

Wireless connectivity spurs Sense and Simplicity

Communication and interaction are basic human needs built into our genetic code. So too is the inquisitiveness that gives us a seemingly insatiable thirst for information.

Bringing people together so that they can share experiences, and delivering the right information to the right place at the right time, are two of the central themes in Philips' vision of the connected consumer. This Password article highlights a range of user scenarios currently being worked on by Philips Research in which wireless connectivity will help to bring Sense and Simplicity to consumer environments.

By Peter Harold

No place like home

It is a well-known fact that hospital patients recover better in the comfort of their own homes. Ensuring the quality of aftercare at home is something that Philips Research addresses through participation in the Body Area System for Ubiquitous Multimedia Applications (BASUMA) project – an initiative supported by the German Federal Ministry of Economics and Labour (BMWA). In the project, Philips is helping to develop body-area networks for in-home patient monitoring. Containing several inter-communicating sensors, these body-area networks will monitor vital functions such as your heart rate, blood pressure and blood oxygen levels, make intelligent decisions about your state of health and pass on relevant data to you, your doctor or local medical services.

What Philips injects into the system is the development of body-area networks that connect without wires and that automatically re-configure themselves in response to the number and type of sensors attached to your body. Attach a single ECG (Electrocardiogram) sensor and the system will monitor your heart rhythm. Add a blood-flow sensor and the system will automatically recognize that it can combine the data from both sensors to continuously compute your blood pressure as well.

“As an ordinary person, communication is about who I talk to, why I do it and what I say. I don't care how technology makes it possible.”

Tobias Helbig, Philips Research

Wireless connectivity between sensors means they can be built unobtrusively into items of clothing, while advanced low-power radio technology and intelligent power management systems will insure that

they operate for months or years from tiny batteries. As a result you will be able to go about your daily life, free from the stigma of being wired up to a machine or having to plug yourself in every few hours for a re-charge!

Unique recognition

There is, however, another interesting challenge associated with these wireless body-area networks. If there are no physical wires connecting the sensors into the network, then how do you know which sensors are on which patient? It is another area where Philips Research is applying its expertise in connectivity solutions by developing a technology that allows sensors to automatically recognize you the instant they come close to your skin (see New enabling technologies – Active Digital Aura). ➔



New enabling technologies

Self-configuring peer-to-peer networks

Philips Research is helping to develop the self-configuring peer-to-peer networks needed for easy-to-use in-home patient monitoring systems by developing middleware – the layer of software that sits between the network and the application to provide system services such as device identification, authentication, and resource discovery.

For plug-and-play simplicity, body sensors in these systems must be able to operate autonomously or in concert with others. Occasionally they must be able to identify and communicate with external network nodes when they come into radio range – for example, weight scales or urine testing kits. In this ad-hoc heterogeneous networking environment it is vitally important for individual nodes to know the extent of resources available at any point in time so that they can negotiate with each other to optimally distribute and re-distribute the application between them.

Other issues addressed in these middleware layers include making the system robust against the effects of radio interference and node failure, minimizing power consumption through intelligent power management, and ensuring software upgradability.

Active Digital Aura

Connecting without wires does not necessarily mean wireless communication. Philips Research's unique Active Digital Aura technology, for example, utilizes an electric field rather than an electromagnetic field to transmit information. Capacitively coupling the signal from a small body-worn tag into your body, it generates a minute yet detectable electric field that extends outwardly a couple of centimeters from the entire surface of your skin. The tag, which is easily built into something as small and unobtrusive as a wristband, modulates this electric field with a unique digital identification code.

Authorized devices that come close to your skin can pick up this identification code and configure themselves to your specific personal profile, while advanced authentication mechanisms between the tag and the device protect your privacy and security. For in-home patient monitoring systems it could mean body sensors that use your identity information to automatically configure themselves to monitor specific medical conditions, but it could just as easily be mobile phones or MP3 players that automatically configure themselves to your personal tastes and preferences the instant you pick them up.



In the Active Digital Aura concept, sensors automatically recognize people as they are brought close to their skin, allowing intuitive personalized applications.

A love affair with cars

Cars are not merely a way of getting from A to B. They are an extension of our personal space and for many of us a love affair. It's not surprising then that we'd like our cars to become more responsive and welcoming.

Your car should let you know where it is on a crowded parking lot, switch on the interior lights and the music of your choice as you approach, but wait until your hand is within centimeters of the door handle before unlocking itself. This, however, means that your car has to know how far you are away from it.

Scientists at Philips Research have now extended Philips' world-renowned keyless car entry technology by designing circuits that measure with nanosecond accuracy the time-of-flight of radio signals to and from the keyless-entry fob that you carry in your pocket. As a result, they have developed a way of accurately determining the distance between you and your car.

“Wireless connectivity makes communication so much simpler that it opens up a whole new range of applications where communicating simply makes sense.”


Tobias Helbig, Philips Research

Wireless connectivity can also make your car more responsive while you're driving, by providing you with information about traffic conditions and driving hazards that lie much further ahead than you can possibly see. Before too long, cars will be equipped with a wide range of sensors that can automatically detect conditions such as slippery road surfaces, poor weather conditions or collisions. Using short-range radio transmissions from one car to the next, the information picked up from these sensors will be able to hop from car to car down the stream of traffic heading for the hazard, alerting you much earlier to what lies ahead.

Staying on call

Large countries such as China often have a mix of different mobile-phone operators, covering different geographical areas and using different cellular standards. To enjoy 100% coverage this means that users typically have to carry more than one phone around with them.

The issue is so relevant to China that Philips Research has a special research group located in Shanghai to help solve it. This group is using Philips' software-defined radio concept (see 'New enabling technologies – Software-defined radio') to create a multi-mode terminal that can automatically switch between different standards and provide seamless hand-over of your call as you move between coverage areas.

But this is only the start of Philips' vision for mobiles of the future. It is not only working towards a unified terminal architecture that will work with all 2.5G and 3G cellular networks, but one that will also allow mobiles to communicate via alternative channels such as wireless LANs, and receive digital TV and radio broadcasts – a single handset for all applications that will work anywhere in the world. 

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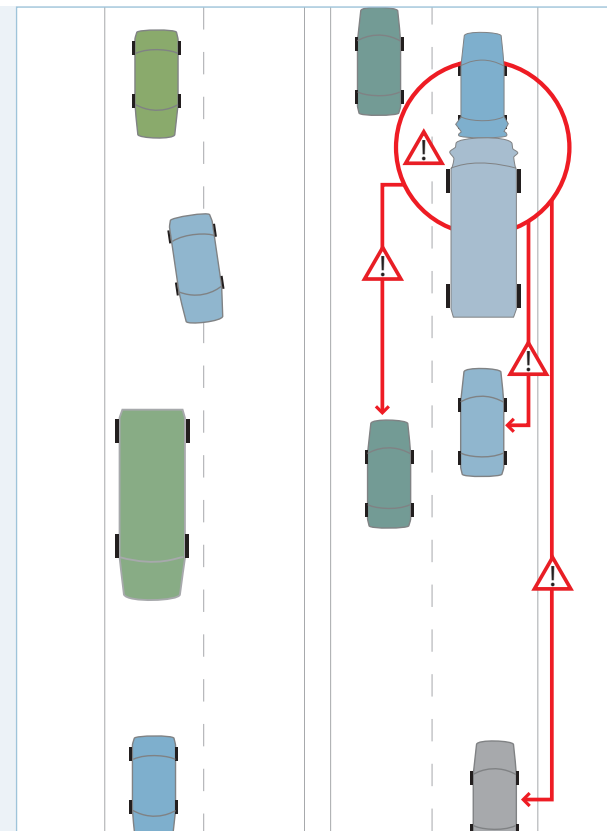
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Extra info www.research.philips.com/password • The BASUMA project • Software Defined Radio • Cognitive Radio

Communication between a car and its environment can greatly improve the driver's anticipation to traffic conditions and hazards.



New enabling technologies

Software-defined radio

In its software-defined radio project, Philips Research is developing new RF transceiver architectures that will allow a single transceiver circuit to receive and transmit using many different digital wireless communications standards. Currently, most RF transceiver circuits are highly tuned to work only with a single standard.

At the digital 'baseband' end of the transceiver chain, it is developing enhanced vector processors that will replace today's dedicated hardware ASICs by a highly flexible software-programmable processor that can execute software codecs, modems and channel filtering functions for a very wide range of wireless transmission standards.

For the RF part of the transceiver, it is developing hardware architectures that can be re-configured under software control to achieve the signal bandwidth and dynamic range needed to tune in to any carrier frequency and modulation scheme. At the antenna end, it is developing ways of allowing multiple antennas to operate in close proximity without interfering with each other.

The objective is to develop a transceiver architecture that can not only switch between standards, but one that can operate on multiple standards simultaneously. All this without paying a penalty in terms of size, cost or power consumption in your mobile phone.

Cognitive radio

If software-configured radio can produce a truly universal transceiver, then why restrict its operation to the relatively small number of frequency bands currently authorized for public use. The unlicensed bands at 2.4 GHz and 5 GHz, for example, are already becoming crowded, yet field testing has shown that overall spectrum usage up to 10 GHz remains well below 10%. Of course, the argument for restricting access to many of the bands is based on the need to prevent interference – for example, on emergency service communications and TV channels.

However, a radically new approach being proposed in the USA would allow public access to these restricted bands in order to make better use of the RF spectrum. The system would prioritize usage in these bands, with transmissions such as emergency service communications having higher priority over unlicensed access. This new approach, often referred to as 'cognitive radio' because it requires a considerable degree of RF environment awareness and intelligence in even the simplest of radios to negotiate usable transmission frequencies, promises access to ten times more RF spectrum than is currently available. In addition, some people see it as the ultimate way of breaking today's close association between specific communication 'pipes' and specific applications, and of providing the highly robust wireless communications systems required for applications such as remote in-home patient monitoring systems (see 'No place like home' on previous page).