Innovative antennae may signal a 'new wave' in health care provision

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Compact, wireless and power efficient body sensors that allow doctors to monitor illnesses and injuries remotely are a step closer thanks to new research.

The use of biosensors attached to the body for health monitoring is not new. However, antennas that enable such devices to be linked together efficiently on a patient's body without wires are currently too uncomfortable to wear for a long time because they need to be large in order to maximise the strength of the signal being received. They can be reduced in size but this leads to the antenna being less efficient, meaning that the battery powering the device has to be recharged more frequently.

Experts in antennas and bioelectromagnetics at Queen's University Belfast (QUB), with funding from the Engineering and Physical Sciences Research Council (EPSRC), have developed new types of antenna that get round these limitations.

Their work could revolutionise the way patient care is provided, making unnecessary visits for tests and check-ups a thing of the past. Instead, biosensors could gather data on heart rate, respiration, posture, gait etc, transmitting this information by radio signal to a control unit also on the patient's body. The data could then be accessed by doctors via the internet or mobile phone, for example.

The new types of antenna are the first in the world to deliberately

harness the so-called ‘creeping wave’ effect. With a conventional on-body antenna the majority of the signal is transmitted either away from the patient or inwards, where it is absorbed by the patient’s body which weakens the signal. The rest of the signal, though, hugs the skin’s surface and ‘creeps’ round the body where it is picked up by the control unit.

However, only a small amount of the signal behaves in this ‘creeping’ way and so its overall strength has to be increased to allow enough of it to reach the control unit. Although traditional antenna designs can be used, they are physically large and typically protrude up to 4cm from the body surface for the frequency bands used by systems such as WiFi. Reducing the size leads to poor system efficiency.

The new antennas developed at QUB solve these problems. They are specifically designed to accentuate the creeping wave effect by maximising the amount of signal radiated out to the antenna’s side, rather than inwards and outwards. They are up to 50 times more efficient than previously available designs of the same dimensions. Due to the lower power requirement resulting from this step change in on-body performance and efficiency, the QUB team has succeeded in reducing antenna thickness from 34mm to less than 5mm thick for their new patch antenna, for example.

The antennas can therefore be fitted almost anywhere on the patient without causing significant inconvenience and are sufficiently low-profile to be incorporated into clothing or worn as part of a wound dressing. One QUB design is now the subject of a patent application, with more anticipated.

The unique design of the new antennas could unlock the full potential of emerging ‘wireless body area network’ (WBAN) technology. A WBAN is a network of biosensors attached to different parts of a patient’s body. Patients wearing a WBAN could carry on with their normal lives – the

doctor remotely monitoring the data gathered by the network would simply contact them to arrange appointments when needed.

“The UK leads the world in the development of wearable communications including WBAN antennas,” says Dr William Scanlon, who is leading the QUB project. “With EPSRC funding, our group at QUB, along with other related projects at the University of Birmingham, Queen Mary College and elsewhere, could help unleash the full potential of WBAN technology. We could change the way that a range of illnesses, injuries and conditions are monitored, perhaps within five years”.

Source: Engineering and Physical Sciences Research Council