RUC schemes using **GNSS** in the world

Legend:
- Deployed / Working
- Planned / Procurement
- Potential

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eTolling/RUC:
Technology comparison related to **technical features**.

| Main technology	OBU Need	Investment costs (CAPEX)	Operational costs (OPEX)	Physical Gantry		Independence on Vehicle speed	Independence on weather conditions	Interoperability	Vehicle registration update for payment	Privacy
				Identification	Enforcement					
GNSS (OBU-based)	➖	➖	➖	✅	➖	✅	✅	✅	✅	✅
DSRC	➖	❌	➖	➖	➖	➖	✅	✅	✅	✅
Video (ANPR)	✅	❌	➖	➖	✅	➖	❌	❌	➖	✅
RFID	➖	❌	❌	➖	➖	❌	❌	❌	✅	✅
GNSS (Smartphone-based)	✅	➖	✅	✅	➖	✅	✅	✅	✅	✅

eTolling/RUC:
Technology comparison related to **Non-technical features**.

Main technology	Costs efficiency	EU directives & standards interoperability and compatibility	Flexibility and scalability	Simplicity of road infrastructure	Reliability in charging Performance (KPIs)	Enforcement	Value added services	User privacy Data security	Deployment time and system availability	Intermittent users management
GNSS (OBU-based)	Dependent on # vehicles and road network	+	+	+	+	=	+	+	+	+
DSRC		+	−	−	+	=	−	+	−	+
Video (ANPR)		−	−	+	−	=	−	+	−	=
RFID		−	−	−	=	=	−	+	−	+
GNSS (Smartphone-based)		−	+	+	+	=	+	+	+	+

The advantages of **GNSS technology** for **RUC** (Road User Charging)

Low infrastructure and maintenance costs
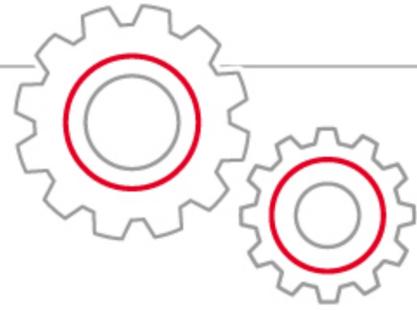
Flexible to configuration of different charging schemes
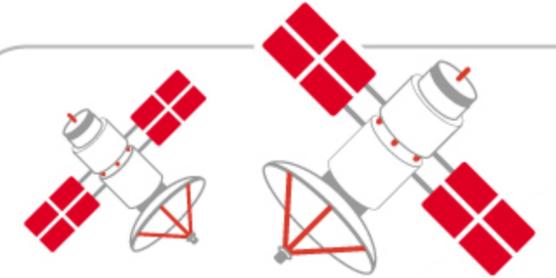
Easily scalable to new toll roads
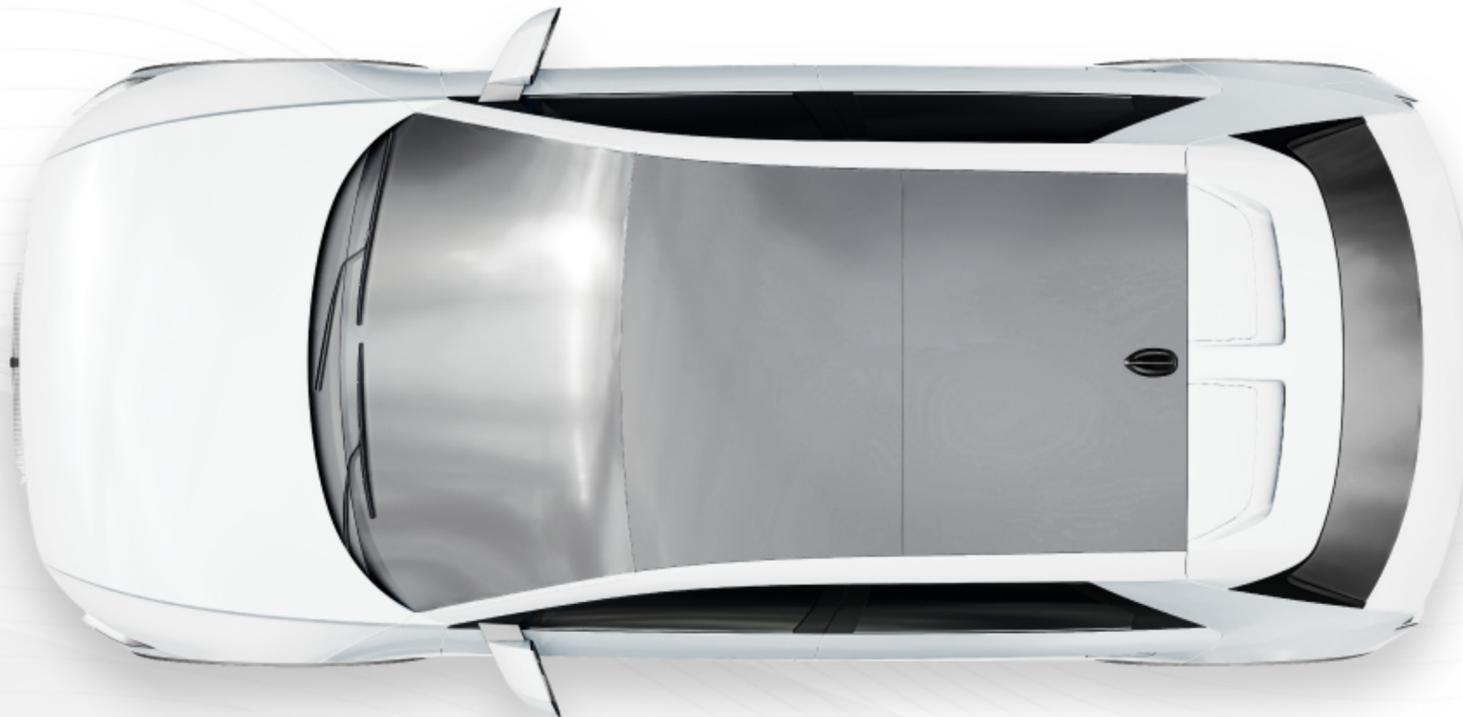
Low infrastructure dependence and reduced environmental impact

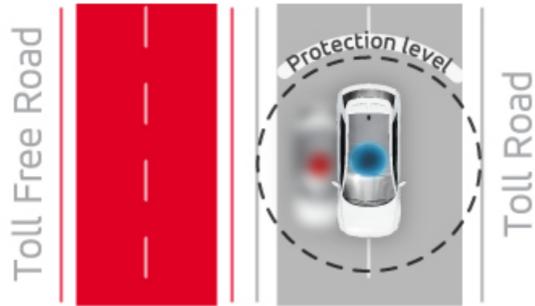Synergies with connected vehicle and C-ITS services
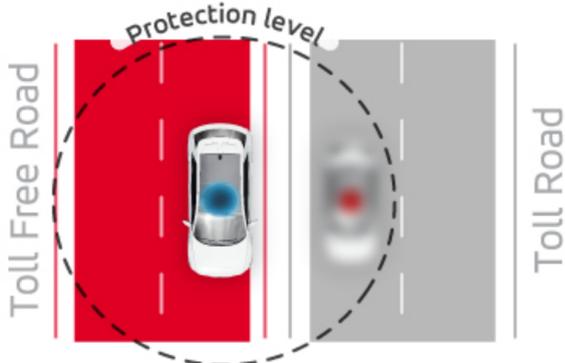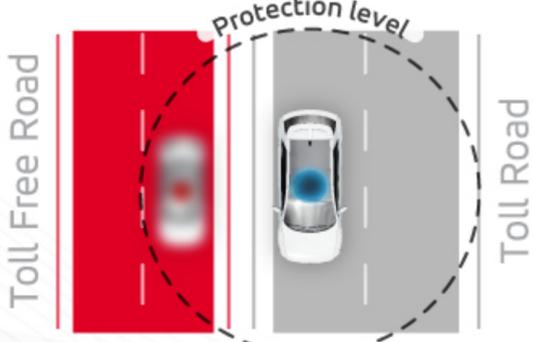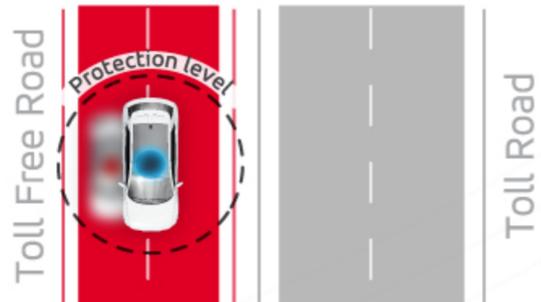
Easy to use in the deployment of traffic policies

GNSS: a mature & reliable technology used in main national schemes

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The importance of **GNSS integrity** for **RUC/eTolling** applications

EVENT MATRIX		System detects charging event	
		Yes	No
Charging event takes place	Yes	**Correct recognition** The vehicle is undoubtedly using the toll highway	**Missed recognition** (Undercharging) Large position errors don't result in an undue charge ✓
	No	**False recognition** (Overcharging) Large position errors don't result in an undue charge ✓	**Correct rejection** The vehicle is undoubtedly not using the toll highway

● True Position ● Estimated GNSS Position ✓ Integrity avoids wrong charging

Advantages of the **smartphone** as an OBU for **eTolling/RUC applications**

Scalable, updatable, and economic solutions

Input → Output

Capability to process complex algorithms with integrity

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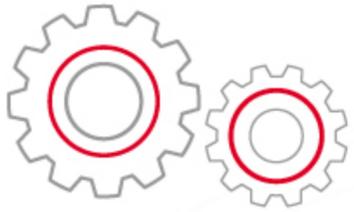
Economy of scale

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Instantaneous information to the driver

Great variety of sensors

Synergies with ITS applications, LZE, geofencing .....

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Reduced logistics and deployment costs

Much shorter development & deployment lifecycles (as compared to OBUs)

PEAJE TOLL

Several countries and operators already using this technology with millions of users

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GMV Solution for **eTolling/RUC (Road User Charging)**

Urban and non-urban scenarios

GNSS-based with map matching and sensor data fusion

SDK

RUC engine SDK available (based on distance, stretch, time, CO_2 emissions)

Customers: concessions, city councils, automotive

Smartphone apps (RUC & eTolling, LEZ, CAZ, Congestion Charging)

Input — Output

Advanced algorithms (high accuracy, integrity and reliable payment, geo-fencing)

Synergies: C-ITS / V2X, Public Transport, MaaS

Configuration System

CUSTOMER APPLICATION

Smartphone User

SDK

Middleware

Raw Data DB

Configuration DB

Processed Data DB

REST API Interface

CUSTOMER BACKEND

Post processing

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