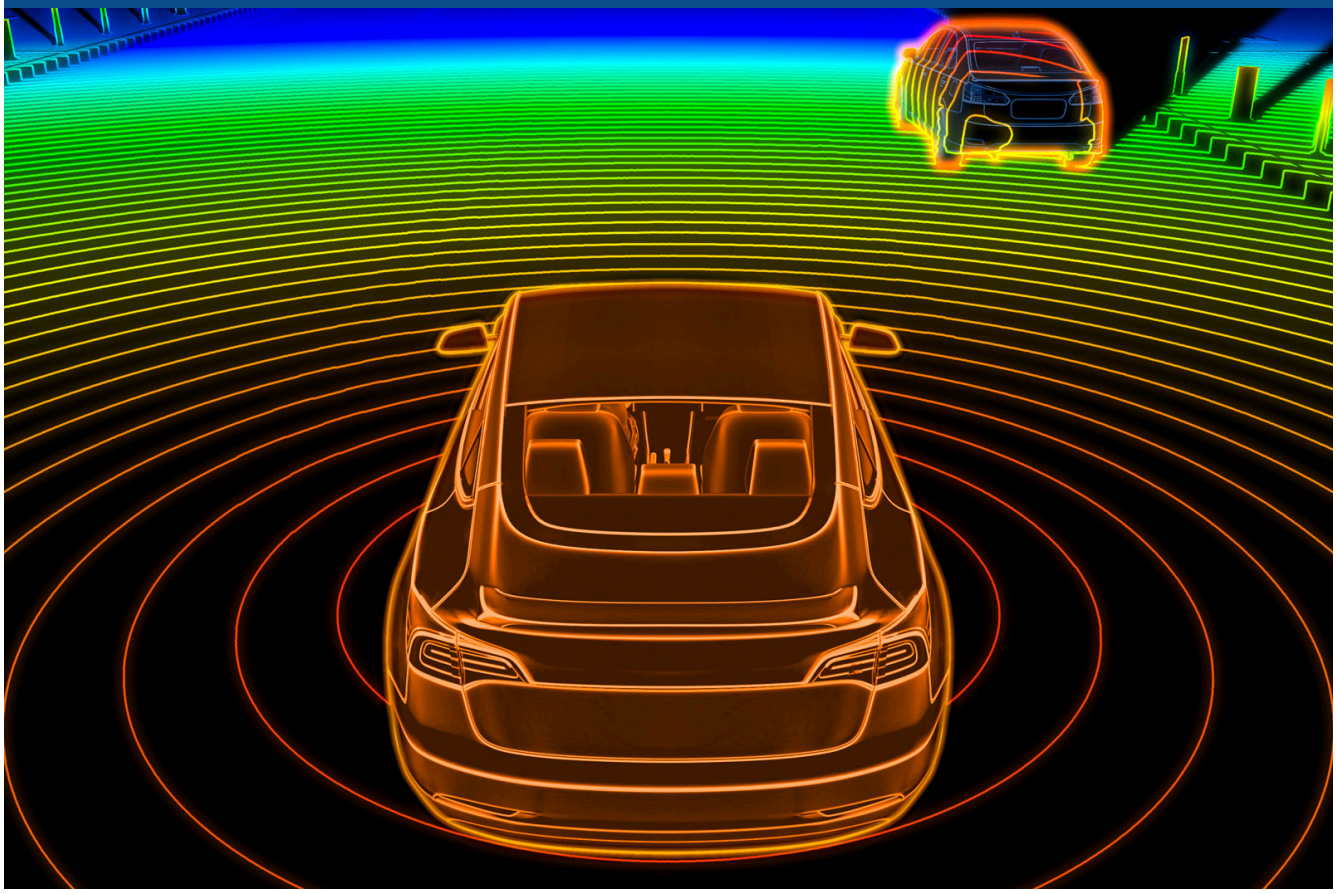
DVN

Sensing & Applications

Monthly newsletter #1

JANUARY 8, 2025



EDITORIAL

NOA L2+ Systems: Will Xpeng Copy Tesla?

In this, your first DVN-Lidar Newsletter of 2025, you will find a special report on Xpeng's intelligent driving and sensing strategy. Up to now, Xpeng—like most Chinese NEV makers—has used lidar to develop NOA (navigation on autopilot) features. That has changed recently with some new models, like their P7+ launching without lidar. Will Xpeng copy Tesla's insistence on sliding by with just a few cameras, even as the world's regulators and safety organizations grow increasingly alarmed at Tesla cars' tendency to get in whole kinds of crashes other makes don't? No, Xpeng is more conservative; they've got three radars in addition to the vision (camera) system.

NOA is the leading application in China with high install rates on NEVs, and it will be really interesting in 2025 to track the strategies of the automakers after Xpeng's announcement. This is one reason we're increasing the scope of our coverage to all the key technologies competing for L^{2+}, L^{3}, and L^{4} systems: cameras, radar, and lidar. You'll find details of the scope expansion in today's newsletter.

And don't miss our special report on the EU microwawe radar conference, and the preliminary docket for the DVN AEB workshop in Detroit.

Upcoming DVN Events
• USA : AEB Workshop—Spotlight on FMVSS 127 (Detroit, 9-10 April)
• China : EAC Lidar Tech Conference & Expo (Hangzhou, 4-6 June), co-hosted by DVN
• Europe : DVN Sensing Conference—Spotlight on NOA sensing strategy (Wiesbaden, 17-18 September)

We're ever so glad you're here with us in the DVN-Sensing community. Enjoy this 34th newsletter!

All best,

Alain Servel

DVN LIDAR ADVISOR

New Scope, New Name for DVN-Lidar: DVN – Sensing & Applications

SCOPE: DVN Sensing & Applications	BASIC	GOLD
Newsletter n°1 – Sensing for ADAS/AD	✓	✓
Newsletter n°2 – Applications ADAS/AD	✓	✓
Access to website incl. special reports	*License x2*	*Licence x5*
Promotion in newsletter	*Product release*	*Product release + Interview*
EU - DVN Conference « Sensing & Applications »	✓	✓
Visitors	*1 free ticket + 1 at 800€*	*2 free tickets*
Presentations	*VODs*	*VODs + PDFs*
CN - EAC LiDAR Tech expo, co-hosted by DVN	-	✓
Visitors		*preferred rates (300€)*
Presentations		*VODs*
US - DVN Workshop « Sensing & Applications »	-	✓
Visitors		*preferred rates (600€)*
Presentations		*PDFs*
MEMBERSHIP Fees	**4.000€**	**8.000€**
+ speakers: priority to exhibitors & members		

Membership fees 2025

After three years' existence and seven yearly conferences, we're expanding the scope of DVN-Lidar to cover innovations in automotive sensing. Lidar will still be prominently featured, of course, but we'll also be bringing you coverage of radar and cameras. Functions related to automotive sensing will also play a bigger role in the organization of the events.

Why? because lidar technology is reaching maturity with respect to highway pilot and robotaxis, because new technologies are emerging such as IR cameras, and because we see the deployment of L^{2+} ADAS and L^{3-4} AD applications becoming mainstream, in turn pulling innovations in sensing and related functions.

It is an evolution, not a revolution; lidar is one of the key sensing solutions for L^{2+} (and above) AD applications, and we will continue to provide deep and broad reporting, insight, and analysis about lidar. Through this expansion, we will maintain our strong, tight focus and our community-building efforts.

Here is the new framework of DVN-Sensing:

Focus: Sensing solutions for ADAS & AD applications
Newsletters : *two* monthly newsletters, one for SENSING and one for ADAS/AD applications
Events in 2025 : one Workshop (US), two Conference/Expo (China, Europe)

- DVN AEB Workshop: Sensing Solutions for FMVSS 127 in Detroit, 9-10 April
- EAC Lidar Tech Expo: co-hosted by DVN and Enmore in Hangzhou, 4-6 June
- DVN Sensing Conference: NOA & Lidar in Frankfurt, 17-18 November

INTERVIEW

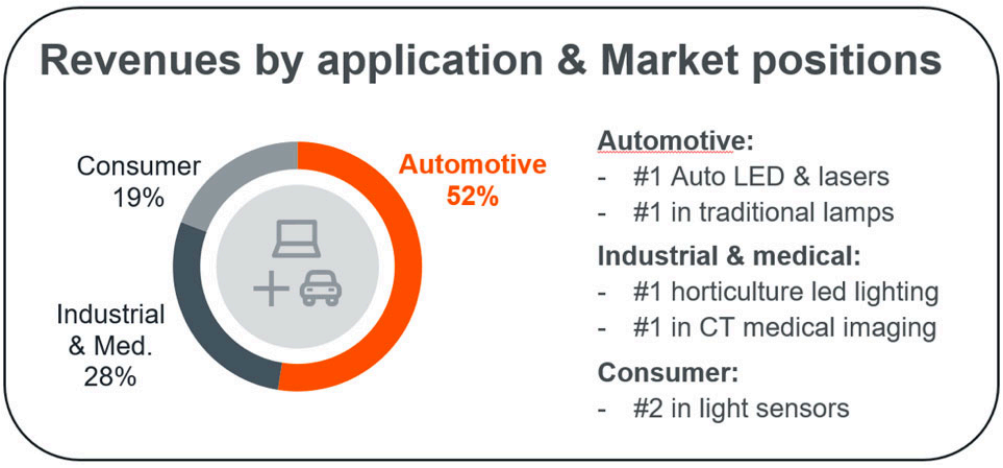
DVN-L Interview: ams Osram's Martin Wittmann

Martin Wittmann is ams Osram's Senior Director of Global Marketing for the Opto Semiconductors Visualization & Sensing business line. Since 2016 at Osram, he has held positions including Manager and Head of Global Marketing for the Sensing Division.

He holds a diploma in electrical engineering (microelectronics) form the University of Applied Sciences in Regensburg. He graciously shared his thoughts with us:

DVN: ams Osram develops optoelectronic components for mobile, medical, and automotive applications. What is your global turnover and the share of the automobile segment?

Martin Wittmann: ams Osram had a revenue of €3.59bn in 2023, with a split of around 50 per cent for the automotive market which is very important to us. Especially for Opto Semiconductors segment (OS), revenues increased by €9m to €381m in Q3-24 compared to €372m in Q2-24. Details are in the shareholder reports.



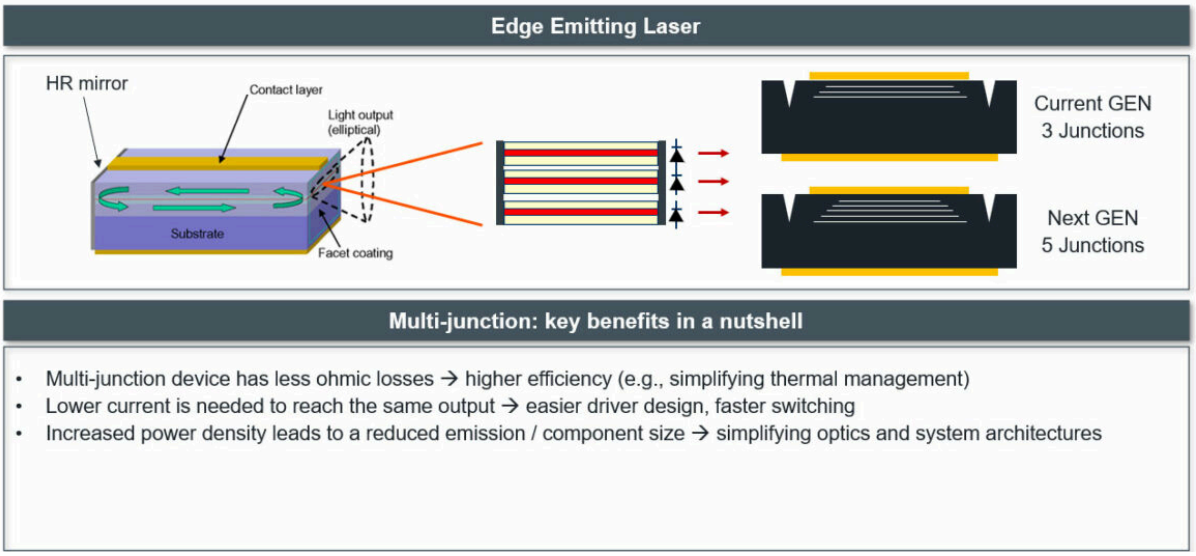
DVN: Could you tell us more about your portfolio and the automotive applications you target?

M.W.: ams Osram's portfolio for automotive applications addresses megatrends such as energy efficiency & sustainability and digitalization with projected lighting, smart surfaces, and advanced displays. Our portfolio contains prize-awarded dynamic forward & signal lighting, in-cabin sensing, and ADAS/AD sensing which leads me to lidar.

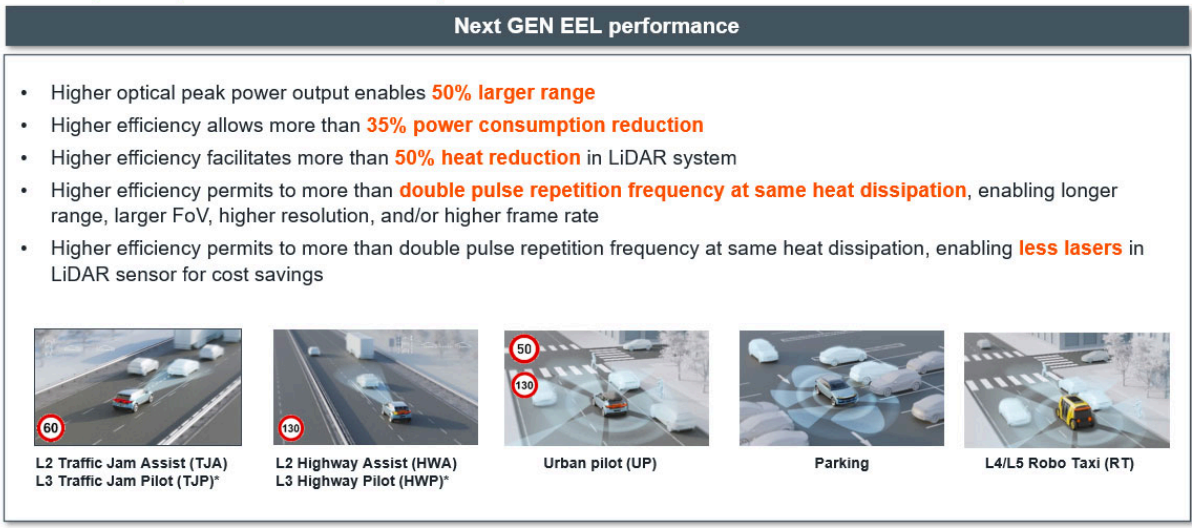
DVN: For ADAS / AD sensing systems, ams Osram has great experience with laser sources for lidars. What are the main components and the new technologies and components coming in the near future?

M.W.: ams Osram lidar offers a wide range of laser components such as bare die lasers, plastic radial packages, TO cans, as well as automotive-qualified SMT packages. They range between 25 and 1000 W and suit automotive and industry customers.

Our latest product, presented at the DVN conference in Wiesbaden, is a 5-junction edge emitting laser chip (EEL). By implementing our new 5-junction technology with our wavelength stabilization, we can reduce the heat dissipation for some operation conditions by over a factor of 2. Alternatively, 5-junction technology can double the optical peak power output of a single channel EEL.



By implementing our new 5-junction technology in combination with our wavelength stabilization, customers can benefit from a significantly increased LiDAR sensor performance



DVN: How do you see the cost curve for lidar Sensors? Can we expect breakthroughs?

M.W.: Similar to what we experienced in the past for other emerging automotive applications, we expect that the Sensor ASPs will become more attractive thanks to the strong efforts on BOM optimization and increasing economy of scale. For the semiconductor portion of the BOM which includes our laser diodes, high volume is key to further reduce cost and our team is constantly working on increasing the laser performance to enable new lidar sensor designs. One key breakthrough is of course our new 5-junction laser diode. Its higher efficiency permits more than double the pulse repetition frequency at the same heat dissipation, which gives lidar manufacturers more room to optimized sensor performance and cost.

DVN: Do you see new applications like short-range lidar emerging soon? Do they need specific components?

M.W.: We see short-range lidar for L^4 trucking emerging soon. Also, the Robotaxi market is expanding as well as players in the Chinese Market who have permits to explore L^4 driving in China. All of them have short-range lidar included. There are no standard solutions established so far, and EEL and VCSEL as well as various scanning solutions are emerging.

DVN: What is your opinion on FMCW?

M.W.: ams Osram is currently observing the progress of FMCW as the current market share is limited according to industry reports like Yole. Technical hurdles are to be solved before implementing the technology in passenger cars with large field of view, high resolution and low power consumption as required by most OEMs.

DVN: For AD L^3 and L^4 sensing systems, there is a debate between Camera + Radar + lidar (most makers) and just Cameras + 'AI' (Tesla). What is your opinion about the two different strategies?

M.W.: Camera technology in ADAS systems is a well developed technology with the most miles driven. Considering, though, the limitations that cameras have in all other-than-perfect conditions, we see full redundancy including lidar as mandatory, especially for L^3 and L^4 sensing systems.

Especially in safety-critical applications, we believe lidar is a must which is also the consensus amongst the majority of OEMs.

SENSING BUSINESS

Sensing Business News

OEM News

Mercedes Drive Pilot Approved for 95 km/h with a (Lidar & System) Software Update

Mercedes-Benz has updated their Drive Pilot conditionally automated driving system and has received approval from he German Federal Motor Transport Authority for sales starting soon in Germany.

This update makes Drive Pilot the fastest system certified for L^3 conditionally automated driving in a standard production vehicle. It's optionally available on two luxury models, the S-Class and EQS. The price of Drive Pilot remains unchanged, starting at €5,950. Existing cars with Drive Pilot will get the update for free, either OTA or during a visit to the dealer. There is no need to change any vehicle components for the software update (which also brings a significative higher performance for the Lidar).

Lidar Business News

Hesai Wins Great Wall, Changan Supply Deals

Hesai Technology has secured an exclusive production contract for several vehicle models from Great Wall Motor's Wey and Tank SUV brands. These models will feature Hesai's ATX lidar, which is slated for mass production in 2025. The lidar will be used for the NOA (Navigation on Autopilot) feature.

Hesai also has been tapped to exclusively supply their ATX lidar for Changan Automobile's new intelligent driving platform. This collaboration involves more than ten vehicle models across multiple Changan brands, with planned orders exceeding 1.5 million units within the next few years. This past October, Changan's Nevo E07 model was launched with two Hesai AT128 lidars.

Mobileye AV Platform Will Use Innoviz Lidar

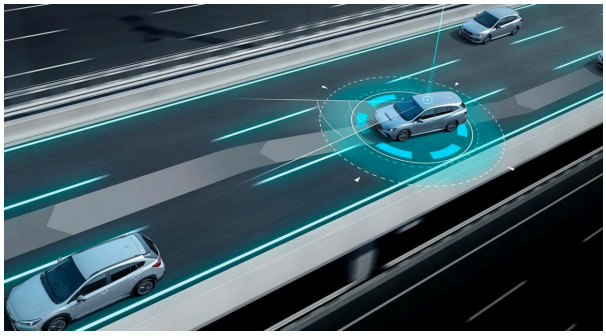
Innoviz lidars will be integrated into the Mobileye Drive™ platform—an autonomous driving system used for various applications, with trials under way in Europe, North America, and Asia. Production will begin in 2026. This collaboration aims to improve the autonomous performance of vehicles through the combination of Innovis lidars, imaging radars, and Mobileye high-resolution cameras.

Aurora Opens Bozeman Lidar Plant; Volvo Starts Texas Truck Tests

Aurora Innovation has opened a new research and testing center to develop their FMCW lidar technology. The 78,000-ft^2 (7,250-m^2) facility, in Bozeman at Montana State University, will be early used to develop Aurora's FirstLight technology, which emerged from the acquisition of Blackmore Sensors and Analytics in 2019. FirstLight uses FMCW lidar for long-range detection, integrated with the Aurora Driver system with high-resolution cameras and imaging radar. Aurora is working with Volvo and DHL to test the system on Texas roads, and plans to begin commercial operations in April.

Camera Business News

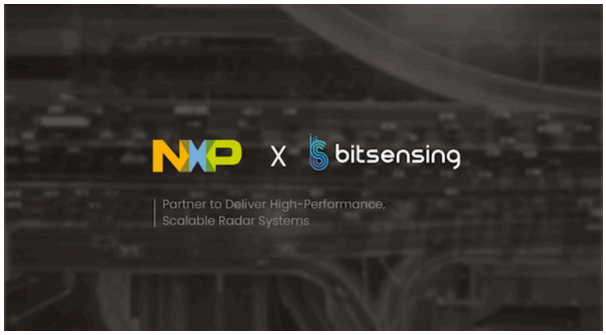
Subaru, Onsemi in Image Sensor Pact



Subaru is partnering with Onsemi to improve the automaker's EyeSight driver assistance system using Onsemi's Hyperlux AR0823AT image sensor. This collaboration aims to enhance 'AI'-based visual recognition in Subaru's stereo camera technology. Subaru's goal is zero fatal road accidents by 2030. The EyeSight advanced driver assistance system combines features such as adaptive cruise control, lane departure assist, automatic emergency steering, and more.

Radar Business News

NXP, Bitsensing in Scalable Radar Pact



Bitsensing, a provider of advanced radar solutions, has entered a MoU with NXP Semiconductors to offer high-performance, scalable radar systems across automotive, smart cities, robotics, healthcare and beyond. The partnership will combine NXP's advanced radar chipsets with Bitsensing's radar hardware and software. Bitsensing will leverage NXP's radar chips (SAF85xx automotive radar one-chip) to develop next-generation radar solutions, supporting customers with pre-development and accelerating overall development.

CES News: Lidar Companies at CES '25

Hokuyo @ LVCC, West Hall, Diamond Lot

The Hokuyo YLM-10LX is a state-of-the-art solid-state 3D lidar sensor tailored for industrial automation and service robotics. It incorporates Lumotive's pioneering Light Control Metasurface technology.

Integrated Quantum Photonics @ LVCC, West Hall, Diamond Lot

IQP will reveal their first long-range Flash qLidar with superior characteristics built around a quantum sensor with silicon photomultiplier architecture—No mechanical moving parts, 1 laser + 1 sensor, 76 × 46 × 41mm size. It offers 400-meter range, dynamic frame rate up to 2 kHz, and overall resolution 1000H × 128V.

Lidwave @ LVCC, West Hall, Diamond Lot

Lidwave's groundbreaking Odem 4D Sensor has been honoured with a CES Innovation Award in the Imaging category. Find an article about it later in this newsletter.

Solidvue @ LVCC West Hall Booth 3574

Solidvue is the only lidar sensor IC fabless company in South Korea. Since establishment in 2020, the company has been continuously developing prototype whole-range lidar sensor ICs for short, medium, and long distances.
Find an article on their high-resolution lidar Sensor IC later in this newsletter.

SOS Lab @ LVCC West Hall Booth 4124

SOS Lab is a 2025 CES Innovation Award winner in Vehicle Tech & Advanced Mobility. Their ML-U is a cameralike lidar sensor that independently generates depth data and colour images. Deep learning is used to colorize infrared intensity data by combining it with depth and camera reference data.

Aeva @ LVCC, West Hall Booth 6900

Aeva will present their future of automated vehicle technology powered by their FMCW 4D lidar for passenger cars and commercial trucks. Their newest long-range high-resolution sensor for mass production automotive applications will also be on display.

AutoL @ LVCC, West Hall Booth 6760

AutoL is a lidar company for autonomous driving systems with a mission to popularize autonomous driving. They will be showing their solutions for lidar pain points such as size, durability, and price.

Cepton / Koito @ LVCC, West Hall Booth 6522

Cepton, now integrated in Koito, provides lidar-based solutions for a range of markets such as automotive (ADAS/AV), smart cities, and smart industrial applications. Cepton’s patented micro motion technology-based lidars enable reliable, scalable and cost-effective solutions.

Hesai @ LVCC, West Hall Booth 6824

Hesai will premiere their newest model, a mini high-performance 3D lidar, during a press conference at CES on 7 January. The new lidar combines high resolution and low power consumption in a compact, lightweight design.

Innoviz @ LVCC, West Hall Booth 4216

Innoviz will present live demonstrations of their latest lidar technology including both short- and long-range lidars, and showcase the BMW i7 and the Volkswagen ID.Buzz vehicles equipped with Innoviz lidar.

Itops Automotive @ LVCC, West Hall Booth 6375

Itops Automotive delivers top-tier, customized lidar solutions through relentless R&D, partnering with leading robotics and automation companies. They design and manufacture cutting-edge components such as actuators, sensors, and lidars to enhance vehicle safety, comfort, and efficiency.

Robosense @ LVCC, West Hall Booth 6700

RoboSense delivers sensors and solutions that harness the power of three core technology areas: 'AI' algorithms, chips, and hardware for global automakers, tier-1 suppliers, robotics, and other related industries.

Seyond @ LVCC West Hall Booth 5060

Seyond will show its **Falcon K** (ultra-long range of over 500m) and **Robin E1X** (long-range sensor with a wide FoV of 120° × 20°). Visitors can experience live the Falcon K and the Robin W point clouds.

CES News: Camera Companies at CES '25

Thermoeye @ LVCC Venetian Expo Hall G 63416

The TMC Edge is a state-of-the-art thermal camera with 'AI', designed for applications in autonomous driving, robot, drone, and more. It's the world's first thermal edge 'AI' camera capable of performing distance estimation and object detection simultaneously.

Intopix @ LVCC Venetian Expo Hall A-D 50752

Intopix is an innovative technology provider of low power, low complexity image processing and video compression IP-cores. At CES, they will be showing how image sensors and cameras, automotive ADAS, mobile devices, 8K displays, and wireless video devices benefit from their technologies.

Litbig @ LVCC Venetian Expo Hall A-D 50017

Litbig is an innovator in advanced embedded systems for automotive safety and entertainment. Specializing in 'AI' and camera vision technologies, they develop Vision ADAS solutions for enhanced safety, among others.

Mcnex @ LVCC West Hall 6166

Mcnex develops and manufactures image technology solutions in consumer product and automotive applications. Based in South Korea, Mcnex provides all sorts of camera solutions for various applications.

Stradvision@ LVCC Westgate Hospitality suite

Stradvision provides SVNet 'AI'-based vision perception software using camera sensors for various applications in the automotive industry. SVNet is being deployed on vehicle models in partnership with automakers.

Toshiba @ LVCC Venitian Tower Suite 29-311

Toshiba offers a broad range of enabling technology solutions that allow OEMs, ODMs, and CMs to develop advanced integrated products for smartphones, tablets, automotive, industrial, networking products

Visionary @ LVCC Venetian Expo Hall G 61701

Listed in the 100 Most Promising 'AI' startups of 2023, Visionary.ai empowers cameras to capture state-of-the-art video quality in extreme low light and HDR. The software uses edge 'AI' to deliver results in real-time: 'True Night Vision', noise reduction, improved object recognition. Applications include drones, security, and automotive.

Zeiss Microoptics @ LVCC North Hall 10149

Zeiss Multifunctional Smart Glass technology enables holographic projection systems, integrated cameras in transparent media, and holographic lighting applications.

CES News: Radar companies at CES '25

Acconeer @ LVCC Westgate Hospitality suite

Acconeer's ultralow-power radar sensors are extremely small, just 29 mm^2, and can detect distance, speed, motion, and objects up to 20 meters away. Acconeer combines low power consumption with highly accurate pulsed radar systems of coherent radar.

Altos Radar @ LVCC West Hall Booth 6874

High-performance and low-cost 4D imaging radars for high-level driver assistance systems and full autonomous driving.

Arbe @ LVCC West Hall Booth 7406

Arbe's products propel the drive for safe hands-free driving and future autonomy. 'AI'-powered solution boosts automaker and tier-1 perception algorithms for real-time free space mapping, redefining safety and performance.

AU @ LVCC Venetian Expo Halls A-D

AU develops millimeter-wave radar sensors for automotive sectors. Their strength lies in the detection of lifeforms, especially humans in cars..

Millilab @ LVCC South Hall 3 Booth 41008

Established in 2019, Millilab provides millimeter-wave radar total solutions that can be used in automotive electronics and IOT devices with a specialization in smart radar solutions for in-car passenger.

Smartmicro @ LVCC West Hall Booth 5066

Smartmicro has been designing, developing, and manufacturing sensor solutions for traffic management and automotive industries, for more than 27 years.

Smart Radar System @ LVCC West Hall Booth 3866

Smart Radar Systemdevelops 4D image radar technology. They integrate 3D information about surrounding objects distance, speed, and angle with height data and applies deep learning technology.

Zadar Labs @ LVCC Venetian Expo Halls G Booth 60907

Zadar Labs has developed next generation software-defined 4D imaging radar platforms. The output of their radar is an ultra-high-resolution point cloud resembling the performance of a lidar. It holds the world's record with a human detection range of over 250 meters and a static/dynamic angular resolution of 0.35° × 0.1°.

LIDAR TECHNOLOGY

Lidar technology news

Lidwave Odem 4D Lidar Sensor Wins CES Innovation Award

Lidwave has received a CES Innovation Award in the Imaging category. The Odem sensor is powered by Lidwave's innovative Finite Coherent Ranging technology. The Odem is a 4D coherent lidar which delivers both high-resolution 3D spatial data and instantaneous velocity information at the pixel level. This capability to capture an object's location and motion in real time significantly enhances how machines perceive and react to their surroundings. From autonomous vehicles and robotics to industrial automation and smart infrastructure, the Odem equips systems with the precision and speed necessary for decision-making in dynamic environments.

A notable feature is the software-defined architecture, which allows users to adapt key parameters—such as field of view, resolution, detection range, and frame rate—to their specific needs without altering the hardware. This flexibility enables industries to test and optimize the Odem for their unique applications, making it a versatile tool for innovation across diverse sectors. Whether streamlining factory operations, improving transportation systems, or advancing next-generation robotics, the Odem is designed to meet the evolving requirements of its users.

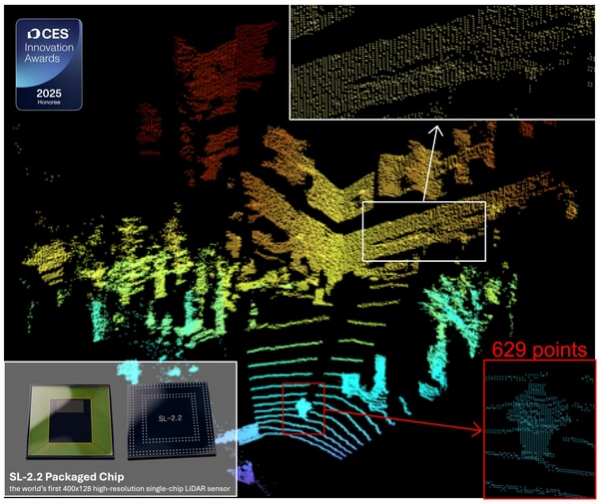
Beyond its outstanding performance in both short- and long-range applications, the Odem represents a breakthrough in scalability and affordability. By integrating a complete lidar system—including lasers, amplifiers, receivers, and optical routing—onto a single chip, Lidwave has made high-performance sensing technology accessible on a large scale. This achievement addresses one of the industry's most critical challenges, ensuring that advanced lidar solutions can be widely deployed cost-effectively.

Founded in 2021, Lidwave is a deep-tech company based in Jerusalem, committed to transforming the future of perception technology. With its innovative Finite Coherent Ranging technology, Lidwave delivers 4D lidar solutions that combine groundbreaking engineering with real-world impact, addressing today's most pressing challenges.

DVN comments

Lidwave's technology leverages the coherence properties of light, offering sensitivity millions of times greater than ToF technology. This allows for detection at greater distances with milliwatt-range power outputs, unlike the high-power lasers needed by ToF systems. Lidwave achieves this range with an angular resolution of 0.04° × 0.04°.

Solidvue Wins CES Innovation Award for High-Res Lidar Sensor IC



Solidvue, a Korean company specializing in CMOS lidar sensor IC development, announced that their SL-2.2 single-chip lidar sensor IC with 400 × 128 resolution has won a CES Innovation Award.

Established in 2020, Solidvue focuses on designing SoCs for lidar sensors. They are the only South Korean company to have developed lidar sensors using semiconductor technology instead of mechanical components.

Solidvue's lidar sensors are compatible with solid-state lidar systems, which are smaller and more cost-effective than traditional mechanical lidar systems. Co-CEO Jaehyuk Choi says their sensors offer a compact chip solution with superior performance compared to competitors.

The company's technologies, such as CMOS SPAD (Single-Photon Avalanche Diode) technology, single-chip sensor architecture, and image signal processor, enhance the company's competitive position. CMOS SPAD technology improves measurement accuracy by detecting sparse photons. Few other companies globally possess single-chip sensor technology.

Solidvue's achievements have been recognized at the IEEE International Solid-State Circuits Conference.

DVN comments

Solidvue's proprietary CMOS SPAD technology enables precise detection of light particles in their lidar sensor chips. The company is advancing in all lidar detection ranges, focusing on medium-to-long distances for autonomous vehicles and robotics. By Q3 2023, they have developed an engineering sample of a solid-state lidar sensor chip with a 150-meter range, aiming for mass production in the very near term.

CAMERA TECHNOLOGY

Camera technology news

TMC Edge: Thermoeye’s 'AI' Camera

Thermoeye, a company specializing in thermal vision solutions, has announced the release of their TMC Edge thermal edge 'AI' camera, scheduled for this March. The TMC Edge is a thermal camera with 'AI', designed for use in autonomous driving, robots, drones, and other applications. It is noted as the first thermal camera capable of object detection and distance estimation simultaneously.

It provides forward visibility in conditions including rain, snow, night, and fog, which can be challenging for regular RGB cameras and lidar. It features a resolution of 640 × 512 (VGA) and a 6-TOPS 'AI' chip that performs object detection and distance estimation up to 150 meters with inaccuracy of less than 2 per cent. Its compact design, with dimensions under 5 cm, allows easy integration into different hardware systems, and the standardized bracket facilitates convenient installation.

The TMC Edge eliminates the need for an additional distance sensor, freeing up space and increasing efficiency in hardware design. It has a high-resolution, high-sensitivity thermal image sensor, offering complete forward visibility even in harsh weather conditions.

Thermoeye is preparing to commercialize the TMC Edge for autonomous applications, and is discussing technology development and cooperation with tier-1 automotive suppliers. According to CEO Dohwi Kim, Thermoeye aims to build a safe autonomous environment based on thermal cameras and is looking to integrate their technology into current and future markets.

FLIR, VSI Labs: Thermal Imaging Helps Meet Nighttime AEB Safety Standard

Teledyne FLIR OEM and VSI Labs have announced test results using the new FMVSS 127 requirements for pedestrian automatic emergency braking (PAEB). VSI Labs' vehicle, equipped with Teledyne FLIR's latest AEB thermal camera, passed all tests, unlike three other 2024-model vehicles which failed two or more nighttime scenarios.

FMVSS 127 requires PAEB systems in all new passenger cars and light trucks under 10,000 pounds by September 2029. These systems must detect pedestrians in various lighting conditions and at higher speeds due to pedestrian fatalities, especially at night, which accounted for 77.7 per cent of deaths in 2022.

NHTSA showed that meeting FMVSS 127 requirements is possible, as the 2023 Toyota Corolla Hybrid XLE passed all PAEB tests at maximum speed. However, other tested vehicles failed some nighttime tests due to challenges with visibility and sensor capabilities.

VSI Labs tested a Ford Fusion Hybrid with a thermal-fused PAEB system using Teledyne FLIR's thermal camera, HD radar, and visible camera against three state-of-the-art 2024 COTS PAEB systems that lacked thermal cameras. The tests revealed :

- **Daytime Performance**: Both thermal-fused and COTS PAEB systems passed all tests.
- **Nighttime Performance**: Only the thermal-fused system passed all tests, showcasing better detection regardless of headlight performance.

Thermal cameras can see through darkness, shadows, glare, smoke, and fog, and they can detect wildlife. Tests by VSI Labs indicated current top-rated PAEB systems struggle at night, emphasizing thermal cameras' potential to meet FMVSS 127 requirements by 2029 for enhanced pedestrian safety. Testing was carried out at the American Center for Mobility in Michigan, using a heated adult pedestrian test mannequin representing a human's thermal signature.

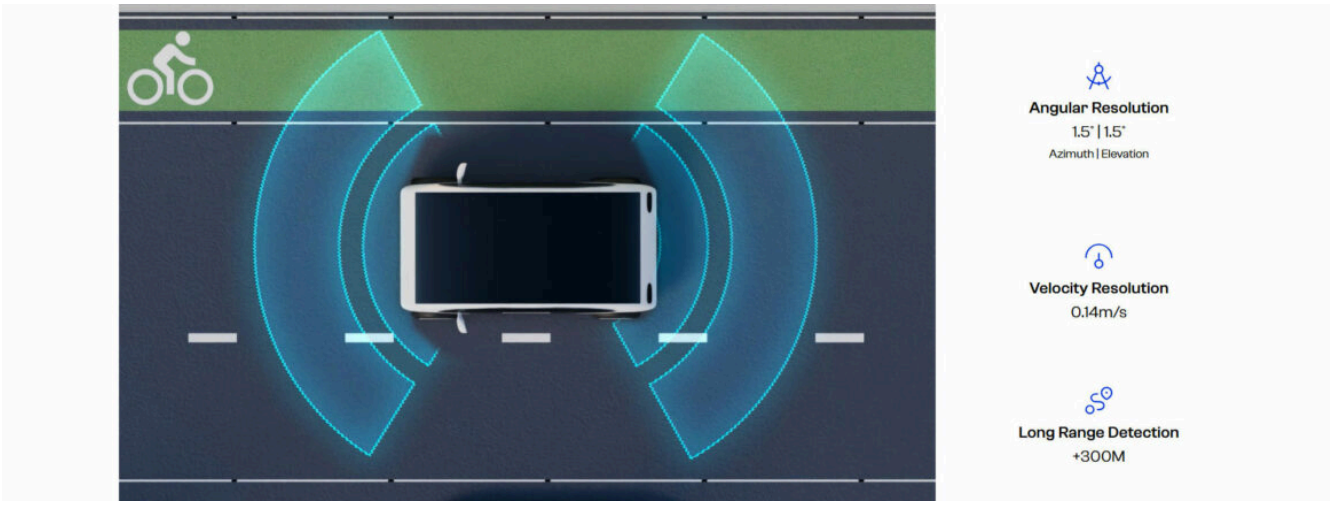
DVN comments

FLIR cameras utilize far infrared radiation to produce images. At night, objects with higher temperatures, such as pedestrians or animals, as well as vehicle engines or tires, emit more infrared radiation compared to the road and surrounding environment due to increased thermal contrast. However, during some summer days, these thermal contrasts may diminish, potentially hindering object detection. Fog scatters infrared radiation but less than visible or near infrared light, allowing FLIR cameras to detect hidden objects. However, thicker fog increases scattering and reduces FLIR camera effectiveness. When thermal contrasts decrease or in thick fog, it becomes necessary to integrate depth images from radars.

RADAR TECHNOLOGY

Radar technology news

Bitsensing Achieves ISO/IEC 27001:2022 Certification



Bitsensing, a South Korean company, has received ISO/IEC 27001:2022 certification for their radar solutions used in various sectors including automotive, smart cities, and healthcare. This certification highlights the company's commitment to high standards of information security and data protection.
ISO/IEC 27001:2022 is the latest international standard for managing information security, offering a framework for organizations to protect sensitive data using a risk-based approach. It includes updated controls to address modern security challenges such as cloud security and data leakage and focuses on continuous improvement of information security management systems (ISMS).

CEO Jae-Eun Lee says, "At bitsensing, we understand the importance of protecting the data and information security of our employees, customers, and stakeholders. Achieving the ISO/IEC 27001:2022 certification supports our mission to provide advanced radar solutions across various applications".

Adopting ISO/IEC 27001:2022 shows a commitment to data protection by aligning with global best practices, enhancing stakeholder trust, and improving credibility in the marketplace. It helps organizations meet legal and regulatory requirements and maintain resilience in a complex security-focused environment.

DVN comments

Bitsensing's Traxight intelligent transport system (ITS) solution received a CES 2025 Innovation Award in the Smart Cities category. The company also partnered with the City of Verona and FAMAS Systems to install advanced traffic sensors at Porta Nuova in Verona. Additionally, bitsensing secured $25m in Series B funding in June 2024, and was included in Forbes' Asia 100 to Watch list in September.

Special Report on European Microwave Week, Paris

***See the complete* document on the DVN website**

In response to new active safety regulations and the deployment of L^{3-4} systems, substantial efforts are being made across all facets of the radar ecosystem. Innovations in antennas structures, internal processing architectures, and the integration of artificial intelligence aim to achieve improved resolution and range performances. Additionally, physical modifications related to various types of coatings are essential for the seamless incorporation of standard or imaging radars. During the recent European Microwave Week, 14 companies showcased their advancements toward enhanced Automotive Imaging Radars during a dedicated Automotive Forum:

Automaker requirements: Mercedes-Benz focused on improving radar performance for ADAS systems, with specific requirements for L^3 and L^4 urban systems, including elevation separability and the use of 'AI'.

Bosch design considerations: Bosch highlighted the benefits of their SoC radar technology, which uses 22-nm FD-SOI technology for low power consumption and high performance, with features such as adaptive cruise control and automatic emergency braking.

Bosch Radar Solutions: Bosch offers the SX600 and SX601 chips, SoC radar solutions running in the 77-GHz band, offering enhanced processing and memory capabilities, and using advanced 22-nm RFCMOS technology.

Radar Interference: Magna discussed the challenges of interference testing, pointing out that the characteristics of the sensor and the interference scenario have a major impact on the effect of interference.

Mobileye Imaging Radar: Mobileye introduced their imaging radar with improved azimuth and vertical resolution, high dynamic range, and low presence of side lobes, enabling accurate target detection.

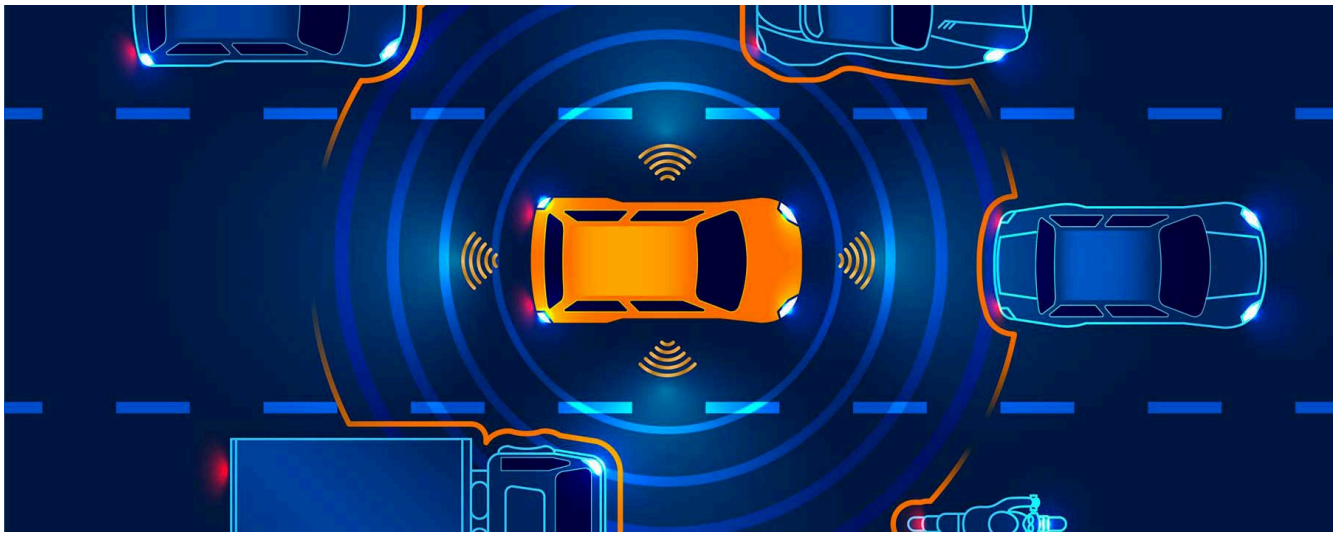
Uhnder's Digital Radar Technology: Uhnder highlighted the benefits of their digital radar technology, which offers better accuracy and resolution, as well as advanced interference reduction techniques.

Zendar Coherent Radar Fusion: Zendar talked about the consistent merging of multiple radars to improve resolution and accuracy, with minimal requirements for classifying road debris and identifying vehicles stopped under a bridge.

Automotive Radar Market: The automotive radar market is rapidly evolving, with significant growth expected for 4D radars and imaging radars between 2023 and 2029, while traditional radars are seeing their market share decline.

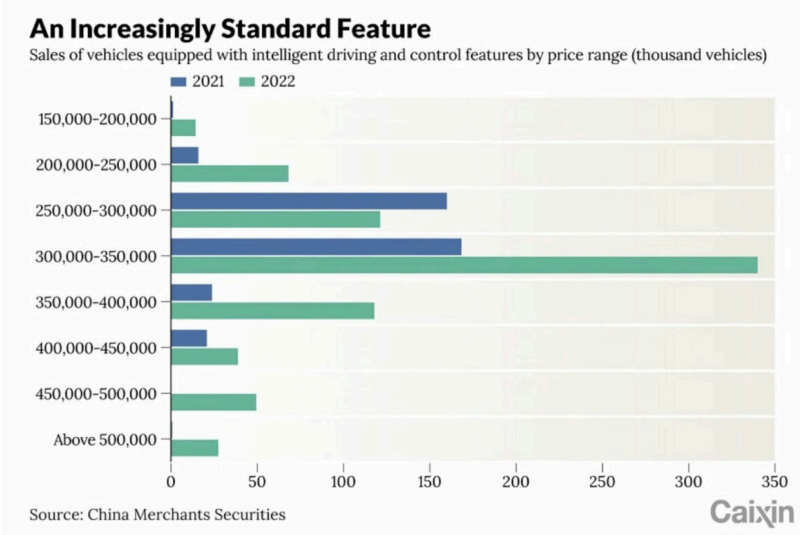
SENSING INTEGRATION & STRATEGY

Sensing Integration and Strategy: NEVs



Xpeng Sensing Strategy for NOA & L2+ Systems

At least 10 chinese automakers and suppliers have launched driver-assistance systems over the past two years that can navigate city streets and make turns at intersections. EV makers Xpeng, Li Auto, BYD, Leapmotor, Xiaomi, Nio, and Huawei are among the carmakers with L^2 or L^{2+} driver systems. Any new model priced at more than the equivalent of USD $30,000 in China now needs advanced driver-assistance features to compete, said Maxwell Zhou, co-founder of DeepRoute, a China-based startup selling software for advanced driver-assistance systems. Carmakers in China have two options: develop the systems themselves, or form alliances with suppliers.



Before Huawei started putting lidars on cars, Xpeng was the original autonomous driving leader in China. Their P5 was the first production car in the world to be fitted with lidar and boast city autonomous driving, but only in one city.

Xpeng is one of the Chinese startups in the field of NEVs (New Energy Vehicles), initially competing with Nio and Li Auto. Below you'll find the ranking of Chinese EV makers for November 2024. For reference Tesla's Gigafactory Shanghai delivered 78,856 vehicles in November 2024.

XPeng Competitive Position

#	EV Maker	Sales
1	BYD	504,003
2	Geely Group	122,453
3	Changan	100,000
4	Chery NEV	77,830
5	Li Auto	48,740
6	GAC Aion	42,301
7	HIMA	41,931
8	Leapmotor	40,169
9	Deepal	36,026
10	Great Wall Motor	35,999
11	Xpeng	30,895
12	Zeekr	27,011
13	Xiaomi Auto	21,955
14	Nio	20,575
15	SAIC-VW	14,360
16	Avatr	11,579

The new Xpeng Mona M03 surpassed 10,000 units in deliveries for two consecutive months since its launch.

Xpeng has reported a third-quarter revenue of C¥ 10.1bn ($1.44bn), beating analysts' estimates of C¥ 9.9bn in a Bloomberg survey, with a gross margin hitting a record high. Xpeng's net loss was C¥ 1.8bn ($256m), compared to C¥ 3.9bn for the same period in 2023 and C¥ 1.3bn for the second quarter of 2024. Xpeng's R&D expenses for the third quarter were a record C¥ 1.6bn, an increase of 25 percent compared to C¥ 1.3bn for the same period in 2023.

For the same quarter, Nio reported vehicle sales of C¥ 16.7bn (US$2,379.4m) and a net loss of C¥ 5.0bn (US$721.0m). Research and development expenses in the third quarter were C¥ 3.3bn (US$472.9m).

After the recent launch of the Mona M03, Xpeng now has quite a large family of car models including sedans, SUVs, and MPVs.

XPeng Mona M03 - 2024 - Compact sedan

XPeng P5 - 2021 - Compact sedan

XPeng P7 - 2020 - Mid-size sedan

XPeng P7+ - 2024 - Full size sedan

XPeng G9 - 2022 - Full-size SUV

XPeng G6 - 2023 - Mid-size SUV

XPeng X9 - 2024 - Full-size MPV

XPENG Experience in Intelligent Driving

Xpeng is one of the NEV brands famous for its intelligent driving features, and here is a look at that history.

In April 2018, Xpeng unveiled their G3 all-scenario automatic parking technology, Xpilot 2.0, with 20 sensors. This vehicle introduced all-scenario intelligent parking through the fusion of visual sensors and ultrasonic sensors. It is the G3's function of automatic parking that branded Xpeng as a leader in intelligent technology, making it one of the closest competitors to Tesla in China.

In June 2018, Xpeng and Desay officially signed a strategic cooperation agreement in Guangzhou. Their collaboration on the autonomous driving system aimed to deliver three core automated driving functions: low-speed valet parking, mid-speed traffic jam assisted driving, and high-speed autonomous driving.

In 2020, Xpeng launched the full-stack self-developed NGP high-speed autonomous navigation and driving. At that time, Xpeng became the second company in the world and the first in China to develop autonomous driving technology based on an open computing platform, following Tesla.

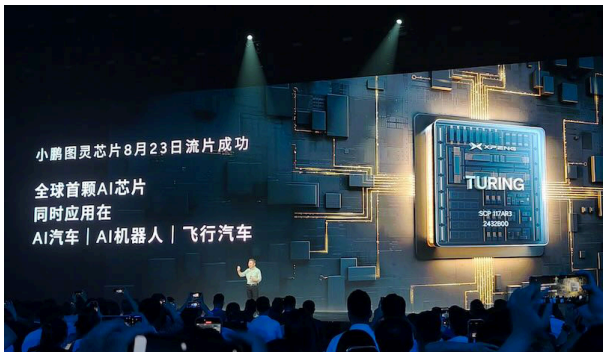
In April 2020, Xpeng partnered with Nvidia, whose Drive OS enabled Xpeng's patented autonomous driving software, Xpilot 3.0, to realize its full potential and continuously enhance its autonomous driving capabilities through OTA updates, By the end of 2022, the Xpeng G9 was equipped with two Nvidia Orin chips, achieving a computing power of 508 TOPS.

In the second half of 2021, Xpeng decided to independently develop driving assistance algorithms without relying on high-precision maps, leading to the creation of XNGP. It introduced a new perception architecture, XNet, enabling all-scenario intelligent driving assistance with just two Nvidia Orin X chips.

In November 2023, Xpeng fully launched its map-free urban navigation feature. By January 1 of 2024, the total number of cities covered by Xpeng XNGP reached 243, far ahead of the competitors.

From the second half of 2023, the 'AI chauffeur' feature became another strong asset for Xpeng's intelligent driving. In January 2024, He Xiaopeng revealed that Xpeng has over 3,000 personnel on their AI R&D and data team, with an annual investment of C¥ 3.5bn.

At the heart of Xpeng's technological advancement is the soon-to-be-integrated Turing chip. Developed by a team of over 200 specialists at the Shanghai R&D Center, this chip represents a major leap in Xpeng's autonomous driving capabilities. The Turing chip, designed for L^4 autonomous driving, has a 40-core processor capable of running large models with up to 30 billion parameters.



The chip supports two independent ISPs, ensuring a robust vision even in challenging conditions such as nighttime driving, rain, or backlighting. This feature is crucial for maintaining safety and reliability in autonomous vehicles.

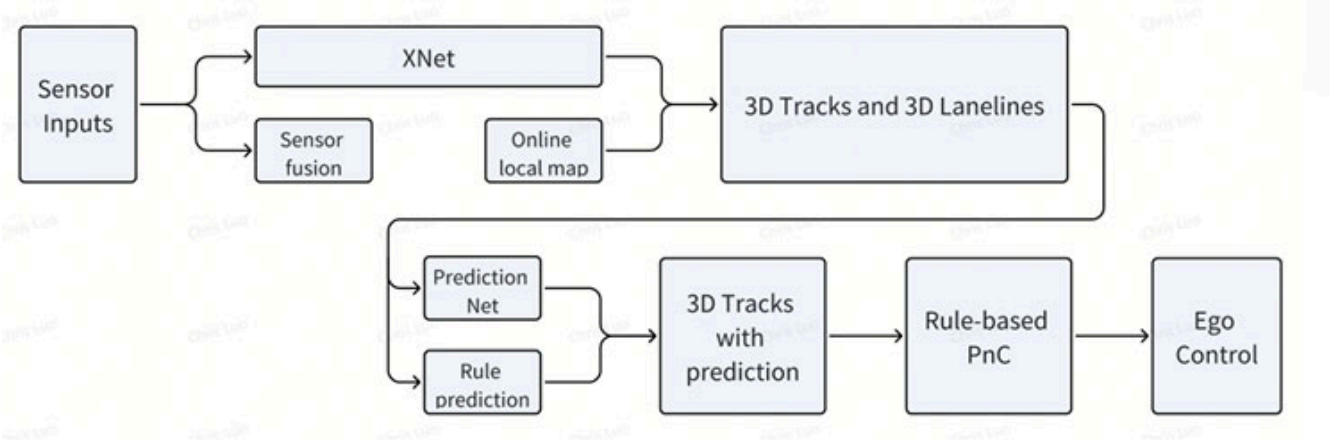
XPENG Sensing Strategy for NOA (Phase 1) – Starting with Lidar

On September 15, 2021, Xpeng launched the P5 electric sedan featuring two lidars (HAP from Livox) in its top variant. Subsequent models, including the P7 facelift (P7i), G6, G9, and X9, also incorporated two lidars.

Supported by HAP lidar, the traditional ADAS system can be more effective in dealing with scenarios such as highway pilot, close cut-in vehicles in urban traffic jam, night driving, adaptive cruise on curves, and park-by-memory, so users can enjoy a better functional experience with ease and security.

Xpeng uses a combination of lidar, radar, and a camera for driver assistance. Xinzhou Wu says, "Lidar will provide the 3D drivable space and precise depth estimation to small moving obstacles even like kids and pets, and obviously, other pedestrians and the motorbikes which are a nightmare for anybody who's working on driving", the radar will detect the vehicles with the ability to detect the speed of the object and its location. The camera will provide the vehicle with basic semantic information as stated.

Details of the algorithm



Sensing suite

- Nvidia Drive Orin: 2 (508 Tops)
- Lidar: 2
- Standard camera: 7
- Fisheye camera: 4
- Millimeter Wave Radar: 5
- Ultrasonic sensor: 12

XNet

Lidar Matters

- **False Positive Elimination**: XPENG' s XNet, the BEV+Transformer, temporal-spatial, vision only perception system is not robust;
- **General Obstacle Detection**: for detection unstructured and irregular shaped objects.

Details of Livox lidar - Model HAP (T1) / HAP (TX)

Wavelength: 905 nm
Laser Safety Class: 1 (IEC60825-1:2014)(Eye Safety)
Detection Range (@100 klx): 150 m @ 10% reflectivity
FOV: 120°V × 25°H
Distance Random Error: (1σ @ 20m) < 2 cm
Angular Random Error: (1σ) < 0.1°
Beam Divergence: 0.28°V × 0.03°H
Angular Resolution @ROI: 0.23°V × 0.18°H
Point Rate: 452,000 points/s (first or strongest return)

Data Port HAP (T1) : 100BASE-T1 Automotive Ethernet / HAP (TX) : 100BASE-TX Ethernet
Data synchronization: gPTP
False Alarm Rate (@ 100 klx): < 0.01%
Operating Temperature: -40 to 85 °C
Power: 12 W typical (Startup: 26W)
Power Supply Voltage Range: 9 to 18 V DC
Noise: 40cm omnidirectional <45 dB (A)
IP Rating: IP67
Dimensions: 105 × 131.6 × 65 mm
Weight: ~1,120 g

XPeng Sensing Strategy for NOA (Phase2) – Now launching some car models without Lidar, some with Lidars

Tesla's assisted driving system has historically avoided lidar, which is expensive to implement. In contrast, most Chinese EV manufacturers, excluding the Baidu-backed Jiyue, have used lidar in their advanced smart driving software.

Xpeng P7+ launching without lidar - October, 2024

Xpeng's latest model is the first of theirs to return to the vision-based approach to self-driving ability, leaving out the lidar. the system has 26 sensors: 11 cameras, three millimeter-wave radars, and 12 ultrasonic sensors. That camera total includes a driver monitoring system. The front-view binocular and rear-view cameras use the industry's first single-pixel Lofic architecture. This helps the system see further where lighting conditions are far from optimal, such as at night. Processing all the data are two Nvidia Orin X chips with a total of 508 TOPS computing power. Pre-sales began at C¥ 209,800 ($29,450).

Xpeng's regulatory filings share plans for facelifts to its G6 and G9 EVs, each abandoning lidar - December , 2024

According to regulatory filings in China, Xpeng plans upgrades to at least two current models. The filings detail facelifts to the Xpeng G6 and G9 SUVs and hint at the automaker's strategy of droppinglidar sensors in favor of just cameras.

Xpilot 4.0 – full scenario advanced driver assistance

The G9 is Xpeng's first model equipped with Xpilot 4.0, the company's in-house proprietary advanced driver assistance system. Xpilot 4.0 will be the first to deliver full-scenario assisted 'smart' driving from vehicle start-up to parking, in an important step towards achieving full autonomous driving in the future.

Xpilot 4.0 is built on a new-generation hardware platform, with 508 TOPS ECU computing power supported by two Nvidia Drive Orin autonomous driving SoC units, 8-megapixel front binocular camera and 2.9-megapixel sideview cameras (covering front, rear, left and right view), and a highly integrated and expandable domain controller.

2024 - Xpeng keeps two lidars when launching a new variant of their X9 MPV – Sept. 25, 2024

Xpeng Motors launched a new advanced version of their X9 MPV, featuring lidar and XNGP ADAS.

When it launched, the X9 variants cost was between C¥ 359,800 ($51,213) and C¥ 419,800 ($59,750) respectively. Now a new variant of the X9 MPV called the 610 Max offers advanced driving features and lidar, along with a higher price. The decision to add lidar is an interesting one, as Xpeng recently dropped lidar and went with just cameras on their new P7+ BEV.

Details of Intelligent driving features at Xpeng (Car model G9)

The intelligent driving functions of Xpeng G9 include the following main functions:

- ACC adaptive cruise: This function can be activated by turning the gear lever down once, which can help maintain the distance from the vehicle in front, and at the same time, the distance and speed with the vehicle in front can be set by the button on the left side of the steering wheel, and the function can be exited by pressing the brake pedal.
- LCC Lane Centering Assist: When activated, the system can assist the driver in controlling the steering wheel and continuously centering the vehicle in the current lane. This feature is suitable for dry road conditions on highways with clear lane markings and should never be used on city streets.
- NGP intelligent navigation assisted driving: In high-speed road conditions, the gear lever can be quickly toggled downward, and the intelligent navigation assisted driving can be realized based on the navigation to reach the destination. In this mode, intelligent lane change overtaking can be realized, and when the speed of the vehicle in front is too slow, the car will automatically turn its turn signal to start changing lanes.
- XNGP full-scene intelligent assisted driving: This is a full-scene intelligent assisted driving system launched by Xpeng Motors, which can realize functions such as intelligent lane change, overtaking, and on/off ramps, and automatically adjust the speed and distance of

vehicles according to road conditions and traffic conditions. In addition, XNGP can provide real-time traffic information and navigation guidance to help drivers better plan their routes.
- 'AI' driving: This function supports point-to-point customized intelligent driving routes within 100 kilometers, and up to 10 commonly used routes. After arriving at the navigation destination, you can open the route management on the route button on the SR page, click Customize to save, and wait for the review to be completed within 24 hours before creating a successful route.

Xpeng's fully upgraded XNGP system emphasizes "nationwide usability" and delivers high-level autonomous driving experiences powered by an end-to-end large model and the AI Eagle Eye vision system.

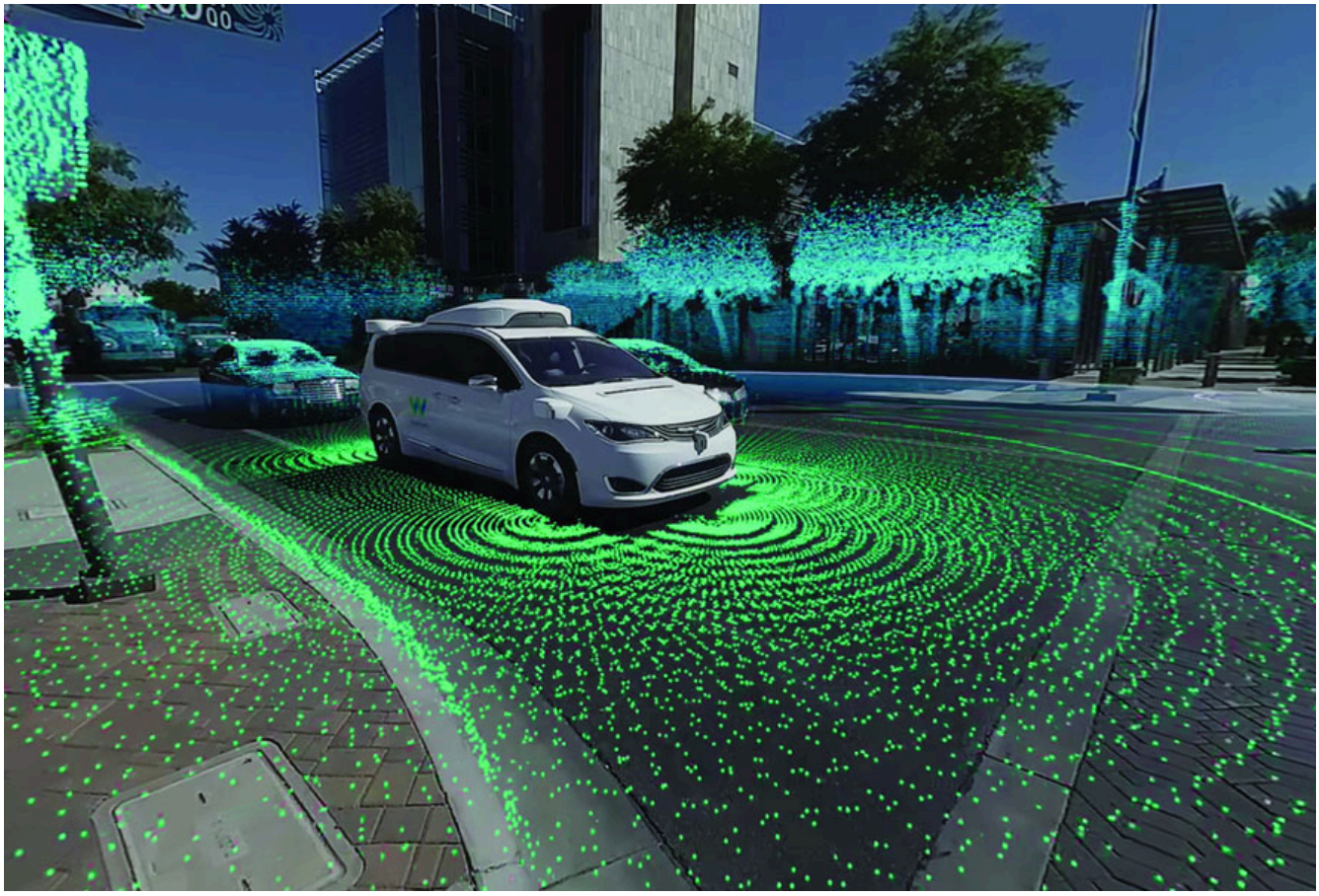
By July 2024, the XNGP system had achieved a full coverage across all Chinese cities, marking a significant milestone in its evolution from being merely "usable" to truly "user-friendly." Xpeng aims to complete a "door-to-door" autonomous driving solution, covering highways, urban roads, and parking, by the end of 2024.

In August 2024, Xpeng unveiled their 'AI' Eagle Eye vision solution. This system upgrades front, rear, and side cameras while eliminating the need for lidar, all while maintaining comparable intelligent driving performance. The system improves perception distance, recognition speed, and adapts to various lighting conditions, significantly enhancing the precision and safety of intelligent driving.

With bi-weekly updates to its intelligent driving system and a strong focus on nationwide deployment, including the neural network XNet, the control model XPlanner, language model XBrain, Xpeng is at the forefront of China's autonomous driving revolution.

WORKSHOPS & CONFERENCES

DVN AEB Workshop—Spotlight on FMVSS 127, Preliminary Docket



DVN Sensing will hold an AEB Workshop in Detroit, focused on the new FMVSS 127 rule which defines challenging scenarios for Pedestrian AEB at night. These specifications will apply to new cars from 2029. The workshop aims to look at the performance and cost of the different technologies, including Camera, Radar, IR and lidar that might be required to meet the new standard and consider safety, validation and integration challenges. Questions? Email **Martin Booth** and **Eric Amiot**.

09th April (Welcome Dinner)

Welcome Cocktail	18:00
Standing Dinner on Exhibition Platform	19:30

10th April (AEB Workshop FMVSS 127)

Opening	08:00

Session 1: NHTSA Requirements vs Current Technologies

Keynote(s) NHTSA Requirements	08:15
Performance of Vision Systems Improved Performance of Lighting Systems Improved Performance of Vision Systems	08:50
Q&A: Opportunities for Vision Systems	10:05
Coffee Break	10:20
Performance of High-Definition Radars Performance of Fusion Systems	10:50
PANEL-1: Benefits of the Fusion Systems	12:20
Lunch Break on Exhibition Platform	12:45

Session 2: NHTSA Requirements vs New Technologies

Performance of IR Cameras Performance of Lidars	14:10
Q&A: Benefits of the New Technologies	15:40

Coffee Break	15:55
Performance validation & simulation	16:25
PANEL-2: Sensing Architectures and Validation Schedule	16:55
Closing Remarks	17:15