

6-Axis Robotic Arm



I. Robotic Arm Body

1. The robot adopts an aluminum alloy structure, ensuring durability and strength.
2. Multiple expansion interfaces are provided to support the connection of various peripheral modules such as vision, voice, end-effectors, and conveyor belts.
3. Degrees of Freedom: 6
4. Maximum Payload: $\geq 1\text{kg}$
5. Weight: $\leq 5\text{kg}$
6. Working Radius: $\geq 410\text{mm}$
7. Repeatability: $\leq \pm 0.1\text{mm}$
8. Communication Interfaces: USB, WiFi, Bluetooth, RJ45
9. Control Methods: Supports PC control, mobile app control, and voice control
10. Base Dimensions: $170\text{mm} \times 135\text{mm}$
11. Joint Motion Range:
 - Axis 1: $\pm 130^\circ$
 - Axis 2: -80° to $+90^\circ$
 - Axis 3: -85° to $+40^\circ$
 - Axis 4: -160° to $+160^\circ$
 - Axis 5: -192° to $+15^\circ$
 - Axis 6: $\pm 179^\circ$

12. Open-source code from lower-level driving to upper-level motion modeling and control, allowing the construction of basic kinematic forward and inverse models and learning from the source code.
 13. Based on the ROS operating system, supports rapid development and deployment of commonly used functions such as vision, voice, and sensors on general-purpose platforms.
 14. Supports programming languages such as C, C++, and Python.
 15. The robot base is equipped with an HD LCD screen, supporting touch-based initialization, zeroing, and control of joints, suction cups, and electric grippers, enabling quick teaching and deployment.
 16. Provides at least 7 ROS-based robotics operation system experiments (training projects).
 17. Provides at least 5 robotics kinematics experiments (training projects).
 18. Provides at least 5 basic robotics operation experiments (training projects).
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II. Ascend Processor (Optional)

1. Processor: 1 DaVinciV300 AI core (500MHz clock), 4 TAISHAN V200M processor cores (1.0GHz clock).
 2. Computing Power:
 - 4 TFLOPS in half precision (FP16)
 - 8 TOPS in integer precision (INT8)
 3. Memory: 4GB 64-bit LPDDR4x
 4. Storage: 128GB
 5. Connectivity: Gigabit Ethernet
 6. Display: HDMI × 2
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III. 2D Vision Suite (Optional)

1. Industrial Camera:
 - 6MP, 1/1.8" CMOS GigE industrial area scan camera
 - Resolution: 3072 × 2048
 - Frame Rate: 17 fps
 - Dynamic Range: 71.3dB

- Gain: 0dB to 20dB
 - Exposure Time: 27 μ s to 2.5sec
 - Black and White/Color: Color
 - Interface: GigE
2. Lens:
 - Fixed focal length, manual aperture
 - 6MP FA lens
 - Focal Length: 12mm
 - Aperture: F2.8 to F16
 - Mount: C-Mount
 - Field of View: 1/1.8"
 3. Ring Light Source:
 - LED Type: SMD LEDs
 - Color: White
 - Color Temperature: 6600K
 - Power: 14.4W
 - Input Voltage: DC 24V max.
 - Housing Material: Aluminum Alloy (oxidized and blackened surface)
 - Operating Temperature and Humidity: 0–40°C, 20–85% RH (non-condensing)
 - Includes light source controller
 4. The vision kit includes a support frame for the industrial camera, lens, and ring light source, with height adjustment capabilities.
 5. Vision Software:
 - Provides all interfaces and documentation for OpenCV image processing functions
 - Allows for both parameter-based image processing and the creation of new vision projects for secondary development
 6. Built-in software and function libraries include object classification recognition, target detection, defect detection, OCR character recognition, screw identification, and more, supporting basic applications and development.
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IV. Depth Vision Suite (Optional)

1. Basic Parameters:
 - Operating Environment: Indoor and outdoor

- Depth Technology: Stereo structured light
 - Depth Range: 0.15m – 10m
2. Depth Vision Parameters:
 - Depth Field of View (horizontal × vertical × diagonal): $91^\circ \times 66^\circ \times 101^\circ$
 - Depth Stream Output Resolution: 1280×800
 - Depth Stream Output Frame Rate: $1280 \times 800 @ 90\text{fps}$
 - Minimum Depth Distance (Min-Z): 0.15m
 3. RGB Parameters:
 - RGB Output Resolution: 1920×1080
 - RGB Output Frame Rate: $1920 \times 1080 @ 30\text{fps}$
 - RGB Sensor Field of View (horizontal × vertical × diagonal): $86^\circ \times 55^\circ \times 94^\circ$
 4. Camera Dimensions (length × thickness × height): $90\text{mm} \times 25\text{mm} \times 30\text{mm}$
 5. Provides depth vision-guided robotic arm grasping case. The system supports point cloud analysis through depth vision, enabling the robotic arm to pick unordered objects from a mixed stack.
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V. Voice Recognition Suite (Optional)

1. Plug-and-play, compatible with Windows 10 and Linux systems
 2. Pickup Distance: Approximately 2m in a typical indoor environment, up to 5m in a quiet environment
 3. 360° omnidirectional sound pickup mode, with open function interfaces, supporting custom voice commands
 4. Power Supply: 5V
 5. Open function interface supports the customization of commands, controlling the robot, vision, sensors, and other components to execute specified actions
 6. Provides voice control for robotic arm sorting tasks. Users can issue voice commands to control the robotic arm to pick up specific objects based on the command.
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VI. Conveyor Belt Suite (Optional)

1. Total Length: $\geq 500\text{mm}$, Width: $\geq 100\text{mm}$, Aluminum alloy material
2. Driven by a stepper motor
3. Running Load: $\geq 500\text{g}$

4. Maximum Speed: $\geq 100\text{mm/s}$
 5. Includes two optical sensors: one triggers the vision system to take pictures, and the other sends a signal to the robot to initiate grasping
 6. Belt Material: Black PVC
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VII. Robotic Arm Rail Suite (Optional)

1. Dimensions (L × W): $\geq 720\text{mm} \times 200\text{mm}$
 2. Material: Aluminum alloy
 3. Maximum Load: $\geq 10\text{kg}$
 4. Maximum Speed: $\geq 500\text{mm/s}$
 5. Repeatability: $\leq \pm 0.05\text{mm}$
 6. Includes optical sensors at both ends to stop the robotic arm during movement to prevent damage to the rail.
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VIII. PLC Suite (Optional)

1. Model: Siemens S7-1200 series
 2. Working Memory: 125KB
 3. Power Supply: 24VDC
 4. Onboard Capabilities:
 - DI14x24VDC (sinking/source type), DQ10x24VDC, AI2, AQ2
 5. Communication Module: 3 serial communication ports
 6. Signal Module: 8 I/O expansions
 7. Processing Frequency: 0.04ms/1000 instructions
 8. Interface: 1 PROFINET port
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IX. Wireless Remote Operation Suite (Optional)

1. The remote operation suite includes a gyroscope to synchronize the spatial posture of the arm, enabling synchronized control via hand gestures.
2. Gyroscope Accuracy:
 - Acceleration: 0.01g (0.098m/s²)

- Angular Velocity: $0.06^\circ/\text{s}$
 - Euler Angles: X and Y: 0.05° , Z: 0.1° (without magnetic interference)
3. Wireless Transmission Range: $\geq 50\text{m}$ (in open, unobstructed environments)
 4. Communication Method: Bluetooth 4.2
 5. Data Refresh Rate: 30Hz
 6. Robotic Arm Response Latency: $\leq 20\text{ms}$
 7. Battery Life: ≥ 8 hours (continuous use)
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X. Mobile Robot Suite (Optional)

1. Weight: Approximately 9.8kg
2. Maximum Load: $\geq 10\text{kg}$
3. Lithium Battery Capacity: 12.6V 9000mAh
4. Charging Time: ≤ 4 hours
5. Battery Life: ≥ 5 hours
6. Drive Mode: Mecanum wheels
 - Maximum Speed: 1m/s
 - Minimum Turning Radius: 0m
7. LiDAR:
 - Maximum Range: 20m
 - Scanning Angle: 0-360°
 - Measurement Accuracy: $\pm 3\text{cm}$
8. Positioning and Navigation: Laser SLAM mapping, real-time navigation, intelligent obstacle avoidance, optimal path mode, and autonomous movement to designated locations
9. Open communication interfaces support external device and hardware expansions, allowing secondary development.
10. Provides main control system and computational unit with open communication interfaces for peripheral and hardware expansions, supporting secondary development.