Driving to

Time to market seems to be impacting many aspects of our lives. Not only do we as consumers demand faster, smaller and fuller featured electronic equipment, but as designers we need to keep up to date with emerging standards and protocols for use in future systems we design. To keep to these ever-decreasing design time scales we need to be able to stay connected and be able to work anywhere.

The advent of the laptop computer was the first step to offices on the move and as we demand more, this has lead to the emergence of in-car offices. The humble automobile has become more than a way of getting from A to B, and can now include GPS navigation with intelligent route finding, integrated PDA functions, built in mobile communications, entertainment systems and in-dash PCs.

However, automotive electronic designers face both the challenges of consumer equipment designers (for example time to market pressures, cost restrictions and a plethora of emerging standards and protocol) and also extra challenges like a constrained physical area to design within and the need for a very simplistic user interface so that the driver can keep his eyes on the road.

For example, the latest BMW 7 series has a joy-stick like user control (part of 'iDrive') that allows the driver to control in-car comfort, entertainment systems, wireless communications, navigation and in-car PC applications, all using one integrated clear display.

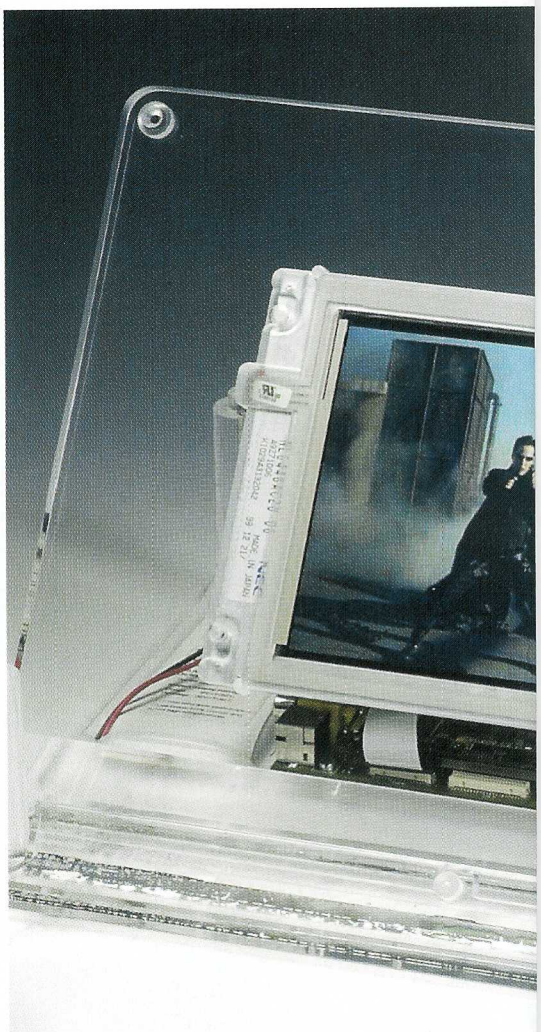
Programmable logic devices can enable new automobiles to provide a more informative, productive, safe and entertaining in-car environment. By using the flexibility, time to market advantage, and after-sale reconfigurability of such devices and software, manufacturers can not only be first to market but remain best in class long after the sale.

The automotive multimedia platform concept

As more and more information and entertainment systems are added to automobiles, we're seeing the inevitable conflict of digital standards and protocols. A bewildering array of emerging standards and protocols are being tried and tested for use in the latest in-car systems. These include: Bluetooth, BlueCAN, MOST (media oriented system transport), FireWire, CAN (controller area network), TTP (time triggered protocol - a communication protocol for fault-tolerant real-time systems), FlexRay and more - but which will prevail?

Designers of the new wave in-car multimedia systems will have to include traffic information systems, Internet/Web access, electronic game consoles, MPEG music download capability, digital radio reception, and mobile commerce services. They must also have the flexibility to provide all or just a few of these functions.

Designers must now also ensure that the in-car multimedia system can "talk" to the other devices introduced into the cabin space. For example, if a mobile phone is brought into the car environment, it should be automatically detected and able to communicate with the car's communications network. This automatic connectivity could also include connection of PDAs, portable PCs, MP3 players, and other personal portable electronic equipment to provide a truly connected and functional in-car environment.



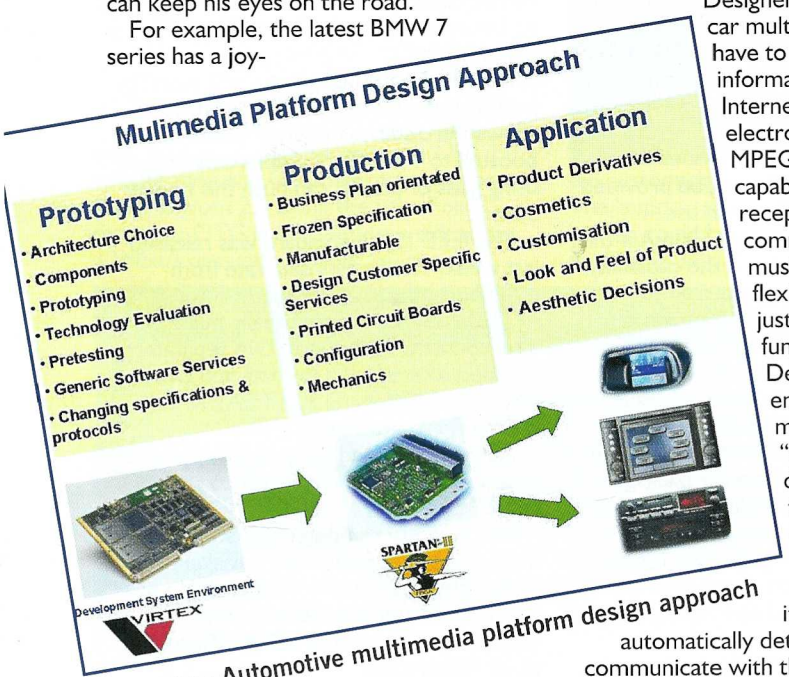


Figure one - Automotive multimedia platform design approach

The new way of designing

As more and more in-car and consumer functions converge - and new automotive and consumer standards and protocols emerge - in-car systems designers are starting to prototype multimedia platforms that can provide as much, or as little functionality, as required. Such multimedia platforms can be best realised by designing reconfigurable hardware.

Reconfigurable hardware can be programmed late in the production flow to

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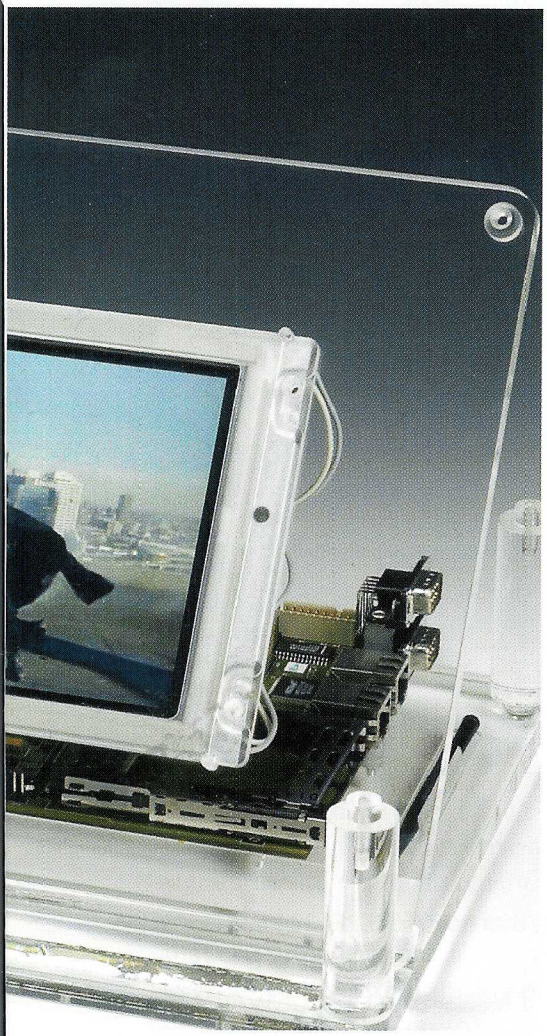
the office



Acunia automotive development platform containing a Xilinx Spartan II FPGA and CoolRunner CPLD

provide custom functionality on a "standard" hardware platform - and can also be configured to accommodate new and emerging in-car standards.

Figure one shows the automotive multimedia platform design approach. This concept will also allow hardware upgrades throughout the lifetime of the car - these upgrades can implemented remotely by utilising the wireless communications and/or Internet connectivity provided by the unit. Xilinx terms this remote hardware upgrading process Internet reconfigurable logic (IRL).

These are systems that can be upgraded, modified or fixed long after they have left the car dealership. For example, an engineer can use the existing wireless comms/Internet infrastructure to reprogram an in-car multimedia system to include extra functionality such as adding an MP3 player or upgrading the system to take advantage of the latest protocol or standard. This same technique can be used to disable the multimedia unit if it is stolen and re-enabled if it is returned back to the original owner.

Multimedia design using FPGAs

The multimedia platform ideally should be based around one Human Machine Interface (HMI) to allow for all functions to be accessed via one colour menu-driven touch screen. As the functions are implemented in software and reconfigurable hardware, the system can be upgraded even after the car has been purchased and driven away.

The new way of developing in-car systems is to prototype using FPGAs in a generic development environment. The elements can then be developed quickly and easily without the need to fix specifications. This initial prototyping phase can be realised using Virtex-II FPGAs.

At this early stage, the different standards, protocols, and functions can be tried, tested, and debugged using the headroom provided by a large FPGA.

As the design firms up, the specifications are "chilled" or "frozen", the specific standard, protocol or function can be chosen from the many tested. This move from prototype to production enables the design to be optimised and fitted into a smaller, low cost FPGA, such as a device from the Spartan IIE family, while still allowing for system upgradability.

Once in production, the FPGA can be used to aid total printed circuit board (PCB) testing using JTAG techniques. If necessary, designs can be 'tweaked' or enhanced at this stage.

Leading next generation telematics technology providers such as Acunia have recognised the need for intelligent prototyping platforms for use by in-car multimedia designers and have produced the Xingu telematics platform shown in the image.

The final stage is the look and feel or aesthetics of the product, which can be designed for each car manufacturer to fit into their specific dashboard (or fascia). All of the production multimedia units are built up around the standard FPGA-based platform. This standard platform can be programmed with its "personality" late in the production flow to accommodate last-minute design changes, or end-user preferences.

Looking Down the Road

Consumers are demanding the comforts of home, the facilities of the office, and the state-of-the-art in information and safety systems in their cars.

This digital convergence scenario requires that the latest interface standards and protocols interconnect and interoperate. These standards and protocols are still emerging - and it may get more complicated before it gets standardised.

So, should manufacturers make an educated guess as to what standard will prevail and produce at risk, or should they wait for the standards to be fixed and get left behind?

With the new family of Xilinx Automotive PLDs - the IQ Family - designers can win the time to market battle risk free by using the ability to reconfigure products to accommodate any standard - now or in the future. By using reconfigurable logic in production, the units can be reconfigured in-car to produce new hardware-based features, thus extending the life of the product.

Xilinx high-volume 'IQ' FPGA and CPLD devices provide cost effective solutions that retain the traditional PLD time to market advantage. Today, Xilinx programmable logic devices are employed by a large number of telematics and infotainment product manufacturers, who recognise the added flexibility and time to market benefits achievable through the use of programmable logic solutions.

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