Variability-Aware Embedded Sensor Tasking
Lucas Wanner, Puneet Gupta, and Mani Srivastava

Motivation: Variation in Power Consumption
- Atmel ARM SAM3U: 9x variation in sleep power across instances
- 4x variation in sleep power for a single instance across 0–40°C
- 40% variation in active power for a single instance across -50–150°C

Embedded Sensor Software
- Typically duty cycled: sleep for most of the time, wakeup to sample
- Duty cycle is constrained by sensor power and lifetime requirements
- More active time: more samples, better quality of sensing
- With power variation, duty cycle must be tailored to each sensor

Variability-Aware Sensor Tasking
- Sleep and active power curves are characterized for each sensor
- Duty cycle is determined for each sensor according to power curves, lifetime requirements, and temperature profile
- Adaptable Tasks in TinyOS: scheduler changes period or number of iterations for tasks according to allowable duty cycle for sensor

Results
- DC based on datasheet spec: doesn’t meet required lifetime
- DC based on worst-case power, low quality, leaves battery untapped
- Variability-Aware DC: highest quality that meets lifetime requirement
- 3-22x improvement over worst-case
- 50% improvement in inference quality for target localization