

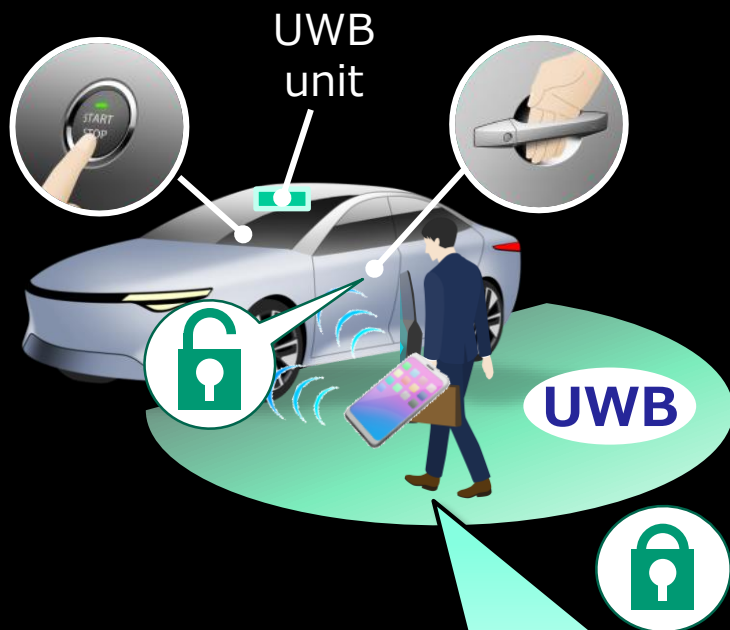
UWB antenna system for digital key

デジタルキー向け統合UWBアンテナシステム

Background

Tokai Rika promotes the use of a smartphone as a digital key.

Combined use of UWB communications to more accurately locate keys, improving safety and convenience



Doors are locked and unlocked around the vehicle, and the engine is started only inside the cabin.

NFC communication for emergencies



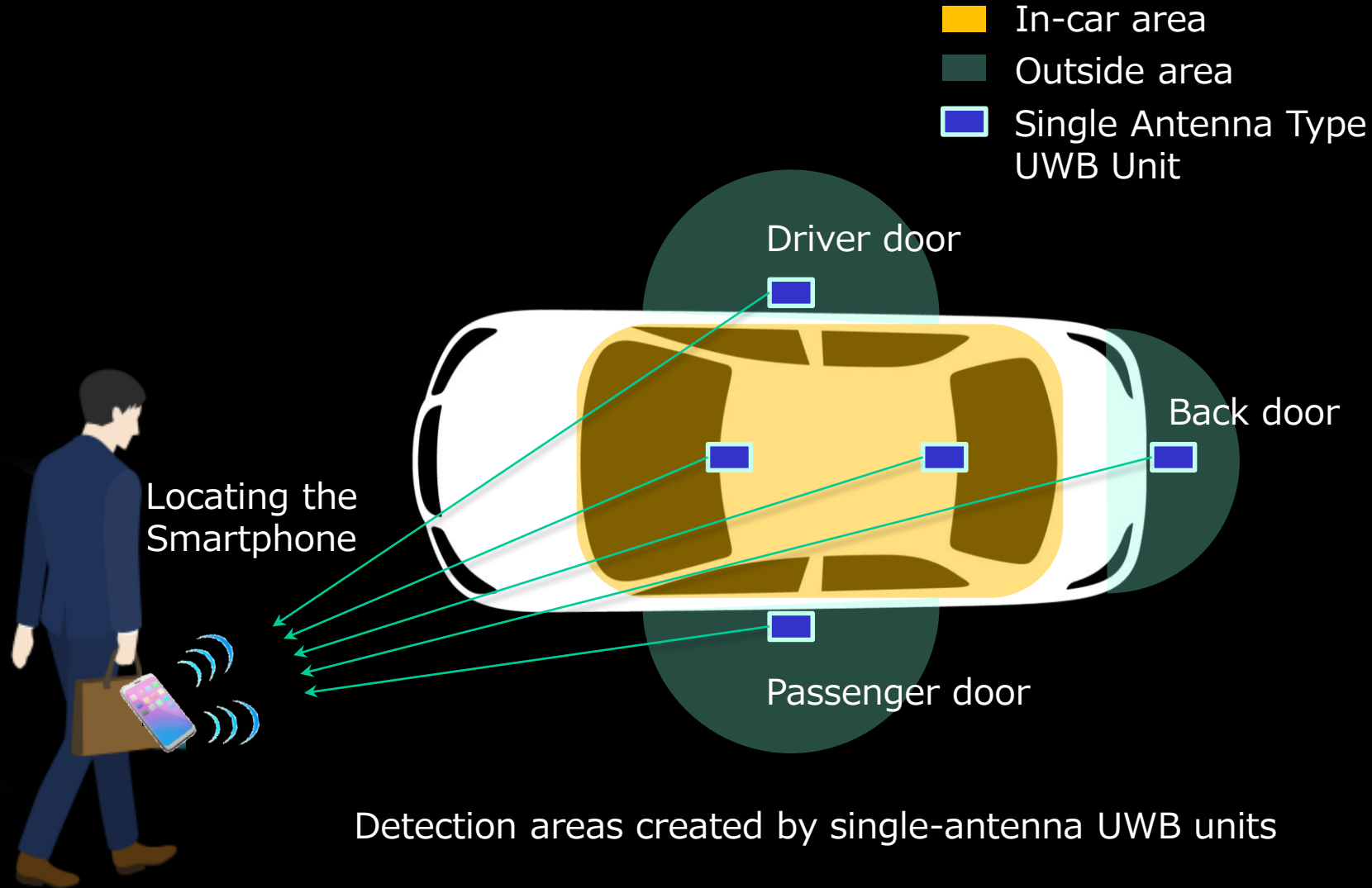
The digital key can access a car through NFC communication in case of dead battery.

Aim

Saving costs by reducing the number of UWB units for the smartphone digital key system.

Outline

Existing technology Requires at least one conventional single-antenna UWB unit per detection area to find which area the key is.



Problems that can occur if area determination is not possible with a smart key

Ex.① : The keys are left in the car and can be locked outside the car.

Ex.② : The engine can be started even though the owner is outside the vehicle.

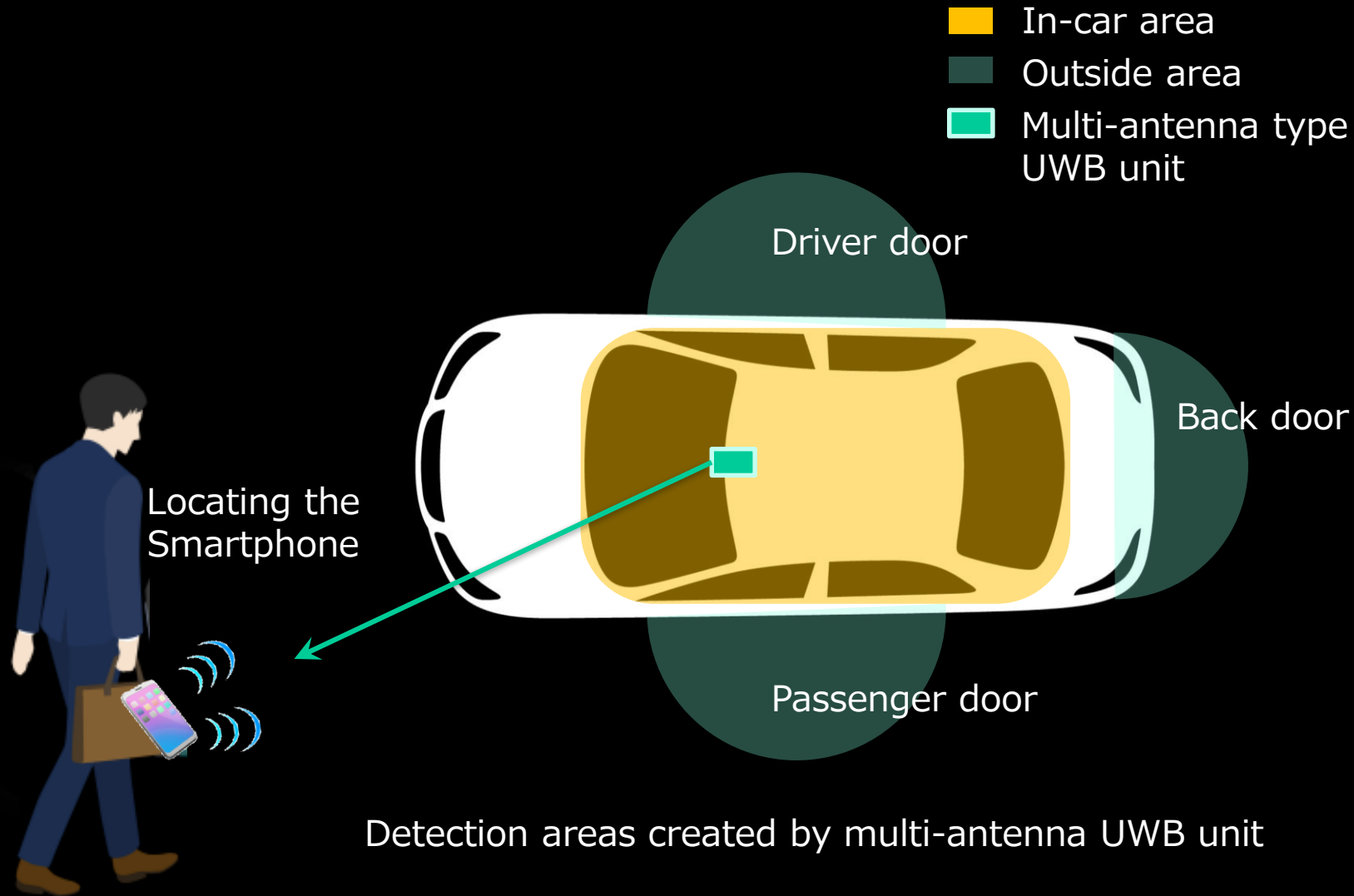


Outline

Our developed technology

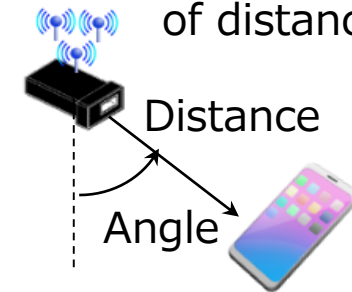
Multi-antenna type can specify not only distance but also angle (i.e., location), thus **reducing the number of units**

※Practical use in 2026 or later



Principle of multi-antenna type

Multi-antenna technique enables the estimation of distance and angle



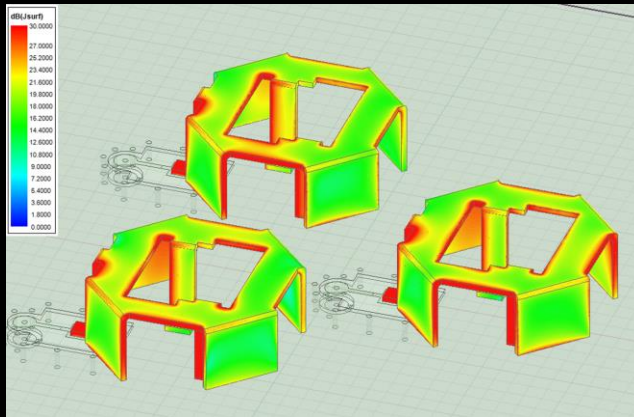
Patent applied

Technology

- The multi-antenna unit detects the angle of an incoming wave.
- Our multi-antenna technology enables each antenna to retain the properties even if they are installed close to each other.

Multi-antenna technology

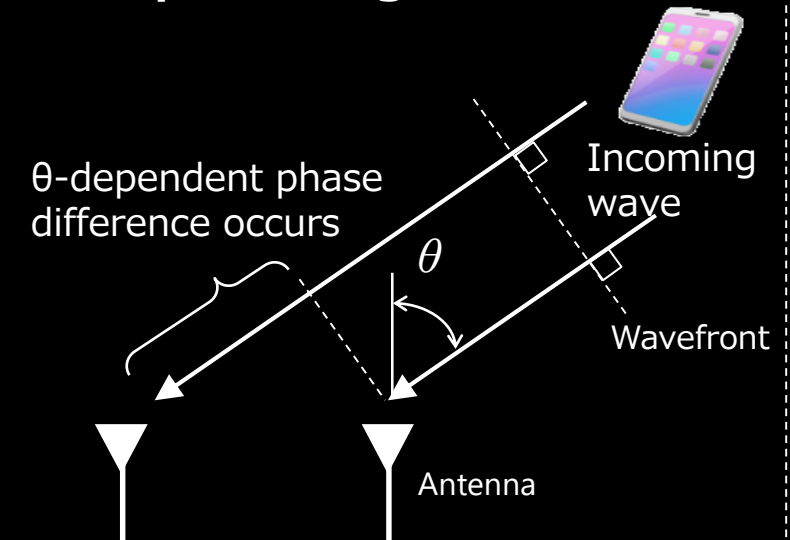
Angle estimation requires that each antenna has the same characteristics, but when placed in close proximity, the characteristics change individually, degrading estimation accuracy.
⇒ Our original technology has produced the compact unit having the same characteristics (same current distribution between antennas) without changing the antenna frequency.



Current distribution of multi-antenna

This indicates characteristics change is prevented because the current distribution of the multi-antenna is the same (same in color) as that of each antenna.

Principle of angle estimation



The arrival angle of a wave is calculated from the phase difference occurs according to the arrival angle

Patent applied

Product configuration

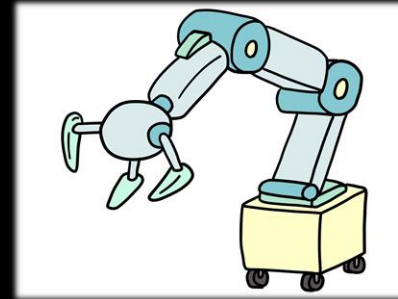
Ranging accuracy	Distance Accuracy : ± 15 cm 、 Angle accuracy : $\pm 5^\circ$
Installation function	UWB & BLE transceiver circuit、 antenna、 clock device
UWB IC	Qorvo DW3220
BLE IC	Nordic Semi nRF52
Adaptation criteria UWB	IEEE802.15.4z
Adaptation criteria Bluetooth	ver.5.x
CPU core	32-bit ARM Cortex M4 CPU
Memory area	512 kB Flash and 64 kB SRAM
Interface	CAN FD
Power supply voltage	12V
Outer dimensions	45 x 85 x 17 mm (Target value)
Operating temperature range	-40 to +105 °C

Future applications

■ Area forming, systems requiring ranging



Drones



Automatic transfer robots



Indoor navigation systems