Unmanned aerial vehicles

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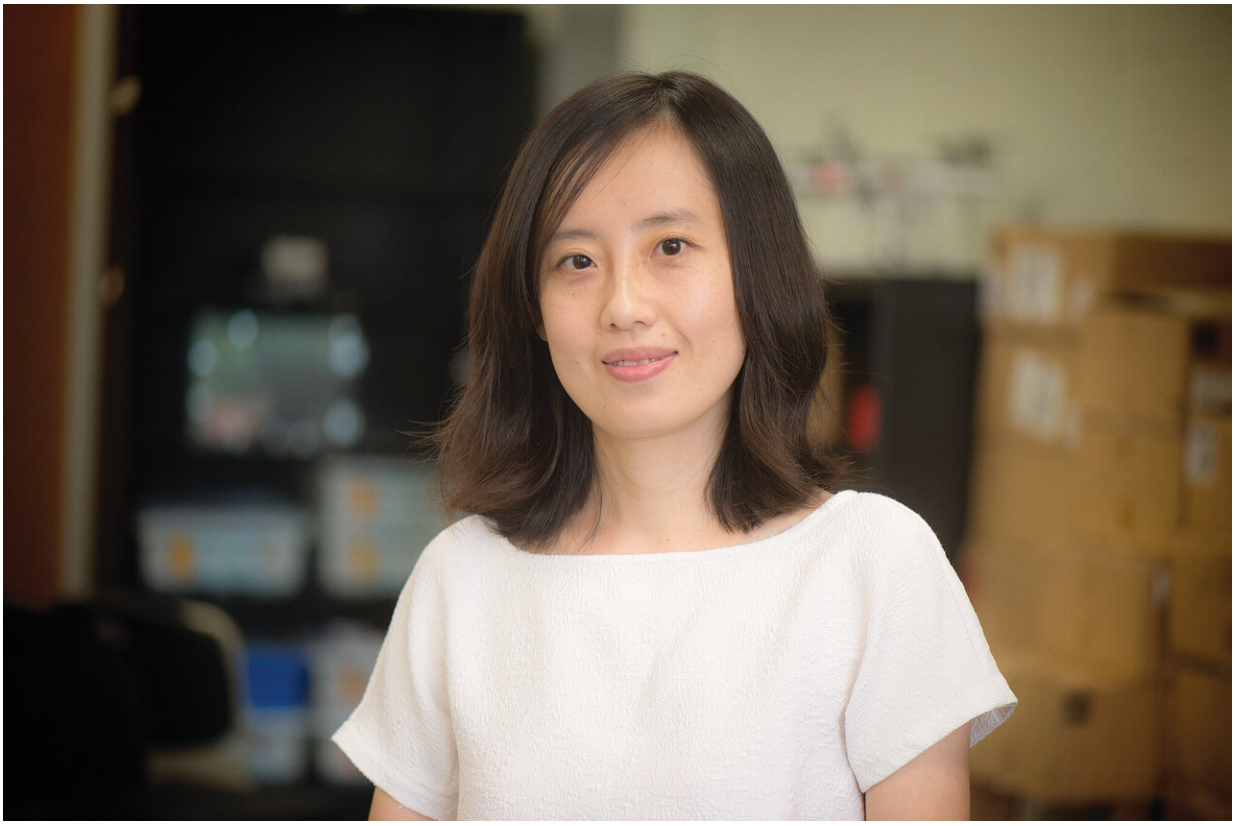

Yan Wan, UTA associate professor of electrical engineering. Credit: University of Texas at Arlington

Unmanned aerial vehicles, or UAVs, are increasingly used for tasks that are too difficult or dangerous for people to complete. But better control and communication among groups of similarly tasked UAVs is still needed, experts say.

Yan Wan, associate professor of electrical engineering at The University of Texas at Arlington, is working to solve this challenge by designing control and communication systems cohesively. Her research, recently published in *IEEE Transactions on Control of Network Systems*, is part of a National Science Foundation Faculty Early Career Development Program, or CAREER, grant she received in 2015.

Wan investigated networking solutions that work best for multiple UAVs trying to accomplish a single goal with limited physical resource constraints. While current control algorithms assume that communication between vehicles is present, that is not always the case because communication demands aren't taken into consideration when designing the controls, she said.

"An important factor in successfully designing remote networked control systems is the amount of throughput being routed through the communications side," Wan said. "A design that requires high throughput, if not met in an imperfect communication environment, can lead to the loss of control signals and failure of control tasks.

"We found that layered structures, in which multiple groups of UAVS communicate with one another through group leaders, are very promising to control networked UAVs," she continued. "We proved that such structures can significantly reduce communication throughput while still allowing efficient completion of distributed control tasks."

Wan's research, while still in the theoretical stages, could have an impact on the design of future unmanned vehicle networks—even, potentially, truly autonomous UAVs that work without human controllers. Understanding how to build networks that consider both control and communication needs would increase efficiency, reduce throughput requirements and improve network management capabilities.

Wan also is the team lead on a $998,803 grant from the National Science Foundation to develop a networked airborne computing platform for multiple unmanned aerial systems. When completed, the platform will be available for researchers and enable the use of networked UAVs for civilian applications such as intelligent transportation, emergency response, infrastructure monitoring and agriculture.

The research is an example of UTA's work in data-driven discovery, one of the themes of the University's Strategic Plan 2020, said Jonathan Bredow, chair of the Electrical Engineering Department.

"Unmanned aerial vehicles have many potential applications," he said. "The more we can increase efficiency and safety through better control, the more flexibility we will have in their use. Dr. Wan's research will help make this possible in the very near future."

More information: Yan Wan et al. On the Structural Perspective of Computational Effectiveness for Quantized Consensus in Layered UAV Networks, *IEEE Transactions on Control of Network Systems* (2018). DOI: 10.1109/TCNS.2018.2813926

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