

# TelloAI V.0.1 - Indoor Autonomous Drone Competition

## Autonomous Robotics Course Ex2:

### Final Event: 3.7.2024, 16-20, 58.3 Ariel University

The Course of Autonomous Robotics (School of Computer Science Ariel University) invites students of the course to take part in an Edge AI computation of Indoor Autonomous Drones - using the 100-gram 100\$ Tello Drones. The TelloAIv0.1 challenge follows the same general motivation as [TelloAIv0.0](#) version did (late 2022)



#### Competition Roles (KIS):

A “circular lap” will be defined in a known University building. The goal is to perform a maximal number of laps in 180 seconds (3 minutes).

- The fight should be without any kind of “human in the loop”!
- The Lap will be well-marked using QRs and other known markers. The lap path will be about 50 meters in length and will include well-marked “gates”.
- The drone is expected to be controlled by a computer program using standard wifi APIs (in Python or ROS).

#### Work-flow & timeline

Background in Edge AI or drones is **NOT** required, all the qualified groups will receive a Tello Drone + Full software kit for controlling the drone from PC.

#### **Stage 0: Perform a group** (up to 5 students in a group)

Start with going over the related links (see below). Perform a team - and have your team leader list your team in this form:

[https://docs.google.com/forms/d/e/1FAIpQLSfLnAwjnqUVPZddir8anxEAnbszViiF2ktnUyO2-pqRSJrOgg/viewform?usp=sf\\_link](https://docs.google.com/forms/d/e/1FAIpQLSfLnAwjnqUVPZddir8anxEAnbszViiF2ktnUyO2-pqRSJrOgg/viewform?usp=sf_link) (deadline is June 11 2024 - but the number of places is limited)

#### **Stage 1: Detect QR on a video**

This is the main Image / Video processing challenge; given a video find all the QR's within it. More formally, on every frame of the video if there is 1 (or more QR) write down the following parameters:

- The QR's ID (number between 0 and 1023),
- The QR's 2D info - the 4 corner points (in frame coordinates).
- The QR's 3D info: the Distance to the camera, the yaw angle with respect to the camera “lookAt” point.

#### **Guidance:**

1. Here are the examples from Class 7 (9/6/2024): [1](#), [2](#), and here is a proper [video](#) (of a GoPro) of the same scenario.
2. Start with working on this [Qualification Challenge](#).

3. The Tello's camera has the following parameters: resolution 720p (1280\*720 30 fps), FoV 82.6, see: <https://www.ryzerobotics.com/tello/specs>, see this [link](#) for the calibration parameters.
4. Your code should run in realtime on your computer (aka processing each frame should NOT take more than 30 ms).
5. Output formats:
  - a. CSV: Frame ID, QR id, QR 2D: [QR leftup coordinate, QR rightup coordinate, QR rightdown coordinate, QR leftdown], QR 3D: dist, yaw, (pitch, roll - nice to have)],
  - b. Video: Mark each detected QR in a green rectangular frame with its ID.
6. Perform a test on the following video file [TelloAIv0.0\\_video](#).

### **State 2: the Competition - real drones will NOT be flying:**

**Due to time and resource limitations, this part was reduced significantly.**

The main goal is as follows: given a “target frame” (T), with one or more QRs, and given a live video (V) (from a camera drone or any camera). Direct the drone (the camera) to the T using the following 8 possible movements: up, down, left, right, forward, backward, turn-left, turn-right.

#### **Guidelines:**

1. Implement your assignment on your PC - and use its camera.
2. The movement commands should be presented on your PC - a single command for each frame.
3. Your solution will be tested in class during the last class (3/7), do come prepared.



Link to a video of a “waking tello” in the 2022 (TelloAIv0.0) competition lap:

<https://drive.google.com/file/d/12WWf1ITyXHhnpMvb0Skmvfr6E8NsvsU1/view?usp=sharing>

### **Related Links:**

- <https://www.youtube.com/watch?v=7UzPlpXn-g4>
- [https://www.youtube.com/watch?v=k4Q03\\_WrpwM](https://www.youtube.com/watch?v=k4Q03_WrpwM)
- [https://github.com/fvilmos/tello\\_object\\_tracking](https://github.com/fvilmos/tello_object_tracking)
- <https://dl-cdn.ryzerobotics.com/downloads/Tello/Tello%20SDK%202.0%20User%20Guide.pdf>
- [https://github.com/tariq86/tello\\_edu.py](https://github.com/tariq86/tello_edu.py)
- <https://www.youtube.com/watch?v=lqBRYkWSmjI>
- <https://github.com/waseemtannous/Autonomous-Drone-Scanning-and-Mapping>
- <https://www.aeroroboticscomp.com/fall2022>
- <https://drive.google.com/file/d/1OISwD1FwhF56rkepgpn0AXVeJHCScoyf/view>
- <https://www.arxiv-vanity.com/papers/2104.09815/>
- <https://github.com/AlonBarak-dev/Tello-Semi-Autonomous>
- YouTube series:  TelloAI - Autonomous Drone Competition - 1
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### **Rules & Guidelines:**

- In order to qualify for, the competition each group should perform a **full autonomous** lap (in less than 3 minutes)
- The group that will complete the **maximum number of autonomous flights wins**.
- Come with all needed equipment: **Bring your own computer** - there should be no problem with the wifi range.
- We will bring spare Batteries (and Tellos) - some Pizza & Beer will be served.

### **Q&A**

1. Can we add sensors to the drone?

A: Sure - yet keep in mind that this might be challenging, and most probably won't help you in this competition.

2. How big can our team be?

A: larger (or equal) than 1, smaller (or equal) than 5.

3. Can we test our drone on the actual "lap" to train it?

A: But of course! detailed information about the route is posted above!

4. In case we need a mentor (or some technical support) - who do we talk to:

A: Feel to send an email to Sahar @ [Sahar45456@gmail.com](mailto:Sahar45456@gmail.com) ( a formal winner of TeloAI0.0)

5. How is the competition (with the real drones) is actually being held?

A: see figure below, the Drone transmits video (and telemetry) to the PC which returns commands to the drone (no human control).



TelloAI 2022 (0.0) - the actual computation is performed on the laptop (which follows the drone)...