

Microradar / Gyeonggi-Russia Technology Cooperation Center

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MRDR

Radar is the crucial sensor

For ADAS, self-driving and smart city applications



The market share is 45% on automotive ADAS sensor market



Works in night and harsh environments



Robust sensor, does not have moving parts



Empowers cameras and lidars, but works as a single sensor as well



4D sensor measures 3 coordinates and velocity

Radar target applications



Automotive

ADAS: ACC, Collision
avoidance/FCW/AEB, BSM

360-degree radar set

Autopiloting

Single- or multi-sensor setup

Should be ISO26262-compliant



UAV

Collision avoidance

Navigation

Altimeter

Single- or multisensor setup

No special regulation applied



Smart city

Traffic radars

Single- or multisensor setup

No special regulation applied

The goal



**The goal is to develop
an automotive/smart city radar, where:**

- RF part is taken from an existing supplier (ADI, Infineon, TI)
- Digital processing part is developed and gives full control for its parameters and reaches maximum speed and efficiency by using native FPGA/ASIC instructions

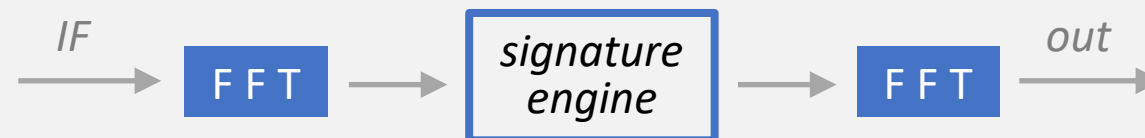
The result is a family of radars capable of various applications

Our approach, technically

Two FFTs is the conventional radar baseband processing scheme



We complement them by our development called signature engine that implements extra operations: signal optimal filtering, free waveform modulation, digital I and Q extraction etc.



It runs in real-time on affordable Altera FPGAs

What is special here?

1. _____

FPGA codes advances radar parameters as it runs about 10x faster than ARM at the same processor price

2. _____

Novel processing method allows one to vary any parameters of the radar depending on the requirements

3. _____

Development tools allow to test various components setups as they appear on the market to update the radar design

Radar overview



24 GHz and 77 GHz single-beam FMCW radars capable of simultaneously detecting range, azimuth, elevation, velocity (4D radar) and extracting extra data with no scanning



2 chip radar, 30 to 50 frames per second, single or multiple sensor configurations supported



Typical parameters:
range up to 200 m with <1m accuracy,
 ± 300 kph range with <1kph accuracy,
up to 150x20 degrees field of view depending on antenna configuration



Target BoM is USD 30-50 in mass production



Built-in AI-based signature comparison engine to save more complex information for further processing, sine waveform modulation for almost interference-free sensor

RF frontend overview

- 1TX/3RX
- The simplest receiver scheme where each RX channel contains a single-ended RF input with an on-chip balun followed by a differential low noise amplifier (LNA) and a downconverter mixer with differential output buffers
- No hardware I and Q separation needed
- Currently available from ADI, Infineon, ST, etc.
- Should support external frequency modulation
- Non-linear external IF amplifier

Processing unit overview

Basic processing algorithm includes:

1. Many FFTs
2. Tough SDRAM operations. Complex optimization is done to fit into affordable low-speed memory limitations
3. Multi-threaded accumulation multiplication

Additional features include:

4. RF part control, signal modulation etc
5. Ethernet (TCP/IP) implementation

Product benefits

4D radar: range, azimuth/elevation angle, velocity estimation

to match existing solutions' functionality

Sine waveform modulation

for much more interference-free radar than conventional LFM radars

Simultaneous range/velocity resolution

for high target resolution

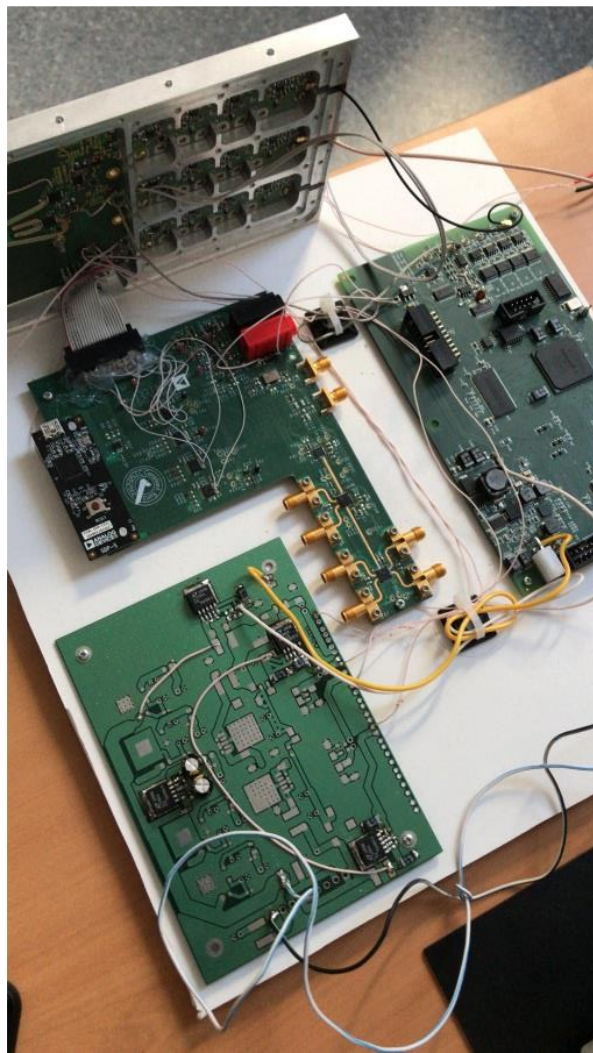
Machine learning techniques may be applied

to improve radar's parameters during its lifecycle

30 to 50 Hz refresh rate

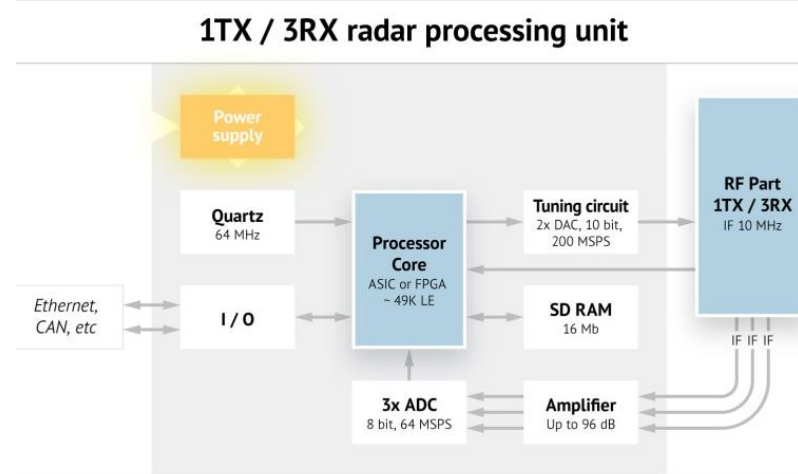
for faster feedback

Some pictures here

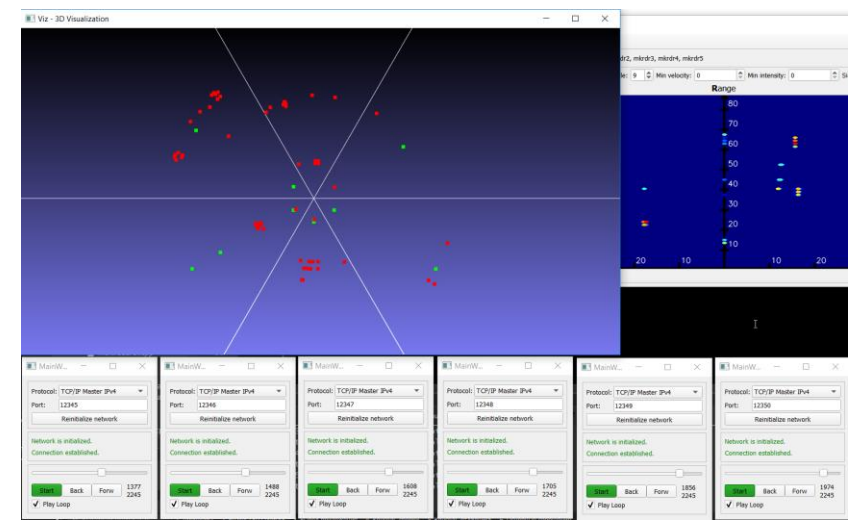


Radar
test mule

Example of HW documentation



Multiradar software kit



Our team



Ivan Koshurinov, CEO/Co-founder

- Nizhny Novgorod technical University engineer degree
- Responsible for business development, project management, marketing.
- Contributing to Microwave Journal, YouTube, habr.com etc.

We also have:

- Tech lead with 15+ years radar algorithm and simulation development.
- HW team capable of doing the design from idea to tests and production.
- Development and manufacturing site in Nizhny Novgorod
- FPGA team with more than 15 years Verilog/VHDL experience in DSP and computing, ASIC/FPGA experience from code to physical synthesis and tests.
- Scientific researcher with 50+ years radiolocation experience, honored by Russian State Award.

Cooperation proposition

We are focusing on a joint development scheme to quickly get a family of original radar sensors.

We offer to work in the niche of low-cost automotive solutions with the goal of reaching USD50 versatile 4D-radar.

We have developed:

- General radar architecture and design, including antennas
- Baseband radar software (> 10,000 LoC for FPGA)
- Additional software (> 5,000 LoC in C++ for x86)
- Test mules and radar samples (5 more to come in October)
- Corresponding IP (2 patents + 1 pending)
- TCP/IP data interface



Everything is ready to start co-development just in weeks

**Ivan
Koshurinov
+79200269268**

info@microradar.ru

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