Smartphones enter Embedded Sector

Do you also happen to carry one of those technological masterpieces in your pocket? We're talking about smartphones, meanwhile more „smart" than „phones" - you can do almost anything with them besides making calls.

A speedy career...

By the time when mobile communication devices had reached the size of modern cell phones, everyone thought it was the end of the line. Even some cell phone manufacturers made this tragic error, until the word „smart" turned up.

… from cell phone to smartphone

Everywhere one sees people busy with small cell phone like devices. But these are not cell phones, but „smart" phones, which means you can do a lot of other things with them.

After all we carry around our record collections, photo albums and even our bookcases, we receive and send E-Mails, we browse the internet, skype with friends all over the world and so on...

There's an App for EVERYTHING

Apps (short for Applications) are small programs, which one can download from an „App-Store". That way smartphones become very flexible, because the number of available apps increases more and more, adapting to the user's requirements.

Of course smartphone users also want to „control" almost anything with their smartphones. TV, light, heating or other machines (even on the go) – numerous apps are offered for that purpose.

Samsung for example provides a „Smart Washer" app, which controls a washing machine via wireless LAN (http://www.chip.de/news/Samsung-WF12F9E6P4W-Die-WLAN-Waschmaschine_63141257.html).

But here it is neccessary to define the term „control" more precisely, and ask: WHO controls WHAT?

Various kinds of „Control"

In the above Smart Washer example the washing machine – like any other - is of course controlled by an embedded electronic circuitry. The machine's functional control requires controller with specialized I/O (i.e. parallel, serial, SPI, I2C, PWM) to interface machine-specific peripherals (i.e. A/D D/A converters, power electronics etc.).

It has to work reliably, in real-time, and autonomously.

Just imagine the washing machine causing a flood, because the valve control failed, reason: Low Bat! Or, the 30 °C laundry gets cooked, because an update of the operating system suddenly stopped all running processes...

And the washing machine example is relatively harmless. Or would you enter a smartphone-controlled elevator... ?

Obviously, it is not a good idea to have smartphones control anything like that. A good idea however is, to use a smartphone to display operating parameters, change settings, or to notice the user when maintenance is due, etc.

That way, the smartphone serves as a „remote" control, or to use the appropriate term – it serves as

HMI

Those, who have ever programmed a user interface for a device with a display and a few keys, know that this

is often more time and cost consuming, than implementing the device's functionality.

A smartphone as „Human Machine Interface" has some significant qualities: Mobile, lightweight, high-resolution color display, touchscreen, sound, haptics, even Gigabytes of memory, all this wireless – what more do you want?

Display too small? Use a tablet! Apps are equally running on tablets, but of course a tablet won't fit in your pocket...

You even don't have to program a special app for the smartphone/tablet. The magic word is:

Browser-based

The device to be controlled must be equipped with an Ethernet interface.

There are ready-to-use solutions. Modules with everything needed (TCP/IP Stack, PHY) on-chip (http://www.mct.net/download/wiznet/w5300.pdf). Also for WLAN (http://www.mct.de/download/rn/rn-131_data.pdf).
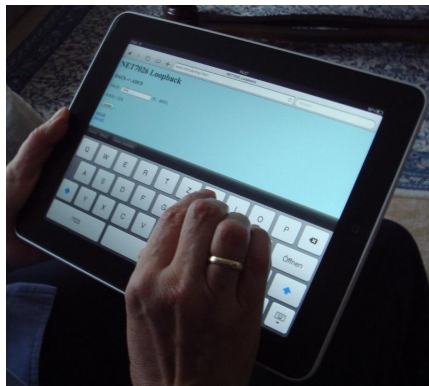
iPad as control unit

A HTTP server completes the Web interface. This sounds more impressing than it is. It could be as simple as a HTML page with a form, sent from the HTTP server to the browser, which returns the user-filled form data.

Routers and Pan-Tilt-Zoom cameras work similarly, so they can be comfortably controlled using any browser.

But a network interface may also cause problems. Not all browsers are always 100 percent compatible. And when data „disappears" into a network, one cannot be sure that it reaches its destination untampered with...

Besides WLAN, smartphones/tablets have a second wireless interface:

Bluetooth

Initially, Bluetooth was designed to be a cable replacement for headsets, i.e. used for audio data. Meanwhile there a many Bluetooth Profiles for exchanging data. One of it - the Serial Port Profile, SPP – serves as cable replacement for serial interfaces (RS232). There are Bluetooth modules for this purpose, which behave like an UART (http://www.mct.de/interfacemodules.html#ifbt41).

Bluetooth connections are believed to be stable and secure.

„Adaptive frequency-hopping spread spectrum (AFH), which improves resistance to radio frequency interference by avoiding the use of crowded frequencies in the hopping sequence." (Wikipedia)

Bluetooth devices must be paired before they can be used. Pairing involves exchanging security-relevant data (PIN). Only during pairing (normally once) there is a security risk. Also, the limited range (about 10m) is an advantage, concerning security.

As a result, Bluetooth is widely accepted for industrial applications.

As opposed to browser-based solutions, Bluetooth solutions require specially programmed apps, which also depend on the smartphone's operating system.

For example, using Google's free downloadable SDK (http://developer.android.com/sdk/index.html) and an Android smartphone/tablet, you can compile, install and run a sample app on your smartphone/tablet in no time. The Google API supports all Android standard components (display, touchscreen, WLAN, Bluetooth,

SD-Card, sensors etc.).

Here http://www.mct.de/android.html MCT Paul und Scherer shows a few Android sample applications using a smartphone/tablet to control external hardware via Bluetooth. Below are a few screenshots:
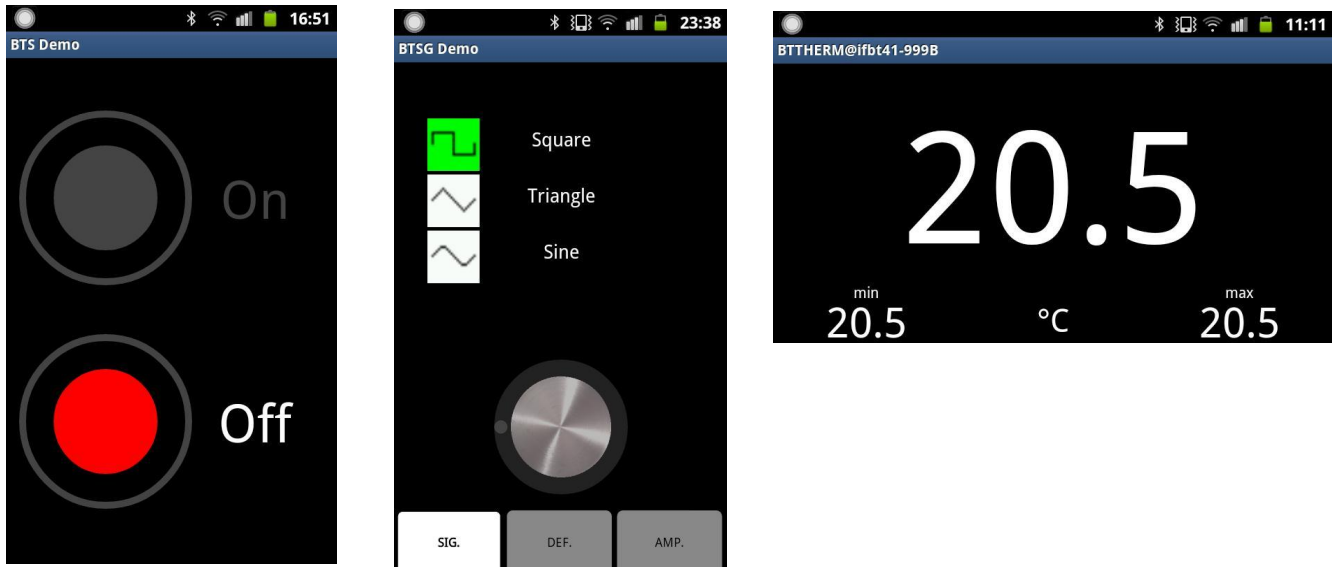
Conclusion

More smartphones/tablets than notebooks/netbooks/PCs have been sold last year. This shows a clear trend. Smartphones/tablets are beginning to replace (mobile) PCs.

Concerning performance, modern smartphones/tablets are more and more able to keep up with mobile PCs. And who needs always a „real" keyboard or Terabytes of harddisk capacity? On the contrary, a lightweight device with a touchscreen instead of a mouse, and no need to boot up, is often more desirable. The service technician plugging in his notebook will vanish as well as the sales agent opening his laptop.

PC-based control concepts are nothing new. Process visualization, data logging and analyzing – all these terms are more associated with PCs than with smartphones/tablets. This will change rapidly. The mass production of smartphones/tablets will make it possible to implement cheap user interfaces - quasi „from the bargain bin". (hdop 12/2013)