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BYDA SENSOR & SYSTEM

For The Smart Traffic Tomorrow

OPENING A SAFER AND SMARTER WORLD WITH BYDA'S TECHNOLOGY

"We will become a company that provides core solution for the ICT industry based on world leading RADAR technology"

BYDA is a pioneering company devoted to advancing the future of smart sensing through innovative millimeter-wave radar technology. With our core principle "Creating a convenient and safe world through smart sensing technology," BYDA continuously works to turn this vision into reality.

As the first in Korea to successfully develop and mass-produce millimeter-wave radar technology, BYDA has grown into a trusted leader, not only in intelligent traffic systems but also in smart city infrastructure solutions.

In an era of rapidly transforming smart solutions, safety and precision are paramount. BYDA is committed to creating a world where everyone can enjoy peace of mind, powered by our advanced radar technology and robust signal processing solutions.

Enhancing everyday life through technology, BYDA is committed to progress, refusing to stand still and continuously innovating to shape a smart and safe future for all to share.

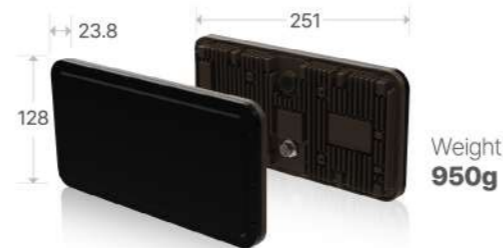


- **2015. 10** Established BYDA Co., Ltd.
- **2016. 01** Established Company Affiliated R&D Center
- **2016. 06** Factory registration(direct production)
- **2017. 07** Supply the first Smart Enforcement Radar Sensor for the National Police Agency in Korea
- **2018. 06** Export VDS Radar to NEXCO (Japan Expressway International Co. Ltd.)
- **2019. 06** Development of Pedestrian Safety Solution
- **2020. 07** Acquired Green Certification
- **2020. 12** Implemented a radar-based Smart Intersection System
- **2022. 06** Supply of radar-based parking sensors to Santander City in Spain
- **2023. 01** Registration of Innovative Products with the Procurement Office
- **2023. 12** Sales and installation records of more than 18,000 radar sensors
- **2024. 07** Acquired GS Certification(Traffic System S/W)
- **2024. 07** Acquired Specialized Green Enterprises Certification
- **2024. 10** Initiated the IFEZ ITS Construction Project (Smart Crosswalk Implementation)
- **2024. 12** Completed the Smart Intersection Development Project in Cheonan City
- **2025. 04** Participated in the 2025 ITS Innovative Technology Competition [Project: Road Collision Prevention System]

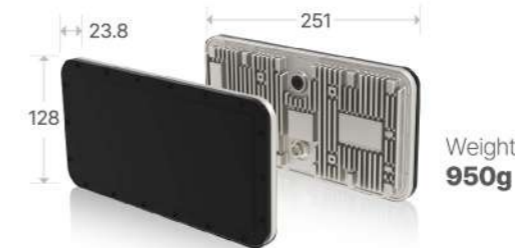
RADAR SPECIFICATION



BSR20S



BSR20P



BSR20U



HDR20

SENSOR REQUIREMENT

Performance		Specification
Coverage	Range	200 m (Passenger Car)
	Velocity	$\geq \pm 300$ km/h
	Azimuth FoV	$\geq \pm 45^\circ$
Resolution	Range	0.3 m
	Velocity	0.6 kph
	Angle	5.2°
Update Rate		35 msec
Number of tracks		Up to 256 tracks

ELECTRICAL REQUIREMENT

Performance	Specification
Supply Voltage	9~27 V
Power Consumption	Max 6 W

ENVIRONMENTAL REQUIREMENT

Performance	Specification
Operational Temperature Range	-40 ~ 85 °C
Storage Temperature Range	-40 ~ 105 °C
Degree of Protection (IP Rating)	IP68

GENERAL REQUIREMENT

Performance	Specification
Frequency Band	61.0 ~ 61.5 GHz
Communication Interface	10/100 Ethernet, RS-485 (Half Duplex)

- * 76~77GHz band option is also available
- * The velocity resolution can be further improved by increasing the update rate.

SENSOR REQUIREMENT

Performance		Specification
Coverage	Range	350 m (Passenger Car)
	Velocity	$\geq \pm 300$ km/h
	Azimuth FoV	$\geq \pm 50^\circ$
Resolution	Range	0.3 m
	Velocity	0.6 kph
	Angle	1°
Update Rate		50 msec
Number of tracks		Up to 256 tracks

ELECTRICAL REQUIREMENT

Performance	Specification
Supply Voltage	9~27 V
Power Consumption	Max 12 W

ENVIRONMENTAL REQUIREMENT

Performance	Specification
Operational Temperature Range	-40 ~ 85 °C
Storage Temperature Range	-40 ~ 105 °C
Degree of Protection (IP Rating)	IP68

GENERAL REQUIREMENT

Performance	Specification
Frequency Band	61.0 ~ 61.5 GHz
Communication Interface	10/100 Ethernet, RS-485 (Half Duplex)

- * 76~77GHz band option is also available
- * The velocity resolution can be further improved by increasing the update rate.

SENSOR REQUIREMENT

Performance		Specification
Coverage	Range	500 m (Pedestrian) ≥ 1 km (Passenger Car)
	Velocity	$\geq \pm 300$ km/h
	Azimuth FoV	$\geq \pm 50^\circ$
Resolution	Range	0.3 m
	Velocity	0.6 kph
	Angle	1°
Update Rate		50 msec
Number of tracks		Up to 256 tracks

ELECTRICAL REQUIREMENT

Performance	Specification
Supply Voltage	9~27 V
Power Consumption	Max 24 W

ENVIRONMENTAL REQUIREMENT

Performance	Specification
Operational Temperature Range	-40 ~ 85 °C
Storage Temperature Range	-40 ~ 105 °C
Degree of Protection (IP Rating)	IP68

GENERAL REQUIREMENT

Performance	Specification
Frequency Band	61.0 ~ 61.5 GHz
Communication Interface	10/100 Ethernet, RS-485 (Half Duplex)

- * 76~77GHz band option is also available
- * The velocity resolution can be further improved by increasing the update rate.

SENSOR REQUIREMENT

Performance		Specification
Coverage	Detection Range	$\geq 10 \times 10$ m
	Azimuth FoV	$\geq \pm 50^\circ$
	Elevation FoV	$\geq \pm 30^\circ$
Update Rate		≥ 100 msec
Output Data format		4D point cloud data for Pedestrian detector

ELECTRICAL REQUIREMENT

Performance	Specification
Supply Voltage	9~27 V
Power Consumption	Max 8.4 W

ENVIRONMENTAL REQUIREMENT

Performance	Specification
Operational Temperature Range	-40 ~ 85 °C
Storage Temperature Range	-40 ~ 105 °C
Degree of Protection (IP Rating)	IP54

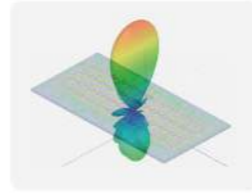
GENERAL REQUIREMENT

Performance	Specification
Frequency Band	60.0~64.0 GHz
Communication Interface	10/100 Ethernet, RS-485 (Half Duplex) or PoE (Power over Ethernet)

- * 76~81GHz band option is also available

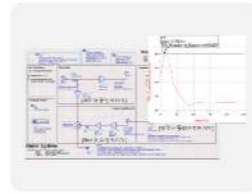
Millimeter Wave Circuit Design

- Antenna design technology considering radar beam synthesis
- Maximization of radar detection area by applying low-noise, low-loss millimeter-wave circuit design technology



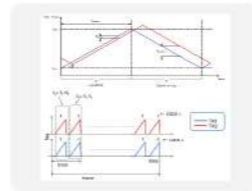
High-Frequency Circuit Design

- Minimization of Circuit BOM(Bill of Materials) through the application of latest high-integration semiconductors
- Miniaturization of PCB through hybrid multilayer boards and high-density interconnect(HDI) technology



FMCW Modulation Design Technology

- Design of RADAR transmission frequency modulation to define specifications such as speed/distance resolution, maximum detectable speed/distance range, etc.
- MIMO-based transmission frequency design for miniaturization and cost competitiveness(including TDM, BPM, DDM, etc.)

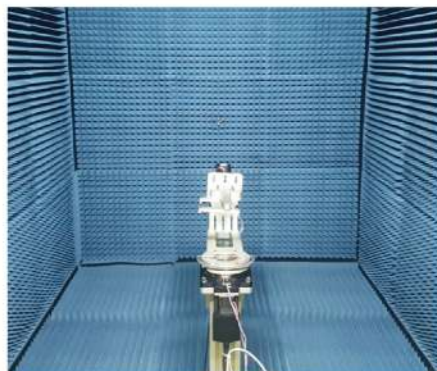


Radar Signal Processing

- Extract distance, velocity and angle components of a target in real time in complex road environment
- Simultaneous tracking of multiple targets in real time



FACILITY | Facilities / Equipment / Quality



Chamber & Target Simulator



PCB Assembly Line



ISO 9001 : 2015 Certified Company

APPLICATION

Our independently developed radar not only provides distance and speed information, but also offers accurate direction and lane information that is not available from existing radar companies, which leads to various applications such as Enforcement system, VDS, Smart Intersection System, Pedestrian safety system, etc.



Speed Enforcement System
Red-light Enforcement System



VDS (Vehicle Detection System)
AIDS (Automatic Incident Detection System)



Smart Intersection System



Pedestrian Safety System
Automatic walking signal extension system



DFS (Driver Feedback Sign)



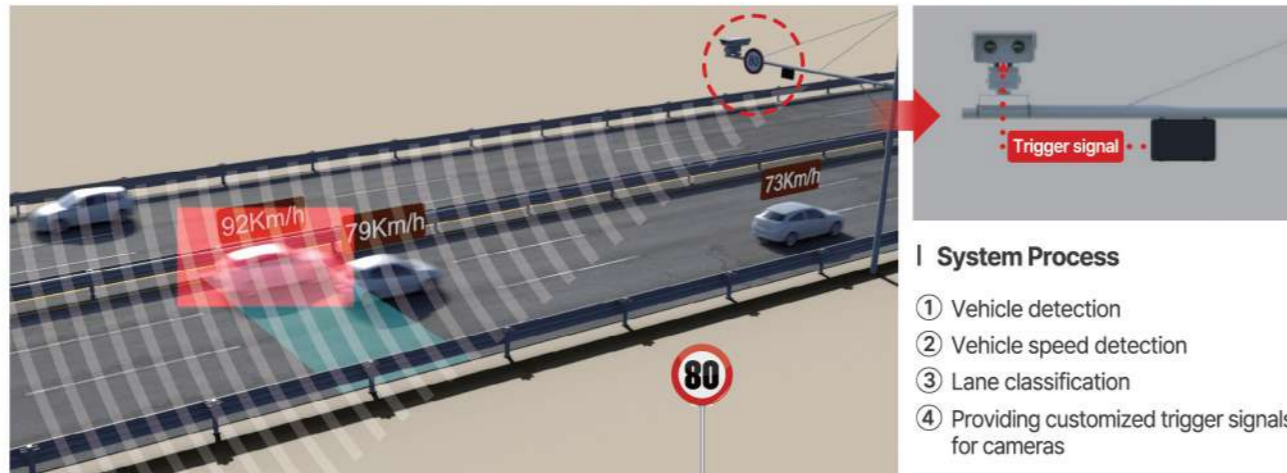
Road Collision Prevention System



4D Radar-Based Emergency Fall Detection

01 | Speed Enforcement System

Detect/distinguish vehicles present in each lane in the detection area and detect the speed of the vehicle to provide a digital trigger signal to a law enforcement camera so that the camera can take a photo of the speeding vehicle.



Features of Speed Enforcement System

- Digital tiggering for speeding vehicles
- Speed measurement for less than $\pm 250\text{km/h}$
- Authenticated speed accuracy
- Side installation for law enforcement possible

02 | Red-light Enforcement System

It detects a stationary vehicle in a stop signal at a specific point on the road, detects a vehicle that ran a red light and provides a digital trigger signal for a law enforcement camera to capture an image

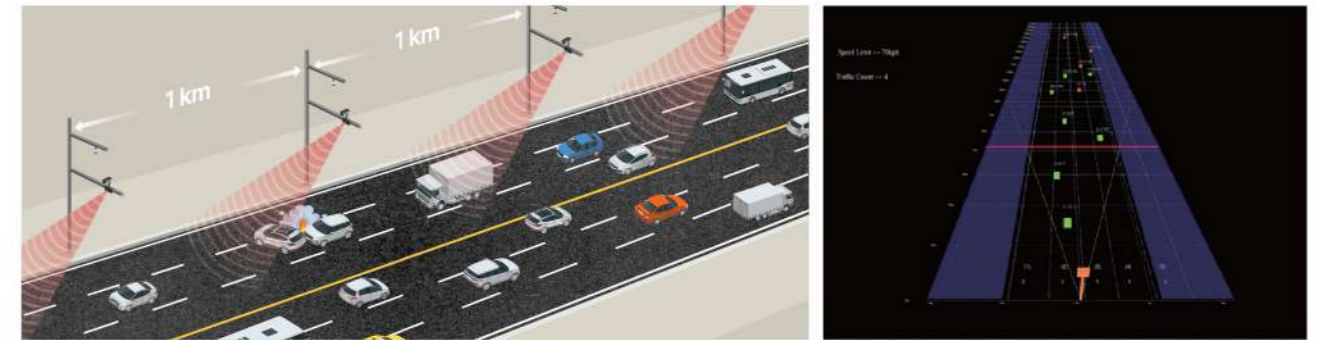


Features of Red-light Enforcement System

- Digital tiggering for vehicles in violation
- Combined Speed/Red-light enforcement
- Lane specific car detection

03 | VDS(Vehicle Detection System)

Collect traffic information(traffic counting, speed, occupancy etc.) on a multi-lane road with one radar. Mainly applied to arterial road difficult to construct or to maintain and repair.



Automatic Incident Detection System(AIDS)



Features of VDS

- Accuracy of traffic measurement: typ. > 95%
- Detecting events for stopped vehicles, slow vehicles, wrong-way vehicles, and vehicles on road shoulder

04 | Smart Intersection System

Real-time collection of various traffic information through radars and cameras installed in each direction within an intersection.



Items	Performance Results
Traffic count	98.0%
Vehicle classification	97.9%
Queue length	97.3%

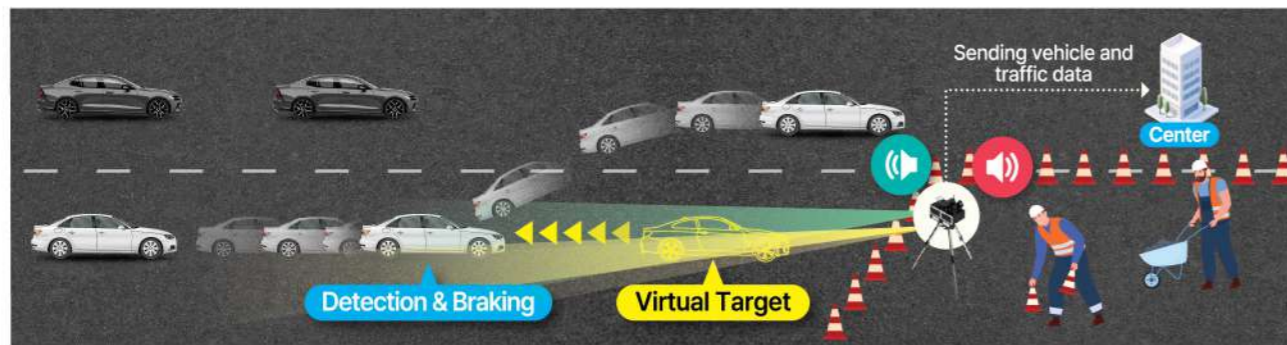
Features of Fusion Systems(Radar + Camera)

- Resilient in nighttime, heavy snow and other environments
- Deep learning-based traffic data collection
- Collected Information: Traffic volume, vehicle classification, occupancy rate, queue length, stop line violations, incident information, location data, etc.
- Achieved Highest Grade in National Certification Performance Evaluation

"Supply the first smart enforcement RADAR sensor for the National Police Agency in Korea [Certified to have passed performance evaluation]"

05 | Road Collision Prevention System

This smart traffic safety solution detects approaching vehicles in road work zones, generates virtual targets, and issues alerts to guide driver attention and induce deceleration, enhancing worker safety and preventing collisions.



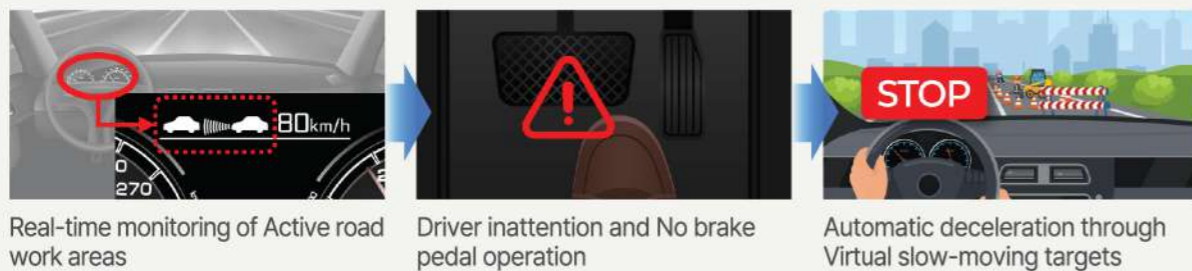
I System Process

- 1 A vehicle equipped with SCC approaching a construction zone
- 2 If the vehicle is approaching at high speed, the system detects the need for deceleration and generates a virtual low-speed driving target
- 3 The virtual low-speed target is transmitted to the vehicle, causing the SCC system to automatically decelerate and avoid the hazard
- 4 Voice alerts from speakers and smart safety helmets alert workers about approaching vehicles

System Concept



System Operating Step



Real-Time On-Site Monitoring System

Real-time data collection through the on-site system



- Collection of local traffic communication data
- Warnings for approaching hazardous vehicles
- Provision of event-related information

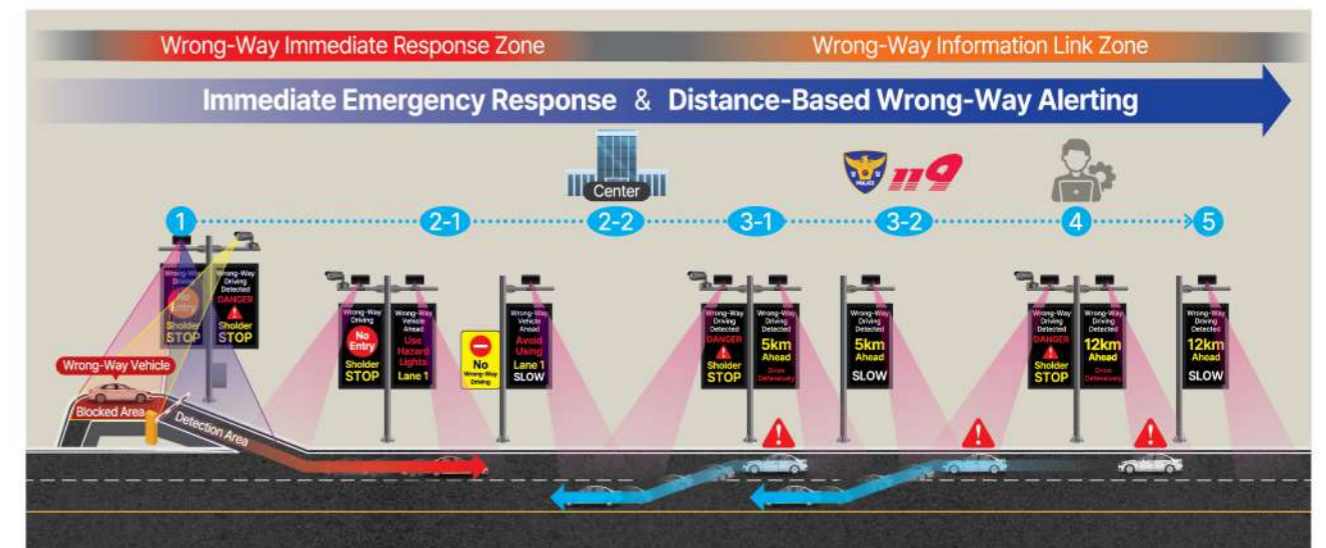
Event Logging & Real-Time Monitoring



- Real-time location tracking of work zones
- Monitoring of traffic delays in work zones
- Real-time monitoring of on-site safety conditions

06 | Wrong-Way Detection & Emergency Response System

This system detects wrong-way vehicles in real time, alerts the driver, and prevents accidents using LED barriers and display boards. It also warns oncoming traffic via displays, enabling them to avoid collisions.



I System Process

- 1 Wrong-Way Detection
- 2-1 Immediate physical block (barrier arm) & Emergency alert display
- 2-2 Transmission of emergency alert to the control center
- 3-1 Distance-Based Tiered Alerts
- 3-2 Coordination with fire and police departments
- 4 Administrator terminates Alert
- 5 Return to Normal Mode

07 | 4D Radar-Based Emergency Fall Detection

The 4D radar sensor ensures privacy without the use of light or cameras. It instantly transmits emergency alerts to the monitoring system for rapid response and offers reliable detection even in darkness or obstructed environments.



I System Process

- 1 A fall incident occurs
- 2 The 4D radar detects the fall using its precise indoor object tracking capabilities
- 3 Radar data is sent to the gateway, which transmits biometric data to the cloud
- 4 The administrator is notified through the management platform, assesses the situation, and takes appropriate action

Features of 4D Radar-Based Emergency Fall Detection

- Privacy-Protected, No Image Data Collected
- Real-Time Fall Event Detection
- Multi-Room Integrated Monitoring
- Expandable to Hospital Automation & Smart Care Systems