Multimodal visual understand + Depth Camera Distance Question Answering(Voice Version)

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1. Course Content

1. Learn to use the robot's visual feedback to map distance to objects.
2. Analyze newly discovered key source code.

2. Preparation

2.1 Content Description

> This lesson uses the Raspberry Pi as an example. For Raspberry Pi and Jetson-Nano boards, you need to open a terminal on the host computer and enter the command to enter the Docker container. Once inside the Docker container, enter the commands mentioned in this lesson in the terminal. For instructions on entering the Docker container from the host computer, refer to **[01. Robot Configuration and Operation Guide] -- [4.Enter Docker (For JETSON Nano and RPi 5)]**. For RDKX5 and Orin boards, simply open a terminal and enter the commands mentioned in this lesson.

📝 This example uses `model:"qwen/qwen2.5-vl-72b-instruct:free","qwen-vl-latest"`

⚠ The responses from the large model for the same test command may not be exactly the same and may differ slightly from the screenshots in the tutorial. To increase or decrease the diversity of the large model's responses, refer to the section on configuring the decision-making large model parameters in the **[03.AI Model Basics] -- [5.Configure AI large model]**.

⚡ It is recommended that you first try the previous visual example. This example adds voice functionality to the singleton example. The functionality is largely the same, so I will not elaborate on the debugging details or the results.

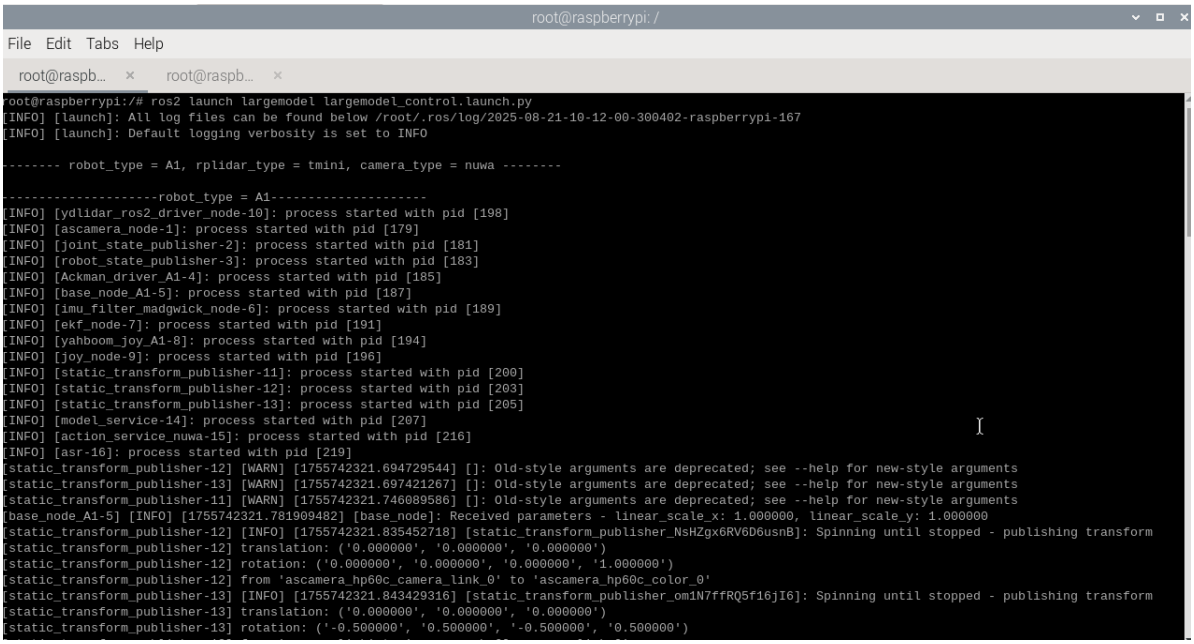
3. Running the Example

3.1 Starting the Program

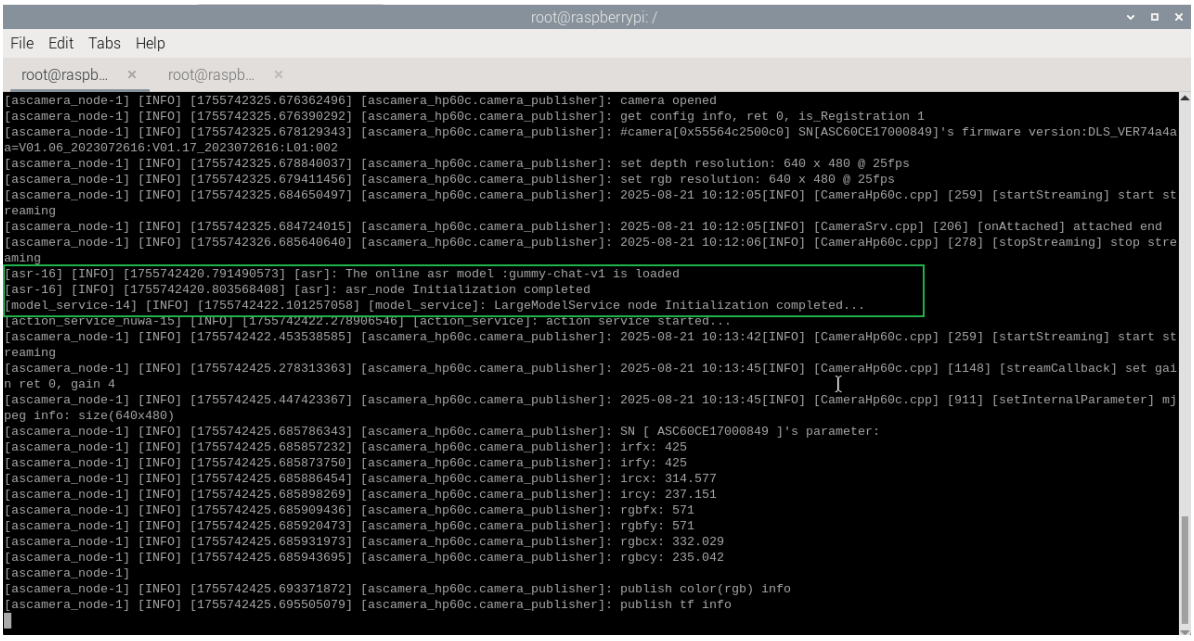
For Raspberry Pi PI5 and jetson nano, you need to enter the Docker container first. For RDKX5 and Orin main controllers, this is not necessary.

Open a terminal in Docker and enter the following command:

```
ros2 launch largemodel largemodel_control.launch.py
```



After initialization is complete, the following content will be displayed, and you can use voice control.



3.2 Test Case

Here are two reference test cases. Users can create their own dialogue commands.

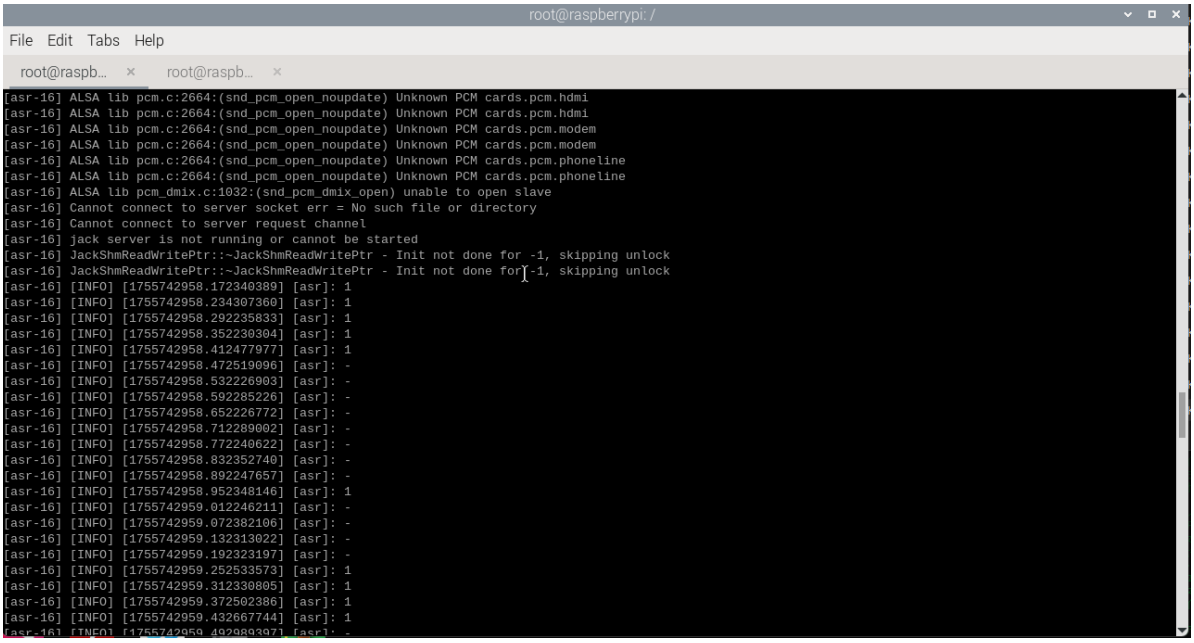
- Please tell me the distance between the object in front of you and you.

  Example: Please tell me the distance between the fan in front of you and you.

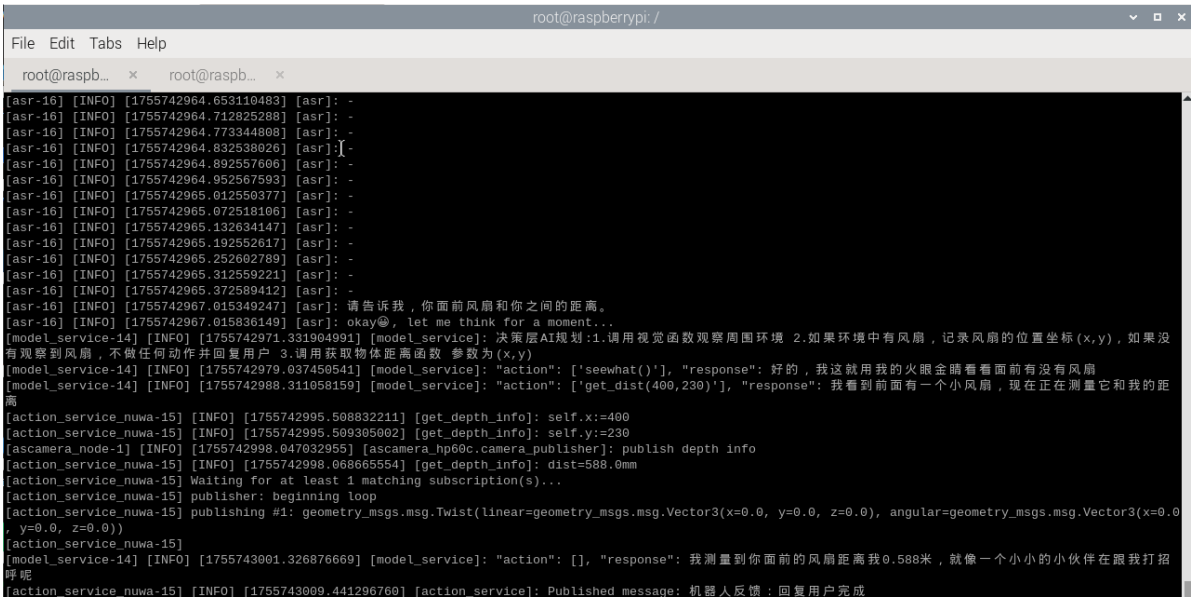
3.2.1 Example 1: "Please tell me the distance between the fan in front of you and you."

First, use "Hi, yahboom" to wake the robot. The robot responds: "I'm here, please tell me." After the robot responds, the buzzer beeps briefly (beep—). The user can then speak. The robot will then perform a sound detection. If there is sound activity, it will print 1; if there is no sound activity, it will print -. When the speech ends, it will perform a tail tone detection. If there is silence for more than 450ms, the recording will stop.

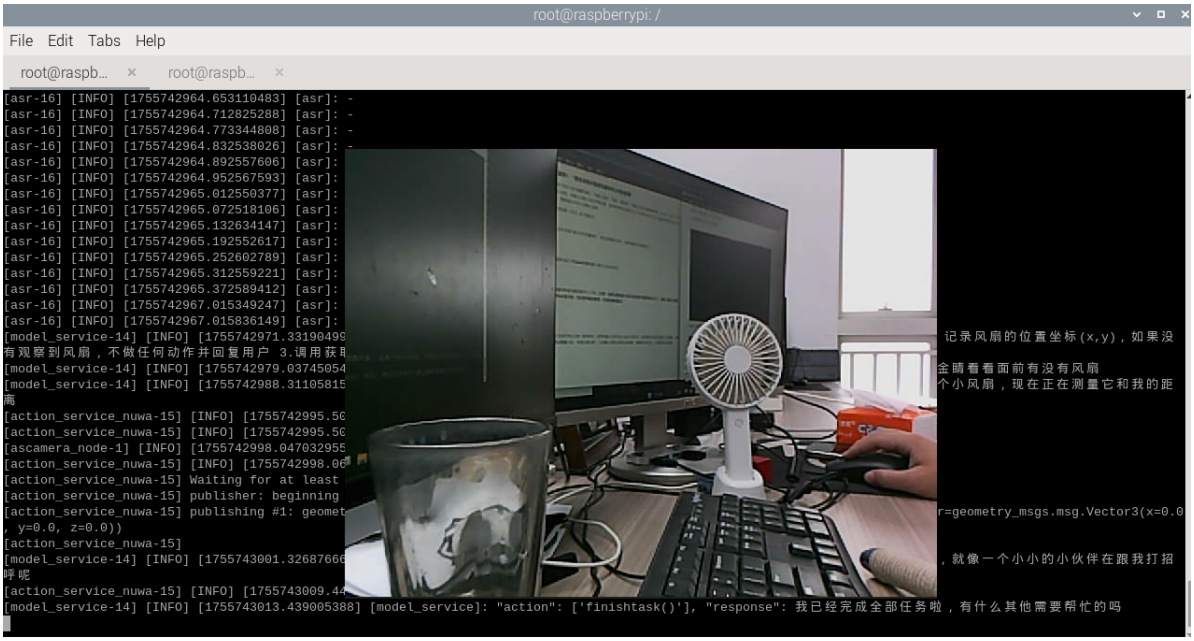
The following image shows Voice Active Detection (VAD):



The robot will first communicate with the user, then respond to the user's instructions. The following information will be printed on the terminal:

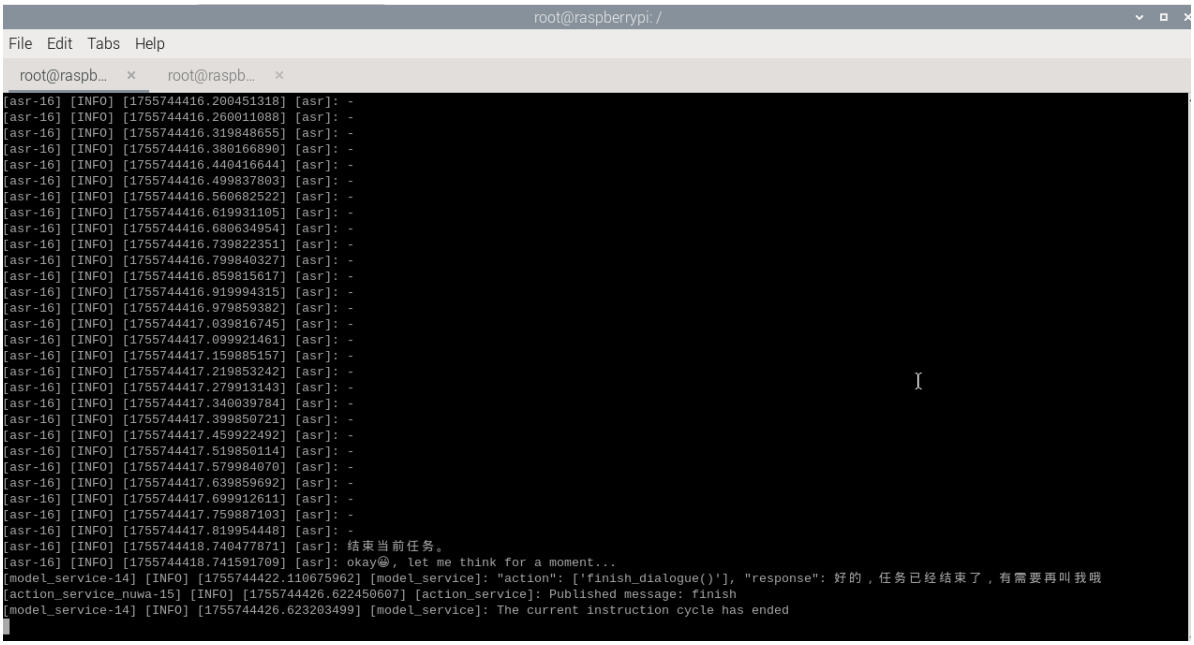


A window titled **frame** will open on the VNC screen and automatically close after 4 seconds.



As you can see, the terminal response distance is 0.588 meters. **(Note: If the feedback is 0.0 meters, it may be because the object being recognized is too small, resulting in inaccurate center coordinates from the large visual model. This can be resolved by replacing the visual model and the recognized object.)**

After completing a task, the robot enters a waiting state, during which it reenters the free conversation state, but all conversation history is retained. At this point, you can wake yahboom up again and select "End Current Task" to terminate the current task cycle, clear the conversation history, and start a new one.



4. Source Code Parsing

Source code located at:

Jetson Orin Nano, Jetson Orin NX Host:

```
#NUWA Camera User
/home/jetson/yahboomcar_ros2_ws/yahboomcar_ws/src/largemodel/largemodel/action_service_nuwa.py
#USB Camera User
/home/jetson/yahboomcar_ros2_ws/yahboomcar_ws/src/largemodel/largemodel/action_service_usb.py
```

RDK X5：

```
#NUWA Camera User
/home/sunrise/yahboomcar_ros2_ws/yahboomcar_ws/src/largemodel/largemodel/action_service_nuwa.py
#USB Camera User
/home/sunrise/yahboomcar_ros2_ws/yahboomcar_ws/src/largemodel/largemodel/action_service_usb.py
```

Jetson Nano, Raspberry Pi Host:

You need to first enter Docker.

```
#NUWA Camera User
/root/yahboomcar_ros2_ws/yahboomcar_ws/src/largemodel/largemodel/action_service_nuwa.py
#USB Camera User
/root/yahboomcar_ros2_ws/yahboomcar_ws/src/largemodel/largemodel/action_service_usb.py
```

4.1 Example 1

action_service.py :

Example 1 uses the **seewhat** and **get_dist(self,x,y)** methods in the **CustomActionServer** class.

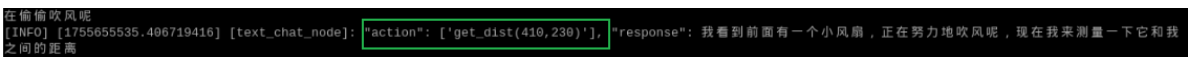
- The **seewhat** function primarily retrieves the color image from the depth camera.
- The **get_dist(self,x,y)** function performs color tracking.
- **dist_callback()** receives the distance callback function

Here we mainly explain the **get_dist(self,x,y)** function. This function requires input parameters x and y, representing the center coordinates of the distance to be obtained.

Subscribe to the feedback distance

```
self.dist_sub =
self.create_subscription(Int32,'dist_topic',self.dist_callback,10)
```

Deep Distance Question and Answer Subprocess




```
# Start the Deep Distance Question and Answer subprocess
process_1 = subprocess.Popen(['ros2', 'run', 'yahboomcar_voice_ctrl_depth',
['voice_get_dist','--ros-args','-p',f'x:={x1}','-p',f'y:={y1}'])
```

The startup program source code path is:

`~/yahboomcar_ros2_ws/yahboomcar_ws/src/yahboomcar_voice_ctrl_depth/yahboomcar_voice_ctrl_depth/voice_get_dist.py`

```
def get_dist(self,x,y):
    self.get_dist_future = Future() #Reset Future object
    x1 = int(x)
    y1 = int(y)
    process_1 = subprocess.Popen(['ros2', 'run', 'yahboomcar_voice_ctrl_depth', 'voice_get_dist','--ros-args','-p',f'x:={x1}','-p',f'y:={y1}'])
    while not self.get_dist_future.done():
        if self.interrupt_flag:
            break
        time.sleep(0.1)

    self.kill_process_tree(process_1.pid)
    self.cancel()
```

Wait for the callback function to feedback the distance and send the future.done signal. Then the `while not self.get_dist_future.done()` in the **dist_callback** function will exit the blocking state. Then the **kill_process_tree** method will be called to recursively kill the process tree of the child process. Finally, the status of the execution action will be fed back to the execution layer model.