## KernalMind- Apex VR Teleoperation System



**Integrated platform for remote operation and data acquisition of robotic arms and grippers**

It captures operator motion and visual input through a VR headset and data gloves, utilizes ROS 2 to handle command publishing and state feedback (via Topics and Services), and drives low-level execution through the MARVIN SDK over UDP.

On the visual side, GStreamer is used for video capture, encoding (MP4), and RTSP streaming (ports 8554/8555).

The system synchronously records robotic arm data (in MCAP format) and video data, aligns them via timestamps to generate structured multimodal datasets, and supports conversion to the LeRobot training format as well as visualization with Rerun—enabling a complete pipeline from teleoperation and data processing to model training.

Support first-person visual passthrough and enable remote teleoperation.

| Teleoperation System | Category | Specification |
|---|---|---|
| | Platform Positioning | Marvin6-Apex Teleoperation System |
| | Control Modes | Position Control + Impedance Control |
| | Control Frequency | 500 Hz |
| | Data Sampling Rate | 500 Hz |
| | Communication Interface | Ethernet/CAN-FD |
| | ROS Support | ROS 2 Supported |
| | Data Formats | HDF5, RLDS |
| | End-to-End Latency | ⩽ 100 ms |
| | Degrees of Freedom | 16 DOF |
| | Power Consumption | 300 W (Average), 600 W (Peak) |
| | Operating Voltage Range | 48 V (+15%) |
| | Video Resolution | 2560 x 720 |
| | Frame Rate | 30 FPS |
| | Transparent Transmission | Supported |
| | Compatible Dexterous Hand Platforms | Wuji, Sharpa, Qiangnao, etc |
| | Optional End Effectors | Vision-Tactile Gripper |
| | Adaptable remote operation platform | meta quest3 / pico |

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# Marvin Pro

## Fixed Force-Controlled Humanoid Dual-Arm Platform

# Marvin Pro

Marvin Pro is a fixed dual-arm robot integrating strong manipulation capability, high-precision data acquisition, high computing power, and a minimalist structure.
Featuring a fixed-height rigid base and a simplified design with a non-movable head, it significantly reduces cost and deployment complexity.
Equipped with a standard 5-camera panoramic vision system and dual 7DoF arms with high-precision force control, it is perfectly suited for industrial fixed-station assembly, fixed-position scientific experiments, high-precision vision, and force-controlled data acquisition applications.



## Fixed Base · High-Precision Stable Operation

14 DoF (excluding dexterous hands) with a fixed rigid stand. By removing the mobile chassis and folding body while retaining dual 7 DoF force-controlled arms, the structure stays lean with maximized stability and optimized cost.
Designed for high-precision fixed-point operation, it delivers repeatability of ±0.03 mm—meeting the stringent requirements of industrial assembly, scientific experiments, and force-controlled data acquisition.

## Full-body dual-arm force control · Safe human-robot interaction

Paradigm shift from "position control" to "force and impedance control"
Dual-arm models come standard with force control; single-arm models support a maximum rated payload of 6 kg and repeatability of ±0.03 mm, achieving full-body compliant impedance control.

Collision detection automatically reduces joint stiffness to ensure safe human-robot collaboration, with smooth, human-like motions free of rigid starts, stops, or vibrations.



## Robotic Arm System

### 14 DoF

7DoF × 2 Full Force-Controlled Dual Arms

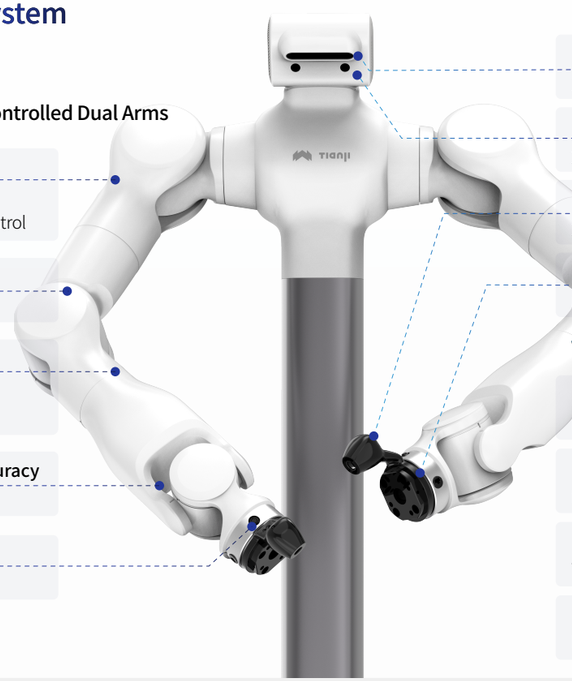
**Dual-arm Force Control**
Impedance Control
Force-Position Hybrid Control

**Rated Payload**
M6 Lite：5kg | M6：6kg

**Working Radius**
M6lite_615 | 680 |750mm
M6_696 | 809mm

**Repeat Positioning Accuracy**
±0.03mm / ±0.04mm

**End Interface**
RS485/CAN/EtherCAT



## Perception System

**Head RGBD**
1 × D435 Depth Camera

**Head RGB**
2 × SH5WG Cameras

**Wrist RGB**
2 × SH5WG or D405GA

**6-Axis Force Sensor**
End Effector Optional

## VR Teleoperation System

**VR Headset**
First-Person View Video Transmission

**Data Controller**
Motion Capture & Data Acquisition

**ROS2 Communication**
Topics/Services

**Data Format**
HDF5/RLDS/MCAP

# Marvin Pro

## Fixed Force-Controlled Humanoid Dual-Arm Platform

| Robot Arm Parameters | M6LITE_615 | M6LITE_680 | M6LITE_750 | M6_696 | M6_809 |
|---|---|---|---|---|---|
| Model | Marvin M6s-Lite-CCS-615-V1.0 | Marvin M6s-Lite-CCS-680-V1.0 | Marvin M6s-Lite-CCS-750-V1.0 | Marvin M6S-CCS-696-V1.0 | Marvin M6S-CCS-809-V1.0 |
| Configuration | 7-axis humanoid arm | | | | |
| Degrees of Freedom | 7 DoF | | | | |
| Wrist Type | Cross-type intersecting-axis wrist | | | | |
| Reach / Working Radius | 615 mm | 680 mm | 750 mm | 696 mm | 809 mm |
| Payload | 5 kg | 4 kg | 3 kg | 6 kg | 5 kg |
| Pose Repeatability | ±0.03 mm | ±0.03 mm | ±0.03 mm | ±0.03 mm | ±0.04 mm |
| Force Repeatability | ≤ 0.15 N / ≤ 0.05 N·m | | | | |
| Max TCP Speed | 1.5 m/s | 1.5 m/s | 1.5 m/s | 2 m/s | 2 m/s |
| Max Joint Speed | 3.14 rad/s (180°/s) | | | | |
| Motion Range J1 | ±173° | ±173° | ±173° | ±178° | ±178° |
| Motion Range J2 | ±120° | | | | |
| Motion Range J3 | ±173° | ±173° | ±173° | ±178° | ±178° |
| Motion Range J4 | -145° ~ +45° | -145° ~ +45° | -145° ~ +45° | -145° ~ +60° | -145° ~ +60° |
| Motion Range J5 | ±173° | ±173° | ±173° | ±178° | ±178° |
| Motion Range J6 | ±60° | | | | |
| Motion Range J7 | ±90° | | | | |
| Braking | With brakes on J1–J4 | With brakes on J1–J4 | With brakes on J1–J4 | Brakes on all joints (J1–J7) | Brakes on all joints (J1–J7) |
| Weight | 8.0 kg | 8.7 kg | 8.8 kg | 12.45 kg | 12.7 kg |
| Control Modes | Position control, impedance control, hybrid force/position control | | | | |
| Communication Protocol | 1 kHz EtherCAT | | | | |
| End-Effector Interface | RS485, CAN, EtherCAT | | | | |
| 6-Axis Force/Torque Sensor (end-effector) | Optional | | | | |
| End-of-Arm Dexterous Hand | In-house gripper, Wuji dexterous hand, and compatibility with mainstream dexterous hands | | | | |
| **Integrated System Specifications** | **Specification** | | | | |
| Whole-Machine Degrees of Freedom | 14 DoF (excluding dexterous hands; 7 DoF × 2 arms) | | | | |
| Base Type | Fixed rigid mounting stand | | | | |
| Head | Fixed, no degrees of freedom | | | | |
| Working Space | 0.6 – 1.8 m | | | | |
| Total Weight | Approx. 80 kg | | | | |
| Force Control | Full force control on both arms (standard) | | | | |
| Communication Interfaces | Wi-Fi, Ethernet | | | | |
| **Vision & Perception System** | **Function** | | | | |
| Head (1× D435 RGB-D + 2× SH5WG RGB) | Environmental perception, global localization, point-cloud capture, object recognition | | | | |
| Wrists (2× SH5WG RGB, or D405GA) | Fine end-effector positioning, workpiece inspection, visual guidance for manipulation | | | | |
| Total (5 cameras) | Standard on all models | | | | |
| **Computing Platform** | **Option 1** | | **Option 2** | | |
| Main Compute Platform | NVIDIA Jetson Orin AGX 64G (275 TOPS) | | NVIDIA Thor | | |
| CPU | 12 cores, up to 2.2 GHz | | 14 cores, up to 2.6 GHz | | |
| GPU | Up to 1.3 GHz | | Up to 1.53 GHz | | |
| **Electrical Specifications** | **Specification** | | | | |
| Power Supply | Direct mains supply (AC 220 V) / adaptable to international voltages | | | | |
| Operating Duration | 24/7 continuous operation | | | | |
| Charging / Battery | None (fixed power supply, no battery module) | | | | |