

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

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1. Course Content

1. Learn to use the robot's visual feedback to determine the distance to an object.
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-v1-72b-instruct:free", "qwen-v1-latest"`

⚠️ The responses from the large model may not be exactly the same for the same test command 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 further debug the program or describe the results in detail.

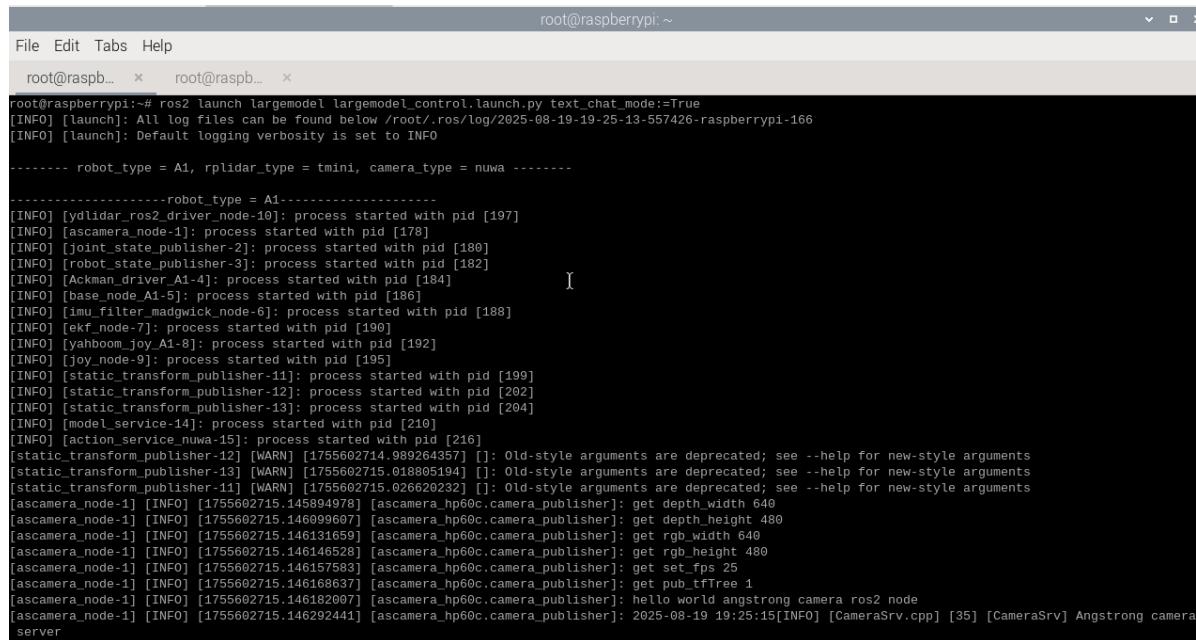
3. Running the Example

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 largemode1 largemode1_control.launch.py text_chat_mode:=True
```



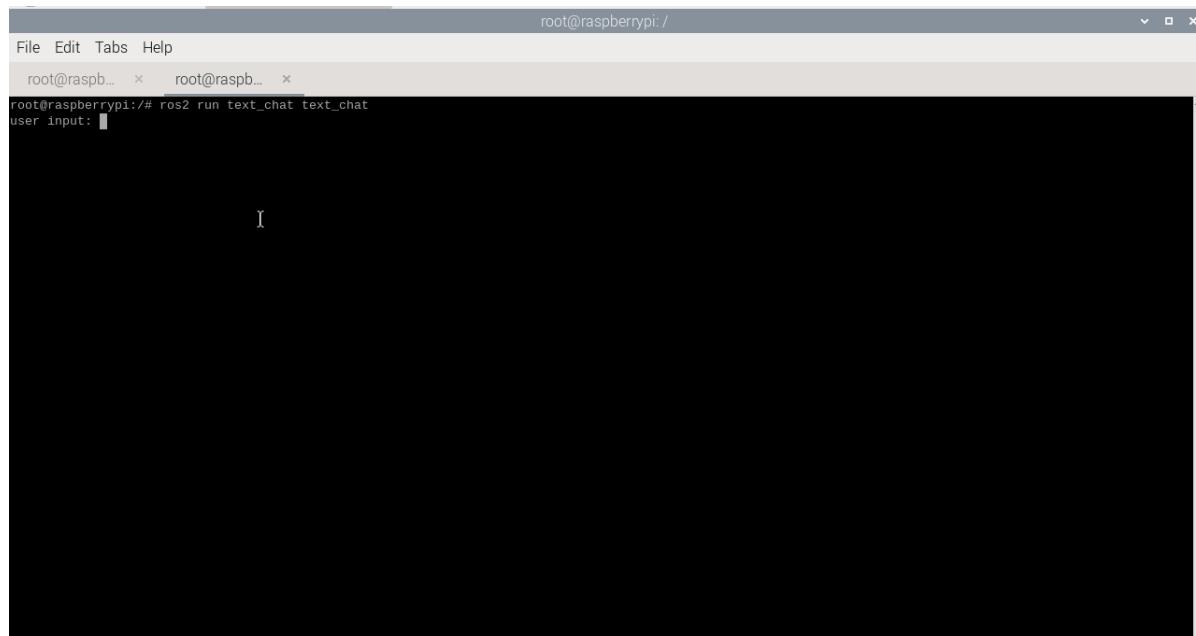
A terminal window titled 'root@raspberrypi: ~' showing the output of running the 'largemode1.launch.py' file. The output includes log messages from various nodes like 'ydlidar_ros2_driver_node-10', 'ascamera_node-1', 'joint_state_publisher-2', etc., all starting with pid values ranging from 178 to 216. There are several warning messages about deprecated arguments. The terminal window has a standard Linux-style header with 'File Edit Tabs Help' and two tabs labeled 'root@raspb...'.

```
root@raspberrypi:~# ros2 launch largemode1 largemode1_control.launch.py text_chat_mode:=True
[INFO] [launch]: All log files can be found below /root/.ros/log/2025-08-19-19-25-13-557426-raspberrypi-166
[INFO] [launch]: Default logging verbosity is set to INFO

----- robot_type = A1, rplidar_type = tmini, camera_type = nuwa -----
-----robot_type = A1-----
[INFO] [ydlidar_ros2_driver_node-10]: process started with pid [197]
[INFO] [ascamera_node-1]: process started with pid [178]
[INFO] [joint_state_publisher-2]: process started with pid [180]
[INFO] [robot_state_publisher-3]: process started with pid [182]
[INFO] [Ackman_driver_A1-4]: process started with pid [184]
[INFO] [base_node_A1-5]: process started with pid [186]
[INFO] [imu_filter_madgwick_node-6]: process started with pid [188]
[INFO] [ekf_node-7]: process started with pid [190]
[INFO] [yahboom_joy_A1-8]: process started with pid [192]
[INFO] [joy_node-9]: process started with pid [195]
[INFO] [static_transform_publisher-11]: process started with pid [199]
[INFO] [static_transform_publisher-12]: process started with pid [202]
[INFO] [static_transform_publisher-13]: process started with pid [204]
[INFO] [model_service-14]: process started with pid [210]
[INFO] [action_service_nuwa-15]: process started with pid [216]
[static_transform_publisher-12] [WARN] [1755602714.989264357] []: Old-style arguments are deprecated; see --help for new-style arguments
[static_transform_publisher-13] [WARN] [1755602715.018805194] []: Old-style arguments are deprecated; see --help for new-style arguments
[static_transform_publisher-11] [WARN] [1755602715.026620232] []: Old-style arguments are deprecated; see --help for new-style arguments
[ascamera_node-1] [INFO] [1755602715.145894978] [ascamera_hp60c.camera_publisher]: get_depth_width 640
[ascamera_node-1] [INFO] [1755602715.146009607] [ascamera_hp60c.camera_publisher]: get_depth_height 480
[ascamera_node-1] [INFO] [1755602715.146131659] [ascamera_hp60c.camera_publisher]: get_rgb_width 640
[ascamera_node-1] [INFO] [1755602715.146146528] [ascamera_hp60c.camera_publisher]: get_rgb_height 480
[ascamera_node-1] [INFO] [1755602715.146157583] [ascamera_hp60c.camera_publisher]: get_set_fps 25
[ascamera_node-1] [INFO] [1755602715.146168637] [ascamera_hp60c.camera_publisher]: get_pub_tfTree 1
[ascamera_node-1] [INFO] [1755602715.146182007] [ascamera_hp60c.camera_publisher]: hello world angstrong camera ros2 node
[ascamera_node-1] [INFO] [1755602715.146292441] [ascamera_hp60c.camera_publisher]: 2025-08-19 19:25:15[INFO] [CameraSrv.cpp] [35] [CameraSrv] Angstrong camera server
```

Open the same Docker container in multiple terminals and start it.

```
ros2 run text_chat text_chat
```



A terminal window titled 'root@raspberrypi: /' showing the output of running the 'text_chat' node. The output shows 'user input:' followed by a cursor. The terminal window has a standard Linux-style header with 'File Edit Tabs Help' and two tabs labeled 'root@raspb...'.

```
root@raspberrypi:/# ros2 run text_chat text_chat
user input: |
```

3.2 Test Cases

Here are two reference test cases; users can create their own test commands.

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

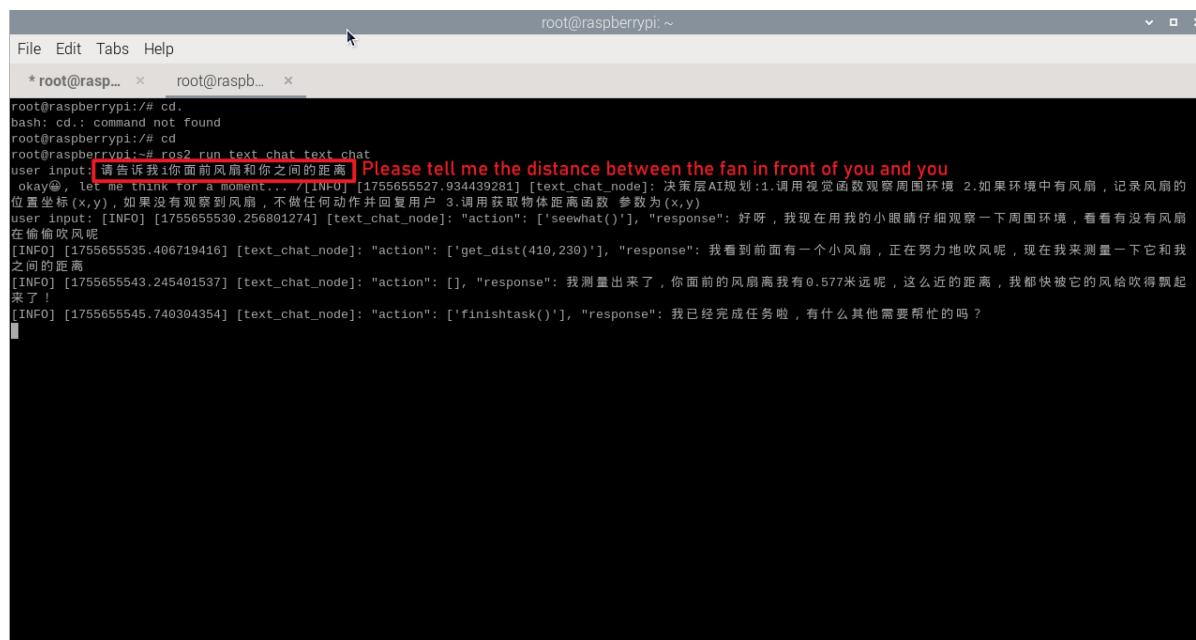
Example: Please tell me the distance between the fan in front of you and you.

⚠ Please do not end the text with a period or any other characters!

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

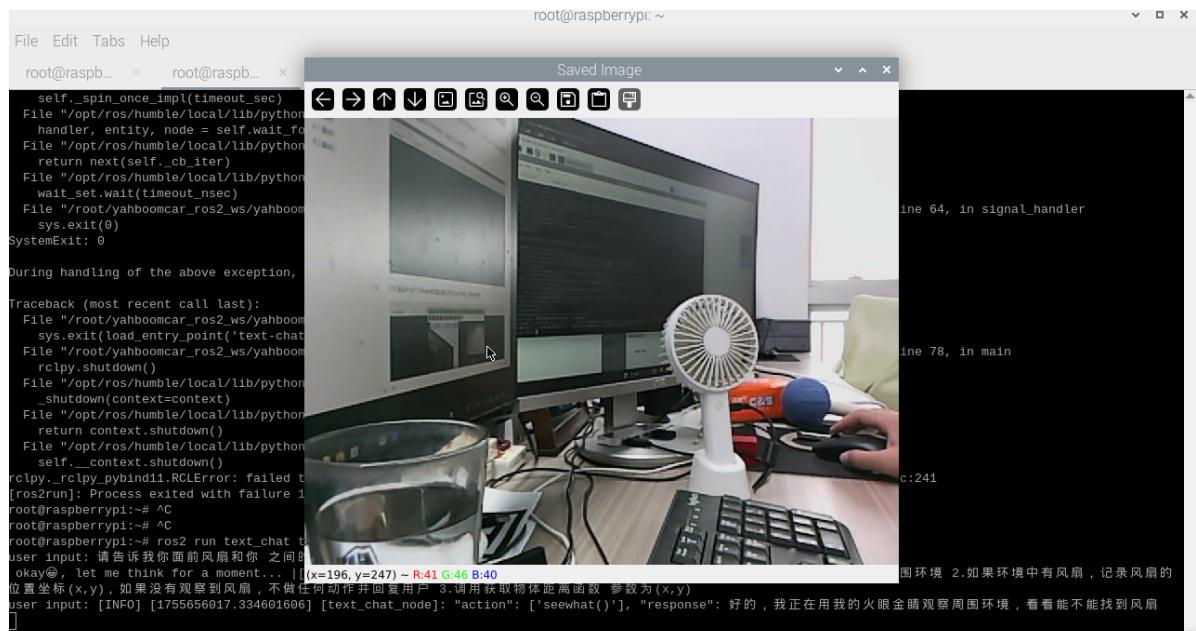
Type "Please tell me the distance between the fan in front of you and you." The terminal prints the following information.

You can see that the terminal responds with a distance of 0.577 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 vision model. This can be resolved by changing the vision model and the recognized object.**)



```
root@raspb... ~
File Edit Tabs Help
* root@raspb... x root@raspb... x
root@raspb.../# cd.
bash: cd.: command not found
root@raspb.../# cd
root@raspb.../# ros2 run text_chat text_chat
user input: [告诉我你面前风扇和你之间的距离] Please tell me the distance between the fan in front of you and you
okay@, let me think for a moment... [INFO] [1755655527.934439281] [text_chat_node]: 决策层AI规划:1.调用视觉函数观察周围环境 2.如果环境中有风扇，记录风扇的位置坐标(x,y)，如果没有观察到风扇，不做任何动作并回复用户 3.调用获取物体距离函数 参数为(x,y)
user input: [INFO] [1755655530.256801274] [text_chat_node]: "action": ['seewhat()'], "response": 好呀，我现在用我的小眼睛仔细观察一下周围环境，看看有没有风扇在偷偷吹风呢
[INFO] [1755655535.406719416] [text_chat_node]: "action": ['get_dist(410,230)'], "response": 我看到前面有一个小风扇，正在努力地吹风呢，现在我来测量一下它和我之间的距离
[INFO] [1755655543.245401537] [text_chat_node]: "action": [], "response": 我测量出来了，你面前的风扇离我有0.577米远呢，这么近的距离，我都快被它的风给吹得飘起来了！
[INFO] [1755655545.740304354] [text_chat_node]: "action": ['finishtask()'], "response": 我已经完成任务啦，有什么其他需要帮忙的吗？
```

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



```
root@raspb... ~
File Edit Tabs Help
root@raspb... x root@raspb... x
self._spin_once_impl(timeout_sec)
File "/opt/ros/humble/local/lib/python3.8/site-packages/rclpy/_rclpy_implementation.py", line 100, in _spin_once_impl
    handler, entity, node = self._wait_for_next_event()
File "/opt/ros/humble/local/lib/python3.8/site-packages/rclpy/_rclpy_implementation.py", line 114, in _wait_for_next_event
    return next(self._cb_iter)
File "/opt/ros/humble/local/lib/python3.8/site-packages/rclpy/_rclpy_implementation.py", line 114, in __next__
    wait_set.wait(timeout_nsec)
File "/root/yahboomcar_ros2_ws/yahboomcar_node.py", line 10, in 
    sys.exit(0)
SystemExit: 0

During handling of the above exception, another exception occurred:

Traceback (most recent call last):
File "/root/yahboomcar_ros2_ws/yahboomcar_node.py", line 10, in <module>
    sys.exit(load_entry_point('text-chat', 'console_scripts', 'text_chat'))
File "/root/yahboomcar_ros2_ws/yahboomcar_node.py", line 10, in <module>
    rclpy.shutdown()
File "/opt/ros/humble/local/lib/python3.8/site-packages/rclpy/_rclpy_implementation.py", line 100, in shutdown
    return context.shutdown()
File "/opt/ros/humble/local/lib/python3.8/site-packages/rclpy/_rclpy_implementation.py", line 100, in shutdown
    self._context.shutdown()
rclpy._rclpy_pybind11.RCLError: failed to shutdown node
[ros2run]: Process exited with failure 1
root@raspb.../# ^C
root@raspb.../# ^C
root@raspb.../# ros2 run text_chat text_chat
user input: 请告诉我你面前风扇和你之间的距离
okay@, let me think for a moment... [x=196, y=247] ~ R:41 G:46 B:40
user input: [INFO] [1755656017.334601606] [text_chat_node]: "action": ['seewhat()'], "response": 好的，我现在用我的火眼金睛观察周围环境，看看能不能找到风扇
[INFO] [1755656017.334601606] [text_chat_node]: "action": ['get_dist(410,230)'], "response": 我看到前面有一个小风扇，正在努力地吹风呢，现在我来测量一下它和我之间的距离
[INFO] [1755656017.334601606] [text_chat_node]: "action": [], "response": 我测量出来了，你面前的风扇离我有0.577米远呢，这么近的距离，我都快被它的风给吹得飘起来了！
[INFO] [1755656017.334601606] [text_chat_node]: "action": ['finishtask()'], "response": 我已经完成任务啦，有什么其他需要帮忙的吗？
```

The other terminal will print the object's center coordinates and distance information.

```
root@raspb... ~ root@raspb... ~
[ascamera_node-1] [INFO] [1755655452.631526367] [ascamera_hp60c.camera_publisher]: 2025-08-20 10:04:12[INFO] [CameraHp60c.cpp] [278] [stopStreaming] stop streaming
[model_service-14] [INFO] [1755655463.042002148] [model_service]: LargeModelService node Initialization completed...
[action_service_nuwa-15] [INFO] [1755655463.072827715] [action_service]: action service started...
[ascamera_node-1] [INFO] [1755655463.395038641] [ascamera_hp60c.camera_publisher]: 2025-08-20 10:04:23[INFO] [CameraHp60c.cpp] [259] [startStreaming] start streaming
[ascamera_node-1] [INFO] [1755655464.833900050] [ascamera_hp60c.camera_publisher]: 2025-08-20 10:04:24[INFO] [CameraHp60c.cpp] [911] [setInternalParameter] mjpeg info: size(640x480)
[ascamera_node-1] [INFO] [1755655465.512129970] [ascamera_hp60c.camera_publisher]: 2025-08-20 10:04:25[INFO] [CameraHp60c.cpp] [1148] [streamCallback] set gain ret 0, gain 4
[ascamera_node-1] [INFO] [1755655465.625295931] [ascamera_hp60c.camera_publisher]: SN [ ASC60CE17000849 ]'s parameter:
[ascamera_node-1] [INFO] [1755655465.625400230] [ascamera_hp60c.camera_publisher]: irfx: 425
[ascamera_node-1] [INFO] [1755655465.625420645] [ascamera_hp60c.camera_publisher]: irfy: 425
[ascamera_node-1] [INFO] [1755655465.625435724] [ascamera_hp60c.camera_publisher]: ircx: 314.577
[ascamera_node-1] [INFO] [1755655465.625448174] [ascamera_hp60c.camera_publisher]: ircy: 237.151
[ascamera_node-1] [INFO] [1755655465.625460956] [ascamera_hp60c.camera_publisher]: rgbfy: 571
[ascamera_node-1] [INFO] [1755655465.625474721] [ascamera_hp60c.camera_publisher]: rgbfy: 571
[ascamera_node-1] [INFO] [1755655465.625487540] [ascamera_hp60c.camera_publisher]: rgbcx: 332.029
[ascamera_node-1] [INFO] [1755655465.625501175] [ascamera_hp60c.camera_publisher]: rgbcy: 235.042
[ascamera_node-1] [INFO] [1755655465.627661299] [ascamera_hp60c.camera_publisher]: publish color(rgb) info
[ascamera_node-1] [INFO] [1755655465.629478499] [ascamera_hp60c.camera_publisher]: publish tf info
[action_service_nuwa-15] [INFO] [1755655465.209281638] [get_depth_info]: self.x:=410
[action_service_nuwa-15] [INFO] [1755655465.209745847] [get_depth_info]: self.y:=230
[ascamera_node-1] [INFO] [1755655339.915863643] [ascamera_hp60c.camera_publisher]: publish depth info
[action_service_nuwa-15] [INFO] [1755655339.935884040] [get_depth_info]: dist=577.0mm
[action_service_nuwa-15] publisher: beginning loop
[action_service_nuwa-15] publishing #1: geometry_msgs.msg.Twist(linear=geometry_msgs.msg.Vector3(x=0.0, y=0.0, z=0.0), angular=geometry_msgs.msg.Vector3(x=0.0, y=0.0, z=0.0))
[action_service_nuwa-15] [INFO] [1755655463.250180775] [action_service]: Published message: 机器人反馈 : 回复用户完成
```

After completing a task, the robot enters a waiting state. Pressing the `ENTER` key allows you to continue the conversation. The command you entered is directly passed to the execution layer model, and all conversation history is retained. You can enter the "**End current task**" command again to terminate the current task cycle and start a new one.

```
root@raspb... ~ root@raspb... ~
File Edit Tabs Help
* root@raspb... ~ root@raspb... ~
root@raspberrypi:/# cd.
bash: cd.: command not found
root@raspberrypi:/# cd
root@raspberrypi:/# ros2 run text_chat text_chat
user input: 请告诉我你面前风扇和你之间的距离
okay@, let me think for a moment... [INFO] [1755655527.9344339281] [text_chat_node]: 决策层AI规划: 1.用视觉函数观察周围环境 2.如果环境中有风扇, 记录风扇的位置坐标(x,y), 如果没有观察到风扇, 不做任何动作并回答用户 3.调用获取物体距离函数, 参数为(x,y)
user input: [INFO] [1755655530.256801274] [text_chat_node]: "action": ["seewhat('')"], "response": 好呀, 我现在用我的小眼睛仔细观察一下周围环境, 看看有没有风扇在偷偷吹风呢
[INFO] [1755655535.406719416] [text_chat_node]: "action": ["get_dist(410,230)"], "response": 我看到前面有一个小风扇, 正在努力地吹风呢, 现在我来测量一下它和我之间的距离
[INFO] [1755655443.245401537] [text_chat_node]: "action": [], "response": 我测量出来了, 你面前的风扇离我有0.577米远呢, 这么近的距离, 我都快被它的风给吹得飘起来了!
[INFO] [1755655445.740304354] [text_chat_node]: "action": ["finishtask('')"], "response": 我已经完成任务啦, 有什么其他需要帮忙的吗?

user input: 结束当前任务 End current task
okay@, let me think for a moment... -[INFO] [1755655681.003785057] [text_chat_node]: "action": ["finish_dialogue()"], "response": 好的, 任务已经结束了, 有需要再叫我哦!
user input: 
```

```
root@raspb... ~ root@raspb... ~
[ascamera_node-1] [INFO] [1755655452.631526367] [ascamera_hp60c.camera_publisher]: 2025-08-20 10:04:12[INFO] [CameraHp60c.cpp] [278] [stopStreaming] stop streaming
[model_service-14] [INFO] [1755655463.042002148] [model_service]: LargeModelService node Initialization completed...
[action_service_nuwa-15] [INFO] [1755655463.072827715] [action_service]: action service started...
[ascamera_node-1] [INFO] [1755655463.395038641] [ascamera_hp60c.camera_publisher]: 2025-08-20 10:04:23[INFO] [CameraHp60c.cpp] [259] [startStreaming] start streaming
[ascamera_node-1] [INFO] [1755655464.833900050] [ascamera_hp60c.camera_publisher]: 2025-08-20 10:04:24[INFO] [CameraHp60c.cpp] [911] [setInternalParameter] mjpeg info: size(640x480)
[ascamera_node-1] [INFO] [1755655465.512129970] [ascamera_hp60c.camera_publisher]: 2025-08-20 10:04:25[INFO] [CameraHp60c.cpp] [1148] [streamCallback] set gain ret 0, gain 4
[ascamera_node-1] [INFO] [1755655465.625295931] [ascamera_hp60c.camera_publisher]: SN [ ASC60CE17000849 ]'s parameter:
[ascamera_node-1] [INFO] [1755655465.625400230] [ascamera_hp60c.camera_publisher]: irfx: 425
[ascamera_node-1] [INFO] [1755655465.625420645] [ascamera_hp60c.camera_publisher]: irfy: 425
[ascamera_node-1] [INFO] [1755655465.625435724] [ascamera_hp60c.camera_publisher]: ircx: 314.577
[ascamera_node-1] [INFO] [1755655465.625448174] [ascamera_hp60c.camera_publisher]: ircy: 237.151
[ascamera_node-1] [INFO] [1755655465.625460956] [ascamera_hp60c.camera_publisher]: rgbfy: 571
[ascamera_node-1] [INFO] [1755655465.625474721] [ascamera_hp60c.camera_publisher]: rgbfy: 571
[ascamera_node-1] [INFO] [1755655465.625487540] [ascamera_hp60c.camera_publisher]: rgbcx: 332.029
[ascamera_node-1] [INFO] [1755655465.625501175] [ascamera_hp60c.camera_publisher]: rgbcy: 235.042
[ascamera_node-1] [INFO] [1755655465.627661299] [ascamera_hp60c.camera_publisher]: publish color(rgb) info
[ascamera_node-1] [INFO] [1755655465.629478499] [ascamera_hp60c.camera_publisher]: publish tf info
[action_service_nuwa-15] [INFO] [1755655465.209281638] [get_depth_info]: self.x:=410
[action_service_nuwa-15] [INFO] [1755655465.209745847] [get_depth_info]: self.y:=230
[ascamera_node-1] [INFO] [1755655339.915863643] [ascamera_hp60c.camera_publisher]: publish depth info
[action_service_nuwa-15] [INFO] [1755655339.935884040] [get_depth_info]: dist=577.0mm
[action_service_nuwa-15] publisher: beginning loop
[action_service_nuwa-15] publishing #1: geometry_msgs.msg.Twist(linear=geometry_msgs.msg.Vector3(x=0.0, y=0.0, z=0.0), angular=geometry_msgs.msg.Vector3(x=0.0, y=0.0, z=0.0))
[action_service_nuwa-15] [INFO] [1755655463.250180775] [action_service]: Published message: 机器人反馈 : 回复用户完成
[model_service-14] [INFO] [1755655681.008500073] [model_service]: The current instruction cycle has ended
[action_service_nuwa-15] [INFO] [1755655681.013758046] [action_service]: Published message: finish
```

4. Source Code Parsing

Source code located at:

Jetson Orin Nano:

```
#NUWA camera user  
/home/jetson/yahboomcar_ros2_ws/yahboomcar_ws/src/largemode1/largemode1/action_s  
ervice_nuwa.py  
#USB camera user  
/home/jetson/yahboomcar_ros2_ws/yahboomcar_ws/src/largemode1/largemode1/action_s  
ervice_usb.py
```

RDK X5:

```
#NUWA camera user  
/home/sunrise/yahboomcar_ros2_ws/yahboomcar_ws/src/largemode1/largemode1/action_  
service_nuwa.py  
#USB camera user  
/home/sunrise/yahboomcar_ros2_ws/yahboomcar_ws/src/largemode1/largemode1/action_  
service_usb.py
```

jetson Nano, Raspberry Pi host:

You need to enter Docker first.

```
#NUWA Camera User  
/root/yahboomcar_ros2_ws/yahboomcar_ws/src/largemode1/largemode1/action_service_  
nuwa.py  
#USB Camera User  
/root/yahboomcar_ros2_ws/yahboomcar_ws/src/largemode1/largemode1/action_service_  
usb.py
```

4.1 Example 1

action_service.py Program:

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

- The **seewhat** function primarily obtains 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

```
在偷偷吹风呢  
[INFO] [1755655535.406719416] [text_chat_node]: "action": ["get_dist(410,230)"], "response": 我看到前面有一个小风扇，正在努力地吹风呢，现在我来测量一下它和我  
之间的距离
```

```
# 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 the 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.

