

EESTEC Hackathon- Radar Based Indoor People Counting

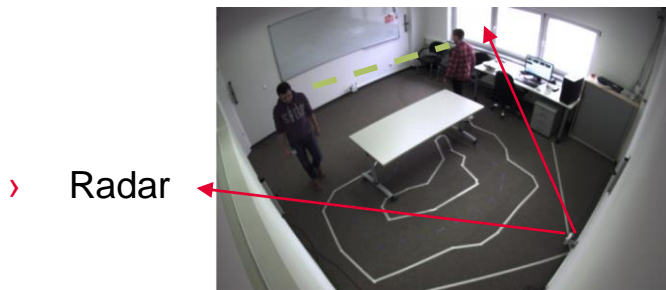
Souvik Hazra

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Problem Statement

- › Build a ML based People Counting solution using Infineon's BGT60TR13C radar chip
 - Target Scenario – Indoor moving person count (0-3 persons) within a range of 3m.
 - Height of Radar from ground – 0.8m to 1.5 m



› Radar

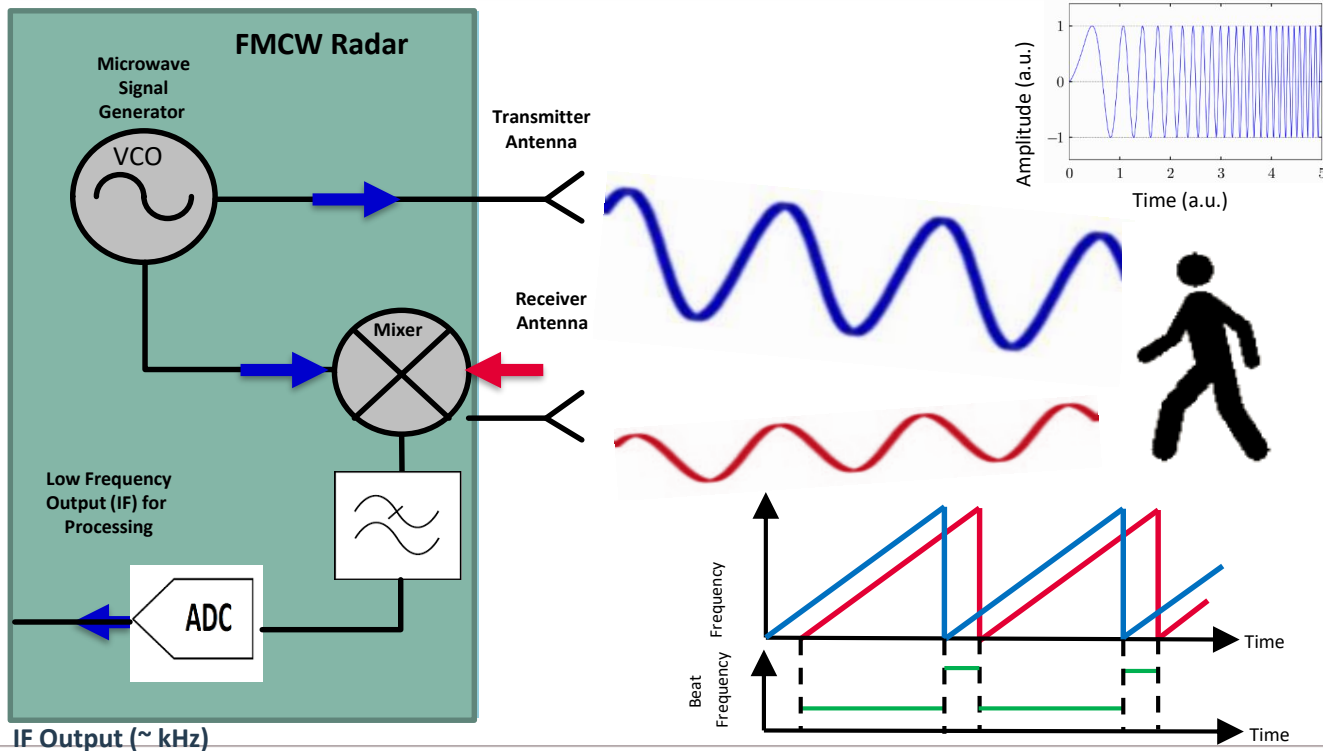
› Target Scenario Example

Evaluation Criteria

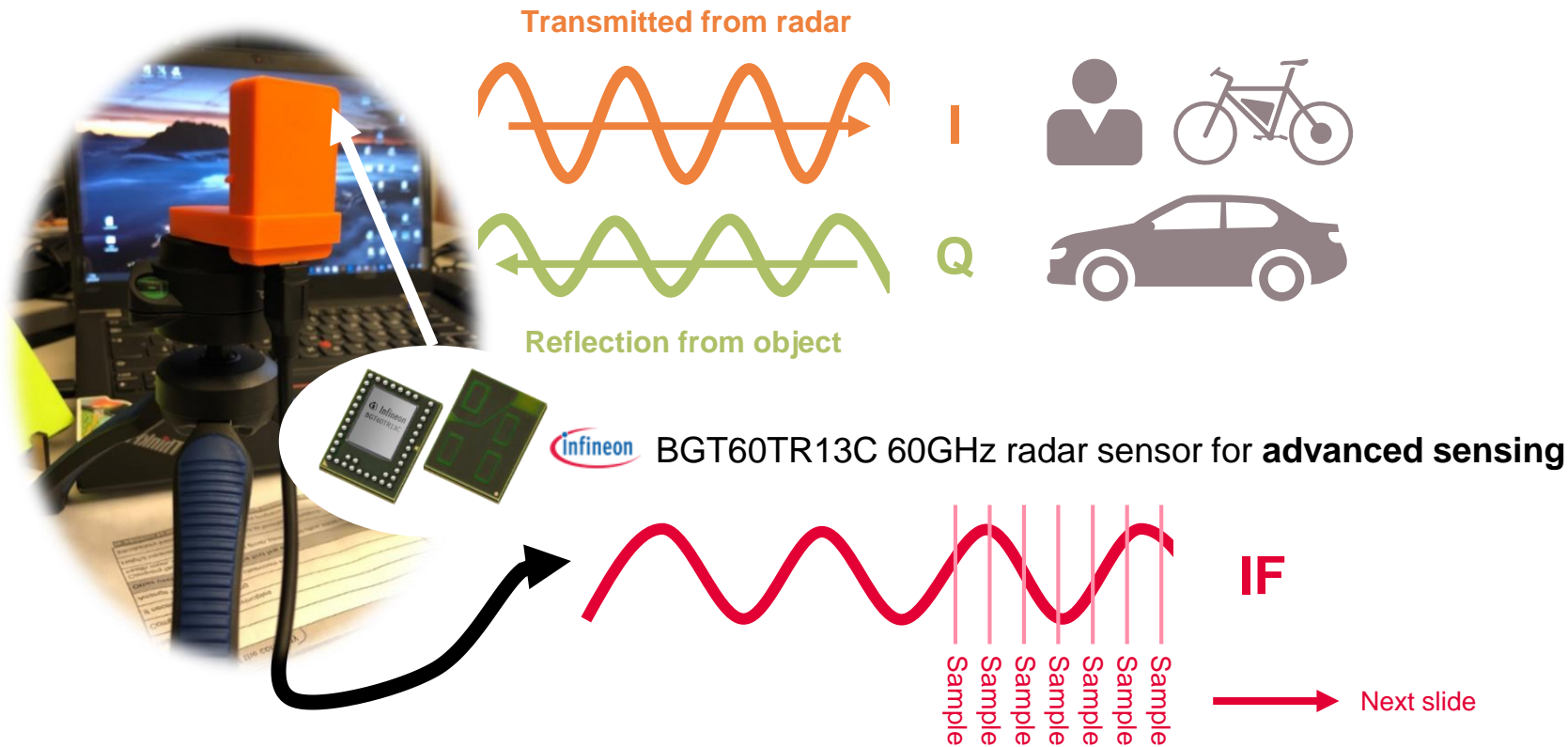
Criteria	Points
Algorithm Innovation (Data Collection, Overall Flow , etc.)	20
People Counting Accuracy	20
Application Note	20
Pitch	20
Algorithm Complexity	20

Frequency-Modulated Continuous Wave (FMCW) Radar

IF (intermediate frequency) output = Beat frequency



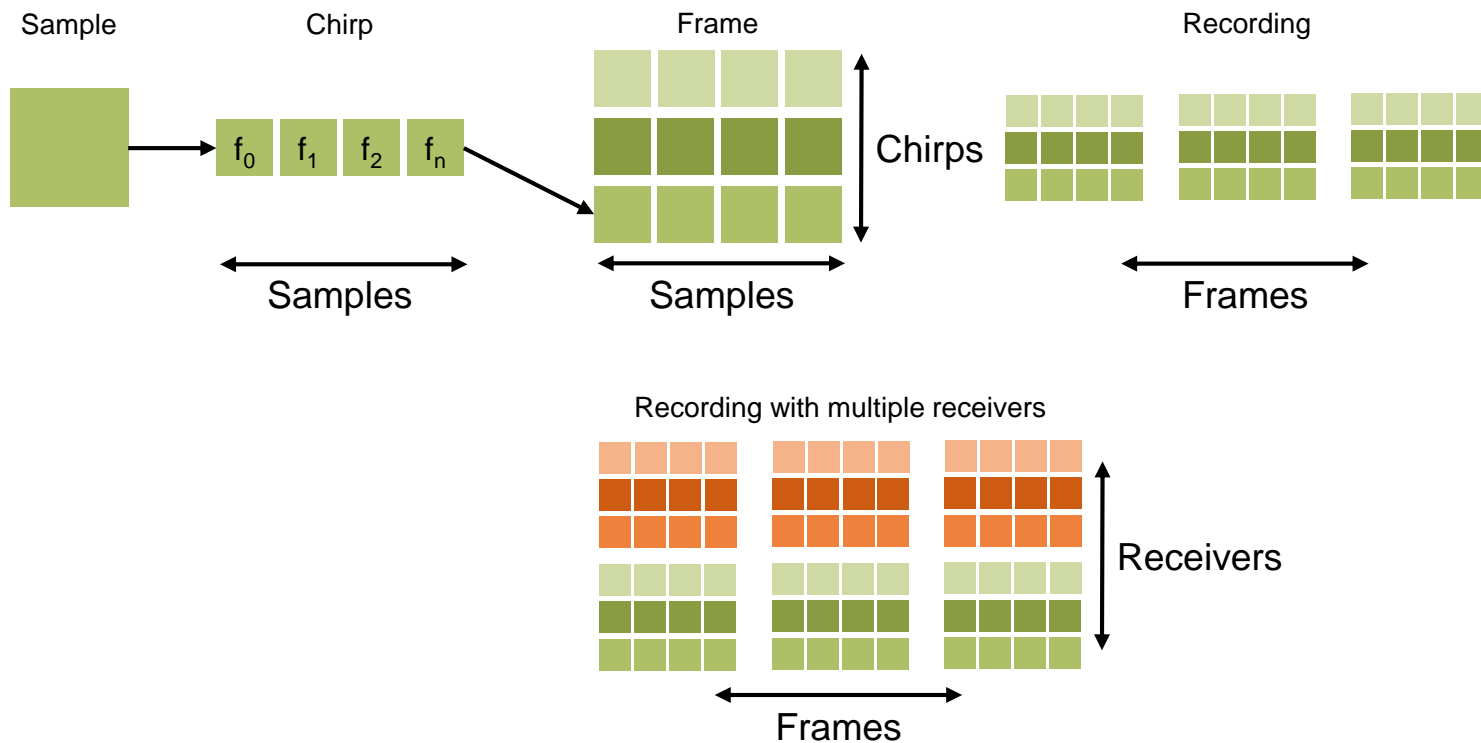
Radar Sensor Principle



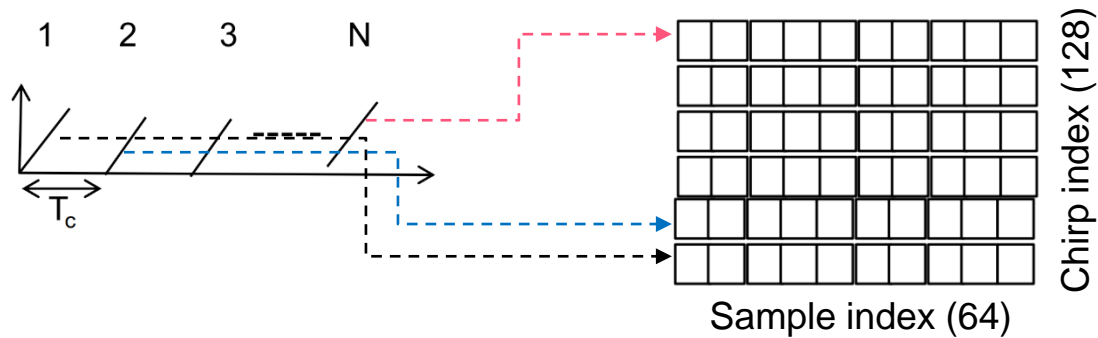
Radar Parameter Settings

Parameters	Symbol	Value
Ramp start frequency	f_{min}	60.5 GHz
Ramp end frequency	f_{max}	61.5 GHz
Bandwidth	B	1 GHz
Range Resolution	δr	15 cm
Max. Range	R_{max}	9.6 m
Sampling frequency	f_s	2 MHz
Chirp repetition time	T	400 us
Tx Power level	P_{max}	31
Frame repetition time	T_{Frame}	0.05 sec
Number of chirps per frame	N_c	64
Num of Tx antennas	N_{Tx}	1
Num of Rx antennas	N_{Rx}	3
Number of samples per chirp	N_s	128

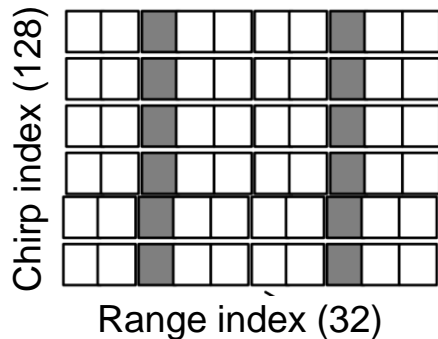
Radar Data Basics



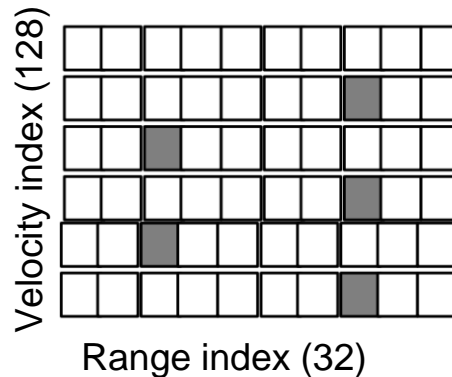
Sample Pre-Processing



1. ADC data corresponding to chirps are stored as the rows of a matrix

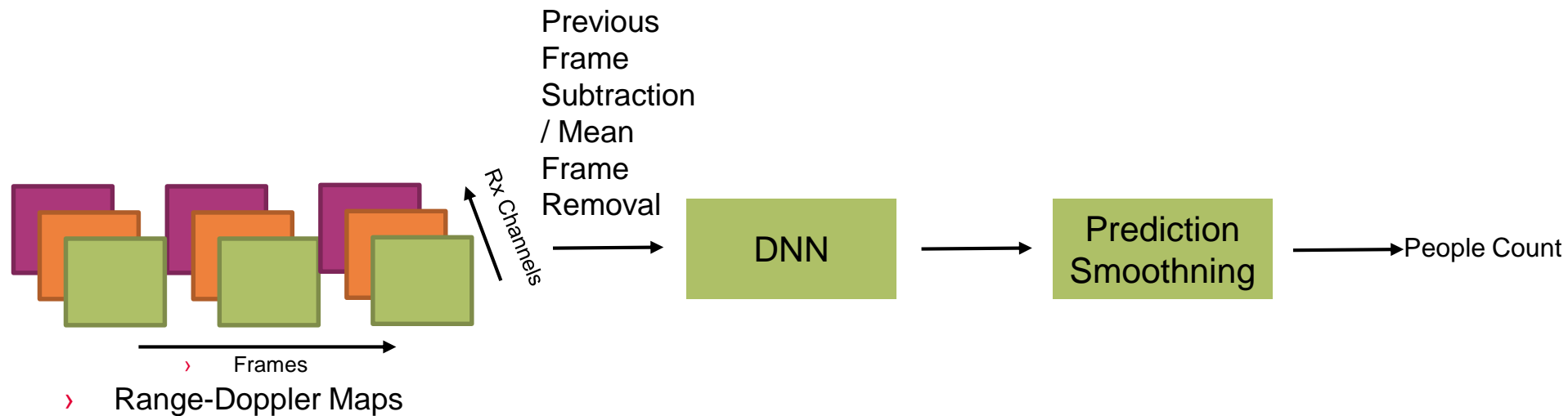


2. A **range-FFT** on each row resolved objects in range (real data is symmetric)



3. A **doppler-FFT** along the column resolves each column in velocity

Example Algorithm Flow



References

- › [Multi-Modal Cross Learning for Improved People Counting using Short-Range FMCW Radar](#)
- › [People Counting Solution Using an FMCW Radar with Knowledge Distillation From Camera Data](#)



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