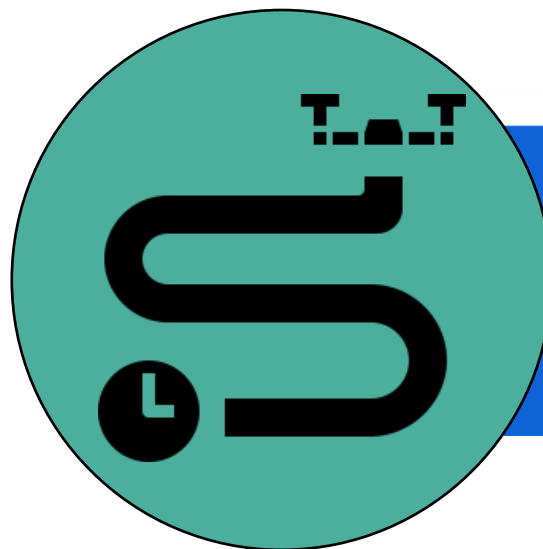


Lesson 4:

Programming Exercise

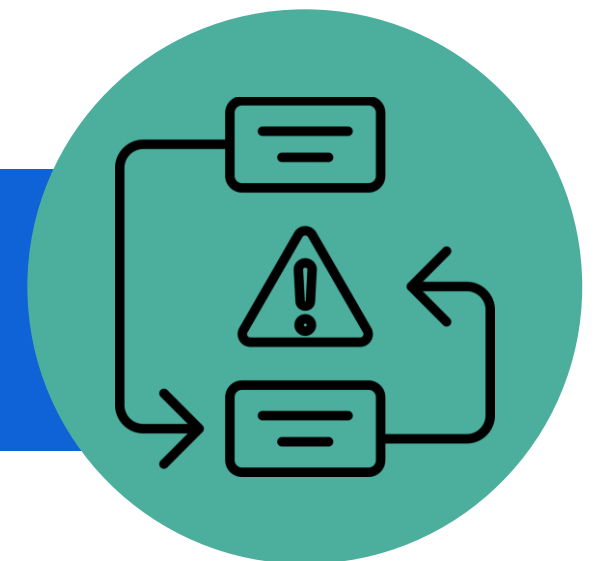
Lesson Objectives

Learn to use block-based programming to control a drone

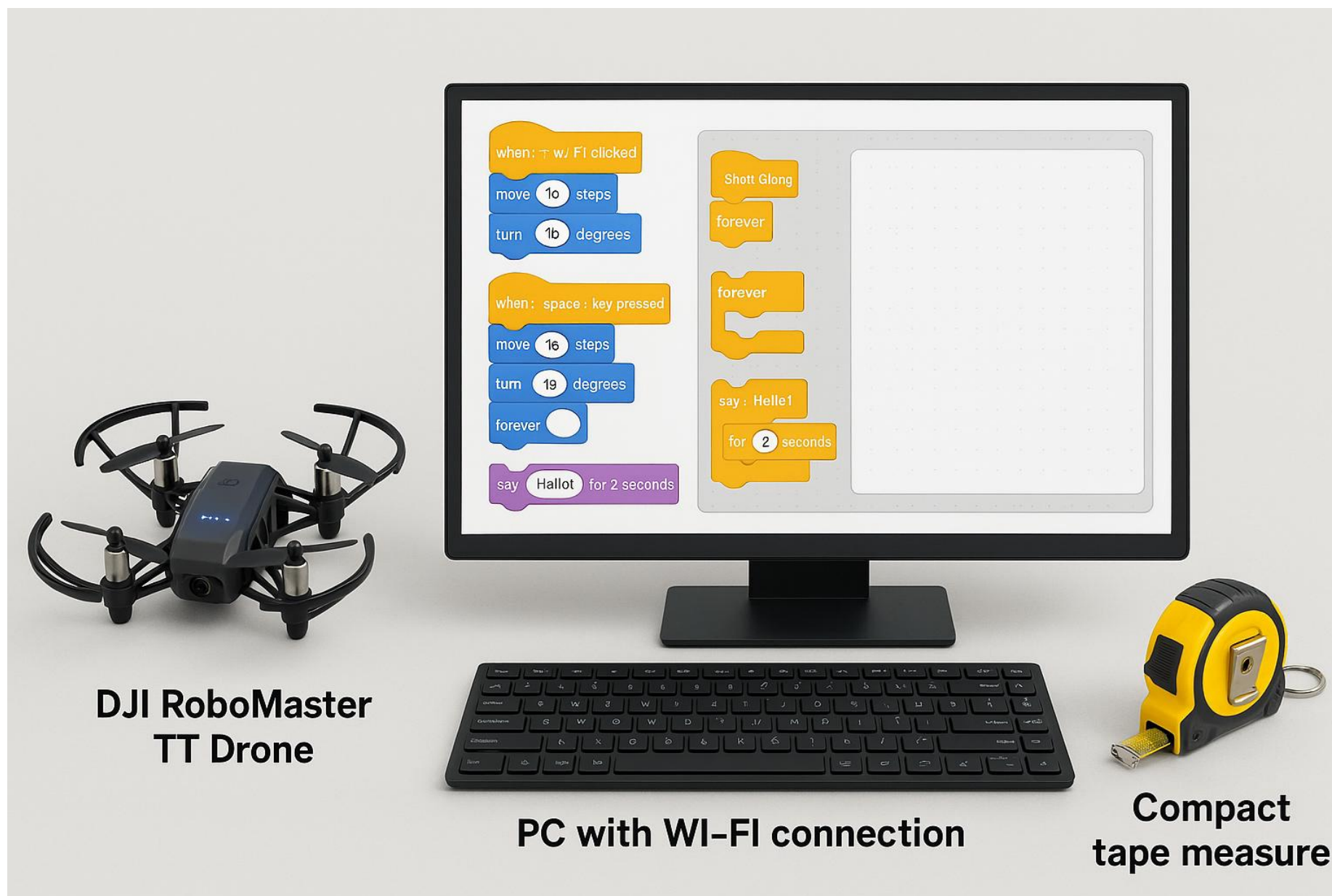


Program a drone to take off, fly in a square pattern and land

Discuss Safety Protocols and Emergencies



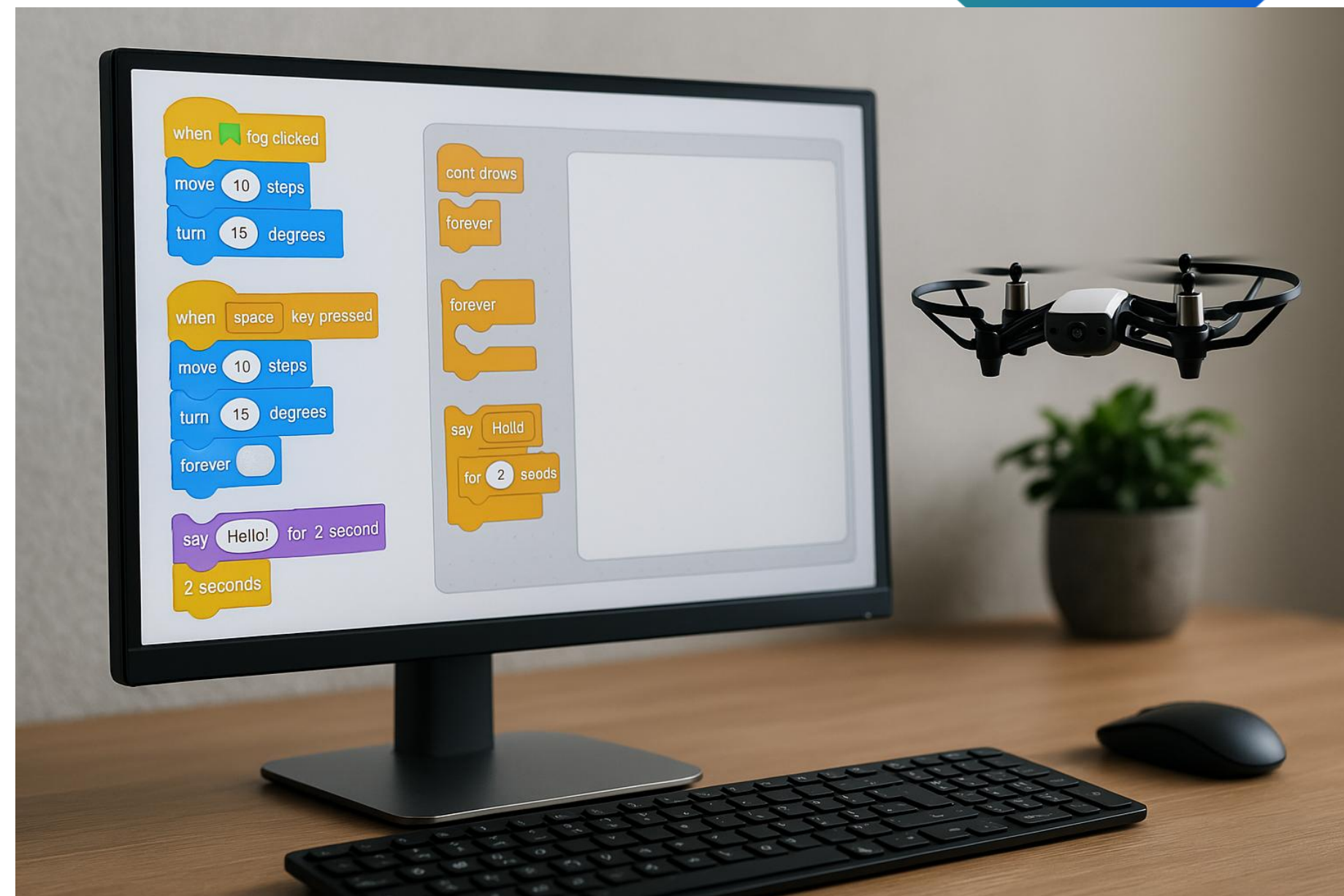
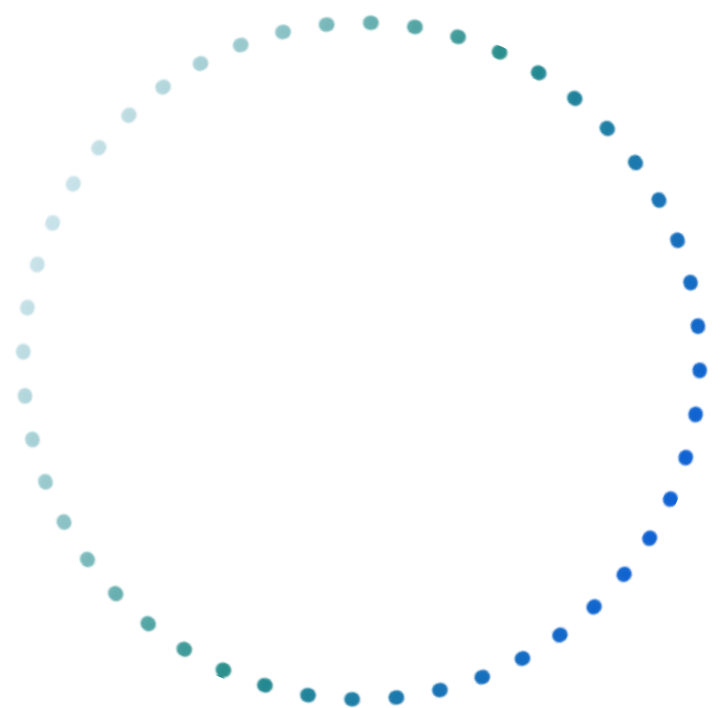
Materials Needed



DJI Robomaster TT Drone,
PC with WI-FI connection,
MIND+ Scratch GUI Platform,
Compact tape measure

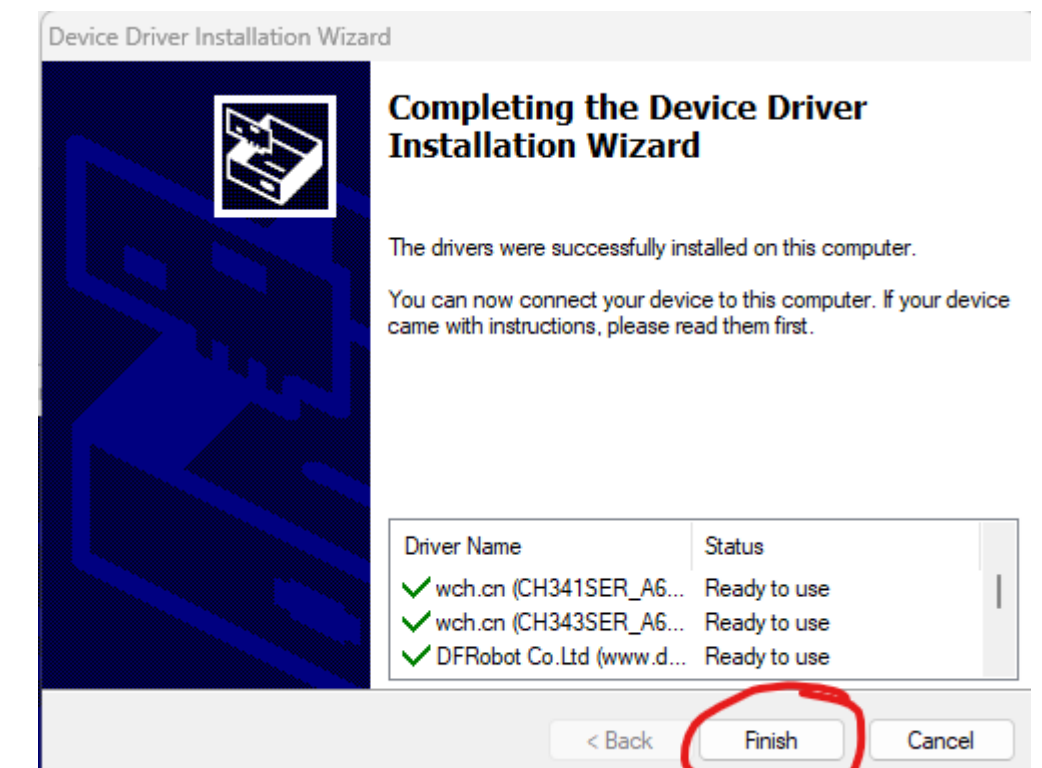
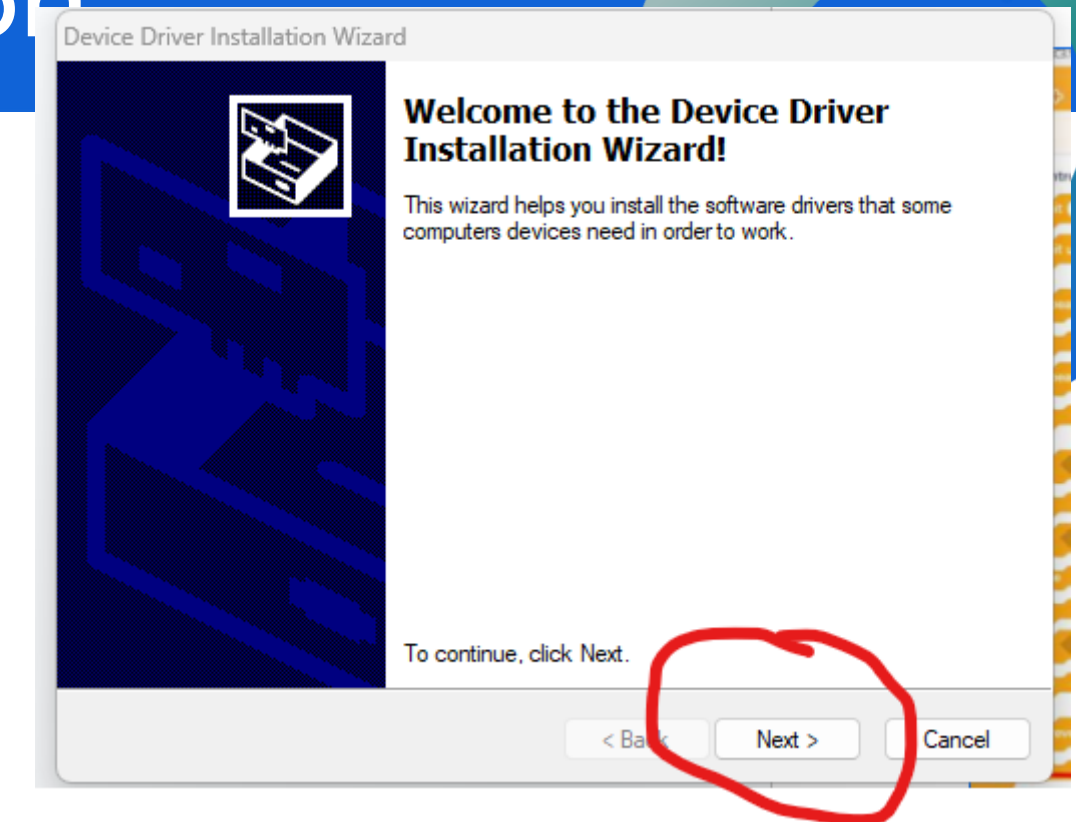
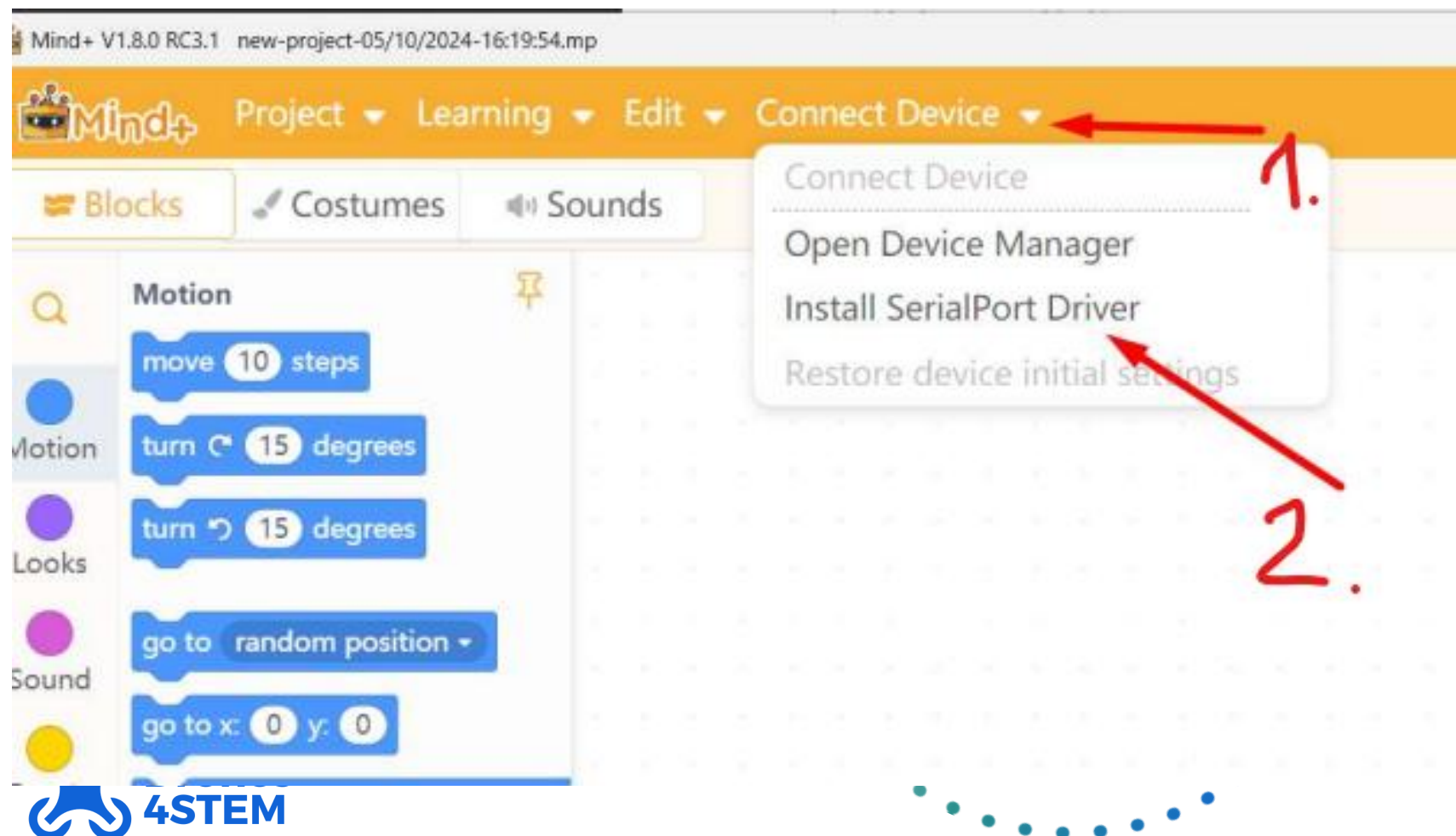
Establishing connections for drone operation

- Connection between Mind+ and TELLO drone
- Wi-Fi connection between PC and TELLO drone

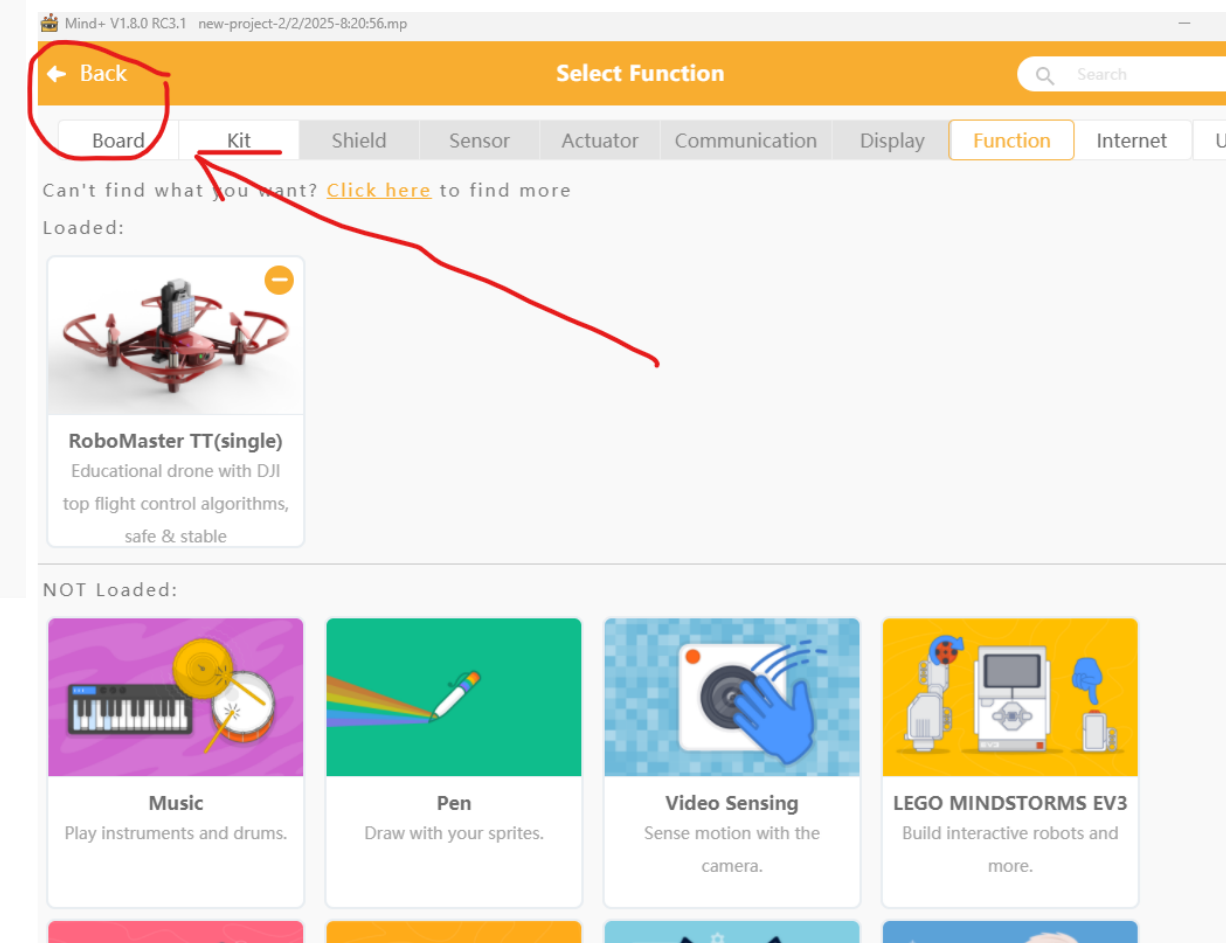
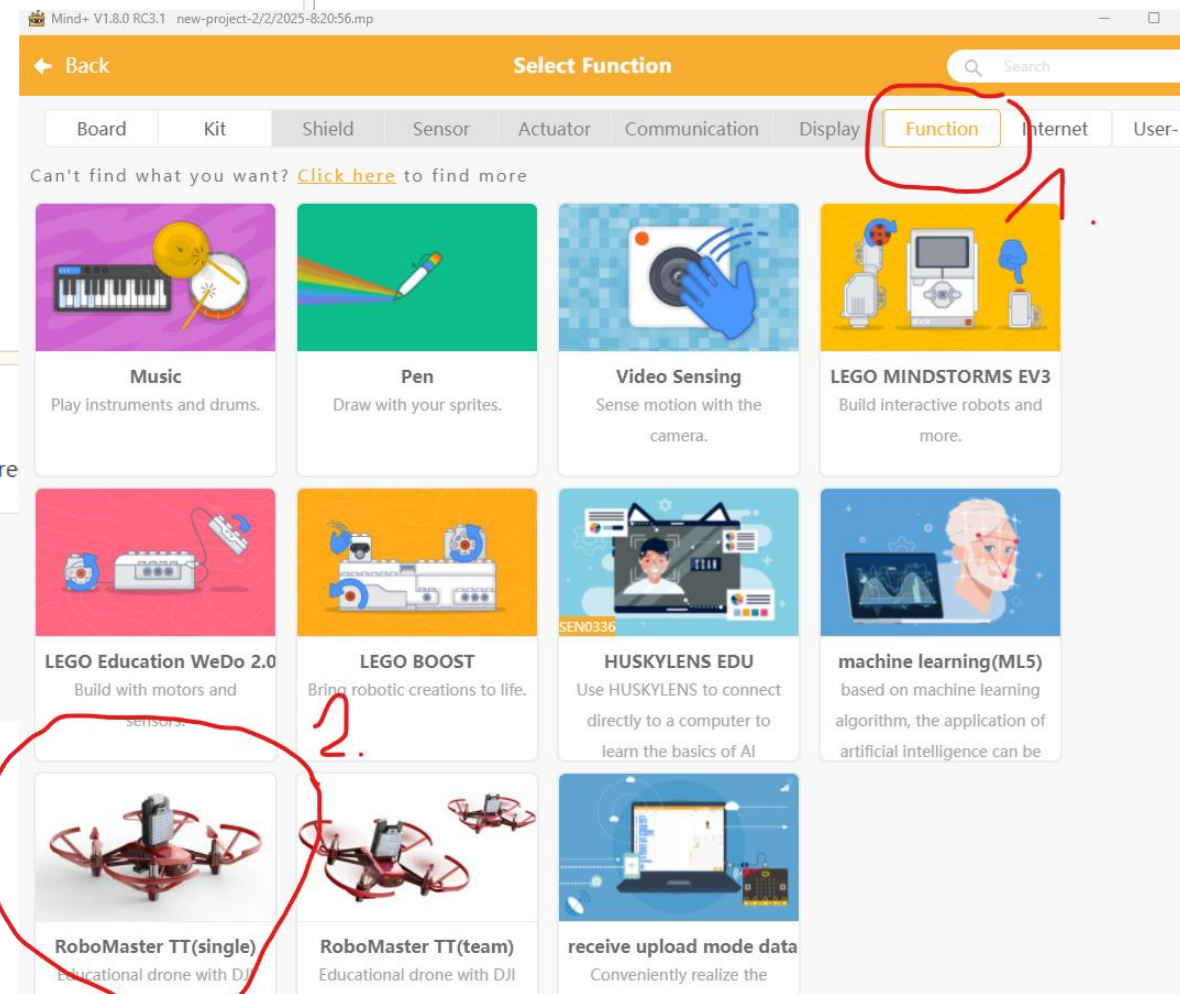
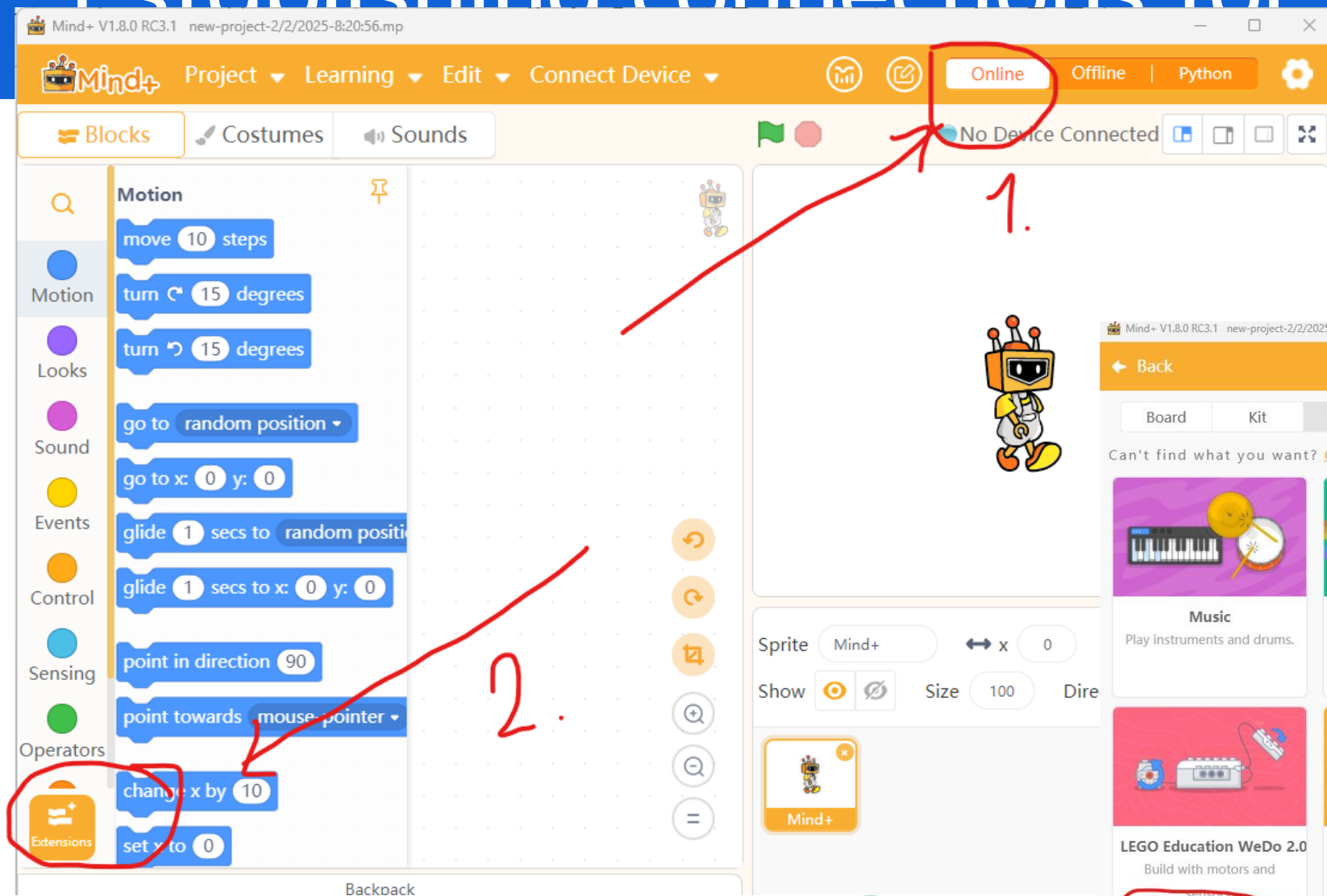


Establishing connections for drone operation

In the Mind+ program, we need to set certain functions that manage the connection between the Tello drone and the Mind+ program.



Establishing connections for drone operation



Establishing connections for drone operation

SIMPLE PROGRAM

The screenshot displays the Mind+ V1.8.0 RC3.1 interface. The top menu bar includes 'Project', 'Learning', 'Edit', and 'Connect Device'. The left sidebar shows various function categories: Motion, Looks, Sound, Events, Control, Sensing, Operators, Variables, and My Blocks. The main workspace contains a script for a 'RoboMaster TT(single)' drone. The script includes the following blocks:

- turn Tello's video open
- Enter propeller mode
- Exit the propeller mode
- take off
- Throw away in 5 seconds
- land
- fly up 50 cm
- fly down 50 cm
- fly left 50 cm
- fly right 50 cm
- fly forward 50 cm

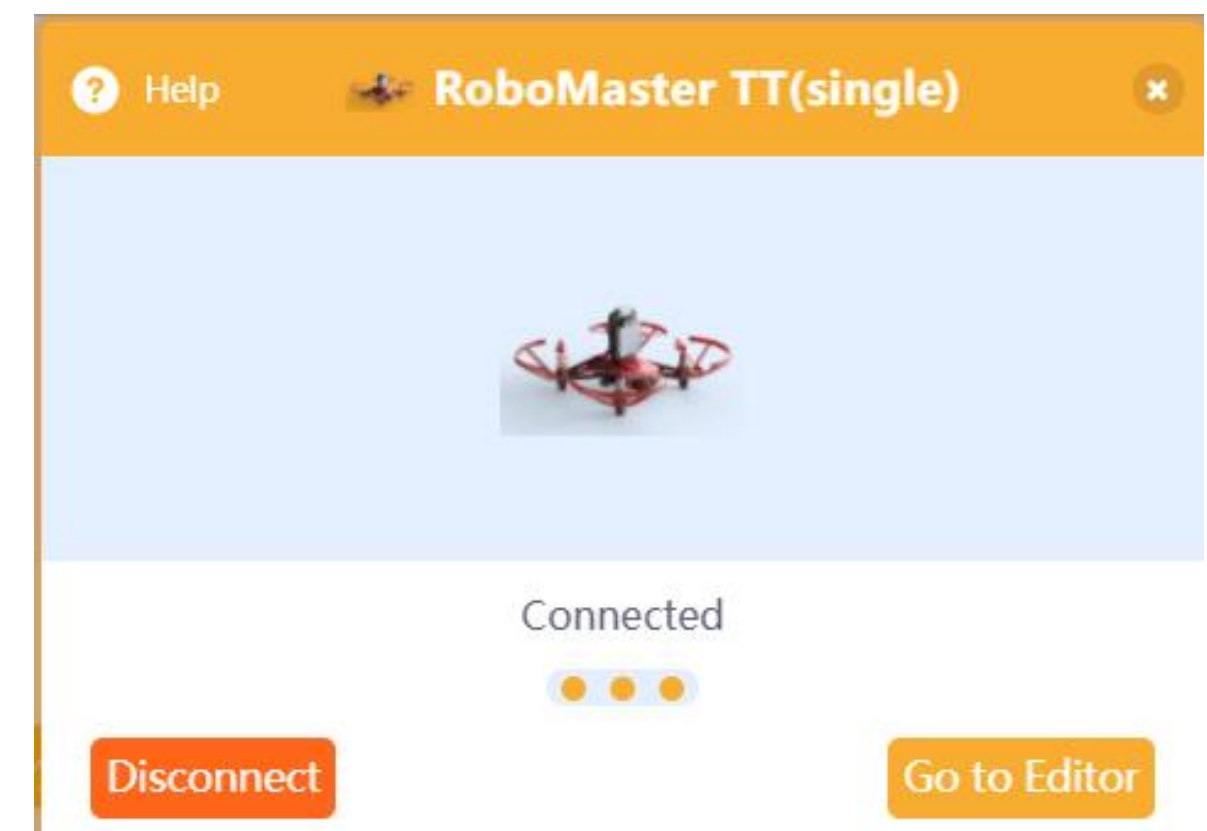
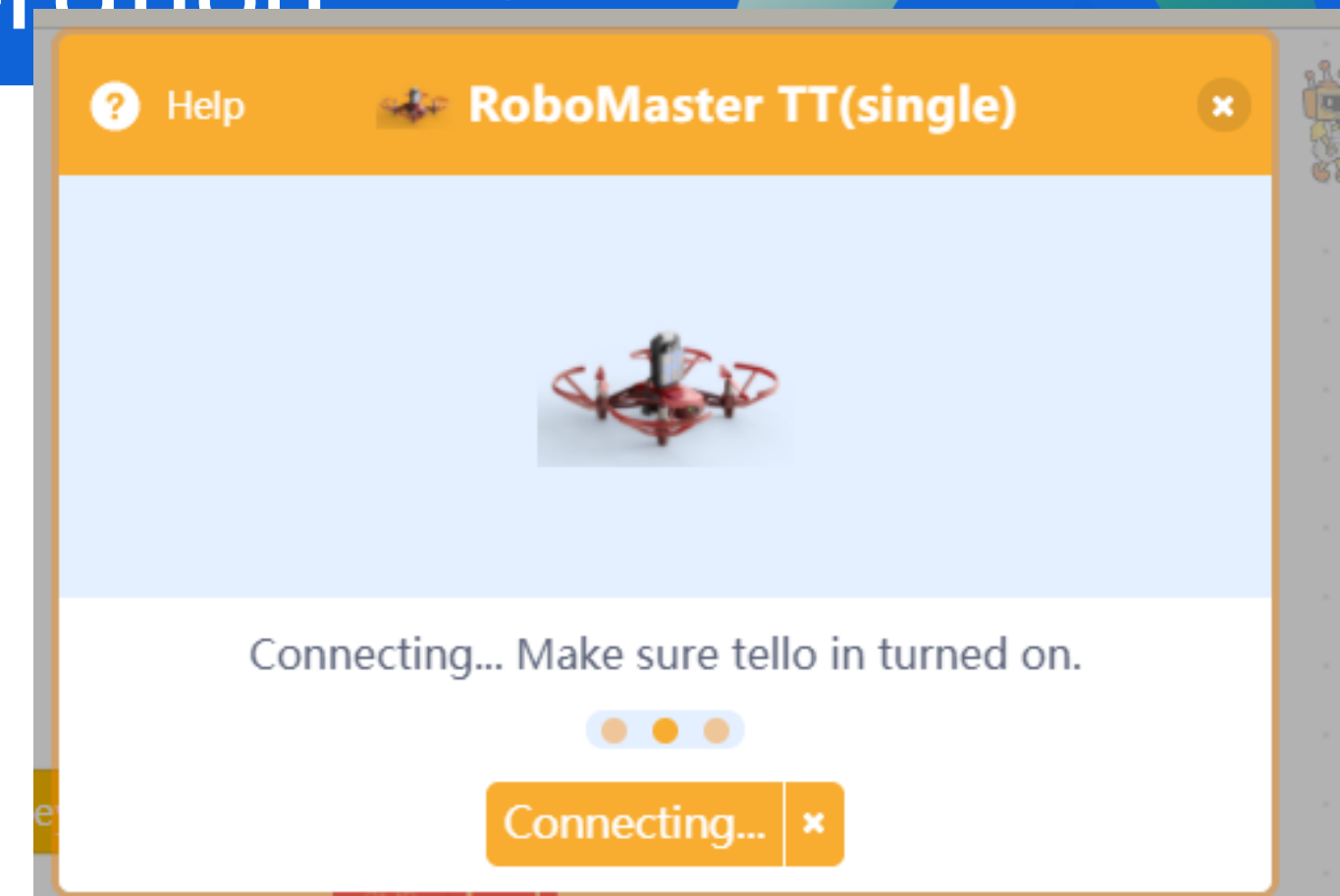
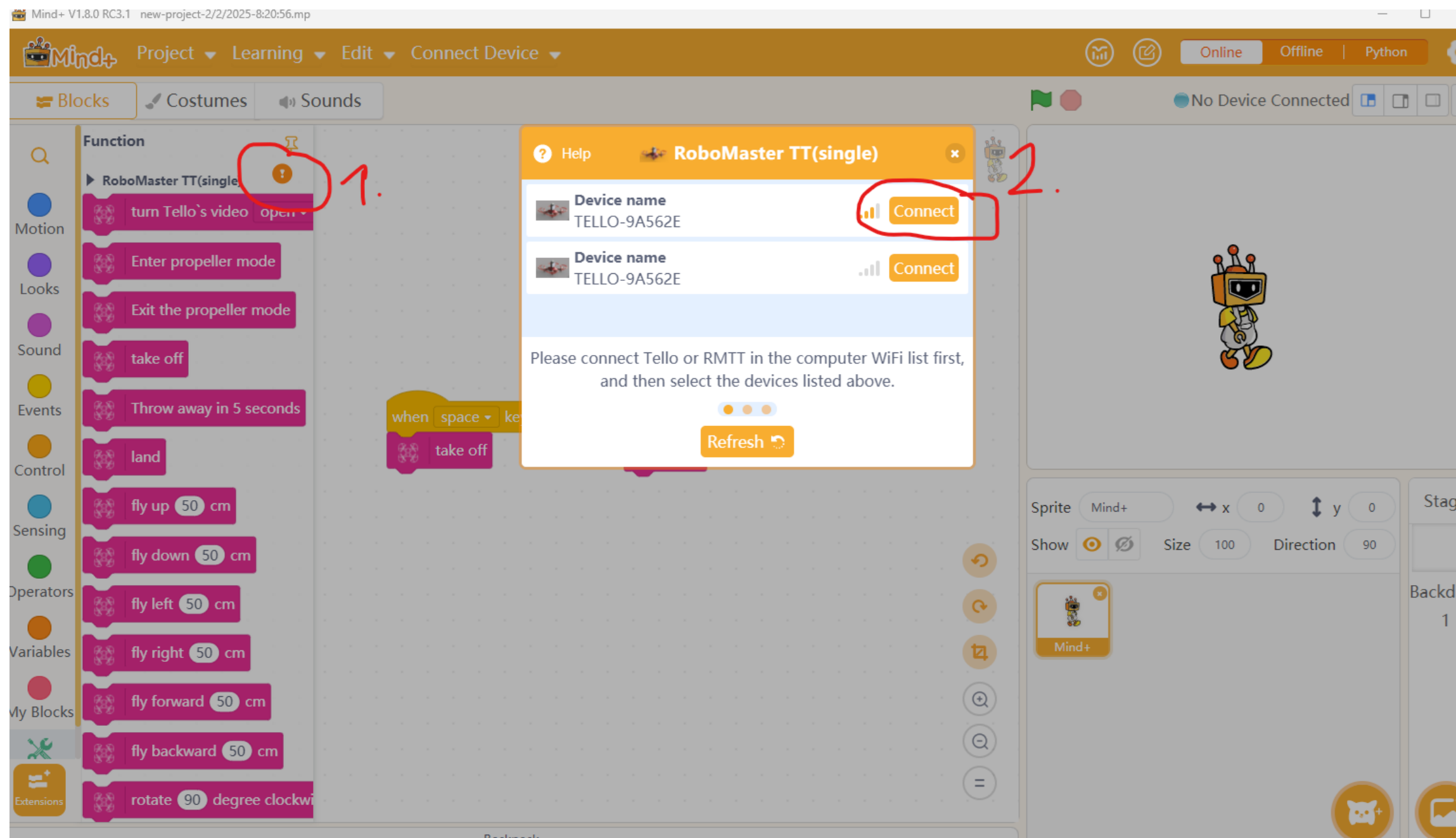
Two event blocks are also present:

- when space key pressed
- when a key pressed

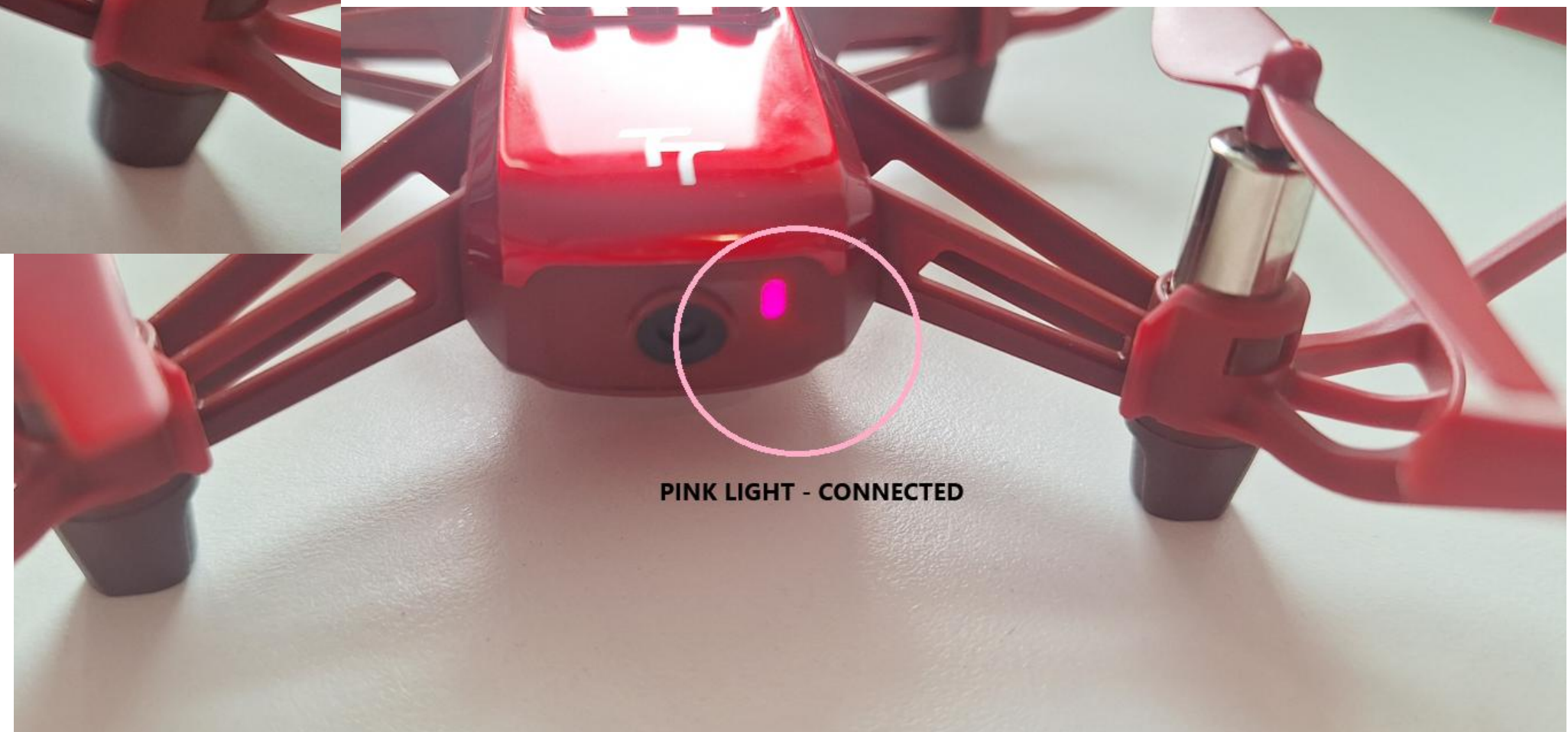
Red arrows and a red oval highlight the 'take off' and 'land' blocks, indicating the primary actions for drone operation. The right sidebar shows the 'Sprite' section with a 'Mind+' sprite and a 'Show' button. The bottom right corner displays the 'Size' and 'Direction' settings.

Establishing connections for drone operation

- The next step is to turn on the drone and enable your computer's Wi-Fi.
Among the available Wi-Fi devices detected by your computer, select the device named TELLO.
- Then, in the Mind+ program, select the left tab "MyBlocks", and click the exclamation mark next to "RoboMaster TT (single)". This will establish a connection between the Tello drone and the Mind+ program.



Establishing connections for drone operation



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 Take-off 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

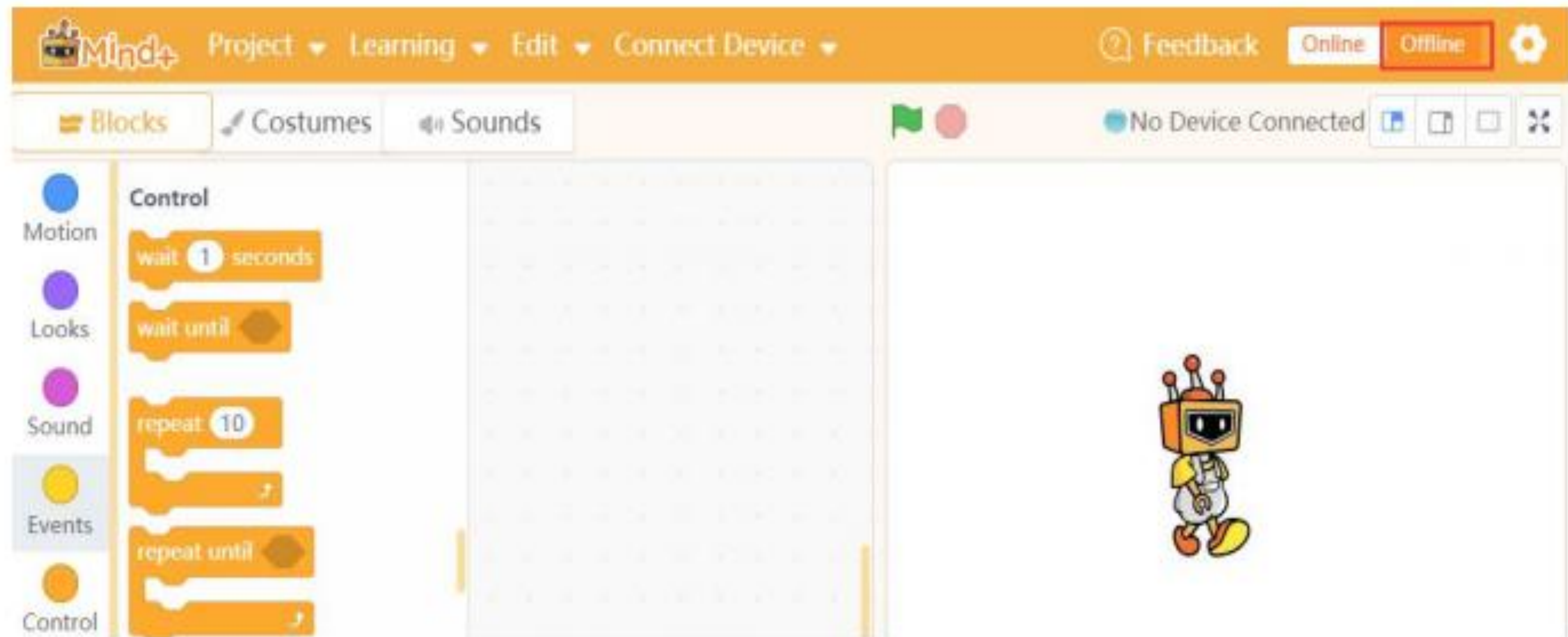
3 After the Flight:

- 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

Demonstration Of Block Based Programming

Introduction to the Programming Interface (MIND+)



Demonstration Of Block Based Programming

Installation CheckList

- Install from <https://mindplus.cc/>
- Choose EXTENSIONS->FUNCTIONS->ROBOMASTER (SINGLE)
- My Blocks
 - TELLO TT Specific functions (Camera,QR,ETC)

The screenshot shows a sequence of blocks in a block-based programming environment. The blocks are as follows:

- Turn on Challenge Card Detection
- Set the detection position Down View
- fly to MissionPad x 50 cm y 50 cm z 80 cm with 50 cm/s Mid m-1
- Flying arc line under challenge card x1 20 cm y1 20 cm z1 80 cm and x2 40 cm y2 60
- Jump along challenge card x 100 cm y 0 cm z 80 cm speed 50 cm/s yaw 0 degree fr
- The aircraft rotates to the 0 angle relative to the challenge card m-1
- Challenge Card Number
- Challenge Cardx(cm)

The screenshot shows the RoboMaster TT(Single) function block menu. The menu is organized into categories: Control, Sensing, Operators, Variables, My Blocks, and Function. The 'My Blocks' category is highlighted with a red box. The 'Function' category is also highlighted with a red box. The 'RoboMaster TT(Single)' block is highlighted with a red box. The 'Function' category contains the following blocks:

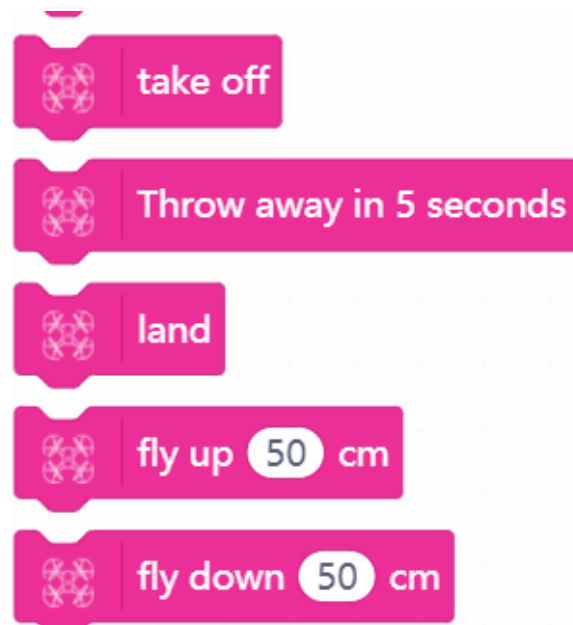
- turn Tello's video open
- Enter propeller mode
- Exit the propeller mode
- take off
- Throw away in 5 seconds
- land

Code functions, live demonstration and example code

Walkthrough

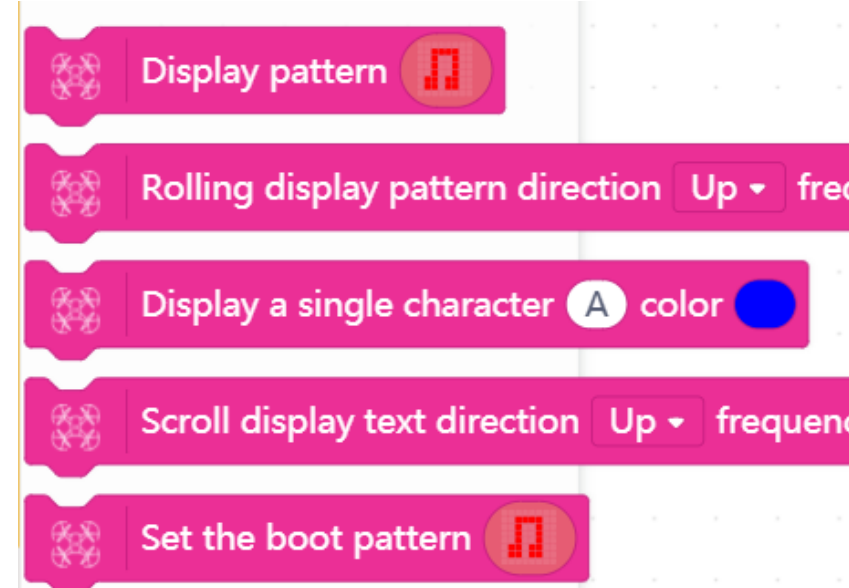
Flight Functions

- Take Off/Land
- Move
- Rotate
- Flip



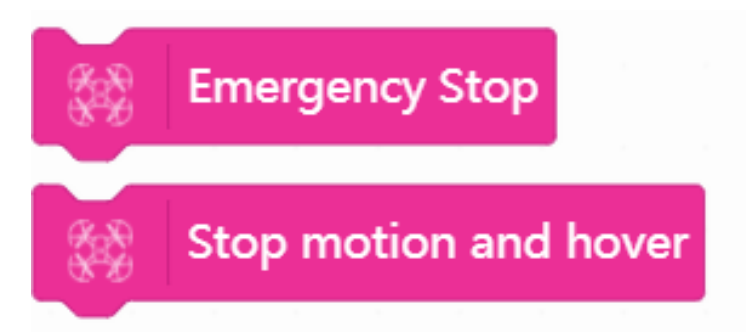
Events

- Challenge Cards Recognition
- Read Distance from obstacles
- Led Color
- Led Matrix Messages



Safety Functions

- Emergency Stop
- Obstacle Avoidance



Code functions, live demonstration and example code

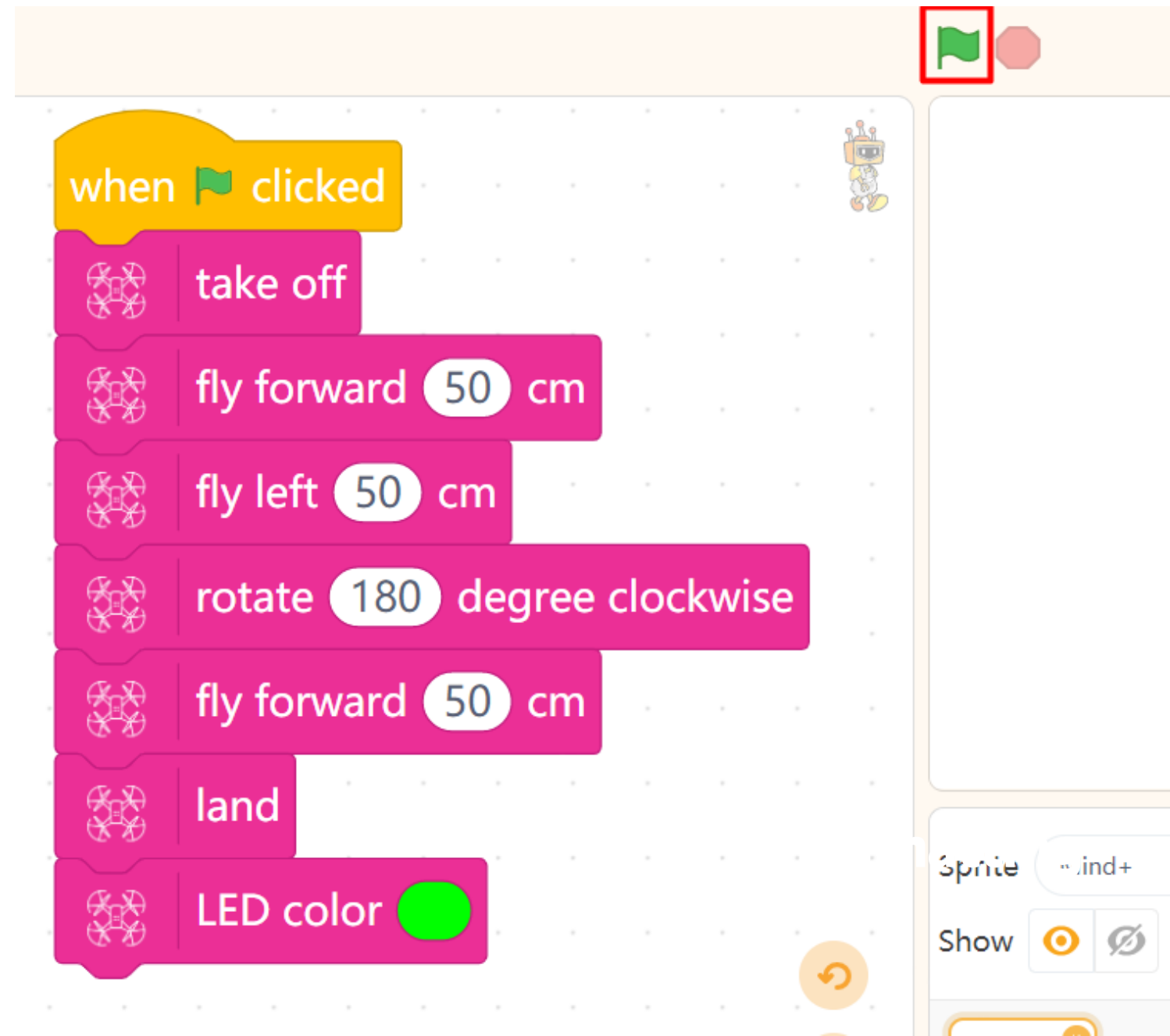
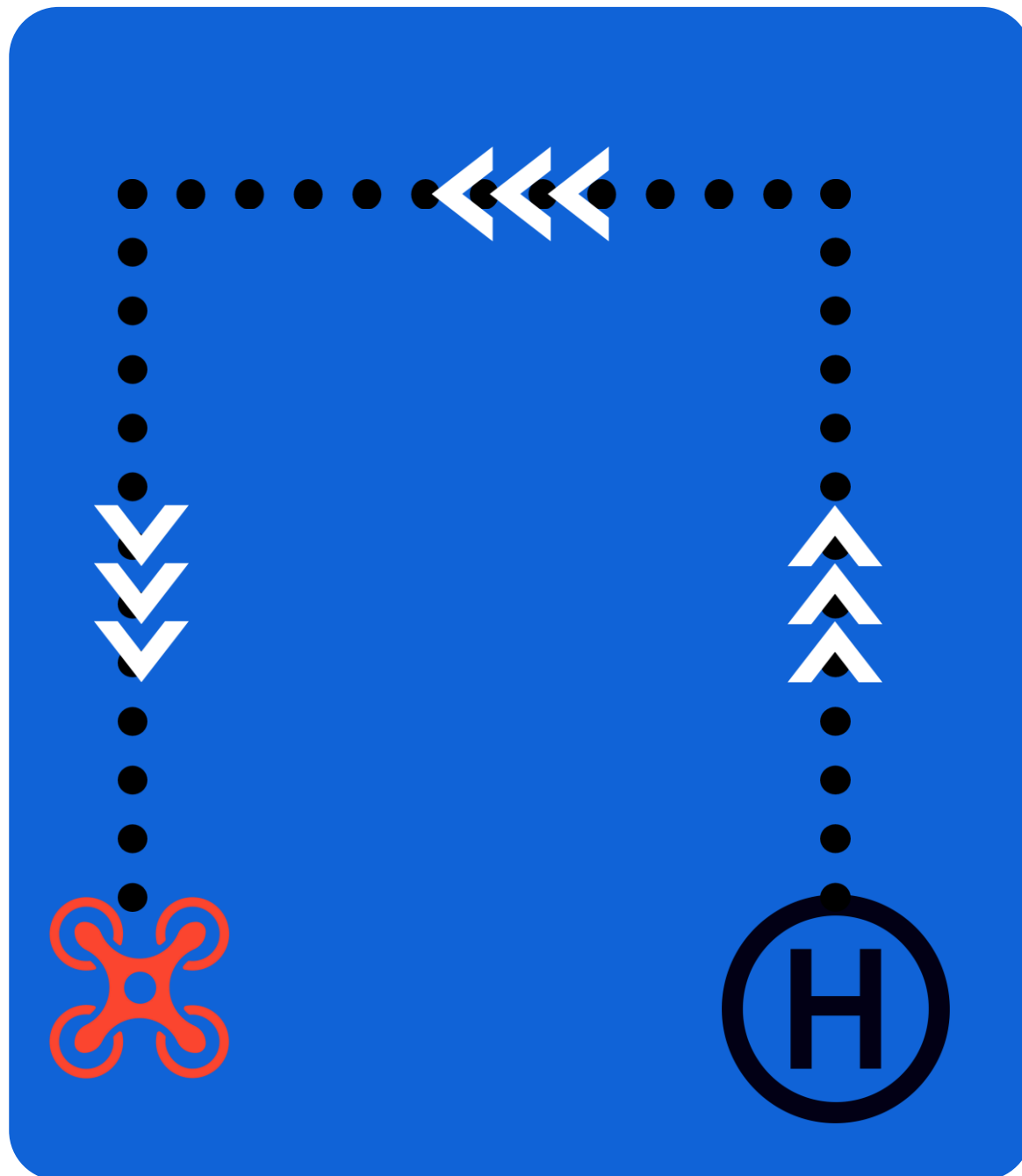
Walkthrough

Programming the drone to take off, fly a short distance, and land.

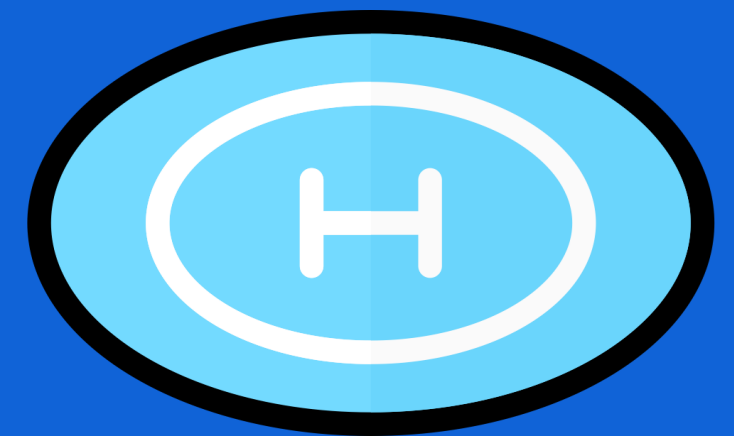
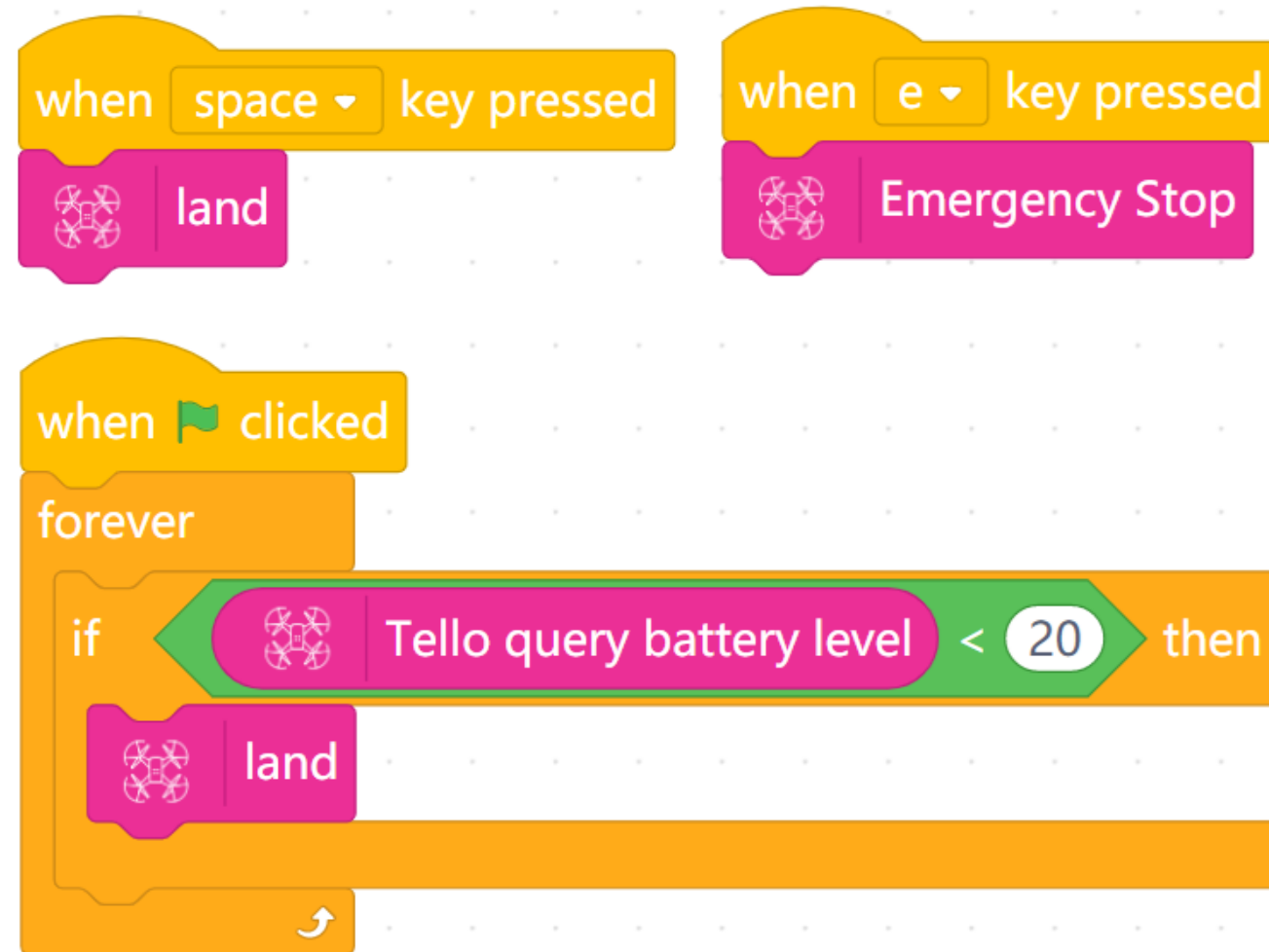


Code functions, live demonstration and example code

Walkthrough



Live Demonstration (Simple Flight Project)

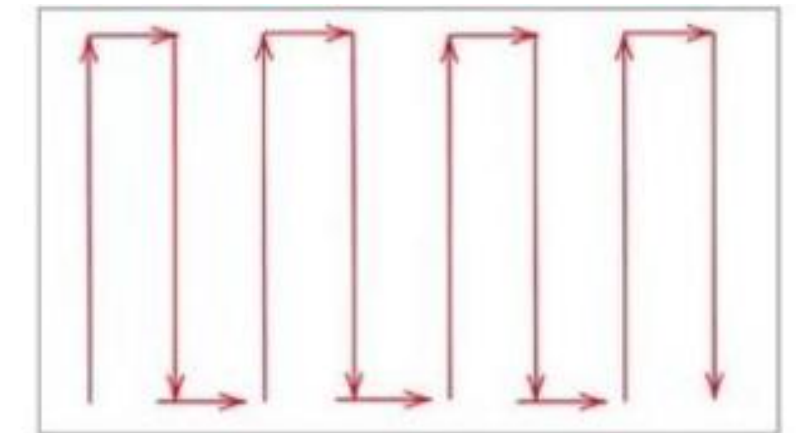


Activity : Programming a Square Flight Path

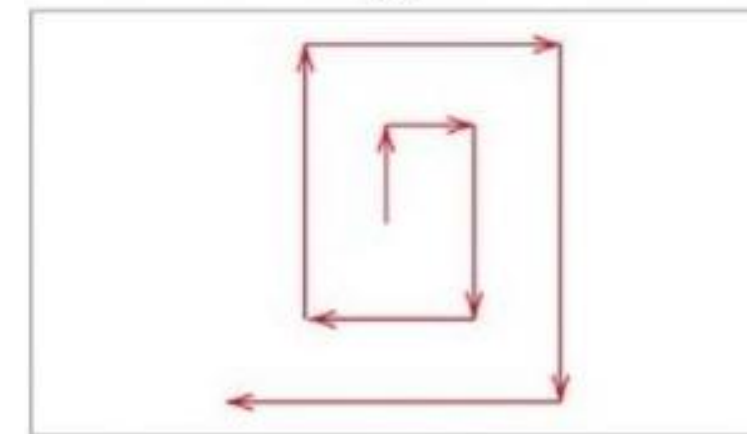
- Take Off
- Fly Forward
- Turn
- Repeat to form a square
- Land



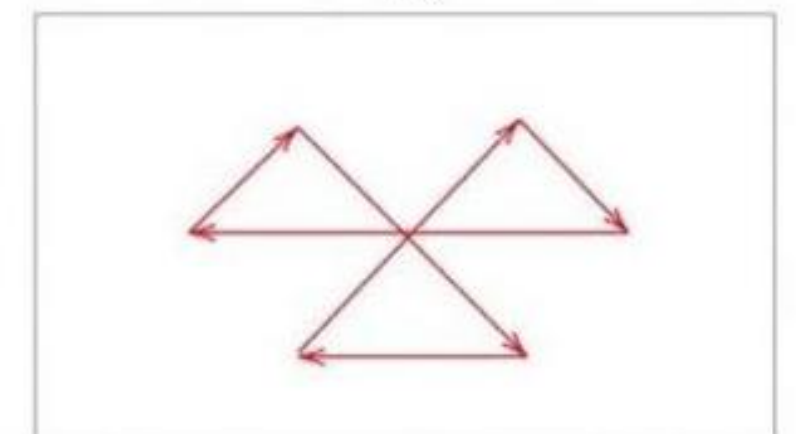
(a)



(b)



(c)



(d)

"Can we program our drone to fly a perfect square and land safely?"

Guided Programming Exercise - Programming a Square

Flight Path and Safety part

Step 1: Events – When __ key pressed

Guide students to use the "When space key pressed" block to make the drone start operating based on the next step.

Step 2: My Blocks – Take Off

Guide students to use the "take off" block to initiate the drone's flight.

Step 3: My Blocks – Fly Left

Use the "fly left" block to move left the drone a 50 cm distance.

Step 4: My Blocks – Fly forward

Use the "fly forward" block to move forward the drone a 50 cm distance.

Step 5: My Blocks – Fly Right

Use the "fly right" block to move right the drone a 50 cm distance.

Step 6: My Blocks – Fly backward

Use the "fly backward" block to move forward the drone a 50 cm distance.

Step 7: My Blocks – Land

Use the "land" block to safely land the drone.



Guided Programming Exercise - Programming a Square

Flight Path and Safety part

Step 8: Safety part Events – When __ key pressed

Guide students to use the "When a key pressed" block to make the drone start operating based on the next step.

Step 9: Safety part My Blocks – Land

Use the "land" block to safely land the drone.



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



Recap with Q&A Session

- Summarize the key steps in programming the drone.
- Highlight the importance of each programming block used.
- Open the floor for any questions from students.
- Address any issues or concerns encountered during the exercise.



Additional Resources

Further Reading

<https://unece.org/un-decade-ecosystem-restoration>

Videos

[Environment \(ecosystem\) restoration](#)



Thank you for your
attention !



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