

New Product Update

TI's new mmWave radar sensor
for medical and home security
applications

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Topics to be discussed

- Advantages and functions of mmWave radar
- How the height detection aspects of IWR6432 are used to determine pose (e.g. laying, sitting etc) and detect that a person has fallen
- How the fine motion detection aspects of IWR6432 can be used to enable contactless vital sign measurements
- How the multi-antenna aspects of IWR6432 can be effectively used to provide precise location and tracking of persons in a defined area
- How information provided by the IWR6432 can be used to reduce the amount of false detection/triggers in surveillance applications

Why radar technology | Advantages

Contactless technology:

- Hassle-free sensing and monitoring of occupants in both indoor and outdoor settings.
- Flexible sensor placement (e.g. inside of equipment, as mmWave passes through solid material).

Privacy ensured:

- Unlike camera, no intrusion to privacy.
- No fear of information/data theft.

Works in challenging conditions:

- Works in any lighting conditions (i.e. bright, dark).
- Not affected by temperature (i.e. cold, hot).
- Accurate detection (lower false detection compared to other technology).



Radar | Target applications & functions

- ❖ Presence detection
- ❖ Localization
- ❖ Counting / tracking
- ❖ Major / minor motion detection
- ❖ Static object detection
- ❖ Velocity and direction detection
- ❖ Stance / fall detection
- ❖ Heart & breath rate detection
- ❖ Human vs. non-human classification



Automated lighting



Mobile robots
Industrial robots



Surveillance



Medical



Automated doors



Occupancy detection

Medical | Sensing problems and challenges

Problems
to solve



Occupancy

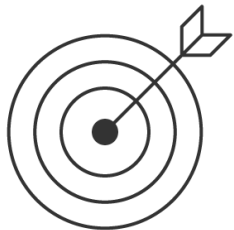


Fall Detection



Vital Signs

Design
challenges



Accuracy/Reliability



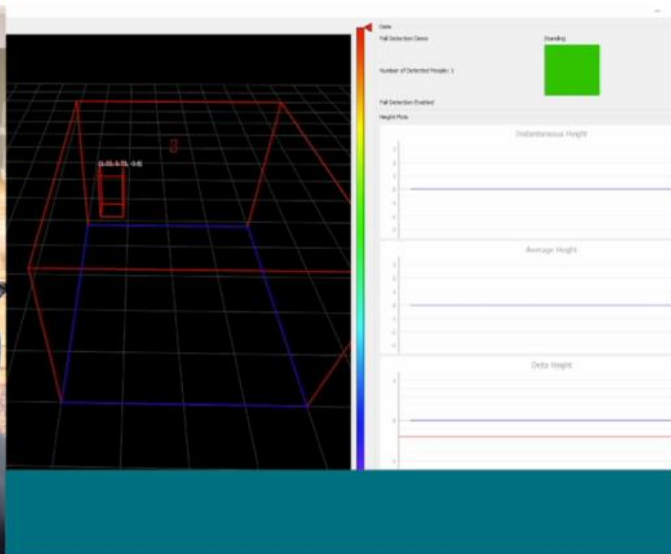
Privacy



Non-Contact

Medical | Fall detection

Fall detection

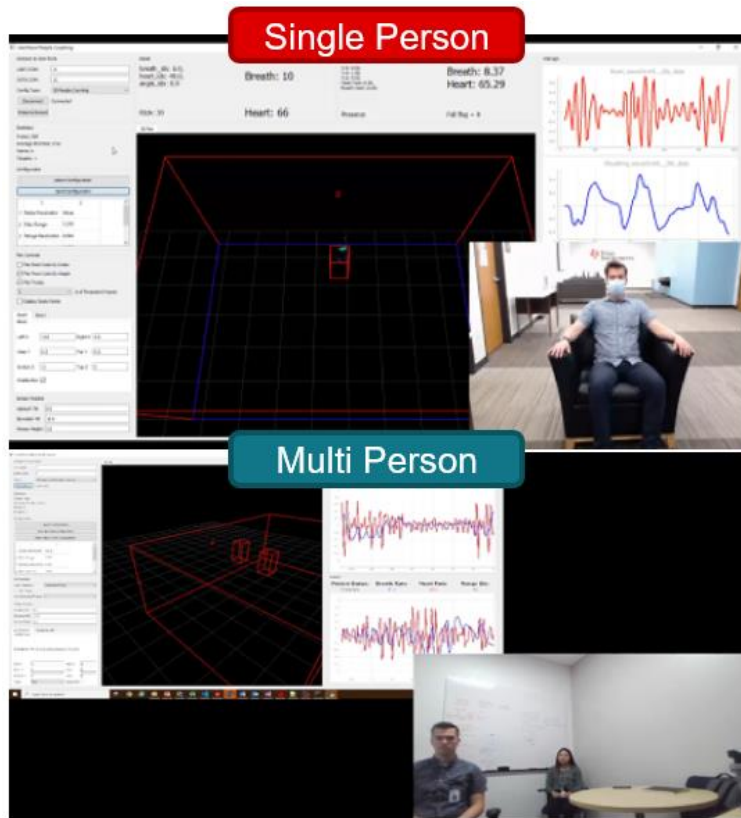


Change in height
can be used to
determine if fall has
occurred

Non-identifiable
information, can be
used in sensitive
environments

- Height and orientation of point cloud (long & thin vs short & wide) to determine posture (standing, sitting, laying)
- Velocity / sudden change in height or orientation to determine a fall event
- IWRL6432 multi-antenna design enables a more dense point cloud to obtain data

Medical | Vital signs detection



Contactless performance on par with leading smart watches brands

- Uses tracking layer to detect the location of the person then uses a vital signs processing chain to measure the heart rate and breath rate
- IWR sensor measures the micro displacements (or very fine movements) of the chest cavity continuously over time to obtain heart rate and breath rate
- Can detect and measure multiple people simultaneously. # of people based on available memory

Accuracy verified vs HRM	IWR6843 (measured)	IWRL6432 (expected)
Heart rate	± 5 bpm	± 10 bpm
Breathing rate	± 2 bpm	± 4 bpm

Two Solutions for **Building Security**

Longer Range Surveillance



IWR6843

Short Range / Video Doorbell



IWRL6432

mmWave Sensing | Short Range Surveillance



20+ meter range 3D motion detection



Track 5 people simultaneously



3.75cm precision



120° or more field of view



False detection mitigation

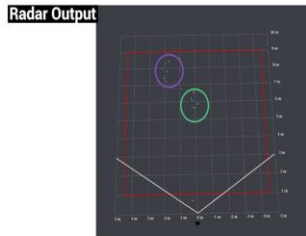
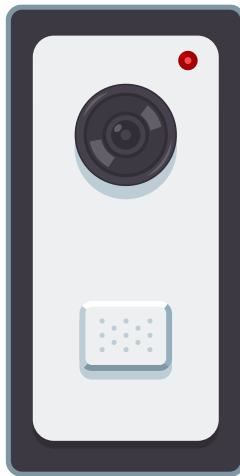
(Trees/Branches, Pets, Rain/Snow, Spiders, Birds, Pets)



Human vs non-human classification



< 1.15mW of power consumption



Distinguish between people side-by-side



Get started today!

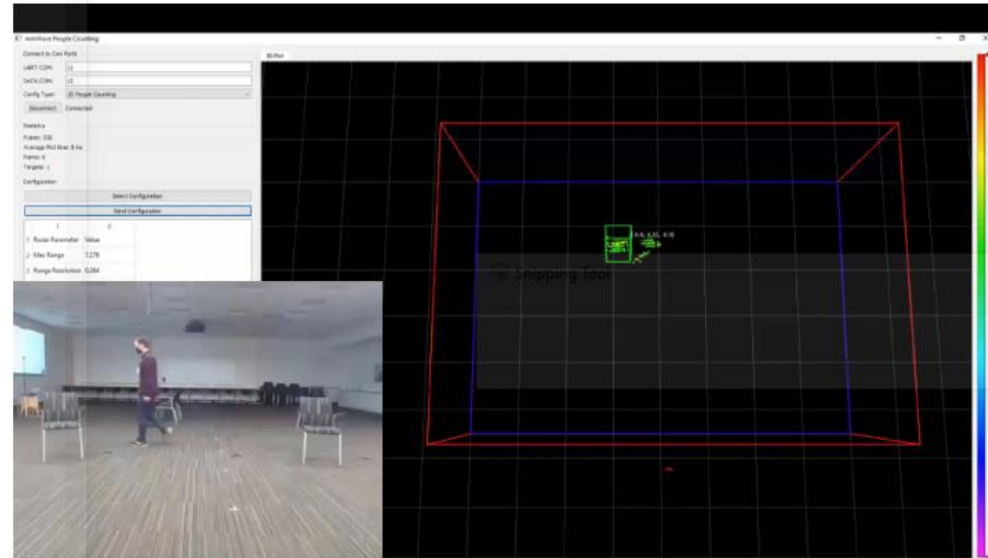
- **Watch:** IWRL6432 in action ([radar enhanced video doorbell](#), [presence detection](#))
- **Read:** [IWRL6432 low power radar enables high accuracy sensing](#)
- **Read:** [IWRL6432 enables new functionality in battery powered proximity sensing](#)
- **Evaluate & design:** with TI's radar sensing [reference code](#), [labs & experiments](#) and [IWRL6432BOOST](#) EVM
- **Communicate:** with TI engineers to get support throughout every step of the design process in TI's [E2E™ design support forum](#)

- Development Resources (including demonstrations and software)
 - [Presence and Motion Detection](#)
 - [People Tracking](#)
 - [Human vs non-human classification](#)
- Target devices & EVM
 - [IWRL6432](#) -- 3R2T low power / cost radar sensor w/ HWA (samples now)

Surveillance | Localization

- Angle of reflection information is used to determine position
- Minimum of 2 receivers is needed to determine localization (X,Y)
- Third receiver has added benefits
 - Height (Z) - improved location accuracy
 - Better angular resolution - distinguish between objects close together
 - Higher SNR – lower power consumption at the same range or see longer ranges

IWRL6432 determines location to within 3.75cm of precision



Surveillance | False detection mitigation

mmWave radar uses several filtering methods to reduce false detections

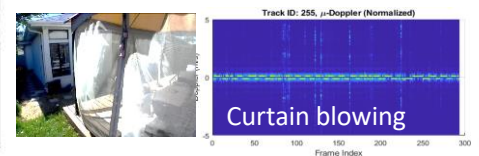
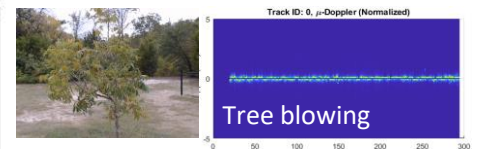
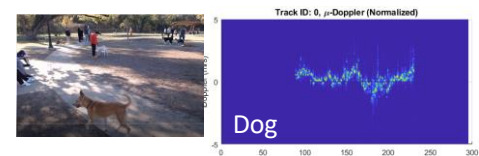
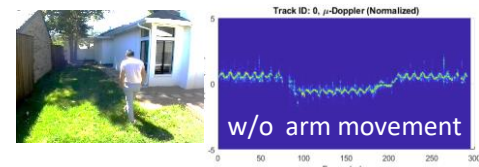
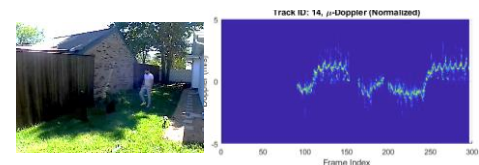
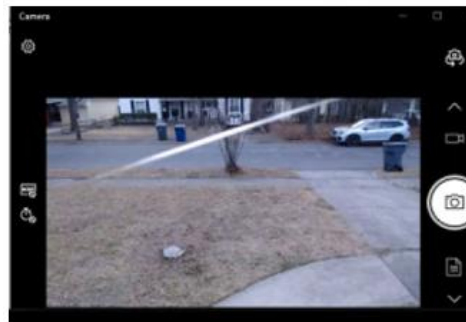
Achievable within Arlo power budget

- Location filtering: uses coordinates to set detection area(s) and filter unwanted data points
- Proximity filtering: uses range (distance from sensor) to filter unwanted data points
- Height filtering: uses height (distance above or below sensor) to filter data points
- Doppler filtering: removes stationary and low speed reflections
- Threshold filtering: uses SNR and # of points to filter signal from noise

Achievable with increased power budget

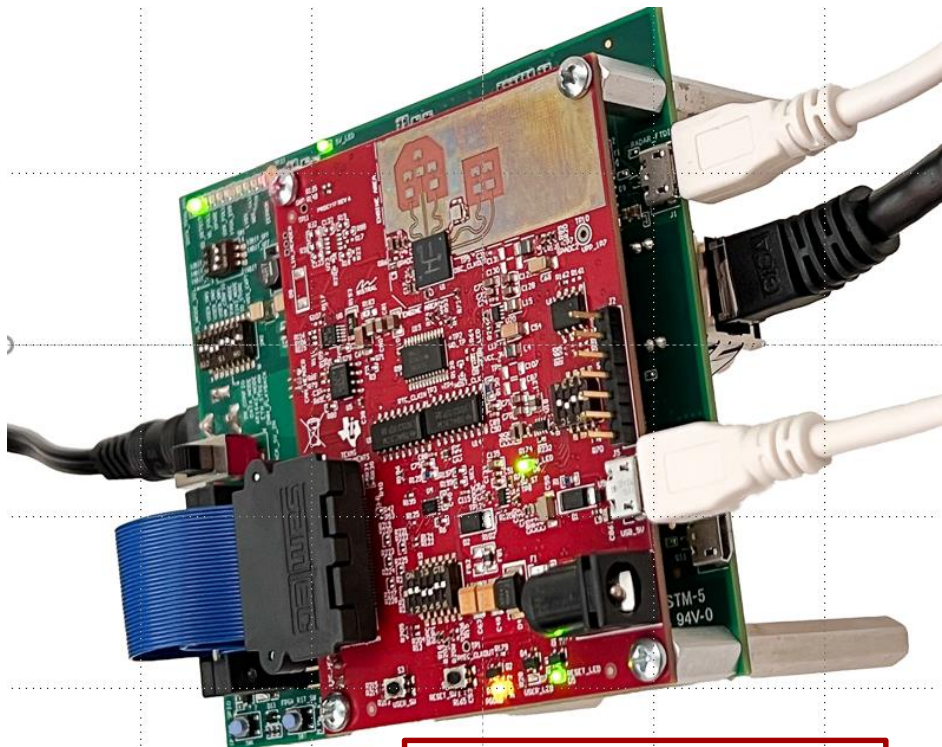
- Classification: uses the motion signature (micro doppler) to identify and object and filter

Cause of false detection	Low power	Mod power
People/objects outside of detection area	● ●	
Trees / bushes	● ● ●	●
Animals (pets, squirrels, rabbits etc)	● ●	●
Spider web	● ●	
Insects (Wasps, Bees, Flies etc)	● ● ●	



IWRL6432 | Evaluation modules

Sample/EVM: Now



IWRL6432BOOST

- EVM: IWRL6432BOOST
- Complete software development and evaluation environment
- Low cost [FR408HR-based](#) antenna design

Development resources

You can start evaluating this device leveraging the following:

Content type	Content title	Link to content or more details
Product & Samples	Product overview	www.ti.com/product/IWRL6432
Training	On-demand training, examples, and videos	Getting started with xWRL6432 reference code, labs & experiments
Technical white papers	Technical blog for xWRL6432 Application brief	IWRL6432 low power radar enables high accuracy sensing IWRL642 enables new functionality in battery powered proximity sensing
Development tools	Using 60-GHz radar sensors in video doorbells Overview of device Module demonstration Laptop presence and onlooker detection Design resources Design support forum	https://www.ti.com/video/6317304690112 https://www.ti.com/video/6317517176112 https://www.ti.com/video/6317353331112 https://www.ti.com/video/6317244314112 IWRL6432BOOST https://e2e.ti.com/

Visit www.ti.com/npu

For more information on the New Product Update series, calendar and archived recordings



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