

## Hardware Innovations for Radar Technologies

# AI-powered radar solution for safe autonomous driving

## Research Project AI Radar

Come snow, rain, heat, or gloom of night - autonomous vehicles have to be safe on the road and work in every weather. In addition, they must be able to navigate routes with little traffic and few turns just as well as busy roads in urban areas.

In order to detect potential obstacles and hazards, even those coming from the side, at an early stage, sensors are needed that enable 360° monitoring all around the vehicle. This requires extremely powerful and coordinated software and hardware components.

### AI Radar for autonomous vehicles

The AI Radar consortium is developing a highly miniaturized multi-sensor module and AI algorithms that increase the spatial resolution for autonomous vehicles and enable early hazard identification and analysis.

### Targets for the radar hardware:

- Angular resolution of azimuth  $\pm 90^\circ$  with a new 3D antenna design
- Antenna gain of 12dBi by focusing in elevation
- Angular resolution  $< 1^\circ$  by merging the DBF data from multiple individual sensors

### Contributions from Fraunhofer IZM:

- Hardware architecture for the AI radar module, cognitive edge, and AI algorithms
- PCB design
- Construction and qualification of SMD-mountable 3D MIMO antennas

### Target innovations:

- 3D deformation process for free-form 3D MIMO antennas

### Project partners

- InnoSenT GmbH
- KSG GmbH
- Creonic GmbH
- Universität Bielefeld

### Project volume

- € 3.49 million
- 65% Funding share

### Duration

- 08/2019 - 01/2023

### Funding code

- 16ES1018

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The innovative compression mold approach enables high integration density while remaining cost-effective, with flexible circuit carriers/foils back-molded with high filled epoxy resins (molding compounds).

SMD-mountable 3D MIMO antennas increase the detection range of the integrated radar system. They are based on 3D-structured substrates, with a geometry precision-made at Fraunhofer IZM.

The radar, GPS, and optical data is processed by AI and takes place directly in the sensor module or in a network of sensor modules (cognitive edge computing).

- Efficient use of resources for the volume of data to be transmitted
- Reduced latency
- Increased robustness and reliability of the sensor technology

The sensors can be mounted in almost any place on the vehicle, as there is no need to account for a spatial integration of optical and radar sensor technology.



Cascading of six MIMO radar systems across the entire vehicle

### Advantages of AI Radar modules:

- 360° all-round coverage
- Highly reliable sensor technology
- Increased safety for driver assistance systems

### Other areas of application:

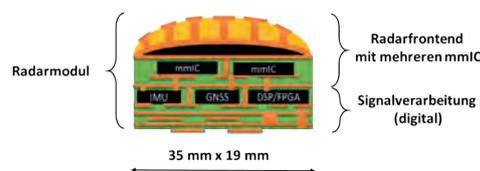
- Robotics
- Drones
- Other mobile applications

### Possible applications:

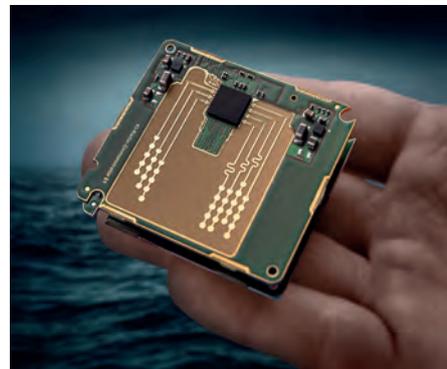
- Safety, traffic monitoring and collision avoidance in manufacturing
- Smart homes

### Project Status (10/2022):

- Construction of the final demonstrator
- Preparation for the demonstration



3D embedding concept (700mm<sup>2</sup>)



79 GHz radar module

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### More information



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### Get to know our packaging and frontend solutions for radar modules!

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