

Learning Unit	
<b>Subject</b>	Programming
<b>Title</b>	Learning Python with Drones
<b>Authors</b>	Patrício Martins
<b>School</b>	FORAVE – ASSOCIAÇÃO PARA A EDUCAÇÃO TECNOLÓGICA DO VALE DO AVE
<b>Description of the unit</b>	The aim of this unit is to learn the basics of programming in Python using programmable drones.
<b>Contents</b>	Programming in Python: <ul style="list-style-type: none"> <li>- drone piloting</li> <li>- algorithm</li> <li>- using the Pycharm interpreter</li> <li>- sending UDP commands to a drone using the djitellopy library</li> <li>- using the OpenCV library for image acquisition and processing</li> </ul>
<b>Learning Outcomes / Skills</b>	Students should be able to: <ul style="list-style-type: none"> <li>- Develop knowledge of programming;</li> <li>- Develop autonomy in dealing with situations involving programming in their school career and in life in society;</li> <li>- Develop an interest in programming and appreciate its role in the development of other sciences and areas of human and social activity.</li> </ul>
<b>Target students/class</b>	Secondary School (15 – 17 years)
<b>Prerequisites</b>	Students should be able to: <ul style="list-style-type: none"> <li>● Make flowcharts in order to structure the resolution of a problem;</li> <li>● Create pseudocode in order to structure the resolution of a problem;</li> <li>● Use compilers/interpreters;</li> <li>● Identify commands in Python;</li> <li>● Know the Python commands needed to fly a drone;</li> <li>● Identify the libraries needed to send UDP commands.</li> </ul>
<b>Time expected</b>	4 hours
<b>Interdisciplinary links</b>	ICT
<b>Methodology</b>	Explanation of contents, solving exercises and problems, resolution of worksheets and pair work.



Learning Unit	
<b>Human Resources</b> <i>(internal and/or external)</i>	Technical Studies Teacher
<b>Resources</b>	<ul style="list-style-type: none"> <li>●Worksheet;</li> <li>●Drones Dji Tello;</li> <li>●Laptops.</li> </ul>
<b>Lesson Plan</b>	<p><b><u>1st Lesson:</u></b></p> <p><b>Sumário:</b> Algorithms. Flowcharts. Pseudocode.</p> <p>The teacher introduces the theoretical concepts related to flowcharts and pseudocode. After introducing the concepts and analysing the solved example, the teacher proposes solving, in pairs, exercise 1 of the worksheet. Clarification of doubts.</p> <p><b><u>2nd Lesson:</u></b></p> <p><b>Summary:</b> How does a drone work?.</p> <p>The teacher introduces the theoretical concepts related to drone piloting. The students will have to fly a drone for 10 minutes.</p> <p><b><u>3rd Lesson:</u></b></p> <p><b>Summary:</b> PyCharm interpreter DjiTellopy library</p> <p>The teacher explains the concepts needed to understand the PyCharm interpreter and the DjiTellopy library and carries out a short example exercise. After introducing the concepts, the teacher suggests solving exercises 2, 3 and 4 of the worksheet in pairs. Clarification of doubts.</p> <p><b><u>4th Lesson:</u></b></p> <p><b>Sumário:</b> OpenCV library.</p> <p>The teacher explains the concepts needed to understand the OpenCV library. After introducing the concepts, the teacher suggests solving exercise 5 of the worksheet in pairs. Correction of the exercise by a student.</p>

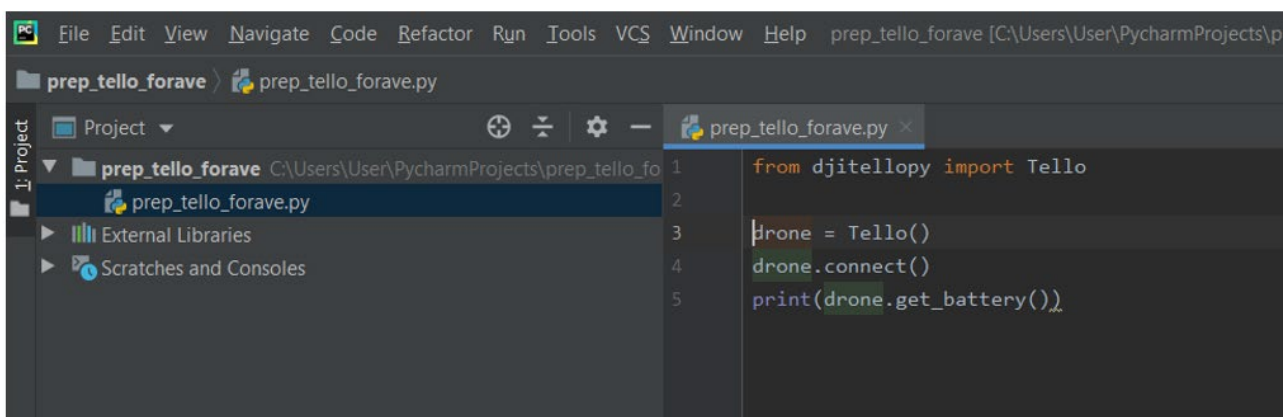


Learning Unit	
<b>Assessment</b>	<p><b>Formative assessment:</b></p> <ul style="list-style-type: none"> <li>- Attendance;</li> <li>- Punctuality;</li> <li>- Behaviour:</li> <li>- Attention and participation in class;</li> <li>- Observation of the student's performance in solving the proposed tasks;</li> <li>- Completion of worksheets (direct observation grids).</li> </ul>
<b>21st Century Skills</b>	<p>Critical thinking: students will be able to analyse data during practical experiments and communicate their conclusions.</p> <p>Collaboration: students will be able to collaborate within their groups and with other groups, helping each other to understand the content and experimental activities.</p> <p>Communication: students should be able to share conclusions and doubts with their classmates and teachers.</p> <p>Technological literacy: students will be able to use different technological tools to carry out tasks.</p>
<b>Remarks</b>	--



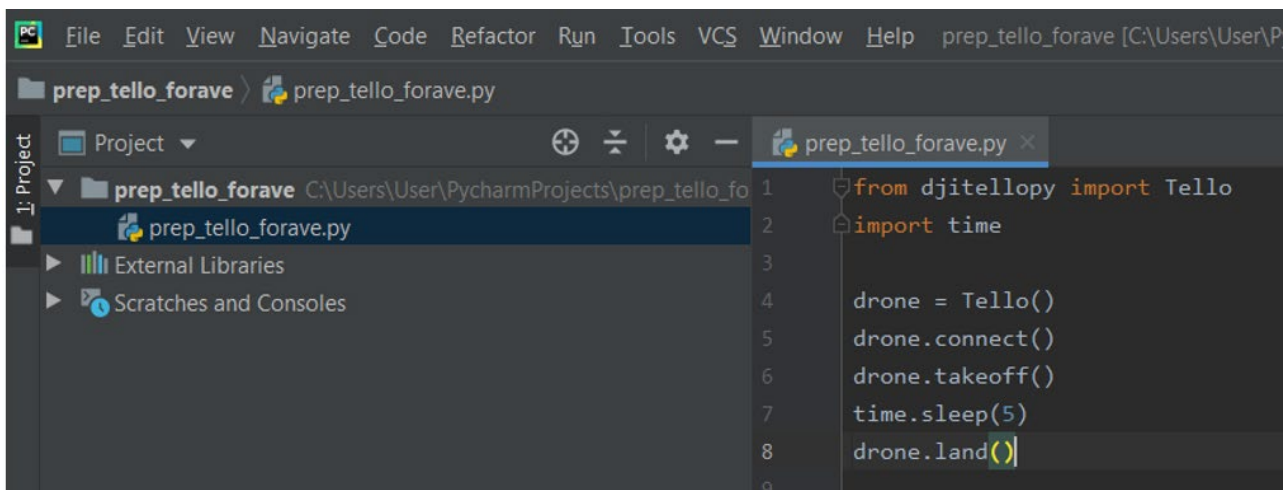
Learning Unit	Aprender Python com Drones
Authors	Patrício Martins
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Date	

## 1 - Create a Python script to acquire battery status via UDP commands:



```
1 from djitellopy import Tello
2
3 drone = Tello()
4 drone.connect()
5 print(drone.get_battery())
```

## 2 - Make a Python script so that the drone takes off and flies for 5 seconds:

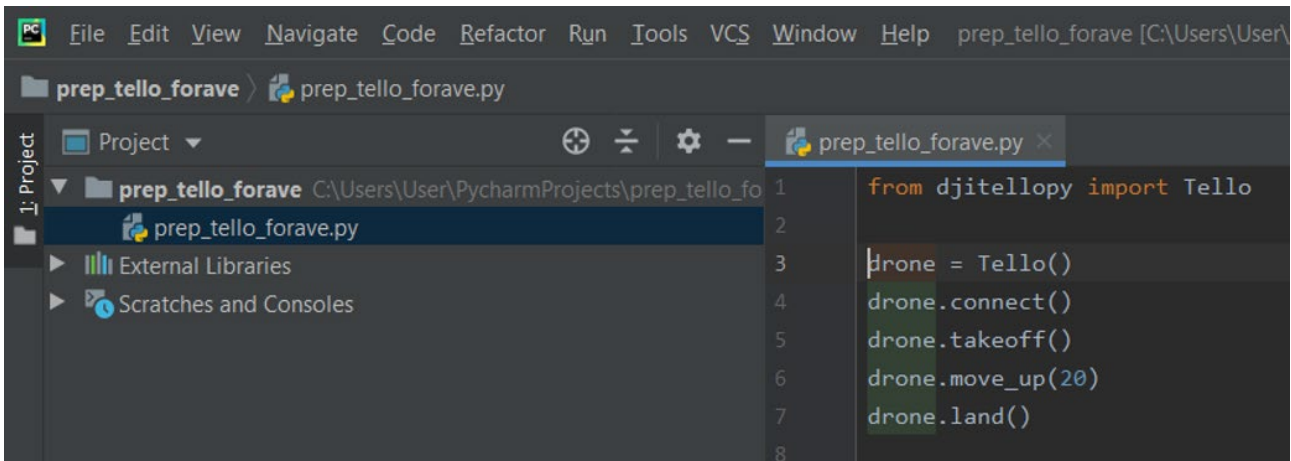


```
1 from djitellopy import Tello
2 import time
3
4 drone = Tello()
5 drone.connect()
6 drone.takeoff()
7 time.sleep(5)
8 drone.land()
```



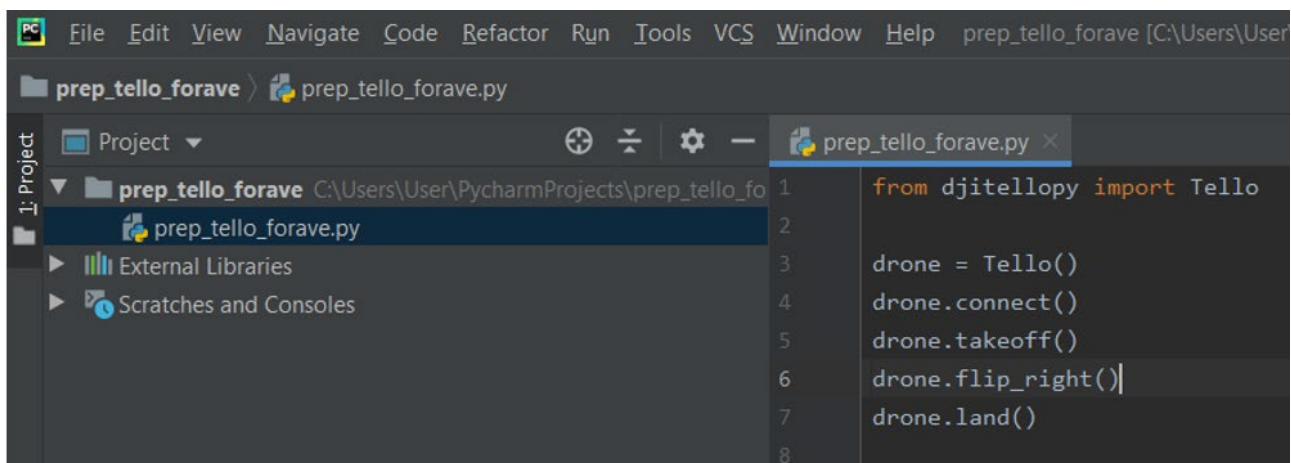
## Worksheet No. 1

3 - Make a Python script so that the drone takes off, then send a UDP command so that the drone rises another 20 cm and finally lands.



```
1 from djitellopy import Tello
2
3 drone = Tello()
4 drone.connect()
5 drone.takeoff()
6 drone.move_up(20)
7 drone.land()
8
```

4 - Make a Python script so that the drone takes off, does a flip to the right and finally lands.



```
1 from djitellopy import Tello
2
3 drone = Tello()
4 drone.connect()
5 drone.takeoff()
6 drone.flip_right()
7 drone.land()
8
```

5 - Create a Python script so that the drone takes off, makes a trajectory forming a 20 cm square and at each corner of the square makes a 'flip' to the right.

6- Create a Python script so that the drone takes off, takes a photo and lands.

