INWITE: Interdisciplinary Research of Wireless Technologies

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1. Introduction & Background

SIX - The Centre of Sensor, Information and Communication Systems
- Established in 2010 by four departments of the Faculty of Electrical Engineering and Communication (FEEC), Brno University of Technology (BUT), Czech Republic
- Full operation since 2014
- Focused on electronic systems for communication and related issues

SIX research centre
sensor, information and communication systems

INWITE - Interdisciplinary Research of Wireless Technologies
- 5-year project supporting 5 topics of research activities in SIX (01/2015 - 12/2019)

2. Ongoing Research

The research of innovative concepts of wireless communication systems, which can provide high reliability, high speed and capacity, jointly ensuring high digital security with a wide applicability

INWITE aims at the priorities of the HORIZON 2020 work program:
- **Smart cities and Communities**
- **Mobility for growth**
- **Digital security**

All activities within the project are covered under the umbrella of five working groups:
WG1 - Sensors
WG2 - Signals
WG3 - Radio Frequency Systems
WG4 - Mobile Communication Systems
WG5 - Cyber Security

Each WG led by one supervisor from SIX and one co-supervisor from Technical University of Vienna (TU Wien)

3. Research Plan

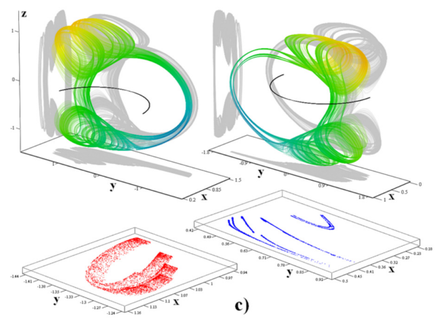
WG1 - Sensors
- autonomous sensor node
- environmental monitoring
- ambient assisted living systems
- security and auto-diagnostic tools

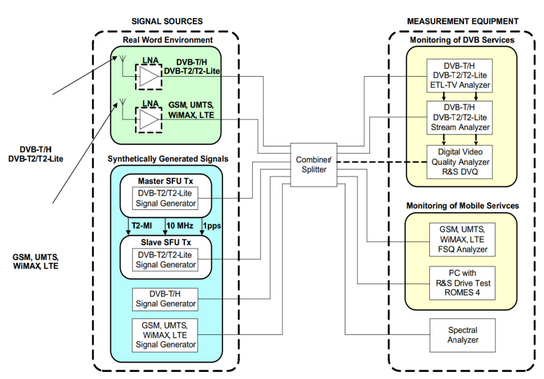
WG2 - Signals
- detection and localization of extraordinary events
- algorithms for handling moving objets
- high performance decision making, analysis and prediction

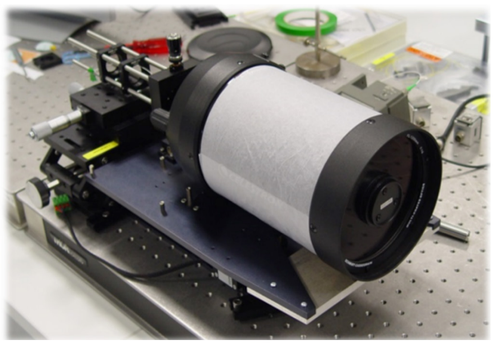
WG3 - Radio Frequency Systems
- vehicle-to-X communication
- hybrid and optical communication channels
- positioning and navigation

WG4 - Mobile Communication Systems
- future generations of mobile communication systems
- machine-to-machine communication
- antenna concepts for future generations of mobile comm. systems

WG5 - Cybernetic Security
- cryptographic protocols
- analytics tools
- privacy enhancing technologies







3. Expected Findings (selected)

Year 1 (2015)

- design of new modifications of CCTO materials with high permittivity
- evaluation of fluctiation phenomena in gas sensors

- selection of features and training for extraordinary event detection
- design and simulation of a ranging model (moving object localization)
- identify the potential of acceleration of the SotA learning algorithms

- measurement and evaluation of V2X channels in frequency domain
- platform for characterization of turbulent atmospheric outdoor channel

- unified architecture for simulating different systems with various RATs
- traffic modeling platform for machine-to-machine communication
- analysis of basic elements for intelligent antenna system

- benchmark lightweight cryptographic protocol primitives
- zero-knowledge cryptogtaphic protocols using existing primitives evaluation, with new algebraic structures

Years 2-5 (2016-2019)

- investigate the potential of CCTO systems and verify CCTO-based super capacitor on a chip
- statistical evaluation and machine learning using multimodal data for extraordinary event detection

- new decentralized and fully distributed learning algorithms

- measurement of UWB, MMW band channels in time and frequency domain and exploiting the models for definition of PHY layer concept

- optimization of physical layer signals of mobile systems to allow operation with minimal power, considering interference cancellation
- simplification of mobile communication stack for low cost devices
- intelligent antenna system and wideband high gain millimeter-wave ant.

- cryptographic protection of smart house, V2X, wearables, etc.
- complex technologies for user authentication and access control