IEEE AEROSPACE & ELECTRONIC SYSTEMS SOCIETY

Integrated Sensing & Communications Initiative

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Motivations: Spectrum Erosion

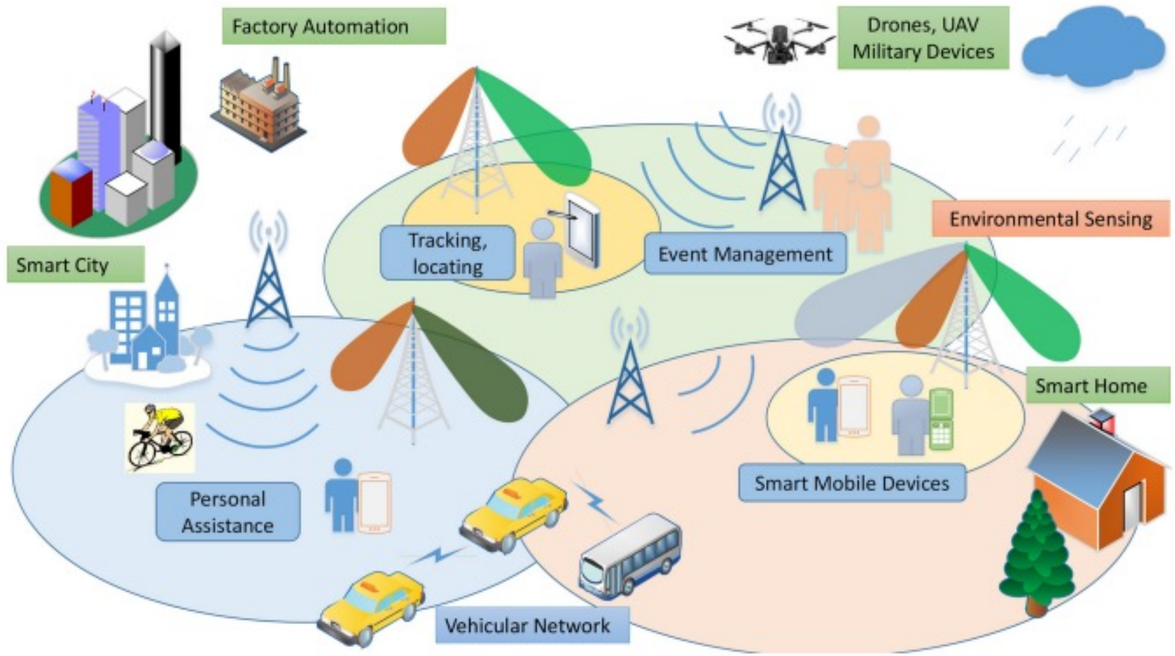



Frequency Band	Radar Systems	Communication Systems
L-band (1-2GHz)	Long-range surveillance radar, ATC radar	LTE, 5G NR
S-band (2-4GHz)	Moderate-range surveillance radar, ATC radar, airborne early warning radar	IEEE 802.11b/g/n/ax/y WLAN, LTE, 5G NR
C-band (4-8GHz)	Weather radar, ground surveillance radar, vessel traffic service radar	IEEE 802.11a/h/j/n/p/ac/ax WLAN
MmWave band (30-300GHz)	Automotive radar, high-resolution imaging radar	IEEE 802.11ad/ay WLAN, 5G NR

Motivations: new technologies

- Widespread diffusion of **mmWave communications (5G/6G)** similar to sensing systems under several viewpoints.
- **Massive MIMO** technology, granting an enormous amount of degrees of freedom, which fosters full integration of the Communications and Sensing functions.
- Development of **Machine Learning/Deep Learning** techniques that can help in handling and processing a huge amount of data from multiple sources.
- Waveform diversity, that again grants more degrees of freedom.

Sensing and Communication System Networks in mmWaves (5G/6G)



Application Areas	Cases and Examples
Smart Trans-portation	- Real-time city-wide vehicle classification and tracking; - Vehicle speed measurement; - On-road parking space detection; - Sensing assistant to autonomous driving; - Drone monitoring and management.
Smart City	- Extensive on-street and open space surveillance for security and safety; - Low-cost automatic street lighting systems; - Crowd management for major events and emergency evacuation; - Integrated personal navigation and safety services provided by PMN and smart mobile devices.
Smart Home	- (Through-the-wall) localization and tracking; - Human behavior recognition and fall detection; - Monitoring of biomedical signals such as respiration patterns; - Human presence detection and radio fence.
Industrial IoT	- Localization and tracking of vehicles, equipment, and workers; - Surveillance and proximity detection; - Object recognition and authentication; - Gesture recognition for equipment operation.
Environ-mental Sensing	- Factory emissions and pollution monitoring; - Rainfall monitoring and flooding prediction; - Animal migration monitoring; - Monitoring of migratory birds and insects.
Sensing-assisted Comms	- Radio signal propagation mapping and site survey; - Beam tracking and predictive beamforming; - Sensing-seeded encrypted communications; - Sensing assisted resource optimization for communications.

Integrated sensing and communications systems: our expertise

- Environment modelling and analysis
- Techniques and systems for passive and active sensing, localization and tracking
- Cognitive and knowledge-based techniques for sensor networks
- Smart resource management and placement
- Data and information fusion methods

This area is attracting a lot of attention and will attract a lot of funds from industry and Government institutions.

1st Workshop organized by AESS: Program

1:30 **Mark Davis** – Welcome and introduction

1:40 **M. Sabrina Greco** – Integrated Sensing and Communications: the AESS Perspective

2:00 **Moeness Amin** - Communication Signal Steganography Using Radar

2: 30 **Christos Masouros** – Securing the Integrated Sensing-Communication Network

3:00-3:30 Coffee break

3:30 **Marco Lops** – Radar-Enabled Ambient Backscatter Communications

4:00 **Kumar Vijay Mishra** - Emerging Technologies for Distributed ISAC Systems

4:30 Concluding remarks

Plan for the future

- Activities already carried out by SPS/ComSoc WTG over the last year:
  - On-line and in presence workshops
  - Special sessions at conferences and special issues on journals
  - Webinar series
  - Newsletter (ISAC Focus)

- Build a **Working Technical Group** on ISAC under AESS aegida (by the end of 2022).
- Merge some of our activities with those of the similar WTG of SPS and ComSoc (Joint MoU?)
- Jointly organize (as multi-society initiative) workshops on ISAC, possibly starting in 2023.