

Dutch Researchers Focus On RFID-Based Sensors for Monitoring Apnea, Epilepsy

IMEC-Nederland's body-monitoring systems employ 2.45 GHz active RFID tags integrated with sensors to record and transmit data about a wearer's vital signs.

By Claire Swedberg

Dec. 5, 2007—Dutch nonprofit research institute [IMEC-Nederland](#) (IMEC-NL) has built several prototypes of human body-monitoring systems using 2.45 GHz active RFID tags integrated with sensors to record and transmit data about a wearer's vital signs to a central system. Work on the devices was carried out at the [Holst Center](#), an Eindhoven-based research institute for wireless solutions. The center was established in 2005 by IMEC and Dutch scientific research institute [TNO](#), and supported by the [Dutch Ministry of Economic Affairs](#). IMEC-NL now hopes to attract the interest of vendors able to market wireless monitoring systems for such conditions as epilepsy and sleep apnea.

A patient hospitalized with epilepsy is often monitored around the clock via 24 electrodes attached to the face and scalp and connected to wires that plug into a box beside a hospital bed. That box receives data about brain and facial activity, and is cabled to a computer that tracks the patient's condition.

For an individual suffering from sleep apnea, treatment typically includes spending a night at a clinic for monitoring purposes. While the patient sleeps, electrodes are attached to the face to measure eye and jaw muscle movement, as well as brain activity, and are wired to a receiving device that connects data to a computer for analysis.

The goal of IMEC is to make such procedures wireless, providing patients mobility and perhaps even allowing them to be monitored in their homes rather than at a clinic or hospital. The institute began developing wireless sensor technology around 2000, says Bert Gyselinckx, IMEC-NL's program director for wireless autonomous transducer solutions. In 2002, the company created the first portable electroencephalogram (EEG), which monitors brain waves. This included 24 electrodes that attach to the head, wired to a shoebox-sized device that amplifies and filters data from the electrodes and transmits that information to a receiver that can then be attached to a PC.

Since that time, IMEC has made the shoebox-sized device smaller, Gyselinckx says—first to the size of a pack of cigarettes, now that of a sugar cube. The system chronicles patterns detected by the sensors, and if those sensors detect an unexpected change in brain activity, they can transmit an alert to an RF interrogator up to 10 meters away. The reader, developed by IMEC, can be cabled to a PC or incorporated in a USB memory stick that can then be plugged into a PC. In the meantime, Gyselinckx says, patients have their mobility back. The prototype has been tested at the [Universitaire Ziekenhuizen Leuven](#) (UZ) in the Netherlands.

In the case of sleep apnea, patients who previously went to a clinic to have their sleep patterns monitored could now potentially do so at home. With an IMEC-developed device—which Gyselinckx estimates would cost about \$100 at the commercial level—a user could attach several electrodes to the chin and around the

eyes before going to bed, to measure muscle and brain activity.

The electrodes would be wired to an RF transmitter that fits onto the head like a hat. The transmitter would function like an active RFID tag, sending electrode data, as well as its unique ID number, to an interrogator up to 10 meters away. The reader could be wired to a PC, which would store the data and transmit it to a physician via the Internet. IMEC has tested the system on its own staff, as well as on patients at Belgium's Centre Hospitalier Universitaire de Charleroi (CHU).

RELATED_ARTICLES In addition, IMEC has been working on a thermal scavenger component that, according to Gyselinckx, will likely require another five years of development. The scavenger would turn the user's body heat into electricity for powering an EEG, electrooculograph (EOG)—for monitoring eye movement—or other devices. However, he notes, "It has yet to be designed as an integrated system."

With all the technology prototyped and tested, Gyselinckx says, the company is now seeking partners to commercialize the systems. "Our focus is on technology," he states. "We then set up partnerships with companies that can develop that technology." Firms currently providing hardware and services to IMEC include semiconductor providers NXP Semiconductors, Intel, Samsung and Target Compiler Technologies, as well as coatings supplier Bekaert Group.

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