Color tracking

1. Introduction

The Astra color tracking of the Yahboom mobile robot has the ability to recognize multiple colors at any time, and autonomously store the currently recognized color, control the car to follow the detected color, and maintain a certain distance from the object.

The color tracking of the Yahboom mobile robot can also realize the function of real-time HSV control. By adjusting the high and low thresholds of HSV, the interfering colors are filtered out, so that the squares can be recognized ideally in complex environments. Ideally, at this time, the car needs to be moved to a different environment for calibration, so that the color we need can be recognized in a complex environment.

- Introduction to HSV

  HSV(Hue, Saturation, Value) is a color space created by AR Smith in 1978 based on the intuitive characteristics of color, also known as the Hexcone Model.

  The parameters of the color in this model are: Hue(H), Saturation(S), Lightness(V).

  H: 0 --180

  S: 0 -- 255

  V: 0 -- 255

  Part of the red is classified as purple here:

	black	grey	white	red		orange	yellow	green	light blue	blue	Purple
H_min	0	0	0	0	156	11	26	35	78	100	125
H_max	180	180	180	10	180	25	34	77	99	124	155
S_min	0	0	0	43		43	43	43	43	43	43
S_max	255	43	30	255		255	255	255	255	255	255
V_min	0	46	221	46		46	46	46	46	46	46
V_max	46	220	255	255		255	255	255	255	255	255

- **HSV hexagonal pyramid**

  - **Hue H**

  Represents color information, that is, the position of the spectral color at which it is located. This parameter is represented by an angle, and the value range is 0° ~ 360°. It is calculated counterclockwise from red, red is 0°, green is 120°, and blue is 240°. Their complementary colors are: yellow at 60°, cyan at 180°, and purple at 300°.

  - **Saturation S**

  Saturation S is expressed as the ratio between the purity of the selected color and the maximum purity of that color. When S=0, there is only grayscale. 120 degrees apart. Complementary colors are 180 degrees apart. A color that can be seen as the result of a spectral color mixed with white. The greater the proportion of spectral colors, the higher the degree of color close to spectral colors, the higher the color saturation. The saturation is high, and the color is deep and vivid. The white light component of the spectral color is 0, and the saturation is the highest. Usually the value ranges from 0% to 100%, the larger the value, the more saturated the color.

  - **Brightness V**

Lightness indicates the brightness of the color. For light source color, the lightness value is related to the brightness of the illuminant; for object color, this value is related to the transmittance or reflectance of the object. Usually the value ranges from 0%(black) to 100% (white). One thing to note: there is no direct connection between it and light intensity.

The 3D representation of the HSV model evolves from an RGB cube. Imagine looking from the white vertices to the black vertices along the diagonal of the cube, and you can see the hexagonal shape of the cube. The hexagonal borders represent color, the horizontal axis represents purity, and lightness is measured along the vertical axis.
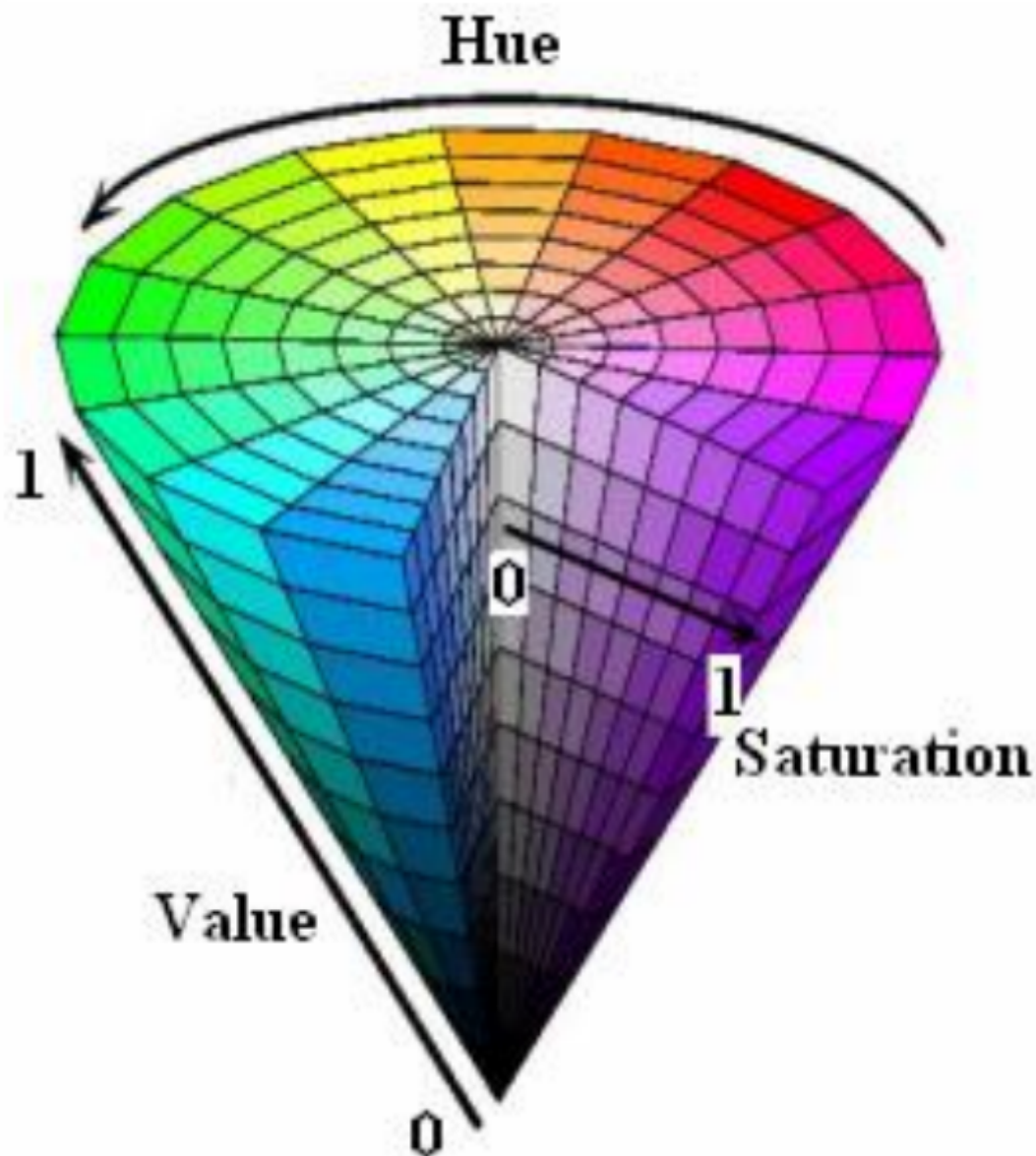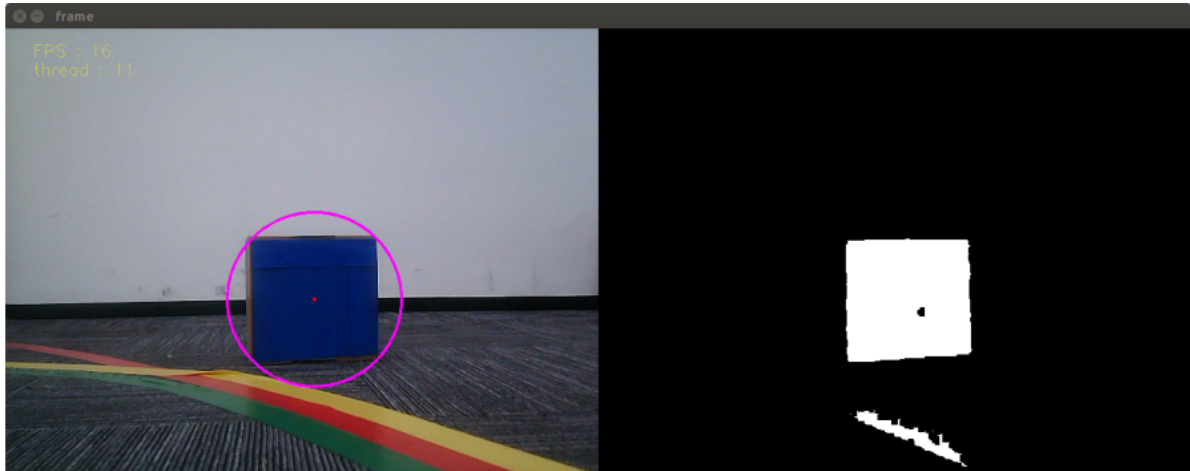

2. Start up

```
roslaunch astra_tracker AstraTracker.launch VideoSwitch:=false
tracker_type:=color
```

- Tracker_ Type parameter: Select the tracking algorithm ['BOOSTING ',' MIL ',' KCF ',' TLD ',' MEDIANFLOW ',' MOSSE ',' CSRT ',' color '], and click the [F] key on the keyboard after startup to switch.

After startup, the system defaults to [Target Detection Mode], as shown in the following figure:

【r】: Color selection mode, where you can use the mouse to select the area of the color you want to recognize (cannot exceed the area range)
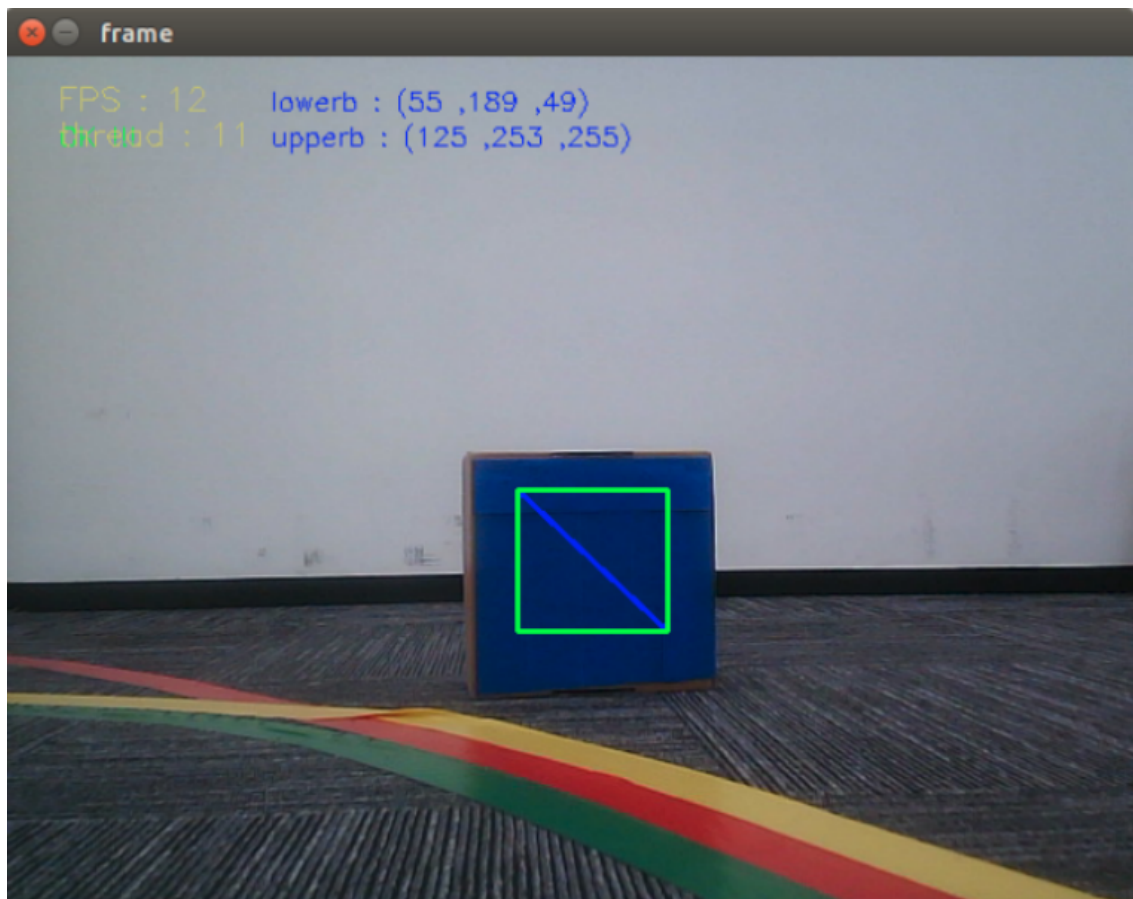
【i】: Target detection mode. Left--Color, Right--Binary

【f】: Switching algorithm: ['BOOSTING ',' MIL ',' KCF ',' TLD ',' MEDIANFLOW ',' MOSSE ',' CSRT ',' color ']

【q】: Exit program
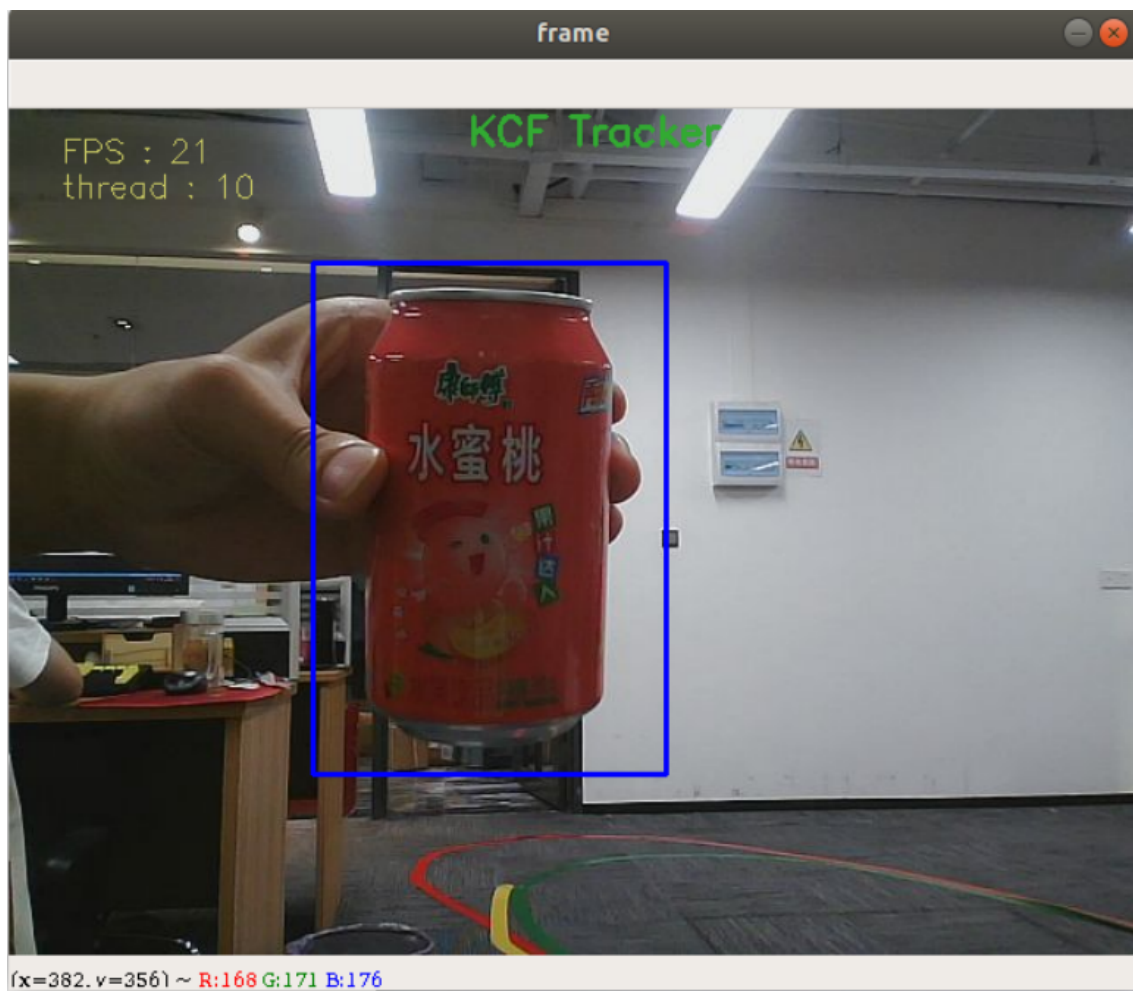
- Color recognition

  In the color selection mode, use the mouse to select the location of the colored object, as shown in the following figure.

  Release it to start recognition.
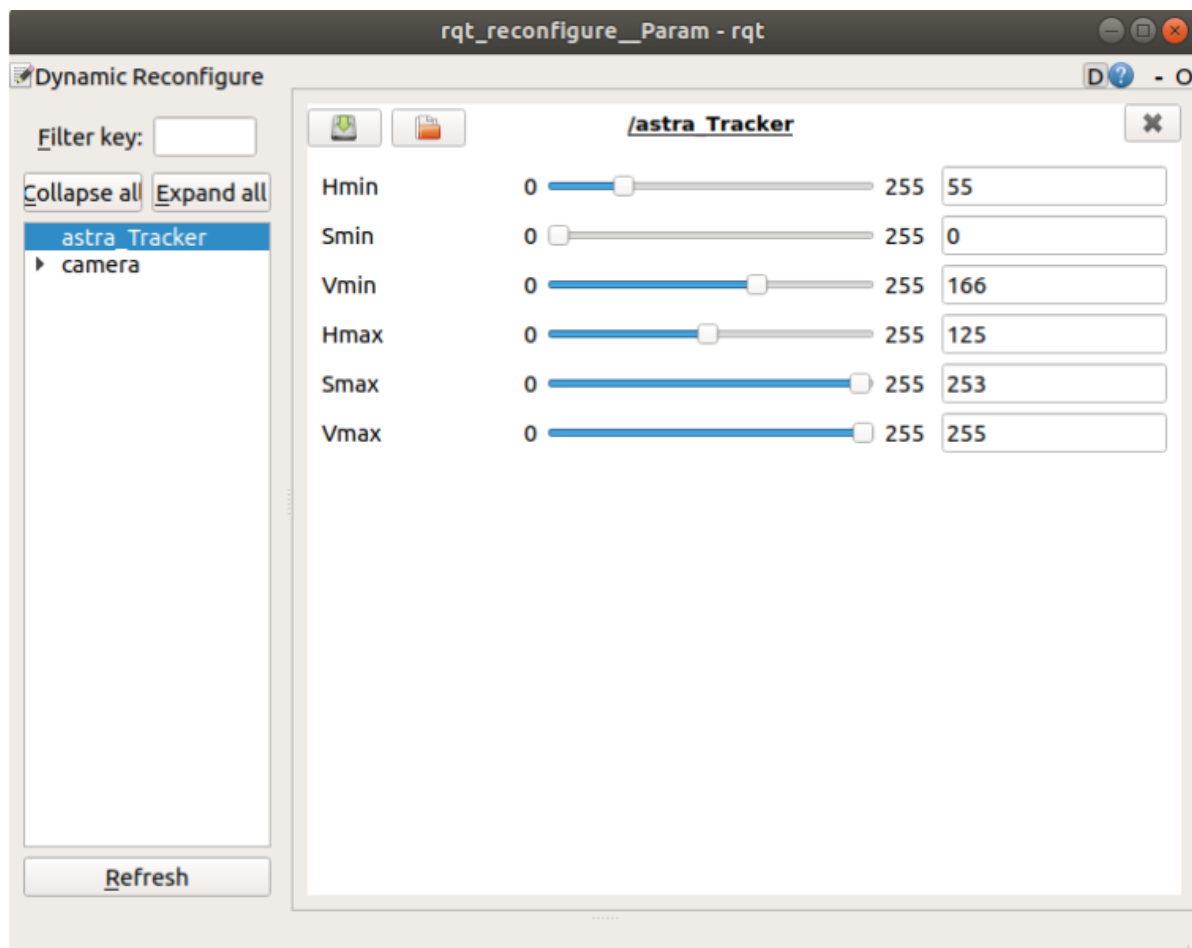
- Object tracking

  After startup, enter the selection mode, select the location of the object with the mouse, as shown in the following figure,

  Release it to start recognition.

3. Color calibration

Input following command to set dynamic parameters.

```
rosrun rqt_reconfigure rqt_reconfigure
```

When selecting the Astra_Tracker node, you usually only need to adjust [Hmin], [Smin], [Vmin], and [Hmax] to recognize these four parameters well.

The slider is always in a dragging state and will not transfer data to the system.

It can only be released; You can also select a row and slide the mouse wheel.