6.808: Mobile and Sensor Computing

Lecture 13: Agriculture IoT

(Complementary to online video)

Logistics & Norm Setting

- What to do now?
  - Turn on your video (if your connection allows it)
  - Mute your mic (unless you are the active speaker)
  - Open the “Participant” List
    - Make sure your full name is shown

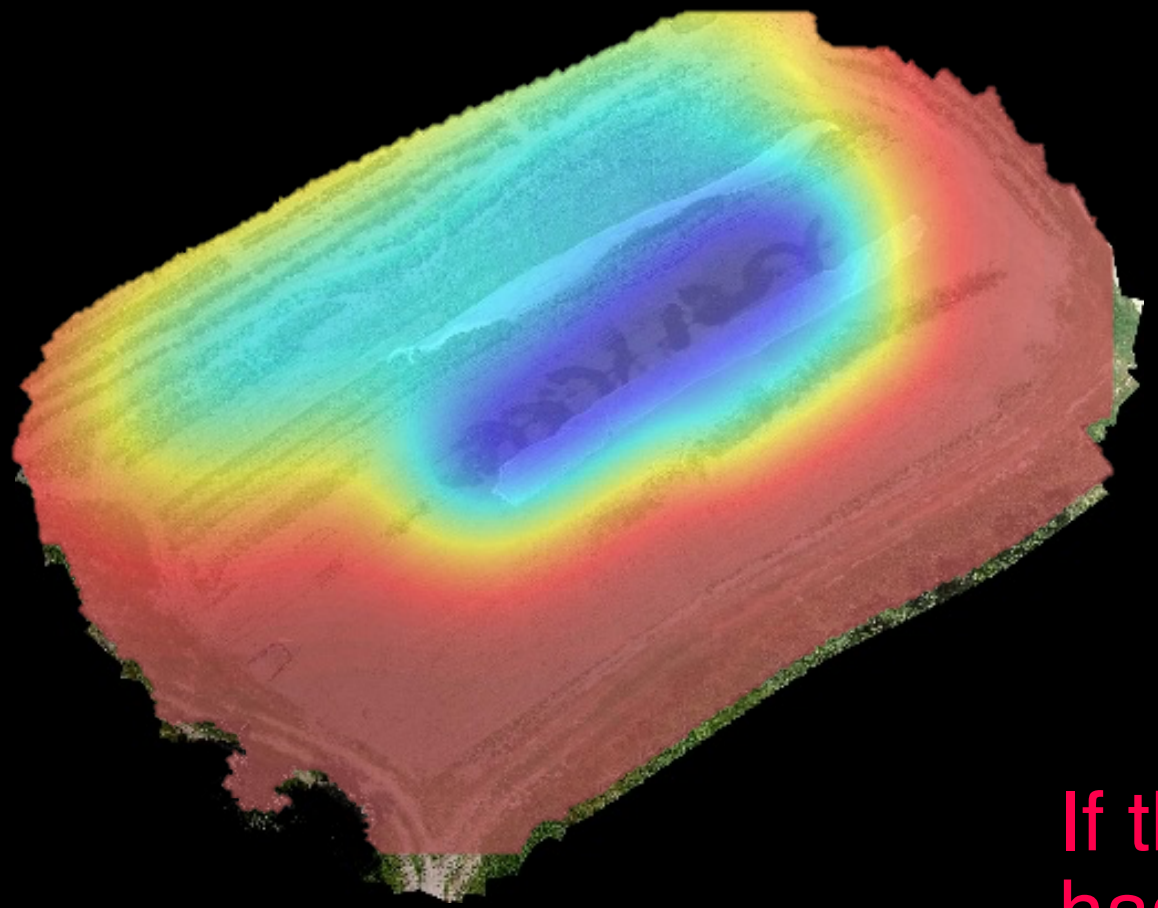
- If you have a question:
  - Use the chat feature to either write the question or to indicate your interest in asking the question
  - James will be monitoring the chat
  - unmute -> ask question -> mute again
  - Same procedure for answering questions

- We will post this online

Purpose of this live session

- An interactive review of the online video lecture
- Q & A

Solution: Data-Driven Agriculture



Traditional vs Data-driven approach

Ag researchers have shown that it:

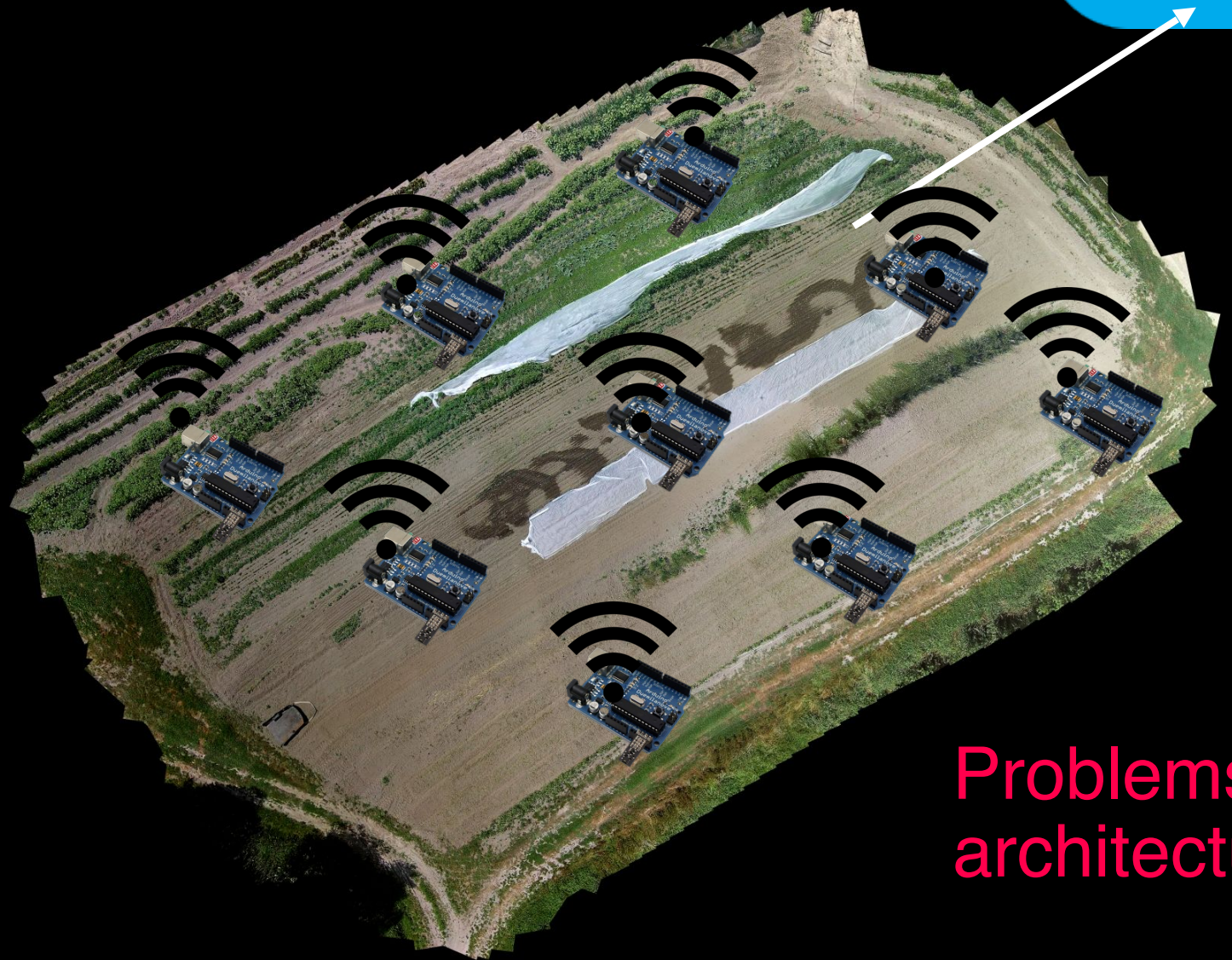
- Reduces waste
- Increases productivity
- Ensures sustainability

If the solution is known, why hasn't it been widely adopted?

But…

According to USDA, high cost of manual data collection prevents farmers from using data-driven agriculture

IoT System for Agriculture



Problems with this architecture?

Problems?

- Internet Connectivity
- Limited Power
- Limited resources (efficiency)

Solutions?

- Whitespace connectivity
- Duty-cycling
- Drone for spatial and temporal smoothing

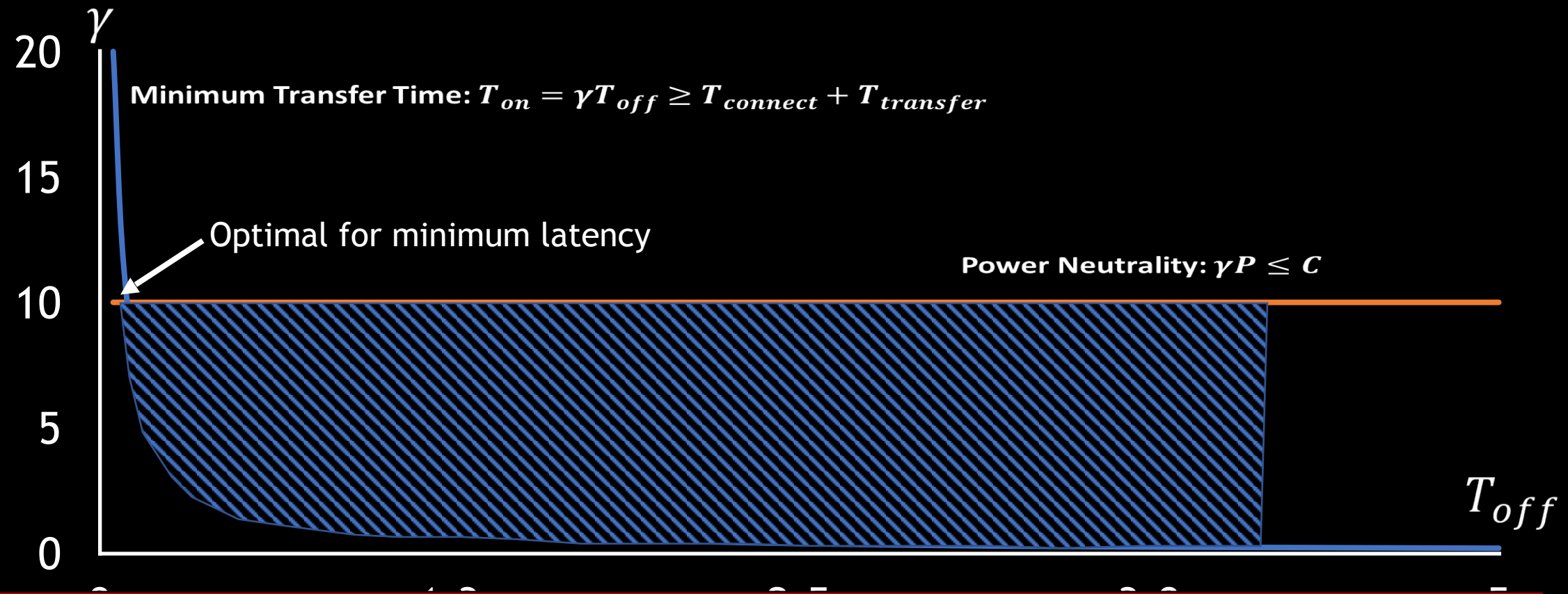
Idea: Weather is Predictable

- γ: Duty Cycle ratio, T_{on}: On time in each cycle, T_{off}: Off time

- $\gamma = \frac{T_{on}}{T_{off}}$

- Constraints:
  - **Power Neutrality: $\gamma P \leq C$**
  - **Minimum Transfer Time: $T_{on} \geq T_{connect} + T_{transfer}$**

Solution: Weather is predictable



FarmBeats can use weather forecasts to duty cycle the base station, with minimum latency

How would you design the sensors?

- Low-power — backscatter
  - problems: intermittent, or base station runs out of power
  - Limited range
- Semi-passive?
- Power decays with 1/d^2 (Sphere) => waste less energy by multiple harvesters
- Can even harness power from whitespace emissions

Announcements

- Lab4 due Wednesday (April 8)

- Projects
  - Met with all teams & scoped projects
  - (Almost) all equipment has already been shipped domestically

- Midterm:
  - Two practice exams & solutions posted (from 2018 & 2019)
    - Imperfect overlap with this year's material
  - Use Piazza & OH to ask questions
  - More midterm instructions coming this week