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# Smart Road: Intelligent Roadside Perception Industry Report, 2020

## Roadside Perception Research: Giants Race to Deploy Radar Video All-in-one and Holographic Perception

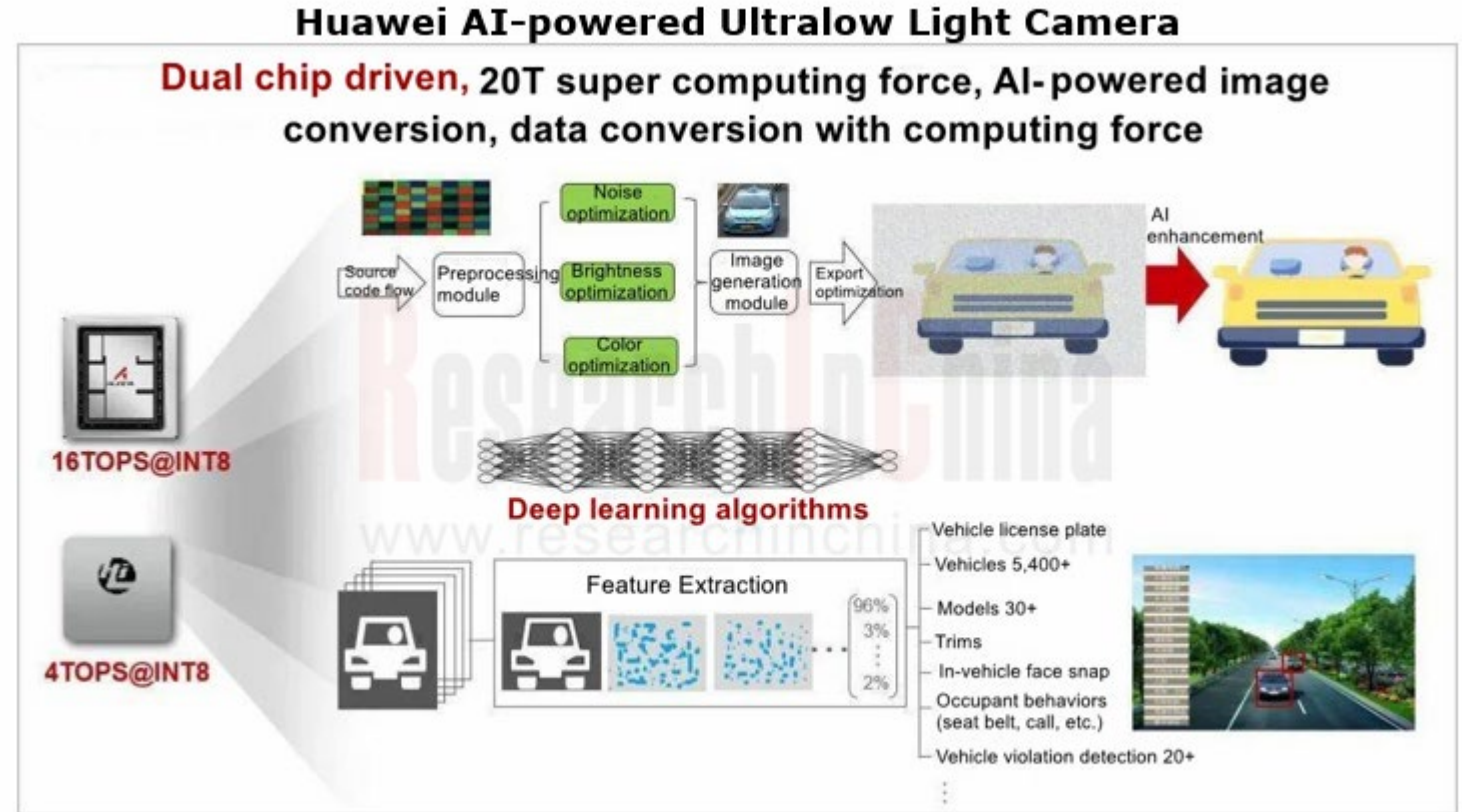
### *Multi-sensor fusion holds a dominant trend for roadside perception*

Current roadside perception solutions are led by HD cameras and radars. In addition, the adoption of radar video all-in-one and LiDAR is becoming widespread. Multi-sensor fusion holds a dominant trend for roadside perception.

#### (1) AI-driven visual camera

Roadside cameras with visual AI analysis function enable more intuitive display of current traffic status and details. At present, vendors like Huawei, Dahua Technology and Hikvision have rolled out their AI-driven roadside cameras.

Based on the open architecture SDC OS, Huawei AI ultralow light camera allows for load of third-party algorithms through Huawei HoloSens Store, making “software-defined” cameras a reality. To make more types of targets detected by cameras, Huawei adds algorithms. For example, the perception and detection of non-motor vehicles only needs to load front-end equipment or ITS800 edge computing nodes with powerful non-motor vehicle video detection algorithms.



Source: Huawei

# Abstract

## (2) Radar

Vendors are trying hard to improve the performance of roadside radars. Based on wide area radar front end and advanced data processing technologies, Hurys introduced a new-generation wide-area radar microwave intelligent perception system that offers more abundant, more diverse data; WAYV series ultra-long-range radars Muniu Technology launched in 2020 afford the longest detection range of 1,000 meters.

Moreover, 4D imaging radars are making their way into the roadside perception market. They provide all-round, three-dimensional, multi-dimensional monitoring and tracking of large intersections and highway scenarios, especially the holographic perception of CVIS at large complex intersections and in mixed traffic in cities. Vendors like Continental, Huawei and Oculii, which deploy roadside perception, have launched their 4D LiDARs.

### Oculii 4D Imaging Radar



## (3) LiDAR

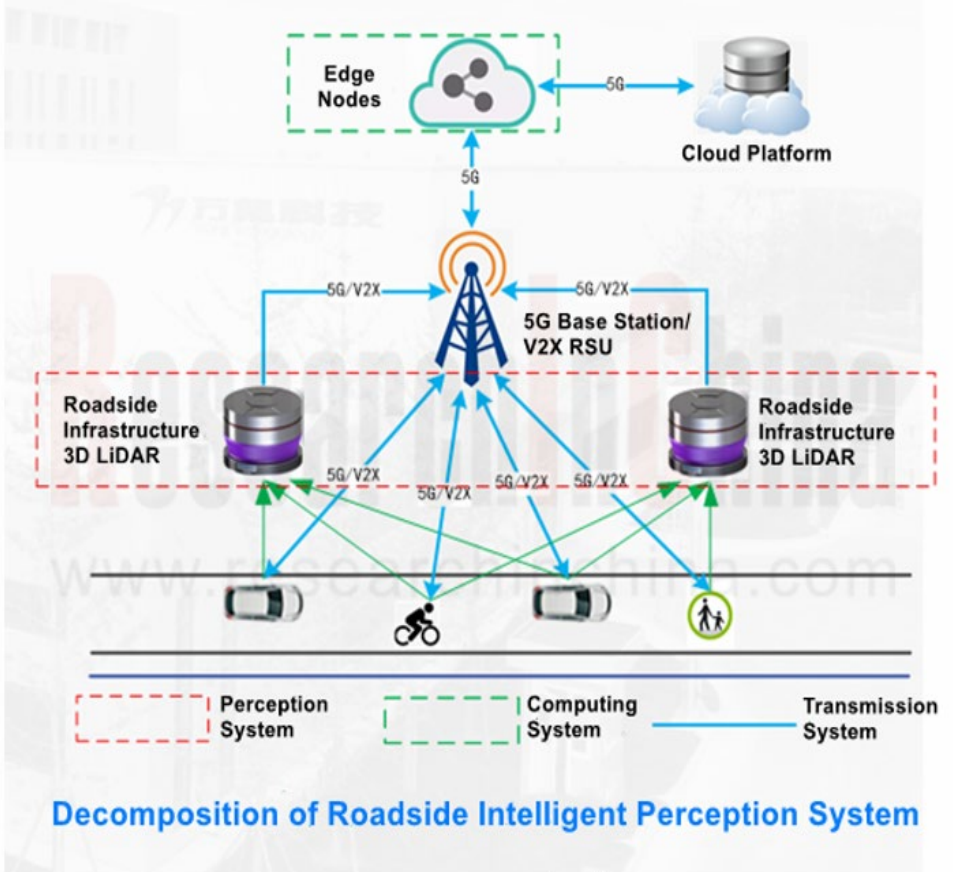
LiDAR that can acquire high-precision three-dimensional information about targets enables e-fence control and some special capabilities (target filtering, customized communication, etc.) in designated areas.

Traditional roadside perception solution providers such as VanJee Technology, Changsha Intelligent Driving Institute Ltd. (CiDi) and China TransInfo Technology already unveil their roadside LiDAR products.

In March 2021, VanJee Technology managed to deploy its smart base stations that integrate with V2X roadside antenna and LiDAR in Xiongan Civic Center V2X Demonstration Project and High-speed Railway Hub Road Intelligence Project.

Also, automotive LiDAR vendors like RoboSense and Ouster have started a foray into the roadside perception field. In 2020, Ouster and LiangDao Intelligence together created a LiDAR-based roadside solution.

## LiDAR-based Roadside Perception System of VanJee Technology



### Decomposition of Roadside Intelligent Perception System

Source: VanJee Technology

## (4) Radar video all-in-one

Radar video all-in-ones that feature integrated design and unified installation and share power supplies, can save a lot of costs of materials and installation. The fronted deployment of perception fusion algorithms at the terminal end leads to a marked reduction in perception latency and computing load at the edge end; and the combination of merits of video and radar offers higher target detection accuracy.

Currently, roadside vision-based HD camera vendors like Dahua Technology and Hikvision and roadside radar vendors such as Raysun Radar, Hurys and DeGuRoon have introduced their radar video all-in-ones. Among them, in 2019 Oculii released 4D radar video all-in-one that uses Falcon, its first-generation point cloud imaging radar; in the second half of 2021, Raysun Radar unveiled IET6LRR, its new-generation radar video all-in-one that provides the maximum detection range of 425 meters.

**Radar Video All-in-ones/Radar Video Integrated Solutions of Major Vendors**

Vendor	Radar Video All-in-one/Radar Video Integrated Solution	Parameters/Features	Application/Solution
Huawei	Radar + AI ultralow light camera	Number of targets detected by the radar at the same time: 256; resolution of AI-driven ultralow light camera: 4096(H)x2160(V)	Available to 50+ intersections in 20+ cities including Shenzhen, Beijing, Foshan (Shunde District), Tianjin and Shanghai; deployed at 22 intersections on 2 new roads in Guiyang.
Raysun Radar	IET6V100 radar video integrated roadside perception sensor	Detection range: 250m, pedestrian 100m FOV: 18° (long distance), 90° (short distance)	4 radar video integrated sensors deployed at 4 directions of Quanxi Intersection in Suzhou Industrial Park
	IET6LRR radar video all-in-one (launched in 2021H2)	Detection range: 425m, 8-10 lanes Angular resolution: up to 05° Azimuth accuracy: <005°	--
Hurys	DTAM D39 radar video integrated microwave detector	Detection range: 8 lanes, 200m Number of targets detected: at most 128 Pixel: 4MP	--
Dahua Technology	Dahua Sentinel radar video all-in-one	Detection range: 250m Video detection range: 15m-80m Pixel: 4.2MP	Jiexiu County of Shanxi deployed radar video all-in-ones at a T-shaped junction to make its traffic much more efficient
DeGuRoon	CitRadar-77LS radar video integrated detector	Support gateway interface, RS485/RS232 serial port, WiFi	--
Costone Technology	Radar video all-in-one	Detection range: 30m-200m (vertical), up to 12 lanes (horizontal)	Chongchuan Internet of Vehicles Industry Demonstration Park in Nantong city deployed intelligent radar video all-in-ones
Oculii	4D radar video all-in-one	Detection range: 300m FOV: 120°*30° Angular resolution: 2°*5°	--

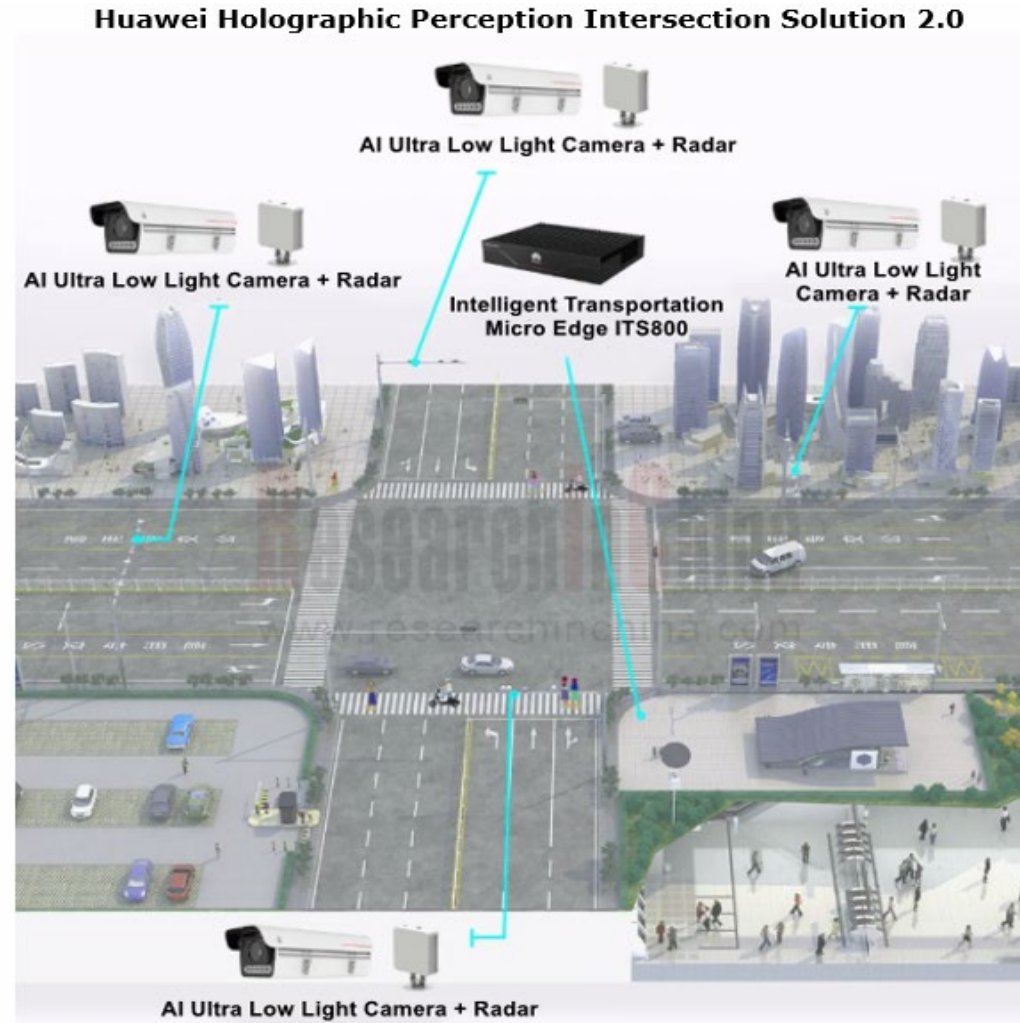
Source: ResearchInChina

# Abstract

## ***Huawei and Baidu have stepped into the field and launched “holographic perception intersection” solutions***

Holographic perception is a foundation for the development of smart roads. It needs roadside perception equipment to provide comprehensive, high-quality, stable traffic data. Since 2000 Huawei, Baidu, OriginalTek and the Institute of Deep Perception Technology (IDPT), among others have rolled out their holographic perception solutions.

**Huawei:** in 2020 Huawei released the solution Holographic Perception Intersection 1.0; in March 2021, Huawei unveiled Holographic Perception Intersection 2.0, a combination of AI ultra-low light camera, radar, ITS800 edge computing node and intersection HD map, which is applicable to crossroads, T/X/Y-shaped intersections and super large intersections. Based on its holographic perception solutions, Huawei will create holographic road section solutions that enable convergence and access, analysis and communication capabilities at intersections and roadsides via edge computing units, and connect traffic signals and vehicle communication units to lay the foundation for CVIS services such as accurate public transit and driving assistance.



Source: Huawei

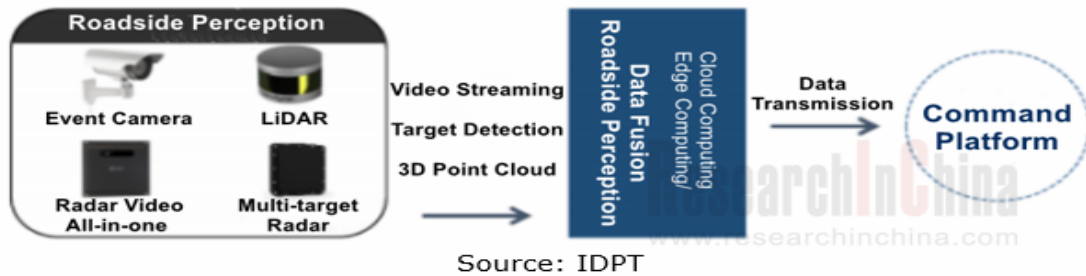
**Baidu:** Baidu ACE Intelligent Intersection Solution launched in March 2021 enables perception of all elements including road vehicles, roads, pedestrians, environments and traffic incidents, with perception and computing devices (camera, fisheye camera, LiDAR, edge computing unit, etc.) deployed at the roadside. The solution integrating with Baidu Map data delivers a data detection accuracy of over 97%. ACE Smart Intersection is an application of Baidu ACE Smart Traffic Engine (a full-stack intelligent transportation solution that integrates vehicle, infrastructure and pedestrian) in the intersection scenario.

In Baidu ACE Intelligent Intersection Solution, devices like camera, LiDAR, communication equipment and edge computing unit are customized by Baidu with its ecological partners.

# Abstract

**IDPT:** the deep fusion of raw data from cameras, LiDARs, radars, and radar video all-in-ones enables 360° image-level holographic perception around the clock in all weather conditions, offering the longest detection range of up to 500m and more reliable data for urban intersections.

## IDPT Deep Sea-1 Holographic Perception Solution Architecture



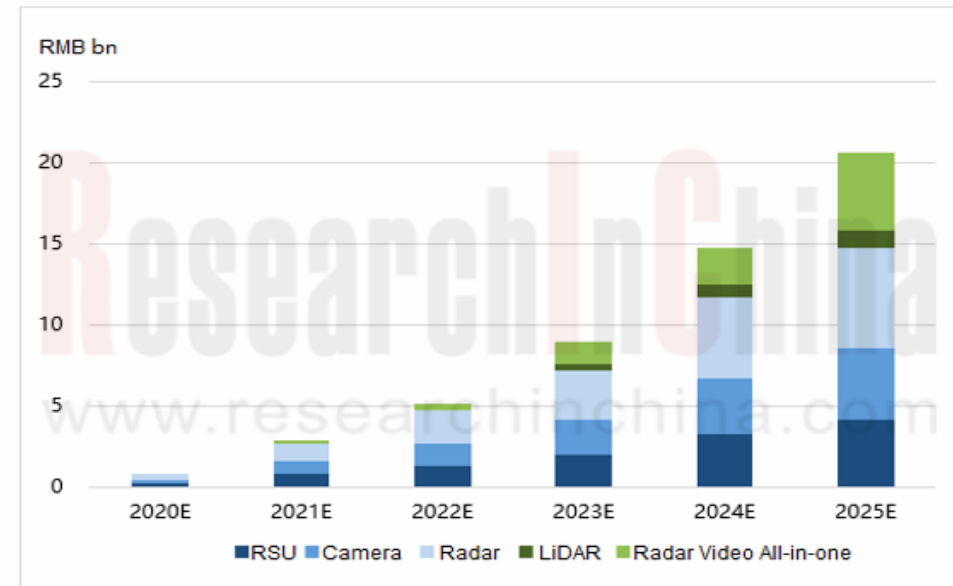
In addition, Hikailink Technology achieves holographic intersection perception with radar, camera, and image-level solid-state LiDAR; OriginalTek deployed BotEye? holographic perception devices in the test park where the 2020 C-V2X Cross-industry & Large-scale Pilot Plugfest was held.

## The roadside perception market will be worth RMB20 billion in 2025

Intelligent roadside perception will firstly cover highways and urban intersections. The official statistics show that China has 149,600km highways in all, with the overall density of road networks averaging 6.1km/km<sup>2</sup> and the total urban construction areas reaching 21,000 km<sup>2</sup> in 36 major cities.

On our estimate, China's intelligent roadside perception equipment market (including RSU, camera, radar, LiDAR, and radar video all-in-one) will be valued at RMB20 billion or so in 2025. Camera and radar will be still mainstream devices for roadside perception, while radar video all-in-one and LiDAR will gather pace.

China's Intelligent Roadside Perception Market Size, 2020-2025E



Source: ResearchInChina

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## Beijing Headquarters

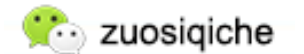
TEL: 010-82601561, 82863481

FAX: 010-82601570

Email: [report@researchinchina.com](mailto:report@researchinchina.com)

Website:  
[www.researchinchina.com](http://www.researchinchina.com)

WeChat: [zuosiqiche](https://www.wechat.com/p/zuosiqiche)



## Chengdu Branch

TEL: 028-68738514

FAX: 028-86930659