Breathe easy

Developing a low-cost, highly effective, portable spirometer

Academic: *Dr David Birch*

A revolutionary 'Sneezometer' measures human breathing accurately enough to catch the speed of a sneeze – something that no other commercially available system can do as inexpensively or effectively – paving the way for wide use in respiratory diagnostic medicine.

While current systems are generally only able to measure average breathing rates, the spirometer developed at Surrey draws on advanced fluid sensor technologies to offer a simple, low-cost and non-intrusive diagnostic solution. The technique used to create the device was enabled by 3D printing technology, with all of the prototypes 'printed' around the internal electronics.

Dr Birch explains: "In the University of Surrey Aerodynamics and Environmental Flow research group we have developed a number of new instruments for measuring things that nobody has measured before. The spirometer was initially developed to address a tricky flow-measurement problem, but a chance discussion with a health professional revealed the potential for the idea in the healthcare field."

This realisation prompted Dr Birch and his team to create an operational prototype within a period of just three weeks – a very rapid development cycle – and to apply for IAA funding.

"SEHTA (the South East Health Technologies Alliance) was approached and, when we explained that the unit we were demonstrating was not a mock-up but a fully functional, operational prototype, was very interested in getting involved," says Dr Birch.

IAA funding has enabled the research team to develop a production-ready prototype and produce ten units of the device for clinical trials, which will be conducted in collaboration with SEHTA. A patent application for the device has been submitted and a spin-out company is being formed in partnership with a medical instrument marketing specialist.

Portable, highly sensitive and time-accurate, the spirometer could be used in the diagnosis of a variety of chronic and acute respiratory conditions including asthma, obstructive sleep apnoea (OSA) and hypopnoea. Breathing disorders are highly prevalent in both the developed and developing world, and constitute a heavy burden both to national healthcare systems and to the lives of patients. While one in twelve people in the UK is currently receiving treatment for asthma, OSA affects 3 to 5 per cent of adult men and 2 to 5 per cent of adult women.

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In addition, the spirometer may have other uses, such as the monitoring of neonatal infants and the training of elite athletes. Believed to be the most sensitive flow meter in existence, the technology could also have applications outside of spirometry. Market analysis already carried out by SEHTA has confirmed that the spirometer is two orders of magnitude more sensitive than any other device currently available, with four times the resolution; it is also at least twice as fast.

Dr Birch comments:

"This project has arisen from our highly specialised expertise in wind-tunnel measurement, and is a great example of how fundamental research can sometimes result in incredibly beneficial technologies in an entirely unpredictable way. In this case, a simple tool developed at Surrey for fundamental turbulence research has evolved into a medical instrument that could affect the lives of millions of people suffering from chronic health conditions, and reduce costs for healthcare providers."