From Proximity to Intent: Designing Technology People Barely Notice

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UXDX 2026

UWB?

Ultra-Wide Band

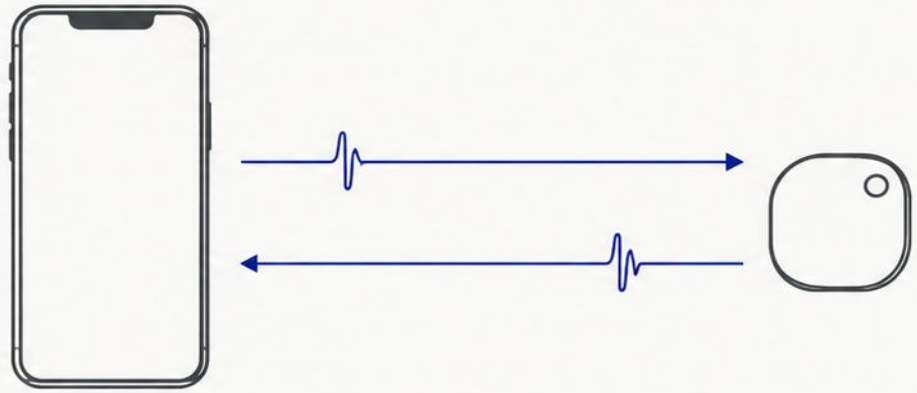
Radio technology for precise ranging.

Distance from travel time

Signal strength



Signal travel time



Travel time → distance

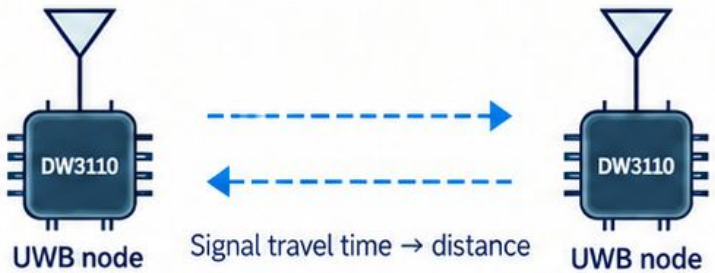
Source: Qorvo, The Road to Ultra-Wideband (2021); Apple WWDC21

UWB, at the chip level

Qorvo DW3110 · Industrial UWB transceiver

01 CONNECTION

Direct UWB link

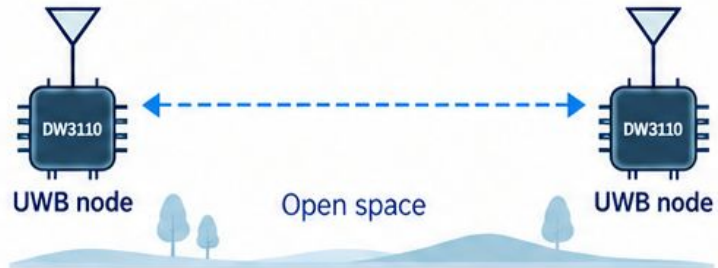


Bluetooth is optional at system level.
A host controller runs the protocol.

Distance: one radio pair
Direction: extra hardware required

02 RANGE & ACCURACY

~50 m Demonstrated range
Tuned DWM3000 prototype



Short-range study

~16 cm RMSE

Tested at 0.5 m and 5 m
Uncalibrated boards
Not a per-reading error limit.
Range and error come from separate tests.

03 ENERGY

Measure. Sleep. Repeat.



Transmit	**~144 mW**
Receive	**~216 mW**
Deep sleep	**~0.8 µW**

Chip-state examples, not average device power.
Channel 5 · 3 V
More frequent measurements use more energy.

Usable range and accuracy depend on antennas, obstacles and calibration.

Sources: Qorvo datasheet · Heinrich et al. (2023) · Zeus WPI prototype report

From distance to guidance



Find your keys.

Distance + direction become guidance.

$29

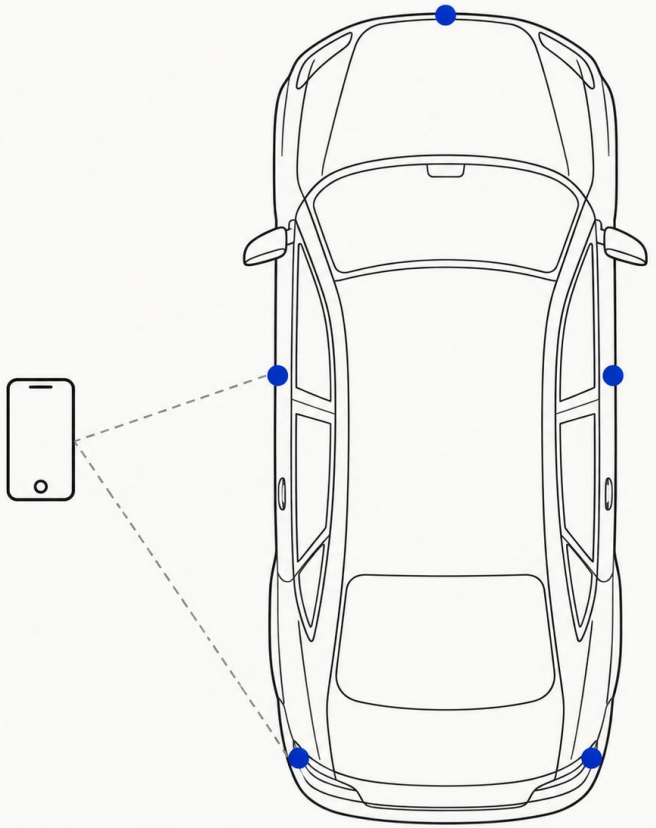
11 g

1+ year battery

Locate the phone around the car

Distances leads to derived direction

Uses UWB positioning and trigger zones for hands-free door and trunk opening.



Source: Illustration based on Tesla US20260011194A1, Fig. 1 (2026)



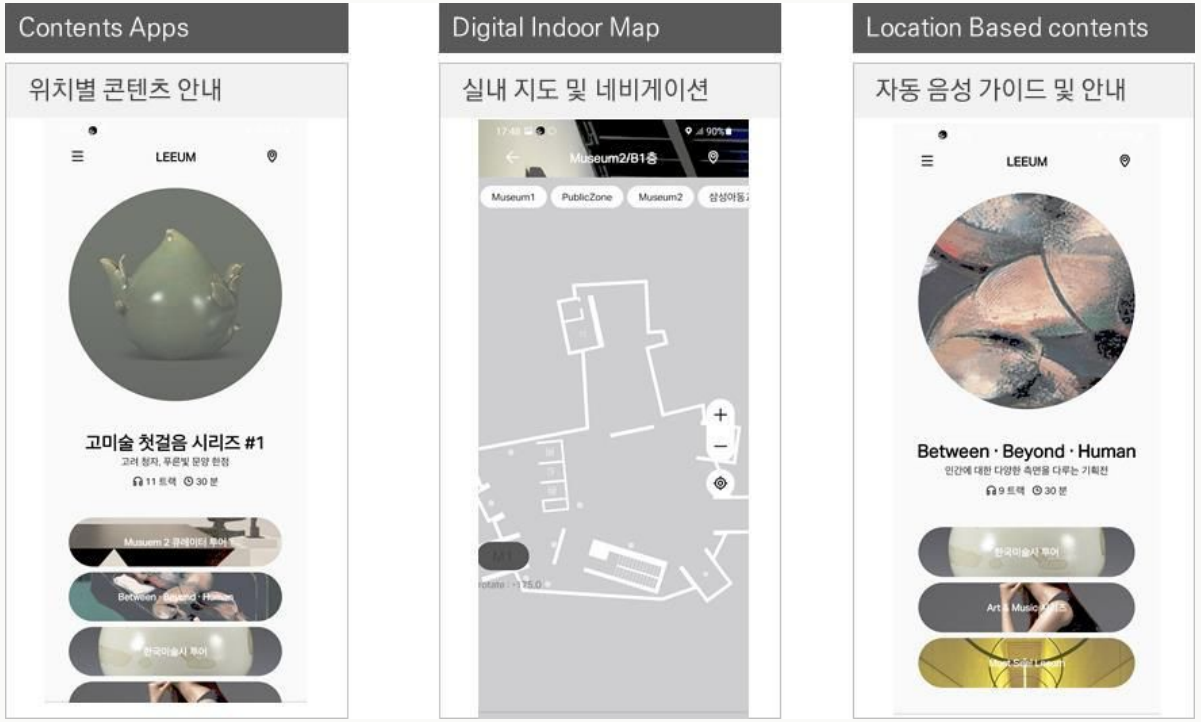
Video demo · YouTube

some other real world cases

Leeum: seamless indoor navigation & guide

Borrow a guide.
Approach an artwork.
The story starts.

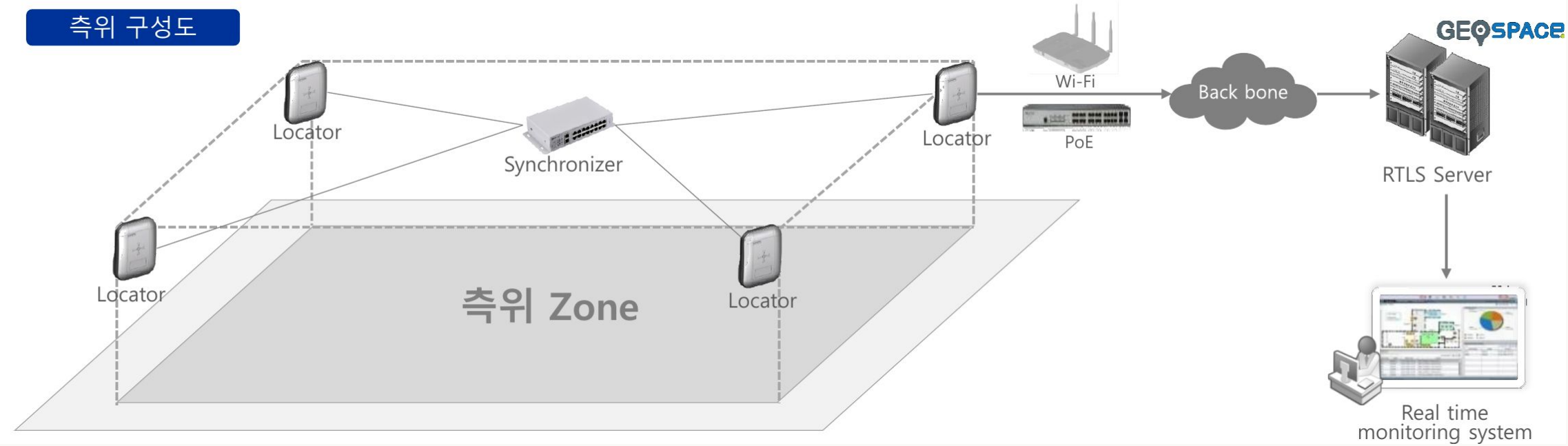
Museum-issued Galaxy S21+



Sources: Leeum visitor guide · GEOPLAN case study · UI: Cisco-hosted PDF, p. 18

Leeum: fixed locators with geometry

600+ guides tested together



Phone → locators → location service → guide

Sources: GEOPLAN Leeum deployment · Original technical diagram: Cisco-hosted PDF, p. 11

Puy du Fou: position becomes a cue

An actor enters.
The mic opens.
The scene responds.



From a pocket tag to a show cue

UWB ties cues to the actor’s position.

Actor’s tag → UWB anchors → Location → Show cues

in a pocket

hidden in the set

estimated position

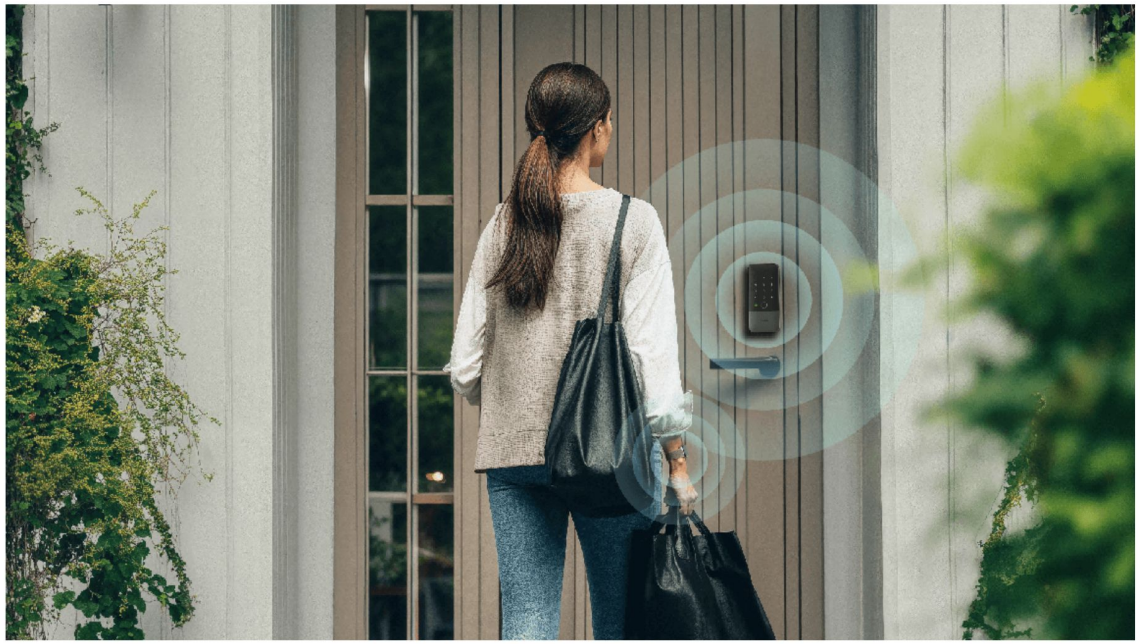
mic · sound · light

Sources: Eliko case PDF · Customer interview · Eliko architecture brochure, p. 2

Aqara Introduces UWB-Powered Smart Lock U400 at CES 2026

The Matter-certified, Aliro-ready lock delivers hands-free home entry with unmatched security and precision

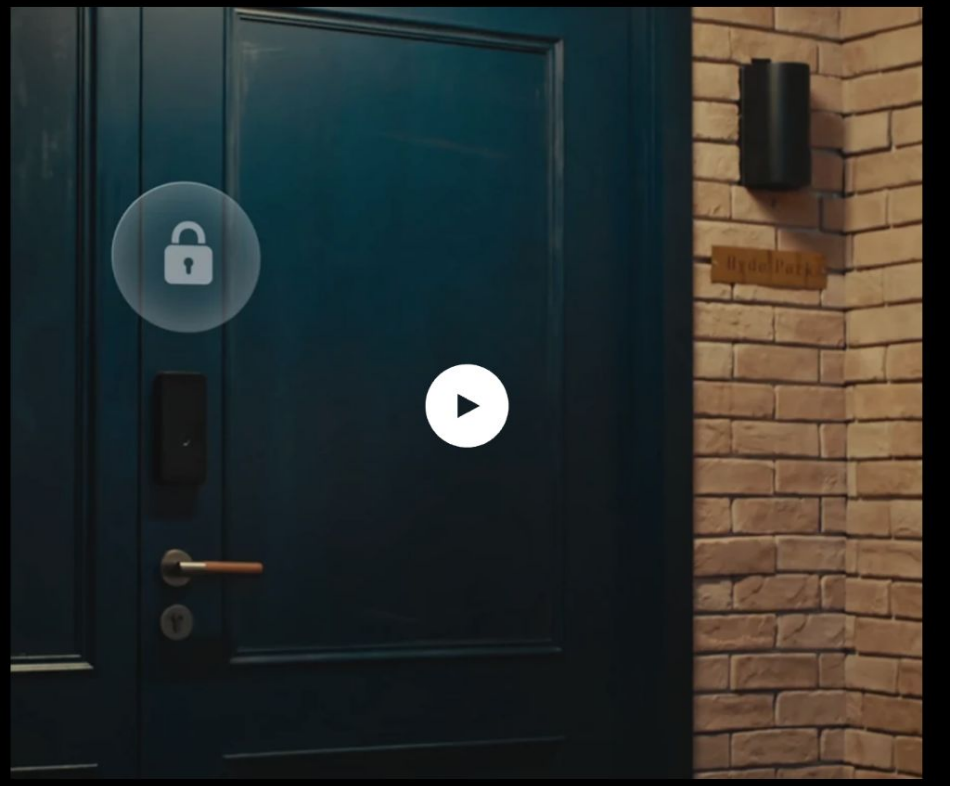
Las Vegas—January 6, 2026—Aqara, a global leader and pioneer in IoT, today unveiled the revolutionary Smart Lock U400 at CES, further expanding its smart lock portfolio. Equipped with the cutting-edge ultra-wideband (UWB) technology, this deadbolt lock uses high-precision location tracking to offer intuitive, hands-free unlocking with home key on iPhone or Apple Watch.[1] With incredible accuracy, the U400 automatically unlocks when an authorized user walks up to the door, marking a major leap forward in secure, convenient, and reliable access control. The Smart Lock U400 is now available for purchase in the US, Canada, Australia, New Zealand, and Singapore.



The Definitive Hands-Free Unlocking Experience

Powered by Ultra-Wideband (UWB), the Smart Lock U400 unlocks as you approach with your iPhone or Apple Watch — a hands-free, privacy-preserving entry experience with no codes and no biometric checks. As an Aliro enabled lock, UWB unlocking will extend to more devices across different ecosystems.

*UWB unlock works with select iPhone and Apple Watch models and requires a Thread-enabled Apple home hub (e.g., HomePod mini or Apple TV 4K).



Presence can govern access

Authorized key
+ verified approach

↓

Unlock hands-free

Too far
or presence unverified

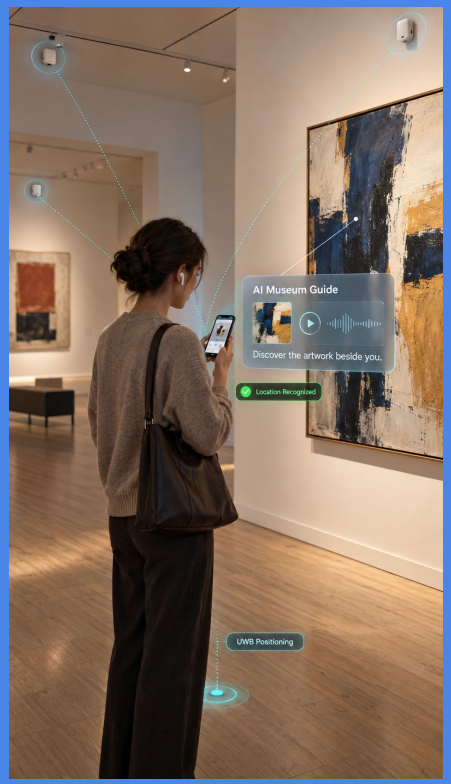
↓

Reject local unlock

From proximity to …



Automated Action



Presence Verification



Spatial Positioning

Super

In the days of ~~Artificial~~ Intelligence…

AI is moving into the physical world

Devices

+263%

AI glasses shipments

Global, H1 2026 YoY

Investment

$47.4B

Physical AI venture funding

+80% YoY, H1 2026

Startup funding activity

521

Physical AI funding deals

+19.5% YoY, H1 2026

Sources: Counterpoint (Sep 2026), Crunchbase (Aug 2026)



Which device do you mean?

“Make this one warmer.”



UWB + pointing + device map

Select the lamp.

“Show it on this screen.”



UWB + pointing + screen identity

Select the display.

Research: PnPSelect (2026 v2). Related demo: Samsung AI Avatar (CES 2022).

What research has demonstrated

Paper	Demonstrated
PnPSelect 2026 v2 · preprint	97.2–98.7% target selection 4 rooms · 10 registered targets each
SeleCon IoTDI 2017	~84% device selection · 8 targets ~97% gesture recognition

Magical experience

Use it as a continuous supportive signal

Tracking, not stalking

Combine with other signals

False negative > False positive

Q&A

References

UWB fundamentals

Qorvo · UWB overview

Apple · Nearby Interaction

FiRa · UWB technical FAQ

DW3110 specs & benchmarks

Qorvo · DW3110 chip specs

Qorvo · DWM3000 module

Qorvo · DW3000 power states

Heinrich et al. · Ranging study

Zeus WPI · Prototype range

AirTag (2021)

Apple · AirTag announcement

Apple · Technical specifications

Tesla

Tesla · UWB patent (2026)

Tesla · Hands-Free Trunk guide

Tesla · Hands-Free Trunk video

Leeum Museum

Leeum · Visitor guide

GEOPLAN · Leeum case study

GEOPLAN / Cisco · UWB guide

Aqara U400

Aqara · Launch announcement

Aqara · Product and imagery

Aqara · Access & compatibility

Aqara · Unlocks on Approach

Puy du Fou

Eliko · Puy du Fou case study

Blooloop · Customer interview

Eliko · RTLS architecture

References (continued)

AI hardware & market data

Counterpoint · AI glasses (2026)

Crunchbase · Physical AI (2026)

IoT Analytics · IoT context (2026)

Related demonstration

Samsung · AI Avatar (CES 2022)

UWB device selection

Chang et al. · PnPSelect
arXiv v2 · September 2026

Alanwar et al. · SeleCon
IoTDI 2017

SeleCon · Open full text

Additional UWB background

Qorvo · DW3000 direction finding

Multimodal reference

Lee et al. · GazePointAR
CHI 2024 · Article 408

GazePointAR · Open full text

GazePointAR · Project & video