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› TonyPi Pro AI Humanoid Robot Instruction Manual

HIWONDER [ModelNumberStartingWithTonyPiPro]

TonyPi Pro AI Humanoid Robot Instruction Manual

Model: [ModelNumberStartingWithTonyPiPro] - Brand: HIWONDER

1. PRODUCT OVERVIEW

The TonyPi Pro is a high-performance AI vision robot designed for advanced AI education and applications. Powered by the Raspberry Pi 5, it integrates OpenCV for image processing and robotic inverse kinematics algorithms. This open-source platform supports sophisticated AI robotics development, offering a flexible environment for learning and innovation.

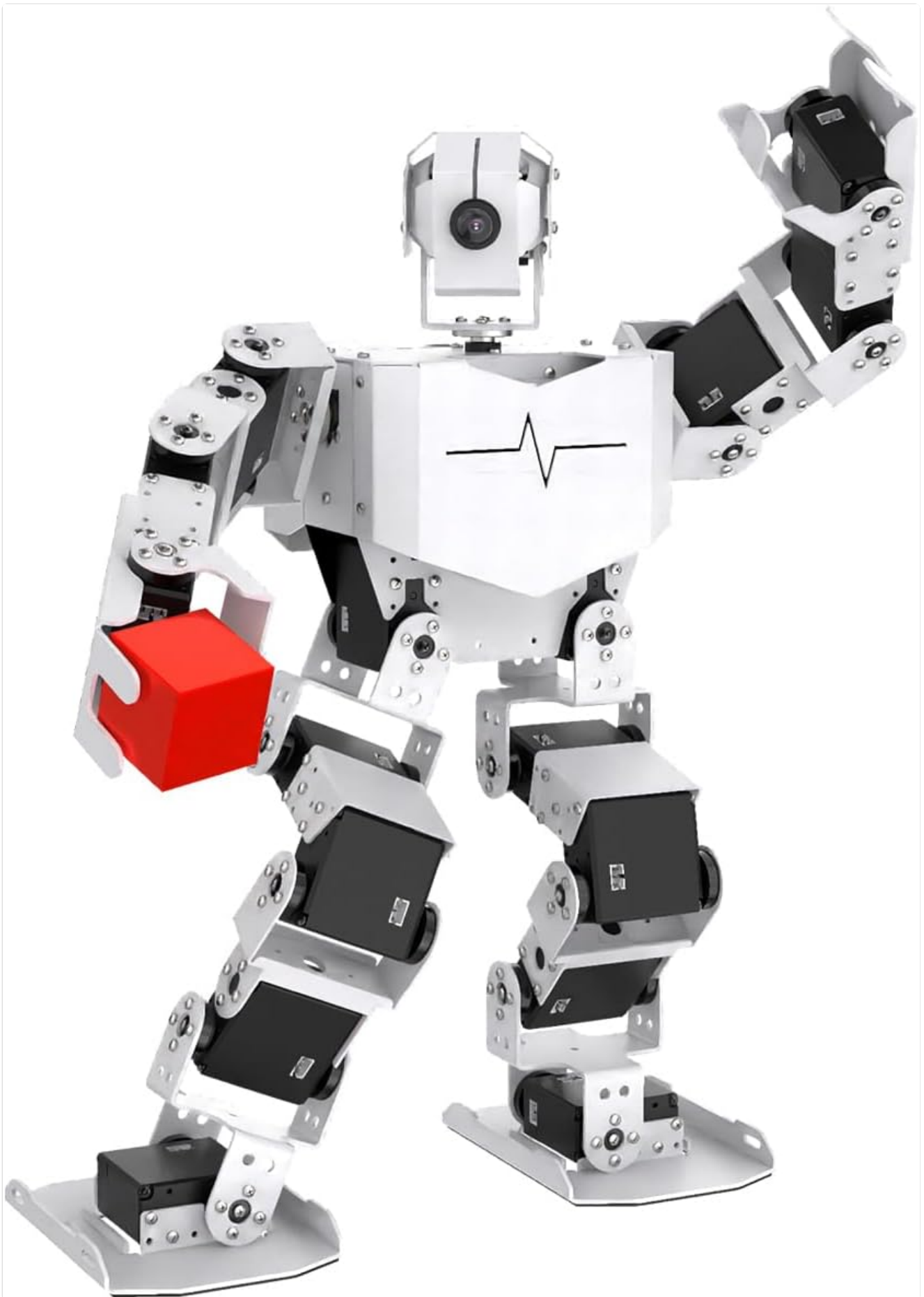


Figure 1: The TonyPi Pro AI Humanoid Robot, a white bipedal robot with multiple joints, holding a red cube.

Key Features:

- **AI-Driven & Raspberry Pi Powered:** High-performance AI vision robot utilizing Raspberry Pi 5, OpenCV, and robotic inverse kinematics.

- **AI Large Model ChatGPT Integration:** Enhanced human-machine interaction through a multimodal model with ChatGPT, enabling advanced embodied AI applications.
- **AI Voice Command & Recognition:** Understands voice commands, analyzes visual scenes, and performs appropriate actions for smooth voice interaction.
- **AI Vision Recognition and Tracking:** Equipped with an HD camera for color recognition, target tracking, ball kicking, line following, and MediaPipe-based motion control.
- **High-Voltage Intelligent Bus Servos:** 16 servos provide rapid response and stable output for precise multi-joint coordination and complex motion control.
- **Comprehensive Learning Resources:** Abundant educational content, source codes, software, and online support for robotic motion control, OpenCV, deep learning, and AI models.

2. SETUP AND ASSEMBLY

The TonyPi Pro kit requires assembly. Follow the detailed instructions provided in the included user manual and video tutorials for proper construction. Ensure all components are securely connected before powering on the device.

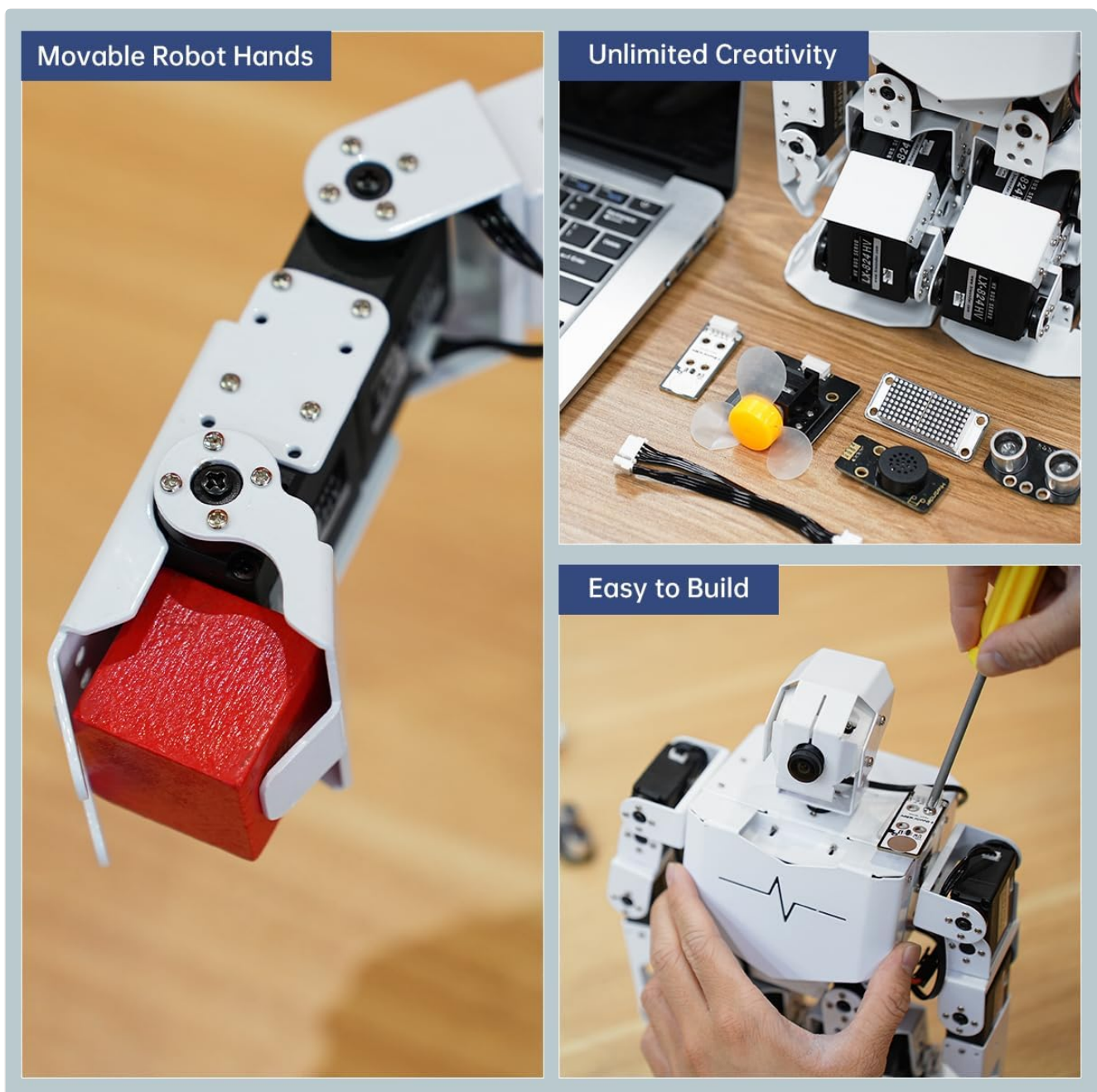


Figure 2: Illustration of the TonyPi Pro assembly process, highlighting its ease of construction.

2.1 Package Contents:

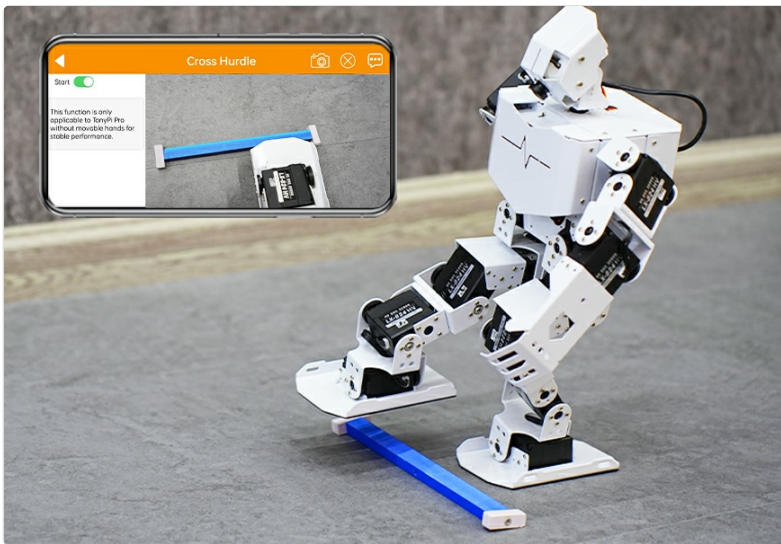
Verify all components are present according to the packing list. The TonyPi Pro Kit includes:



Figure 3: Visual representation of the TonyPi Pro Kit contents, including robot parts, controller, and accessories.

2.2 Powering On:

The robot is powered by a Lithium Ion battery (11.1V 2000mAh 10C). Ensure the battery is fully charged before first use. Connect the battery to the designated port on the robot's main control board. The robot features a real-time voltage display to monitor battery levels.



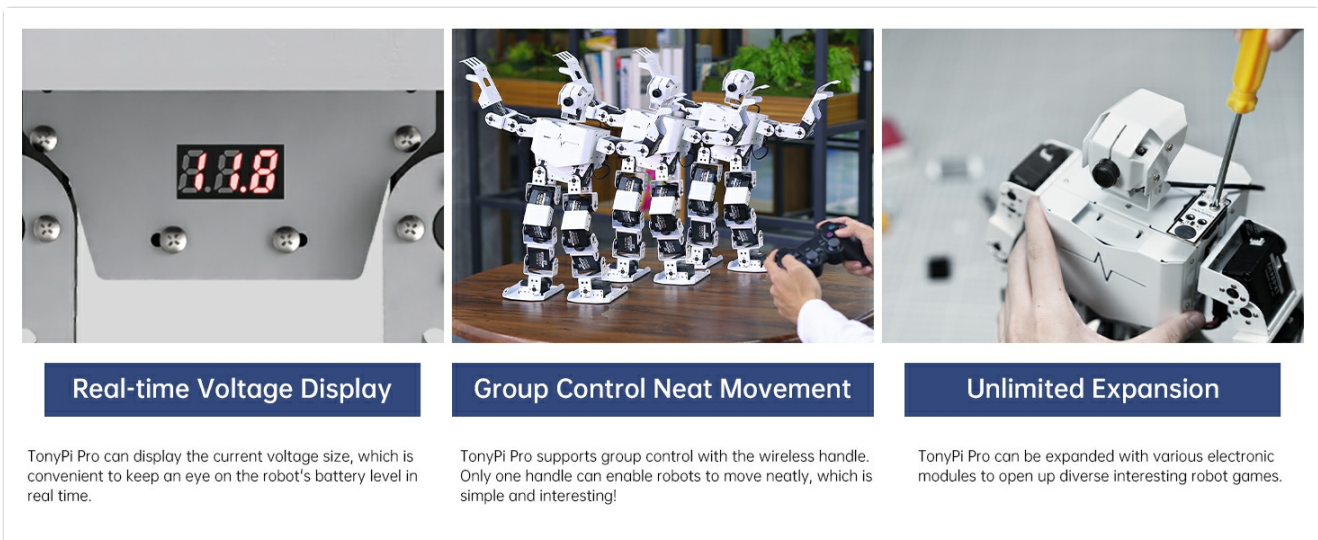
AI Vision Autonomous Hurdles

By identifying the position of the railing, the crossing of the railing can be achieved, and the movement is natural and smooth.

Figure 4: The robot's real-time voltage display, allowing users to monitor battery status.

2.3 Software Installation:

The TonyPi Pro operates with dedicated software for various control and programming functions. Refer to the provided learning materials and online resources for detailed instructions on installing the necessary APP (Android/iOS) and PC software. The Raspberry Pi Control System features the Raspberry Pi 5, an expansion board, and an active heat sink for stable performance.



Real-time Voltage Display

TonyPi Pro can display the current voltage size, which is convenient to keep an eye on the robot's battery level in real time.

Group Control Neat Movement

TonyPi Pro supports group control with the wireless handle. Only one handle can enable robots to move neatly, which is simple and interesting!

Unlimited Expansion

TonyPi Pro can be expanded with various electronic modules to open up diverse interesting robot games.

Figure 5: Diagram illustrating the Raspberry Pi Control System components.

3. OPERATING INSTRUCTIONS

The TonyPi Pro offers multiple modes of operation and interaction, leveraging its advanced AI capabilities.

Your browser does not support the video tag.

Video 1: An overview of the TonyPi Pro Hiwonder Humanoid Robot's various functions and capabilities.

3.1 AI Voice Command & Recognition:

Equipped with ChatGPT and an AI voice interaction box, TonyPi Pro can understand and respond to voice commands, enabling natural human-machine interaction. It can analyze visual scenes and carry out appropriate actions based on verbal instructions.

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Video 2: Demonstrates TonyPi's ability to engage in AI voice interactions and answer questions using ChatGPT.

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Video 3: Illustrates how to use programming to integrate ChatGPT for AI vision and voice capabilities.



Large Speech Model

With the integration of the AI voice interaction box, TonyPi Pro is equipped with speech input and output capabilities—functionally giving it 'ears' and a 'mouth.' Utilizing advanced end-to-end speech-language models and natural language processing (NLP) technologies, TonyPi Pro can perform real-time speech recognition and generate natural, human-like responses, enabling seamless and intuitive voice-based human-machine interaction.

Figure 6: TonyPi Pro's voice control and scene understanding capabilities, powered by ChatGPT.

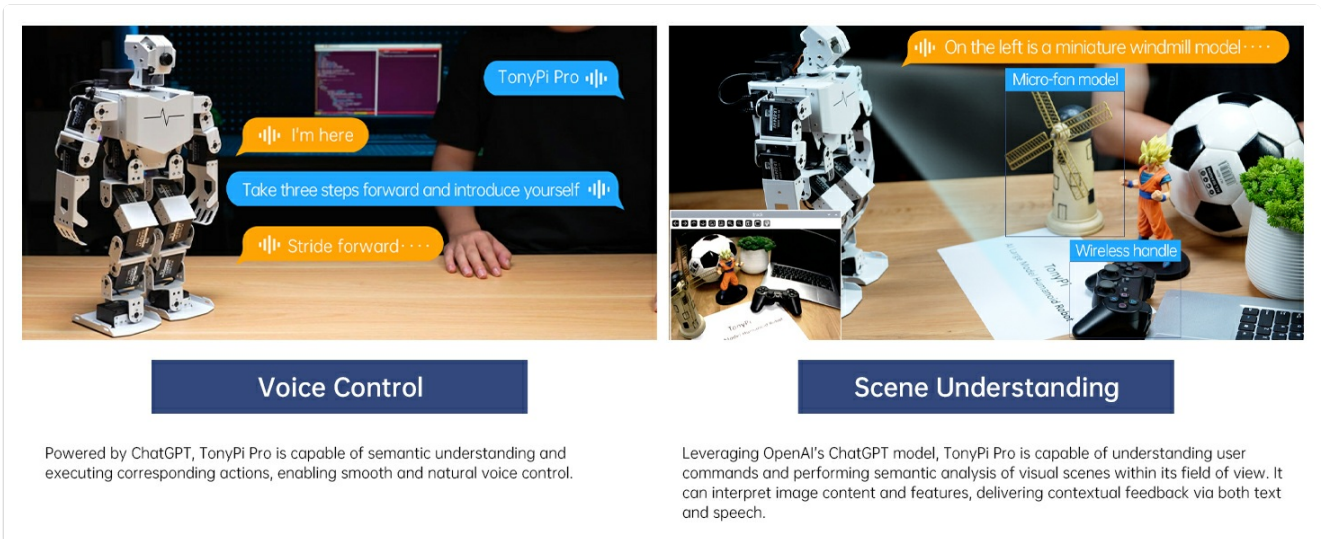


Figure 7: TonyPi Pro functioning as a smart assistant and reporting environmental conditions like temperature.

3.2 AI Vision Recognition and Tracking:

TonyPi Pro's HD camera and OpenCV integration enable various vision-based tasks, including object tracking, color recognition, face detection, and QR code recognition. Its 2DOF head provides a wide field of view for dynamic tracking.

AI Vision Recognition and Tracking

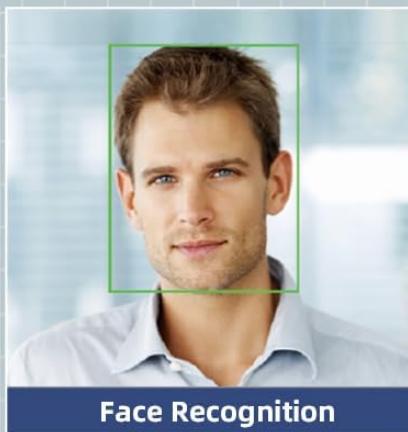
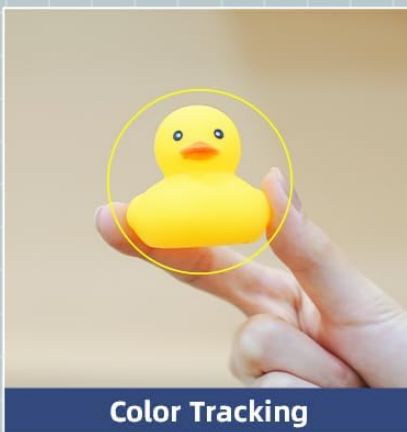


Figure 8: Examples of AI vision capabilities: Object Tracking, Color Tracking, Face Recognition, and QR Code Recognition.

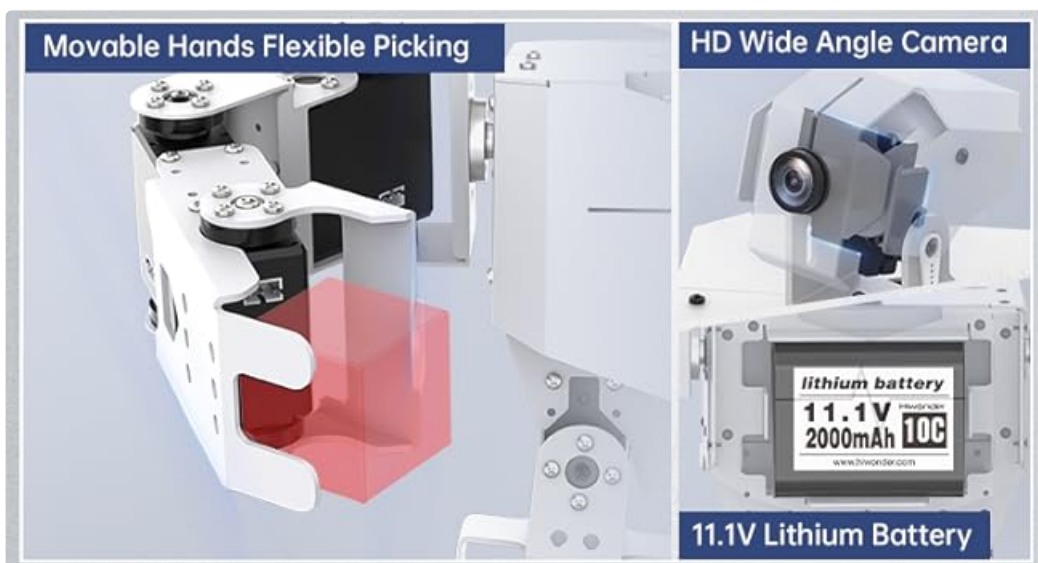


Figure 9: Detailed view of object tracking and tag recognition using OpenCV algorithms.

Dual-Controller Design for Efficient Collaboration

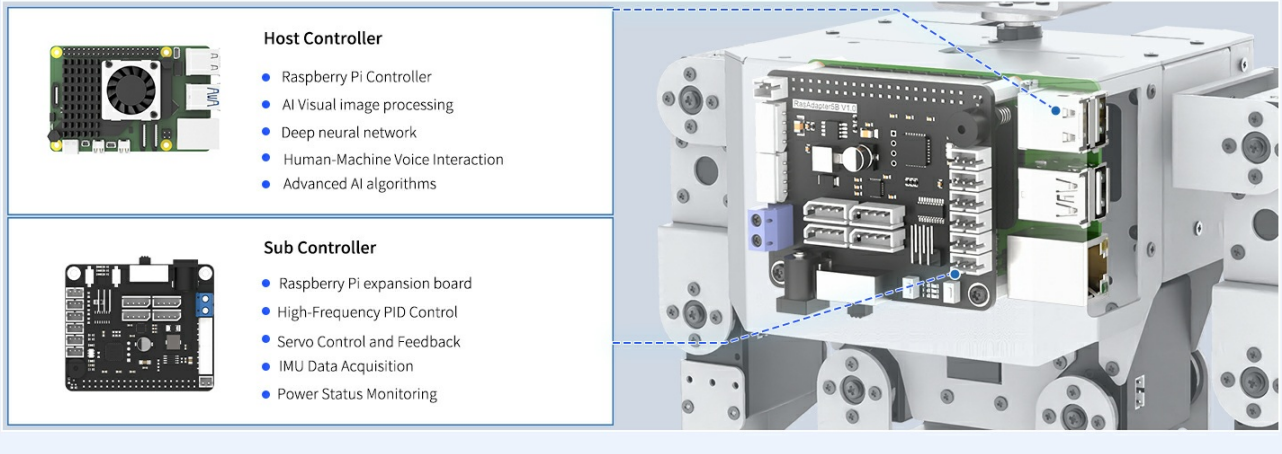


Figure 10: TonyPi Pro's capabilities in face detection and autonomous line following.

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Video 4: Demonstrates AI humanoid robot's line-tracking capabilities with ChatGPT integration and Raspberry Pi 5 controller.

3.3 Advanced Motion Control:

With 16 high-voltage intelligent bus servos, TonyPi Pro can perform complex movements and interactive actions, including ball kicking, obstacle crossing, and intelligent transport.

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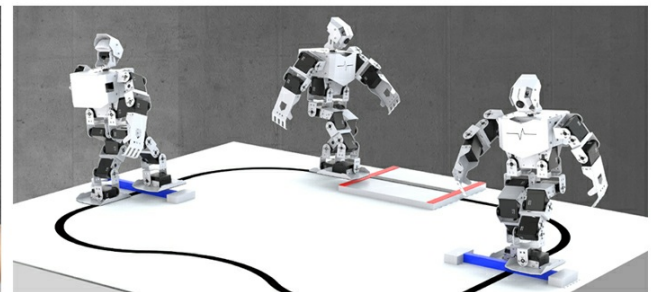
Video 5: Smart AI robot with ChatGPT, programmable in Python with Raspberry Pi 5 for ball tracking & kicking.

Upgraded Hand-Eye Coordination & Dynamic Gait



Open-Close Robotic Hand

Thanks to its innovative design, the robotic hand can open up to 66mm. When integrated with the vision system, it enables seamless hand-eye coordination, allowing the robot to accurately and stably grasp target objects based on various user commands.



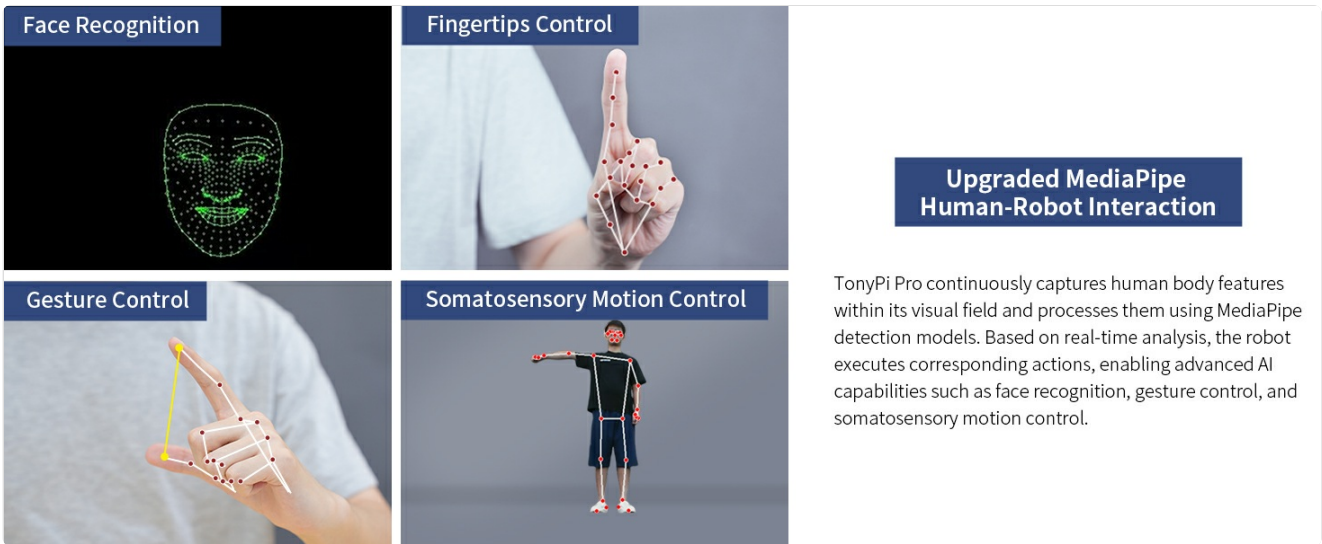
Upgraded Gait Unlimited AI Creativity

Using the OpenCV vision library, TonyPi Pro can seamlessly detect hurdles and stairs in real-time during its line-following process. It captures essential details like coordinates and geometric contours, enabling the robot to autonomously navigate over obstacles and climb stairs with ease.

Figure 11: TonyPi Pro performing auto shooting by tracking a ball and kicking it into a goal.

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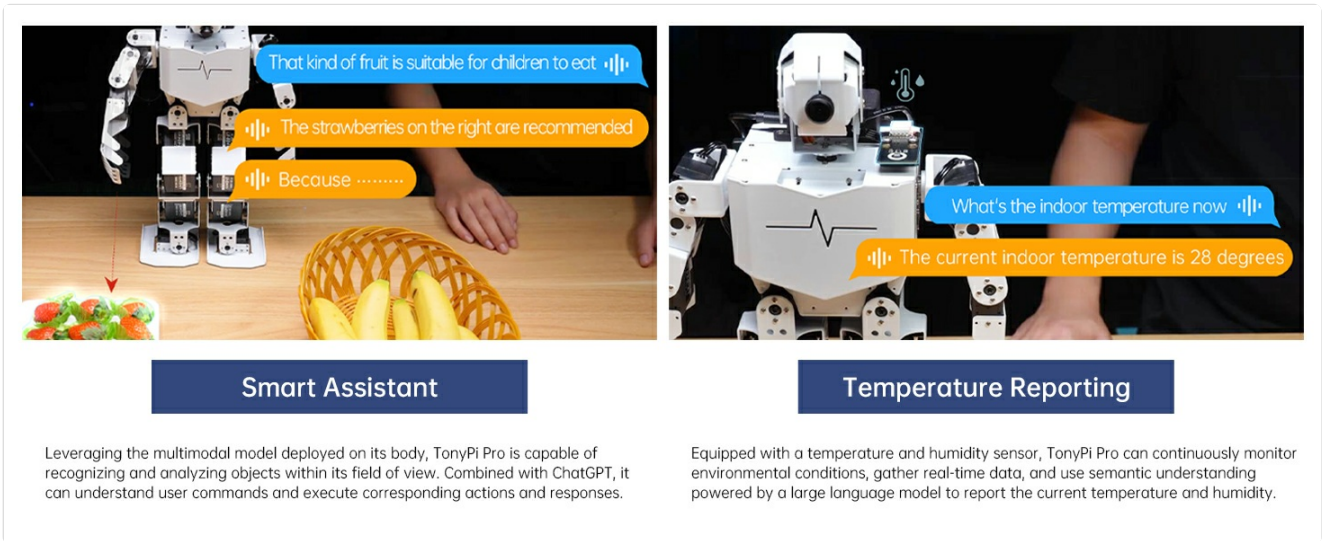
Video 6: TonyPi AI smart robot demonstrating cross hurdle, up & down step, and kick ball for bionics & programming learning.



Upgraded MediaPipe Human-Robot Interaction

TonyPi Pro continuously captures human body features within its visual field and processes them using MediaPipe detection models. Based on real-time analysis, the robot executes corresponding actions, enabling advanced AI capabilities such as face recognition, gesture control, and somatosensory motion control.

Figure 12: TonyPi Pro autonomously crossing hurdles by identifying their position.



Smart Assistant

Leveraging the multimodal model deployed on its body, TonyPi Pro is capable of recognizing and analyzing objects within its field of view. Combined with ChatGPT, it can understand user commands and execute corresponding actions and responses.

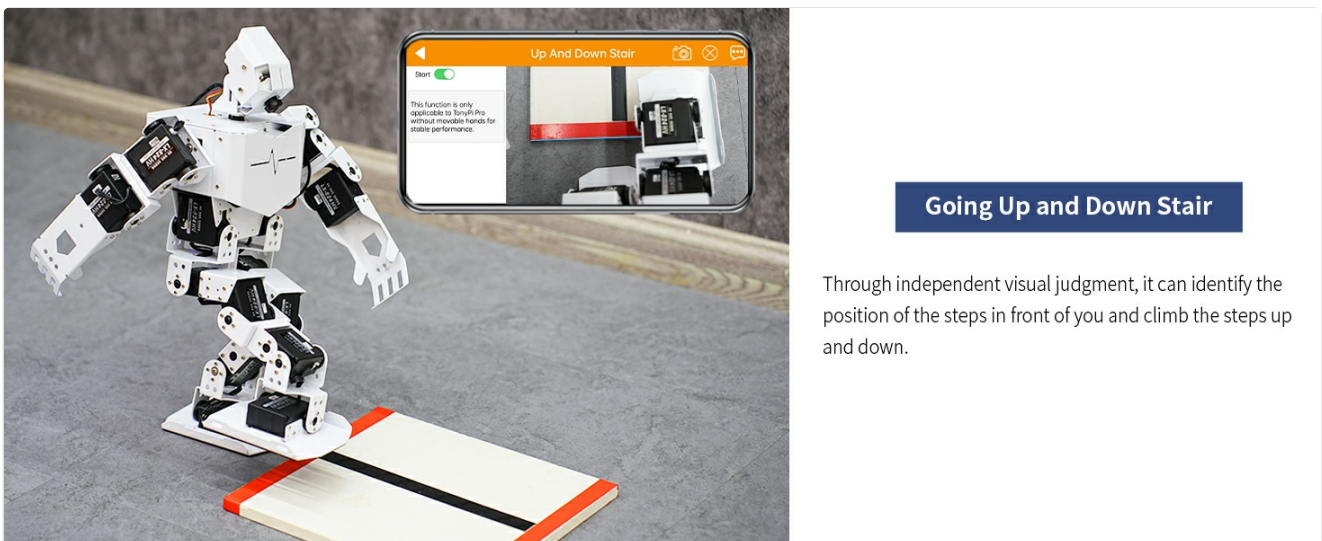
Temperature Reporting

Equipped with a temperature and humidity sensor, TonyPi Pro can continuously monitor environmental conditions, gather real-time data, and use semantic understanding powered by a large language model to report the current temperature and humidity.

Figure 13: TonyPi Pro navigating stairs through independent visual judgment.

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Video 7: Smart AI robot with ChatGPT, Python programming, and Raspberry Pi 5 for intelligent transport tasks.



Going Up and Down Stair

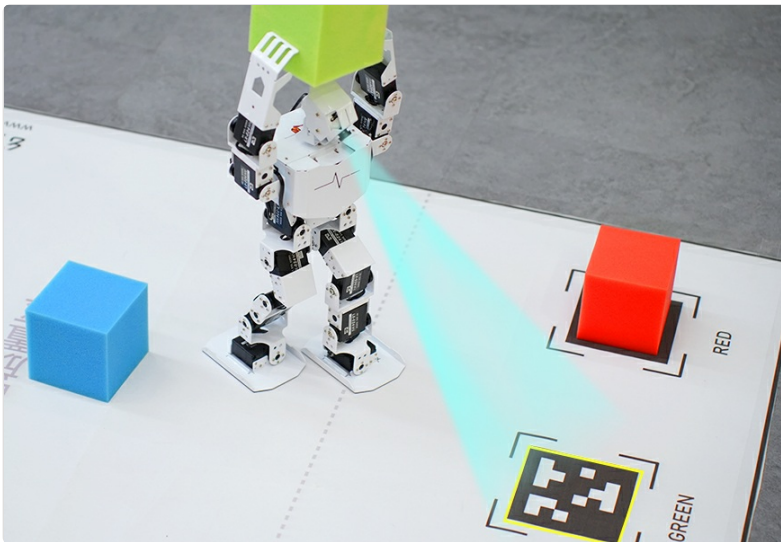
Through independent visual judgment, it can identify the position of the steps in front of you and climb the steps up and down.

Figure 14: TonyPi Pro performing intelligent transport by identifying and moving objects to designated locations.

3.4 Control Methods:

TonyPi Pro can be controlled via a dedicated mobile application (Android/iOS), PC remote control, or PC software with a

graphical interface for editing robot actions.



Intelligent Transport

TonyPi Pro can visually identify the distance of the item, and finally move the target item to the designated tag.

Figure 15: Overview of control methods: APP Control, PC Remote Control, and PC Software Control.

4. MAINTENANCE

Regular maintenance ensures the longevity and optimal performance of your TonyPi Pro robot.

4.1 Cleaning:

Use a soft, dry cloth to clean the robot's exterior. Avoid using abrasive cleaners or solvents that may damage the finish or internal components. Keep the camera lens clean for optimal vision performance.

4.2 Battery Care:

The robot uses a Lithium Ion battery. Always use the provided charger. Do not overcharge or completely drain the battery. Store the robot and battery in a cool, dry place when not in use.

4.3 Servo Maintenance:

The TonyPi Pro is equipped with high-voltage intelligent bus servos. These servos are designed for durability, but avoid excessive force or continuous stalling, which can lead to overheating and damage. If a servo malfunctions, refer to the troubleshooting section or contact support.



Sensor Expansion for Enhanced Functionality

TonyPi Pro is equipped with a comprehensive sensor expansion pack, including a temperature and humidity sensor, ultrasonic sensor, touch sensor, and a range of additional electronic modules. This flexible architecture enables seamless integration into diverse AI applications, supports deep learning tasks, and provides a robust foundation for advanced development and creative exploration.

Figure 16: Details of the intelligent high-voltage bus servos used in TonyPi Pro.

5. TROUBLESHOOTING

This section provides solutions to common issues you might encounter with your TonyPi Pro robot.

Problem	Possible Cause	Solution
Robot does not power on.	Low battery or loose connection.	Ensure battery is charged and securely connected. Check power switch.
AI Vision not tracking objects accurately.	Poor lighting, dirty camera lens, or incorrect software calibration.	Ensure adequate lighting. Clean camera lens. Recalibrate vision software as per manual.
Voice commands not recognized.	Noisy environment, incorrect microphone setup, or software issue.	Reduce background noise. Verify microphone connection and settings. Restart voice recognition software.
Robot movements are jerky or unresponsive.	Loose servo connections, low battery, or software error.	Check all servo connections. Charge battery. Restart robot and software.

6. TECHNICAL SPECIFICATIONS

Detailed specifications for the TonyPi Pro AI Humanoid Robot.



Figure 17: Comprehensive table of TonyPi Pro technical specifications.

- **Package Dimensions:** 17 x 13 x 7 inches
- **Item Weight:** 7 pounds
- **ASIN:** B0C99DDMF9
- **Item Model Number:** [ModelNumberStartingWithTonyPiPro]
- **Manufacturer Recommended Age:** 15 years and up
- **Batteries:** 1 Lithium Ion battery required (included)
- **Manufacturer:** Hiwonder
- **Camera Pixel:** 480P
- **Pan-tilt DOF:** 2DOF
- **Battery Capacity:** 11.1V 2000mAh 10C lithium battery
- **Working Hour:** About 60 minutes
- **Hardware:** Raspberry Pi and Raspberry Pi expansion board
- **Software:** APP + PC software
- **Communication:** WiFi, Ethernet

- **Servo Type:** LX-824HV Bus servo / LFD-01M anti-blocking servo

7. WARRANTY AND SUPPORT

HIWONDER is committed to providing high-quality products and excellent customer service. For any inquiries, technical support, or warranty claims, please refer to the following resources:

- **Online Resources:** Visit the official HIWONDER website for comprehensive learning materials, source codes, software updates, and video tutorials.
- **Customer Service:** Contact HIWONDER customer support directly through their website or the platform where the product was purchased for assistance with any issues.
- **Warranty Information:** Specific warranty details are typically provided with the product packaging. Please retain your proof of purchase for warranty validation.