8.4、 machine code recognition

8.4.1、 Experimental goal

This lesson mainly learns the machine code recognition function. According to the recognized machine code, it will be framed and the relevant data will be printed.

The reference code path for this experiment is：K210_Broad\05-AI\find_apriltags.py

8.4.2、 experiment procedure

The factory firmware of the module has integrated the AI vision algorithm module. If you have downloaded other firmware, please burn it back to the factory firmware and then conduct experiments.

1. Import related libraries, and initialize camera and LCD display.

```
import sensor, image, time, math, lcd

lcd.init()
sensor.reset()
sensor.set_pixformat(sensor.RGB565)
sensor.set_framesize(sensor.QQVGA)
sensor.skip_frames(time = 100)
sensor.set_auto_gain(False)
sensor.set_auto_whitebal(False)
clock = time.clock()
```

2. Set the machine code family members to be recognized, and comment out that line if you don't need to recognize which one. The default here is the TAG36H11 family.

```
tag_families = 0
tag_families |= image.TAG16H5   # comment out to disable this family
tag_families |= image.TAG25H7   # comment out to disable this family
tag_families |= image.TAG25H9   # comment out to disable this family
tag_families |= image.TAG36H10  # comment out to disable this family
tag_families |= image.TAG36H11  # comment out to disable this family (default
family)
tag_families |= image.ARTOOLKIT # comment out to disable this family
```

3. Create a new function to convert the family name to a string.

```python
def family_name(tag):
    if(tag.family() == image.TAG16H5):
        return "TAG16H5"
    if(tag.family() == image.TAG25H7):
        return "TAG25H7"
    if(tag.family() == image.TAG25H9):
        return "TAG25H9"
    if(tag.family() == image.TAG36H10):
        return "TAG36H10"
    if(tag.family() == image.TAG36H11):
        return "TAG36H11"
    if(tag.family() == image.ARTOOLKIT):
        return "ARTOOLKIT"
```

4.Create a new while loop, call the find_apriltags function to find the machine code in the image, and when it is found, it will be displayed and the relevant information will be printed.

```python
while(True):
    clock.tick()
    img = sensor.snapshot()
    #img = img.resize(280, 195)
    #img = img.resize(292, 210)
    for tag in img.find_apriltags(families=tag_families):
        img.draw_rectangle(tag.rect(), color = (255, 0, 0))
        img.draw_cross(tag.cx(), tag.cy(), color = (0, 255, 0))
        print_args = (family_name(tag), tag.id(), (180 * tag.rotation()) / math.pi)
        print("Tag Family %s, Tag ID %d, rotation %f (degrees)" % print_args)
    lcd.display(img)
    #print(clock.fps())
```

8.4.3、 Experimental effect

Connect the K210 development board to the computer through the TYPE-C data cable, click the connect button in CanMV IDE, and click the run button after the connection is completed to run the routine code. You can also download the code as main.py to the K210 development board to run.

After the system initialization is completed, the LCD will display the camera screen, and use the camera to capture the machine code. The recognized types include: TAG16H5, TAG25H7, TAG25H9, TAG36H10, TAG36H11, ARTOOLKIT. Due to the limited processing capability of the K210, a large amount of storage space and computing power are required to process the AprilTag machine code, so it is currently impossible to set a full-screen resolution size screen.

You can see that the machine code is framed, and the serial terminal at the bottom of the IDE prints out the machine code information.

```
串行终端    ⤴ 🖫
Tag Family TAG36H11, Tag ID 16, rotation 1.271711 (degrees)
Tag Family TAG36H11, Tag ID 17, rotation 1.350201 (degrees)
Tag Family TAG36H11, Tag ID 16, rotation 1.330411 (degrees)
Tag Family TAG36H11, Tag ID 17, rotation 1.422991 (degrees)
Tag Family TAG36H11, Tag ID 16, rotation 1.085476 (degrees)
Tag Family TAG36H11, Tag ID 17, rotation 1.621595 (degrees)
Tag Family TAG36H11, Tag ID 16, rotation 1.380341 (degrees)
Tag Family TAG36H11, Tag ID 17, rotation 1.286299 (degrees)
Tag Family TAG25H9, Tag ID 4, rotation 271.907377 (degrees)
Tag Family TAG36H11, Tag ID 16, rotation 1.340031 (degrees)
Tag Family TAG36H11, Tag ID 17, rotation 1.733174 (degrees)
<
搜索结果   串行终端
```

8.4.4、 Experiment summary

Since machine code recognition requires a lot of calculations, the K210 itself has limited conditions, so the screen cannot be set to full screen.

If you need to display a larger screen, you can set sensor.set_framesize(sensor.QVGA), and then after capturing the camera image, add img = img.resize(292, 210) to modify the image size. But this will reduce the video frame rate and recognition rate, please operate with caution.
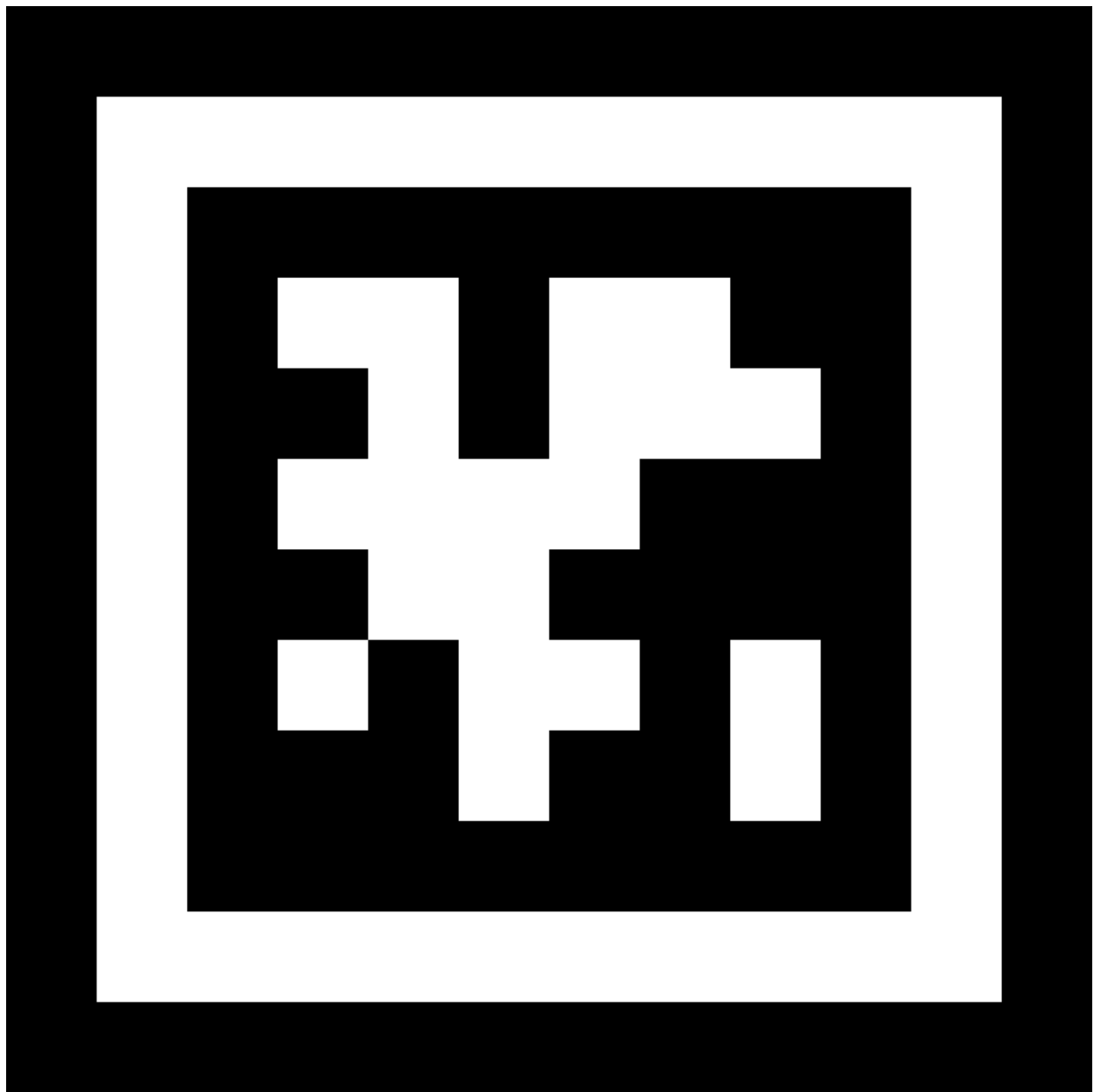
The machine code test uses the TAG36H11 family machine code by default. If you need to apply for other machine codes, you can click Tools->Machine Vision->AprilTag Machine Code Generator on the CanMV IDE.
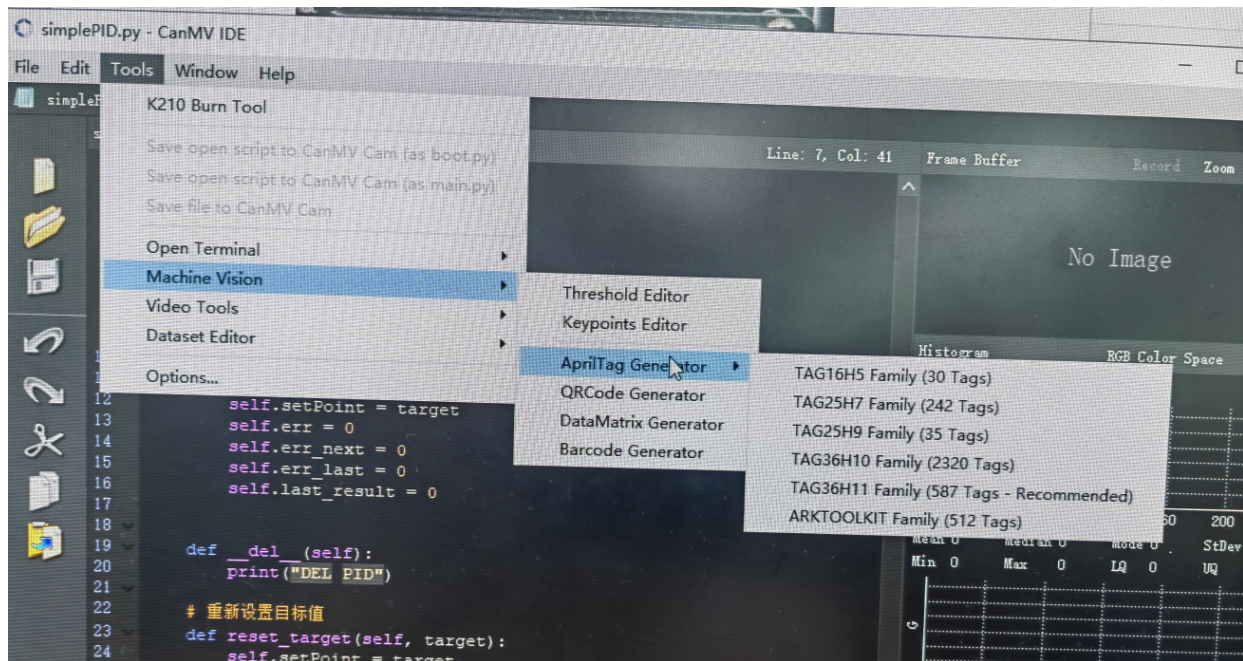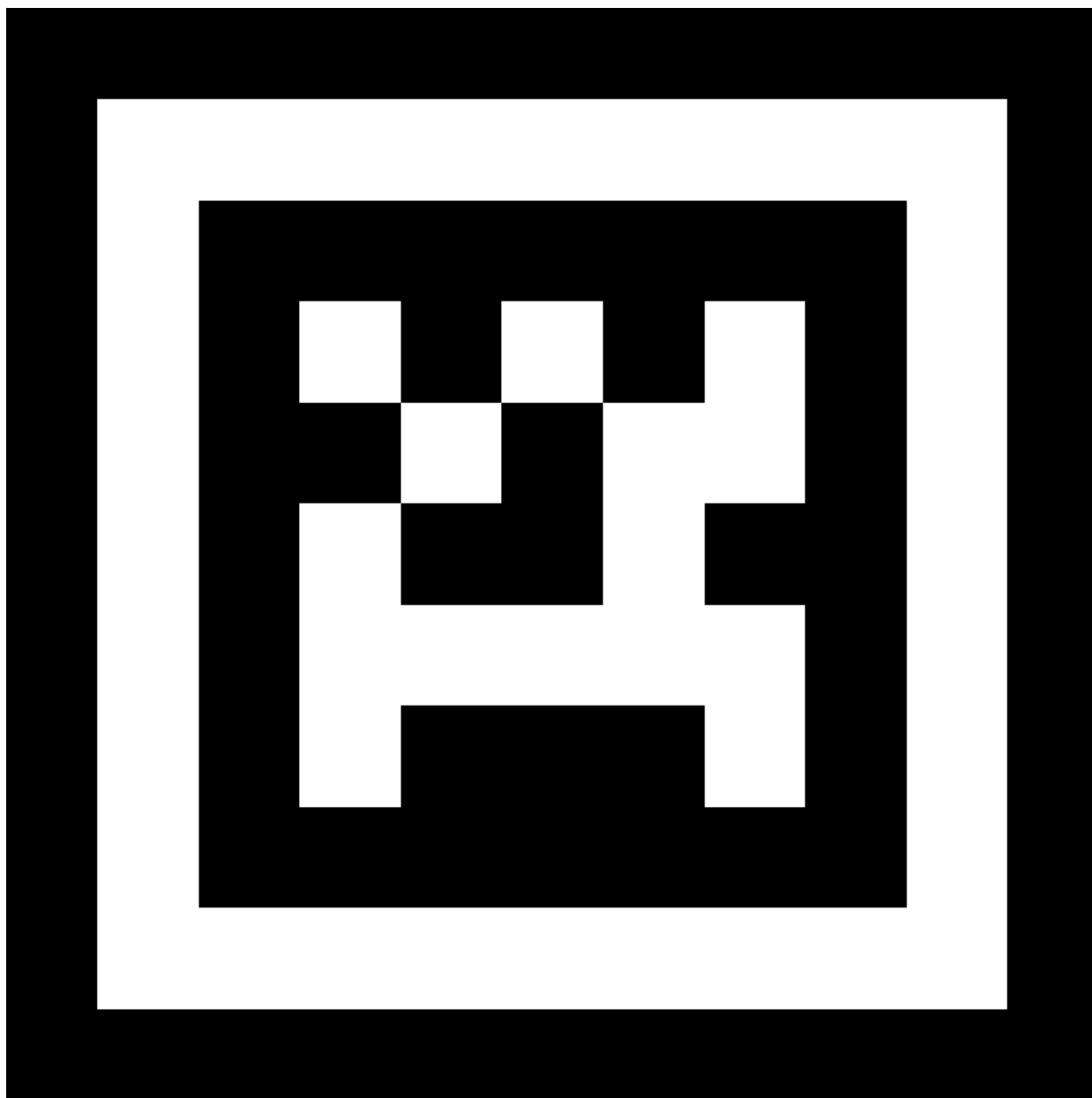

Attachment 1: Machine code of TAG36H11
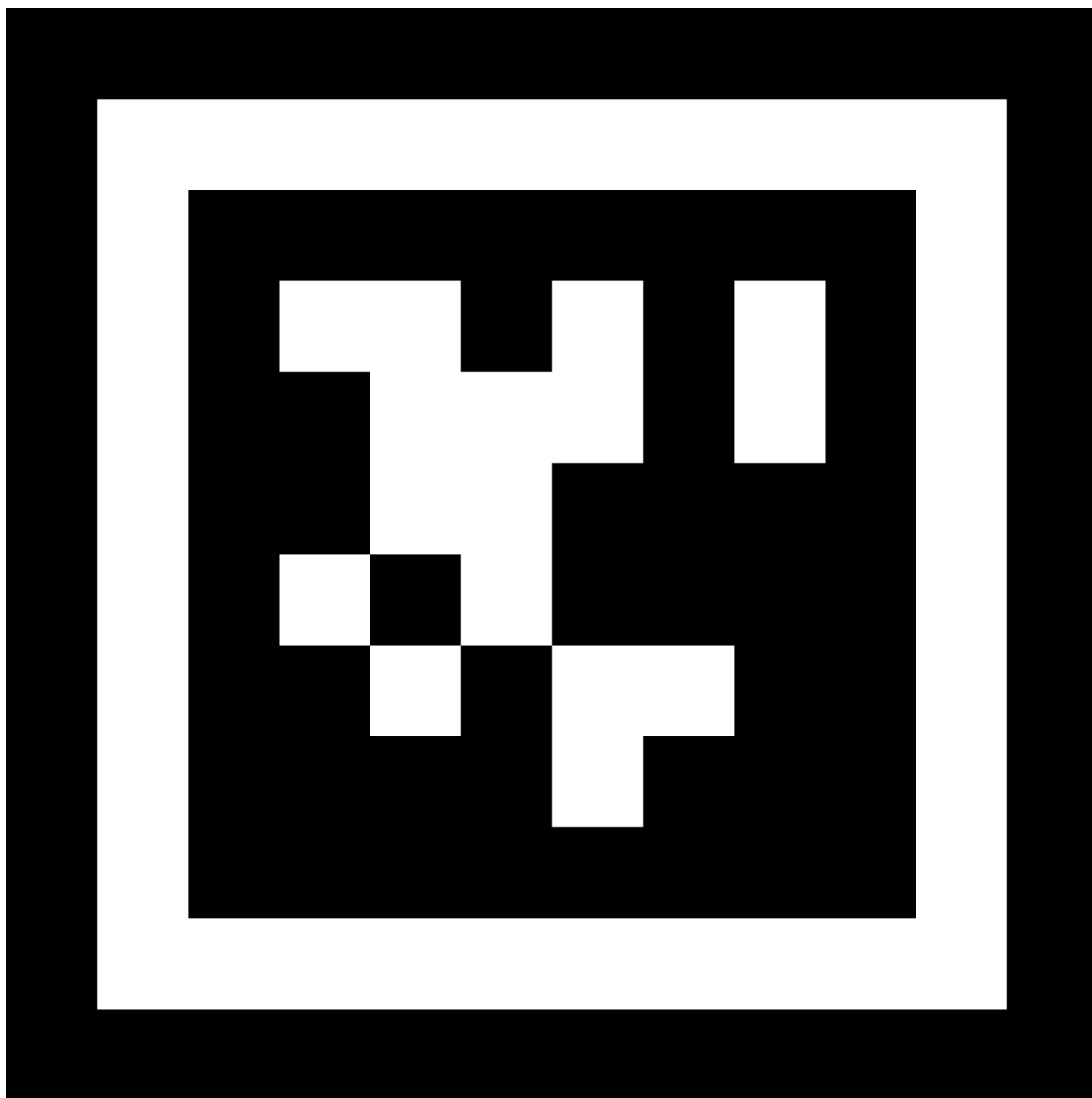
TAG36H11 - 0

TAG36H11 - 1

Attachment 2: Machine code of TAG25H9

TAG25H9 - 0