



Law Yee Wei

## Smart sensors co-operating without wires

Law Yee Wei from Malaysia studied electrical engineering in his home country and in Southampton and Singapore. Having completed this 'worldwide education', he is currently with CTIT, conducting research on 'intelligent sensor networks': networks of tiny sensors with built-in intelligence, capable of communicating and co-operating. All this has to be wireless with an absolute minimum of energy use. Within this European project, Law Yee Wei focuses on security issues.

"In the near future, we expect a far more extensive use of sensors: in buildings, in our own home, in clothes, or even on or inside the human body. They are present, but not visible. They will be part of a new type of intelligent human-computer interfacing, known as ubiquitous computing or ambient intelligence.

The sensor in itself can be quite simple, it can measure temperature, light intensity, it can be a camera or detect presence. But imagine networks of sensors sharing information and working together. All these intelligent functions have to be put into a very tiny device, using wireless communication and working in an extremely energy-efficient way. At the same time, you have to address matters of security in a satisfactory manner. That's a huge problem!"

"These sensor networks are 'hot', especially in the US where military applications are predominant. We are investigating applications closer to daily use. A door lock, for example, can be made intelligent, communicating with a wireless system for updating the access information. There are various sides

### *Examples of current projects:*

- Reconfigurable computing in hand-held multimedia Computers (Netherlands Science Foundation / PROGRESS)
- Energy Efficient Sensor Networks (EYES – EU Fifth Framework Program)
- At Home Anywhere (Netherlands Science Foundation)



to this, however. You run the risk of eavesdropping. But you also have to find a way to get the information to the right place and on time. From sensor node to sensor node, you communicate hop-by-hop. But you have to take into account changing conditions, networks that are not 'always on'."

"Security precautions of existing networks and information systems are not meeting our demands in sensor networks. Energy use has never been a real issue for the designers. Public-key cryptography, for example, makes extensive use of memory, and therefore needs a great deal of processing power, and therefore a great deal of energy. This is unacceptable to us. We have to make clear choices. In practice, it will be a trade-off. So far, this group has conducted quite a lot of research with regard to energy-efficient mobile systems, and we already concluded that the architecture of a desktop PC cannot be translated one-on-one to a handheld system. This projects therefore fits in with our greater ambition of designing systems that are energy-efficient."

"In this European EYES project (Energy Efficient Sensor Networks), we co-operate with partners in universities and industry in France, Italy and Germany. And, closer to home, with the Nedap company in Groenlo. This company specialises in smart identification and access systems, and has a keen interest in a wireless system for many novel applications like intelligent door locks. Within CTIT, we also see new and maybe unexpected applications, the MobiHealth project, for example."

"Personally, I am interested in various fields of information technology and security research. In a way, I made the choice for CTIT by coincidence. In Southampton I met professor Pieter Hartel, the leader of one of the research groups involved in EYES, and he told me about the research in Twente. It seemed very interesting to me, so the choice was made quite easily. These first six months were full of questions about where to begin, what to do, but we are now approaching the point where we have to make concrete choices and book first results."

Prototype of a sensor node: still to be significantly reduced in size.

