

FMCW Millimeter-Wave Radar-Augmented People Tracking Solution for Video Surveillance Systems

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People tracking in video surveillances systems (e.g. camera) require clear images to detect a person or object in a reliable manner. Extreme conditions like zero-lux, presence of smoke or difficult outdoor weather conditions create challenges to artificial intelligence/machine learning (AI/ML) image processing algorithms.

Multi-sensory platforms composed of different sensing typologies act as possible solutions to circumvent such challenging situations, bringing complementary characteristics that when fused together, increase system performance (e.g. better accuracy in people/object detection) and aggregate outcomes that are more informative (e.g. velocity and direction).

In this abstract, we introduce the development and test of a frequency-modulated continuous wave (FMCW) radar working on the 60 GHz millimeter ISM band, which allows complementing surveillance camera real-time video streaming with intelligent insights [2] from the scene (e.g. distance of an object, motion speed and/or angle of arrival), even when operated in tough scenarios. Due to the spatial diversity of the antenna pattern, one can create 3D point clouds, which are further processed to apply tracking algorithms to pinpoint relative location of the identified objects and may even permit the objects' classification as human or non-human by considering the physical dimensions of the point cluster.

The piece of hardware employed in the experiments, shown in Figure 1, is a 60 GHz Radar model IWR6843ISK-ODS [1] from Texas Instruments. It has a built-in RF system and digital signal processing (DSP) unit that outputs through UART a point cloud with static and Doppler-affected points. With the help of a clustering algorithm (DBSCAN) and by feeding only the points with motion, one can accurately pinpoint the location of a moving object/person; calculate its speed and identify the direction of movement.

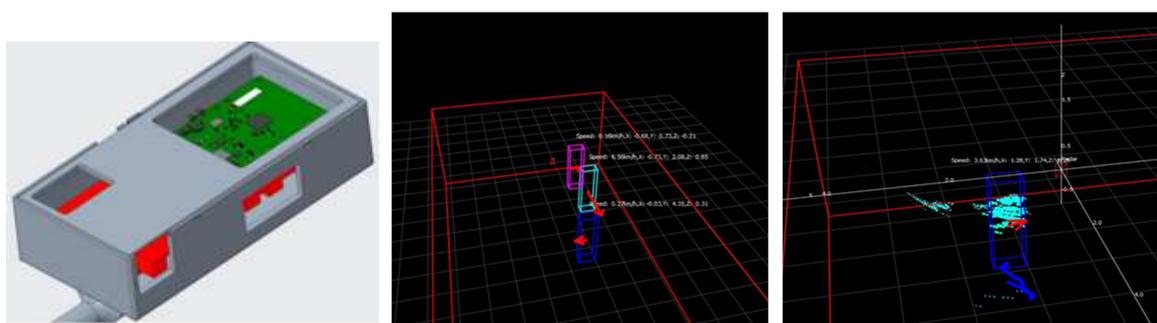


Figure 1. (left) Developed Radar package, (center) post-processed point cloud with three objects: a person sitting close to the radar positioned in (0, 0, 0) (magenta), another person stepping away from radar position at 6 km/h (cyan) and a small object with a right-turn movement (dark blue) and (right) the point cloud with all moving reflections (cyan) and their trajectory in blue.

References

- [1] Texas Instruments Inc., “IWR6843 intelligent mmWave overhead detection sensor (ODS) antenna plug-in module”, Technical Datasheet, 2021. Online: <https://www.ti.com/tool/IWR6843ISK-ODS>.
- [2] Bosch Safety and Security Systems, “Intelligent Insights: Making data visible and usable”, 2021. Online: <https://www.boschsecurity.com/xc/en/solutions/management-software/intelligent-insights/>.