Leveraging Honey Bees as Bio-Cyber Physical Systems

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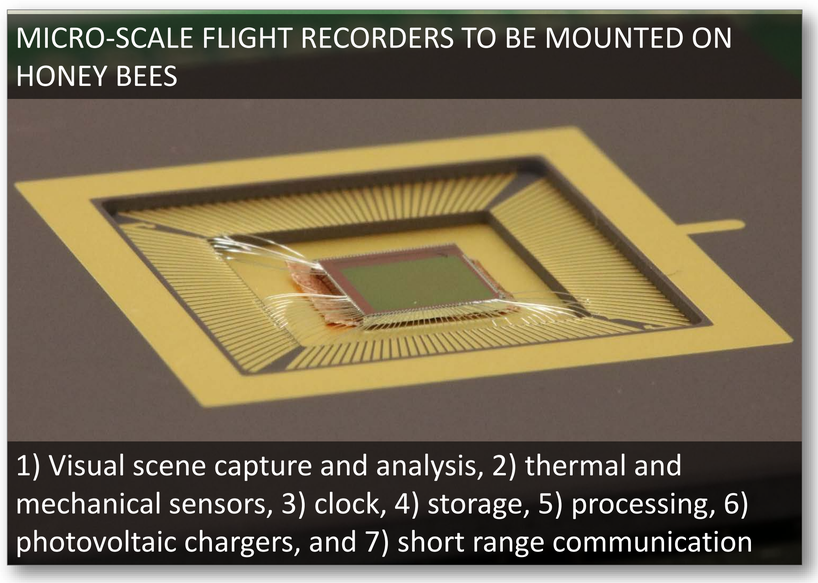
Challenge:

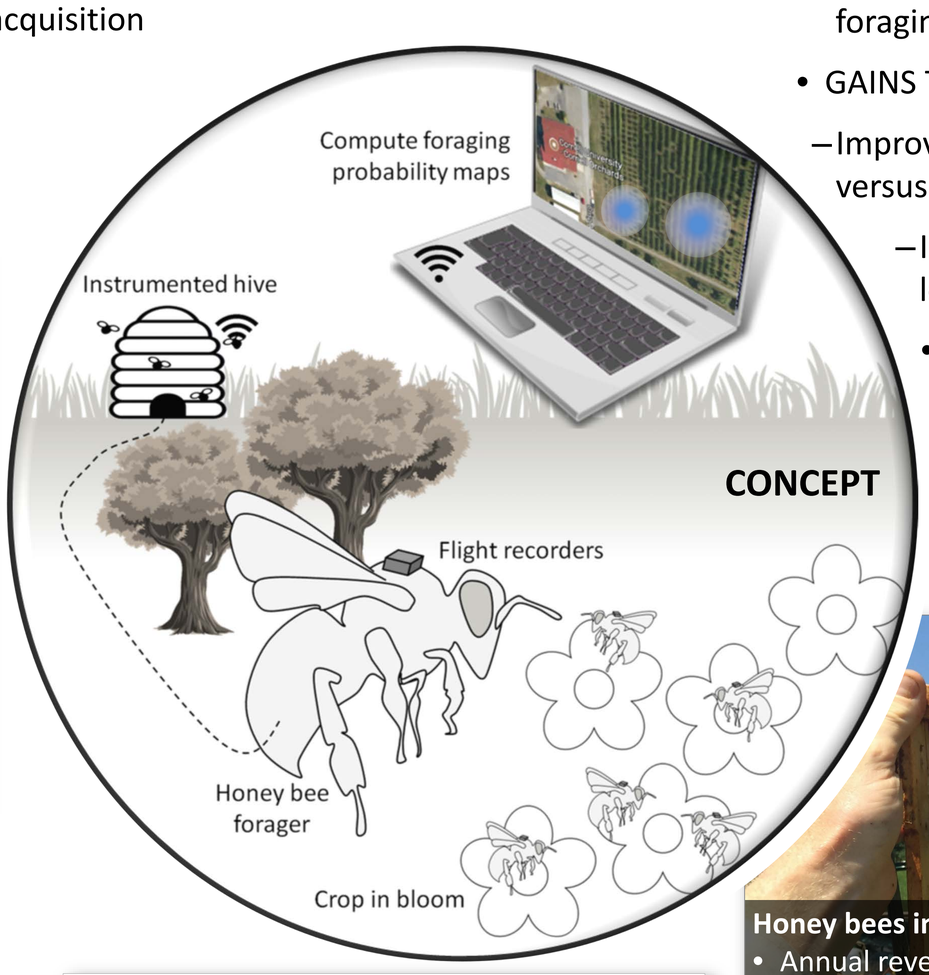
Can we improve upon the ability of social insects to sense and interact with the physical world, while providing data acquisition and control on par with explicitly engineered systems?

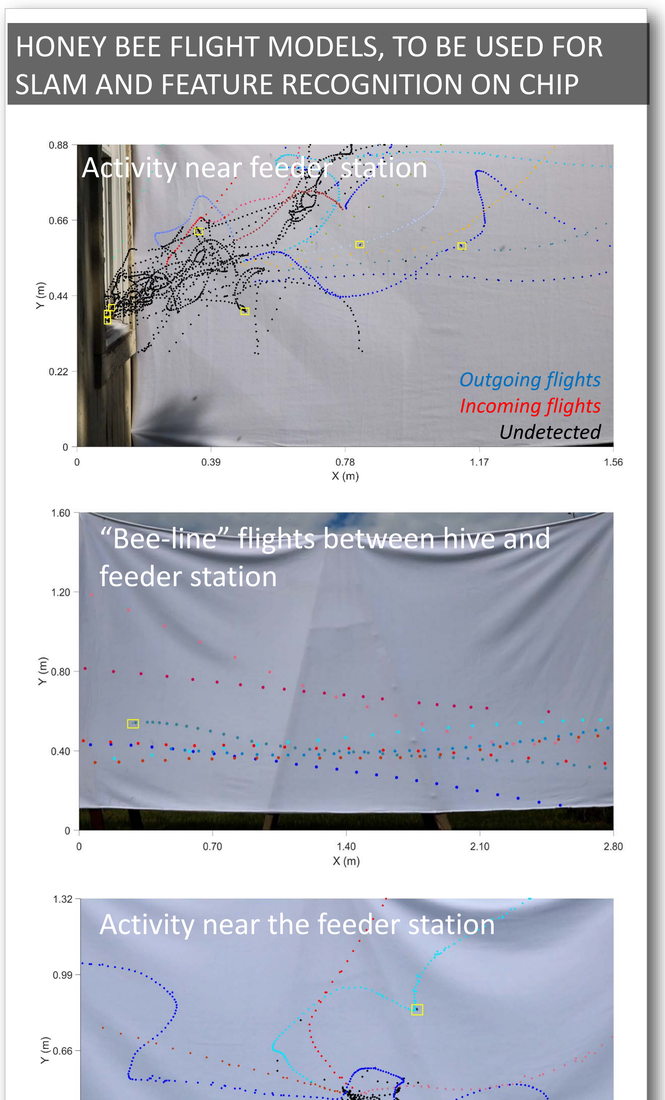
Solution:



WESTERN HONEY BEE (Apis Mellifera):

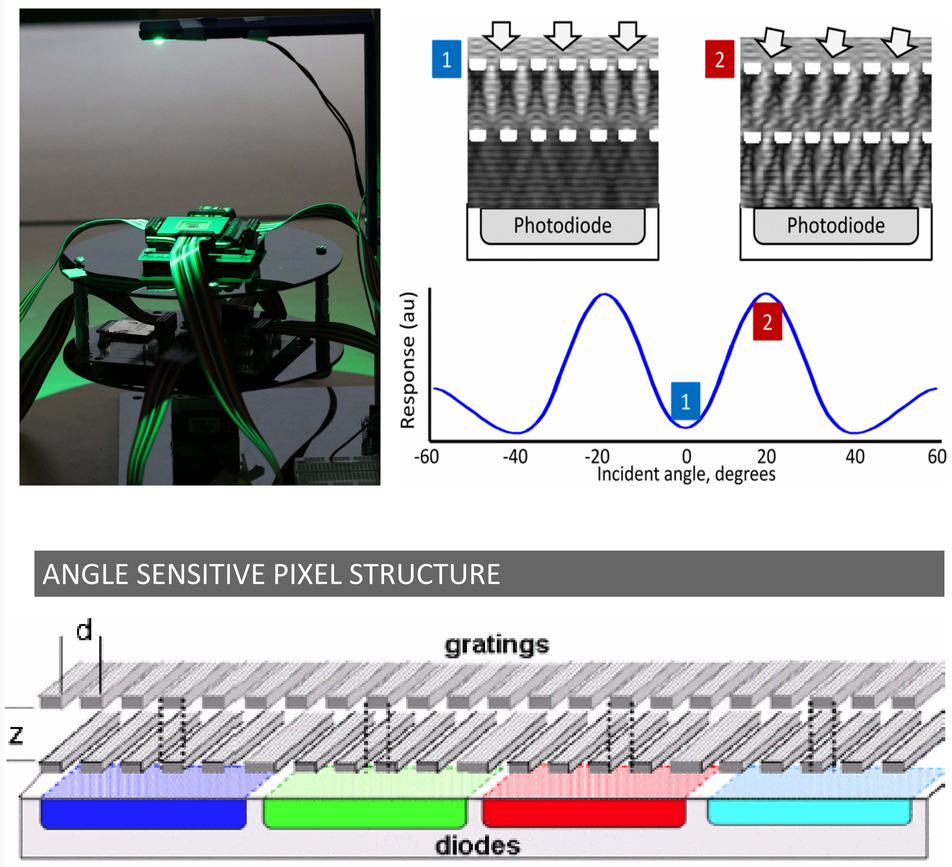
- Foragers in a colony: 20,000
- Flight distance: 600m
- Max flight distance: >10km
- Flight speed: 24-32km/h
- Forager payload: 55-65mg





Impact:

- ULTRA-LOW POWER ELECTRONICS AND SENSING
  - Micro-scale, power autonomous, integrated circuits for flight recording and analysis
- PROBABILISTIC INFERENCE FROM LARGE-SCALE DISTRIBUTED DATA SOURCES
  - Fusion of heterogeneous sensor data
  - Finding trends in large incomplete bio-datasets
- FEEDBACK CONTROL OF BIO-HYBRID SYSTEMS
  - Towards gains for both data acquisition and improved foraging
- GAINS TO APICULTURE AND ENTOMOLOGY
  - Improved knowledge of how bees forage in cultivated versus natural landscapes
    - Improved models of how bees advertise the location of food sources
- GAINS TO PRECISION AGRICULTURE
  - Instrumented hives for farmers with hourly updates on busts and blooms
  - Improved output by control of colony activity level



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