LiDAR vs Radar for Security Applications

Elevating Security with 3D LiDAR: A Comprehensive Comparison with Radar

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Introduction

In the security sector, 3D LiDAR and Radar are often used as alternatives to traditional camera based systems. While both technologies bring unique features to the table, there are key differences that can lead to vastly different customer outcomes. This article underscores the benefits of Quanergy's 3D LiDAR-based system, Q-Track, over Radar and clarifies the use-cases that are best addressed by either technology. Before we jump into the specifics, here's a quick overview of how the two technologies compare to each other:

	Quanergy LiDAR	Typical RADAR
Sensing Dimension	3D	1D/ 2D
Reflections & RF Interference	No	Yes
Precise Location of Intruders	±3 cms	± 1 to 3 meters
Field of View	360°	90° to 120°
Object Classification Accuracy	Very High	Poor
Continuous Tracking with Mesh Architecture	Yes	No
False Alarm Rates	1-2%	Up to 40%
Object Stitching	Yes	No
Horizontal Angular Accuracy	Very High	Average

RF Interference and Reflections

Quanergy's LiDAR technology is immune to RF interference, offering more reliable object detection. This advantage extends to preventing false alarms caused by both RF interference and reflections. In contrast, Radar can face challenges related to RF interference and multipath reflections. Imagine a substation with a lot of exposed metal everywhere. A LiDAR will do much better than a Radar in that case.

Precise Location of Intruders

Quanergy's LiDAR provides unparalleled object detection accuracy in terms of ascertaining the exact location of a potential intruder, typically within ±3 cms. This precision is in sharp contrast against Radar systems, which generally offer ± 1 to 3 meters of accuracy for high-end solutions. Quanergy's LiDAR allows multiple points, with small spot sizes (beam diameter), on people and vehicles so it knows the size better and can recognize things better. Even the best Radar will only have a 2 degree resolution. Most are worse than that. This gives Quanergy a 10x advantage in understanding what it is looking at. Is it a person behind a tree or is it just a tree? This stark difference in location accuracy is of grave importance when the task is to protect densely populated assets with a lot of obstacles, for example, sub-stations, water treatment plants, data centers, and where pinpointing the exact location of perpetrators is of utmost importance.

Field of View

Q-Track LiDAR boasts a full 360° field of view, ensuring comprehensive coverage and proactive situational awareness. Conversely, Radar systems typically have a limited fields of view (90° to 120°) and users will require 3x to 4x more Radars to eliminate blind spots and provide 360 degree coverage. In addition to this, the infrastructure cost, installation, and maintenance will further increase the total cost of ownership (TCO) making Quanergy's advantage even more stark.

Continuous Tracking Capabilities and Mesh Architecture

Quanergy's Q-Track excels in continuously tracking various object types though a large perimeter and/or large crowds. Q-Track can differentiate between 600 simultaneous objects per server and assign a unique ID to each object. It can then uniquely and continuously track each object throughout the entire perimeter. Furthermore, multiple LiDARs can be stitched together and the object IDs can be passed from LiDAR to LiDAR, and server to server, thanks to Quanergy's innovative feature called Automated ID Handover (AIDH). This ensures that users never lose sight of bad actors wherever they are in the entire perimeter. A Radar based system simply cannot do this, as it doesn't have enough information about the objects to assign unique IDs to them, let alone pass them from Radar to Radar. Ultimately, Radar simply cannot continuously track each object throughout the entire perimeter.

Low False Alarm Rates

Due to its hyper accuracy Q-Track LiDAR exhibits an exceptionally low false alarm rate in security applications and brings the operators' attention only to real threats. This minimizes unnecessary disruptions, costly guard services, and proves more reliable when compared to Radar systems, which experiences higher false alarm rates. One of Quanergy's customers, a global data center, did a shootout of various technologies including Quanergy LiDARs and Radars, they reported only 1-2% false alarms from Quanergy's solution compared to up to 40% false alarms from a Radar based system.

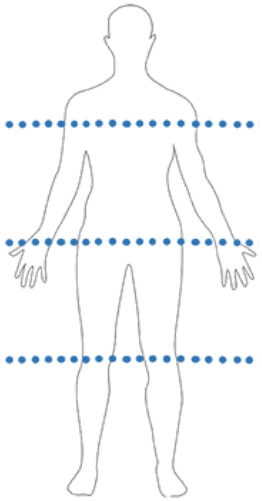
Occlusion Filter

Q-Track can get more information about an object (multiple points) compared to any Radar system. This key ability coupled with its innovative Occlusion Filter allows objects to go in and out of the field of view and still be stitched back to their old IDs when they come back into the scene, minimizing false alarms. In contrast, a Radar would generate a new alarm every time an object goes in and out of its field of view because it simply doesn't have enough information about the object.

Horizontal Angular Accuracy

Quanergy's LiDAR is inherently more angularly accurate than Radar and has a higher refresh/frame rate which comes in handy when objects are moving fast, running, or crawling. Approach detection can be challenging for Radar if bad actors crawl into the alarm zone. Radars with resolutions of 2 to 6 degrees cannot resolve a person crawling on the ground, especially at any significant distance. Quanergy LiDARs' resolution is 10x better. Quanergy's LiDAR can gain situational awareness by a magnitude of order difference. The image below shows Quanergy's high angular resolution advantage even at far ranges (70m). A Quanergy LiDAR is able to get more points on a person leading to a much higher detection and classification accuracy (> 95%).

QUANERGY Q-Track Number of Points on a Person at 70m Range (5Hz)



Advanced Threat Detection

In the security industry, effectively detecting potential threats from individuals breaching a perimeter is a common challenge. Quanergy LiDAR excels by not only detecting individuals but also discerning their speed and direction. LiDAR's highly detailed and accurate data rendering enables security operators to predict a person's path, the trajectory of an intruder or a vehicle, and to use those value insights to predict and prevent bad outcomes.

Conclusion

Quanergy's 3D LiDAR security solution offers a multitude of advantages compared to Radar when addressing security challenges. While protecting large open spaces without any obstacles or when high accuracy is not needed, Radar is undoubtedly valuable. However, the hyper accuracy, immunity from reflections, comprehensive field of view, continuous tracking capabilities and low false alarm rates make LiDAR a compelling choice for perimeter protection use cases, especially where the cost of missing a real threat can be catastrophic.