# Lesson 1 ArmPi FPV Introduction

1. Introduction

The intelligent vision robotic arm ArmPi FPV is powered by Raspberry Pi 4B, with built-in inverse kinematics algorithm, bus servo, and a high-definition camera.

Combined with OpenCV, a cross-platform computer vision library, ArmPi FPV can perform image recognition, color sorting, moving, tracking, picking, smart stacking etc.
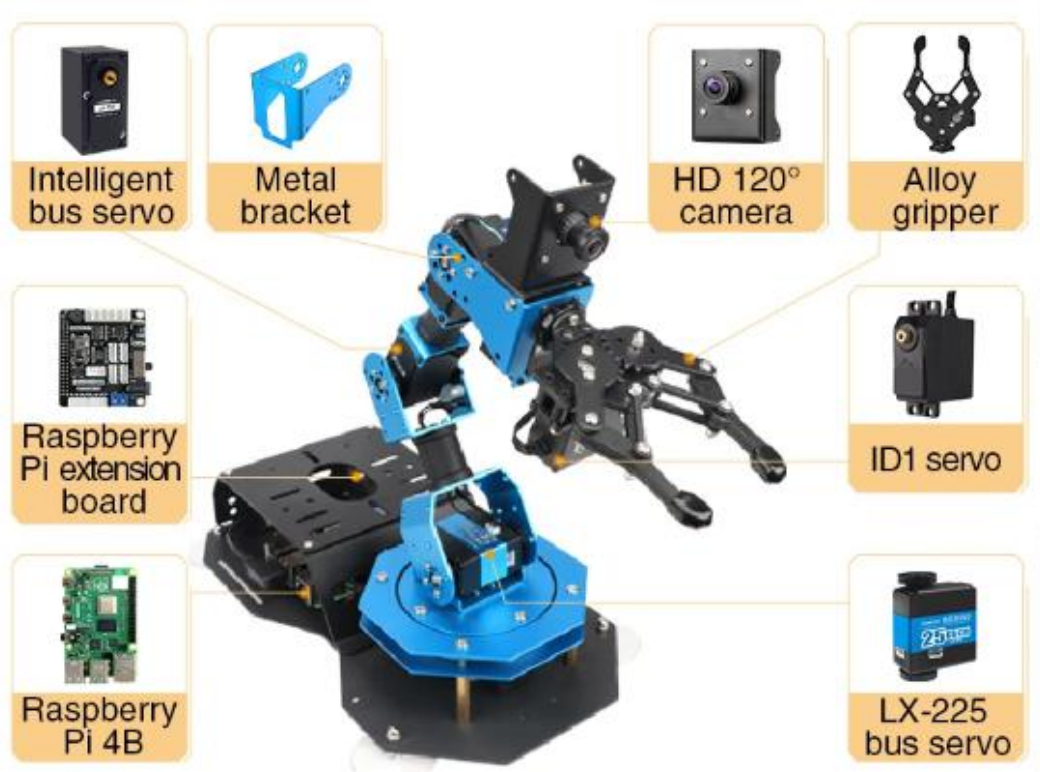
In order to meet the different learning needs, we have prepared the following two versions for you to choose.

Standard Version: Based on their own needs, users can choose Raspberry Pi controller with different versions of memory. It includes map and

tools, which helps to play AI vision game.

Advanced Version: On the basis of the "standard version", a new smart warehousing game and other creative games are added.

Warm notice: The system images of these two versions are burned before delivery. In order to reduce learning disabilities, we have prepared abundant tutorials and related software, and you can follow the tutorials.

2. Overview of Learning Tutorials

Step 1: ArmPi FPV Introduction

Folder "1.ArmPi FPV Introduction" explains the structure, assembly, software and how to start the ArmPi.

In this folder, you can get a basic understanding of its structure, study how to prepare the hardware, start the device, and grasp the state of the device after it is turned on.

Step2: Quick Start Instructions

Please go to the folder "2.Quick User Experience" to learn how to calibrate position and the APP control.

In this folder, you can learn how to use APP to connect and control the device, and play the AI vision games through the APP.

Step3: Getting Ready for AI Vision Programming Games

Please go to "Lesson 1 Set Development Environment" in folder "3. AI Vision Games Lesson" to learn the installation, usage and connection of Nomachine, a remote tool, and get a basic understanding of system directory structure of ArmPi FPV.

The "Frequency Modification Method" is for your reference, which is

suitable for all the users who have no 5G network card on their computer. And we provide a solution to modify the frequency when the device cannot be found. (Note: The ArmPi FPV defaults to the 5G frequency, which has a better experience than the 2.4G frequency. Users who use desktop computers are advised to prepare a 5G frequency network card.)

Step4: AI Vision Programming Learning

Please go to folder "3.AI Vision Games Lesson" to learn color tracking, face recognition, goods sorting and smart stacking.

Learning the command line startup method of each AI Vision games to have a brief understanding of the implementation process. In addition, users can modify the program with their ideas. Compared with the mobile phone APP games, it can further deepen the experience of OpenCV machine vision and robotic arm inverse kinematics.

Step 5: Advanced Learning

This chapter is optional. Whether to watch or not to watch does not affect the function realization. Users can learn the following content in folder "4. Advanced Program Lessons"

1. **Smart warehousing: this chapter consists of three lessons, including stock enter, stock deliver and stock transfer. Warm notice: this chapter is customized for user who have bought deluxe version.**

In "Lesson 1 stock enter", we learn how to control the robotic arm to recognize goods and place them on shelves through command line. In "Lesson 2 stock deliver", we can master how the robotic arm pick the goods on the shelf and place them on the map. In "Lesson 3 stock transfer", we are going to study how robotic arm transfer the goods between two shelves.

2. **ArmPi Action Programming: this chapter includes Lesson 1 PC Software, Lesson 2 Action Group Programming, Lesson 3 Execute Actions and Lesson 4 Integrate Action Groups.**

In this chapter, we mainly learn about the body of ArmPi FPV robotic arm, learns how to use PC software, how to program a simple action, how to call and execute the action in the ArmPi FPV system after editing, and how to integrate multiple action files into the same document.

3. **Raspberry Pi Basic Lessons: it contains 10 lessons, from Lesson 1 Raspberry Pi Introduction to Lesson 10 Raspberry Pi System Backup.**

This chapter aims at making you grasp the basic understanding of Raspberry Pi controller and master how to control it.

4. **Raspberry Pi Extension Board Tutorial: it consists of 6 lessons, from "Lesson 1 Control Bus Servo Rotate" to "Lesson 4 Buzzer Control".**

Combining the Raspberry PI expansion board, this chapter lets you learn representative example of hardware control, including controlling serial bus servo, buzzer and RGB color lights. These simple cases can provide ideas for later development.

5. **OpenCV Basic Lesson: it is made up of 5 lessons, from "Lesson 1 Computer Image Processing" to "Lesson 5 Advanced Image Processing Technology".**

This chapter mainly makes brief explanation of some mainstream recognition technology of machine vision OpenCV, which can help users quickly understand OpenCV and provide a thinking direction for further learning OpenCV.

6. **Forward&Inverse Kinematics: it involves 5 lessons, namely**

Lesson 1 Establish Robotic Arm Coordinate System, Lesson 2 Brief Analysis of Forward Kinematics, Lesson 3 Brief Analysis of Inverse Kinematics, Lesson 4 MoveIt Introduction and Lesson 5 MoveIt Kinematic Model and Motion Planning.

This chapter will assist the user in learning the trajectory planning and controlling. ArmPi FPV mainly adopts the inverse kinematics.
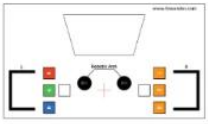
At the same time, we provide some formulas of inverse kinematics algorithm and mark the path of relevant program source code. Users, who is interested in it, can check the code comments.

7. ROS Basic Lesson: it has 5 lessons, respectively Lesson 1 Ros System Introduction, Lesson 2 Ros Common Documents and Terminology Description, Lesson 3 Create Ros Software Package, Lesson 4 Ros Basic Case 1- Creating messages and services, Lesson 5 Ros Basic Case 2- Writng a Simple Publisher and Subscriber and Lesson 6 Ros Base Case 3-Write a simple server and client.

This chapter is beneficial for users to get systematic understanding of ArmPi FPV Ros system. Let you understand the distribution of Ros system, learn how to create software package and realize the basic function, which guides the direction toward further learning of Ros.

3. Product list

ArmPi FPV Standard Kit

ArmPi FPV assembled	7.5V 6A adapter	Map	3*3cm Color block
Color ball	Wooden block	Tag	16GB U disk with tutorial
Card reader	Cable tie	Screwdriver	

ArmPi FPV Advanced Kit

ArmPi FPV assembled	7.5V 6A adapter	Map	3*3cm Color block
Color ball	Wooden block	Tag	16GB U disk with tutorial
Card reader	Cable tie	Screwdriver	Shelf unassembled
4Pin wire			