Experiment 1: Warehousing Goods

- Scene Description

When goods warehousing, porter carry goods to a particular point according to the category that may cause the wrong positioning of the goods, damage to the packaging, and long carrying time. To avoid those problems, this experiment created an AI goods warehousing system to ensure that goods are placed accurately, the packaging is intact and the warehouse is quickly.

二、Experiment Principle

The AI goods warehousing system adopts OCR recognition technology to realize automatic warehousing goods by robotic arm. First, the robot uses visual sensors to obtain the data of the goods box, then uses OCR recognition technology to identify the goods name, and finally uses the Magician Lite to carry the goods box to a particular point on the shelf.

OCR (optical character recognition) refers to the process in which electronic devices (such as scanners or digital cameras) check characters printed on paper and then use character recognition to translate shapes into computer text; Then the image file is analyzed and processed to obtain text and layout information.

三、Experiment Equipment

Equipment Image	Name	Number

- OFFICE AND ADDRESS OF THE PARTY OF THE PAR	Dobot Magician Lite	1
	Suction cup	1
	Camera	1
	Power Adapter	1
	Tape-C Cable	1
	Goods Boxes	4
A 就製廠金 B Bank Lib.	Maps	1
2	She1ves	1

四、Experiment Steps

1. Scene Create

(1) Please put Magician Lite, shelves, goods cards on the map as shown below.



Figure 1.1 The map of warehousing goods system $\,$

(2) Prepare the experimental equipment and place the equipment, the physical picture is shown in Figure 1.2.



Figure 1.2 The physical map of warehousing goods system

2. Program Design

Step 1: Read the flow diagram of warehousing goods, as shown in Figure 1.3.

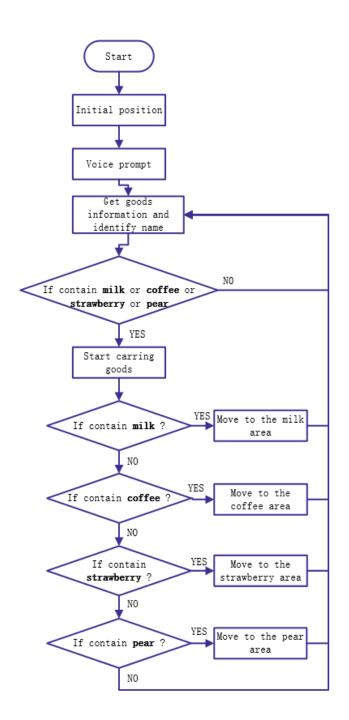


Figure 1.3 The flow diagram of warehousing goods system

Step 2: Add device and connect it. As shown in Figure 1.4

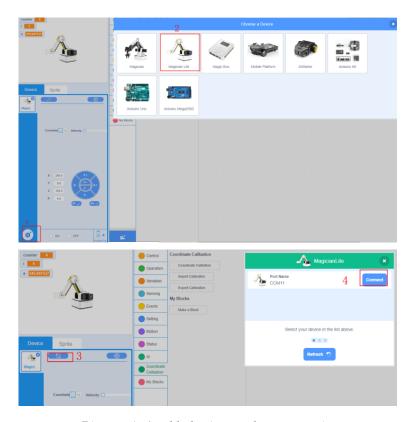


Figure 1.4 add device and connect it

Step 3: Add AI extension module, as shown in Figure 1.5.

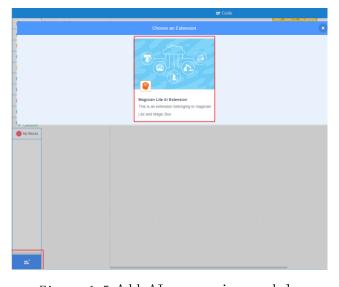


Figure 1.5 Add AI expansion module

Step 4: Initial settings.

1) Create a list called "goods", as shown in Figure 1.6.

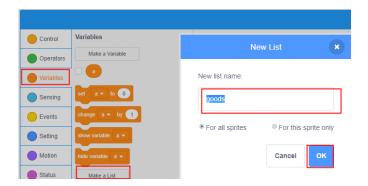


Figure 1.6 create a list

2) Set the starting method, set the end tool of the robot arm to the suction cup, set the lifting height in jump mode and the goods list, as shown in Figure 1.7.

```
when clicked

delete all of goods 

Select End Effector Suction Cup 

Set Jump Height 80 mm zLimit 120 mm

Jump To X 240 Y 0 Z 120 R 0
```

Figure 1.7 Basic settings

3): Voice prompt. The robot first introduces itself, and then voice prompts, as shown in Figure 1.8

```
when clicked

delete all of goods 

Select End Effector Suction Cup

Set Jump Height 80 mm zLimit 120 mm

Jump To X 240 Y 0 Z 120 R 0

speech broadcasting Hi, I am an intelligent warehouse manager

wait 5 seconds
```

Figure 1.8 Speech prompt

4) Add goods such as milk, coffee, strawberry, pear to the goods list, as shown in Figure 1.9.

```
when clicked

delete all of goods 
Select End Effector Suction Cup 
Set Jump Height 80 mm zLimit 120 mm
Jump To X 240 Y 0 Z 120 R 0

speech broadcasting (Hi, I am an intelligent warehouse manager)

wait 5 seconds

add milk to goods 
add coffee to goods 
add strawberry to goods 
add pear to goods
```

Figure 1.9 Add goods to the list

Step 5: Obtain goods information. The robot moves above the goods recognition area, then automatically takes photos to obtain goods data and recognize name, as shown in Figure 1.10.

```
when sicked

delete all of goods 

A Select End Effector Suction Cup 

Set Jump Height 80 mm zLimit 120 mm

Jump To X 240 Y 0 Z 120 R 0

speech broadcasting Hi, I am an intelligent warehouse manager

wait 5 seconds

add milk to goods 

add strawberry to goods 

add strawberry to goods 

Jump To X 47.3 Y 257.3 Z 9.9 R 79.6

speech broadcasting please put your goods under the camera

wait 3 seconds

Timeout 3 s to take picture
```

Figure 1.10 Get the text on the goods card
Step 6: Determine whether the identified goods
name is a goods in the product list, and if it
is, then perform the operation related to the
goods warehouse, as shown in Figure 1.11.

```
when clicked delete all of goods clicked delete all of goods clicked.

Select End Effector Suction Cup clicked.

Set Jump Height 80 mm zLimit 120 mm clicked.

Jump To X 240 Y 0 Z 120 R 0 speech broadcasting Hi, I am an intelligent warehouse manager wait 5 seconds add milk to goods clicked.

add colfee to goods clicked.

Jump To X 473 Y 2573 Z 99 R 796 speech broadcasting please put your goods under the camera wait 3 seconds.

Timeout 3 sto take picture.
```

Figure 1.9 Judging OCR recognition result

Step 7: If the goods list contains the text in the OCR recognition picture, voice play "Robot is moving the goods" first, and then grab the goods box, as shown in Figure 1.12.

```
when 📜 clicked
delete all of goods ▼
Select End Effector Suction Cup ▼
A Set Jump Height 80 mm zLimit 120 mm
✓ Jump To X 240 Y 0 Z 120 R 0
speech broadcasting Hi, I am an intelligent warehouse manager
   5 seconds
add milk to goods ▼
add coffee to goods ▼
add strawberry to goods ▼
add pear to goods ▼
✓ Jump To X 47.3 Y 257.3 Z -9.9 R 79.6
   ech broadcasting please put your goods under the camera
   3 seconds
Timeout 3 s to take picture
      goods ▼ contains OCR recognize picture Picture words ? them
 speech broadcasting the robot is carring goods
  wait 1 seconds

Jump To X 53.7 Y 313.7 Z 242 R 80.2
 wait 0.2 seconds

^ Suction Cup ON ▼
 wait 0.2 seconds
```

Figure 1.12 Identify and grab goods cards

Step 8: Determine whether the text in the OCR recognition picture contains "milk". If so, move the robot above the position of the milk, place the grabbed milk box in the position of the milk, and then voice prompt "Please place the product in the identification area"; otherwise, determine whether it is other goods, as shown in Figure 1.13.

```
when 📁 clicked
Select End Effector Suction Cup ▼
A Set Jump Height 80 mm zLimit 120 mm
→ Jump To X 240 Y 0 Z 120 R 0
speech broadcasting Hi, I am an intelligent warehouse manager
wait 5 seconds
add milk to goods ▼
add coffee to goods ▼
add strawberry to goods ▼
add pear to goods ▼
✓ Jump To X 47.3 Y 257.3 Z -9.9 R 79.6
speech broadcasting please put your goods under the camera
vait 3 seconds
   eout 3 s to take picture
 speech broadcasting (the robot is carring goods)
 ✓ Jump To X 53.7 Y 313.7 Z -24.2 R 80.2
  wait 0.2 seconds
 Suction Cup ON ▼
 wait 0.2 seconds
     Does string OCR recognize picture Picture words contain milk
   Jump To X 204.0 Y 270.2 Z 47.5 R 53.0
 Suction Cup OFF ▼
```

Figure 1.13 The recognized goods is milk

Step 9: If the text in the OCR recognition picture does not contain "milk", it is judged whether other goods are recognized. If so, the

goods are placed in the corresponding position, as shown in Figure 1.14.

```
when 📜 clicked
    Set Jump Height 80 mm zLimit 120 n
    Jump To X 240 Y 0 Z 120
       np To X 53.7 Y 313.7 Z -24.2 R 80.2
   Jump To X 250.1 Y 226.1 Z 47.5 R 42.1
   Jump To X 122.7 Y 233.8 Z -15 R 62.3
   Jump To X 221.9 Y 143.3 Z -15 R 32.9
```

Figure 1.14 recognized other goods

Step 10: There is usually more than one goods that needs to be stored in the warehouse, and different products need to be identified repeatedly; until the program stops running, the goods storage operation is stopped, as shown in Figure 1.15.

```
when 💌 clicked
delete all of goods ▼

Select End Effector Suction Cup ▼
A Set Jump Height 80 mm zLimit 120 mm
✓ Jump To X 240 Y 0 Z 120 R 0
   och broadcasting Hi, I am an intelligent warehouse manager
vait 5 seconds
add milk to goods ▼
add coffee to goods ▼
add strawberry to goods ▼
add pear to goods ▼
 1 Jump To X 47.3 Y 257.3 Z −9.9 R 79.6
     sch broadcasting please put your goods under the camera
          roadcasting the robot is carring goods
   wait 0.2 seconds

Suction Cup ON 

    rait 0.2 seconds
    Does string OCR recognize picture Picture words contain milk the
      Does string OCR recognize picture Picture words contain coffee the Jump To X (250.1) Y (226.1) Z (47.5) R (42.1)
      - Jump To X 122.7 Y 233.8 Z -15 R 62.3
         Does string OCR recognize picture Picture words contain pear the
     Jump To X 221.9 Y 143.3 Z -15 R 32.9
   Suction Cup OFF ▼
```

Figure 1.15 The completed program of warehousing goods system