HURYS

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500m 4D Imaging Radar-Vision Radar White Paper

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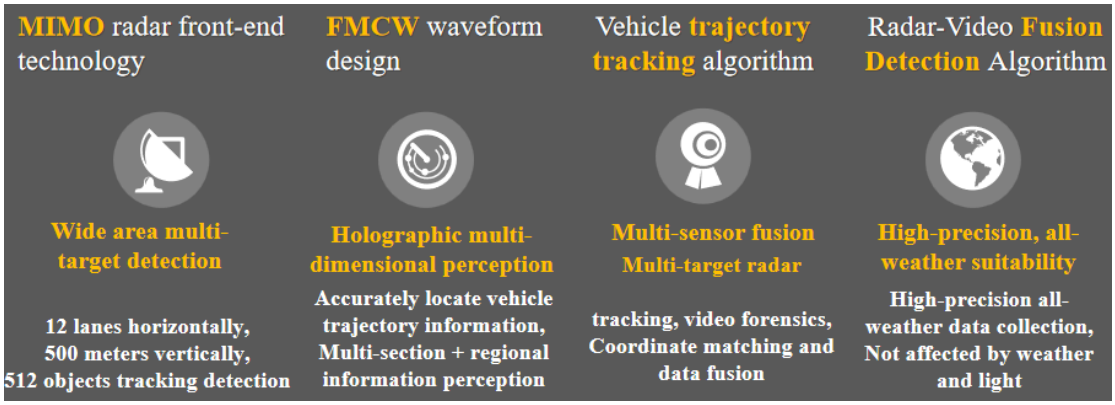
Contents

1. Product Introduction

The Hurys 4D Imaging Radar-Video Integrated Machine RTE V49-V adopts a brand-new high-resolution 4D imaging radar front-end and a high-definition video module. On the basis of all-weather working ability, it significantly improves the number of point clouds, resolution, trajectory stability, and video algorithm capabilities.

Based on the new hardware platform, through the implantation of the Trajectory Modeling 2.0 algorithm, Radar-Ideo Fusion 2.0 algorithm, and Multi-Mode Traffic Behavior Recognition algorithm, it ensures low-latency and high-precision structured data output, meeting the construction needs of intelligent expressway perception and roadside perception equipment in the vehicle-road-cloud integration scenario, and building a more abundant and solid data base for various scenarios.

2. Product Features



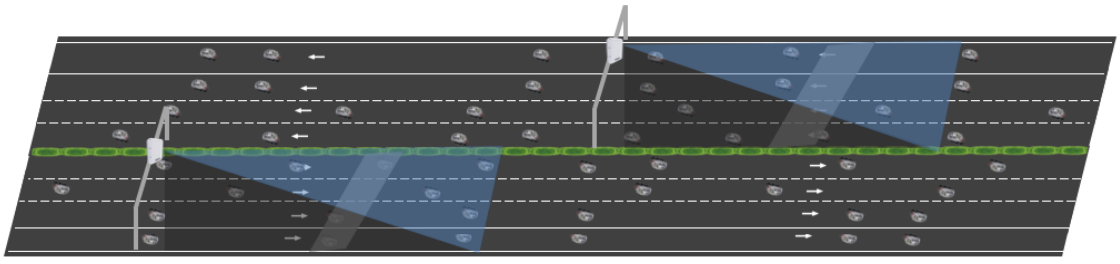
- Optimize the distance and angle of the near and far beams to improve detection accuracy and enhance anti-interference ability;
- Pulse compression radar modulation technology, with a higher signal-to-noise ratio to achieve more accurate and continuous trajectory tracking;
- Horizontally cover up to 12 lanes and vertically cover 500 meters to achieve high-precision detection in a large area;
- Support decimeter-level high-precision distance detection;
- Support high-precision speed detection;
- Support a maximum data output frequency of up to 20Hz;

- Support NTP time synchronization and manual time adjustment to achieve high-precision time synchronization;
- In typical high-speed scenarios, the effective detection rate of targets reaches over 98%, and the effective tracking rate reaches over 95%;
- Support the detection of multiple types of events, including congestion, lane change, parking, reverse driving, ultra-high speed, ultra-low speed, and occupation of emergency lanes;
- Have all-weather working ability, not affected by light and weather conditions such as rain, snow, and fog.

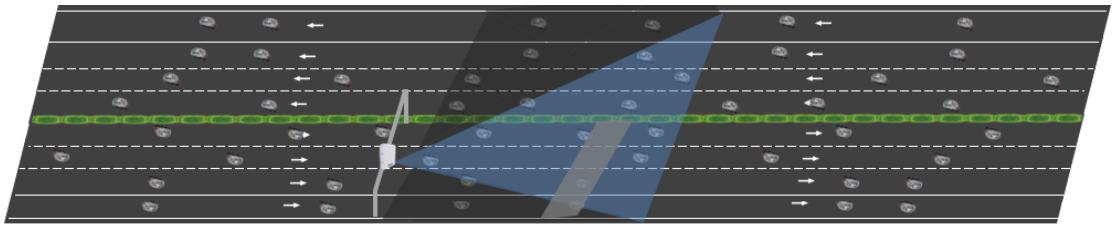
3. Installation Instructions

The installation methods of the RTE V49-V device on the road section are divided into front installation and side installation. Front installation is usually on the gantry, covering one-way or two-way lanes. Side installation is recommended on the side pole of the gantry or the roadside L-shaped pole, covering one-way lanes. The maximum coverage range is 12 two-way lanes, and the detection distance reaches 500 meters.

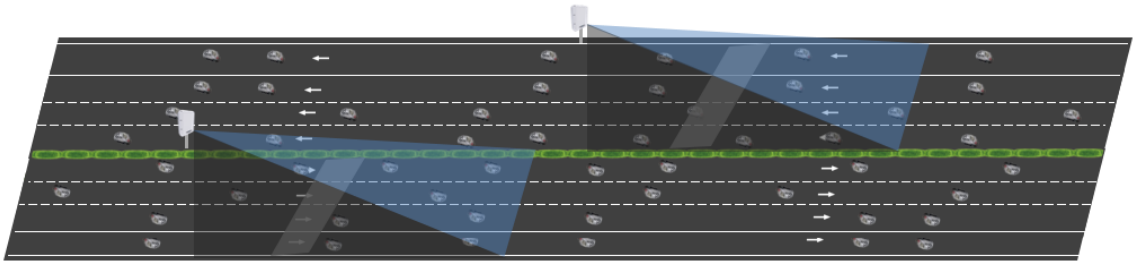
Method 1: Installation on the gantry to cover one-way lanes



Method 2: Installation on the gantry to cover two-way lanes



Method 3: Installation on the roadside to cover one-way lanes



4. Application Instructions

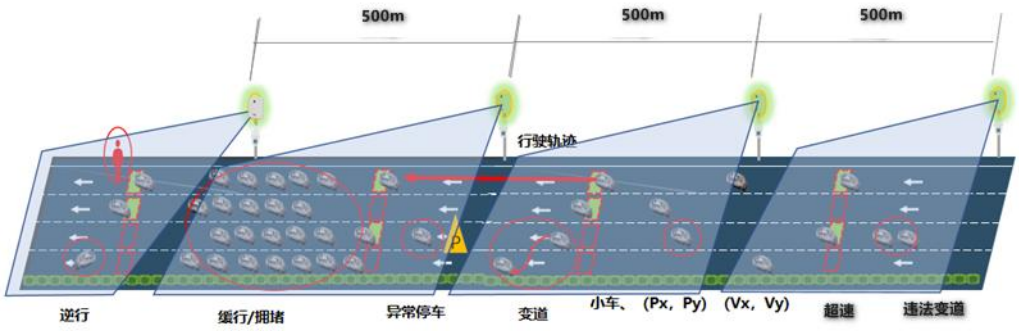
The RTE V49-V is a millimeter-wave radar launched by our company for highway scenarios. It is highly compatible with the vehicle-road collaboration scenario, supports ultra-long-range perception for autonomous driving, provides real-time and high-precision multi-dimensional data such as vehicle position information, traffic flow status information, and traffic events. At the same time, it supports the fusion of the perception fields of multiple radars to achieve continuous and real-time tracking of the trajectories of group vehicles in a larger area, constructs a holographic traffic perception system suitable for various road scenarios, and provides data services for scenarios such as safety, efficiency, and information services.

4.1 Applications in Digital Expressways/Fast Road Sections

Based on the stable trajectory tracking algorithm of a single radar and the continuous trajectory splicing technology of radar groups, it is compatible with high-precision maps of expressways and fast road sections, realizes the real-time digital reproduction of the real motion states of group vehicles, constructs a digital twin system for the traffic operation of road section scenarios such as expressways and highways, and provides managers with a "holographic perspective" of the real-time traffic status.

At the same time, it takes advantage of the 4D imaging radar-ideo integrated machine to improve the real-time trajectory tracking ability, detect various traffic events such as congestion, reverse driving, abnormal parking, ultra-high speed,

ultra-low speed, occupation of emergency lanes, and illegal lane changes, and provide accurate event information for traffic management departments.



Schematic diagram of road section event detection and recognition driven by radar trajectory data

The digital expressway and fast road section system, based on the construction of the digital twin system and driven by technologies such as artificial intelligence and big data, empowers the management of fast roads with trajectory data, conducts in-depth analysis of the traffic operation status of fast roads, diagnoses road traffic problems, mines vehicle driving characteristics, clarifies the influence mechanism of events on traffic operation, and provides detailed data analysis and decision-making support services for management departments.

Schematic diagram of real-time simulation of all elements of traffic operation in digital expressways/fast road sections

5. Product Parameter Table

Table 1 Radar Parameters

No	Specifications	Parameters
1	Frequency Band	77GHz
2	Coverage	12 lanes in both directions
3	Simultaneous Detection	Up to 512 objects
4	Maximum Detection Range	25 ~ 500m
5	Range Accuracy	0.2m
6	Range Separation	0.4m
7	Range of Speed Coverage	-200km/h～+200 km/h
8	Speed Accuracy	0.1m/s
9	Speed Separation	≤±0.25m/s
10	FOV	Near beam 90° (horizontal)/18° (vertical) Far beam 18° (horizontal)/18° (vertical)
11	Angle Accuracy	0.1°
12	Angle Separation	1.2°

Table 2 Traffic Datas

Number	Data Items	Data Composition
1	Real-Time Data	ID, Px, Py, Vx, Vy, Object Type
2	Passing Vehicle Data	Section ID, Lane ID, Entry Time, Exit Time, Presence Duration, Entry Speed, Exit Speed, Object Type
3	Statistical Data	Statistic Time, Statistic Interval, Section ID, Lane ID, Vehicle Volume, Average Speed, Headway (Time Headway), 85th Percentile Speed
4	Incident Data	Time, Lane ID, Incident Type (High-Speed / Low-Speed, Abnormal Stop, Reverse Drive, Congestion, Pedestrian Intrusion, Illegal Lane-Changing, etc.)

Table 3 Video Parameters

Serial number	Parameter item	Parameter requirements
1	Sensor	1/2.5-inch CMOS
2	Lens	12mm fixed-focus lens
3	Pixels	3840 x 2160 px
4	Video field of view	26°
5	Picture encoding	JPEG

	format	
6	Video docking protocol	Supports ONVIF protocol and national standard GB/T28181 protocol
7	Network protocol	Supports TCP/IP, HTTP, DNS, RTP, RTSP and FTP transmission
8	Minimum illumination	Color: 0.1Lux@(F1.2, AGC ON); Black and white: 0.01Lux @(F1.2, AGC ON)
9	Maximum resolution	3840 x 2160
10	Compression standard	H.265/H.264/MJPEG
11	Video frame rate	Main stream: 3840 x 2160, 2560*1920, 2560*1440, 1920*1080, 1 - 20 frames per second Sub - stream: 1280*720, 704*576, 640*480, 352*288, 1 - 20 frames per second
12	Output bit rate	Adjustable from 16kbps to 20Mbps

Table 4 Other radar parameters

No	Specifications	Parameters
1	Operating temperature	-40℃～+70℃
2	Working voltage	DC 24V (Wide voltage range: 20 - 28V)
3	Working humidity	0～95%
4	Power Consumption	≤30 W
5	Installation height	8 - 12 meters
6	IP rating	IP67

6. Hardware Interface and Dimensions

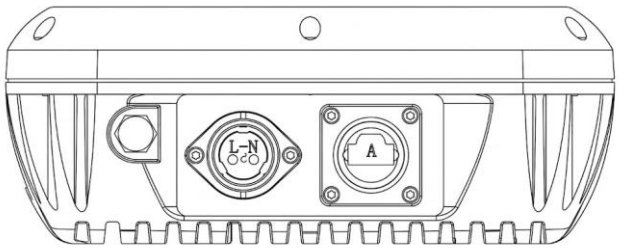


Table 5 Interface Parameters

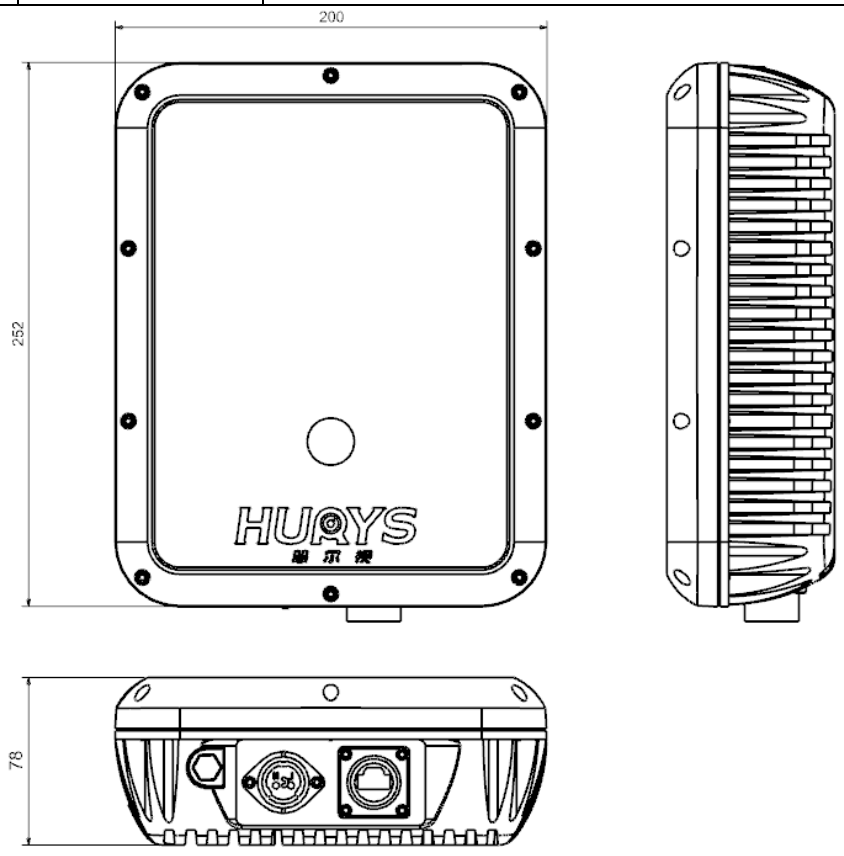
Mark	Name	Description
L	V+	DC 24V
N	V-	GND
A	RJ45	Interface

Notes:

- It is strictly forbidden to use AC 220V voltage to directly power the radar.
- When selecting the installation point, avoid placing the radar too far away from the power supply or transmission node. If the radar data transmission exceeds 80 meters, optical fiber must be used for link access.

Table 6 Product specifications

Serial Number	Parameter Name	Description
1	Product Size	252×200×78mm (Length * Width * Height)
2	Product Weight	3.2kg
3	Material	The front of the antenna is made of PC material, and the rest is a metal shell.



RTE V49-V Layout