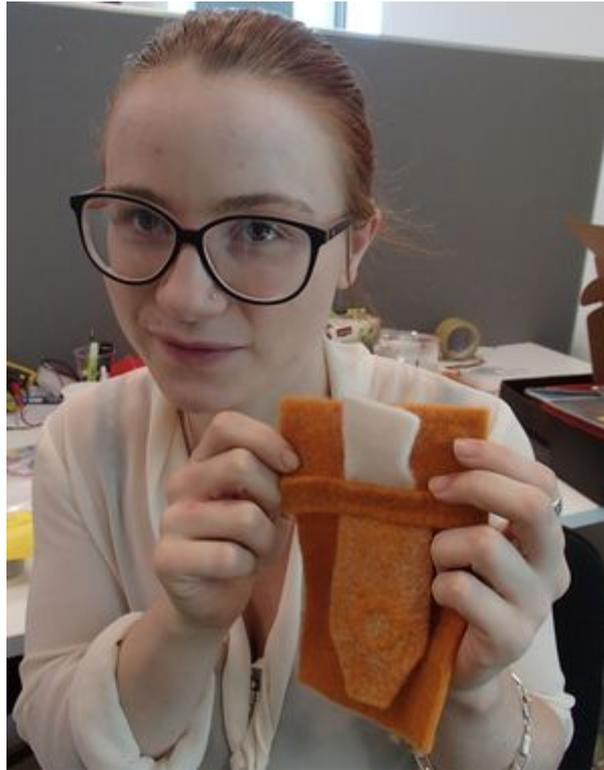
Photo: RNZ / Alison Ballance

The world is getting smarter and more connected – and clothes are no exception. And when engineering and IT meets fabric design, the result is a knitting together of ideas that might result in anything from a smart cardigan to a responsive mat.

Textile designer Frances Joseph from Auckland University of Technology is excited by the many possibilities, especially the idea of creating affordable wearable technologies that could be used in physiotherapy rehabilitation in the home.

She says the responsive mat they are developing at AUT could be used by people working with balance, and as a tool, for example, for people recovering from a stroke.

“It’s not just about measuring whether someone follows the [rehabilitation] routine, but it can also give them feedback, to a mobile phone ... or in terms of sound or lighting effects,” says Frances.

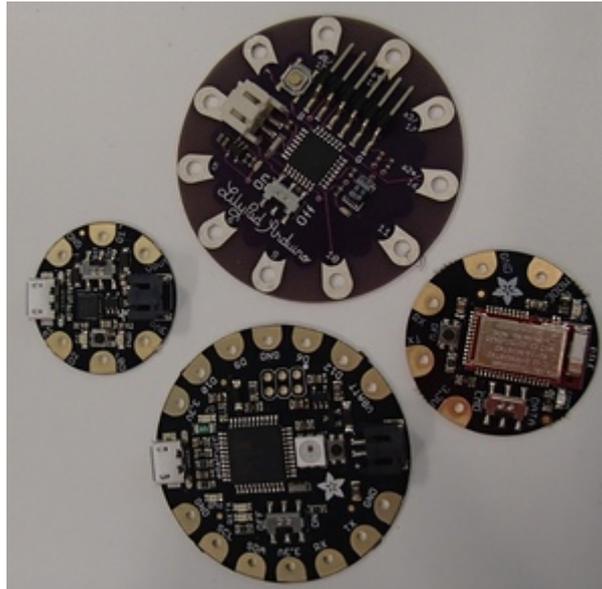


Charlotte Alexander holds a pocket that has a magnet and electronic sensor felted into the fabric so the flap can be made to open and close, Photo: RNZ / Alison Ballance

When it comes to knitted fabrics, Frances says “we can play around with compression, with stretch sensors or pressure sensors that are constructed through the textile itself.”

Although it is straightforward to integrate conductive yarns into a woven fabric, the challenge comes in connecting the woven sensor to microprocessors or other hardware. Frances says one research group in the United Kingdom has begun integrating microprocessors into the yarn itself, and that “the idea of the textile not just being a sensor but being part of a whole electronic system” is very exciting.

Another exciting new area, says Frances, is the use of nanofibre yarns and conductive inks. Frances says that e-textiles work at a number of levels, “from a molecular level, to the structure of the yarn and whether that’s all conductive or a combination of conductive and non-conductive. Then there’s the stitch structures, and with knit it’s very interesting because there’s plain and purl, combinations of stitches that can be more or less stretchy ... and you can start to get different electronic behaviours.”



Small sewable programmable computers called LilyPad Arduinos - the holes enable conductive wires or thread to be attached. Photo: RNZ / Alison Ballance

Recent Masters graduate Charlotte Alexander has been creating e-textile kits, and working with school students to introduce them to the concept of smart fabrics.

She uses small programmable microcontrollers known as arduinos, and in particular LilyPad arduinos, which have sewable tabs and can be integrated with conductive thread to create circuitry. The LilyPad arduinos were specifically designed to introduce young women to programming in a fun and interactive way.

“You can attach sensors or outputs such as LED lights or motors,” says Charlotte.

“We also French knitted sensors made with conductive fibres, and you can make an LED fade based on how much you pull that little bit of French knitting,” says Charlotte, of a workshop that she recently ran with secondary school students.

“It’s really interesting to bring that hand-craftedness to technology, and it makes it more accessible. Everyone can learn how to French knit and it becomes really exciting ... when you can stretch this little bit of knitting you’ve made and see the LEDs lighting up.”



French knitted sensors made with conductive fibres can make an LED fade, with the lights getting dimmer or brighter depending on how tight you or loose the knitting is pulled. Photo: RNZ / Alison Ballance

Frances Joseph co-directs AUT’s Textile and Design Lab, and also Co-Lab, which she describes as a “collab-oratory.”

