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ITS Application of IHI 3D Laser Radar

June. 20156
Security Project Dept.
Intelligent Information Management Headquarters
IHI Corporation

About: IHI Corporation

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- IHI seeks to solve the various environmental, industrial, social and energy related problems of the 21st century by utilizing it's engineering expertise and focusing on _"Monozukuri"_ technology.
- In striving towards these goals, IHI is becoming a _global enterprise_ offering the safety and security solutions for the benefit of both the environment and humanity.
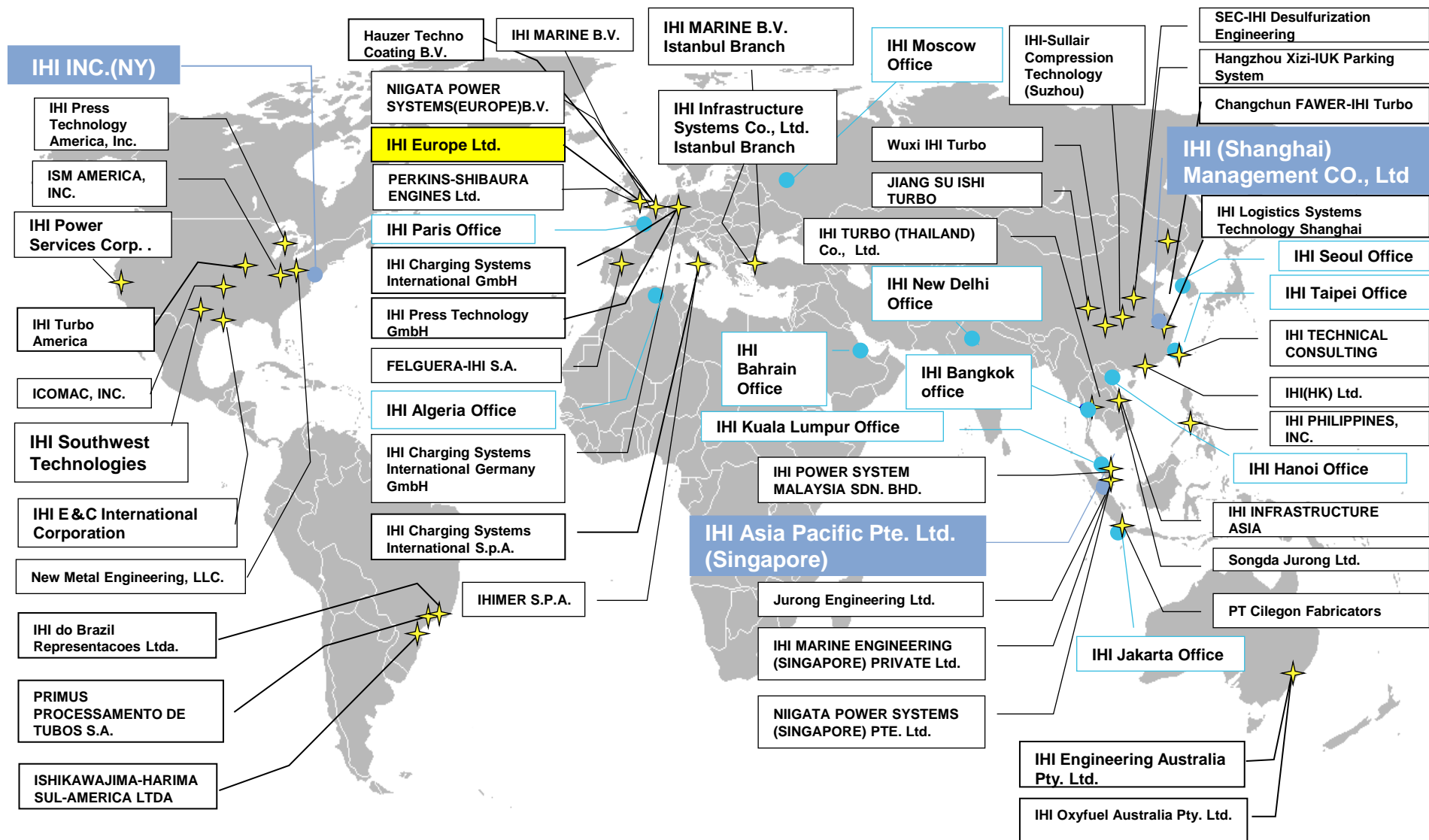

Company Name	IHI Corporation
Founded	December 5, 1853
Capital	107.1 billion yen
Net Sales (Consolidated)	1,455.8 billion yen (FY 2014)
Employees (Consolidated)	28,533 (as of March 31, 2015)
Branches & Offices	Domestic: 18 / Overseas: 15
Subsidiaries & Affiliates	253 (including 166 overseas subsidiaries & affiliates) as of March 31, 2015

Business Areas

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Resources, Energy and and Environment
(Boiler, Gas Turbine/Gas Engine, LNG Terminal, Process Plant, Nuclear Equipment, etc.)

Aero Engines and Space
(Jet Engine, Rocket)

Social Infrastructure and Offshore Facilities
(Bridge, Transportation System, Security, etc.)

Resources, Energy and Environment

Aero, Engines and Space

Social Infrastructure and Offshore Facilities

Industrial Systems and General-Purpose Machinery

General-Purpose Machinery
(Compressor, Separator, Turbo charger, etc.)

Industrial Systems
(Steel Manufacturing Furnaces, Heat/Surface Treatment Equipment, Logistics Systems, Material Handling Equipment, etc.)

IHI Global Network

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IHI INC.(NY)

- IHI Press Technology America, Inc.
- ISM AMERICA, INC.
- IHI Power Services Corp. .
- IHI Turbo America
- ICOMAC, INC.
- **IHI Southwest Technologies**
- IHI E&C International Corporation
- New Metal Engineering, LLC.
- IHI do Brazil Representacoes Ltda.
- PRIMUS PROCESSAMENTO DE TUBOS S.A.
- ISHIKAWAJIMA-HARIMA SUL-AMERICA LTDA

- Hauzer Techno Coating B.V.
- IHI MARINE B.V.
- NIIGATA POWER SYSTEMS(EUROPE)B.V.
- **IHI Europe Ltd.**
- PERKINS-SHIBAURA ENGINES Ltd.
- IHI Paris Office
- IHI Charging Systems International GmbH
- IHI Press Technology GmbH
- FELGUERA-IHI S.A.
- IHI Algeria Office
- IHI Charging Systems International Germany GmbH
- IHI Charging Systems International S.p.A.
- IHIMER S.P.A.

- IHI MARINE B.V. Istanbul Branch
- IHI Infrastructure Systems Co., Ltd. Istanbul Branch

- IHI Moscow Office
- IHI-Sullair Compression Technology (Suzhou)
- Wuxi IHI Turbo
- JIANG SU ISHI TURBO
- IHI TURBO (THAILAND) Co., Ltd.
- **IHI New Delhi Office**
- IHI Bahrain Office
- IHI Bangkok office
- IHI Kuala Lumpur Office
- IHI POWER SYSTEM MALAYSIA SDN. BHD.

IHI Asia Pacific Pte. Ltd. (Singapore)

- Jurong Engineering Ltd.
- IHI MARINE ENGINEERING (SINGAPORE) PRIVATE Ltd.
- NIIGATA POWER SYSTEMS (SINGAPORE) PTE. Ltd.

- SEC-IHI Desulfurization Engineering
- Hangzhou Xizi-IUK Parking System
- Changchun FAWER-IHI Turbo

IHI (Shanghai) Management CO., Ltd

- IHI Logistics Systems Technology Shanghai
- IHI Seoul Office
- IHI Taipei Office
- IHI TECHNICAL CONSULTING
- IHI(HK) Ltd.
- IHI PHILIPPINES, INC.
- IHI Hanoi Office
- IHI INFRASTRUCTURE ASIA
- Songda Jurong Ltd.
- PT Cilegon Fabricators
- IHI Jakarta Office
- IHI Engineering Australia Pty. Ltd.
- IHI Oxyfuel Australia Pty. Ltd.

★ **Subsidiary**   ● **Regional Head Quarter**   ● **Liaison Office**

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Proven Performance & Reliability

Automatic Detection of obstacles in real time regardless of weather and lighting conditions with high resolution results.

For Railway Level Crossing Safety

- ✓ **Rich Experience; over 1,500 units in Japan and 130 units in Italy**

- ✓ **High Reliability based upon SIL4 (Safety Integrity Level) Certificate**
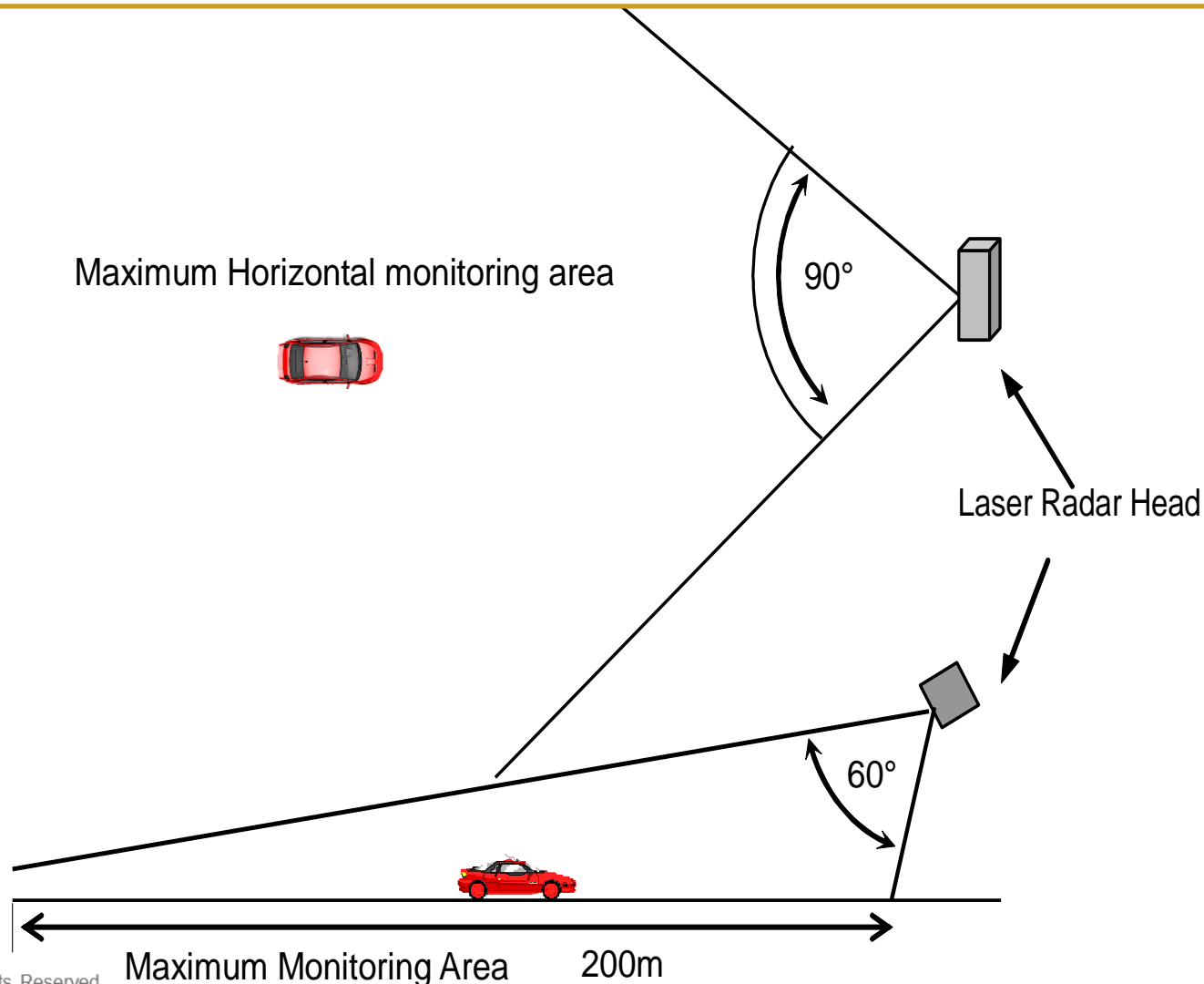 *(EN50129:2003, etc.)*

IHI 3D Laser Radar *for the Road Industry*

for ITS* Application

✓ **Trial Operations for DSSS (Drivers Safety Support System) and Automotive Vehicle Project executed in Japan and Singapore from 2012.**

(Over 50 Units under operation)

✓ **Multiple Car Accident Prevention System tested in Japan from 2015.**

ITS(Intelligent Transport System)

Features of IHI 3DLR for ITS

- ✓ One laser scanner per traffic junction approach
- ✓ Scanning range: up to 200m
- ✓ Updates vehicle/pedestrian location and speed every 100ms

Maximum Horizontal monitoring area

90°

Laser Radar Head

60°

Maximum Monitoring Area   200m

7

ITS Application 1: Junction Safety System (Support for Right & Left Turn)

Vehicle OBU Screen

DO NOT CROSS
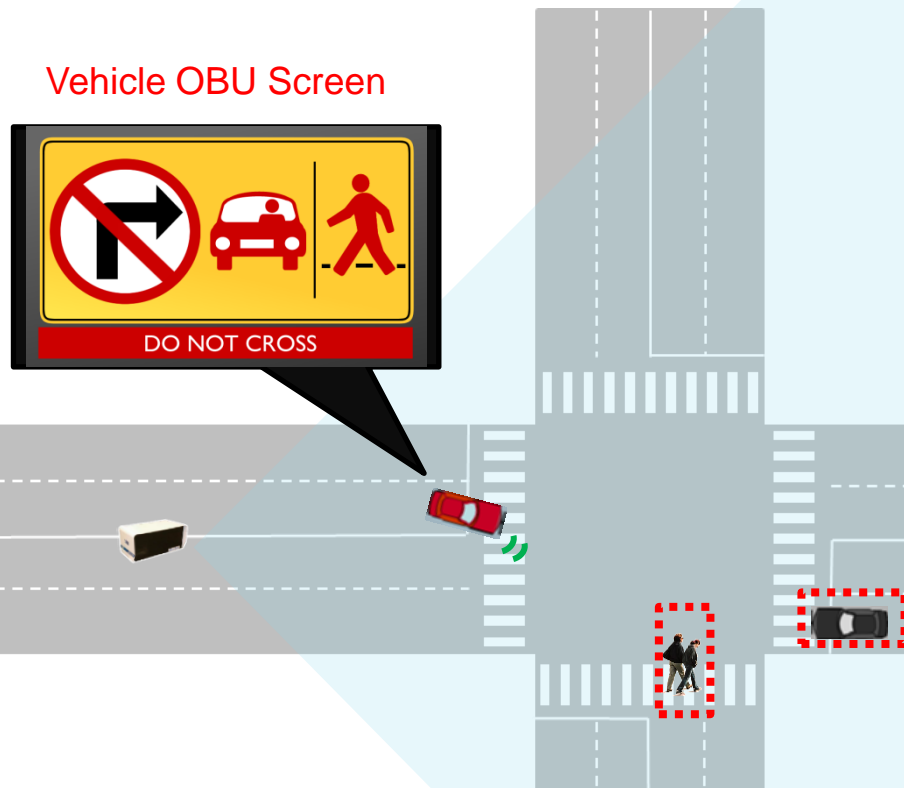
✓ **Opposed Vehicles & Pedestrians** detected by 3DLR

✓ **Detection data transmitted to vehicle via wireless communication**

✓ **Drivers are warned via alarm screen of OBU(On Board Unit)**

Drivers Safety Support System at right-hand turns has started its commercial service (limited in IHI 3DLR installed junction) in Japan from 2015.

ITS Application 2:
Vehicle Counter for Traffic Management
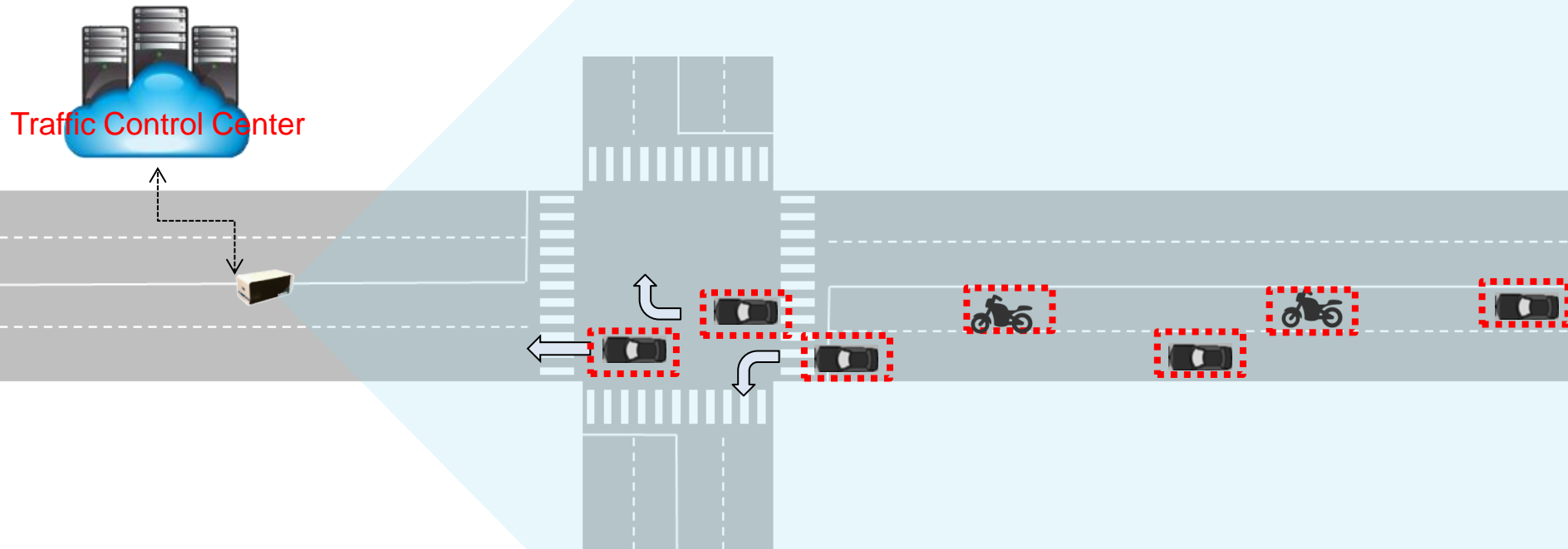
✓ **Detects not only quantity of vehicles but also direction taken at junction (higher accuracy compared to conventional vehicle detector).**

✓ **Accumulated data can be utilized by government or police for efficient traffic management.**

✓ **Contributes to smooth traffic management and CO_2 reduction.**

✓ *This application is currently under social testing in Singapore.*

ITS Application 3:
Detection of Traffic Violations: Safety Junction
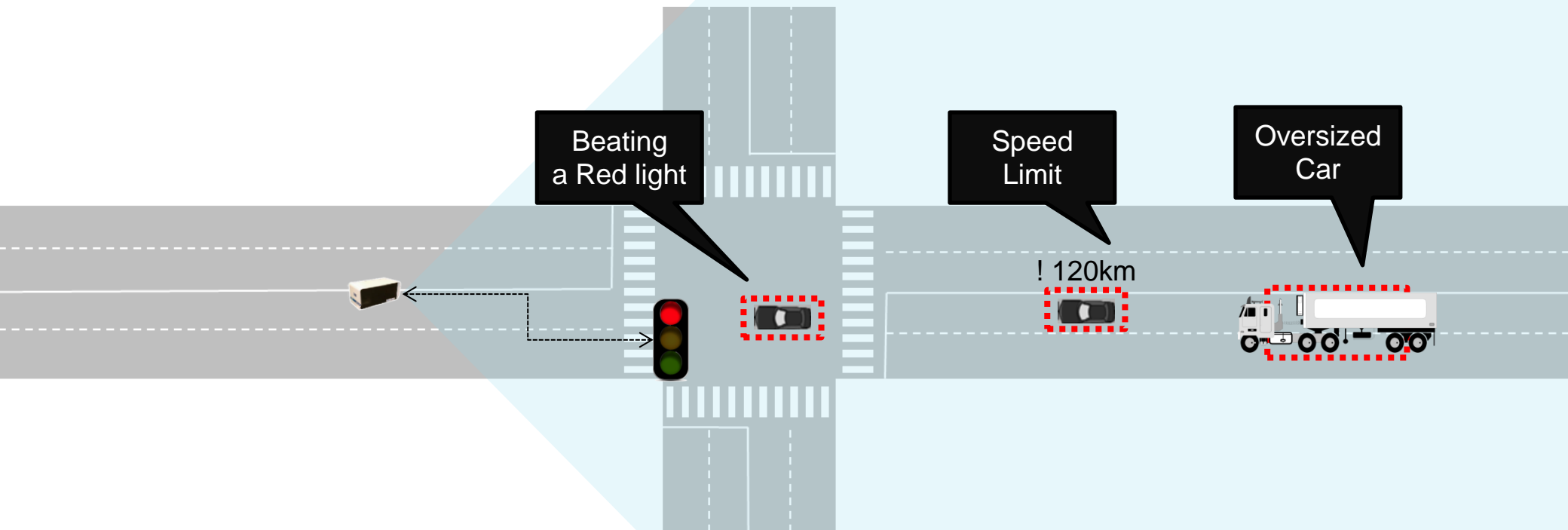
- **Communicating with traffic signal sequence condition data, 3DLR can detect traffic violations such as those highlighted above.**

- **By combining 3DLR and ANPR*'s data, the violated vehicle can be identified.** *ANPR: Automatic Number Plate Recognition*

- *This application is under social testing in Singapore in conjunction with Singapore government agencies (LTA, A*Star).*

Safety Lane Merging System *(under social testing in Singapore)*
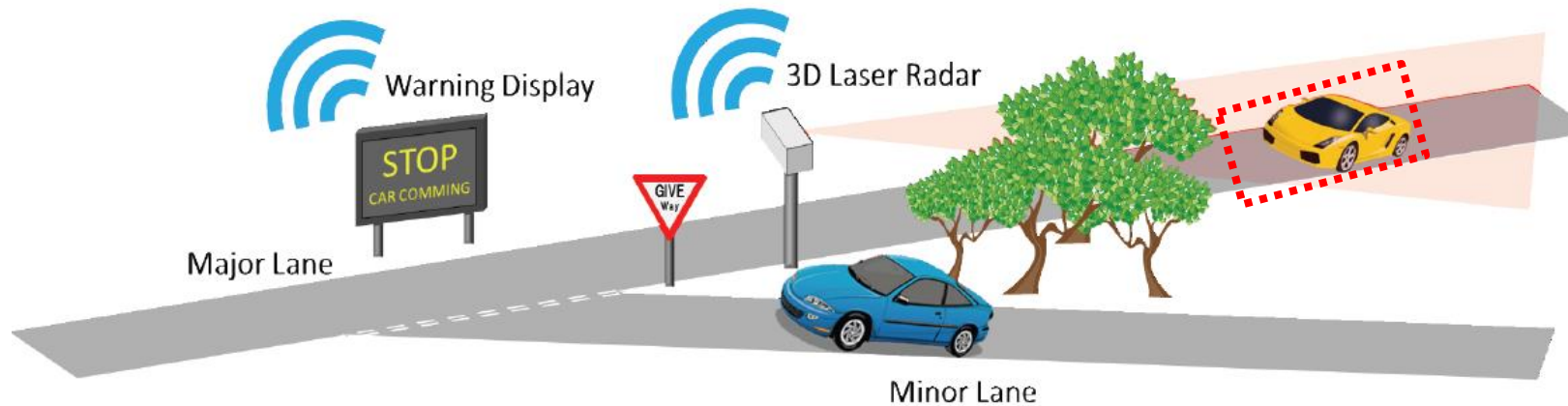
Multiple Car Accident Prevention *(under trial operation in Japan by NEXCO Central)*
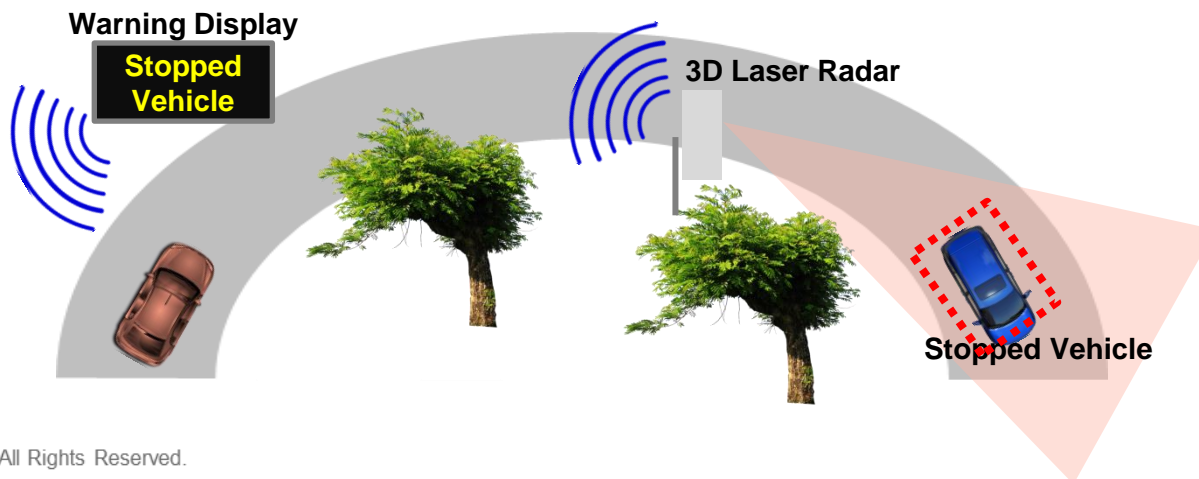
Advantages of the 3DLR ITS Application

1. World Highest Level of Detection Ability

Detects location, size, direction and velocity of object precisely regardless of weather or light conditions.
A wide detection range and high speed processing capability make it possible that just one 3DLR unit can detect numerous vehicles and pedestrians simultaneously in real time.
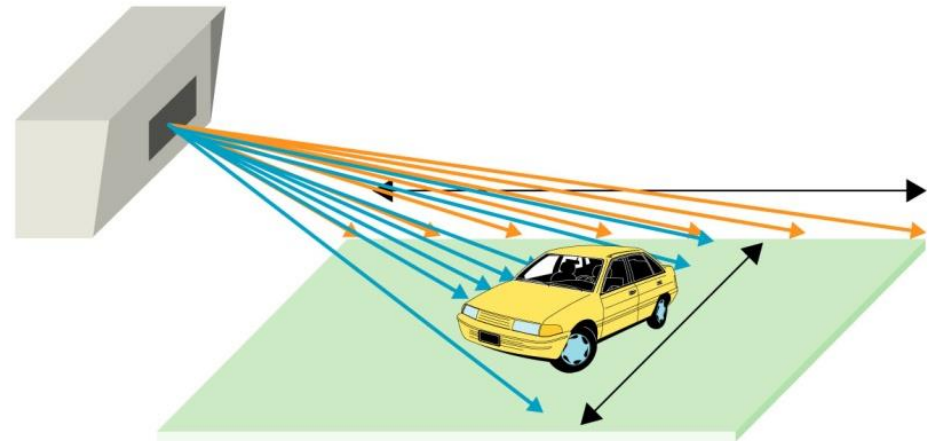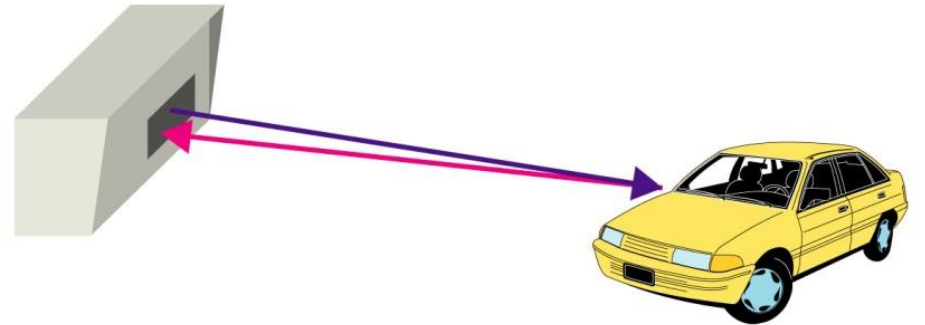
2. Multiple ITS Applications

From the driver-safety support system to vehicle counter and traffic violation detection systems, just one 3DLR is capable of being utilized for various ITS applications.
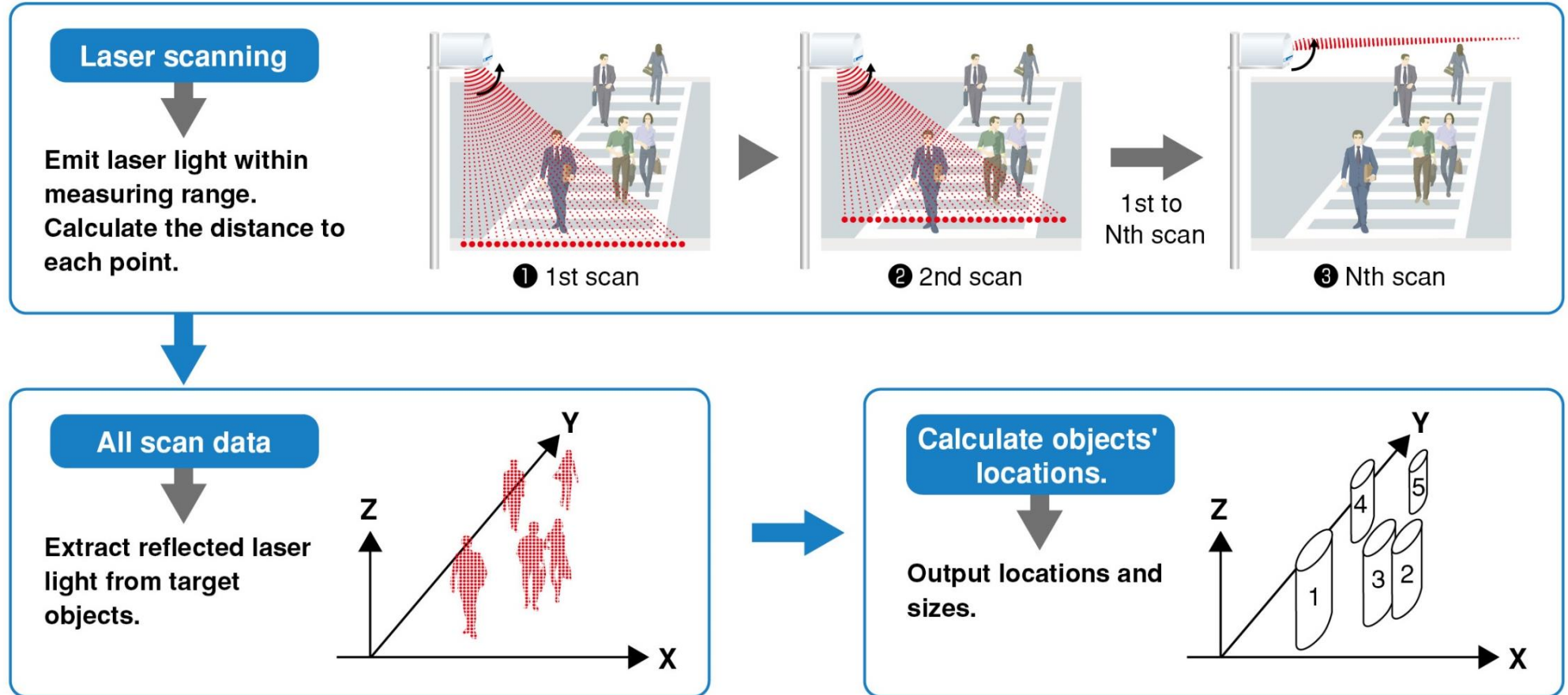
3. Improve Road Safety & Reduction of Social Costs

Our 3DLR based driver-safety support system will improve road safety remarkably. This means indirect social costs caused by road accidents can simultaneously be reduced. Other 3DLR ITS functions, such as vehicle counter, also will reduce the costs shouldered by governments and police who conduct traffic management and traffic enforcement.

Technical Information: Detection Method 1

1. The light from the laser beam reflects off the object back to the 3DLR head. The time it takes for the reflection to return is then measured in order to calculate the position of the object. (TOF: Time of Flight)

2. The laser beam scans in different directions at different points to gain a 3D image.

3. When the above information is combined, a 3D shape can be detected as well as its velocity.

Technical Information: Detection Method 2

Laser scanning

Emit laser light within measuring range. Calculate the distance to each point.

❶ 1st scan

❷ 2nd scan

1st to Nth scan

❸ Nth scan

All scan data

Extract reflected laser light from target objects.

Calculate objects' locations.

Output locations and sizes.

Technical Information: 3DLR Specification

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Item	*Specification*
Measuring range (m)	Max 200m*
Measuring angle (degree)	Horizontal　max 90°
	Vertical　max 60°
Detection time (s)	Min 0.1(s)〜Max 3(s)
Laser safety standard	IEC60825-1　Class1 JIS C 6802　Class1

* Variable depending on the object

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