IoT for Agriculture

Opportunities:

The Internet of Things (IoT) can transform agriculture by improving productivity, efficiency, and sustainability. With IoT, farmers can use sensors, drones, autonomous machinery, and other connected devices to collect data and automate various processes, enabling them to make better decisions and achieve higher yields.

One of the primary scenarios enabled by IoT in agriculture is precision farming. By using sensors, cameras, and drones to monitor soil moisture, nutrient levels, and other environmental factors, farmers can optimize the use of resources such as water, fertilizer, and pesticides. This helps to reduce waste and minimize the environmental impact of farming operations.

Another area where IoT can have a significant impact is in livestock management. Connected sensors can monitor the nutrition, health and well-being of animals, detect diseases, and track their movements. This information can be used to identify potential health issues early, improving animal welfare and reducing the need for antibiotics.

IoT can also enhance supply chain management in agriculture. By tracking the movement of goods from farm to table, farmers can improve inventory management, reduce waste, and ensure that products are delivered to consumers in a timely and efficient manner. This can reduce costs and improve profitability for farmers, as well as increase transparency and trust for consumers.

By harnessing the power of connected devices and data analytics, farmers can improve the efficiency and sustainability of their operations, while also meeting the growing demand for food.

Barriers:

There are several barriers to the adoption and implementation of IoT in agriculture. Some of the key ones are:

1. High initial investment: The cost of setting up an IoT system can be significant, including the cost of hardware, software, and installation.
    - Depending on the type of farm – broadacre, horticulture, livestock – the cost of deploying an IoT system at scale can be significant.
    - Tractors with IoT, drones with multispectral cameras, barns with cameras are examples of expensive IoT deployments
    - Recurring connectivity subscription fees can be a deterrent
2. Limited Internet connectivity: In many rural areas, internet connectivity is limited, making it difficult to establish a reliable connection for IoT devices.
    - A recent USDA report reported that 60% of US farmland doesn't have good Internet connectivity

- Point to point solutions, or satellite-based connectivity, quickly become expensive, and do not get connectivity to the middle of the farm

3. Lack of interoperability: Different IoT devices from different manufacturers may use different protocols and standards, making it challenging to integrate them into a cohesive system.

    - IoT systems are typically closed with their own smartphone application. A farmer has little choice when integrating data from multiple providers.
    - Data standards are still lacking.

4. Data privacy and security concerns: With the vast amounts of data collected by IoT devices, there is a risk of data breaches and cyber-attacks, which can have severe consequences for farmers.

    - Farmers are wary of sharing data from their fields. If data can be shared, it could lead to richer applications for agriculture.
    - There is a lack of awareness of applications and benefits of data sharing

5. Complexity of implementation: IoT systems require a high level of technical expertise to set up and maintain, which may be a challenge for farmers who lack the necessary skills.

    - Farmers need tech training
    - Lack of broadband in farms limits remote assistance

6. Resistance to change: Farmers may be resistant to adopting new technologies, especially if they have been successful with traditional methods in the past.

7. Lack of standards and regulations: The lack of clear standards and regulations for IoT in agriculture can create uncertainty and inhibit adoption.

    - NLOS operations of drones
    - Data standards is missing, thereby limiting sharing

8. Environmental factors: Extreme weather conditions or other environmental factors can damage IoT devices or disrupt connectivity, making them unreliable in certain conditions.

    - IoT systems can malfunction due to weather conditions, exposure to wild animals
    - Need ways to flag configuration changes, e.g. a soil moisture sensor that is still working correctly, but is at a different depth, due to critter or other reasons

9. Energy access: Many farms may not have reliable access to electricity, which can make it challenging to power IoT devices that require a constant energy supply. In such cases, the use of alternative sources of energy such as solar power, wind power, or micro-hydro power may be necessary.

    - Alternative energy sources can also be expensive to set up and may require technical expertise to install and maintain, which can be a barrier for small-scale farmers.
    - Lack of energy access can also limit the use of IoT devices in remote areas, where power infrastructure may be limited or non-existent.

List of speakers:

- Steven Mirsky, USDA
- Someone on drones
- Professor Joao from UW Madison for barns
- Connecterra for cows
- Arable, Davis Instruments, … (assuming you and I cover CropX and Microsoft)
- Ethos Connected (Paige Wireless)

References: