Getting Started with Tello

Hello Tello

These mini-projects are designed to help you learn to operate the Tello flying drone using your TI-Nspire CX II with Python programming.

They assume you have a working knowledge of Python programming on the TI-Nspire CX II. While the hardware setup requires a micro:bit, expansion board, and wi-fi adapter, the Tello functions and methods do not require coding skills involving these intermediate devices.

Note: These activities are compatible with the Tello (White), Tello EDU (Black), and Tello TT (Not shown).

The TI-Nspire communicates with the Tello using:

- the Tello Python module
- mini-OTG USB to micro-USB cable
- a BBC micro:bit V2 with the TI runtime hex file
- a Grove BitMaker V2 expansion board
- a Grove Wi-Fi V2 module
- an external battery (either USB or micro:bit AAA battery pack)

The setup seen here involves connecting the hardware, installing the Tello Python module to your TI-Nspire CX II, installing the special TI-developed micro:bit .hex file, and then configuring the system (pairing the Tello drone with the micro:bit).

You can watch the YouTube videos for an overview of this process or read the setup instructions included in the download package. The necessary files (tello.tns and ti_runtime.hex) along with detailed step-by-step instructions are available here.

This first mini-project just gets the Tello drone off the ground…

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Tello needs to 'see' the ground and a colorful, patterned surface helps Tello maintain its position in the air. Tello has a camera on the bottom and a 'Vision Positioning System' to help it stay in one place while hovering. If the surface below Tello is a plain, solid color (that is, no pattern) then Tello switches to an 'Attitude Positioning System' which is not as reliable as its Vision System so be careful. The blinking LED on the front of Tello indicates which system is in use (green=Vision, red= Attitude). This is explained in more detail in the Tello User Manual.

Proceed to the next step to program your TI-Nspire to control Tello when your hardware and software are ready.

1. In a TI-Nspire document, start a new Python program (ours is called **first_tello.py**). **Import** the tello module using **[menu] > More Modules > Tello** and select

   from tello import *

   Note: if you do not see **Tello** *on the More Modules menu, review the installing module section in the video or Getting Started guide.*

2. Before proceeding, ensure you've completed the one-time activation and pairing of your Tello.

3. Make sure the Tello is turned on. Wait until the LED on the front of the Tello is rapidly blinking yellow. This indicates Tello is ready. Check your connections now by running the program. You should see

   Connecting to micro:bit...
   micro:bit is ready ✓
   Connecting to Tello 1...
   Tello 1 is connected✓
   >>>

   You may have assigned a different name to your Tello during pairing. The Tello used here is named '**Tello 1**'.

   If you experience a connection problem, reference the troubleshooting section in the Getting Started guide.

Note: the split-screen in the image is just to show both the code and the output of the program. Your Shell will appear on a page after the program page.

4. A good practice is to check the Tello battery charge at the beginning of your programs.
   Get the **battery( )** function from
   [menu] > More Modules > Tello > Flight Data

   And replace var with any variable name: **b** is a common choice, for 'battery'. When running, this function reports the battery charge level in a percent. If the charge is too low(<10%), Tello will not fly.
   Note: there's no need to **print(b).** *The* **battery()** *function, as well as most other Tello methods, displays information for you.*

5. If the connections are successful and there's enough battery charge, then prepare to fly!

   The **takeoff()** command causes the Tello to fly upwards about 70 - 80cm (about 27-32 inches). Be sure there is room above the Tello for this maneuver.
   Also, what goes up must come down. <u>We must have full control of the drone at all times</u>, so we must make the Tello **land()** as well.

6. In your program, add these two statements, both found on
   [menu] > More Modules > Tello > Fly

   tello.takeoff()
   tello.land()

7. Again, make sure all hardware is on, including Tello, and run the program. Your Shell screen will display the previous 'Connecting…' messages and then show messages for each command that is sent to the Tello. The Tello will go up, hover for a few seconds, and then land.
   Tello should land very close to its starting location. If it drifts a little bit that's OK, but if it wanders too far, then Tello is having trouble 'seeing' the ground. Be sure the surface has a colorful pattern and that the area is well-lit.
   Tello communicates with the micro:bit and the TI-Nspire to confirm that the tasks are properly **Completed** ✓.
   After Tello lands, the program is finished.

8. Congratulations on your first successful flight! The Wright Brothers would be proud of you!

   Let's try another maneuver…

* John T. Daniels, Public domain, via Wikimedia Commons

https://commons.wikimedia.org/wiki/File:First_flight2.jpg

9. The **Tello > Fly** menu contains lots of possible maneuvers. Two simple but elegant maneuvers are the **turn_right( )** and **turn_left( )** methods. These keep the Tello in one position and rotate it the given number of *degrees*.

   Try

   tello.turn_right(360)
   tello.turn_left(360)

   Insert these functions between the **takeoff()** and **land()** methods in your program and enter the number of degrees to turn as each argument.

   See the next step for the code…

10. Your program should look like the one shown here.

    Again, re-check your hardware, including Tello itself and then run the program. Tello turns itself off after a few minutes of inactivity to save the battery.

    Tello will take off, spin to the right a full turn, then spin to the left a full turn, and then land.

11. While the program is running, your TI-Nspire screen will report the progress of each maneuver.

12. Another pair of maneuvers to use are **tello.up( )** and **tello.down( )** which are also found on the **Tello > Fly** menu. The *distance* argument is measured in centimeters. Be sure that when flying upward, there is room above to make the maneuver. Tello does not have a camera or sensor on top so it may crash into the ceiling!

13. **Fail:** When using **tello.down( )**, Tello cannot go below about 30cm (12 inches) from the floor. Tello does have a sensor on the bottom to measure its height above the ground. In the screen to the right, after takeoff, Tello attempted to go down 100cm as the code requested, but only went down about 50cm, where it reached the 30cm limit. It hovered there for a while then reported "**Fail**" and landed the drone. The program's **land( )** function also failed because the drone had already landed.

There are other situations where an operation can 'Fail'.

14. Congratulations on your first Tello flying experience! In the subsequent mini-projects, you will experience more of the possible flight maneuvers and practical applications of drones using Tello.