

1. Application examples of the Vision app

1.1 Pick and Place

The Vision App can be used for pick and place tasks. The vision app can be used to determine a gripping point for an object. This gripping point can then be approached with a movement command and the object can be picked up with a gripper, for example, and placed at a different location. With a conveyor belt with cyclic operation the objects can be moved to the robot's working area. The robot can pick the objects from the conveyor belt and place them in a blister, for example. In addition to cyclic operation of the conveyor belt, operation with a constant velocity is possible as well.

1.2 Localization for glueing applications

In addition to pick and place applications, the Vision App can also be used to localize objects for glueing applications. Assuming that objects are moved at a constant speed on a conveyor belt, the orientation and position can be determined using the Vision App. A glueing point or a glueing path can then be travelled depending on the determined position.

1.3 Sorting out on object

Objects can be sorted using the Vision app. It is conceivable that only the cream jars of a certain colour and shape could be picked from a conveyor belt with different cream jars.

1.4 Positioning and arrangement

Imagine there are objects on a conveyor belt and some of them are rotated for production reasons. The Vision App can be used to recognize the angle of the objects and then the robot can rotate the object accordingly so that all parts have the same angle.

The following describes the optical requirements that must be met for objects to be recognized with the Vision app.

2. Requirements for recognizing the objects

2.1 Gripping monochrome objects on a monochrome background

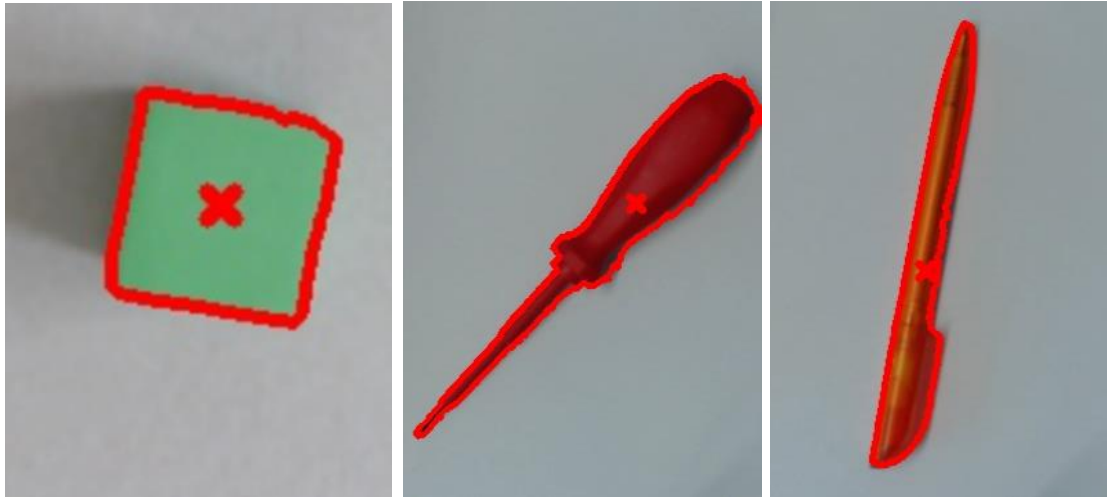


Figure 1: Examples of monochrome objects on a monochrome background

2.2 Gripping multicolored objects on a monochrome background

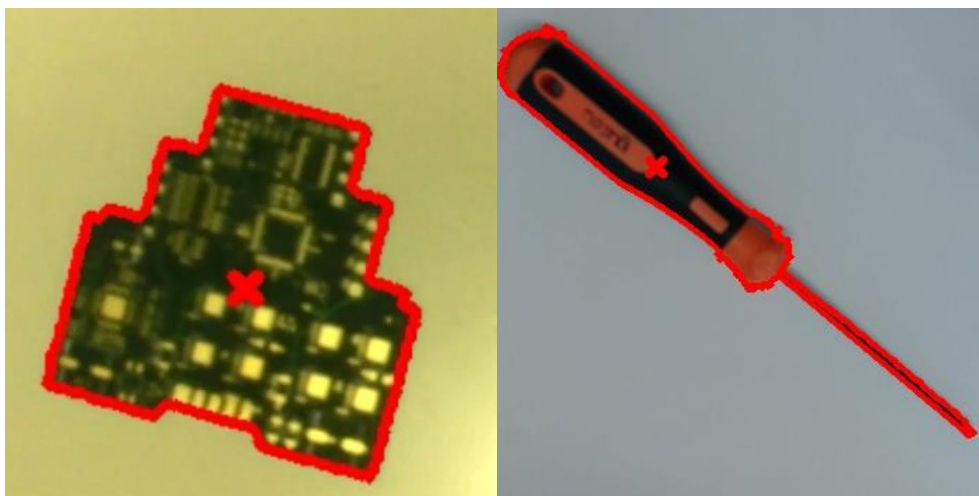


Figure 2: Examples of multicolored objects on a monochrome background

2.3 Gripping objects of a specific color or several specific colors with a monochrome background

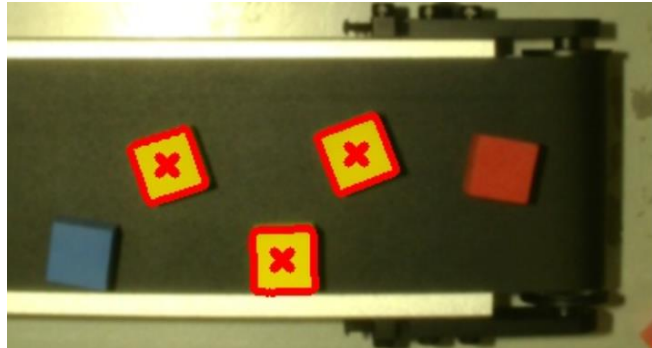


Figure 3: Setting that only the yellow cubes are identified

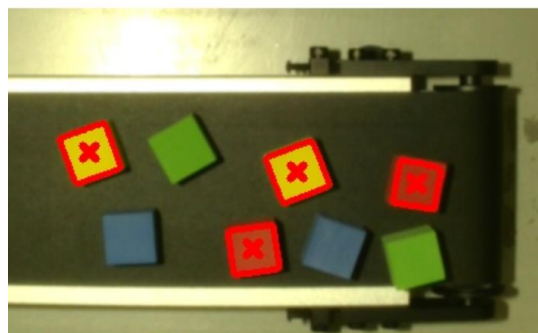


Figure 4: Setting that the yellow and red cubes are identified. However, it is not possible to identify any combination of colours, as adjacent colors can only be recognized in the HSV colour space (see chapter 2.2).

2.4 Selecting and gripping based on the sizes

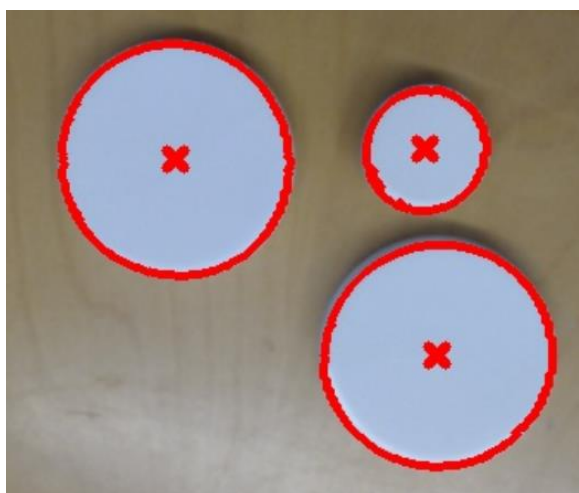


Figure 5: All objects regardless of size should be gripped

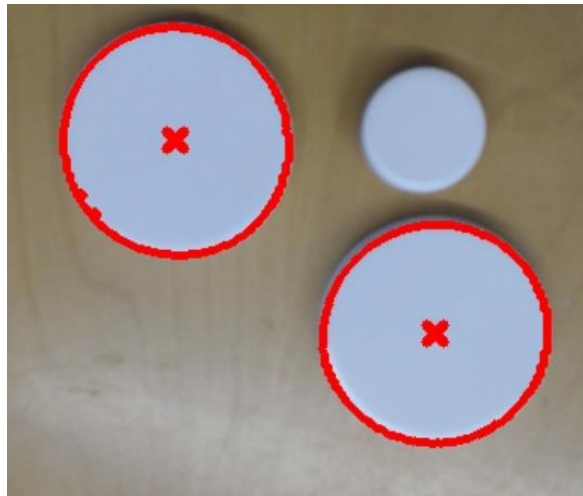


Figure 6: Only objects of a certain size should be gripped

2.5 Gripping based on the contour of the objects

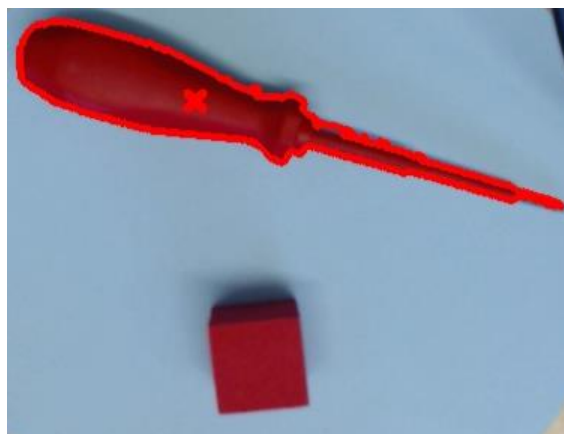


Figure 7: Only objects that correspond to the shape of the screwdriver should be gripped

2.6 Shifting the gripping point to off-center gripping

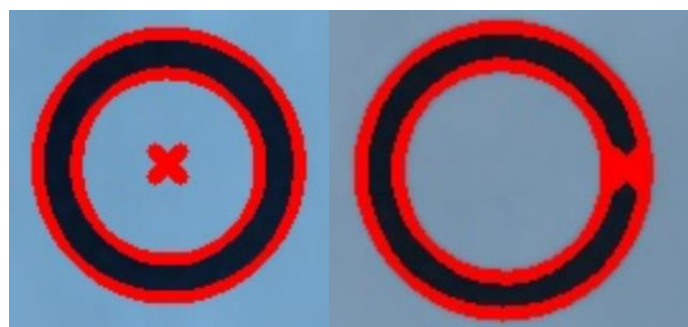


Figure 8: Left: Gripping point not possible without moving, as the object is hollow; right: Moving the gripping point to the edge of the object

2.7 Determining the rotational position of an object

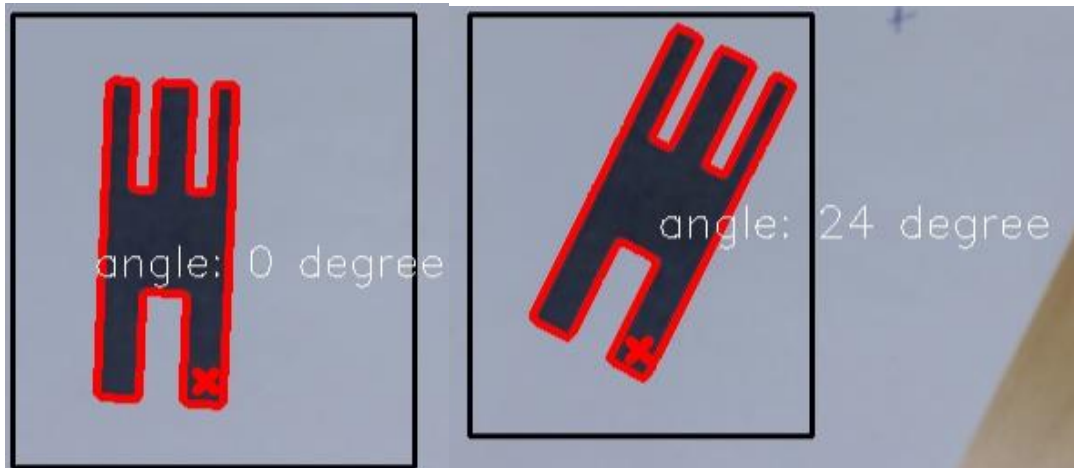


Figure 9: Consideration of the angle of rotation of an object and displacement of the gripping point taking the angle into account

3. Limits of the Vision App

3.1 Overlapping and touching objects

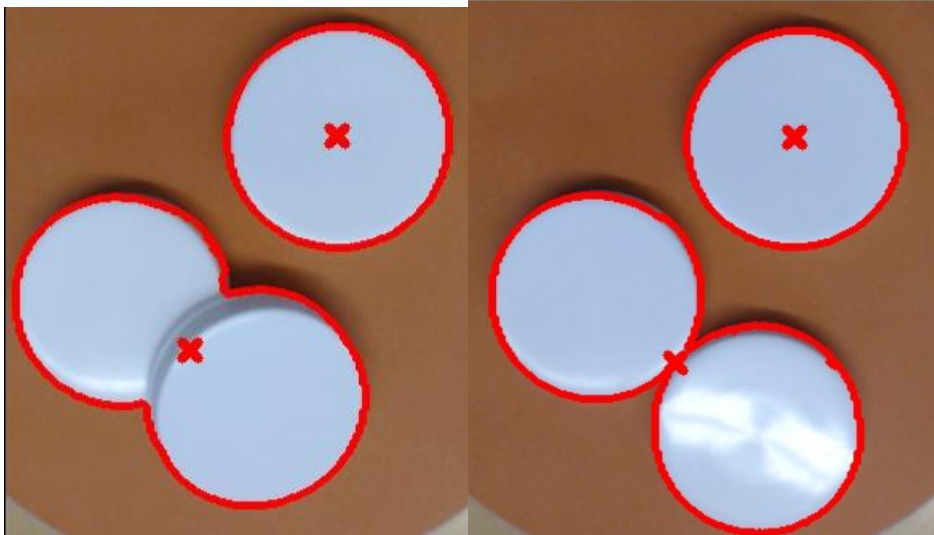


Figure 10: Overlapping or touching parts cannot be detected individually

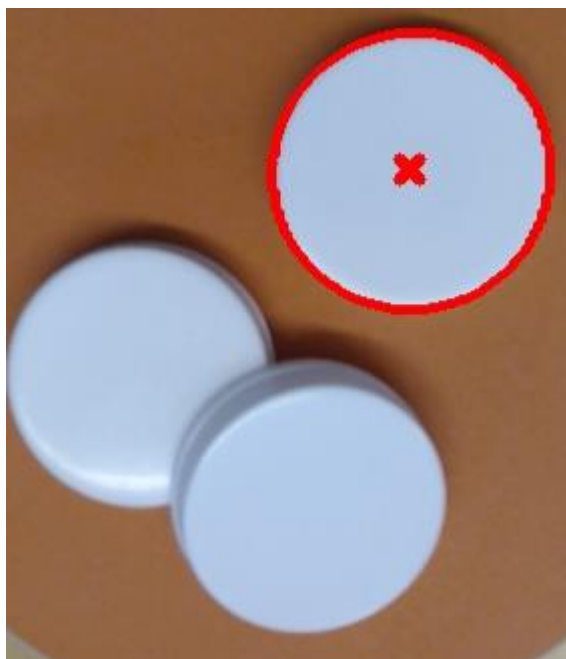


Figure 11: By filtering the shape or size it can be set so that only non-contacting or overlapping parts are detected

3.2 Recognition of different colors

It is not possible to classify between different objects. Nevertheless, objects of different colors can be picked.

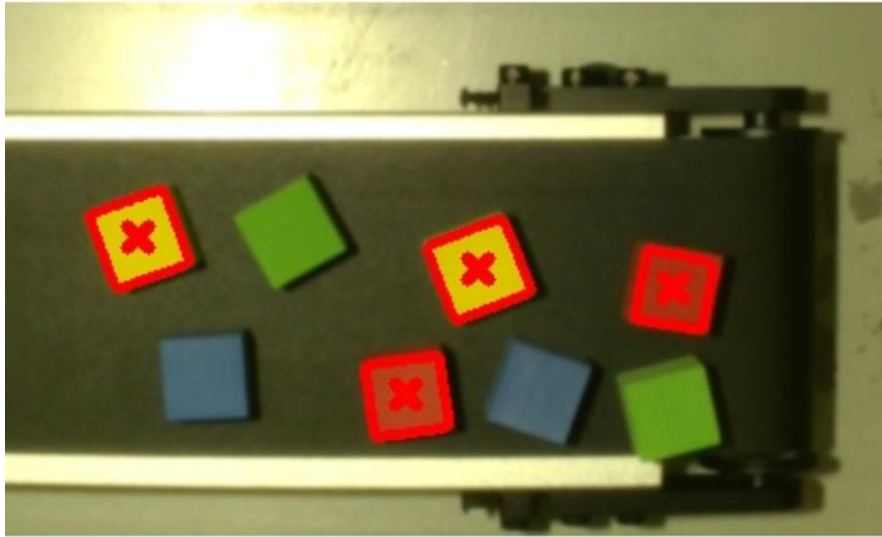


Figure 12: On the black background, the settings can be made so that either one of the colors, any combination of two, three or all four colors are recognized as an object.

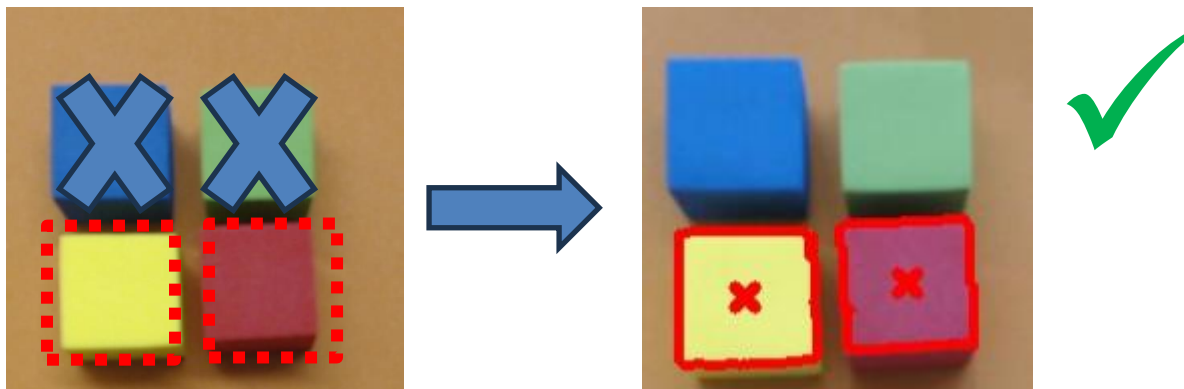


Figure 13 Not all colour combinations can be recognized on a coloured background in the colour range of the objects. The red and yellow cube can be detected together by selecting the orange background as the background color.

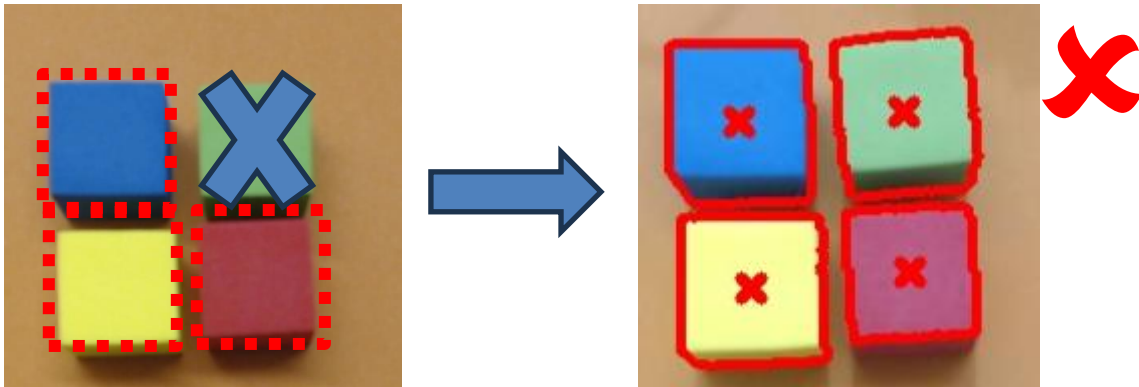


Figure f: The yellow, red and blue cubes cannot be recognized together. This is not possible because in the HSV color space the green cube lies between them in terms of color and the orange background is already selected as the background color, so that the green cannot be selected as the background and can therefore be ignored.

Multiple colours can only be detected if they are contiguous in the HSV colour space, as only colour ranges to be detected can be specified. A colour range can be selected as the background colour and ignored. The image shows the detection of yellow and red. These are next to each other in the HSV colour space, so recognition is possible. If the blue cube is also to be detected, the problem is that green lies between blue and yellow and is therefore also detected.

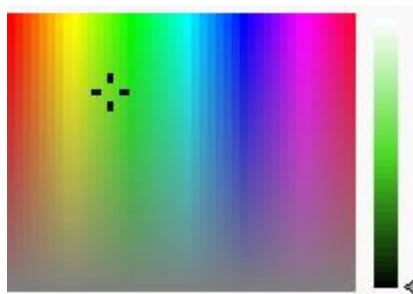


Figure 14: The image shows the color gradient in the HSV area. The color hue (H value) increases from left to right. The saturation (S value) increases from bottom to top. The brightness (V value) is shown in the adjacent bar for the selected green area. This also increases from bottom to top.

3.3 Sequence for multiple objects

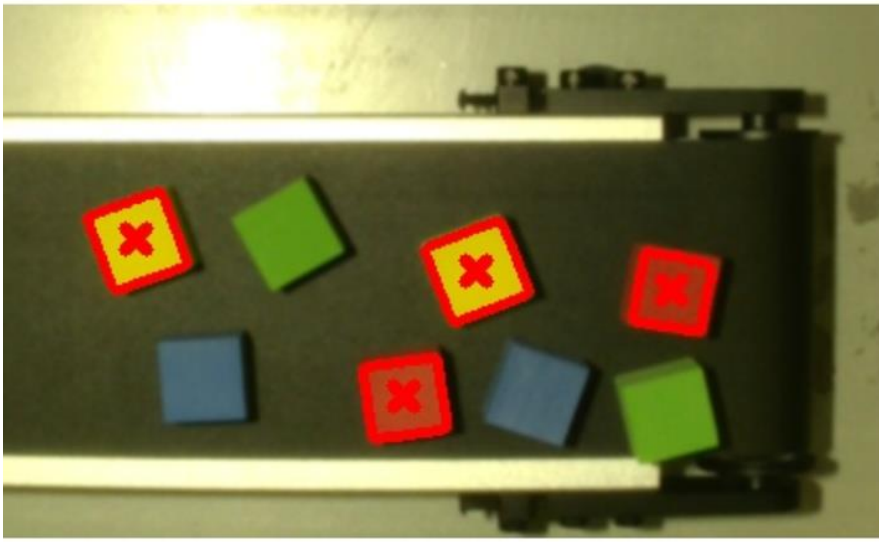


Figure 15: If more than one object is detected, the order of which object is processed first cannot be influenced.

3.4 Quality control of components, e.g. a circuit board

Quality control is not possible with the Vision App, as objects can only be selected based on color, shape and size. No classification can be made or minor differences on a component can be detected.

3.5 Recognition of 3D objects

The Vision App can only be used with 2D cameras in the 2D range.