



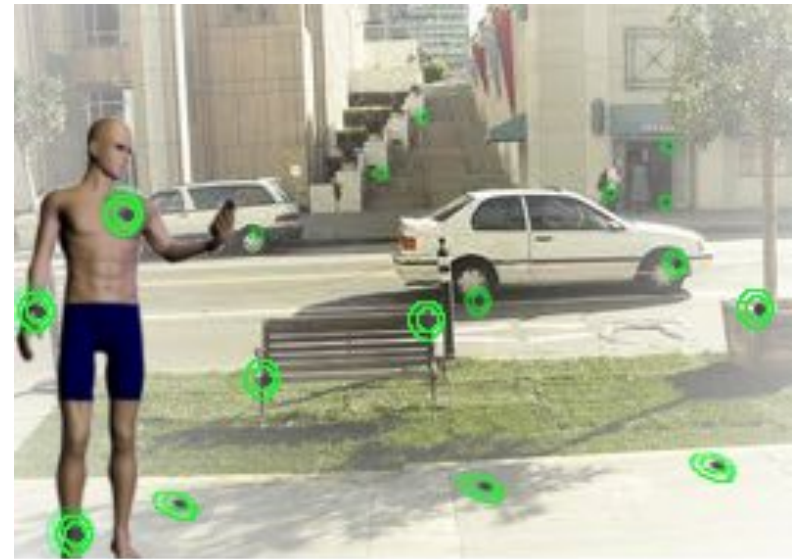
# Towards Dependable Self-Powered Things for the IoT

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# Self-Powered IoT

Envisioned scale of IoT demands self-powered operation

- 1 trillion “things” each with a 5 year battery life requires 548 million battery changes per day!



Device and energy harvester efficiencies depend on physical world dynamics

- Statically configured harvesters, circuits, and systems will provide limited dependability
- Even responding only to instantaneous conditions is sub-optimal

| Requirements                     | Constraint                          |
|----------------------------------|-------------------------------------|
| Small, wireless, long lasting    | ULP operation                       |
| >1 trillion nodes                | High energy harvesting              |
| Vigilant monitoring              |                                     |
| Interact w/ humans & environment | Cyber-physical design and operation |
| Respond to system dynamics       |                                     |

# Profiling and Adapting to Physical World Dynamics

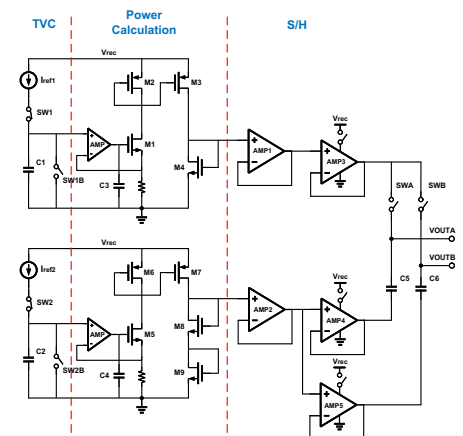
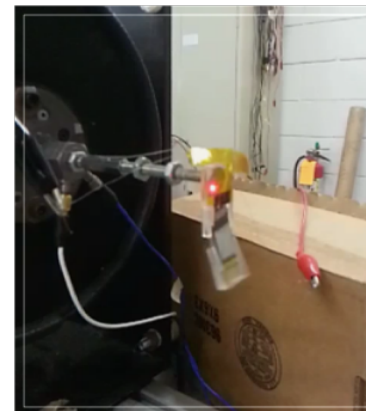
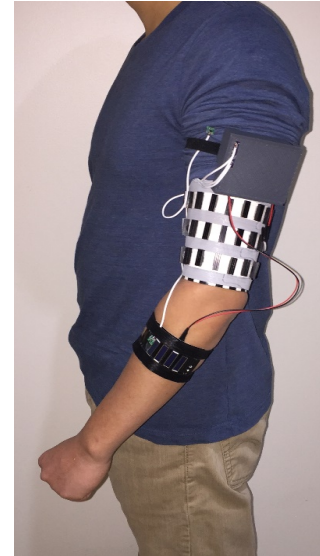
Profile physical world dynamics that impact device and harvester efficiency

- Ambient conditions, motion, electromagnetic interference, human behavior, etc.

Dynamics models inform algorithms for dynamic system adaptation

- Based not only on past and current conditions but also on **predictions** of future conditions

Innovations in ULP circuit operation and UHE energy harvesting to engineer and operate dependable self-powered things for the IoT



# Profile-Driven Simulation & Emulation for Self-Powered Operation

