



## Hongjing Drive Bridges the Final Gap to Automotive-Grade ADCUs with Xilinx MPSoC Platform

Xilinx [XA Zynq® UltraScale+™ MPSoC Platform](#) Helps Hongjing Drive Build L1-L4 Full-Stack Autonomous Driving Solution

### AT A GLANCE:

For autonomous vehicles to meet strict requirements for safety, power consumption, and cost, the domain controller, which acts as the car's "brain," must perform to higher technical standards. Apart from industry giants such as Tesla, few players have a commercial solution in this segment. Hongjing Drive, founded in 2018, however, is one of the pioneers in the area of advanced autonomous driving domain controllers.



Figure 1: Hongjing Drive's "Gemini" hardware-software integrated Autonomous Driving Computing Unit (ADCU)

Hongjing Drive (Hongjing) is a full-stack autonomous driving system solution provider committed to developing the advanced computation platform and solutions required for autonomous driving. With experience in both hardware and software, as well as autonomous driving system integration, the company is enabling the complete lifecycle of L1-L4+ level intelligent driving innovation. Hongjing has received nearly 100 million RMB (US\$15.3M) in Pre-A round funding. It is headquartered in Hangzhou, China, with R&D facilities in Shanghai, Hefei, and Detroit in the U.S.

**Industry:** Automotive

**Head Office:** Hangzhou, China

**Established:** 2018

**Website:** <http://www.hongjingdrive.com/>

### SUMMARY:

Hongjing was looking to enter the autonomous driving market with an automotive domain controller ADCU that supports L3 or higher-level autonomous driving systems. Autonomous systems require significantly higher levels of functionality and complexity. Though technically strong, the company knew there were several challenges that its solution had to address, including compute power, scalability, safety, and power consumption.

Hongjing tapped Xilinx's ultra-flexible, automotive-grade XA Zynq UltraScale+ MPSoC platform and Vitis™ software development platform to build its new line of Gemini ADCUs. The result was a high-performance platform that is being used in L3 and L4 vehicles, and in a variety of applications including intelligent trucks, robotaxis, and unmanned mining vehicles.

## CHALLENGE:

Hongjing's domain-controller ADCU is a central controller for intelligent driving that supports L3 or even higher-level autonomous driving systems. Compared to traditional distributed control systems such as L0-L2 ADAS, L3 and higher-level autonomous driving systems are a great leap forward. With less intervention by the driver, the system must follow more-stringent requirements for vehicle safety, and therefore it demands a significantly higher level of functionality and complexity.

Though technically very strong, Hongjing knew that by entering the autonomous driving market, it would face many unprecedented challenges, including:

**Compute Power** – As machine-learning algorithms become more complex, there is an increase in the type and number of sensors used and stronger computational power is needed to support information processing and decision-making on the domain controller. Traditional MCUs running at several hundred megahertz or even CPUs are unable to address such massive demands. Another compute-related challenge is how to deploy intelligent AI processing engines on the domain controller to enable intelligent driving.

**Scalability** – In the area of scalability, one important consideration is how to provide scalability with continuously optimized algorithms without compromising performance and cost. Hongjing believes that only those autonomous driving systems that can be specifically customized for different users and application scenarios will be truly accepted by consumers and commercialized.

**Safety** – Automotive electronics require more strict compliance to safety standards than other markets. Most L3 and more-advanced autonomous driving systems are based on industrial controllers that cannot meet automotive-grade mass production requirements. In addition, the domain controller for L3 and higher-level autonomous driving systems must meet more-stringent ISO26262:ASIL-D functional safety requirements.

**Power consumption** is also a challenge for domain controllers. Compared to standard, in-car ECUs, advanced autonomous driving domain controllers may consume much more power. Most industrial controllers available on the market consume between 500W to 1,000W and are unable to meet even the basic requirements of mass production.

**Design tools** also present another challenge for autonomous driving systems. Developing excellent products requires excellent tools and finding the right combination of integrated hardware and easy-to-use software can be quite difficult. A perfect autonomous driving system is the result of the collaboration of hardware and software engineers.

## SOLUTION:

Featuring unique adaptability and high-performance computing, Xilinx's automotive-grade [XA Zynq UltraScale+ MPSoC platform](#) is the perfect fit for Hongjing's hardware-software integrated Autonomous Driving Computing Unit platform, named "Gemini." This platform addresses many of the issues described above, including safety, power consumption, and performance. Gemini delivers an autonomous driving computation platform with high performance, power efficiency, safety, reliability and versatility. It is a rare, versatile domain controller solution in China that supports advanced autonomous driving development.

Feilong Liu, the CEO of Hongjing Drive said, "While defining the ADCU's product design, we holistically compared a range of silicon solutions and ultimately we chose Xilinx's automotive XA Zynq UltraScale+ MPSoC for its high performance, low latency, low power consumption, and hardware configurability."

The ISO26262 ASIL-C certified 16nm Zynq UltraScale+ MPSoC is a heterogeneous multi-core adaptive SoC platform designed for L2+ to L4 Advanced Driver Assistance System (ADAS) and Autonomous Driving (AD) applications. This platform features state-of-the-art chip integration, excellent programmability, outstanding computing performance, and a rich set of I/O ports that fully met Hongjing's requirement for automotive compliance, safety, quality, reliability, customizability, and scalability.

## RESULTS:

Benefiting from the strong support of Xilinx's high-performance adaptive SoCs and Vitis AI software development platform, Hongjing's ADCU offers powerful hardware and software performance.

Hongjing's full-stack autonomous driving solution provides five unique advantages. These include:

1. High performance on heterogeneous architectures with multi-cores
2. High power efficiency with a total consumption less than 70W
3. High safety with ASIL-D-level functional safety achieved
4. High reliability that supports automotive-grade mass production
5. High versatility with a modular software architecture that covers L1-L4 applications

This solution supports up to 12-channel cameras, 6-channel LiDAR systems and multi-channel, millimeter wave radar processing that enables real-time multi-channel and multi-object AI sensing and processing. It also supports ASIL-D grade functional safety modular software architectures tailored for L1-L4 multiple application scenarios.

In addition, Hongjing has adopted Xilinx's Vitis AI platform, a complete, software-based AI development environment that provides a full range of AI acceleration processors, AI Optimizer, AI Quantizer, AI Compiler tools and reference designs for deep-learning neural networks. This tool has been helpful to Hongjing for deep-learning model deployment and optimization, and to meet the requirement of higher AI performance-per-watt in its autonomous driving computation platform.

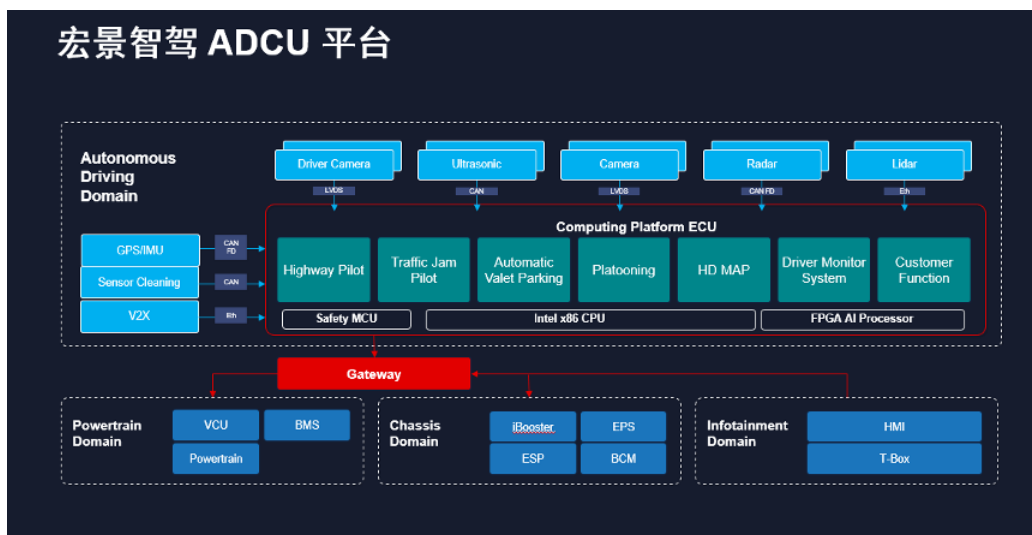


Figure 2: Hongjing Drive's Autonomous Driving Computation Platform Unit

With Xilinx's support, Hongjing was able to launch its Gemini platform prototype in July 2019 and released the production version in January 2020. Gemini has now been successfully deployed in some L3 and L4-level vehicles. Hongjing has also received sampling orders from several leading OEMs in China. Moreover, the company has realized the successful application of this platform in a variety of applications including intelligent driving trucks, urban autonomous driving taxis (robotaxi), and unmanned mining vehicles in controlled environments.

ADDITIONAL RESOURCES: Learn More About Xilinx [XA Zynq UltraScale+ MPSoC platform](#)

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