

MITSUBISHI

Intelligent Transport Systems Solutions, Technologies and Products



Mitsubishi's ITS realizes better life

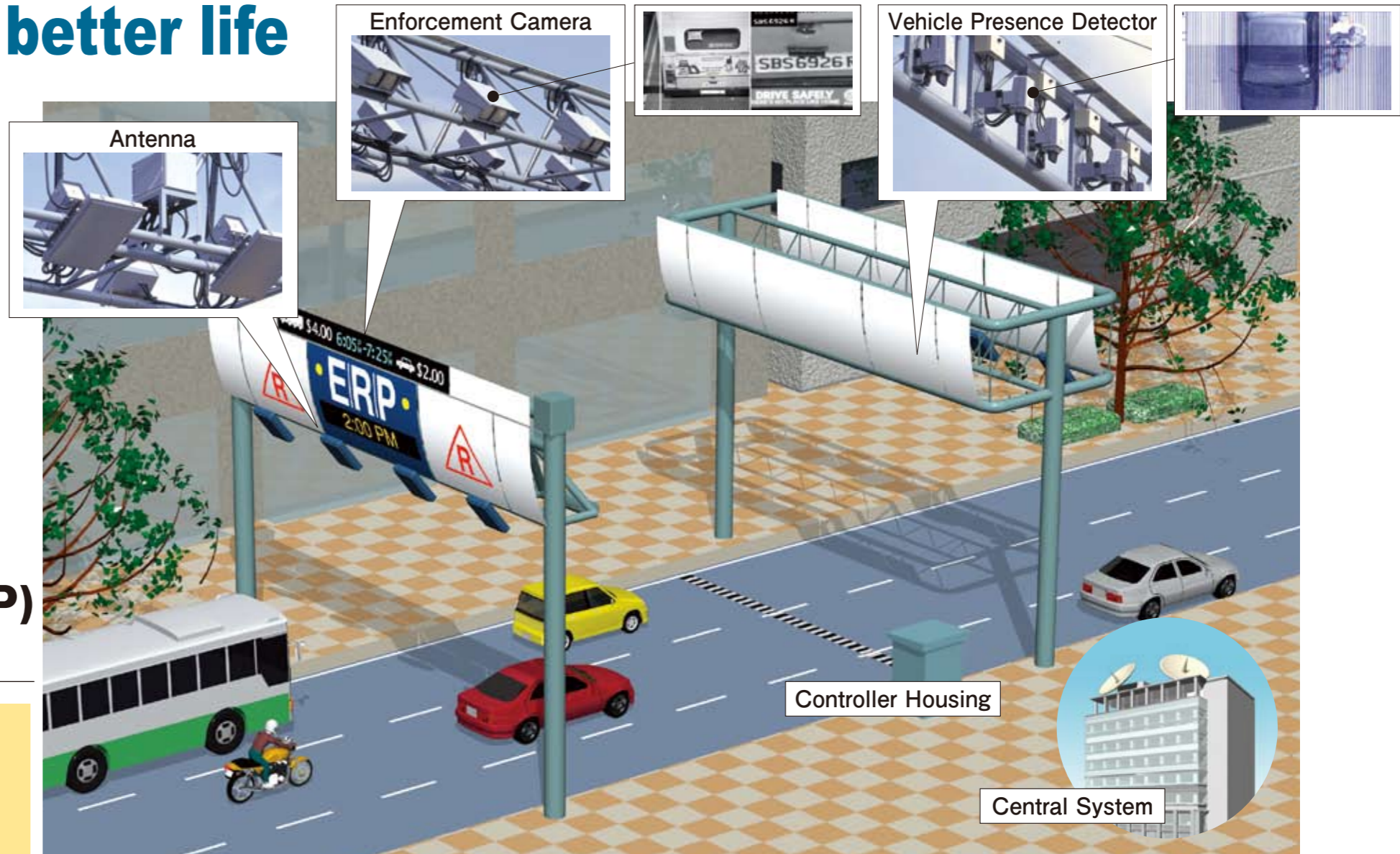
Mitsubishi has been the world leading company in the field of Toll Collection System since started business in 1964, and Mitsubishi has been offering the best solutions to clients at any time as technology advances.

Through continuous effort to develop toll collection systems, Mitsubishi has accumulated technical know-how for payment, vehicle identification/classification, enforcement, data acquisition, system integration of those technologies and its operation. Mitsubishi provides these technologies and overall solutions to clients.

By using these know-how, Mitsubishi expanded its business field into Intelligent Transport Systems in order to realize safe and eco-friendly motorized society.

Electronic Road Pricing (ERP) System in Singapore

World First Automated Road Pricing System (Since 1998)
Required Error Rate : Less than 1/100,000
85 outstations(as of Dec. 2008)



1 Purpose

In order to reduce traffic congestion in the city area, Singapore Government introduced the world-first automated road pricing system, which charges toll from all motorists entering into city area through electronic payment.

2 World First Automated Multi-lane Free-flow Road Pricing System

This is the world first system as 1) Multi-lane Free-flow and 2) 2-piece On-board Unit (OBU) with IC card. Every vehicle has to equip "IU" (In-vehicle Unit, same as OBU) with IC card. Outstation (Gantry) deducts money from IU through microwave DSRC (Dedicated Short Range Communications) immediately after the vehicle passes through the Gantry. The error rate required by the system is less than 1/100,000.

3 Vehicle Identification

The Vehicle Presence Detector (VPD) scans the road and identifies the vehicle width in 250mm. VPD triggers Enforcement Camera to capture the image of offending vehicles.

4 Enforcement

When ERP system consolidates the communication logs and the result of vehicle classifications and identifies "Violation" such as No IU, No IC Card, and Low Card Balance, Enforcement Camera System automatically captures the license plate number by Optical Character Recognition (OCR) technologies.

In-vehicle Unit (IU)

All vehicles are categorized into 6 types for ERP in Singapore. The IU is fitted with secure method on windshield inside vehicle and accepts both Contact IC Card and Contactless IC Card for payment. Power is supplied by vehicle battery.

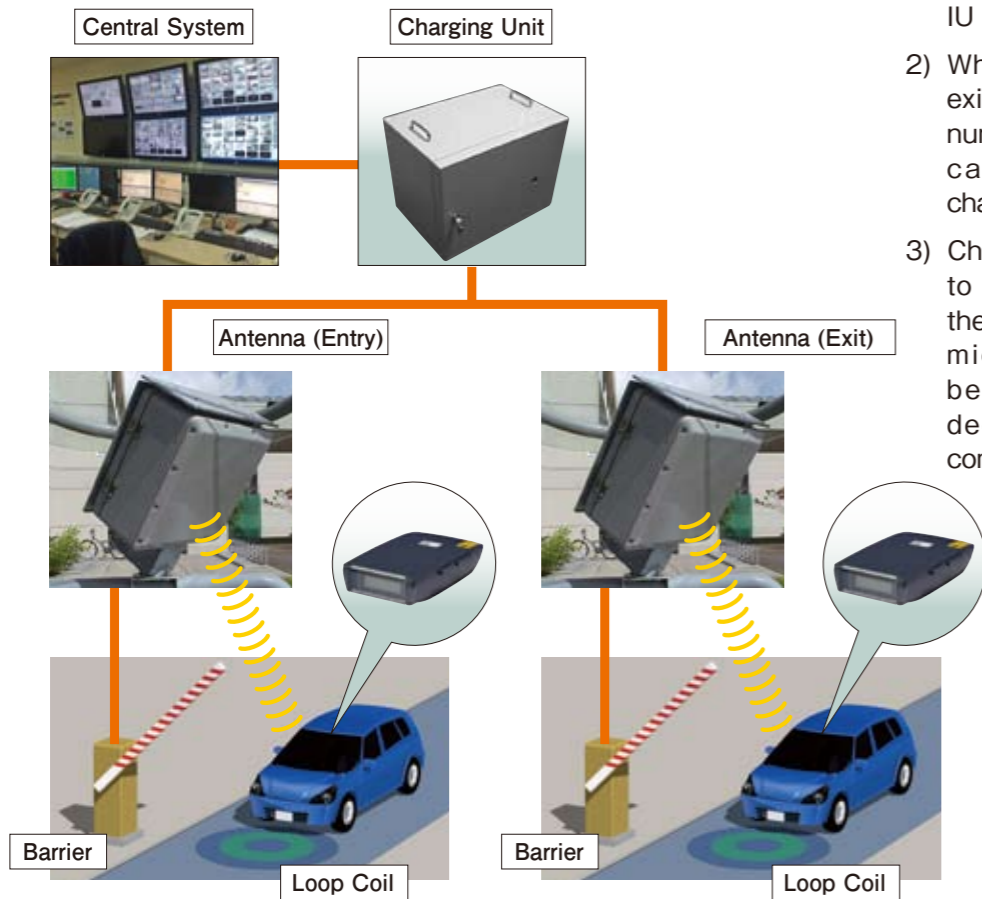


Electronic Parking System (EPS)

In Singapore, many parking spaces adopt automated fee collection system by using ERP technology, so called EPS. Since each IU has unique identification number, the system is able to recognize the time how long each vehicle has been in the parking lot. The parking fee can be deducted from IU, in the same manner as ERP System. The system can be used not only for parking fee collection, but also for access control and other purposes.

Motorist just goes through the entry/exit of the parking lot.

System Configuration



How does it work?

- 1) When a vehicle approaches entry point, antenna reads the IU number.
- 2) When the vehicle approaches exit point, antenna reads the IU number again, and the system calculates the time to be charged.
- 3) Charging Unit gives commands to the exit antenna to charge the calculated amount. By the microwave communication between antenna and IU, deduction of the charge is completed.
- 4) As for Access Control System, only registered vehicles is authorized to enter into restricted area by identification of the unique IU number.



Outdoor Space Parking

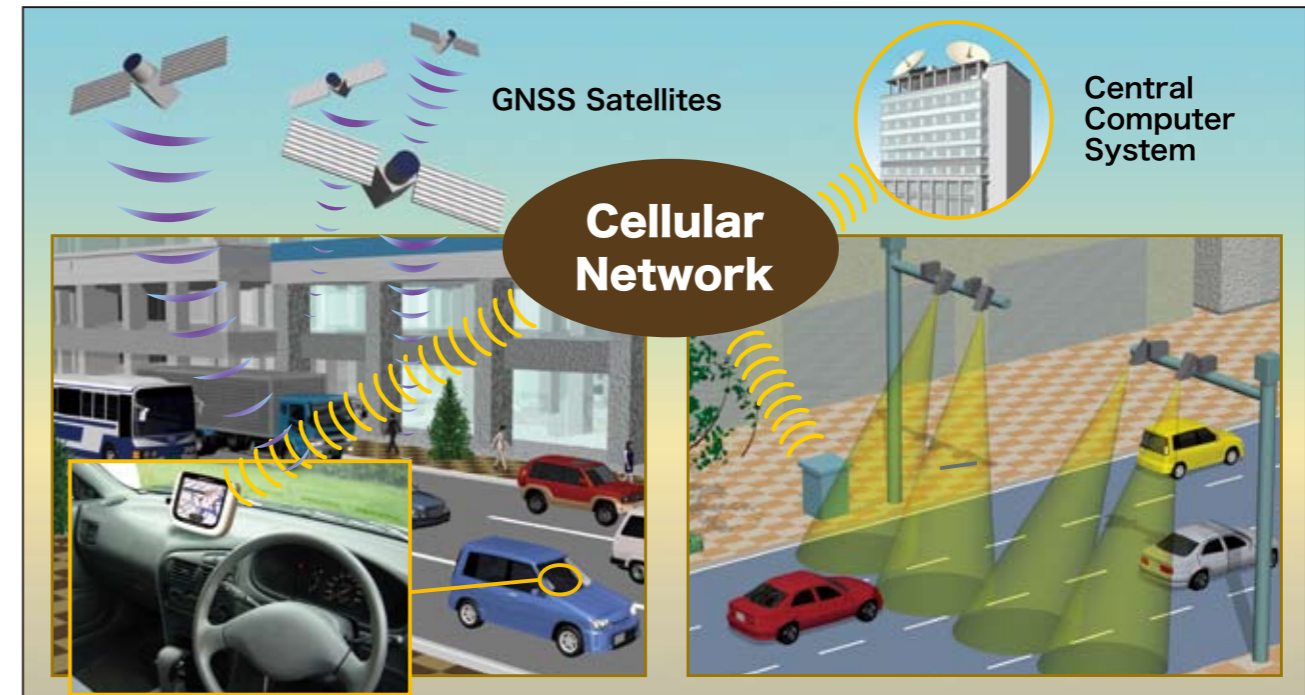


Indoor Space Parking

GNSS/CN-based System

Mitsubishi's new ITS system based on Global Navigation Satellite System and Cellular Network (GNSS/CN) is developed for traffic demand control scheme especially for road user charging.

- 1) Flexible Charging Scheme
- 2) No Heavy Infrastructure on Roadside
- 3) Various Applications



Applications

1 Congestion Management System

By information collected from vehicles, the system identifies the congested place and show the recommendable route to drivers.

2 Bus Location System

The system informs the bus locations to every bus stops and passengers are able to know how long they should wait for the bus which they want to take.

3 Designated Vehicle Tracking System

Hazardous goods vehicles are tracked by the system. The system and OBU have alarms if the vehicle goes out of the designated routes.

4 Broken-down Vehicle Alarm

When any vehicle stops at roadside of expressway, the system will send a command to expressway operator to help the broken-down vehicle.

5 Suspicious Vehicle Alarm

In case there are vehicles moving or staying in the restricted area, the system sends an alarm automatically to the police or security guard to help them eliminate the danger.

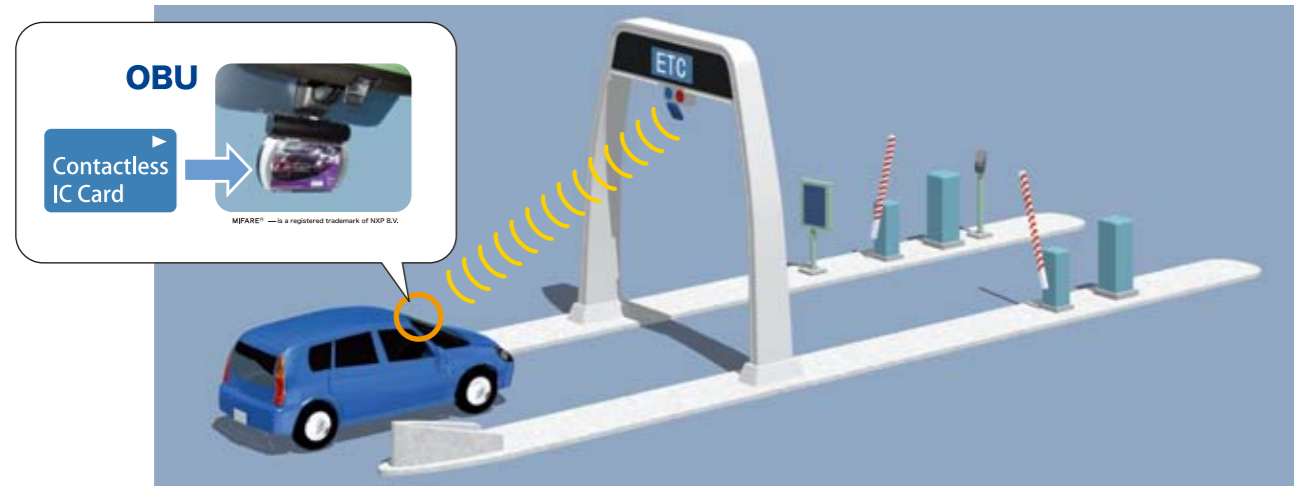
Active 5.8GHz DSRC Electronic Toll Collection (ETC) System

Mitsubishi's newly launched ETC System adopts the Active 5.8GHz Microwave Dedicated Short Range Communication (DSRC) in compliant with ITU and ISO standards. This world latest technology has more advantages than that of other technologies and standards.

- 1) High Speed and Reliable Communication
- 2) Payment by IC card in On-board Unit
- 3) One Gantry Structure for Free-flow Operation
- 4) Expandability toward ITS applications

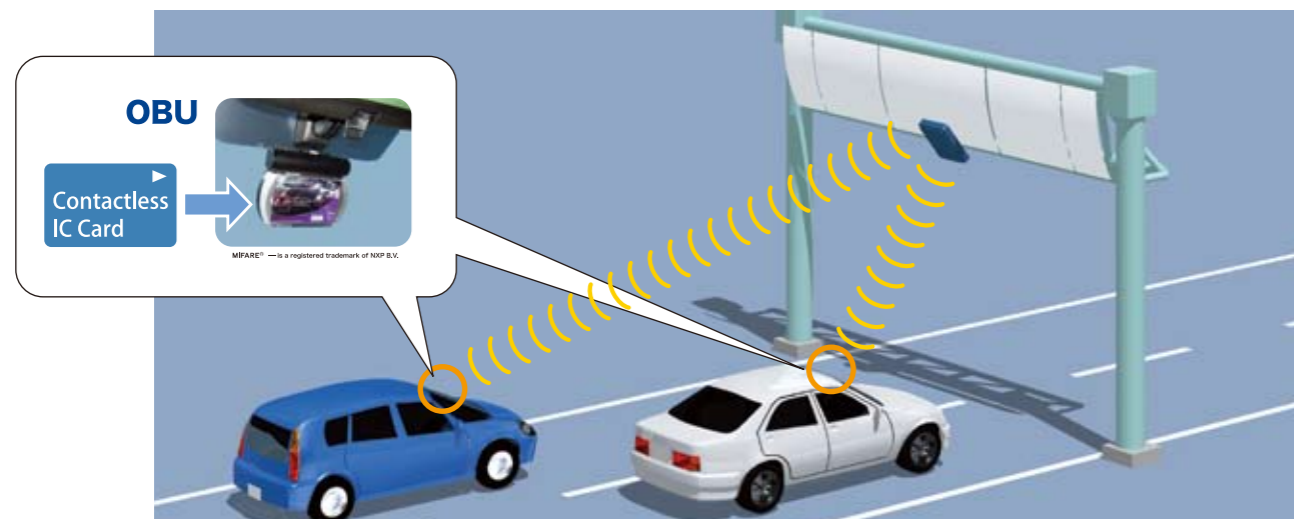
Single-lane

A vehicle goes through the dedicated ETC lane for toll collection.



Multi-lane Free-flow (MLFF)

Multiple numbers of vehicle go through a gantry with highway speed. The vehicles can change their lanes even under the gantry.



On-board Unit (OBU)

Communication Method : 5.8GHz Active Microwave DSRC
 Payment : Contactless IC Card
 Power : Cell Type Battery

What is Active DSRC?

The chart below shows the comparison between Active and Passive DSRC. Even though both technologies are authorized by ITU and ISO and each radio frequency is equal, Active DSRC is much more powerful in terms of data rate and communication distance. These technical features allow Active DSRC to realize reliable payment by IC card even high speed under multi-lane free-flow operation and support future ITS applications.

Active-DSRC	RF	Passive-DSRC
5.8GHz	5.8GHz	5.8GHz
Active (Transceiver)	Comm.	Passive (Transponder)
1M	Speed (bps)	Down:500k Up:250k
30m	Coverage (Footprint)	15m
80MHz	Band	20MHz

Proof-of-concept Pilot Project

Mitsubishi demonstrates Active 5.8GHz DSRC ETC in various locations to prove its quality and reliability. In Malaysia, the OBU is designed to accept existing multi-purpose prepaid contactless IC card (electronic purse) to facilitate upgrade from current toll system to Mitsubishi's new ETC system.



Operation at Kuala Lumpur, Malaysia



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