

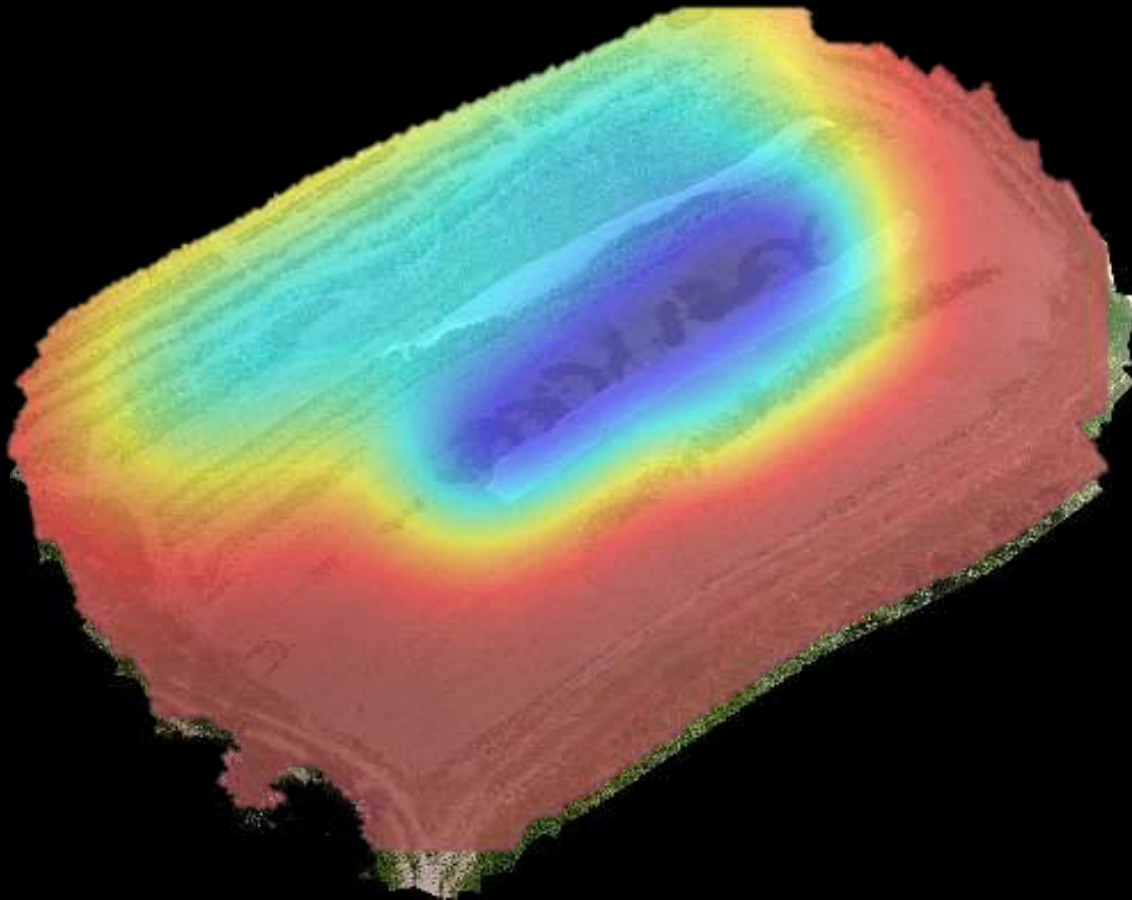
FarmBeats: AI & IoT for Agriculture

enabling affordable data-driven farming

Ranveer Chandra



Data-Driven Agriculture



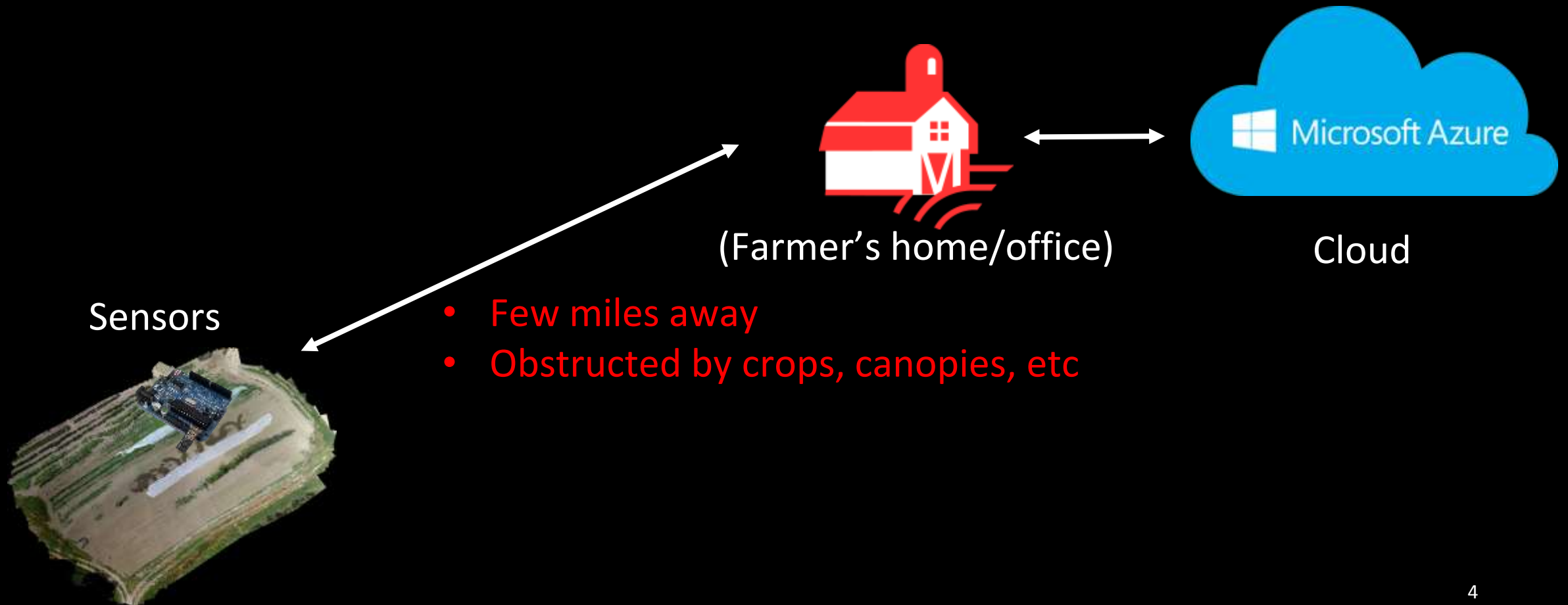
Ag researchers have shown that it:

- Improves yield
- Reduces cost
- Ensures sustainability

But...

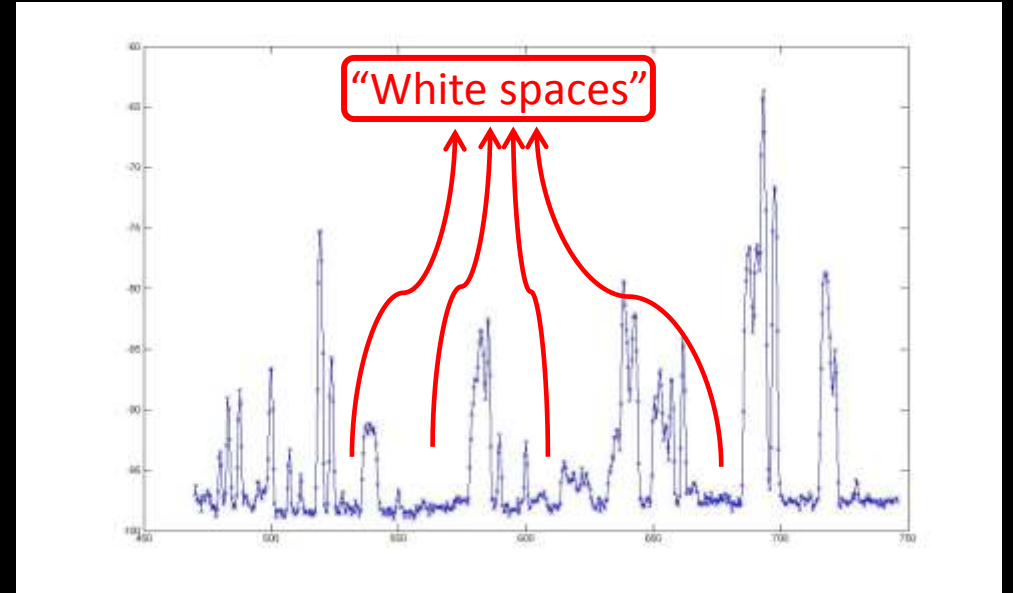
According to USDA, **high cost of data collection** prevents farmers from using data-driven agriculture

Challenge 1: Internet Connectivity



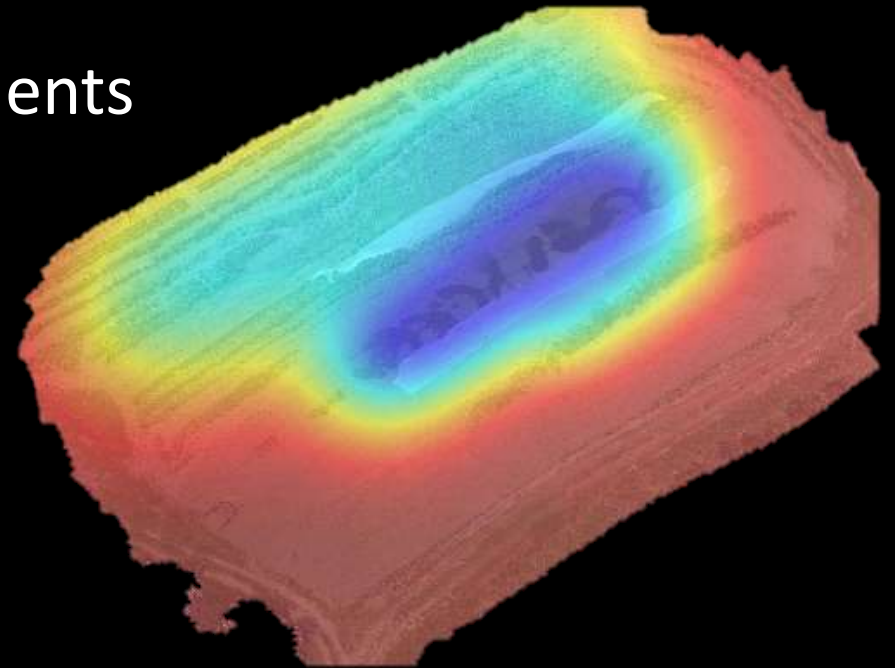
TV White Spaces in the Farm

- What are the TV White Spaces?
 - Unused TV channels
- Benefits over Wi-Fi, Zigbee, etc
 - High throughput at long range
- Key insight for farms:
 - “lots” of TV spectrum is available, more than 100 MHz
 - Just like Wi-Fi router covers the home, TVWS base station can cover the farm



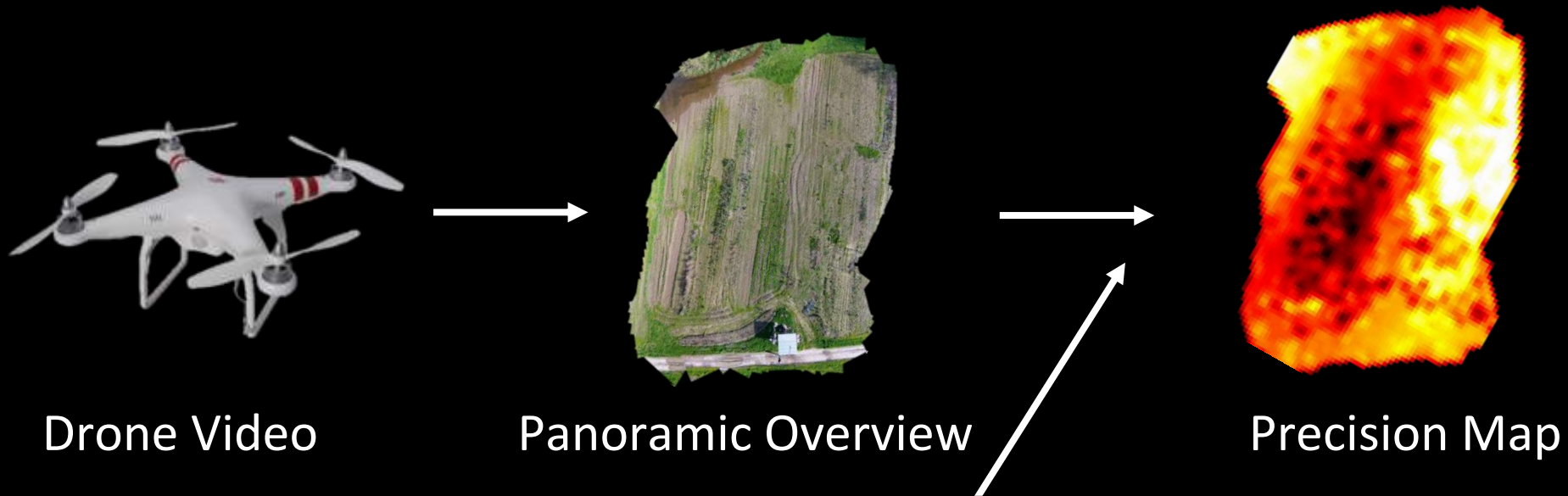
Challenge 2: Limited Resources

- Need to work with sparse sensor deployments
 - Physical constraints due to farming practices
 - Too expensive to deploy and maintain



- How do we get coverage with a sparse sensor deployment?

Idea: Use Drones to Enhance Spatial Coverage



FarmBeats can use drones to expand the sparse sensor data and create summaries for the farm

Challenge 3: Internet at Farmer's House

Base Station



TV White Spaces



Few miles



(Farmer's home/office)

- Weak Connectivity
- Prone to outages



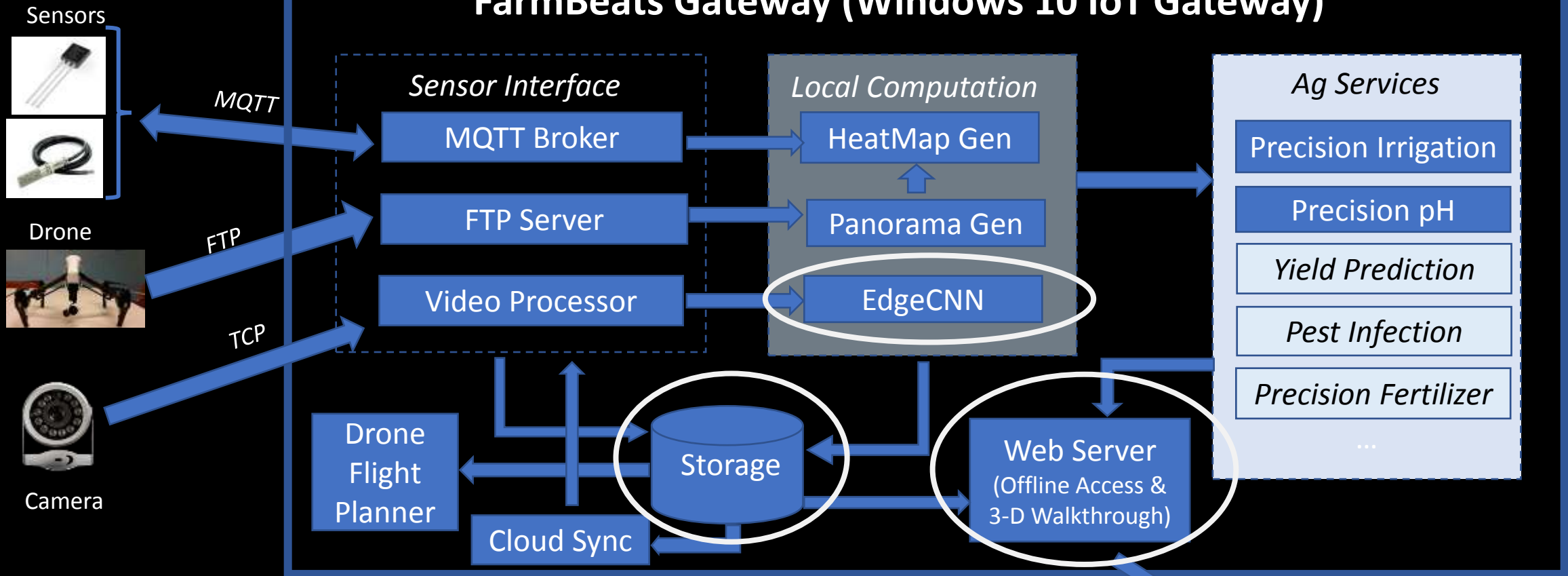
Cloud

Wi-Fi, BLE

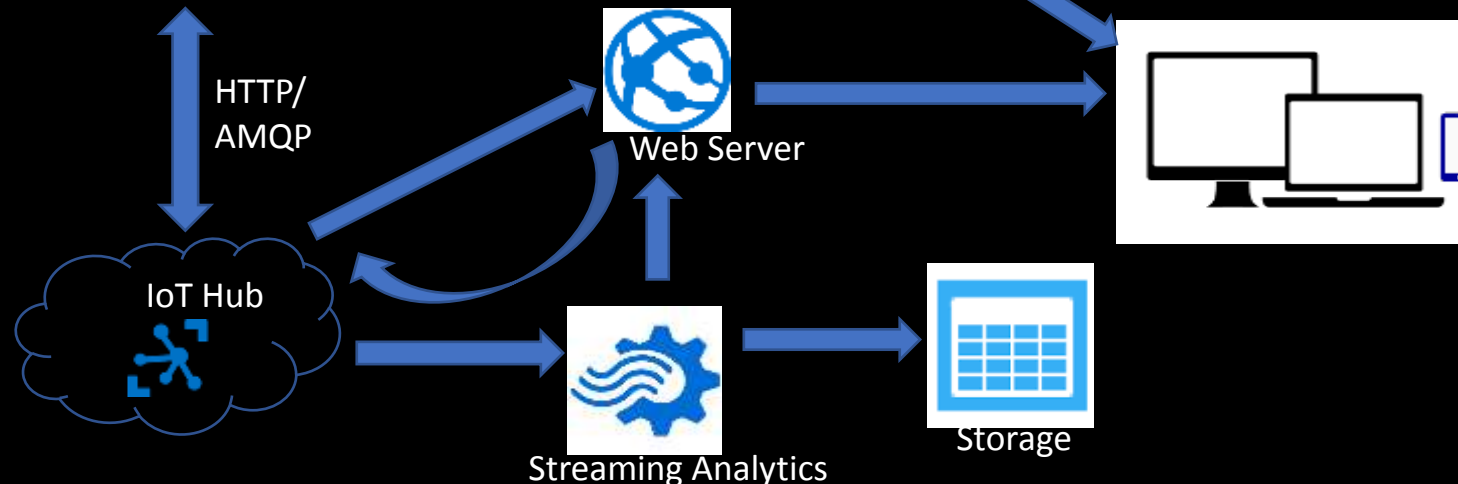


Sensors

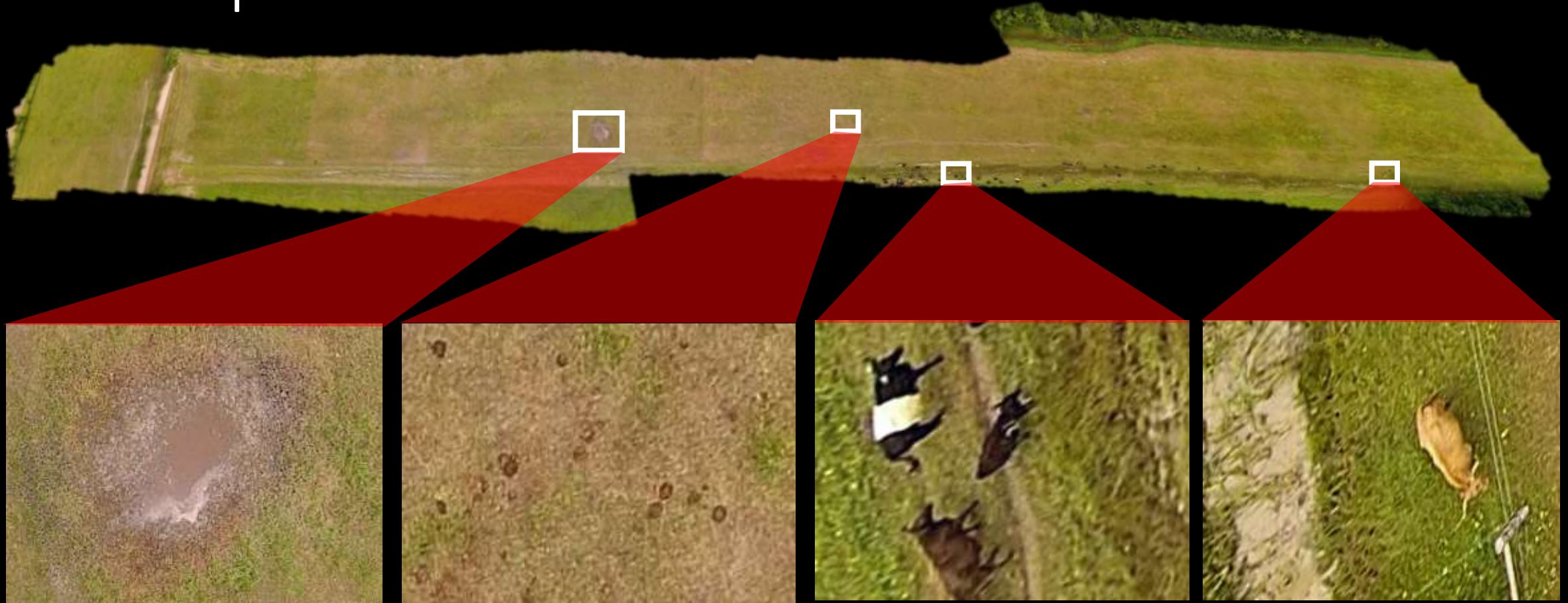
FarmBeats Gateway (Windows 10 IoT Gateway)



- Can run offline
- Unique Gateway services
- Deep Learning at Edge
- Component Migration



Example: Panorama



Water puddle

Cow excreta

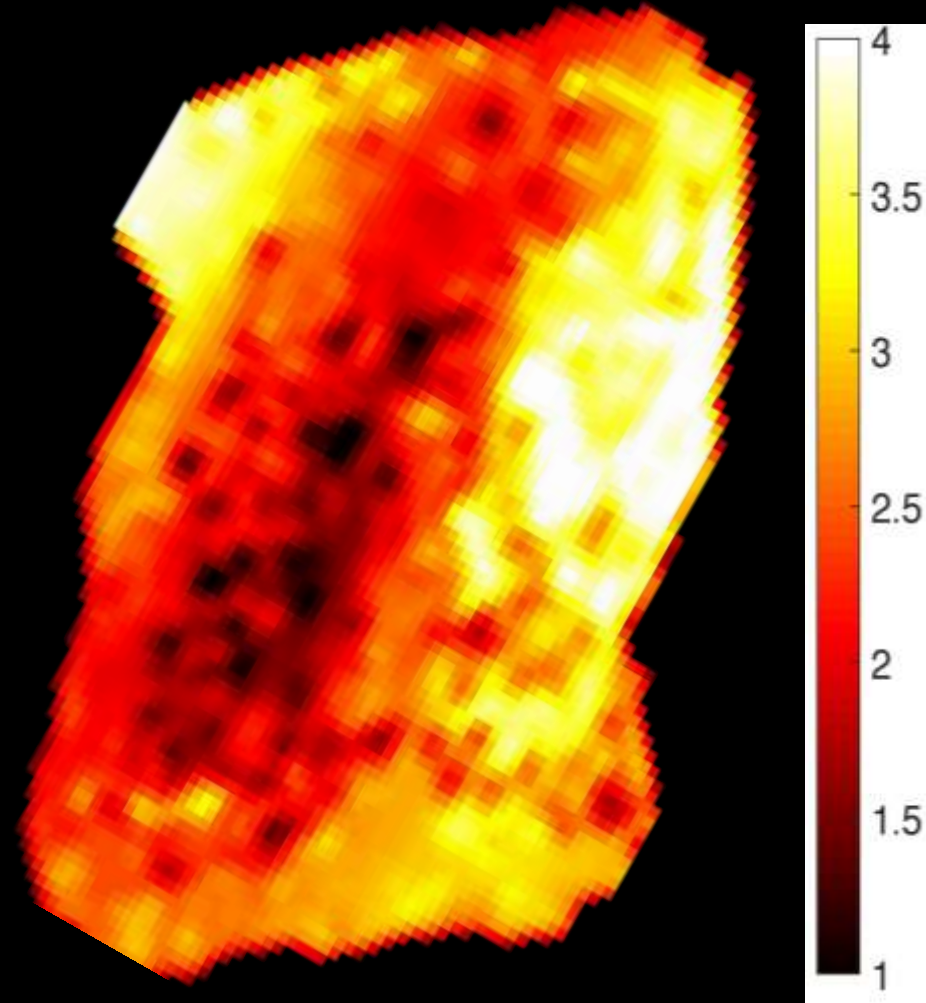
Cow Herd

Stray cow

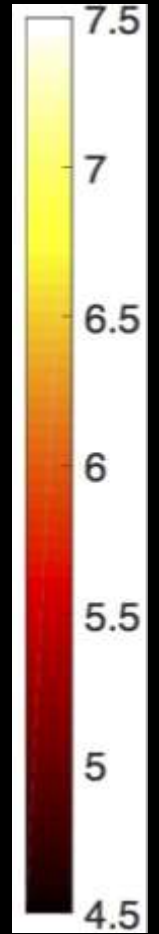
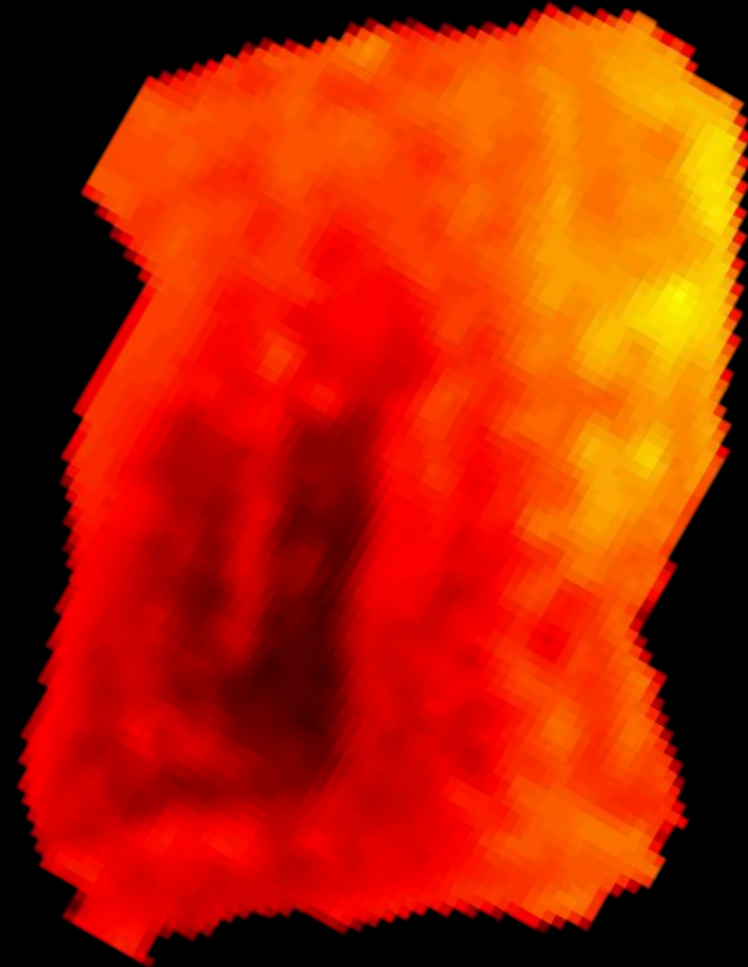
Precision Map: Panorama Generation



Precision Map : Moisture



Precision Map : pH



Thank you!

Sean Stratman, Dancing Crow Farm, WA



Mark & Kirstin Kimball, Essex Farm, NY



Questions

<http://www.microsoft.com/en-us/research/project/farmbeats-iot-agriculture/>
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