Seamless user experience with 'wireless intelligent sensing technology'

By G Botha, WiST

Governments and policy makers globally are realising the potential benefits of encouraging the growth in sensor technology. The United Nations Industrial Development Organisation's 'Technology Foresight' is conducted regularly to examine potential opportunities to promote wealth creation and enhance quality. This forum identified sensor technology as an integral element in the overall development of products and services. In fact it emerged as the key technology supporting a wide variety of research and industrial applications.

Sensor technology is a key in the seamless integration of systems. Any technology system requires an input to trigger a process; intelligent wireless sensor technology does not only provide this input automatically, but also senses important environmental aspects – and in so doing, triggers the appropriate system process. Science fiction is always an indication of where technological development is headed. Star Wars was released in 1977 and at that stage it stretched the imaginations of most people. What was farfetched then is a possibility today. During the late 1990s I attended a book launch at one of the big advertising agencies for a book called 'Next'. The book was all about the trends in the advertising industry, but what I remember is that the book predicted seamless integration between the individual and their world.

Billboards would sense your presence and who you are (by your demographic profile) – triggering advertising which targets you personally. When alone, it would advertise to you only, taking your personal demographics into account. When with your family, it would determine the most appropriate information to display, using the combined demographics of the group. This example illustrated that if correctly targeted, advertising becomes relevant information that is non-invasive. What was farfetched then is possible today.

Although it is possible to implement what we have seen in science fiction over the last decades, something is still missing. A logical deduction could be that the inability of the various technologies to detect or sense according to a universal standard, still makes technology fragmented and dependent on human intervention. Even though technology is used in everything around us, it has not yet been integrated into a seamless solution. We carry electronic vehicle keys, remote controls to gates and garage doors, we type codes into keypads, we have chipped bank cards, ID cards for access control, loyalty cards, USB devices to do banking and so on. Almost everything in our world is controlled by a different device or some form of intervention.

The main reason why every technology uses a different device is because the users need to identify themselves to the technology, providing it with some input; up to now, there has been no single identification method that could work universally. As a result people are accustomed to bunches of keys, with a couple of remote controls, a wallet full of cards, passwords and pin codes, and the other devices that we interact with on a daily basis. But is it really possible to do away with all of this? The answer is YES! Imagine a unique identification that is accessible to all technologies, combined with an improved ability to sense relevant environmental attributes. Such a combination could give us the ability to seamlessly integrate and automate much more than what we do today. To understand how it is possible we need to explore intelligent sensing technology.

What is 'Intelligent Sensing Technology'?

The human body is a good example of how intelligent sensing technology works. We are familiar with five standard senses, but in reality there is a network of sensors throughout the body. On a cellular level, these micro sensors know how to respond when triggered and maintain a natural balance.

Think about the enzyme produced in the liver to cope with whatever humans consume. The eyes have sensors that detect light and sensors that detect the three primary colours. The ear has sensors that enable you to hear, as well as sensors that detect your orientation in the gravitational field and that give you a sense of balance. In your muscles and joints, there are sensors that tell you where the different parts of your body are and about the motion and tension of the muscles. These senses enable us, for example, to touch our index fingers together with our eyes shut. Hunger and thirst can be said to be monitored by sensors too.

In our environment an electronic sensor is a device, which responds to an input quantity - just as human cells do - by generating a functionally related output, usually in the form of an electrical or optical signal. These signals are then used to provide the inputs to technology that would have otherwise have been manual. During the past two decades, there has been an unprecedented growth in the number of products and services, which utilise information gained from different types of sensors. The development of sensors to meet this need is referred to as sensor technology and is applicable across a very broad spectrum - from the environment to medicine, commerce and industry.

How does this work in practice?

As practical example to demonstrate this, consider the systems present in an office block. Although sometimes quite 'primitive', these systems are related to building automation or energy management, access control and security, time and attendance, asset management or stock control, office automation and so on. Now, imagine if every person working in the building had a wireless identification that could be verified on entry through some form of biometrics. From that point on, all the systems could respond to the presence of the person without any further intervention. By using a single wireless identification method and environmental sensing technology, the systems can be seamlessly integrated. The individual's journey via the basement elevator can be scheduled on entry into the basement parking; the air-conditioning system in the person's office could be switched on according to personal preference, taking the outside temperature into account.

The sensor in the person's pocket could also sense body temperature that could be a further input. The person will only be able to enter and exit the building with computer equipment that has been allocated to them. The access control and attendance systems will automatically be updated as the person approaches an entrance. The security systems will stay activated, but will ignore people with valid identification as they walk through the building.

Should they try to access to unauthorised areas, the system will either block access or notify the relevant people. The lights will switch on as the person walks through the building and switch off as they leave. The business systems will automatically know who is accessing the systems and allow access. When the individual leaves his or her desk, the computer will automatically lock, unlocking upon their return. When entering a meeting room, the computer could automatically log a specific user on and load the presentation linked to the calendar booking. Personal selections can be made by tapping a sensor when asked. The meeting could be recorded and automatically sent to attendees selected via the sensor to receive the recording. At this point you might wonder how to protect your identity. The answer is simple, when you do not want to use the functionality, you always have the ability to temporarily disable your sensor. Also remember that you decide who you provide your information to.

Without providing access to your own information, the sensor will just provide a number when detected. With some development in progress, identification sensors will automatically sense if the sensor is being used by its rightful owner and potentially limit the need for separate biometric verification. The same identification can be used to transact within multiple retail stores, for banking, to gain access to facilities (like your local gym) and to monitor your progress, unlock your vehicle, open your garage door and your home.

Wireless Intelligent Sensing Technology

The author's company recently launched a new range of sensing products that is able to realise most of the examples cited above.

Broadly speaking, this company provides two types of sensors. The first will detect changes in the status quo, and the second will provide exact measurements. The sensor has a level of intelligence and communicates on predefined intervals to notify the updater/reader that it is still present. However, when any change in the status quo occurs, the sensor will immediately send an alert. Although alerts triggered on an exception are a key component of the value proposition, the data collected on an ongoing basis cannot be under-estimated. Analysis of this data will provide key business insights. Sensor data is either used by local systems or is transmitted to a secure database on the internet, depending on the application. In the last case the rule-based management system responds to alerts from every sensor according to predefined rules. The rules can be as simple as to notify the owner via SMS. Standard sensors can be packaged to suit the client's application in short and long range formats. The sensor can be packaged in a credit/ access card for financial and access control applications – or packaged in wall mountable housings for security sensing purposes, flat figure eight enclosures for asset tracking and more robust and waterproof enclosures for industrial applications. Sensors can also be moulded into plastic containers and crates.

Updaters

Updaters are not merely devices to transmit the data to the relevant system or database. These devices have a very important role and provide another level of intelligence. The entry level Updater could either be used as a PC USB updater that uses the PC's infrastructure to transmit data to the database, or could be integrated in any other device that could use or transmit the sensor data. This updater is a powerful, reliable low cost option. The mobile Updater is a small GSM/GPS/3G updater which is ideal to track high value movable assets like vehicles and containers. Static updaters can also be installed on client networks. In this case the updater is typically wall-mounted and either linked to the client's wireless, or fixed cable network infrastructure.

Central database

Sensors can be used to provide input to a local system or updated to the author's company's high speed secure database, from where it will be switched to the appropriate destination. Should the Identity sensor - or any of the items tagged with the sensor - be stolen, the sensor can be marked as stolen on this database. Should any other updater locate any stolen sensor or item anywhere in the world, it will immediately report on its whereabouts and inform the relevant parties.

Sensors

The following are examples of sensors:
- Identity sensor - has a unique ID, in addition to one or more sensors. The identity sensor is typically fitted with a magnetic switch, but the main purpose of the sensor is to provide ONE unique identification code for financial and loyalty transactions across banks, retailers, insurance companies and access control in the work place and at home. The sensor can trigger energy saving devices and be your unique ID that protects your data on your computer. Identity sensors can also be used for asset management, if it is not important to track movement.
- Movement sensor - will detect when items that should remain

stationary, are moved; the mobile Updater will activate upon movement of sensors.

- Vibration sensor - detects a change in vibration. Furthermore, vibration sensors can detect forced entry through the vibration it causes on a building structure, or when motors or generators are started.
- Magnetic sensor - detects 'open' and 'closed' via a magnetic switch. These sensors will send an alarm when the magnetic switch is opened or closed. The sensors are ideal to detect when, for instance, a door is opened. The sensor can also be utilised to detect if a seal was broken. This example would apply to the door of a delivery truck, and also on products where the warranty is voided if the consumer tampers with or opens the device/ package.
- Tilt sensor - is able to detect if an item is tilted at more than a pre-determined angle. For instance, these sensors can identify if a vehicle has been jacked up when a tyre is removed.
- G-Force sensor - is able to detect any rapid movement such as a vehicle accident, when a firearm is discharged or when a parcel is dropped.
- Light sensor - is able to detect any change in light. The sensor will activate if a parcel or travel bag is opened, or when the back of a delivery vehicle is opened. The sensor can also be used for security purposes.
- Temperature sensor - is able to detect a change in temperature, or be used to measure accurate temperature readings. Temperature sensors can be used to monitor cold storage, fresh produce, store fridges and wine cellars. In a similar way, these sensors can be used to measure heat variations.
- Pressure sensor - is able to detect a change in pressure. The sensors can be used to monitor pallets, shelves and to count foot traffic. The sensors can switch lights on and off, and are capable of acting as a safety device when machines are required to switch off as the operator steps away from the machine.
- Input sensor - is able to detect analogue and digital outputs from other devices. The sensor transmits data from other devices on the author's company network and allows clients to measure activity not currently included in this particular range of products.

Software applications

The author's company and its Centre of Excellence Partners have various software applications available and the sensor data can also be integrated into any other business application, depending on the client's requirements.

Benefits

- Tracks, protects, secures and streamlines your business assets
- Easy to install non-intrusive wireless architecture
- Easy to integrate any other sensing equipment
- Easy to integrate into business and ERP systems
- Affordable and scalable
- On duty 24/7, collecting real-time data that provides insight to business problems
- The product has a long battery life with a configurable battery management system
- Comprising very small sensors with a variety of functions, the technology/application is available in both long and short range
- The global database and software can be accessed anywhere in the world
- Brings back control in a hectic world

Conclusion

In nature and in the human body there is an invisible network of sensors at work, which maintains a natural balance through continuous fine-tuning and adjustment. Sensors will progressively become part of every aspect of modern life. These networks of sensors can monitor and manage everything around us in a similar precise and economical way. Just think about it:

- Energy efficiency can be achieved by automatically eliminating any wastage
- Crime can be curbed if assets are tracked through a global network and stolen items can be identified every step of the way
- Consumers can utilise ONE identity sensor, instead of a wallet full of cards
- Complete data security and identity protection on the internet and social media sites is now a reality
- Individuals will now have complete control over who has access to their identity
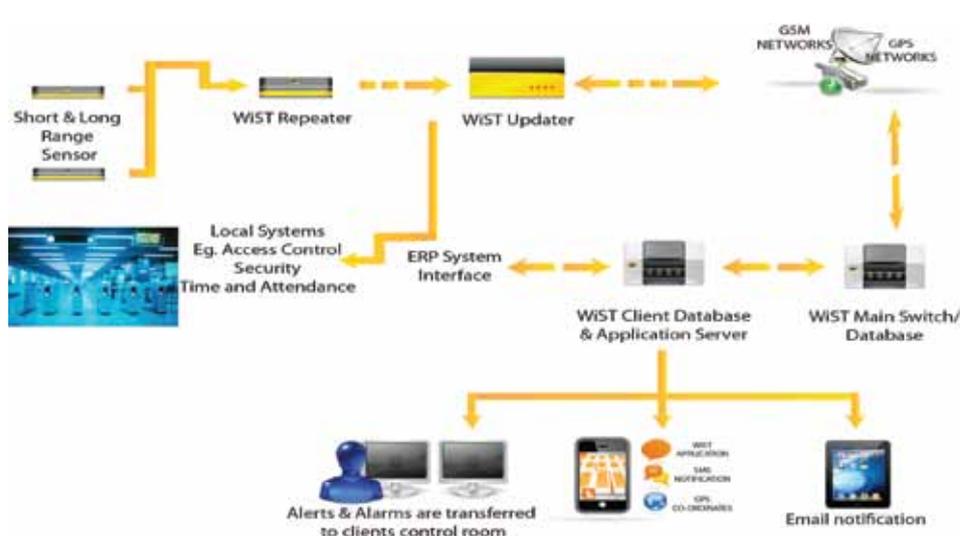
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