congatec

Case study

Best practice in railway infotainment computing

New AMD Embedded G-Series processors on congatec COM Express modules

Best practice in railway infotainment computing

Infotainment systems in modern maglev magnetic monorail High-Speed Rail (HSR) trains in China integrate state-of-the-art railway computing platforms.

Passenger information systems in maglev and light rail trains are transforming into connected broadcasting systems with location-based passenger information, news and advertisements. So what can we next expect? 4k? Facial recognition for targeting advertisements? Video door surveillance including cloud connectivity? All-in-one systems with digital ticketing? All this connected to passenger predictive analytic systems? Difficult to foresee, but railway infotainment engineers can be prepared for all these scenarios, if they opt for modular state-of-the-art platforms!

With the availability of both low-power small form factor SoC processor technologies as well as high bandwidth cellular connectivity, standard passenger information that was mainly distributed by human voice in the past is undergoing a massive transformation process. Multi-functional, multi-display, in-seat infotainment systems that are always connected and that distribute location-based information, news and advertisements have taken over. And with display technologies shifting towards 4k, operators will soon be carrying out updates, thus enabling stunning graphics as used in the latest TVs, computer monitors and smartphones. On top of this, advertisement systems with facial recognition will improve overall campaign performance and, once a video stream is captured, why not exploit this in video surveillance installations? With integrated wireless ticketing readers for NFC, RFID or barcodes, an infotainment system located at the door can 'mutate' to an all-in-one system which advertisers could even use for product sales via wireless cash tools.

A global growth market

These scenarios demonstrate quite clearly how railway infotainment systems are undergoing a massive transformation process and that the future looks bright for smart wagon technologies. This outlook is seconded by reports from market researchers such as Markets and Markets. They estimate that the global smart railway market will grow at an impressive compound annual growth rate (CAGR) of over 20 % from 2015 to 2020. At the projected CAGR, the market will grow to a value of $13.7 billion by the end of 2020. Europe is expected to contribute the largest market share, followed by North America. Asia-Pacific (APAC) and Middle East and Africa (MEA) are expected contribute highest CAGR driven by smart cities projects.

Requirement analysis

So if we regard the highly dynamic transformation of applications and businesses, what is the best basic technology to rely on for building latest smart infotainment systems? It goes without saying that this technology has to deliver latest state-of-the-art graphics performance and interfaces. Plus, it must cater for future demands by being multi-functional and freely programmable. In addition, system designers want a clearly defined roadmap towards future multifunctional and thus heterogeneous system architectures. Furthermore, this technology needs to fulfill all the demands required for operation in harsh railway environments. This includes, for instance, high vibration and shock resistance, extended temperature range support for railway operation and very low power consumption for fanless 24/7 operation. Finally, long-term availability is a must and naturally this and all the aforesaid must come at a reasonable price.

Design options

Technologies that actually do cater for all these benefits are computer modules based on the COM Express standard that integrate processor technologies that are designed for harsh environments. The multi-functional layout of the COM Express technology published by the vendor independent PICMG (PCI Industrial Computer Manufacturers Group) makes this possible. The form factor is small and the interfaces are individually customizable by deploying individual carrier boards and highly multi-functional owing to their 440 pin counting connectors to the baseboard. If fewer interfaces are needed, the Qseven form factor from SGET (Standardization Group for Embedded Technologies e.V.) is an interesting alternative. This form factor is smaller and offers fewer interfaces. By way of a summary, if a comparison was made analog to the consumer market, it would look as follows: COM Express targets the PC and notebook and Qseven the tablet and smartphone performance class of embedded systems.

In a nutshell, what are the precise benefits of computer modules for railway engineers? They can use these modules to build their own dedicated systems that fit their applications. There is no need to lay hands on the computing core, so they can concentrate on engineering their own specific infotainment systems. The modular approach also offers an upgrade path towards future power and performance classes so that existing designs can easily be upgraded by switching the module. Plus, standardized computer modules are also deployed in very varied application areas, so engineers benefit from a huge economy of scale compared to full custom designs. And they have access to a large ecosystem with components, design guides, trainings and second sources.

State-of-the-art SoC graphics

Once the decision on the right form factor standard for the infotainment system platform has been made, the next important choices are the right processor technology and the preferred module vendor.

AMD Embedded G-Series SoC processors present one of the best choices available in the market today. They are available at congatec in two options:

- The most recent option are the third generation AMD G-Series SOCs (Codename Brown Falcon) that are pin compatible to the High-End AMD Embedded R-Series. Both processor lines are available on the COM Express form factor so that developers of infotainment systems can easily scale their designs up or down according to the performance, power and cost demands of their applications.

The AMD G-Series SoC (code name Brown Falcon) on a conga-tec COM Express module.

- The alternative are the smaller AMD G-Series processors (Codename Steppe Eagle) that are available in extended temperature configurations (-40 to +85°) on the small sized computer module form factors Qseven and COM Express compact.

The Com Express compact module conga-TCG is based on the the G-series SoC (code name „Steppe Eagle").

The low-power AMD Embedded G-Series SoCs (code name Steppe Eagle), which are also very popular in professional gaming and infotainment applications, deliver powerful graphics, and are robust and long-term available. For media-rich railway applications congatec offers them on Qseven modules for extended temperature ranges.

All of these platforms offer the integrated, high-performance AMD Radeon Graphics which makes AMD SoC based modules so attractive. A further factor is that AMD was the very first x86 vendor to integrate the CPU, graphics and chipset components - which until then were separately operated – onto one single System-on-Chip (SoC). The high level of SoC integration of the AMD Embedded G-Series opens a window to new solutions, which reach new performance levels with minimum energy requirements.

Despite the low power consumption of just a few watts, the new AMD Embedded G-Series supports 4k resolutions, multiple screens and the latest graphics codecs. For video broadcasting, the integrated video engine also allows the energy efficient decoding of streams directly up to the latest H.265 codec on the decentralized system, saving valuable bandwidth. The low power requirements of the AMD Embedded G-Series SoCs enable fanless, completely sealed designs without any notable waste heat. Another practical feature is the configurable maximum power consumption (TDP = Thermal Design Power). This gives designers the freedom to optimize the layout of the cooling solution and power supply, ultimately the overall system costs, according to application-specific needs. Alternatively, they can adapt an application to any existing system design. Latest modules with the AMD Embedded G-Series combine all this with industrial robustness and real-time capability including extended temperature ranges as well as a long-term availability of up to 10 years.

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