
SIMPLE BROCHURE

# Wireless Sensing and Ranging

## Unlock contextual awareness for smart IoT devices with Wi-Fi and Bluetooth®

www.infineon.com

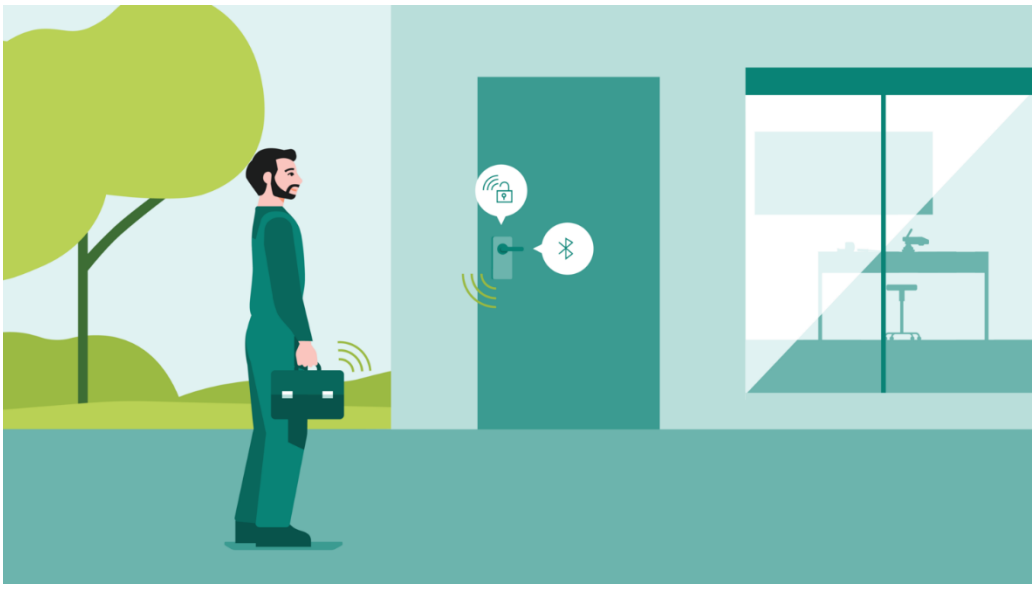
## Table of contents

## 1 What is Wireless Sensing and Ranging for IoT

Wireless sensing and ranging transform existing radios in smart devices into non-intrusive perception systems. Wireless sensing infers movement, presence, and environmental changes by analyzing how radio waves are reflected and perturbed in a space. It uses signal characteristics inherent to a wireless standard, such as Channel State Information (CSI) for Wi-Fi and Received Signal Strength Indicator (RSSI) to detect motion patterns without cameras or microphones.

Wireless ranging estimates distance between devices using precise timing and/or phase measurements. On Wi-Fi, fine timing measurements can estimate round-trip time for meter-level distance. On Bluetooth® Low Energy (LE), the Channel Sounding feature enables time-of-flight ranging for proximity checks and distance estimation.

Given that most IoT devices already carry Wi-Fi and/or Bluetooth® LE radios, these capabilities can often be enabled via software and firmware updates, reducing bill of materials and avoiding extra sensors. The result is privacy-preserving, cost-effective contextual awareness that works in any lighting condition and through common obstructions. By fusing wireless sensing and ranging with other sensing signals, IoT products can be smarter to enable broader, more accurate, richer use-cases.



## 2 Why Contextual Awareness Matters

Contextual awareness is the ability of devices to understand what is happening in the devices' environment and adapt behavior accordingly. Rather than running at full power or reacting to every trigger, context-aware devices decide when to wake, when to act, and when to stay quiet. For example, a video doorbell can use BLE ranging to verify an authorized device is nearby before unlocking or sending high-priority alerts. This reduces false detections (e.g., moving foliage or passing cars) and prevents nuisance notifications. Another example would be to use Wi-Fi sensing to trigger a camera based on presence.

### 2.1 Energy Efficient Applications

- Targeted activation and standby: Turn on lights, HVAC, and appliances only when human presence is detected via Wi-Fi sensing and turn them off when areas are vacant. Use BLE distance trends to pre-wake entryway lights or devices as an authorized user approaches, keeping everything else in low-power mode.
- Event-driven scanning and duty cycling: Save power when there is no motion, and when there is trigger devices to wake up

- Edge-first processing: Classify presence locally and gate cloud activity by confidence thresholds. Local inference reduces backhaul transmissions and compute bursts, lowering overall energy consumption.

- Policy-aware scheduling: Align power-intensive tasks (e.g., firmware updates or data uploads) with periods of low occupancy and defer or cancel nonessential operations when no authorized device is nearby.

## 2.2 Wi-Fi Sensing Applications

- Smart Home Automation and Zoning:  Wi-Fi sensing leverages radio reflections, rather than image or audio data, to analyze signal perturbations across access points and clients. This technology detects people moving or lingering in a room, enabling privacy-preserving presence-based automation such as lighting control, HVAC zoning, and “room-aware” actions without the need for cameras. By correlating multi-node observations, triangulation, and temporal patterns, Wi-Fi sensing can be used with other sensors to create room-level zones to trigger precise actions—such as hallway night lights or living room scenes. These capabilities ensure greater reliability and more accurate human motion differentiation.

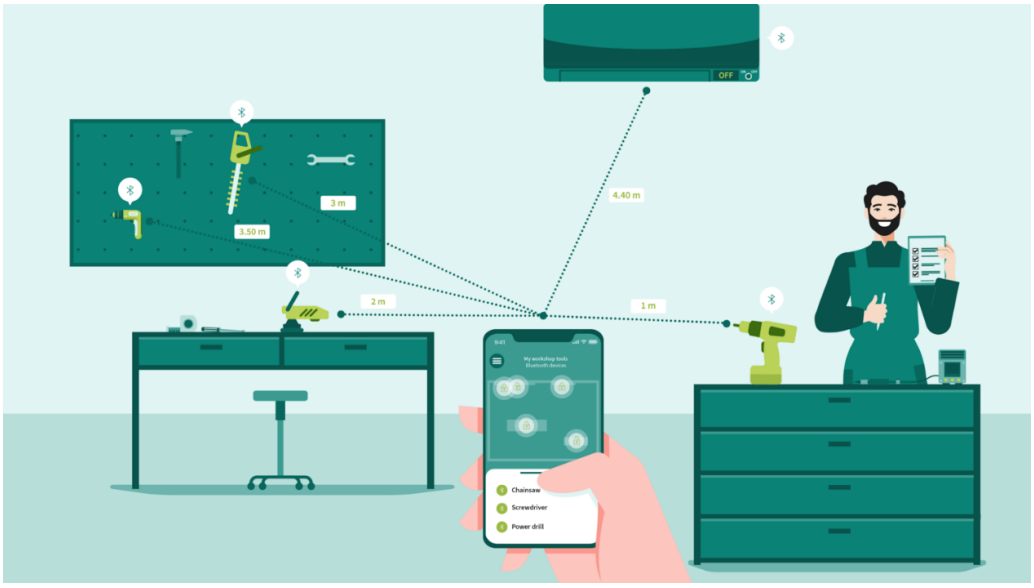
- Aging in place: Using camera-free presence detection to identify activity in the home, users receive real-time alerts and detailed motion analytics. This enables active monitoring of their space while providing peace of mind that loved ones are safe at home.

## 2.3 Ranging Applications

- Distance measurement and proximity: Bluetooth Channel Sounding enables ranging between devices, providing a reliable measure of how close an authorized device (e.g., a user’s smartphone or badge) is to an IoT endpoint. This strengthens access control, presence confirmation, and context-aware automation.

- Asset tracking and anti-theft: Combine distance estimates with known device identities to monitor valuable items. Using Bluetooth® LE tags, you can trigger alerts if an asset moves beyond a defined proximity or if a trusted controller is no longer nearby. Distance checks can be performed with cryptographically secure links to resist spoofing and relay attacks.

- Presence confirmation for smart home on/off: Use Bluetooth® LE proximity as a second factor alongside Wi-Fi presence. For instance, keep a front door locked if motion is detected but no authorized device is within range, or arm/disarm systems as users leave or approach.



Published by
Infineon Technologies AG
Am Campeon 1-15, 85579 Neubiberg
Germany



**Public**

Version: V1.0_EN
Date: MM/2025

**Stay connected!**

Scan QR code and explore offering
www.infineon.com

**Please note!**
This Document is for information purposes only and any information given herein shall in no event be regarded as a warranty, guarantee or description of any functionality, conditions and/or quality of our products or any suitability for a particular purpose. With regard to the technical specifications of our products, we kindly ask you to refer to the relevant product data sheets provided by us. Our customers and their technical departments are required to evaluate the suitability of our products for the intended application.

We reserve the right to change this document and/or the information given herein at any time.

**Additional information**
For further information on technologies, our products, the application of our products, delivery terms and conditions and/or prices, please contact your nearest Infineon Technologies office (www.infineon.com).

**Warnings**
Due to technical requirements, our products may contain dangerous substances. For information on the types in question, please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by us in a written document signed by authorized representatives of Infineon Technologies, our products may not be used in any life-endangering applications, including but not limited to medical, nuclear, military, life-critical or any other applications where a failure of the product or any consequences of the use thereof can result in personal injury.