

LewanSoul WonderMV

LewanSoul WonderMV K210 Vision Camera Module User Manual

Model: WonderMV

1. INTRODUCTION

The LewanSoul WonderMV K210 Vision Camera Module is an advanced AI vision module designed for integration with various microcontrollers such as Arduino, Raspberry Pi, Jetson Nano, and ESP32. Built on the Kendryte K210 AI chip, it offers high-performance computing for neural network operations and supports a wide range of AI image recognition tasks. This manual provides essential information for setting up, operating, and maintaining your WonderMV module.

2. PRODUCT OVERVIEW

2.1 Key Features

- **K210 Chip-Based Performance:** Features a 64-bit RISC-V kernel processor and 1TOPS computing power for efficient AI tasks.
- **Multi-Functional AI Vision:** Supports color recognition, road sign recognition, vision line following, face recognition, tag recognition, QR code & barcode recognition, feature detection, and number recognition.
- **LCD Capacitive Touch Screen:** 2-inch screen with 320x240 resolution and 2-megapixel camera for debugging and control.
- **Connectivity:** Integrates serial and I2C ports for easy connection with various sensors and controllers.
- **Open-Source Code:** Fully open-source program code with extensive development materials and tutorials.
- **Multi-Controller Compatibility:** Seamless connection with Arduino, Raspberry Pi, Micro, STM32, and more.

2.2 Module Components and Functions

The WonderMV module integrates several key components for its operation:

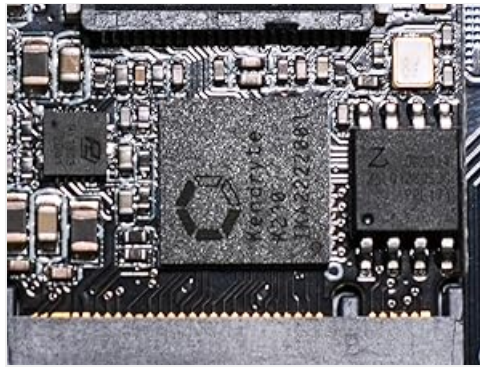


Figure 1: Vision Module Function Diagram. This diagram illustrates the various components of the K210 vision module, including the K210 chip, Type-C port, I2C port, UART serial port, TF card slot, 128Mbit Flash storage chip, power management chip, fill light, LED, and customizable keys (K1, K2).

2.3 Powerful Hardware

The WonderMV module is built with robust hardware components to ensure reliable performance:

- **Metal Shell:** Industrial-grade craft for durability.
- **200W HD Camera:** High-definition camera for clear image capture.
- **Dual Communication Ports:** For versatile connectivity.
- **LEGO-Compatible Holes:** For easy integration into robotic and maker projects.



Figure 2: Powerful Hardware Features. This image highlights the robust design of the WonderMV module, showcasing its metal shell, 200W HD camera, dual communication ports, and LEGO-compatible mounting holes.

2.4 Kit Contents

The WonderMV Vision Module Kit includes the following items:



Figure 3: WonderMV Vision Module Kit Packing List. The kit typically includes the WonderMV vision module, a Type-C data cable, 4PIN wires, a 32GB SD card with card reader, waste cards, traffic sign cards, number cards, and tags for various recognition tasks.

3. SETUP

3.1 Connecting to Controllers

The WonderMV module can be connected to various microcontrollers using its serial and I2C interfaces. Ensure proper wiring for power and data communication.

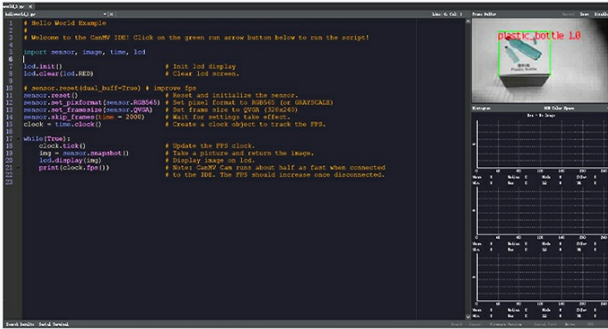


Figure 4: Wiring Diagram with Various Controllers. This diagram illustrates how to connect the WonderMV module to common development boards like Arduino, Raspberry Pi, and others, detailing the 5V, GND, RX, and TX connections. A Type-C cable provides 5V power and data for the module.

3.2 Development Environment

The WonderMV module supports the CanMV IDE and MicroPython for development. Users are encouraged to utilize the provided development materials and tutorials to set up their environment.

CanMV Development Environment



Programming with MicroPython

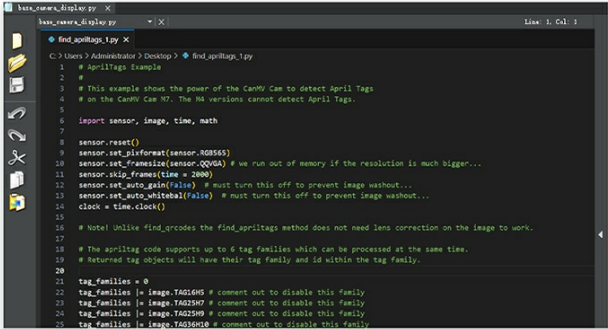


Figure 5: CanMV Development Environment and MicroPython Programming. Screenshots show the CanMV IDE interface and example MicroPython code, demonstrating the programming environment for the WonderMV module.

4. OPERATION

4.1 AI Vision Functions

The WonderMV module offers a variety of AI vision capabilities:



Figure 6: AI Vision Intelligent Expansion. This image displays the module's diverse AI functions, including QR code recognition, barcode recognition, handwritten number recognition, face detection, mask identification, object recognition, autonomous learning and classification, color recognition, and autonomous driving.

4.1.1 Number and Code Recognition

The module can recognize AprilTags, barcodes, QR codes, and handwritten numbers. This functionality is useful for various automation and data entry applications.

<p>AprilTag Recognition</p>	<p>Barcode Recognition</p>	<p>Powerful Number & Code Recognition Capability</p>
<p>QR Code Recognition</p>	<p>Handwritten Number Recognition</p>	

Figure 7: Powerful Number & Code Recognition Capability. Examples of the module successfully identifying AprilTags, barcodes, QR codes, and handwritten numbers.

4.1.2 Face Functions

The WonderMV module can perform face detection, face feature detection, mask identification, and face recognition, enabling applications in security or interactive systems.

<p>Abundant Face Function</p>	<p>Face Detection</p>	<p>Face Feature Detection</p>
	<p>Mask Identification</p>	<p>Face Recognition</p>

The WonderMV vision module can realize interesting gameplay such as face detection, face feature detection, mask identification, and face recognition, helping you quickly learn AI visual creative projects.

Figure 8: Abundant Face Function. Visual examples of the module's face detection, face feature detection, mask identification, and face recognition capabilities.

4.1.3 Object Recognition

The module can identify up to 20 different types of objects, including common items like animals, furniture, and vehicles. It frames the target and displays its name on the screen, and can transmit data via serial communication.

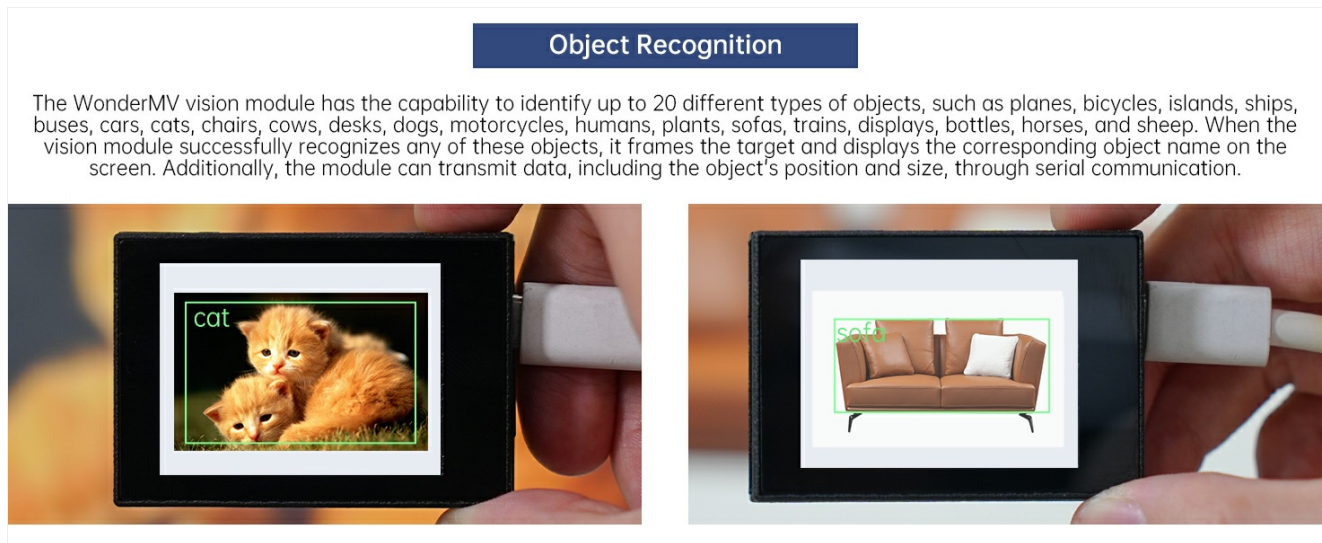


Figure 9: Object Recognition. The module successfully identifies a 'cat' and a 'sofa' in these examples, outlining the objects and displaying their labels.

4.1.4 Autonomous Learning and Classification

Users can enable autonomous learning by capturing multiple pictures of an object. The module extracts features, learns, and classifies objects, comparing new images to recorded data to determine class and score.

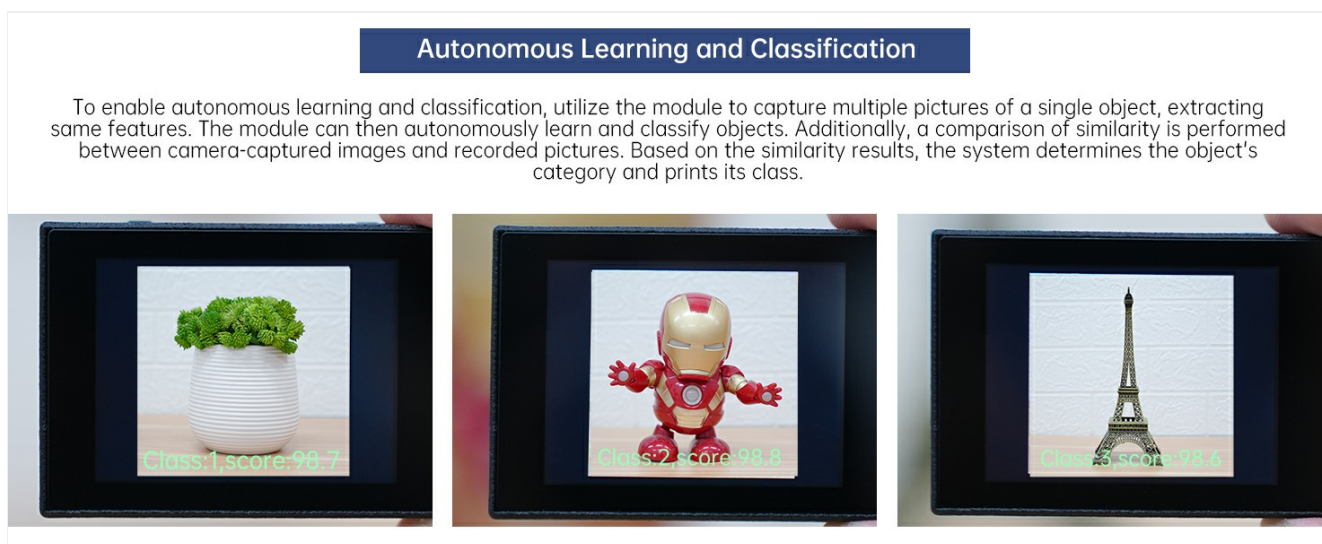


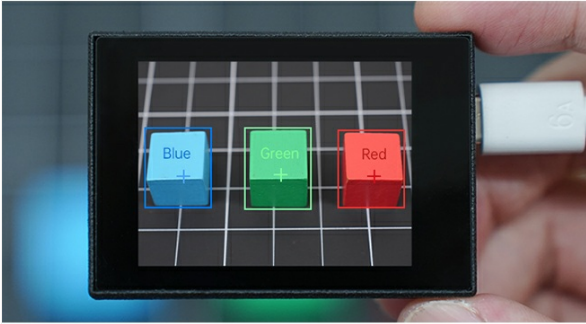
Figure 10: Autonomous Learning and Classification. Examples show the module classifying objects into different classes with a confidence score, such as a plant (Class 1), an Iron Man figure (Class 2), and the Eiffel Tower (Class 3).

4.1.5 Color Recognition and Autonomous Driving

The K210 vision module can accurately identify and outline colors of objects. Through serial communication, an external control device can retrieve detailed information about the position and size of colored blocks. It also supports vision line following for autonomous driving applications.

Color Recognition

The K210 vision module can accurately identify the colors of objects on the screen and outline them. Through serial communication, the external control device can retrieve detailed information about the position and size of blocks in various colors.



Autonomous Driving (Vision Line Following)

The K210 vision module recognizes colored lines on the screen and frames them. Utilizing the serial port, the external device can acquire data such as the offset, angle, and direction of the line on the screen, enabling smooth vision line following.

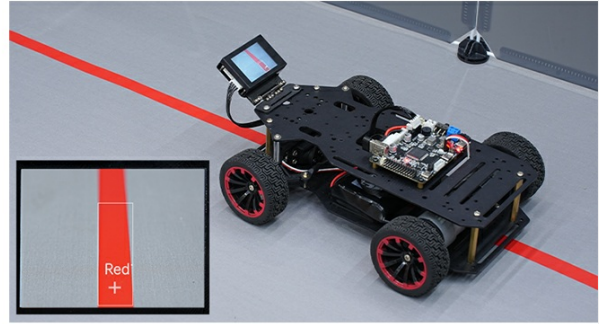


Figure 11: Color Recognition and Autonomous Driving (Vision Line Following). The left image shows the module recognizing blue, green, and red blocks. The right image demonstrates the module performing vision line following for an autonomous vehicle.

4.2 Physical Integration

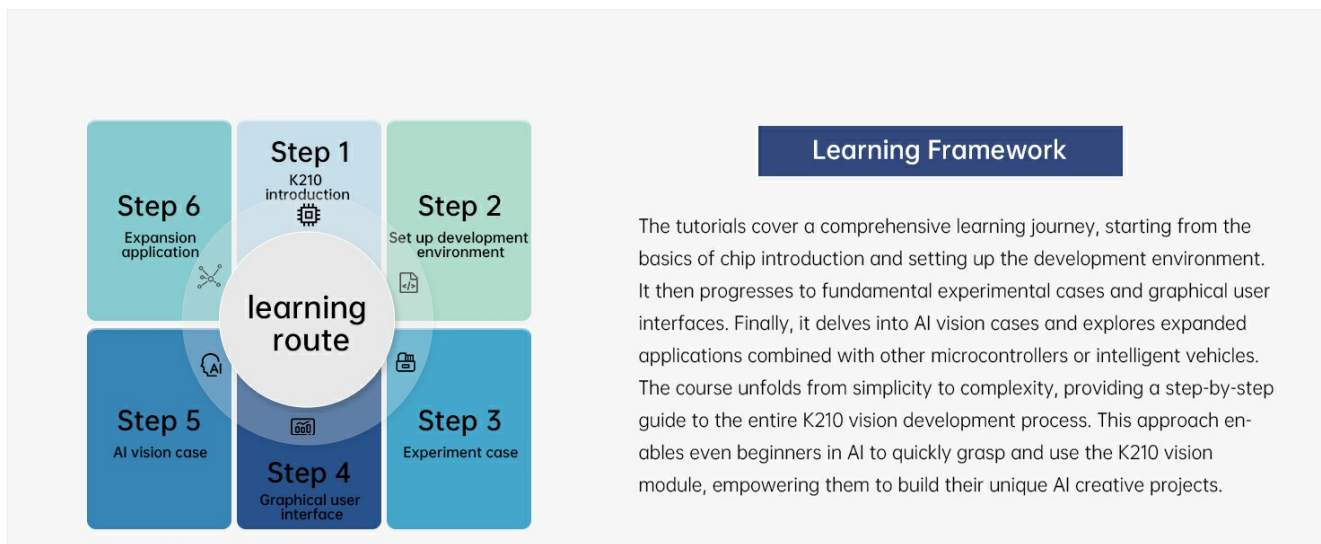
The module supports expansion with a bracket for adjustable positioning, facilitating integration into various robotic or custom projects.



Figure 12: Support Bracket Expansion. This image illustrates the use of an adjustable hinge bracket to mount the WonderMV module, allowing for flexible positioning in projects like robotic arms.

4.3 Learning Framework

LewanSoul provides a comprehensive learning framework to guide users through the development process, from basic chip introduction to advanced AI vision applications.



Learning Framework

The tutorials cover a comprehensive learning journey, starting from the basics of chip introduction and setting up the development environment. It then progresses to fundamental experimental cases and graphical user interfaces. Finally, it delves into AI vision cases and explores expanded applications combined with other microcontrollers or intelligent vehicles. The course unfolds from simplicity to complexity, providing a step-by-step guide to the entire K210 vision development process. This approach enables even beginners in AI to quickly grasp and use the K210 vision module, empowering them to build their unique AI creative projects.

Figure 13: Learning Framework. This diagram outlines a structured learning path, covering K210 introduction, development environment setup, experimental cases, graphical user interfaces, AI vision cases, and expansion applications.

5. MAINTENANCE

To ensure the longevity and optimal performance of your WonderMV K210 Vision Camera Module, follow these general maintenance guidelines:

- **Keep Clean:** Regularly clean the camera lens and screen with a soft, dry, lint-free cloth. Avoid abrasive materials or harsh chemicals.
- **Handle with Care:** Avoid dropping the module or subjecting it to strong impacts.
- **Proper Storage:** Store the module in a dry, dust-free environment away from extreme temperatures and direct sunlight.
- **Power Supply:** Always use a stable 5V power supply to prevent damage to the module.
- **Firmware Updates:** Periodically check the official LewanSoul website or community forums for firmware updates to ensure you have the latest features and bug fixes.

6. TROUBLESHOOTING

If you encounter issues with your WonderMV K210 Vision Camera Module, consider the following troubleshooting steps:

- **No Power:** Ensure the Type-C cable is securely connected and the power source is providing a stable 5V. Check the power indicator LED on the module.
- **Screen Not Displaying:** Verify power connection. If connected to a host, ensure the host is properly initialized and sending display commands.
- **Communication Issues:** Double-check wiring for serial (RX/TX) and I2C connections. Ensure baud rates and I2C addresses are correctly configured in your code.
- **AI Function Not Working:** Confirm that the correct firmware is loaded and the necessary libraries are installed. Ensure the lighting conditions are adequate for image recognition.
- **Module Overheating:** Ensure adequate ventilation around the module. If persistent, reduce workload or check for short circuits. The module includes a heat sink for normal operation.
- **SD Card Not Detected:** Ensure the SD card is properly inserted into the TF card slot. Verify the card is formatted correctly (FAT32) and not corrupted.

For further assistance, refer to the official documentation and community resources provided by LewanSoul.

7. SPECIFICATIONS

7.1 WonderMV Vision Module Parameters

Parameter	Value
Processor	Kendryte K210
Chip architecture	RISC-V architecture
Development environment	CanMV IDE
Camera	2 megapixel
Power supply	5.0V
Working current	about 300mA
Interface	Type-C, UART, IIC
Display	LCD capacitive touch screen with a resolution of 320x240
Display size	2.0 inch
Built-in function	MicroPython firmware
LED	User-defined LED light
Fill light	Supply light for dim environments, customizable by the user
TF card slot	TF card can be inserted. 32GB TF card is recommended
Key	2 (Costume function key)
Size	58.9*40.7*16.2mm
Weight	45g

7.2 K210 Chip Basic Parameters

Parameter	Value
Core	RISC-V Dual Core 64bit, with FPU
Main frequency	400MHz (can be boosted to 600MHz)
Chip Manufacturing Process	TSMC's advanced 28-nanometer ultra-low power process
Core instruction set	RISC-V, a simplified instruction set
Safety	Supports firmware encryption, AES, and SHA256 encryption algorithms
SRAM	Built-in 8 megabytes.
Image recognition	QVGA@60fps VGA@30fps
Voice recognition	Microphone array (8 mics)

Parameter	Value
AI Vision	Equipped with KPU, supports convolutional neural network calculations, and more. Supports YOLOv3&MobileNetv2 TinyYOLOv2, face recognition, and others
Network models	Compatible with TensorFlow/Keras/Caffe/Caffe2, among other mainstream frameworks
Peripheral interfaces	GPIO, FPIOA, UART, Timer, SPI, I2C, I2S
Operating temperature	-30°C to 85°C
Operating voltage	Dual voltage support at 3.3V, 1.8V, eliminating the need for level shifting



Figure 14: WonderMV Vision Module and K210 Chip Parameters. Detailed tables outlining the technical specifications for both the WonderMV module and its core K210 chip.

7.3 Dimensions

The physical dimensions of the K210 Vision Module and its adjustable hinge bracket are provided below:



Figure 15: K210 Vision Module and Adjustable Hinge Bracket Dimensions. Technical drawings with measurements in millimeters for the K210 Vision Module and its compatible adjustable hinge bracket.

8. WARRANTY INFORMATION

There is no explicit warranty description provided for the LewanSoul WonderMV K210 Vision Camera Module. Please refer to the retailer's return policy or contact LewanSoul directly for any specific warranty inquiries.

9. SUPPORT

LewanSoul is committed to providing support for its products. For technical assistance, development resources, or further inquiries, please utilize the following resources:

- **Official Website:** Visit the LewanSoul official website for documentation, tutorials, and software downloads.
- **Community Forums:** Engage with the developer community for shared knowledge and troubleshooting tips.
- **Customer Service:** Contact LewanSoul customer service for direct support regarding product issues or questions.

LewanSoul aims to make programming, robotics, and AI accessible to all by providing abundant learning resources, source codes, software, and technological support.