

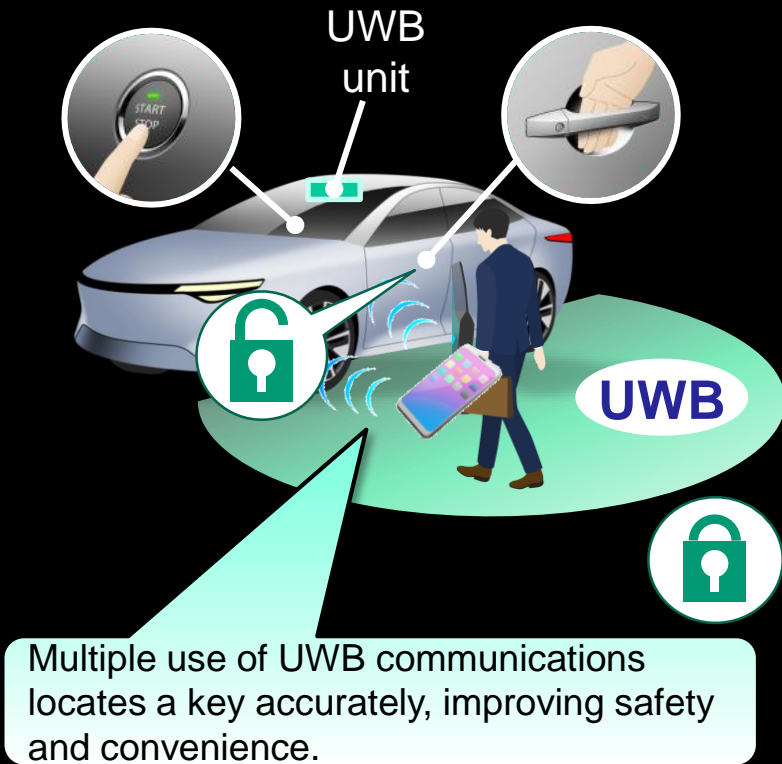
# UWB Antenna System for Digital Key

デジタルキー向け統合UWBアンテナシステム

**Background**

Tokai Rika, a car key manufacturing leading company for 70 years, is offering a one-stop secure digital key system from the server to the device.

The doors can be locked and unlocked when the key is around the car. The engine is started only when the key is inside.



The digital key can access a car through NFC when the smartphone battery is dead.



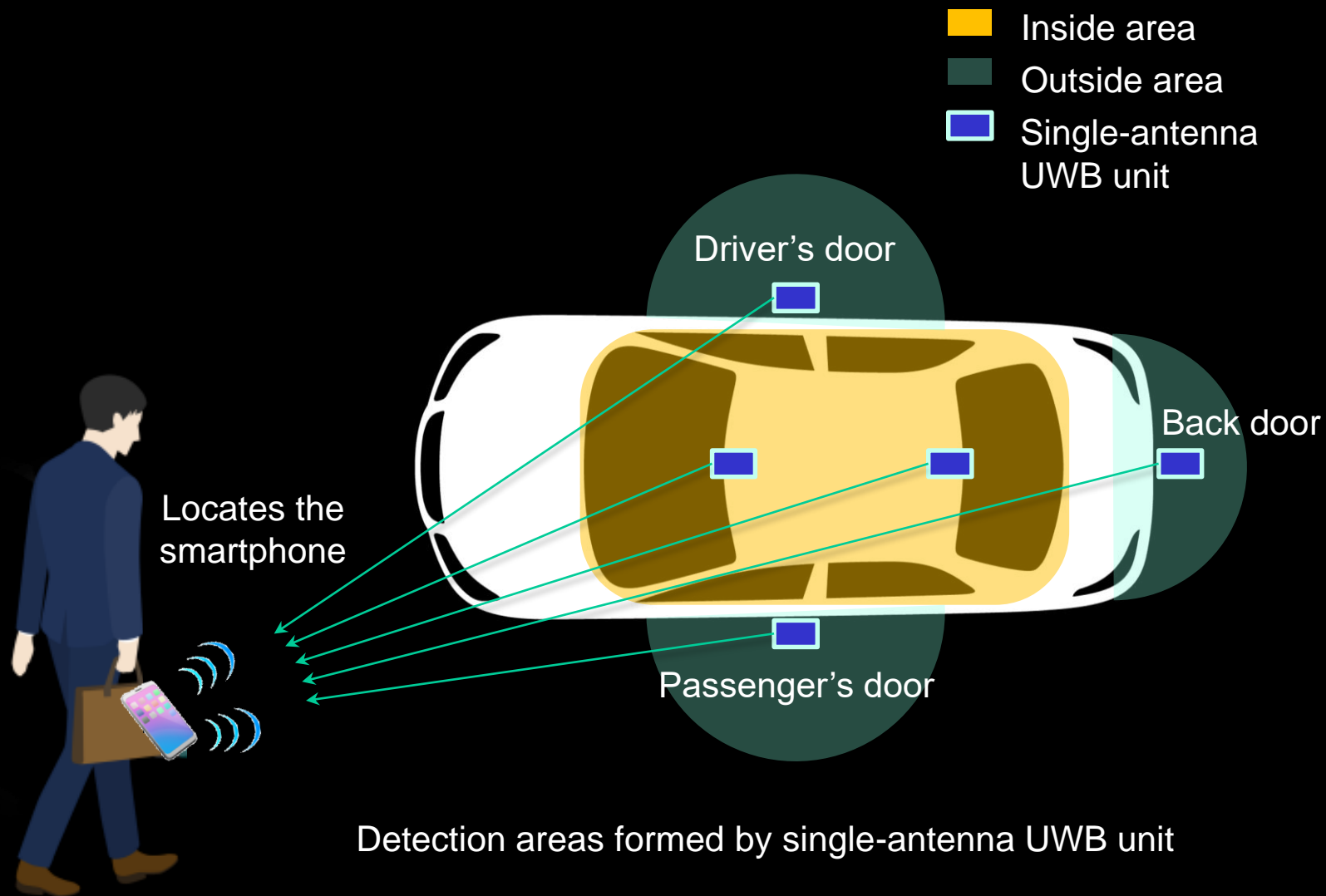
**Purpose**

Cost saving by using fewer UWB units in a smartphone digital key system

**Outline**

**Existing technology**

Requires at least one conventional single-antenna UWB unit for each detection area to locate the key.



**Problems that can occur if area determination is inoperable**

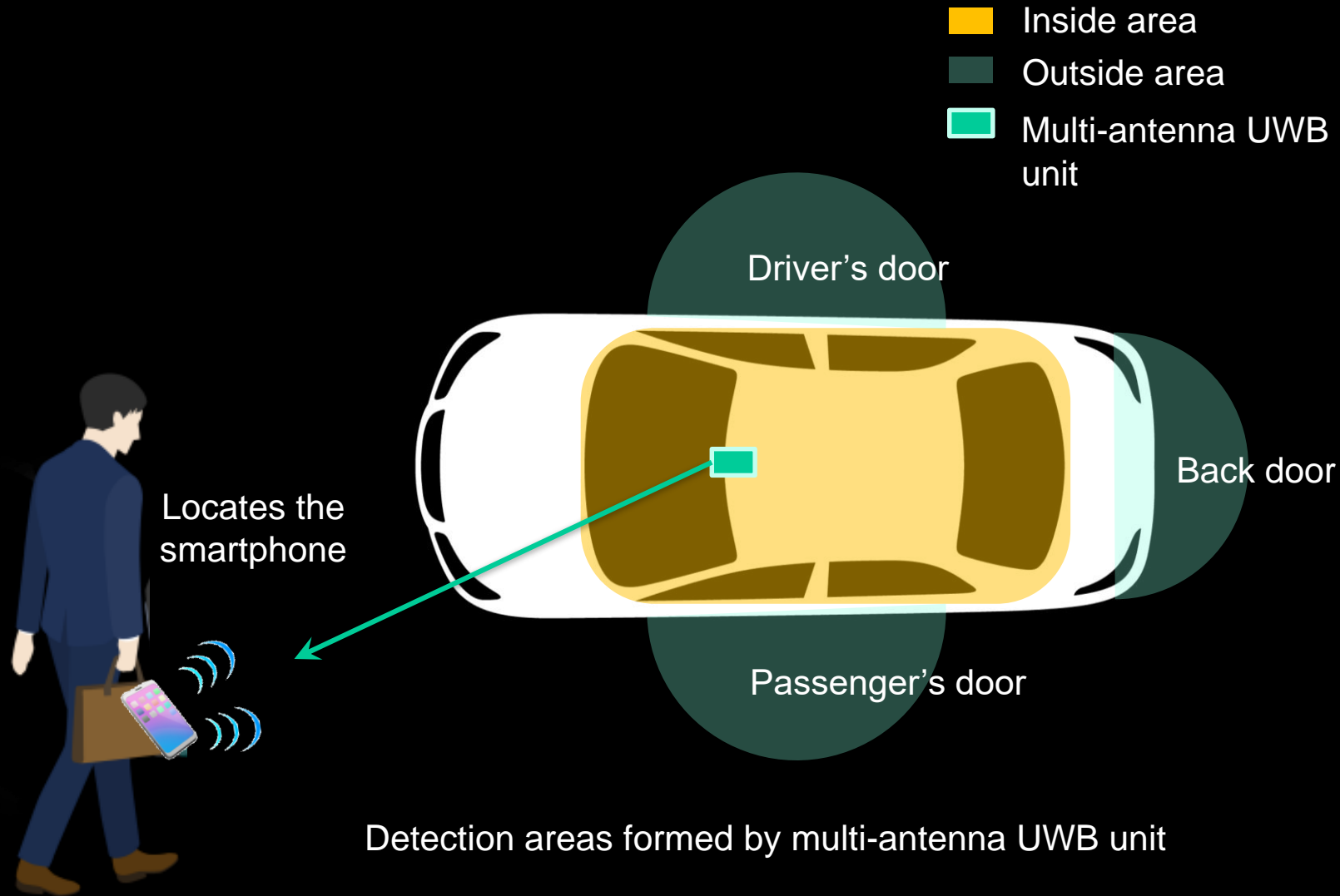
- Ex. 1: The doors can be locked from outside when the key is left inside.
- Ex. 2: The engine can be started when the driver is outside.



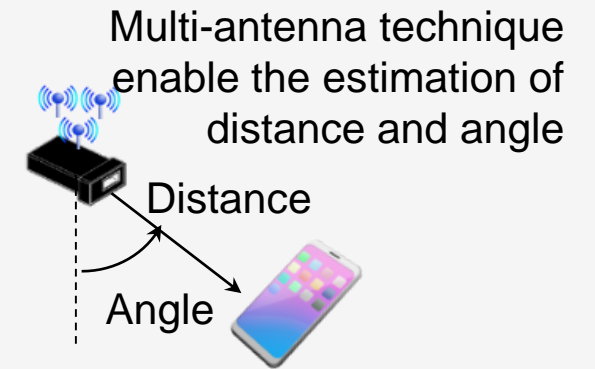
## Outline

### Developed technology

Our multi-antenna system consists of **fewer UWB units** because it detects distance and angle (locate the key).  
Practical use will be in 2026 or later.



### Principle of multi-antenna system



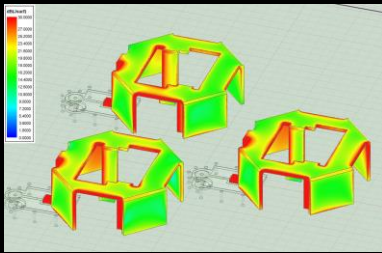
## Technology

- The multi-antenna detects incoming wave angle.
- The patented multi-antenna technology and the area determination logic improve performance.

## Multi-antenna technology (three patents)

Antennas installed close to each other are deteriorated in accuracy by electromagnetic bonding.

⇒ Our patented technology enables downsizing and high accuracy by preventing electromagnetic bonding.



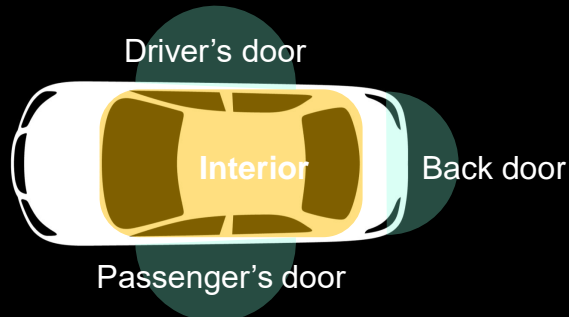
Multi-antenna current distribution

Each antenna has the same current distribution (same colors in the figure), showing that the characteristic change is prevented.

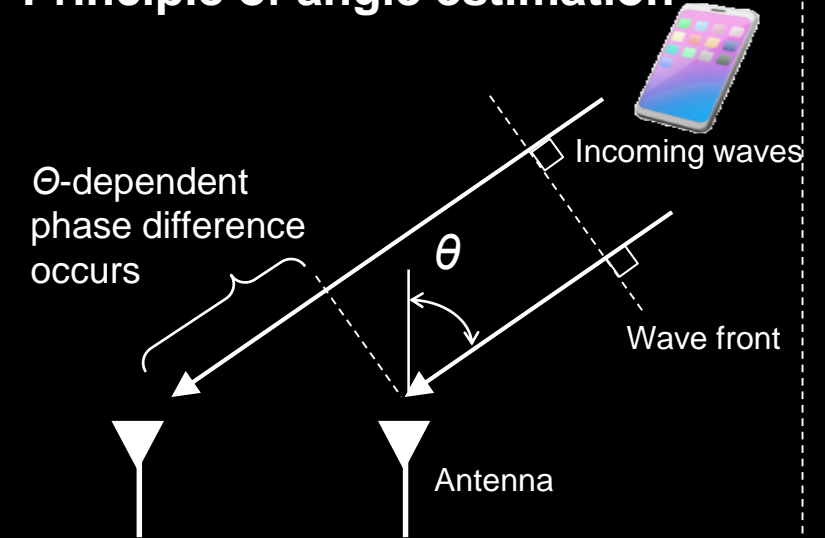
## Area determination logic (13 patents)

In a car, a wave diffusive environment, the accuracy of angle measurement is poor, causing false area detection.

⇒ The patented technology enables the detection of proper waves, improving the accuracy of area determination.



## Principle of angle estimation



The arrival angle of waves is calculated from the phase difference caused by the angle.

Patent applied

## Specifications

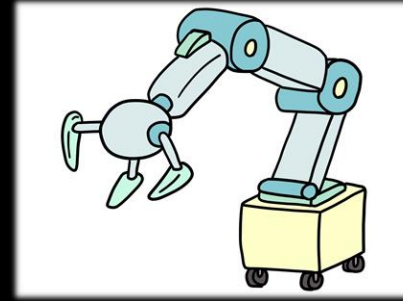
|                             |  |
|-----------------------------|--|
| Ranging accuracy            | Distance accuracy: $\pm 15$ cm, Angle accuracy: $\pm 5^\circ$              |
| Installed function          | UWB & BLE transmit and receive circuit, antenna, clock device incorporated |
| Conformance UWB             | IEEE802.15.4z  |
| Conformance 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        | 12 V   |
| Dimensions                  | 45 x 85 x 17 mm (target values)  |
| Operating temperature range | -40 to +105 °C   |

## Future use

- Area forming or ranging systems



Drones



Automatic transfer robots



Indoor navigation systems