AprilTag instructions for Spectacular AI SDK (beta)

Getting started

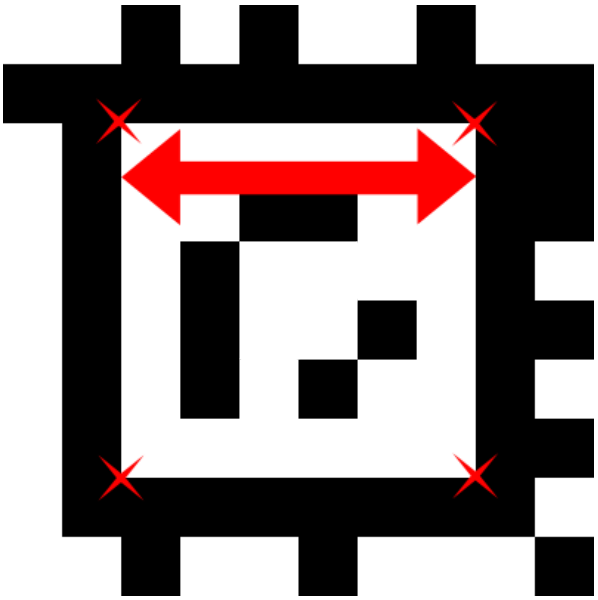
1. First download pre-generated AprilTag images from here: https://github.com/AprilRobotics/apriltag-imgs, the AprilRobotics developers recommend using tagStandard41h12 layout.

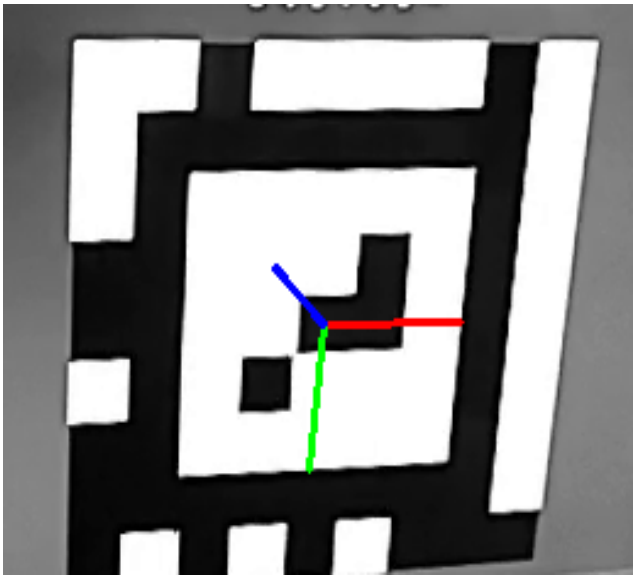
2. The downloaded images are very small, and they need to be rescaled, e.g. use
   `convert <small_marker>.png -scale <scale_chosen_in_percent>% <big_marker>.png`

3. It is recommended to print the tags, instead of showing them from a screen since they easily become blurry in the captured images.

4. Measure the tag size in meters. Note that the tag size is defined as the distance between corners: https://github.com/AprilRobotics/apriltag/wiki/AprilTag-User-Guide

5. The tag's coordinate frame is centered at the center of the tag, with **x-axis to the right, y-axis down, and z-axis into the tag**.





Using AprilTags with the Spectacular AI SDK

The Spectacular AI SDK supports one, or more tags, but in each case the pose of the april tags is assumed to be known in advance. AprilTag detection is enabled by setting the following internal parameters:

```
"useSlam": "true",
"useLandmarks": "true",
"aprilTagEnabled": "true",
"aprilTagFamily": "tagStandard41h12",  # Options: "tag36h11", "tag25h9", "tag16h5",
"tagCircle21h7", "tagCircle49h12", "tagStandard41h12" (default), "tagStandard52h13",
"tagCustom48h12"
"useMapPoints": "false" # Recommended for speed
```

1. Single AprilTag (for convenience)
   With a single tag, the tag is assumed to be at world origin with the tag's **y-axis pointing towards gravity direction** (i.e. negative z-axis in world coordinates). Otherwise, you should follow the instructions in 2. Multiple AprilTags. Now the user only needs to provide the following internal parameters:

   ```
   "aprilTagSize": "0", # Length of the april tag's size in meters (required!)
   "aprilTagId": "-1" # Id of the april tag to track. Value -1 (default) means
   that the first observed tag is tracked. For example, the tag image
   tag41_12_00001.png corresponds to id=1.
   ```

2. Multiple AprilTags
   With multiple tags, the tag information is given to the SDK using a .json file, and a single internal parameter pointing to this file.

   ```
   "aprilTagPath": "/path/to/tags.json" # Path to .json file with following format

   # tags.json example, the format is subject to change in future releases.
   [
      {
         "id": tag id,
         "size": length of the tag's sides in meters,
          // Tag pose in world coordinates (right handed, z-is-up),
          // i.e. the tag->world transformation.
         "pose": [x,y,z,qx,qy,qz,qw]
      },...
   ]
   ```

When using these parameters, the `VioOutput::status` is `TrackingStatus::INIT` until AprilTags are detected. After initialization is successful, the status is changed to `TrackingStatus::TRACKING`, and the output coordinates are transformed to match the AprilTag world coordinates.