AI Butler-Intent Inference

Before running the function, you need to close the App and large programs. For the closing method, refer to [4. Preparation] - [1. Manage APP control services].

1. Function Description

After the program starts, describe symptoms to the large model, such as "I have a bit of a headache" or "My stomach is not comfortable". The program will find medications on the desktop that can relieve the symptoms and control the robotic arm to point to that medication.

2. Startup

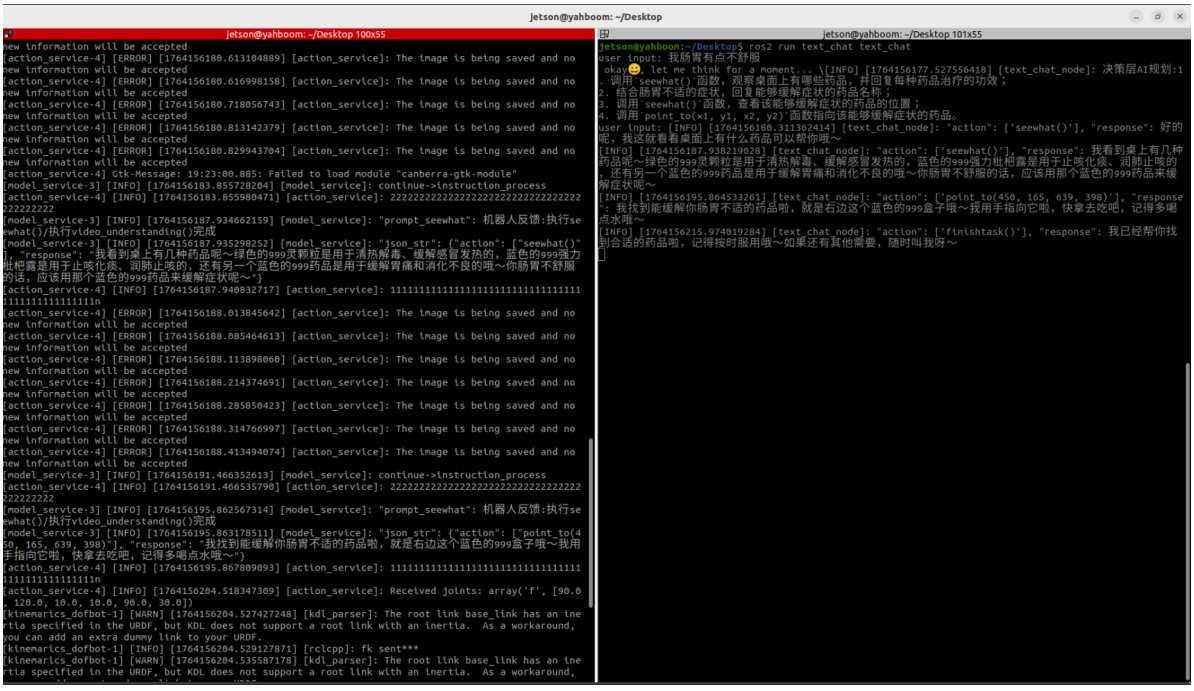
Taking the text version as an example, users with Jetson-Nano mainboard version need to enter the docker container first and then input the following command. Users with Orin mainboard can directly open the terminal and input the following command:

```
ros2 launch largemodel largemodel_control.launch.py text_chat_mode:=True
```

Then open a second terminal and input the following command:

```
ros2 run text_chat text_chat
```

Then input symptoms in the text_chat terminal, such as "My stomach is a bit uncomfortable", and press Enter; if it's the voice version, wake up the voice module and directly say to the voice module "My stomach is a bit uncomfortable", then wait for the large model to think and reply, as shown in the figure below:



As shown in the figure below, the robotic arm will point to the target medication:

3. Task Planning

1. Call the seehat() function to observe what medications are on the desktop and reply with the therapeutic effects of each medication;
2. Based on the symptom of stomach discomfort, reply with the name of the medication that can relieve the discomfort;
3. Call the seehat() function to check the position of the medication that can relieve the discomfort and get the coordinates of the top-left and bottom-right corners of the outer bounding box (x1, y1, x2, y2);
4. Call the point_to(x1, y1, x2, y2) function to point to the position of the medication that can relieve the discomfort.

4. Core Code Analysis

Mainly look at the point_to function, which is in action_service.py, located in LargeModel_ws/src/largemodel/largemodel/.

```
def point_to(self, x1, y1, x2, y2):
```

```
    # Start two programs, one executes ALM_Point_To, and the other calculates
object position information ALM_KCF_Tracker
    cmd1 = "ros2 run largemodel_arm ALM_Point_To"
    cmd2 = "ros2 run largemodel_arm ALM_KCF_Tracker"
    subprocess.Popen(
        [
            "gnome-terminal",
            "--title=ALM_KCF_Tracker",
            "--",
            "bash",
            "-c",
            f"{cmd2}; exec bash",
        ]
    )
    time.sleep(5.0) # Wait for ALM_KCF_Tracker_Node to start completely
    subprocess.Popen(
        [
            "gnome-terminal",
            "--title=grasp_desktop",
            "--",
            "bash",
            "-c",
            f"{cmd1}; exec bash",
        ]
    )
    time.sleep(2.0)
    if self.stack_flag == True:
        self.get_logger().info('Publish the stack_step topic...')
        step_ = Int16()
        step_.data = self.step
        self.step_pub.publish(step_)
        self.step = self.step + 1
    # Pack the outer bounding box coordinates and publish them through the topic,
the ALM_KCF_Tracker node program will subscribe to this topic
    x1 = int(x1)
    y1 = int(y1)
    x2 = int(x2)
    y2 = int(y2)
    self.object_position_pub.publish(Int16MultiArray(data=[x1, y1, x2, y2]))
```

ALM_KCF_Tracker Node Program

`Source code path: LargeModel_ws/src/largemodel_arm/largemodel_arm/ALM_KCF_Tracker.py`

```
# In the kcfTrack function, get the depth distance of the center point based on
the center point (self.cx, self.cy) values and depth image information, then
publish it through the topic /pos_xyz
if self.cx!=0 and self.cy!=0 and self.circle_r>10 :
    center_x, center_y = self.cx,self.cy
    cv2.circle(depth_to_color_image,(int(center_x),int(center_y)),1,
(255,255,255),10)
    self.cur_distance = depth_image_info[int(center_y),int(center_x)]/1000.0
    #print("self.cur_distance: ",self.cur_distance)
    dist = round(self.cur_distance,3)
    dist = 'dist: ' + str(dist) + 'm'
```

```
    cv.putText(result_frame, dist,  (30, 30), cv.FONT_HERSHEY_SIMPLEX, 1.0,
(255, 0, 0), 2)
    pos = Position()
    pos.x = center_x
    pos.y = center_y
    pos.z = self.cur_distance
    Track_pos = Position()
    Track_pos.x = center_x
    Track_pos.y = center_y
    self.pub_track_pos.publish(Track_pos)
```

ALM_Point_To Node Program

`Source code path: LargeModel_ws/src/largemodel_arm/largemodel_arm/ALM_Point_To.py`

```
# Process the message data of /pos_xyz published by the ALM_KCF_Tracker node, and
call the Point_To_Move of the dofbot_tracker object, passing the obtained message
data and the current end pose of the robotic arm
def TrackAndGrap(self,position):
    center_x, center_y = position.x,position.y
    self.cur_distance = position.z
    if self.done == True:
        self.get_current_end_pos()
        self.get_logger().info('-*-*-*-*-*-*-*-*-*-*')
        print("self.CurEndPos: ",self.CurEndPos)

 self.dofbot_tracker.Point_To_Move(center_x,center_y,self.cur_distance,self.CurE
ndPos)
        self.done = False
```

Point_To_Move function source code is in the `LargeModel_ws/src/largemodel_arm/largemodel_arm/Dofbot_Track.py` library:

```
def Point_To_Move(self,cx,cy,cz,CurEndPos):
    # Calculate the end pose of the robotic arm
    self.CurEndPos = CurEndPos
    camera_location = self.pixel_to_camera_depth((cx,cy),cz)
    print("cz: ",cz)
    PoseEndMat = np.matmul(self.EndToCamMat,
self.xyz_euler_to_mat(camera_location, (0, 0, 0)))
    EndPointMat = self.get_end_point_mat()
    WorldPose = np.matmul(EndPointMat, PoseEndMat)
    pose_T, pose_R = self.mat_to_xyz_euler(WorldPose)
    pose_T[0] = pose_T[0] + self.x_offset
    pose_T[1] = pose_T[1] + self.y_offset
    pose_T[2] = pose_T[2] + self.z_offset
    print("pose_T: ",pose_T)
    request = Kinemarics.Request()
    request.tar_x = pose_T[0]
    request.tar_z = pose_T[2] + 0.03
    request.tar_y = pose_T[1]
    request.kin_name = "ik"
    request.roll =  -1.0  #self.CurEndPos[3]
    print("calcutelate_request: ",request)
    # Inverse kinematics to get the values of servos 1-4
    try:
```

```
            future = self.client.call_async(request)
            rclpy.spin_until_future_complete(self, future, timeout_sec=10.0)
            response = future.result()
            joints = [0.0, 120.0, 10.0, 10.0, 90.0,150.0]
            joints[0] = response.joint1 #response.joint1
            joints[1] = response.joint2 #response.joint1
            joints[2] = response.joint3 #response.joint1
            joints[3] = response.joint4 #response.joint1
            # Control the robotic arm to move to this pose
            self.Arm.Arm_serial_servo_write6_array(joints,2000)
            grasp_done = Bool()
            grasp_done.data = True
            self.pubGraspStatus.publish(grasp_done)

        except Exception:
            pass
```