Rensselaer researchers to develop and test next-generation radar systems

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Professor Birsen Yazici at Rensselaer Polytechnic Institute is leading a new project to develop and test radar systems comprised of hundreds of miniature sensors communicating with ground sensors, unpiloted aerial vehicles, and satellites. Such a system could allow radars to be used in crowded cities and other urban environments. Credit: Rensselaer Polytechnic Institute

Researchers at Rensselaer Polytechnic Institute have received a grant for $792,000 from the U.S. Air Force to create a new laboratory for developing and testing next-generation radar systems that overcome one of the key limitations of conventional radars.

The new test bed, led by Birsen Yazici, associate professor of electrical,

computer, and systems engineering, will allow simulations of radar systems that are comprised of hundreds of miniature sensors communicating with ground sensors, unpiloted aerial vehicles, and satellites. Such a system could allow radars to be used in crowded cities and other urban environments.

"Conventional radar systems are designed for open spaces, and they do not work very well when used in urban environments with clutter from power lines, buildings, and dynamically changing elements like vehicles and people," Yazici said. "Active distributed and layered sensing, which is what we are doing, offers a whole new paradigm that addresses these challenges. The new test bed will be a huge step toward making these theoretical systems a reality."

The grant was awarded by the U.S. Air Force Office of Scientific Research. Margaret Cheney, professor of mathematics at Rensselaer, and Kenneth Connor, professor of electrical, computer, and systems engineering at Rensselaer, are co-investigators on the project.

Radar plays an important role in transportation, communications, and other applications because radio waves can pass through clouds, smoke, and other obstructions that often limit visibility, Yazici said. However, the usefulness of radar in cities and urban environments is quite limited due to their dynamically changing nature, as well as radio signal echoing. Just as echoes can make auditorium speakers difficult to understand, radar gets muddled when there are extra signals bouncing off different objects in an area.

Yazici and her colleagues have worked for some time to develop theoretical models in which conventional radar systems are replaced or augmented by many small, inexpensive radio frequency (RF) sensors that are stationary or deployed on air, space, or ground vehicles. These swarms of RF sensors communicate and share data and instructions in

real-time, have access to established data networks and databases, and are programmed to autonomously adapt to changing environments and goals.

To simulate such a system, the new test bed will position antennas in a large cylindrical chamber. The antennas will transmit and receive test signals, resulting in an extensive collection of data that is equivalent to that obtained with hundreds of small RF sensors. The 25-foot diameter chamber will be situated in Rensselaer's Watervliet research facility.

The capabilities of the test bed will include developing accurate and simple wave propagation models for complex environments; performing experiments with waveform, polarization, and 3-D spatial diversity and time-reversal methodology; as well as testing and evaluating new capabilities in opportunistic sensing, passive imaging, wide-aperture imaging, integrated sensing and processing, and moving target imaging.

Yazici said the new test bed will also promote the transfer and exchange of ideas and capabilities with federal laboratories, serve as a shared facility for Rensselaer and the Air Force Research Laboratory, and facilitate interdisciplinary and multi-university research in sensing, medical imaging, networking, robotics, advanced antennas, and control of stray RF energy from power systems. It will also be used for education, outreach, and training activities involving radar and other RF technologies.

More information: For more information on the new the RF test bed visit: hibp.ecse.rpi.edu/~connor/RF/T … ography/Testbed.html

Source: Rensselaer Polytechnic Institute (news : web)