# 10. Mediapipe gesture control robotic arm action group



## 10.1. Introduction

MediaPipe is a data stream processing machine learning application development framework developed and open sourced by Google. It is a graph-based data processing pipeline for building data sources that use many forms, such as video, audio, sensor data, and any time series data. MediaPipe is cross-platform and can run on embedded platforms (Raspberry Pi, etc.), mobile devices (iOS and Android), workstations and servers, and supports mobile GPU acceleration. MediaPipe provides cross-platform, customizable ML solutions for real-time and streaming.

## 10.2. Using

Note: [R2] of the remote controller has the function of [pause/on] for this gameplay.

The case in this section may run very slowly on the robot master. It is recommended to connect the camera on the virtual machine side. The NX master control will work better, you can try it.

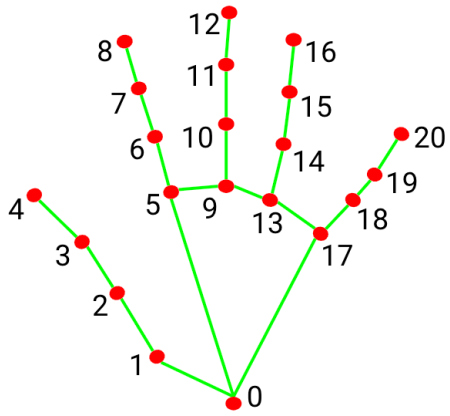
```
roslaunch arm_mediapipe mediaArm.launch          # Robots
rosrun arm_mediapipe FingerCtrl.py      # The robot can also be started in a
virtual machine, but the virtual machine needs to be equipped with a camera
```

After the program is running, press the handle's R2 key to touch the control. The camera will capture the image, there are five gestures, as follows

- Gesture Yes: Robotic arm dancing
- Gesture OK: the robotic arm straightens, the gripper opens and closes alternately.
- Gestures contempt (clenched fist, thumbs out, thumbs down): the robotic arm raises its body,the gripper opens
- Gesture number 1: robotic arm nods
- Gesture number 5: robotic arm applauding

Here, when each gesture is finished, it will return to the initial position and beep, waiting for the next gesture recognition.

MediaPipe Hands infers the 3D coordinates of 21 hand-valued joints from a frame.




0. WRIST
1. THUMB_CMC
2. THUMB_MCP
3. THUMB_IP
4. THUMB_TIP
5. INDEX_FINGER_MCP
6. INDEX_FINGER_PIP
7. INDEX_FINGER_DIP
8. INDEX_FINGER_TIP
9. MIDDLE_FINGER_MCP
10. MIDDLE_FINGER_PIP
11. MIDDLE_FINGER_DIP
12. MIDDLE_FINGER_TIP
13. RING_FINGER_MCP
14. RING_FINGER_PIP
15. RING_FINGER_DIP
16. RING_FINGER_TIP
17. PINKY_MCP
18. PINKY_PIP
19. PINKY_DIP
20. PINKY_TIP

## 10.4. Core files

### 10.4.1、mediaArm.launch

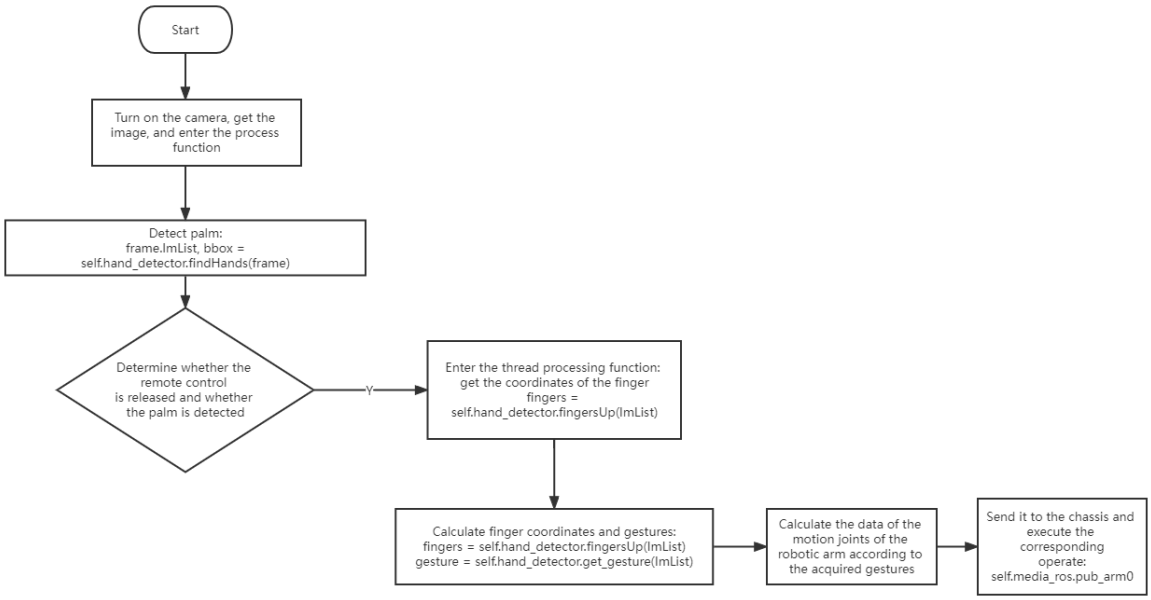
```
<launch>
    <include file="$(find transbot_bringup)/launch/bringup.launch"/>
    <node name="msgToimg" pkg="arm_mediapipe" type="msgToimg.py" output="screen"
required="true"/>
</launch>
```

### 10.4.2、 FingerCtrl.py

```
The implementation process here is also very simple. The main function opens the
camera to obtain data and then passes it into the process function. Inside it,
"detect palm" -> "obtain finger coordinates" -> "obtain gestures" in sequence,
and then decide what needs to be done according to the gesture results action
performed frame, lmList, bbox=
self.hand_detector.findHands(frame) #detect palm
fingers = self.hand_detector.fingersUp(lmList)  #get finger coordinates
gesture = self.hand_detector.get_gesture(lmList)    #get gesture
For the specific implementation process of the above three functions, you can
refer to the content in media_library.py
```

The implementation process here is also very simple. The main function opens the camera to obtain data and then passes it into the process function. Inside it, "detect palm" -> "obtain finger coordinates" -> "obtain gestures" in sequence, and then determine the needs according to the gesture results action performed.

## 10.5. Flowchart


Start
Turn on the camera, get the image, and enter the process function
Detect palm:
frame.lmList, bbox =
self.hand_detector.findHands(frame)
Determine whether the remote control is released and whether the palm is detected
Y
Enter the thread processing function:
get the coordinates of the finger
fingers =
self.hand_detector.fingersUp(lmList)
Calculate finger coordinates and gestures:
fingers = self.hand_detector.fingersUp(lmList)
gesture = self.hand_detector.get_gesture(lmList)
Calculate the data of the motion joints of the robotic arm according to the acquired gestures
Send it to the chassis and execute the corresponding operate:
self.media_ros.pub_arm0