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300m 4D Imaging Radar-Vision Radar White Paper

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Contents

1. Product Overview

The HURYS RTE V29-V is an advanced 4D imaging radar-video fusion unit that combines a next-generation high-resolution 4D imaging radar front-end with a high-definition video module. Building on its robust all-weather operational capability, the RTE V29-V delivers significant improvements in point cloud density, spatial resolution, trajectory stability, and video analytics performance.

Leveraging a newly developed hardware platform and enhanced with proprietary algorithms—including Trajectory Modeling 2.0, Radar-Video Fusion 2.0, and Multi-Mode Traffic Behavior Recognition—the unit ensures low-latency, high-precision structured data output. It is specifically designed to meet the requirements of urban intelligent road network perception systems and roadside sensing infrastructure for vehicle-road-cloud integrated scenarios, establishing a richer, more reliable data foundation for diverse smart city applications.

2. Product Features

- Pulse Compression Radar Modulation Technology: Achieves higher signal-to-noise ratio for more accurate and continuous trajectory tracking.
- Wide-Area Coverage: Supports up to 12 lanes horizontally and up to 300 meters longitudinally, enabling high-precision detection across large areas.
- Decimeter-Level Ranging Accuracy: Capable of distance measurement with sub-meter (decimeter-level) precision.
- High-Precision Speed Detection: Accurately measures target speeds with high fidelity.
- High Data Output Rate: Supports data output frequency up to 20 Hz for real-time responsiveness.
- Precise Time Synchronization: Features NTP time synchronization and manual time calibration for high-accuracy timing alignment.
- High Detection & Tracking Performance: In typical intersection scenarios,

achieves >98% target detection rate and >95% effective tracking rate.

- Comprehensive Event Detection: Supports multiple traffic event types, including queue overflow alerts.
- All-Weather Operation: Unaffected by lighting conditions or adverse weather such as rain, snow, or fog—ensuring reliable 24/7 performance.

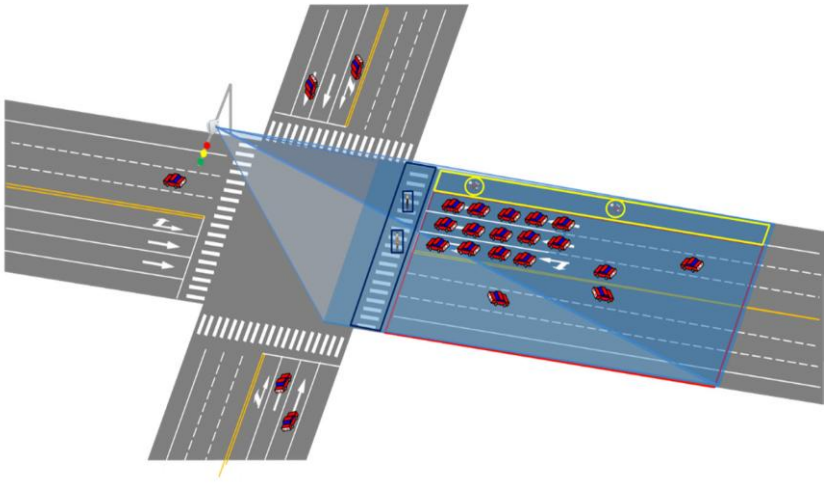
3. Installation Guidelines

3.1 Intersection Scenarios

Types of urban intersections include: cross intersections, It is recommended to install the device on the traffic signal pole. Please follow the installation diagram strictly as shown below.

Typical installation method for intersections:

Installation and deployment of signal light poles



4. Application Scenarios

The RTE V29-V represents the latest generation of 4D imaging radar-video fusion units, integrating HURYS core technologies in multi-target trajectory tracking, multi-mode behavior recognition, and multi-dimensional data processing. It provides

capabilities including object classification, stable group trajectory tracking, traffic flow data collection, and traffic incident detection.

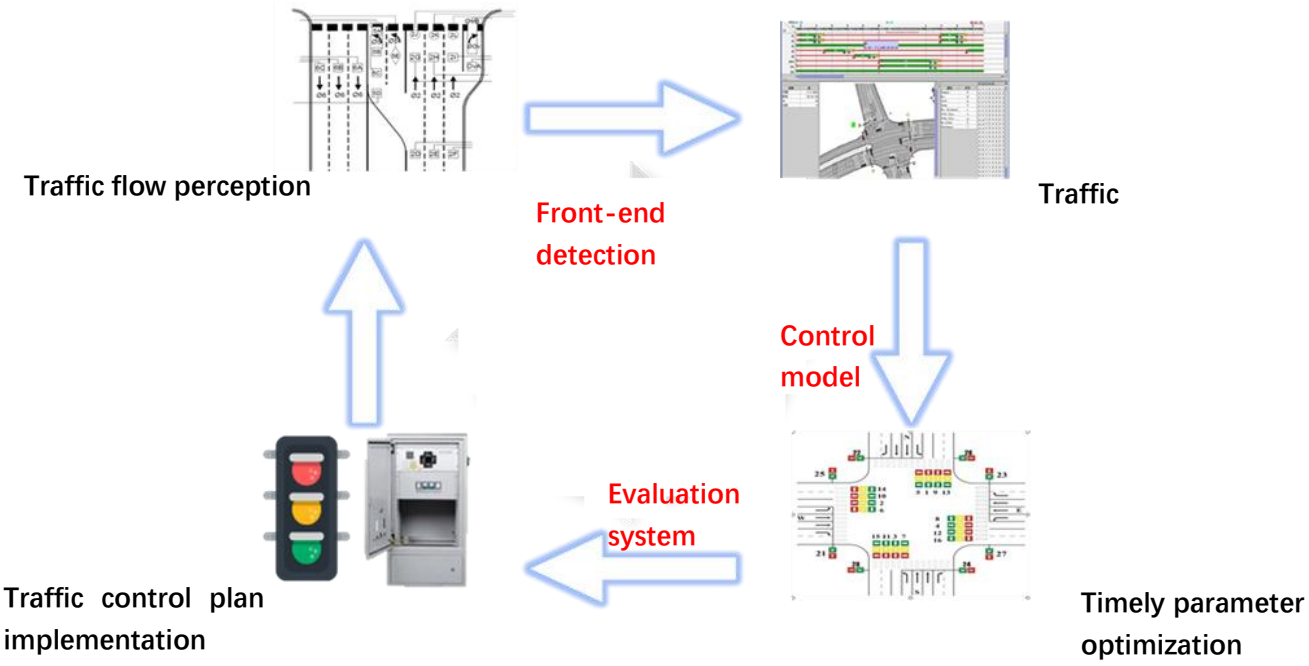
It is widely deployed in:

- Urban intelligent traffic signal control systems
- Digital and intelligent urban transportation networks
- Traffic digital twin platforms
- Vehicle-infrastructure cooperative systems (V2X)

4.1 Urban Intelligent Signal Control System

The radar-video fusion microwave detector employs a combined detection model of “multiple cross-sections + zone status + event detection,” efficiently adapting to urban traffic signal control systems. It accurately outputs cross-section data for each lane, vehicle distribution information within zones, queue overflow events, and vehicle characteristic information. It also analyzes and compiles trajectory data of objects within each cycle, providing efficient, concise, and real-time comprehensive data throughout the entire process. This fully supports traffic signal control modes such as inductive control, adaptive intersection control, mainline green waves, area control, reversible lane control, and bus priority coordination control.

The traffic signal control system uses real-time queue lengths and vehicle counts in all directions provided by the radar-video fusion microwave detector, combined with cycle traffic volume data to calculate signal cycle lengths and estimate green light durations. By dynamically adjusting the green signal ratio based on real-time multi-section presence data, vehicle distribution, and event information, it improves green light utilization efficiency.



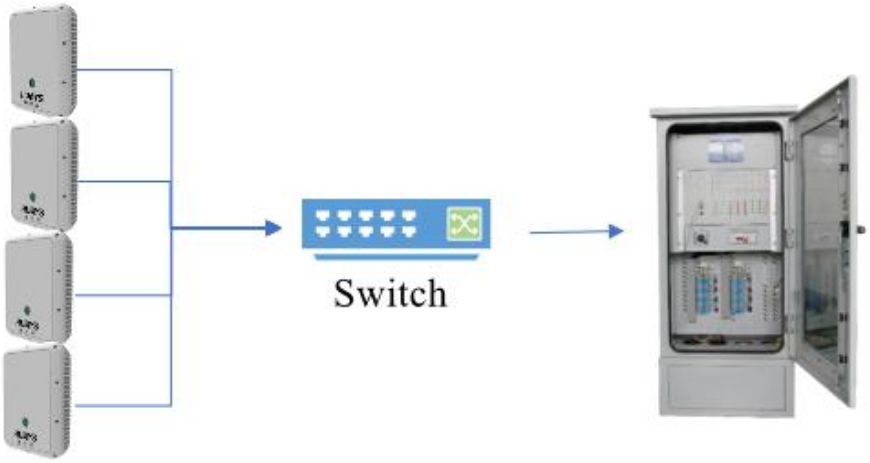
Structure diagram of intersection signal control system model

5. Product Parameters

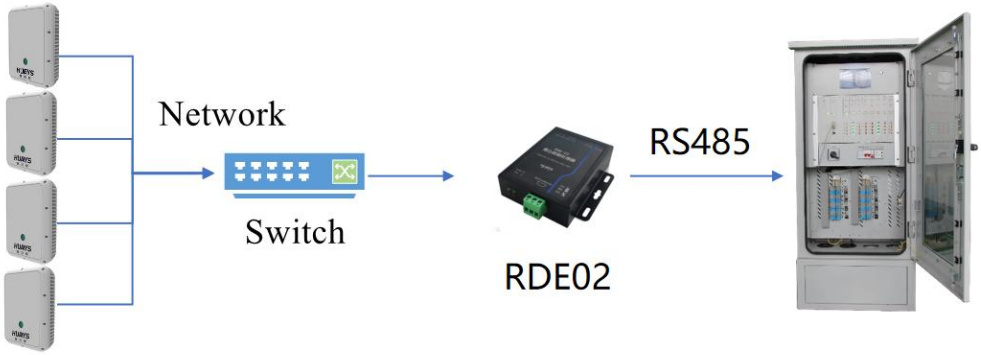
Table 1: Radar parameters

Number	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 ~ 300m
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°

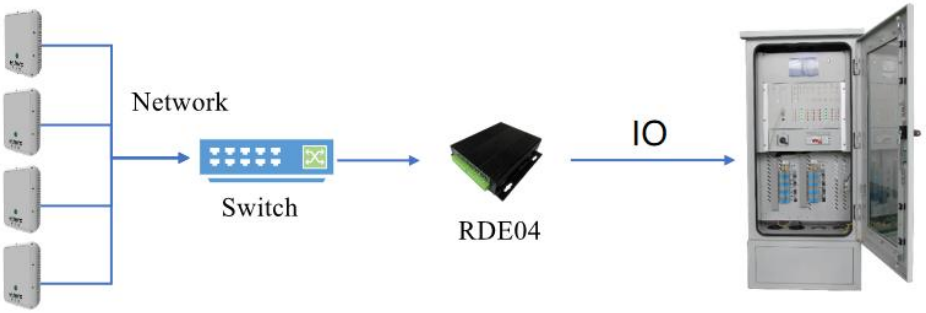
Attached: Typical cases of docking with intersection controller



Case #1: docking with intersection controller



Case #2: docking with intersection controller



Case #3: docking with intersection controller

Table 2: Data Output Types

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 (Queue overflow incident)

Table 3: Video parameters

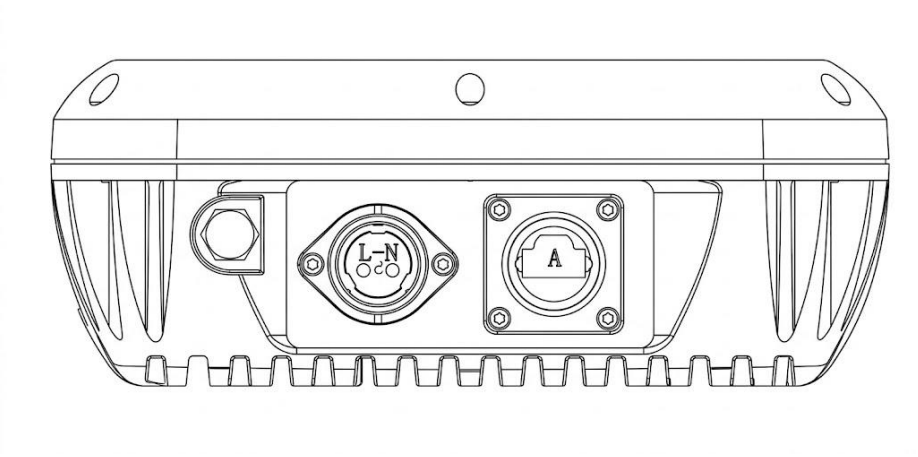
Number	Specifications	Parameters
1	Sensor	1/2.5 inch CMOS
2	lens	12mm fixed focus lens
3	Pixel	3840 x 2160px
4	Video FOV	±13°
5	Image format	JPEG
6	Video protocol	Supports docking with ONVIF protocol and national standard GB/T 28181 protocol
7	Network protocols	Supports TCP/IP, HTTP, RTSP and FTP transfer
8	Max resolution	3840 x 2160px
9	Compression standards	H.265/H.264/MJPEG
10	Video frame rate	Mainstream:3840x2160 2560*1920 2560*1440 1920*1080 1-20 fps Sub-stream:1280*720 704*576 640*480 352*288 1-20 fps
11	Output bit rate	16kbps~20Mbps adjustable

Table 4：Other radar parameters

Number	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: Functions corresponding to each interface



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

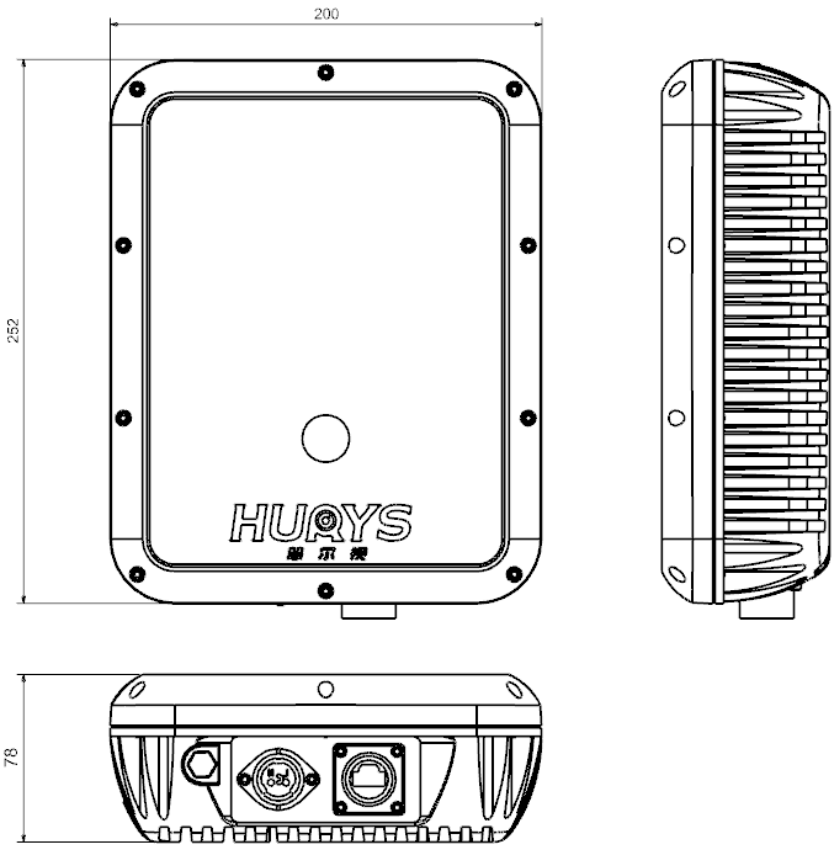
Notes:

✧ 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 dimensions

Number	Name	Description
1	Dimensions	252×200×78mm(length*width*height)
2	Weight	3200g
3	Material	Front radome: Polycarbonate (PC) Body: Metal enclosure



RTE V29-V Layout