

## Faculty Candidate Seminar – Autonomous and Connected Systems



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PhD Candidate  
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Monday, March 7, 2022

Presentation: 10:30 A.M. – 11:30 A.M.

Q & A: 11:30 A.M. – 12:00 P.M.

**Purdue Graduate Student Center**

504 Northwestern Ave. ~ Room 105A & B

<https://purdue-edu.zoom.us/j/99415358372>

## Connecting farms, forests, and cities with new approaches to wireless communication and sensing

**Abstract:** The Internet of Things (IoT) plays a critical role in connecting society to the digital world. Billions of IoT devices are used today to enable applications from smart homes and cities to digital healthcare and smart agriculture. While we have seen significant benefits, to fully realize the potential of these systems, we need to address a key challenge: enabling power and connectivity for resource-constrained environments. How can we collect data in remote forests, farms, or even oceans where there is no Internet connectivity or access to power?

In this talk, I will present two examples of my research that address this challenge. First, I will present FarmBeats, a system that enables seamless data collection by using new technologies such as TV White Spaces for communication and low-power sensors for data collection. FarmBeats is designed to enable data-driven agriculture techniques for farms that are located in areas that lack power and connectivity infrastructure. I have deployed the FarmBeats system across the United States and Europe, and we have demonstrated that the system can provide significant benefits for farms in the form of cost savings and productivity. Finally, I will talk about enabling battery-free sensing using novel passive wireless communication techniques. Conventional communication techniques view noise sources as something that harms wireless communication capacity and something that needs to be eliminated. On the contrary, it is possible to use noise to enable low-power communication on resource-constrained devices. I will present the design and implementation of the first wireless communication system that uses modulated Johnson (thermal) noise. I will conclude the talk with future research directions, including further applications for smart agriculture, healthcare, and space.

**Bio:** Zerina Kapetanovic is a Ph.D. candidate in the Electrical and Computer Engineering Department at the University of Washington. Her research focuses on low-power wireless communication, battery-free sensing, and the Internet of Things. Her research has been featured in BBC, the Economist, and Gates' Notes and has been recognized by top technological executives such as Bill Gates and Satya Nadella. She is also a recipient of the Microsoft Research Dissertation Grant. Before joining the Ph.D. program, she received her bachelor's degree in Electrical Engineering at the University of Washington, where she received the Electrical Engineering Outstanding Undergraduate Student Award in recognition of her achievements and commitment to service activities.