

CPS: Small: Scaling Cyber-Physical Systems to the Low-Power Internet of Things



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Problem & Challenges

Goal:

Scale CPS to Billions of Batteryless Sensors for

- Communication
- Localization

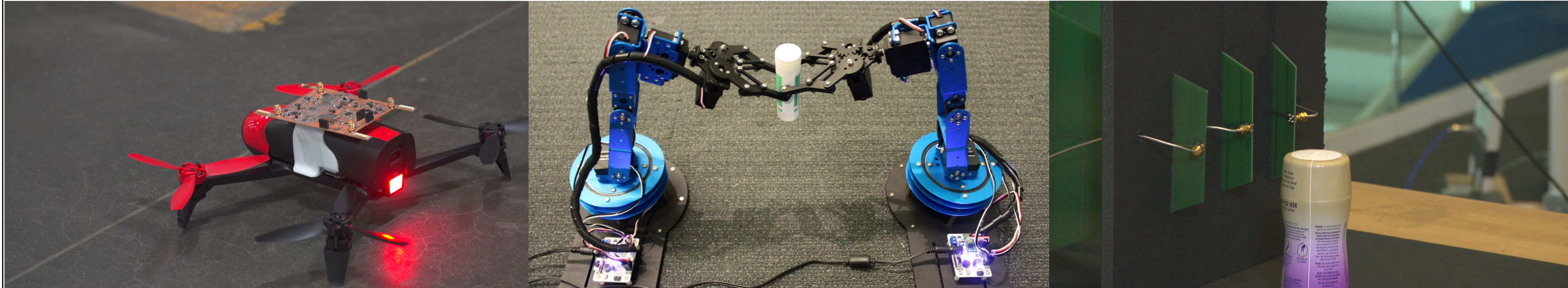


Challenges

- Ultra-Low Power ⇒ Limited Communication Range
- Interference from Thousands of Sensors
- Need High Localization Accuracy

Solution & Impact

Our Work: Transforming *hundreds of billions* of batteryless devices into powerful physical sensors



Drone relays enable wide-area sensing




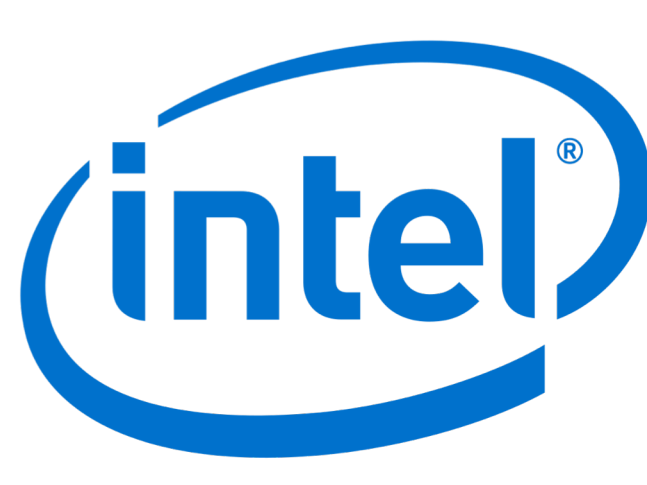

Micro-location & robotic perception

Non-contact & non-invasive food sensing

Scientific Impact

- Bridge Three Fields: RF-based Sensing, Robotic SLAM, and Full-Duplex
- Hardware-Software Innovations:
 - New Hardware for Communication Relays for Wideband Sensing
 - New Algorithms for Low-latency, High-Precision Localization in Non-Line-of-Sight
- Real-time Prototypes for Drone Relays and Robotic Manipulation

Broader Impact

- Solve *Multi-Billion Dollar* Challenges (Shrinkage, Inventory, Misplaced Items)
 - Increased National Security
 - Demoeed to more than 100 companies
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- Presented to 53 state senators & house representatives
 - Videos watched by millions of viewers

Publications: Rfly [SIGCOMM'17], RFind [SIGCOMM'17, MobiCom'17], RFIQ [HotNets'18], TurboTrack [NSDI'19]

