

Lesson 5:

Data Collection with Drones

Smart Farming with Drones – Advanced Automation

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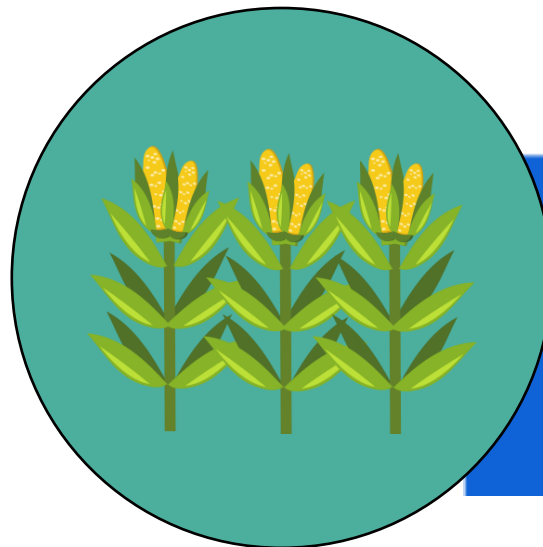
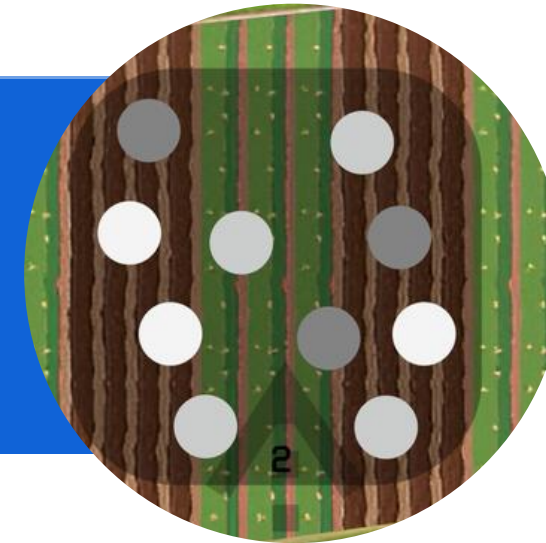


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Lesson Objectives

Program a drone to perform an advanced flight path and recognize crop conditions using QR codes.

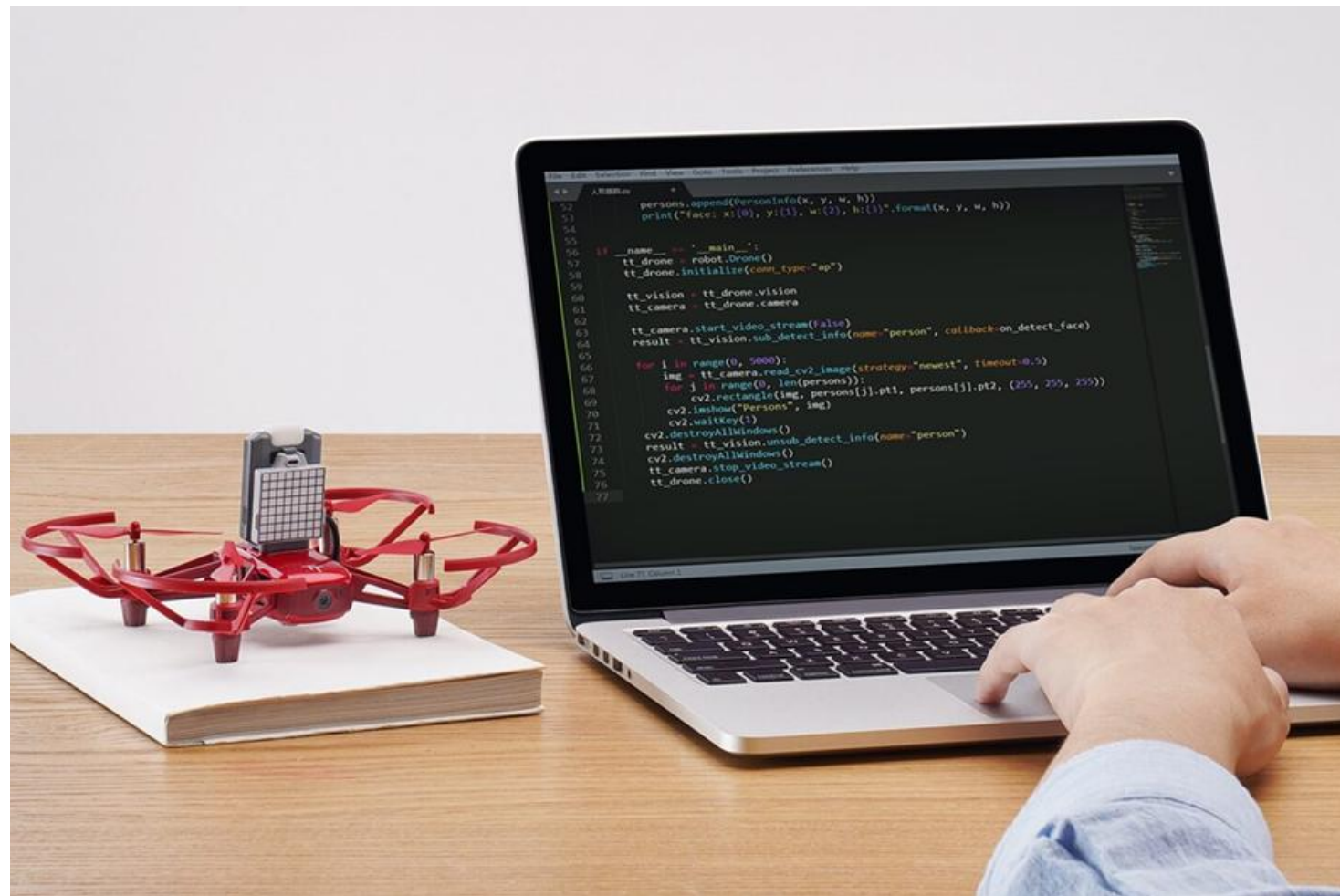


Understand how drones can assist in smart farming through automation and data collection.

Learn to capture images, analyze data, and respond to field challenges.



Materials Needed



HARDWARE

DJI Robomaster TT Drone

Drones4STEM FloorMat

PC SOFTWARE

MIND+ Scratch GUI Platform

Advance Flight Planning Project File

Indoor Drone Flying Safety Rules

1 Before the Flight:

- Inspect the Drone
 - Check for damage or loose propellers.
 - Ensure the battery is fully charged.
- Prepare the Area
 - Remove obstacles like chairs, desks, and other items.
 - Ensure a spacious and open environment.
 - Close Windows or air stream sources
- Inform Participants
 - Brief everyone on safety protocols.
 - Maintain a safe distance of at least 2 meters from the drone.

Indoor Drone Flying Safety Rules

2 During the Flight:

- Controlled Takeoff and Landing
 - Launch and land on a flat, stable surface.
 - Avoid flying near people or objects.
- Flight Boundaries
 - Keep the drone within visual line-of-sight.
 - Fly at low altitudes to avoid ceiling impact.
 - Land when battery <20%
- Emergency Protocol
 - Stop the drone immediately if it veers out of control. (SPACE initiates LANDING)
 - Use the "emergency stop" button on the app if needed. ("e" stops motors)

Indoor Drone Flying Safety Rules

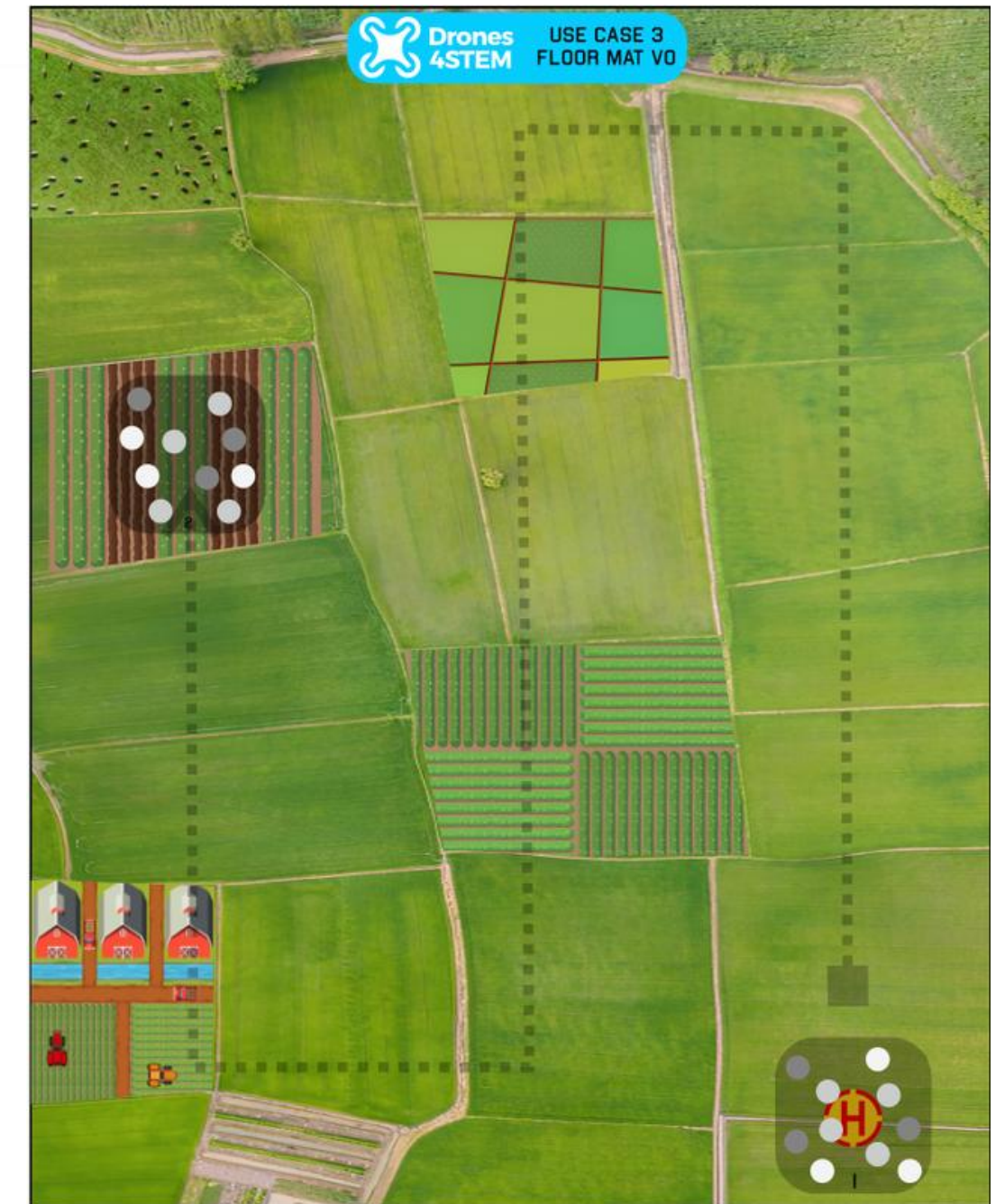
3 After the Flight:

- Power Off Safely
 - Turn off the drone and disconnect the battery.
- Inspect for Damage
 - Check for any issues after flight.
- Store Safely
 - Keep the drone in a secure, dry place.

ALWAYS STAY CALM AND FOCUSED

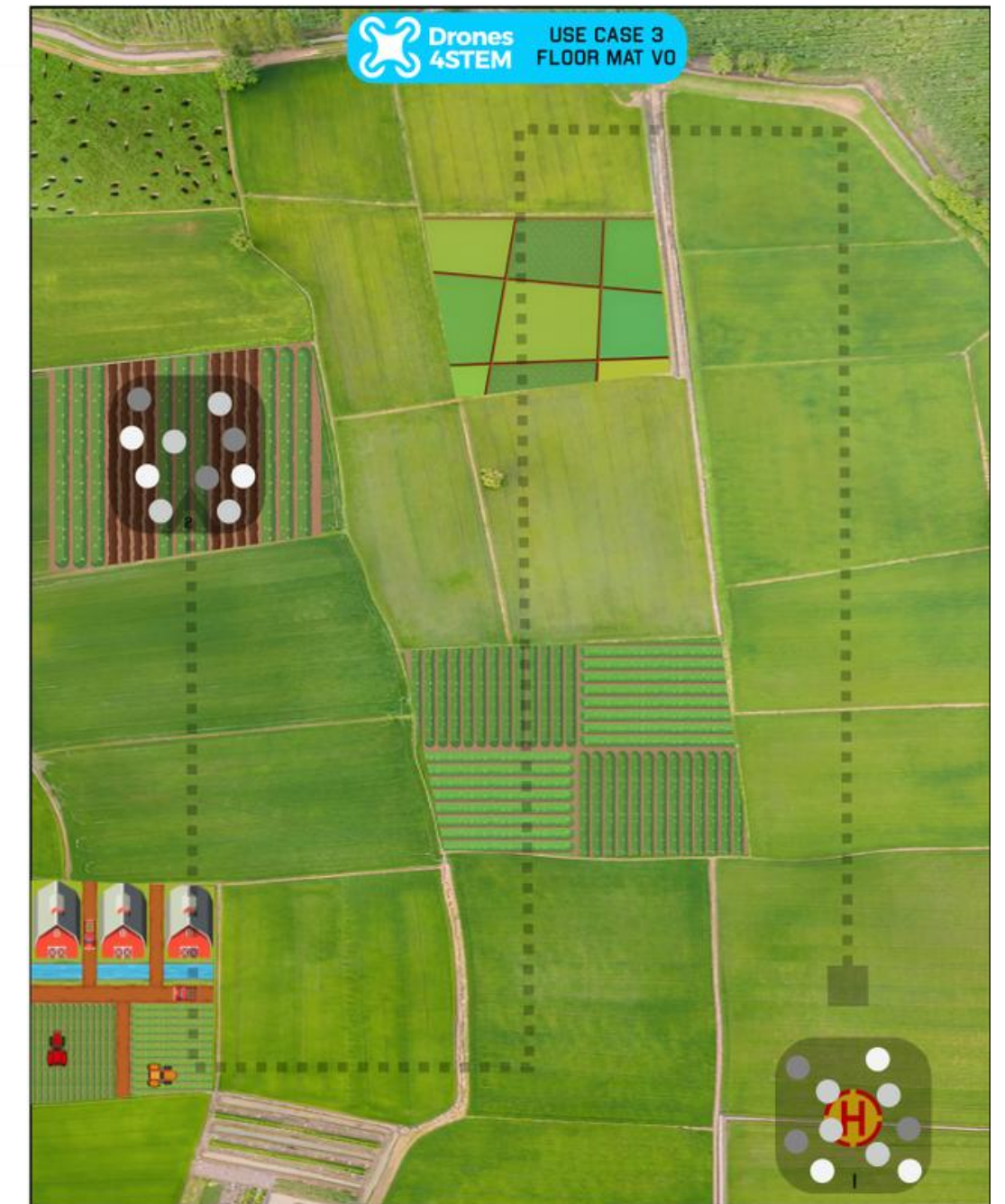
Activity : Programming Advanced Flight Path

- Take off.
- Perform a search pattern over a predefined area (e.g., grid pattern).
- Identify QR codes representing bad crops.
- Alert the farmer with a green/red LED matrix.
- Capture an image
- Return to home and land.



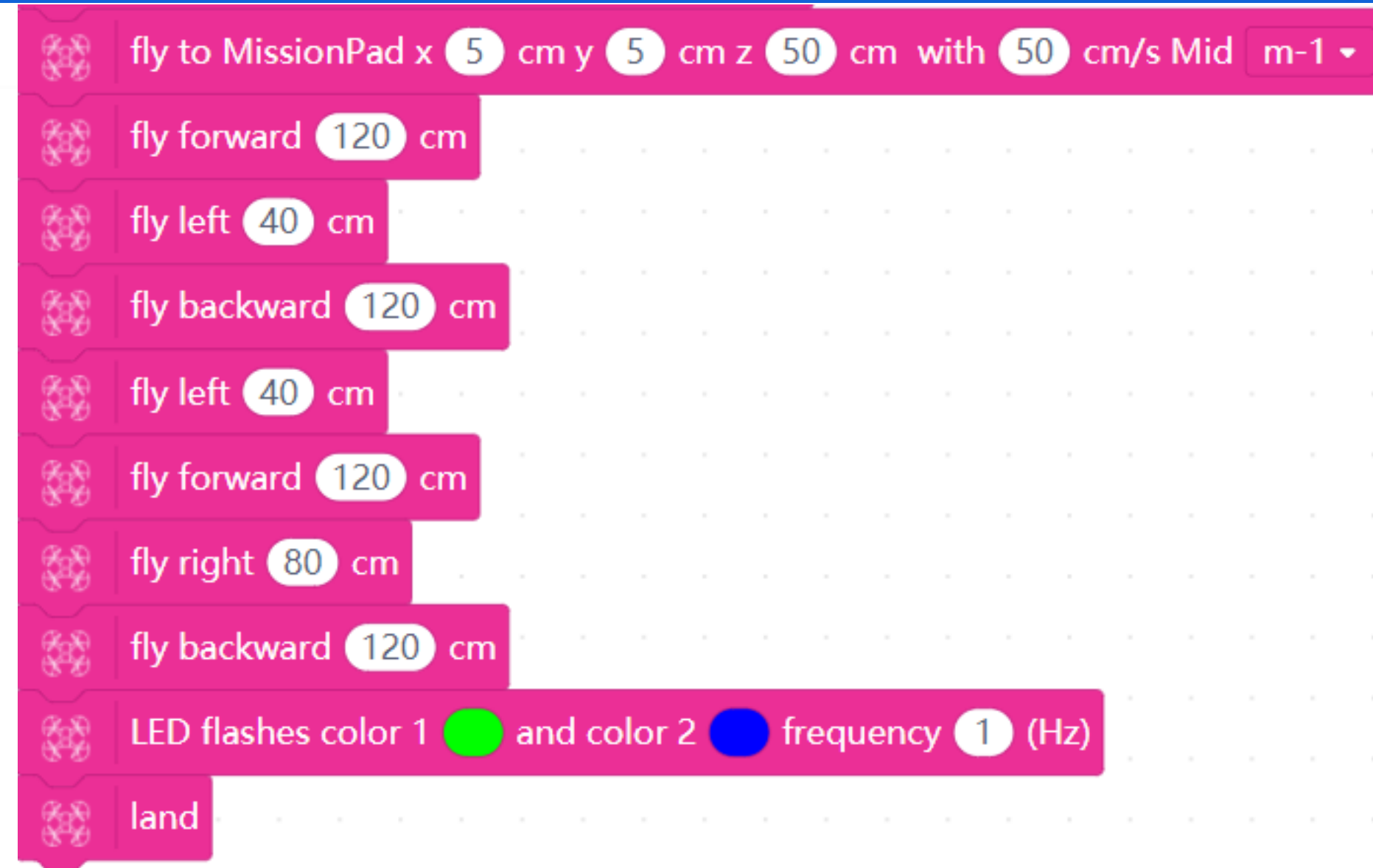
Activity : Programming Advanced Flight Path

- Demonstrate advanced block-based programming concepts:
- Creating loops for the search pattern.
- Using conditional blocks to identify QR codes.
- Triggering the LED matrix and camera.
- Returning to base after completing the search.



Activity : Programming Advanced Flight Path

- Search Box Pattern
- Return To Home if nothing found



Activity : QR Code Detection

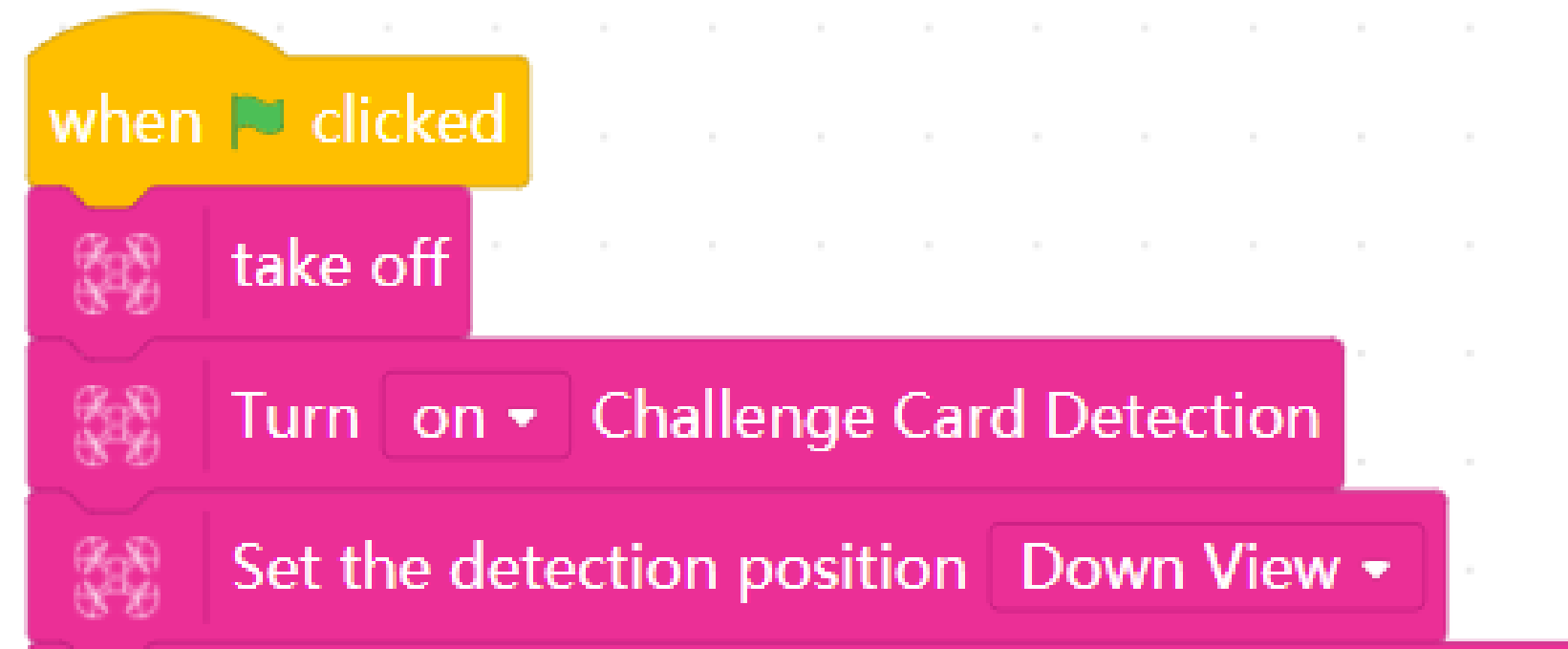
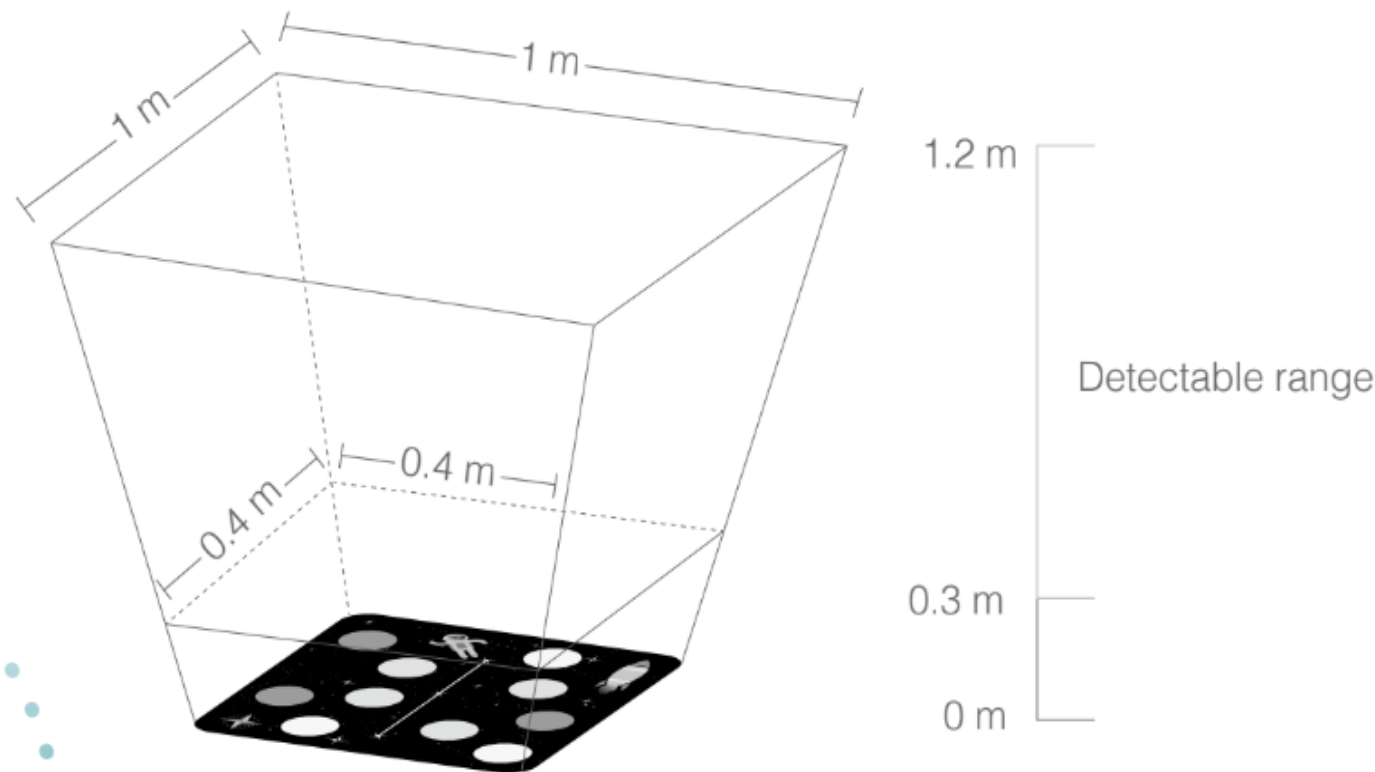
- Drone can recognize QR numbers (1,2,3,4...)

Effective Mission Pad Recognition Range

Recognizable height range: 0.3 - 1.2 m

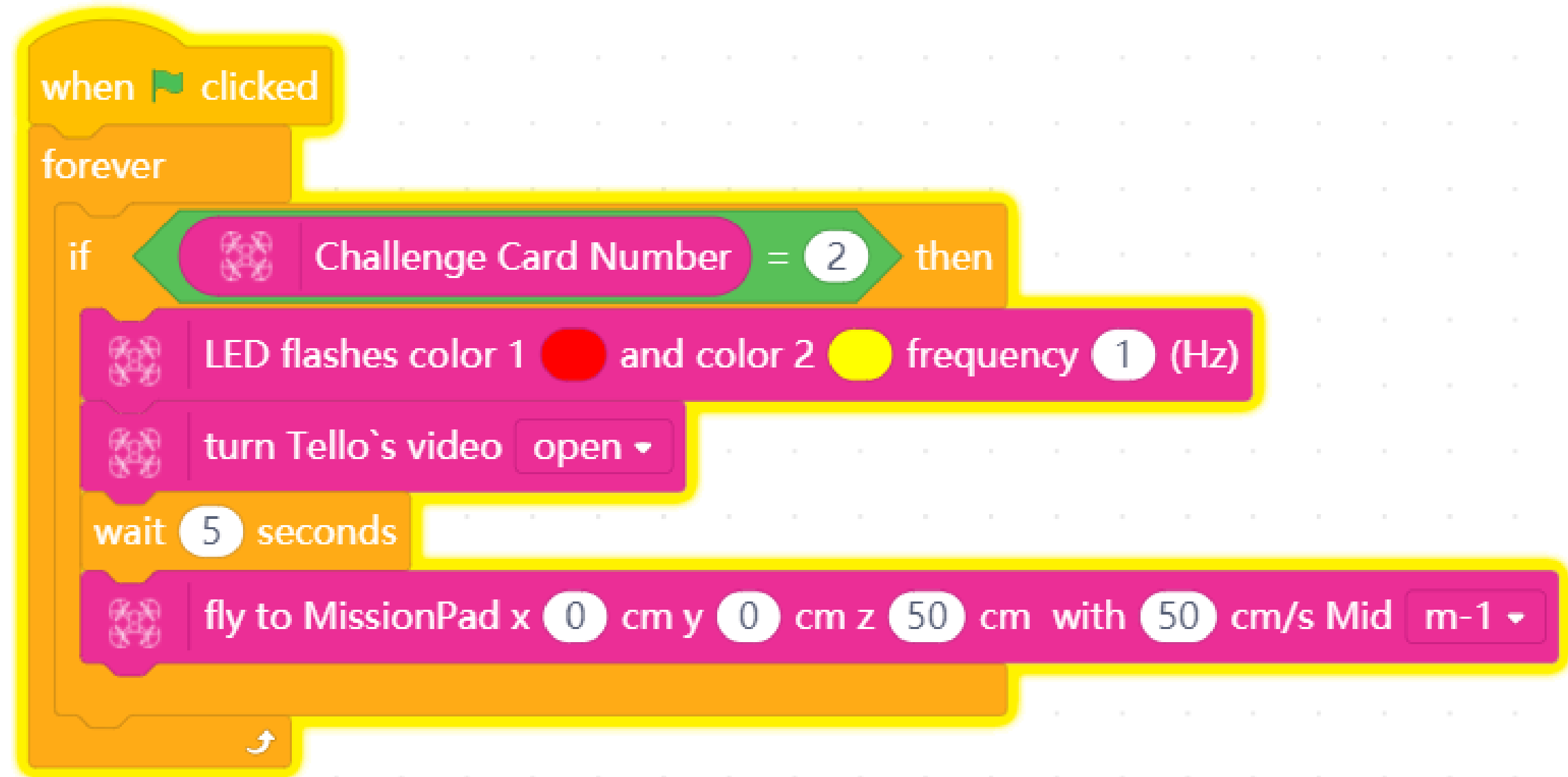
Recognizable range at 0.3 m: 0.4 m×0.4 m

Recognizable range at 1.2 m: 1 m×1 m



Activity : QR Code Detection

- Needs a Loop Function
- When bad crop found:
 - Flash Led
 - Turn Video On
 - Fly back to HOME



Activity : Programming Advanced Flight Path

- Emergency Functions
 - Not flying the predicted path
 - Someone entered the fly zone
 - Emergency Stop -> Fall out of the sky



Test the Simple Flight Path Mission



Troubleshooting

1 Drone Connection

- Is the drone connected?
- Initiate connection again

2 Mission Start

- Did you add an event?
- Did you add the take off command?

3 Flight Path

- Check for correct commands
- Clockwise vs Counter Clockwise



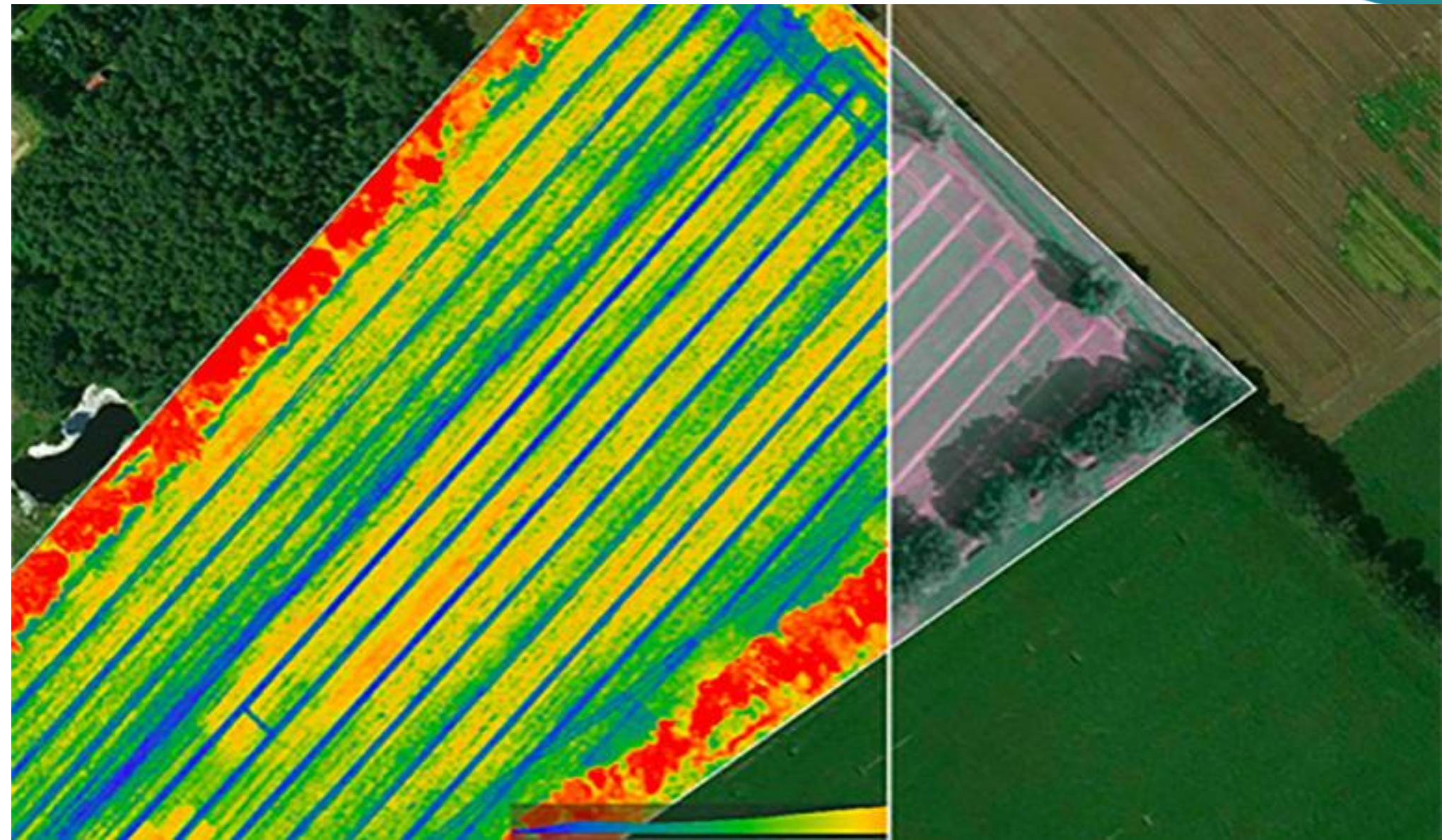
Improvements and Limitations

- How can we use less functions for pattern (LOOPS)?
- How can we make it more reliable?
- Can we fly higher?
- What else can we detect?
- Can we add swarm drones with spray function?



RECAP

- What We Achieved:
 - Advanced Programming:
 - Programmed a drone to perform a grid search pattern over a field.
 - Used conditional logic to detect and respond to crop issues (QR codes).
- Challenge Response:
 - Triggered an LED matrix to signal detected problems.
- Captured images them based on detected QR codes (e.g.,)



Real World Applications

- Precision farming: Identifying and addressing problem areas in crops.
- Automating data collection to save time and resources.
- Leveraging drones to improve agricultural efficiency and sustainability.

What are your questions?



Additional Resources

Further Reading

<https://www.croptacker.com/blog/drone-technology-in-agriculture.html>

Videos

<https://www.youtube.com/watch?v=263dJ7Fm>



Thank you for your
attention !



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