

Hardware Innovations for Radar Technology

60 GHz radar for combined gesture and position tracking

Research Project DAYSI

Fraunhofer IZM has developed radar technology that combines the advantages of an FMCW radar with the angle estimation possible with MIMO radar for the simultaneous detection of objects' position and motion through space. This opens up new areas of application that require a contactless means to detect objects or track their movement. In addition to home automation, there is a wide range of possible applications in industrial automation.

Tables equipped with radar

Communication - both verbal and non-verbal - plays an important role in care for the elderly. To facilitate communication in the work with people suffering from dementia, the partners involved in the DAYSI research project are developing an interactive table equipped with radar and communication technology.

Gesture recognition allows the patient to communicate non-verbally with the table and the objects on it. The objects are linked to the table via standard communication interfaces, and their position is tracked by the radar sensors. The radar concept pursued in the project works with high-resolution coverage of the room above the table in order to detect the objects.

Purpose of the radar frontend:

- covering horizontal surfaces at close range (from 10 mm)
- detecting objects in space with high resolution
- modular design with variable interfaces with the system environment

Contribution of Fraunhofer IZM:

- development of the radar system
- development of the system concept
- hardware development and deployment
- software development
- wireless charging with Qi standard

Target innovations:

- radar system for 3D position and motion detection

Project partners

- Böhm GmbH & Co. KG
- Charité Universitätsmedizin Berlin
- CONTAG AG
- Creonic GmbH
- Evang. Altenhilfe Duisburg GmbH

Project volume

- € 2.11 million
- 74% Funding share

Duration

- 01/2019 - 06/2022

Funding code

- 16SV8124

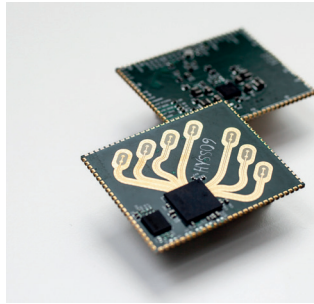
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By combining MIMO and FMCW radar, the radar system developed in this project differs from current systems on the market, which allow either gesture recognition or position tracking.

Using 3D backscatter information enables the recognition of previously learned objects. This is done by pattern matching of the recorded frames with those of the stored frames.

A frame refers to the point cloud of the backscatter information gained in each scan. It is possible to record 30 frames per second.



Basic data of MIMO radar concept

60 GHz	Operating frequency
1.200 mm*800 mm	Lateral detection range (X-Y direction)
1.000 mm	Max. possible detection depth (Z-axis)*
12 mm	Resolution of position determination on the X/Y-axis
125 mm	Resolution of position determination on the Z-axis
100 mm*120 mm	Size

* greater depths of coverage in preparation

Advantages of the radar frontend:

- Combined distance, angle, and velocity tracking at distances from a few centimeters up to several meters
- Good resolution in the X-Y plane, adequate discrimination in the Z-axis
- Plug & Play solution, can be used without radar expertise
- Compact design, easy to integrate in applications
- Robust against humidity, contamination, and temperature changes
- Radiographic reach through optically dense media

Radar sensor targets:

- Presence
- Distance, level
- Position in space
- Movement, motion pattern
- Object detection

Radar applications:

- Industrial sensors
- Robotics
- Safety and security
- Home automation
- Virtual worlds

Project status (03/2023):

- Design of a pre-series radar sensor
- Test of different application scenarios for functionality and robustness
- Sensors available for suitability tests by customers

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The radar system is part of a universal radar platform developed by Fraunhofer IZM for the efficient realization of radar projects. With this ready-to-plug&play radar kit, 24, 60, and 79 GHz applications with ranges from 0.1 to 260 meters and angular resolutions of less than 5° are possible. The frequencies can be combined with single, phase array, and MIMO antenna designs. The boards are mounted via SMD (plated half holes) on conventional printed circuit boards.

You would like to get to know our packaging & frontend solutions for radar modules?

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Fraunhofer IZM: Invisible - but indispensable. Nothing works anymore without highly integrated microelectronics and microsystems technology. The basis for their integration into products is the availability of reliable and cost-effective assembly and interconnection technologies.

Fraunhofer IZM, a world leader in the development and reliability assessment of electronic packaging technologies, provides its customers with customized system integration technologies at the wafer, chip, and board level. The research done at Fraunhofer IZM helps make electronics more reliable and provides customers with reliable data about the durability of electronics.

More information



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