

Extreme IoT: Wireless & Sensor Technologies for Oceans, Health, and Robotics

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Abstract:

The evolution of communication technologies over the past 140 years has enabled ubiquitous connectivity with billions of sensors globally. However, today's technologies still face fundamental obstacles, which prevent them from seamlessly extending to complex domains like the ocean, the human body, or supply chain environments.

In this talk, I will describe new technologies developed by my group that allow us to bring the Internet-of-Things (IoT) to extreme environments. First, I will describe a new generation of underwater sensor networks that can sense, compute, and communicate without requiring any batteries; our devices enable real-time and ultra-long-term monitoring of ocean vitals (temperature, pressure, coral reefs) with important applications to scientific exploration, underwater climate monitoring, and defense. Next, I will talk about new wireless technologies for sensing the human body, both from inside the body (via micro-implants) as well as from a distance (contactless), paving the way for novel diagnostic and treatment methods. Finally, I will describe new RFID-based micro-logistics solutions that can bring extreme visibility to supply chain processes, with applications to retail, warehousing, and manufacturing; these

technologies also allow us to extend robotic perception beyond line-of-sight, enabling robots to perform complex manipulation tasks that were not possible before.

The talk will cover how we have designed and built these technologies, and how we work with medical doctors, climatologists, oceanographers, and industry practitioners to deploy them in the real world. I will also highlight the open problems and opportunities for these technologies, and how researchers and engineers can build on our open-source tools to help drive them to their full potential in addressing global challenges in climate, health, and automation.

Speaker Bio:

Fadel Adib is the Doherty Chair of Ocean Utilization at MIT and Associate Professor in the Media Lab and the Department of Electrical Engineering and Computer Science. He is also the founding director of the Signal Kinetics group which researches wireless and sensor technologies for health, computing, and climate. Adib was named by Technology Review as one of the world's top 35 innovators under 35 and by Forbes as 30 under 30, and his research was recognized as one of the 50 ways MIT has transformed Computer Science. Adib's commercialized technologies have been used to monitor thousands of patients with Alzheimer's, Parkinson's, and COVID19, and he has had the honor to demo his work to President Obama at the White House. Adib is also the recipient of various awards including the NSF CAREER Award (2019), the ONR Young Investigator Award (2019), the ONR Early Career Grant (2020), the Google Faculty Research Award (2017) and the Sloan Research Fellowship (2021), and his research has received Best Paper/Demo Awards at SIGCOMM, MobiCom, and CHI. Adib received his Bachelors from the American University of Beirut (2011) and his PhD from MIT (2016), where his thesis won the Sprowls award for Best Doctoral Dissertation at MIT and the ACM SIGMOBILE Doctoral Dissertation Award.