International first place

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MSU’s IEEE Antennas and Propagation Symposium Student Design team wins top honors

Spartan Engineers from Michigan State University sounded the channel and won the “foxhunt” at the 2018 IEEE Antennas and Propagation Symposium Student Design Competition at 2018 AP-S in Boston, July 8-13.

The team of undergraduates Anton Schlegel and Justin Opperman and graduate students Pratik Chatterjee and Billy Stevers designed and built a radio system that located a 5 GHz radio transmitter and sounded a radio channel in real time to win the international contest.

Team advisor Jeffrey Nanzer, the Dennis P. Nyquist Assistant Professor of Electrical and Computer Engineering (ECE), said six finalist teams were selected from around the world – MSU, Colorado School of Mines, University of Alabama, two teams from Greece, and a team from Spain -- and provided with funds to build their proposed design.

“This ‘foxhunt’ allowed each team to showcase the various aspects of their design,” Nanzer said.

“The team put together an outstanding design, which included a software-defined radio (SDR) as a primary component,” Nanzer explained. “SDRs are going to play a huge role in future wireless systems. This experience gave our students critical experience which will help them in their research and future careers.”

See the MSU FoxFinder design in this video.

Nanzer noted that the MSU team’s system is based on the theory of an additive interferometer and has a custom interferometric antenna configuration with a single low-cost SDR serving as the receiver.

“The winning design is able to tune to frequencies within the 5GHz ISM band (5.725 - 5.875 GHz) and can switch between two baselines or a single antenna,” he said. “The narrow baseline used a shared patch antenna with each antenna separated by \( \frac{\pi}{2} \) (at 5.875 GHz) and enable coarse estimates of the transmitter location. The wide baseline consists of two patch antennas separated by about 4.77\( \pi \) (at 5.875 GHz), which allowed for high-accuracy location following the coarse estimation.

By using a standard omnidirectional antenna and the narrow baseline, the team could sound the channel and get close
to the transmitter by monitoring the power density spectrum using a real-time waterfall plot, Nanzer continued. The system can also be used to detect any multipathing from the transmitter by generating a delay spread profile of the transmitted bit sequence.

The team’s design and results will be published in a future edition of the *IEEE Antennas and Propagation Magazine*.

**Related Website:** [Communications contact: Patricia Mroczek](https://www.egr.msu.edu/news/2018/07/17/international-first-place)