CS 598, WSI: LECTURE 17

- Motivation: Insect IoT
- Communication
- Localization
- Limitations and Evaluation

Insect IoT: Motivation

(video)

- battery free flying.
- ubiquitous.

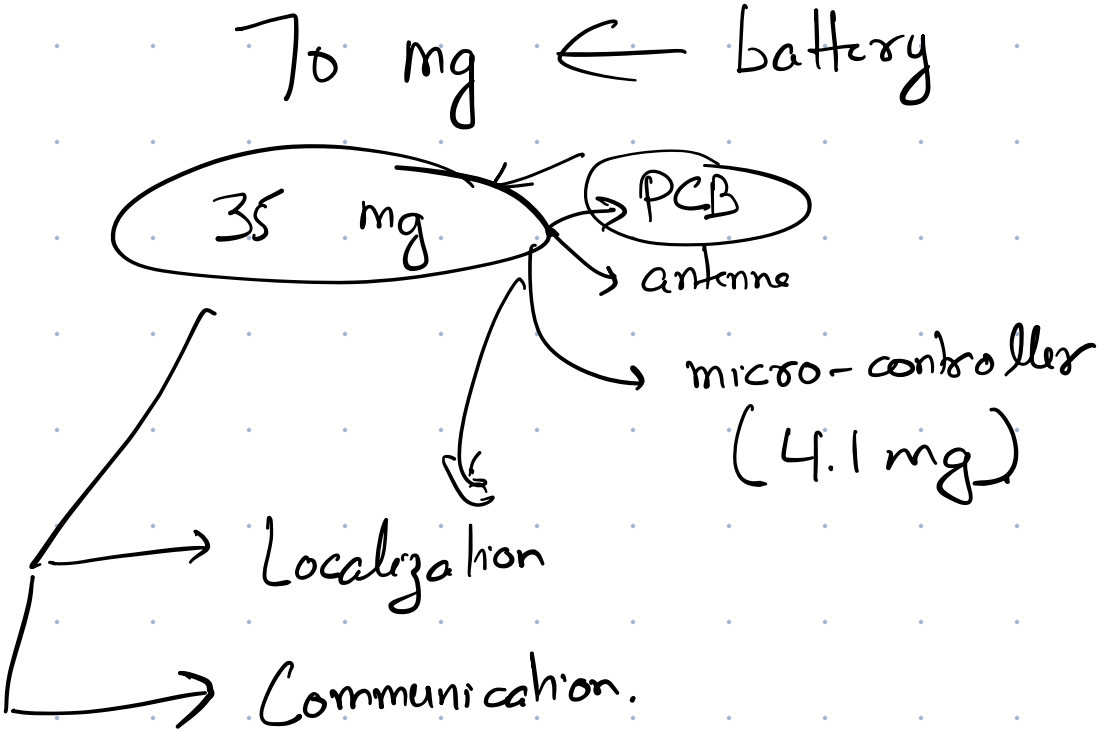
---

new sensory capabilities.

Budget

Weight budgets.

(105 mg)



Communication

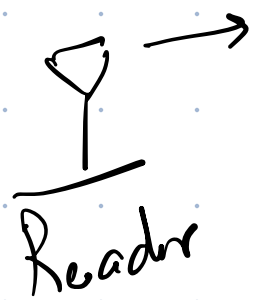
Get data from these sensors

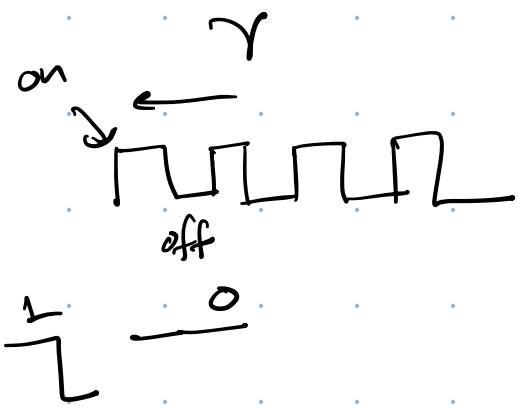
high power consumption
(70 mg battery)

Backscatter ← really low power.

Range ↓

on-off keying





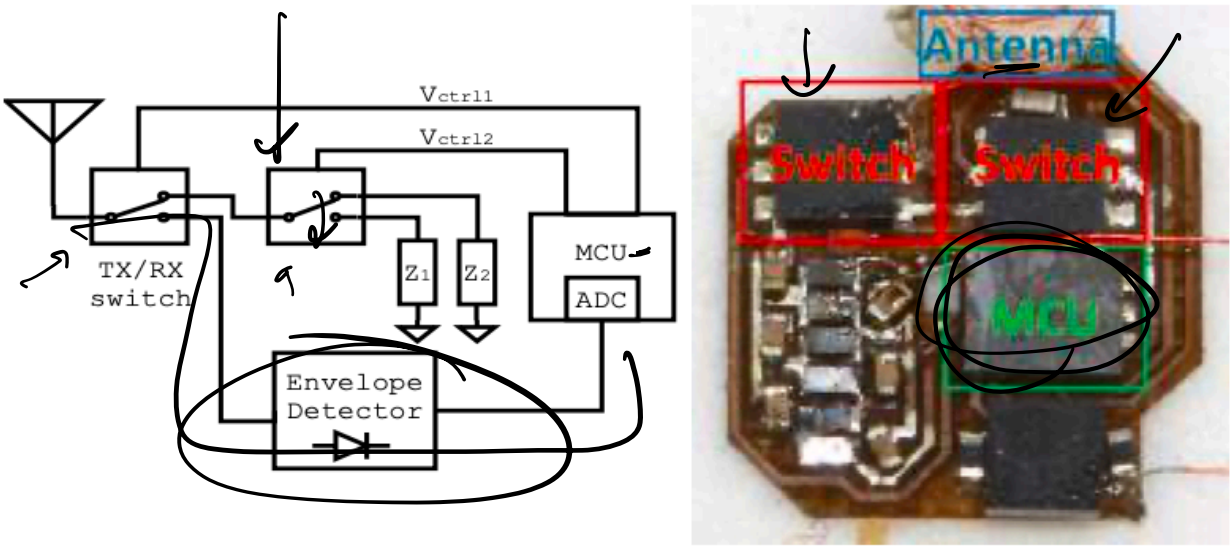
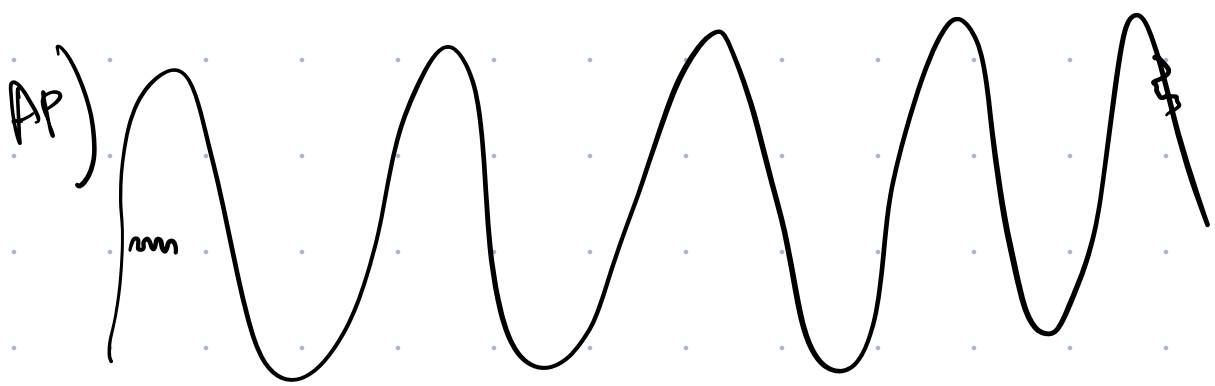
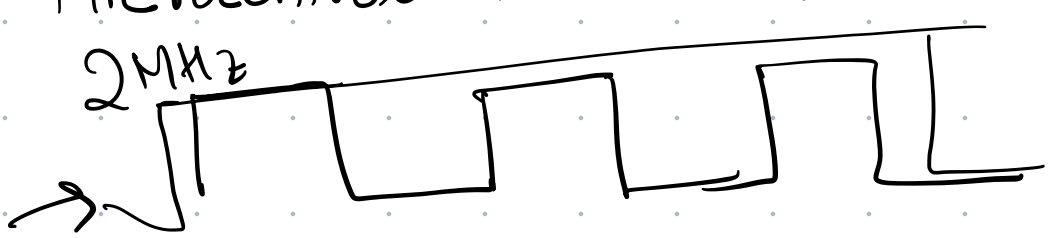


Figure 8: Backscatter hardware including a block diagram (left) and light-weight hardware implementation (right).

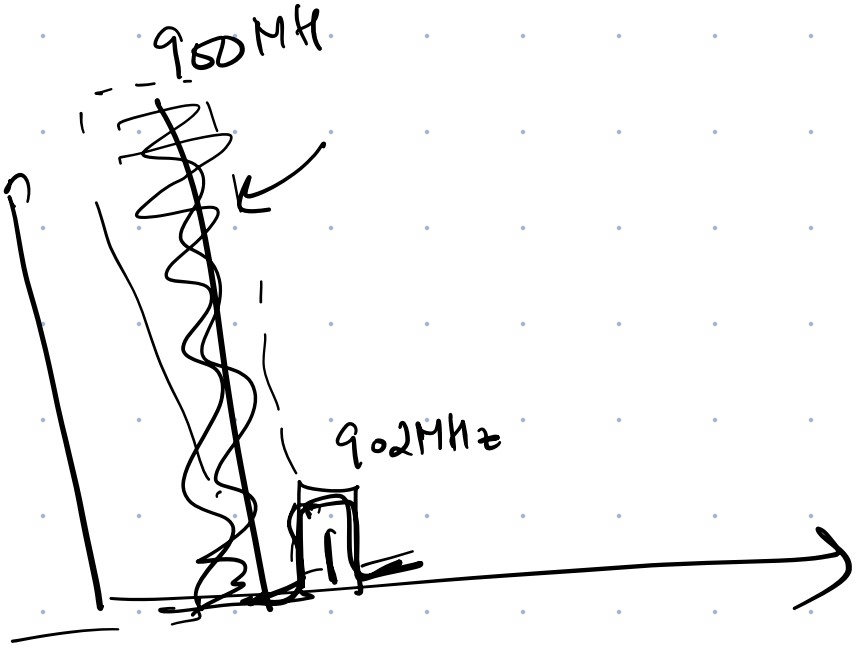


Shift - freq. of reflection by 2MHz.

Microcontroller: 8MHz.



Reflected signal



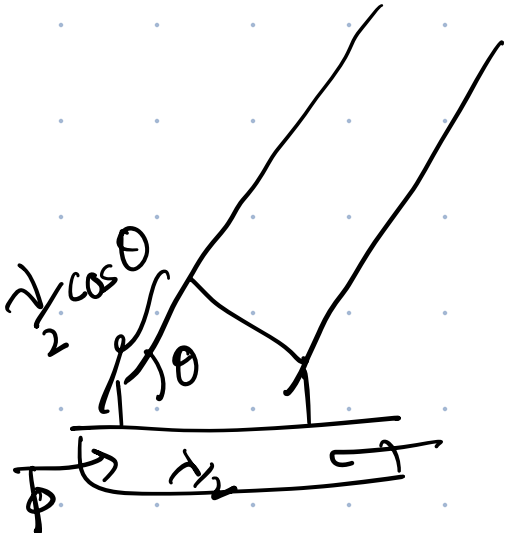
↳ few Kbps

Localization

GPS? → power
↳ heavy

RF-based localization.

Antenna array to get angle?

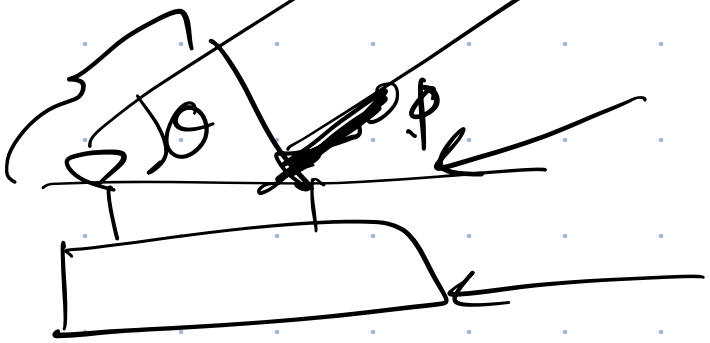


$\frac{2\pi}{\lambda} \cdot \frac{\lambda}{2} \cos\theta$

$\pi \cos\theta$.

AP

precompensah for the extra- phase.



transmit

one of them adds an extra phase ϕ

when $\phi = \pi \cos\theta$, the rx signal at the bee is high.

Temp, Amp ⟹ AP

Temp, amp

θ_1 θ_2

{Temp, Amp1, Amp2} ⇒ AP

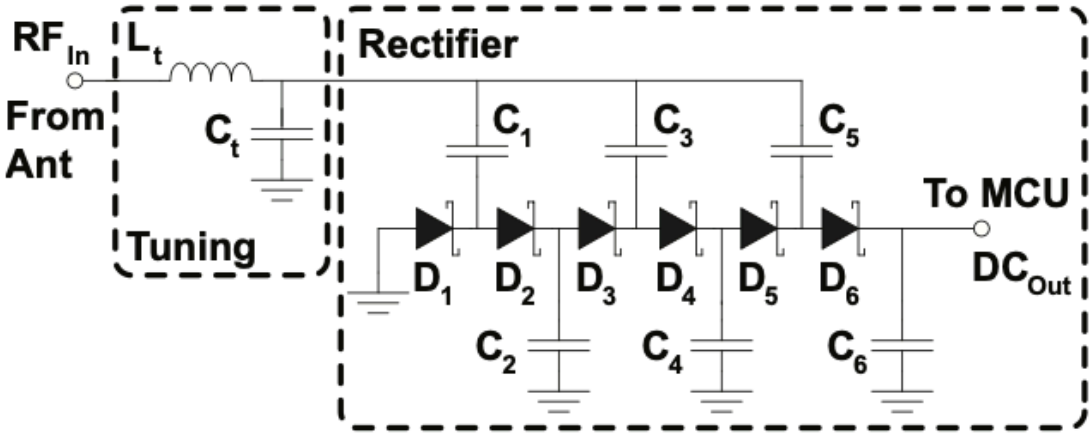
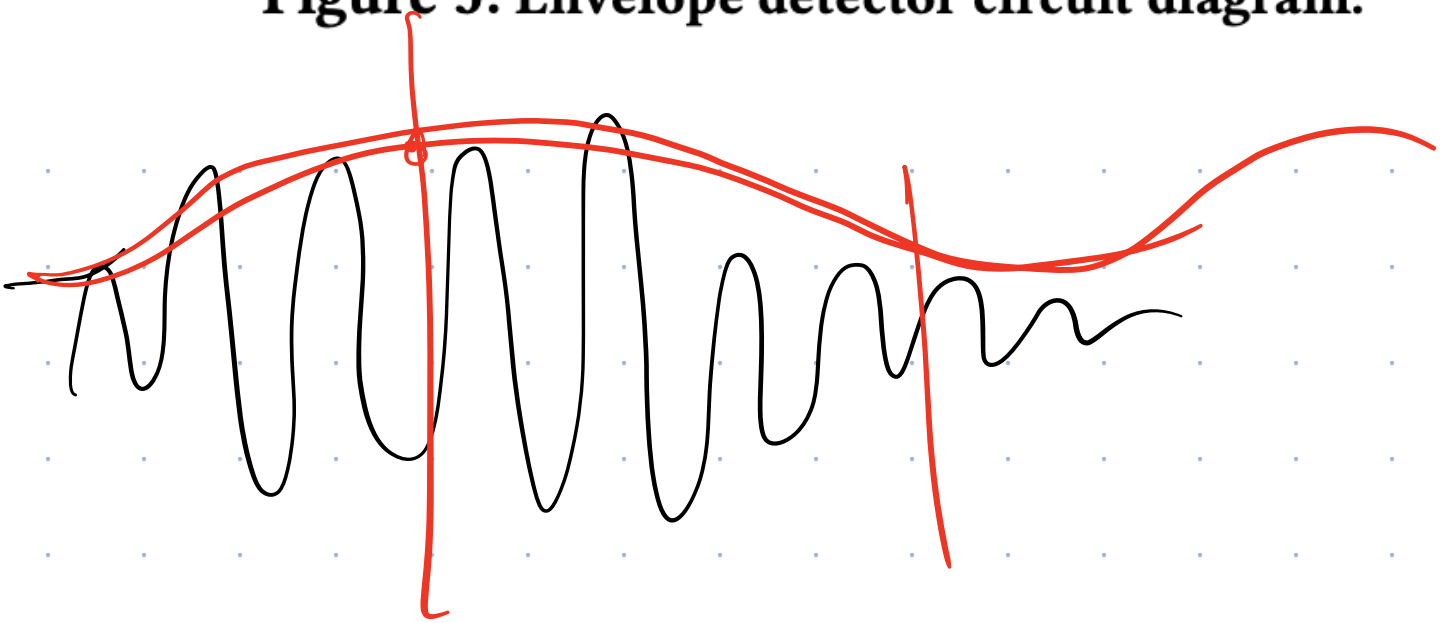
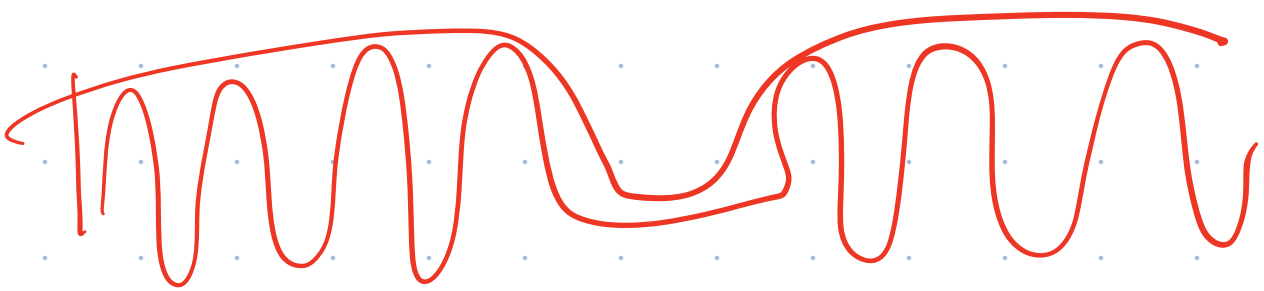
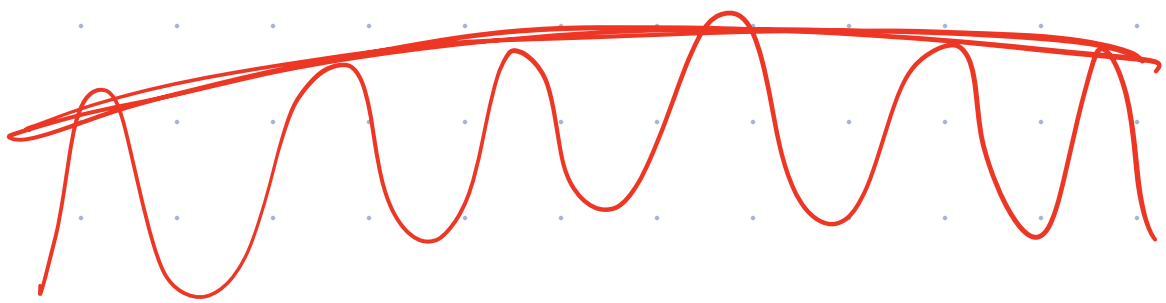
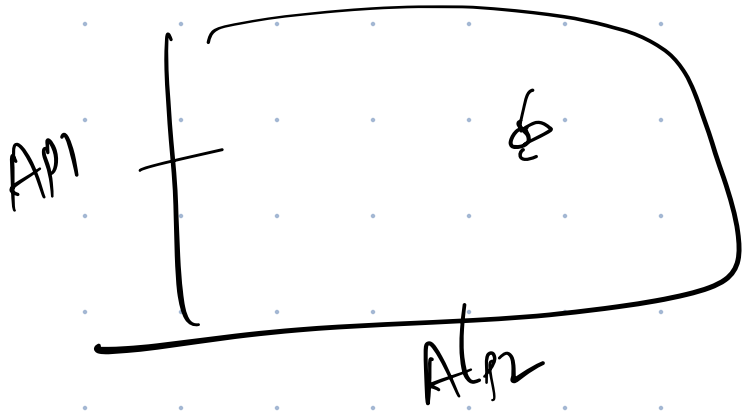


Figure 5: Envelope detector circuit diagram.








API
&
Alg2

Evaluation

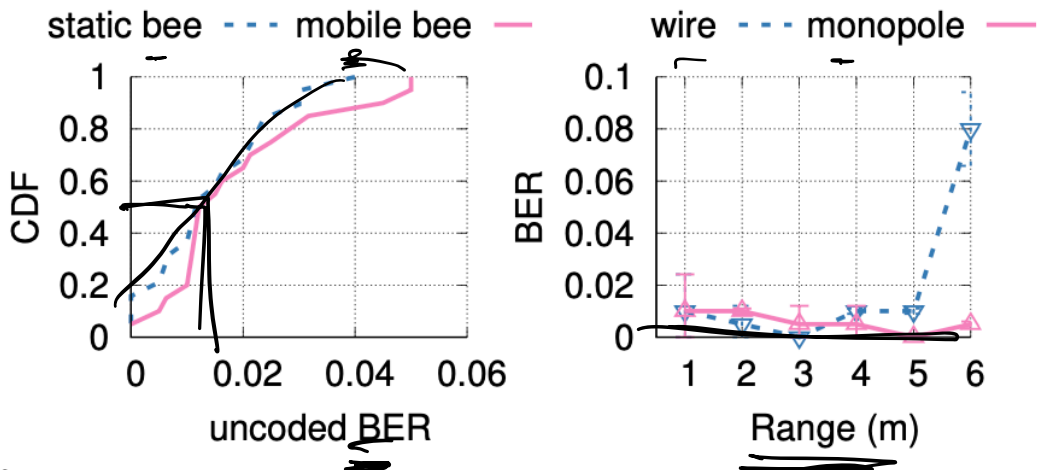


Figure 14: Backscatter performance. The uncoded BER is low and comparable to prior backscatter designs [77] and the bee can upload data when it is back at the hive.

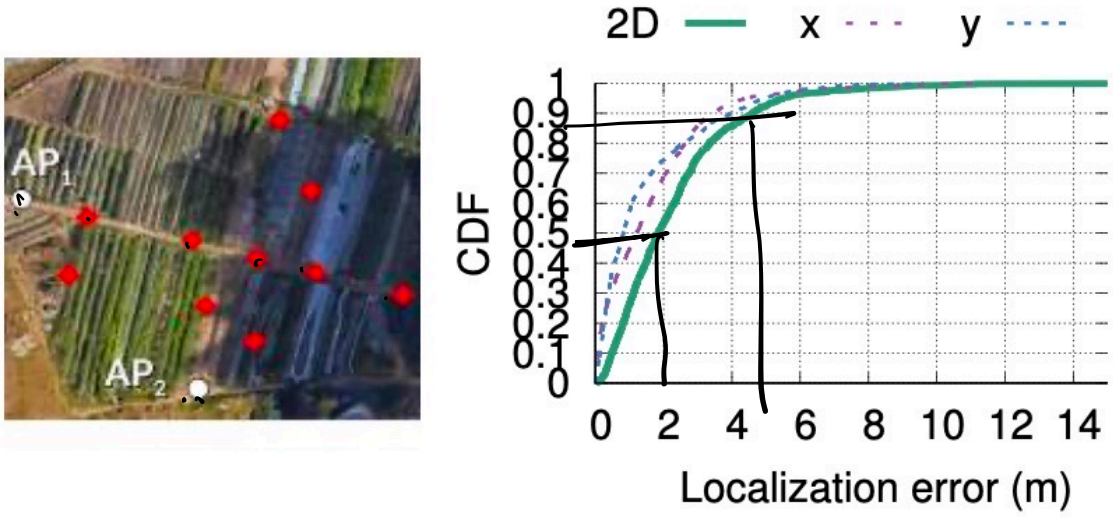


Figure 11: 2D accuracy with deployment in farm.

Limitations

- Datarate
- hard to recharge the bees
  - Solar power.
  - RF harvesting
- No control
- Sensors are small & low fidelity
- Assume hive.
- e-waste / effort waste
- Impact on bees & hives.