INTER-IIT HIGH PREP

DRONA AVIATION

TASK 2 REPORT

PRIMARY ID: 17

SECONDARY ID: 34

DRONE TRACKING USING COMPUTER VISION

Aruco Detection: First the video is captured by the camera frame-wise and aruco marker is detected. A box is formed around the aruco marker upon detection in the initial frame. The corners of the aruco marker detected are initialized as the corners of the bounding box for CSRT to track.

Channel and Spatial Reliability Tracker (CSRT): CSRT tracker was used to track the motion of the drone accurately even when the drone moved with increased velocity. The input to the tracker was the output obtained through aruco detector. The bounding box is set as the base position, and it follows the drone as it moves with the aruco marker attached to it. CSRT tracker works by training a correlation filter with compressed features (HoG and Colornames). The filter is used to search the area around the last known position of the object in successive frames. The tracker stops tracking once the object goes out of the frame.

CONTROL

The control class implements PID control on roll, pitch and throttle values so that the drone can achieve the desired position. The positionhold() function is responsible for making the drone hold its position at any point in the 3D coordinates which is visible in the camera. The z coordinates come from the realsense camera pipeline and the x, y (pixel) values come from the camera frame and are transformed to the corresponding x, y values in the real-world coordinates using the z values.

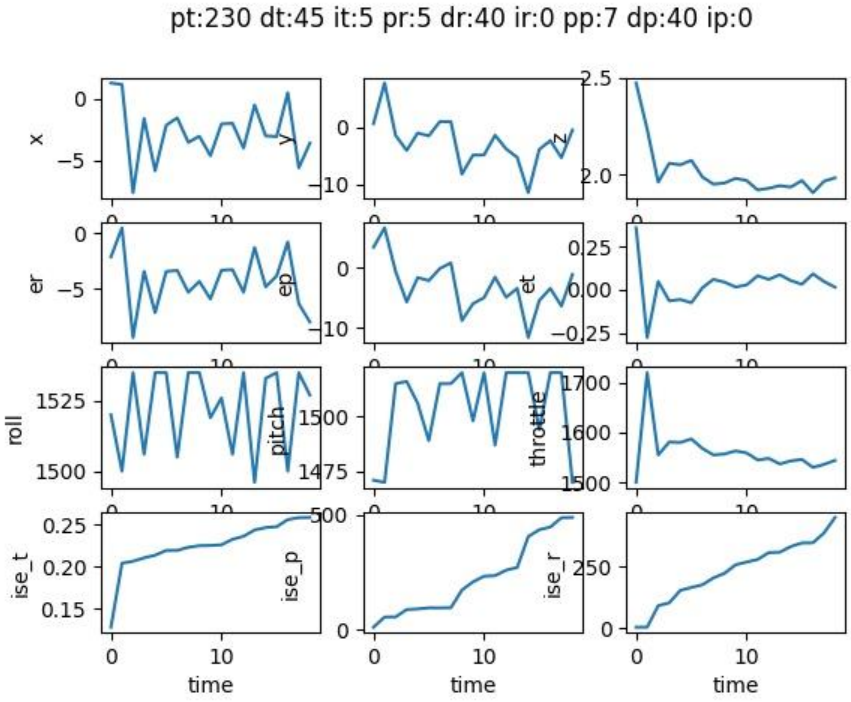
The error value is defined by the difference between the current position and the desired position. The ierror refers to the integrated error and the derror refers to the derivative error. The roll, pitch and throttle values are set by summing the reference values with the sum of the errors multiplied by their respective constants. In the case of throttle, the reference value varies as the drone battery drops to a particular value. Before setting the values, they are limited between two values so that there is less overshooting from the desired position.

In case of hovering the drone, a waypoint just above the initial position of the drone is passed to the positionhold() function and positionhold() function is repeatedly called.

In the plot shown, the left column shows x, roll error, roll and integral square error of roll respectively.

Similarly, the middle column shows y, pitch error, pitch and integral square error of pitch.

Finally, the last column shows z, throttle error, throttle and integral square error of throttle.



For making a rectangle, positionhold() is called on four points of the rectangle as waypoints, and the code is written such that the drone hovers for some time on all four points.

DISTRIBUTED MEMORY-CACHING

When the tracking and control was done serially, it was observed that there was a time lag due to extra computation time. To reduce this time lag, the detection and control scripts are run parallelly using distributed computing.

Memcached is a general-purpose distributed memory-caching system. The tracking script stores the values of control values (roll, pitch and throttle) into a memory cache, and the control script reads these values from the cache in real time.

Initially, memcache clients are initialised at a specific localhost port in each of the scripts. Then the values of control values are set in the tracking script using the set_multi() function. The control script reads these values using the get_multi() function.