



## Lesson 9: Drone Programming 3 - Loops

### Key Concepts:

### Objectives:

- Students learn how to shrink their CircuitScribe Drone programs with the Loop block!



### Instructor Background: Grades 5 -12+

**Time:** 1 hour

### Supplies:

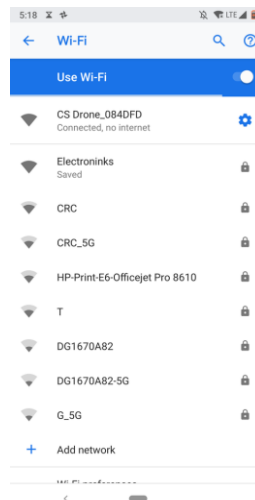
1. Circuit Scribe Drone Builder Kit or Drone Builder Classroom Kit
2. iOS or Android-enabled device.
3. CS Pilot App

## Instructions:

### Connect your Drone to your Phone

Power your Drone with the button on the bottom. Make sure the Drone's battery is fully charged.

Pull up your device's Wi-Fi settings. Connect to the "CS Drone" Wi-Fi network that your powered Drone is using. When your Wi-Fi app says you are connected, switch out of the settings and open the CS Pilot App.



### INSTRUCTOR TIP:

#### Try these steps if your Drone's Wi-Fi is not showing up:

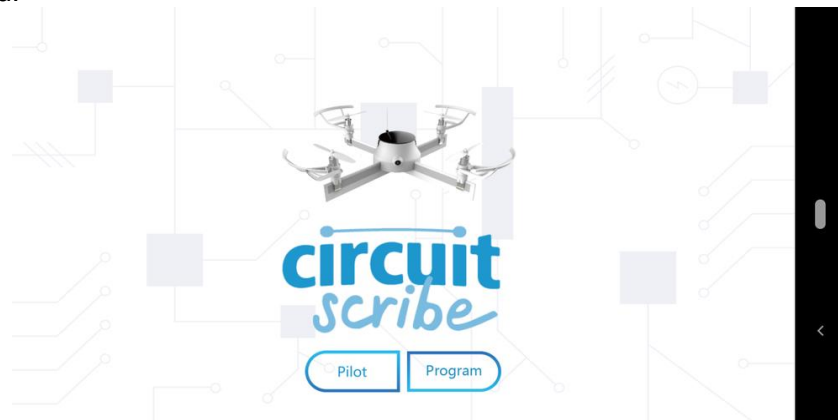
- Make sure your Drone's battery is fully charged and plugged in correctly (the charger will have a lit red LED when the Drone battery is charging. It will turn off when the battery is fully charged ~20m).
- Make sure the Drone is powered correctly (the red light will flash).



- Turn off auto-connect in your Wi-Fi preferences.
- Close the CS Pilot app.
- Turn Wi-Fi off and back on.  
If your Wi-Fi hasn't shown up, try power cycling the Drone (turn off, unplug the battery, wait 15 seconds, plug it back in and turn the battery back on).
- Open the CS Pilot app.

## Launch the Pilot App and select "Program Mode"

Once you are connected over Wi-Fi, launch the app and select "Program Mode", the red LED on the Drone should flash rapidly and then turn solid. Now your Drone is connected and ready to be programmed!



### INSTRUCTOR TIP:

If your Drone disconnects during programming (i.e. your Drone's LED is flashing red, but your Wi-Fi on your device says it is still connected), try switching to "Pilot" mode. Once the LED stops flashing red and turns solid, you are connected and can switch back to programming mode.

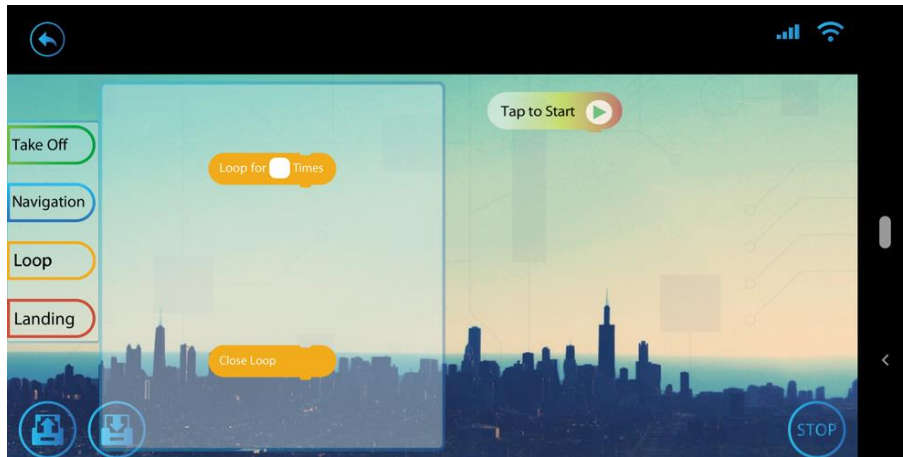
## Explore the Loop Menu

The loop menu has two coding blocks in it: the Loop block and the Loop Close block.

- The Loop block has an input field where you can write a number from 1 to 99, which specifies how many times the code inside the loop will run. The Close loop block specifies the end of the code that is run in the loop.

Using the blocks is easy: drop the Loop block into your program anywhere below the Take Off block and before the Land block and add the code blocks you would like to run multiple times afterwards. Finally, use the Close Loop block to specify that the code you want to loop over is done.

When the Drone runs your code, it will run the code inside the loop as many times as you specify in the Loop block input field! This makes long repetitive code easier to read and conserves valuable screen space!

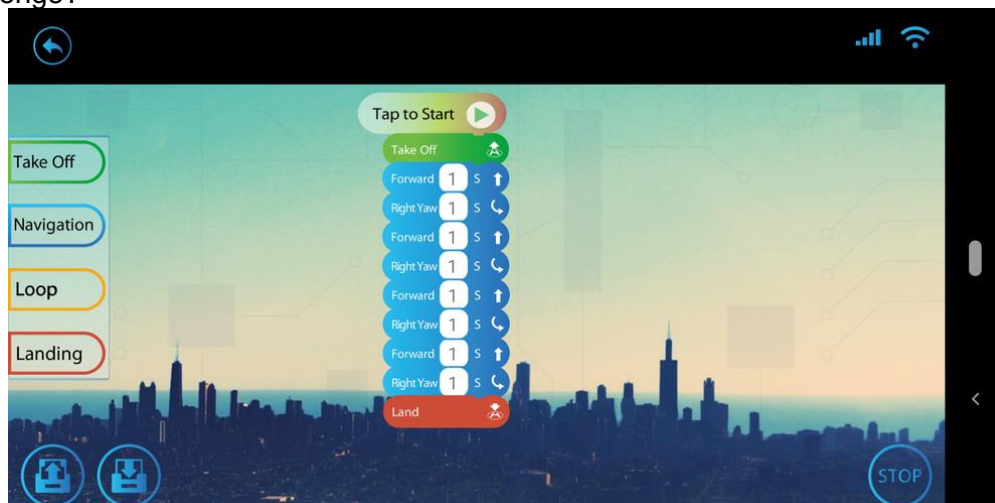


### Write your First Loop Program

Now that you understand loops and how to use them with your CS Drone, let's write our first loop program! In the program we would like to solve the box challenge put forth in the last lesson, but by using loops.

If you remember from the Box Challenge, you were to write a program to autonomously fly in a box pattern. There are many different ways to complete the challenge, in this step we are going to explore one such way. By using the power of loops, we are going to shrink a 10-block program into a 6-block program, which means less dragging and more blocks that can fit on your screen.

The program is fairly straight forward, the Drone takes off, flies forward for 1 second, turns right for 1 second (~90°) and repeats these steps four times before landing. The Drone flies around the perimeter of an invisible box in the same way that you would walk around the box, walking forward first, turning once you reached a corner and then repeating for all other sides of the box! Can you think of another program you could you write, using the loop blocks, to complete the box challenge?

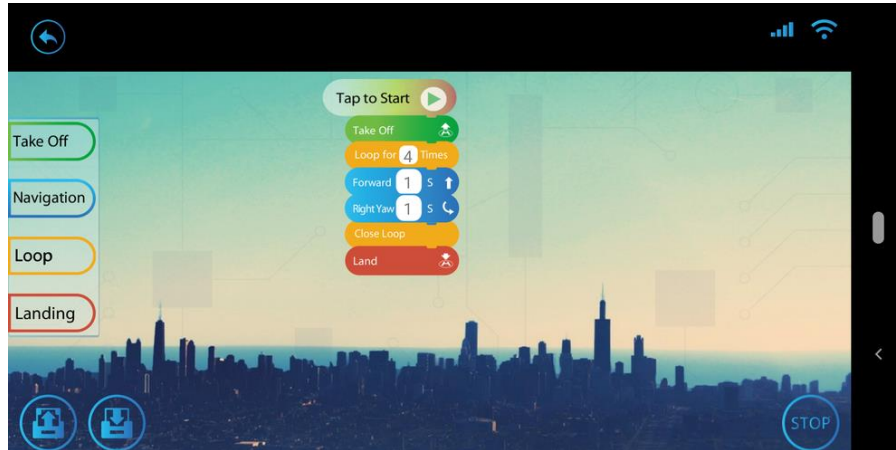


### Loop Challenge



Try to write the challenge programs below using the loop blocks to simplify them!

- BOX COUNTERCLOCKWISE - Move in a box formation counterclockwise using loops.
- ROCK AND ROLL- Back and forth 4 times and then a 360° spin.
- SURVEILLANCE - Complete the box challenge, but take a photo at every corner of the box.
- HOVER DRONE - Move back and forth with hover commands after each navigation command 5 times.
- MANUAL 1080 - Turn 3 full rotations without using the Turn command block.



### Class Discussion

Offer the cadets a question and answer session after the activities. Once all of the cadets' questions are answered, begin to review the discussions as a whole class.