Experiment 3: Smart Shopping Assistant

- Scene Description

With the development of artificial intelligence, more and more positions may be replaced by artificial intelligence, such as supermarket salesman. Compared with traditional salesman, smart shopping assistant can significantly reduce labor costs, complete sales more efficiently, and settle accounts more accurately. In this experiment, a smart shopping assistant system was built to simulate the process of voice order, intelligent settlement and face payment.

二、Experiment Principle

This experiment used speech recognition and face recognition. Customers can control the robot to grab the corresponding goods through voice commands to complete the order, and then the smart shopping assistant system will automatically calculate the bill according to the goods grabbed by the robot, and finally the customer completes the payment through face recognition.

Speech recognition, also known as automatic speech recognition, has the goal of converting vocabulary content in human speech into computer content, such as text information, binary

encoding, or character sequences. The process of speech recognition is as follows:

- 1. Collect speech data;
- 2. Extract speech features;
- 3. Identify initials and finals;
- 4. Identify vocabulary or a single word
- 5. Output a sentence;

Face recognition is a kind of biometrics recognition technology based on human facial feature. A series of related technologies that use cameras to collect images or video streams containing human faces, and automatically detect and track human faces in the images, and then perform face recognition on the detected faces, usually also called portrait recognition and facial recognition. Face recognition needs to complete the following process:

- 1. Collect face data;
- 2. Create a face model;
- 3. Train the face model;
- 4. Test the face model;
- 5. Apply the face model;

一、Experiment Equipment

Equipment Image	Name	Numbe r
	Dobot Magicia n Lite	1

	Gripper	1
	Camera	1
	Power adapter	1
	Tape-C cable	1
milk	Goods models	4
② AI智慧性語 Af Burt Ut	Map	1
	Shelves	1

二、Experiment Steps

1. Scene Create

(1) According to the map of the smart shopping system, place the experimental equipment, as shown in Figure 3.1.



Figure 3.1 The map of smart shopping assistant system $\,$

(2) Physical map of smart shopping assistant system is shown in figure 3.2.



Figure 3.2 The physical map of smart shopping assistant system

2. Program Design

Step 1: Read the flow diagram of smart shopping assistant system, as shown in Figure 3.3.

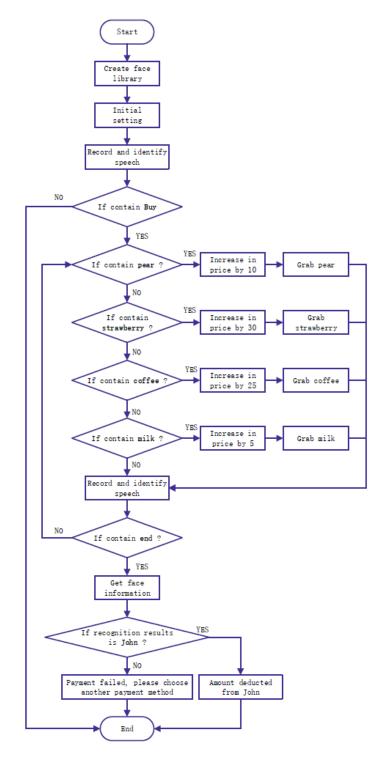


Figure 3.3 The flow diagram of smart shopping assistant system

Step 2: Create face set

1) Connect Magician Lite, add AI expansion module, select the AI, tab and click the New Face

Data, as shown in Figure 3.4.

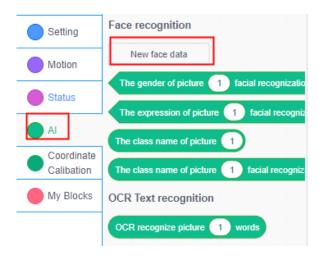


Figure 3.4 create face data

2) Create a face set label. Face photos can use face pictures or actual faces, as shown in Figure 3.5.

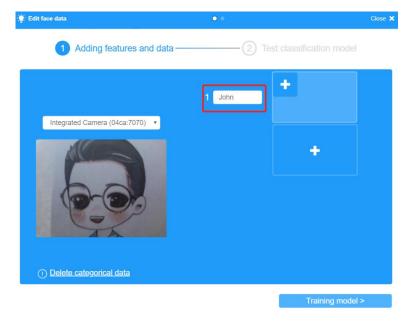


Figure 3.5 create face label

3) Collect face data. Put the face at the camera, click the + in the data set frame to add image data, as shown in Figure 3.6.

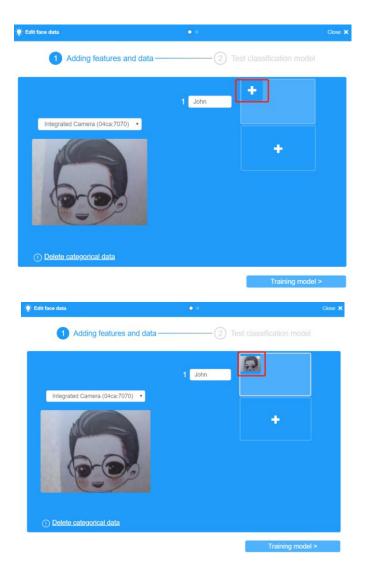


Figure 3.6 Collect face data

Step 3: Train and test face model

1) Train face model as shown in figure 3.7.

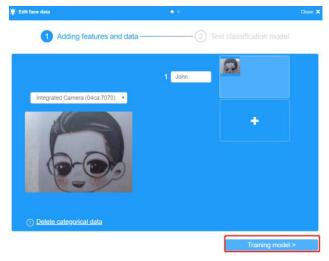


Figure 3.7 Train face model

2) Test face model. Place the face of John in front of the camera and click **Test**. If the probability value after the test is greater than 90%, click **Finish**, otherwise return to the previous step and collect the face data, as shown in Figure 3.8.

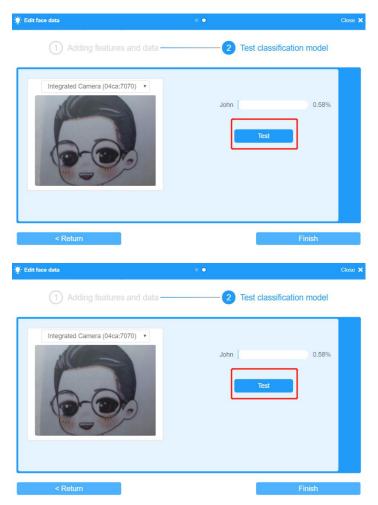


Figure 3.8 test face model

Initialize the smart shopping assistant system. Set the initial position of the robot, create a variable **price** to store the customer's bill, and then make a voice prompt, as shown in Figure 3.9.

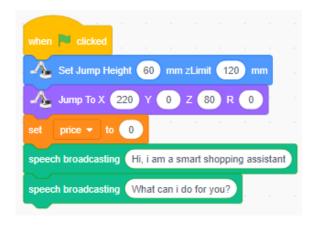


Figure 3.9 Initial smart shopping assistant

Step 4: Record speech, as shown in Figure 3.10.



Figure 3.10 record speech

Step 5: Recognize voice and determine whether the text of the voice recognition contains "buy" text. If it contains "buy", continue to judge whether the voice recognition result contains the text of "pear". If it contains, the robot will grab the pear. The bill is increased by 10, as shown in Figure 3.11.

```
when clicked

Set Jump Height 60 mm zLimit 120 mm

Jump To X 220 Y 0 Z 80 R 0

set price to 0

speech broadcasting What can i do for you?

wait 8 seconds

start Chinese_putonghua voice recognition, continued for 3 second

if Does string speech recognition results contain Buy then

if Does string speech recognition results contain Pear then

change price by 10

Gripper Release v

Jump To X 231.6 Y 150.3 Z -19.9 R 33.0

wait 0.5 seconds

Gripper Grip v
```

Figure 3.11 Whether recognize pear

Step 6: Determine whether the instruction to buy other goods is recognized, if it is recognized, grab the corresponding goods, as shown in Figure 3.12.

```
when 📜 clicked
Set Jump Height 60 mm zLimit 120 mm
✓ Jump To X 220 Y 0 Z 80 R 0
    price ▼ to 0
 eech broadcasting Hi, i am a smart shopping assistant
   ch broadcasting What can i do for you?
   8 seconds
   Does string speech recognition results contain Buy then
      nge price by 10
   A Gripper Release ▼
   Jump To X 231.6 Y 150.3 Z -19.9 R 33.0
   Gripper Grip ▼
if Does string speech recognition results contain Strawberry the
   hange price • by 30
   A Gripper Release ▼
   √ Jump To X 114.0 Y 245.3 Z -11.9 R 64.8
   wait 0.5 seconds

Gripper Grip ▼
   Does string speech recognition results contain Coffee the
  change price ▼ by 25

A Gripper Release ▼
   Jump To X 249.3 Y 239.9 Z 60.4 R 43.9
   wait 0.5 seconds

Gripper Grip ▼
   Does string speech recognition results contain Milk the
   change price ▼ by 5

A Gripper Release ▼
   Jump To X 202.7 Y 280.2 Z 61.2 R 54.1
   wait 0.5 seconds

A Gripper Grip ▼
```

Figure 3.12 Speech order goods

Step 7: Place the goods in the goods settlement area to facilitate customers to take the goods, as shown in Figure 3.13.

```
when 📜 clicked
Set Jump Height 60 mm zLimit 120 mm
✓ Jump To X 220 Y 0 Z 80 R 0
    price ▼ to 0
 eech broadcasting Hi, i am a smart shopping assistant
   ch broadcasting What can i do for you?
   8 seconds
    Chinese_putonghua ▼ voice recognition, continued for 3 second
   Does string speech recognition results contain (Buy) then
     Does string speech recognition results contain Pear there
      nge price • by 10
   A Gripper Release ▼
   Jump To X 231.6 Y 150.3 Z -19.9 R 33.0
  Gripper Grip ▼
if Does string speech recognition results contain Strawberry the
   thange price v by 30

    Gripper Release 

▼

   √ Jump To X 114.0 Y 245.3 Z -11.9 R 64.8

    Gripper Grip ▼

     Does string speech recognition results contain Coffee then
  change price ▼ by 25

Gripper Release ▼
   Jump To X 249.3 Y 239.9 Z 60.4 R 43.9
  wait 0.5 seconds

A Gripper Grip ▼
    Does string speech recognition results contain Milk the
  change price ▼ by 5

Gripper Release ▼
   Jump To X 202.7 Y 280.2 Z 61.2 R 54.1
   ouait 0.5 seconds

Gripper Grip ▼
  ait 1 seconds

Jump To X 310.0 Y 11.0 Z 48.7 R 2.0
   oit 0.5 seconds

Gripper Release ▼
  Jump To X 220 Y 0 Z 80 R 0
```

Figure 3.13 Grab goods to settlement area

Step 8: After ordering a product by voice, the smart shopping assistant system continues to wait for the customer's voice instruction. If the voice recognized the "end" instruction, the order is finished, otherwise the order is continued, as shown in Figure 3.14.

```
when 💌 clicked
Set Jump Height 60 mm zLimit 120 mm
✓ Jump To X 220 Y 0 Z 80 R 0
     price ▼ to 0
   ech broadcasting Hi, i am a smart shopping assistant
  ech broadcasting What can i do for you?
        voice recognition, continued for 3 second
                           ognition results contain Buy then
     Jump To X 231.6 Y 150.3 Z -19.9 R 33.0
    wait 0.5 seconds

Gripper Grip •
   Does string speech recognition results contain Strawberry then
     change price ▼ by 30

Gripper Release ▼
     114.0 Y 245.3 Z −11.9 R 64.8
      ait 0.5 seconds
   Does string speech recognition results contain Coffee there
      hange price • by 25

    Gripper Release ▼

     ↑ Jump To X 249.3 Y 239.9 Z 60.4 R 43.9
      ait 0.5 seconds
    Gripper Grip ▼
      Does string speech recognition results contain Milk then

    Gripper Release ▼

     Jump To X 202.7 Y 280.2 Z 61.2 R 54.1
    Gripper Grip ▼
   vait 1 seconds
   Jump To X 310.0 Y 11.0 Z -8.7 R 2.0
  wait 0.5 seconds

Gripper Release
```

Figure 3.14 Recognize end instruction

```
wait 0.5 seconds

Speech broadcasting please continue your shopping

wait 2 seconds

start Chinese_pulonghua voice recognition, continued for 3 second
```

Step 9: Face payment. The smart shopping assistant system will settle the bill and costumers pay the bill through face recognition.

```
when 💌 clicked
A Set Jump Height 60 mm zLimit 120 mm
1 Jump To X 220 Y 0 Z 80 R 0
   price ▼ to 0
speech broadcasting Hi, i am a smart shopping assistant
speech broadcasting What can i do for you?
wait 8 seconds
start Chinese_putonghua ▼ voice recognition, continued for 3 second
repeat until Does string speech recognition results contain End
      Does string speech recognition results contain Pear then
     change price ▼ by 10
     ⚠ Gripper Release ▼
     ✓ Jump To X 231.6 Y 150.3 Z -19.9 R 33.0
     wait 0.5 seconds
     A Gripper Grip ▼
      Does string speech recognition results contain Strawberry
     change price ▼ by 30

    Gripper Release 

▼

     ✓ Jump To X 114.0 Y 245.3 Z -11.9 R 64.8
      vait 0.5 seconds

    Gripper Grip ▼

      Does string speech recognition results contain Coffee then
       nange price ▼ by 25

    Gripper Release ▼
```

```
Jump To X 249.3 Y 239.9 Z 60.4 R 43.9
     wait 0.5 seconds
    - Gripper Grip ▼
      Does string speech recognition results contain Milk then
     change price ▼ by 5
    Jump To X 202.7 Y 280.2 Z 61.2 R 54.1
     wait 0.5 seconds

    Gripper Grip ▼

   wait 1 seconds
   ✓ Jump To X 310.0 Y 11.0 Z -8.7 R 2.0
   vait 0.5 seconds
   Gripper Release ▼
   vait 0.5 seconds
   ✓ Jump To X 220 Y 0 Z 80 R 0
   wait 0.5 seconds

    Gripper OFF ▼

 speech broadcasting please continue your shopping
 start Chinese_putonghua ▼ voice recognition, continued for 3 second
speech broadcasting join your spending join price yuan
speech broadcasting Please face to the camera to start payment
Timeout 5 s to take picture
if Does string The class name of picture Picture contain John then
 speech broadcasting payment successful
 speech broadcasting thank you for coming
 speech broadcasting payment failed
 speech broadcasting please choose other payment methods
```

Figure 3.15 Figure 3.15 Face payment