

Sansera - MMRFIC

TLDR

1. Sansera Engineering has a stake in deep-tech startup called MMRFIC. The deal is a steal given that the startup is bootstrapped and developing a technology that is extremely difficult to replicate.
2. MMRFIC develops MM wave radars that find object and motion detection applications across industries including automotive, A&D, healthcare, industrial, robotics etc.
3. Optionality: It's a great option to have given the MMRFIC team's technical knowledge and experience in semiconductors. Could pave the way for Sansera to enter into A&D space. MMRFIC could leverage Sansera's strong network in auto space for commercialization. MMRFIC is frontrunner in India in MMWave RF radars
4. Risk: Commercialisation, product acceptance might take longer than anticipated

About MMRFIC

May sound like a buzzword but MMRFIC is indeed a deep-tech startup (lengthy R&D and significant capital investment before commercialisation).


MMRFIC is a semiconductor startup that develops MM Wave Radars.

BusinessWorld - MMRFIC is a fabless semiconductor startup with a focus on mm-wave products for a wide range of markets, including next-gen radars for drone surveillance, advanced communication technology targeting (5G and 6G) and wireless connectivity solutions for healthcare. The bootstrapped startup has been a profit-making venture for more than seven years and has been granted six patents globally.

MMRFIC - MMRFIC's unique expertise in MMIC and RFIC enables them to offer world's most integrated, robust, reliable and easiest-to-use MMW and RFIC solutions...MMRFIC has expertise in handling MMW, RF and AMS design and layout at chip or module level along with floor planning for multi-level blocks and their integration in different process nodes and packaged Silicon.

References:

What is MMRFIC (30 mins onwards in this video)?

 3. IESA India Fabless Conclave 2018 - Part 3

Why did Sansera invest in MMRFIC? [Sansera Signs a Definitive Agreement for a strategic investment in MMRFIC Technology Private Limited](#)

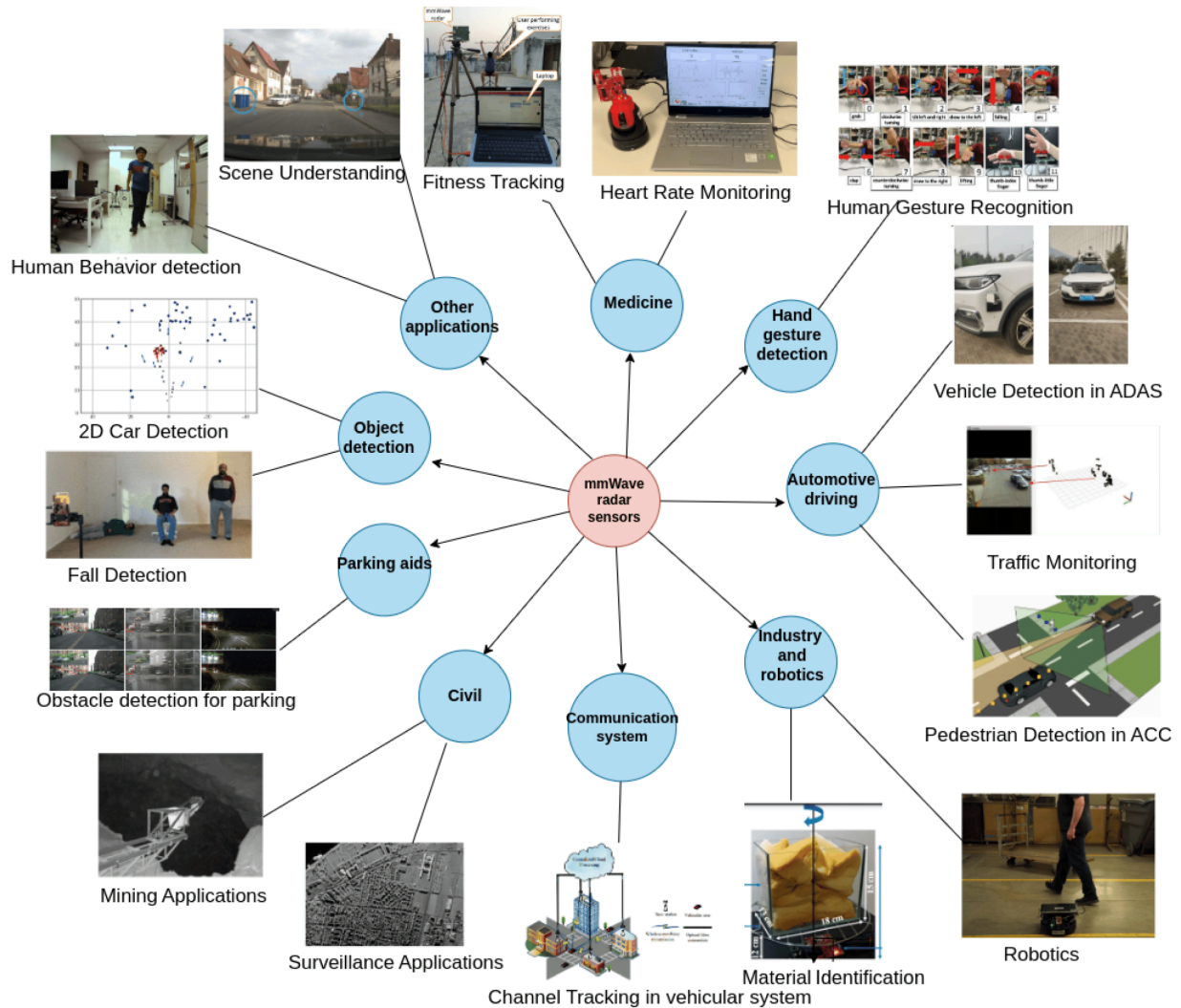
What is MM Wave?

- Miniaturised form of radar.
- Millimetre wave Radar Uses radio waves to detect object position and distance
- MMWave sensing is similar to how a bat uses echolocation to navigate and feed in the dark.
 - Bats emit a high frequency call and then listen for the reflections / echo. Depending on the time taken and phase difference of the reflected call, the bat can identify the prey and navigate
- An MMWave sensor emits a Chirp (FM Continuous wave)
- Above 60 Ghz - maintains accuracy even in dusty environments, works well even in low-light conditions and dazzling light conditions
- Differentiator - It can determine the object's dynamic information, such as range, velocity, and angle of arrival (AoA)

Learn more: [▶ What is mmWave sensing ? | Mouser Electronics | Texas Instruments](#)

Applications

- Sensor's basic application - Presence and motion detection
- Satellite remote sensing
- Missile navigation
- 5G communications
- Millimetre-wave radar has been used in luxury cars since the last century
- Defence - Seeking the targets and guiding the systems
- Potential applications
 - ADAS
 - Healthcare / patient monitoring
 - Industrial applications
 - Vehicle anti-collision (including trains)



References:

[Sensors | Free Full-Text | Recent Advances in mmWave-Radar-Based Sensing, Its Applications, and Machine Learning Techniques: A Review \(mdpi.com\)](#)

▶ Short range radar demonstration using TI's mmWave sensors

Sansera's investment rationale in MMRFIC

- Technologies not available in India at present (imported from US, Russia and Israel)
- With Defence + electronics + indigenisation focus, eventually these components/technologies will benefit from import substitution
- Geek/Technocrat promoters (ex Texas Instruments): Low profile, tech focused, skin in the game
 - The team has a proven track record in delivering products up to 110GHz

- Small, focused, Bootstrapped, profitable - No frills
- Has been working with BEL, HAL and other A&D companies: most products yet to commercialise but definitely has a foot in the door

Stake purchase in MMRFIC is a masterstroke on the lines of product diversification

In FY23, Sansera made a strategic investment of ₹200 mn to acquire a 21% stake in MMRFIC. The latter specializes in millimeter-wave radar technology (30-110 GHz), which is not fully available in India and is imported from countries like Russia, Israel, or the US. MMRFIC's radar technology finds applications in both defence and non-defence sectors, including target seeking, system guidance, electronic warfare, surveillance (for securing critical installations' perimeters), and drone detection. Additionally, MMRFIC is exploring the production of smaller automotive radars for Advanced Driver Assistance Systems (ADAS), with potential entry into Auto OEMs facilitated by Sansera.

Following 4-5 years of development, most radar components have undergone mill testing, and field testing is set to conclude shortly. MMRFIC expects good inflows of orders once the final field testing is concluded and certifications are received. Sansera holds an optimistic outlook regarding the future potential unlocked by MMRFIC's technology, which will be complemented by Sansera's engineering expertise and existing OEM relations. The company foresees the realization of MMRFIC's full potential within 18-24 months, driven by strong demand in both the defence and automotive segments. We anticipate strong margins in the MMRFIC business as the company positions itself as a frontrunner in millimeter-wave radar technology in India and it is strategically poised to capitalize on the golden opportunity to make a mark in the defence sector amid the growing emphasis on localizing defence component production. We maintain a positive outlook on the application of this technology in the automotive sector, particularly for ADAS. The company has already received a favorable response from a European OEM for this technology, and a dedicated product is in the development pipeline. We anticipate a surge in orders from the automotive sector in the coming years, fueled by the rising demand for vehicle automation. Sansera's potential to raise its stake from around 21% to approximately 51% at a predetermined valuation adds to the favorable outlook going ahead. The significant returns from this investment are projected to take off from FY26 once multiple products enter into production phase.

Revival in Sweden is expected by FY26

Product portfolio

1. W Band Radar - Auto and Industrial
2. Proprietary Beam Formers - Comms (5G, satellite) and Radar
3. IP - Low Power RFID @5.8GHz - Commercial and industrial

Global peers

- Texas Instruments
- Delphi

- NavTech
- Bosch
- Continental
- NXP

Demerits?

- Long gestation - R&D-focussed
- Commercialisation of some products still a few months/quarters away

Recent Progress

- Moving towards Commercialisation - around 6-8 quarters away
- **Most of the radars are mill-tested, field testing going on**
- Added new R&D + packing facility

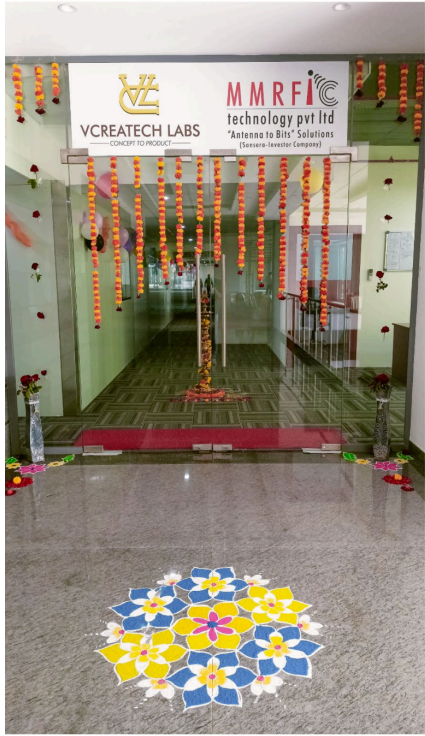
Monday, 3rd June 2024, Bangalore – MMRFIC Technology Private Limited (MMRFIC), a group company of Sansera Engineering Limited announced the grand opening of a new R&D facility in Bangalore integrating Semiconductor Packaging, Precision PCB Assembly, and the Testing & Qualification of in-house developed products as a strategic diversification of its product development range.

With an investment outlay of 4 million USD, MMRFIC's new facility is being developed in phases.

The first phase of 14000 sq.ft is operational. It includes an ISO Class 10,000 cleanroom for Semiconductor Packaging that handles die attach, bonding, and sealing. Along with it, a fully automated precision SMD assembly facility is equipped with jet printing pick-and-place machinery, a 10+3 zone oven with nitrogen integration, and other equipment. The operational facility provides for production-scale integration of miniaturized Systems in Packages (SiP) and off-the-shelf Components (COTS).

The new facility also enables the strategic integration of 3D semiconductor packaging, SiP design, PCB design and assembly, functional testing, and supply chain management for comprehensive product development all under one roof. Additionally, it offers failure analysis support for customers worldwide, backed by a dedicated team of engineers across various functions.

Commenting on this Mr. Saravana Kumar, CEO said that we are thrilled to announce the grand opening of fast-growing Semiconductor Packaging and Assembly manufacturing at MMRFIC. This strategic move aligns with our vision to become a key player in the semiconductor value chain going forward. The investment from Sansera Engineering Limited is a strong validation of our capabilities and growth potential in this space. Their support will be instrumental in serving the rising demand for advanced packaging solutions. By leveraging our expertise in this space and Sansera's valuable industry connections, we are confident of our ability to deliver cutting-edge packaging, assembly, and test services to semiconductor companies worldwide. This venture marks an exciting chapter for MMRFIC and we look forward to contributing to the technological advancements shaping our increasingly connected world.



Currently, these technologies are being imported either from Russian countries or from Israel or from US. So, these are the technologies today which are being used currently by both defense and non-defense applications. In the defense application, primarily it is used in the seeking application where the radars are used for seeking the targets and then guiding the systems. And in the non-defense area, it is also used for surveillance, primarily on perimeter surveillance on critical establishments, also used in drone detection technology as well.

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Sansera Engineering Limited
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Now, it is also used in electronic warfare where primarily prior to any missile that goes, this radar goes, detects all the ground-based radars and generally neutralizes them, and then the warhead follows. So, it is primarily used in the EWA application as well. But these are very, very high technologies which are being developed from last four to five years. Most of the components of the radar are already mill-tested, and it is expected to go on field testing towards the end of this year.

We expect that mass production of these would commence from next financial, towards the middle or end of the next year, next calendar year. We expect that **MMRFIC** would start generating meaningful revenues between 18 months and 24 months. We've also identified their technology, the second radar which I spoke about, which is used for perimeter surveillance and surveillance. In this, some channels of this could be used for altimeters, which are used primarily in all the aircrafts in the space application, as well as drones and missile applications, a wide variety of applications.

We have a very good client base on aerospace, so we would work with them to find out a collaboration between our existing customers and **MMRFIC**. And we also see potential going forward because most of the automobile companies are also working on radar with vision for the future generation of autonomous driving. So, we are very excited about this collaboration, and with Sansera's management capabilities and wide network of customer base, we expect that this collaboration would be very fruitful. Thank you.

Alternate technologies

Sensor Types	4D mmWave Radar	3D mmWave Radar	LIDAR	Camera
Max Detection Range	300-350m	150-200m	210-250m	150-160m
Range/Velocity Accuracy	High	High horizontally, low vertically	High	Low
Resolution	7.5-60cm/<1°	20-60cm/5°	Min 1mm/0.1°	-
Pedestrains & Object Identification	Yes	No	Yes	Yes
Road/Traffic Signs Identification	No	No	No	Yes
Performance in Severe Weather	Excellent	Excellent	Fair	Poor
Performance in Sunlight	Excellent	Excellent	Fair	Poor
Electromagnetic Compatibility	Poor	Poor	Excellent	Excellent
Tech Maturity Level	Good	Excellent	Fair	Excellent
Cost	High	Relatively high	Very high	Affordable

- Compared with lidar, the millimetre-wave seeker has better penetration ability to fog, smoke and dust.
- The disadvantages of millimetre-wave radar are also intuitive. Its detection range is directly limited by the loss of the frequency band (if you want to detect far, you must use a high-frequency radar), it cannot sense pedestrians, and it cannot accurately simulate all surrounding obstacles.
- The maximum distance of millimetre-wave radar is 1 km, while lidar is only 300 meters.
- Millimetre-wave radar has general recognition ability, strong penetrating ability, and is not easily affected by the weather environment; Lidar has high accuracy and poor penetration, and is easily affected by dense fog, rain and snow.
- The cost of radar is relatively high, but Lidar is even higher.

Inference - For most commercial operations, a combination of the above technologies will be / are being used.

Source: [Best of Both Worlds: How mmWave Can Bridge the Gap Between LiDAR and Radar - Engineering.com](#)

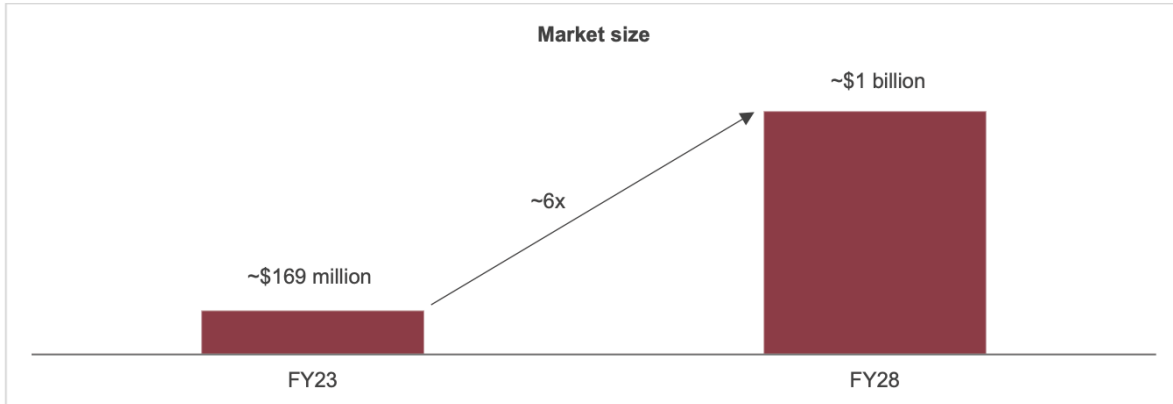
[TI mmWave radar vs LiDAR demonstration](#)

Key application: ADAS

- ADAS: Advanced Driver Assistance System - Prevent accidents and enable safer driving
- Adoption in India - 2% of PV sales but growing fast

- Of this - Mahindra XUV700, MG Hector, Tata Harrier, Tata Safari account for 67%
- Market set to explode - customers' demand and govt's push for vehicle safety

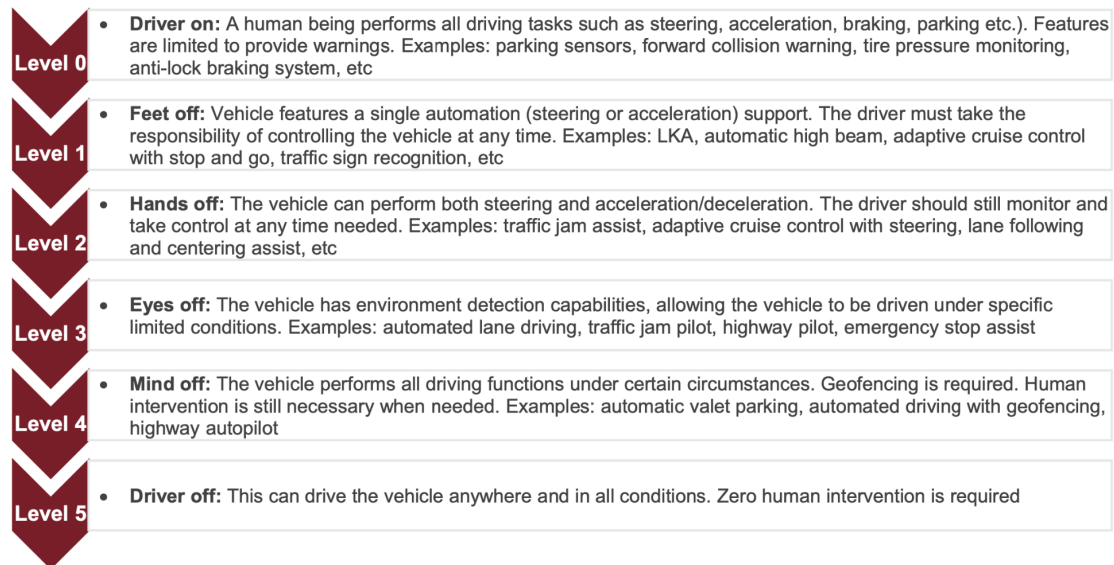
ADAS components market size in India – current situation and outlook



Note: Sizing is based on the Society of Indian Automobile Manufacturers' sales of domestic passenger vehicles and not luxury brands like Mercedes, BMW, Audi, JLR, Volvo, etc.

Source: CRISIL MI&A Consulting, industry

ADAS has various levels depending on the degree of automation that a vehicle has been programmed to perform:



Resources:

[ADAS in the driver's seat | CRISIL](#)

[BriefCASE: More twists than a Bollywood plot - India's road to ADAS adoption | S&P Global.](#)



Table 6. Automotive applications using popular radars.

Reference	Year	Application	Radar Used
[58]	1997	Intelligent cruise control with collision warning	FMCW (76 GHz–77 GHz)
[59]	2017	Blind spot detection and warning system	AWR1843 (76 GHz–77 GHz)
[60]	2017	Automated emergency braking	TI-AWR1243 (76 GHz–78 GHz)
[60]	2017	In-car occupant detection	TI-AWR1642 (76 GHz–81 GHz)
[61]	2017	Driver vital sign monitoring	TI-AWR1642 (77 GHz)
[62]	2018	Automotive body and chassis sensing applications	TI-AWR1642 (77 GHz)
[50]	2018	In-car controlling with gestures	FMCW-mmWave (60 GHz)
[63]	2019	Automated parking system	TI-AWR1843 (77 GHz)
[64]	2020	Lane change assistance with obstacle detection	TI-AWR1843AOPEVM (77 GHz)
[65]	2020	Parking assistance with obstacle detection	TI-AWR1642BOOST (77 GHz–81 GHz)
[66]	2020	Debris detection for automotive radar	mmWave (76 GHz–81 GHz)
[67]	2021	Automotive vehicle detection in parking lot	TI AWR2243BOOST-MIMO (76 GHz–81 GHz)
[65]	2022	Motor cycle safety and Blind spot detection	TI-AWR1843AOP (76 GHz–81 GHz)
[55]	2022	Automotive corner radar for cross traffic alert	TI-AWR1843EVM (76 GHz–81 GHz)

Appendix: Other applications

Industrial

Table 7. Industrial applications using popular radars.

Reference	Year	Application	Radar Used
[75]	2006	Surface sensing	mmWave sensor (29.72 GHz–37.7 GHz)
[76]	2013	Measuring the liquid level and interface sensing	mmWave Doppler sensor (77 GHz)
[68]	2015	Crack detection in ceramic tiles	V-Band Imaging Radar (60 GHz)
[69]	2017	Fluid level sensing	TI-IWR1443 (77 GHz)
[77]	2018	Material classification	FMCW radr with Infineon's DEMO-BGT60TR24 sensor (60 GHz)
[78]	2018	Motion detection and intersection monitoring	IWR6843 60 GHz radar
[79]	2019	Foam detection in chemical applications	IC with mmWave ssensor (80 GHz)
[10]	2020	Obtaining the performance on detecting vibrational targets	FMCW 80 GHz sensor integrated on SiGe chip
[80]	2022	Eavesdropping and spying on phone calls	TI-AWR1843BOOST (77 GHz)
[70]	2022	Material identification	TI-IWR1443 FMCW (77 GHz–81 GHz)

Medical

Table 8. Medical applications with popular radars.

Reference	Year	Application	Radar Used
[81]	2018	Blood glucose level detection	FMCW-XENSIV (60 GHz)
[85]	2019	Multiple patients behavior detection	TI-AWR1642BOOST (77 GHz)
[90]	2020	Skin cancer detection	Designed sensor (77 GHz)
[87]	2021	Contactless fitness tracking	TI-IWR1642 (77 GHz–81 GHz)
[82]	2022	Contactless monitoring of patients and elderly people alone	IWR6843AOPEVM (60 GHz–64 GHz)
[92]	2022	Measuring systolic blood pressure	TI-IWR6843AOP (60 GHz–64 GHz)
[93]	2022	Vital sign measuring	TI-IWR1443 (77 GHz–81 GHz)
[94]	2022	Health monitoring with posture estimation	TI-IWR6843 (60 GHz–64 GHz)
[95]	2022	Blood pressure monitoring	TI-AWR1843 (77 GHz–81 GHz)
[96]	2022	Cardiorespiratory rate monitoring	Commercial FMCW (122 GHz)
[97]	2022	Galvanic skin test to assess mental acuity and stress levels	TI-AWR1843 (77 GHz)
[98]	2022	Automated heart rate and breathing rate monitoring	TI-AWR1443BOOST (77 GHz)

Robotics and automation

Table 9. Robotics and automation applications with popular radars.

Reference	Year	Application	Radar Used
[102]	2019	Intelligent robot for transparent object sensing	IWR6843 (60 GHz)
[103]	2020	Robot-mounted mmWave radar for tracking heart rate	IWR6843 (62 GHz)
[54]	2020	Predicting autonomous robot navigation	FMCW (77 GHz)
[101]	2020	Collision detection and avoidance	IWR6843 (60 GHz)
[104]	2020	mmWave radars as safe guard robots	IWR6843 (60 GHz)
[100]	2021	Automated indoor navigation and path tracking	AWR6843 (77 GHz)
[99]	2021	Glass wall and partition detection	IWR1443BOOSTEVM (77 GHz)

Security and surveillance

Table 10. Security and surveillance and civilian applications with popular radars.

Reference	Year	Application	Radar Used
[114]	2006	Power line prediction in helicopter rescue	mmWave radar (94 GHz)
[115]	2008	mmWave radars for safe helicopter landing	Radar module with 94 GHz
[116]	2010	Providing indoor security of short range	mmWave SAR (77 GHz)
[117]	2010	Debris detection on airport runways	mmWave radar (73 GHz–80 GHz)
[118]	2013	Concealed threat detection	W-band (75 GHz–110 GHz)
[108]	2015	Surveillance imaging applications	MIRANDA radar (35 GHz and 94 GHz)
[113]	2018	Traffic monitoring	IWR1642EVM 77 GHz radar
[119]	2019	Human target detection, classification, tracking	ISM band (24 GHz MIMIC)
[120]	2020	Tracking of malicious and hidden drones	mmWave (77 GHz)
[121]	2021	Ego-motion estimating in indoor environments	TI-AWR1843BOOST (76 GHz–81 GHz)
[2]	2021	Unmanned aircraft system detection and localization	AWR1843 Boost (76 GHz–81 GHz)
[106]	2021	Aerial vehicle locating and air traffic management	AWR1843 (76 GHz–79 GHz)
[122]	2021	3D human skeletal pose estimation	TI-AWR1843 (77 GHz)
[123]	2023	Indoor positioning system	IWR6843ISK (60 GHz–64 GHz)

References

[17132552990.83466200.pdf \(business-standard.com\)](#)

[Transcript-of-Earnings-Call-Q4FY23-1.pdf \(sansera.in\)](#)

https://www.youtube.com/watch?v=r_AqsJGIRUo

[The fundamentals of millimeter wave radar sensors \(Rev. A\) \(ti.com\)](#)

[Millimeter-Wave Radar - an overview | ScienceDirect Topics](#)

[17132552990.83466200.pdf \(business-standard.com\)](#)

[List of LiDAR Players in China. When it comes to LiDAR for autonomous... | by Shuai Chen | Medium](#)