Researches in wireless innovative technologies laboratory (witLab) focus on wireless communication systems engineering and networking. The witLab is conducting research to improve the wireless network performance and design innovative and efficient algorithms for current and next-generation wireless communication systems. The research contribution of witLab is mainly to the methodologies for the efficient use of radio resources such as frequency, power, and space. Our research results are in the areas of RRM, diversity, and networks. For RRM, efficient power/rate allocation and proportionally fair scheduling algorithms in MultiCarrier-based systems have collected a lot of attention in the fields. Diversity techniques from the soft/softer handoff in 2nd generation CDMA-based systems, vertical handover in HetNet, and to CoMP in current systems are also among the key results from witLab. Also, research activities on optimal dynamic operation of HetNet including FFR, and network coding can be mentioned. Other areas of research include MIMO-OFDM, Multicell Coordination, Cooperative network, Network coding, Cognitive Radio, etc.

Current research projects include development of 5m accuracy ULS platform supporting AR service jointly with ETRI. In this project, we focus on designing smartphone-based indoor positioning algorithm using embedded inertial sensors without global positioning system (GPS) or Wi-Fi positioning system (WPS). Also, the witLab is conducting research on optimal radio resource allocation as well as interference mitigation method for the prior occupation of next generation’s wired and wireless convergence communication network technologies. In addition to wired and wireless convergence network currently, we are working on heterogeneous wireless network which includes diverse network topology such as satellite, mobile, micro, and femto cells for future network environment. Since heterogeneous network provides complicated environments than homogeneous network from the perspective of interference, scheduling, power allocation, and handover issues will be challenging problems in heterogeneous network.

KEY ACHIEVEMENTS


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The research of Advanced Radio Technology (ART) laboratory focuses on signal processing for digital communication systems. The various related topics are being studied such as Massive Multiple-Input Multiple-Output (Massive MIMO) for green communication, cognitive radio (CR) for spectral efficiency, collaborative signal processing for physical-layer security. We also do researches on localization without using Global Positioning Systems for indoor applications.

Massive MIMO: While the research on multiple-input multiple-output (MIMO) techniques has focused on increasing link reliability and spectral efficiency, the new direction is being established for the energy-efficient communications. By installing hundreds of antennas on transmitting part, the significant amount of energy can be saved. Our focus is on the optimal design of the beamformer for the energy-saving problem.

Cognitive Radio: Among cognitive radio (CR) techniques, we propose the MIMO-based underlay strategy based on pre-coder design of the secondary transmitter.

Localizalization: For location-aware services, the less complex but accurate ranging technology is essential. We develop low-complexity algorithms for super-resolution time-of-arrival or angle-of-arrival estimation, which can be used for sensor networks or for WiFi and cellular networks.

Secrecy Communication: Besides the conventional key-exchange based security strategy, the physical-layer security is getting great attention in the research fields. Our work is focused on secrecy enhancement via MIMO cognitive radio.

Cooperative Communication: Cooperative communication systems, such as multi-cell coordinated system and relay based system, provide reliable data transmission that satisfies user’s QoS. We study the optimal relay’s beamformer design for various objectives.

KEY ACHIEVEMENTS


MAJOR ACHIEVEMENTS in 2011/2012


Advanced Radio Technology Laboratory

WitLabs and ARTs: Ever since the Wireless Innovative Technologies Laboratory (witLab) in 2001, we have fostered a synergy with the Advanced Radio Technology (ART) laboratory in the Advanced Radio Technology Laboratory (ARTL). Under the umbrella of ARTL, we have been developing many innovative technologies for efficient and secure wireless communication systems.