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XYGStudy JetRacer

XYGStudy JetRacer AI Kit Instruction Manual

Autonomous AI Racing Robot Car

1. Introduction

The XYGStudy JetRacer AI Kit is an advanced autonomous AI racing robot car designed for deep learning and self-driving applications. Powered by the NVIDIA Jetson Nano, this kit enables interactive programming via a web browser, facilitating high frame rate processing through torch2trt (PyTorch to TensorRT translator) for efficient autonomous line following. It also supports the DonkeyCar open-source project, utilizing deep learning frameworks like Keras/TensorFlow and the OpenCV computer vision library to achieve self-driving capabilities.

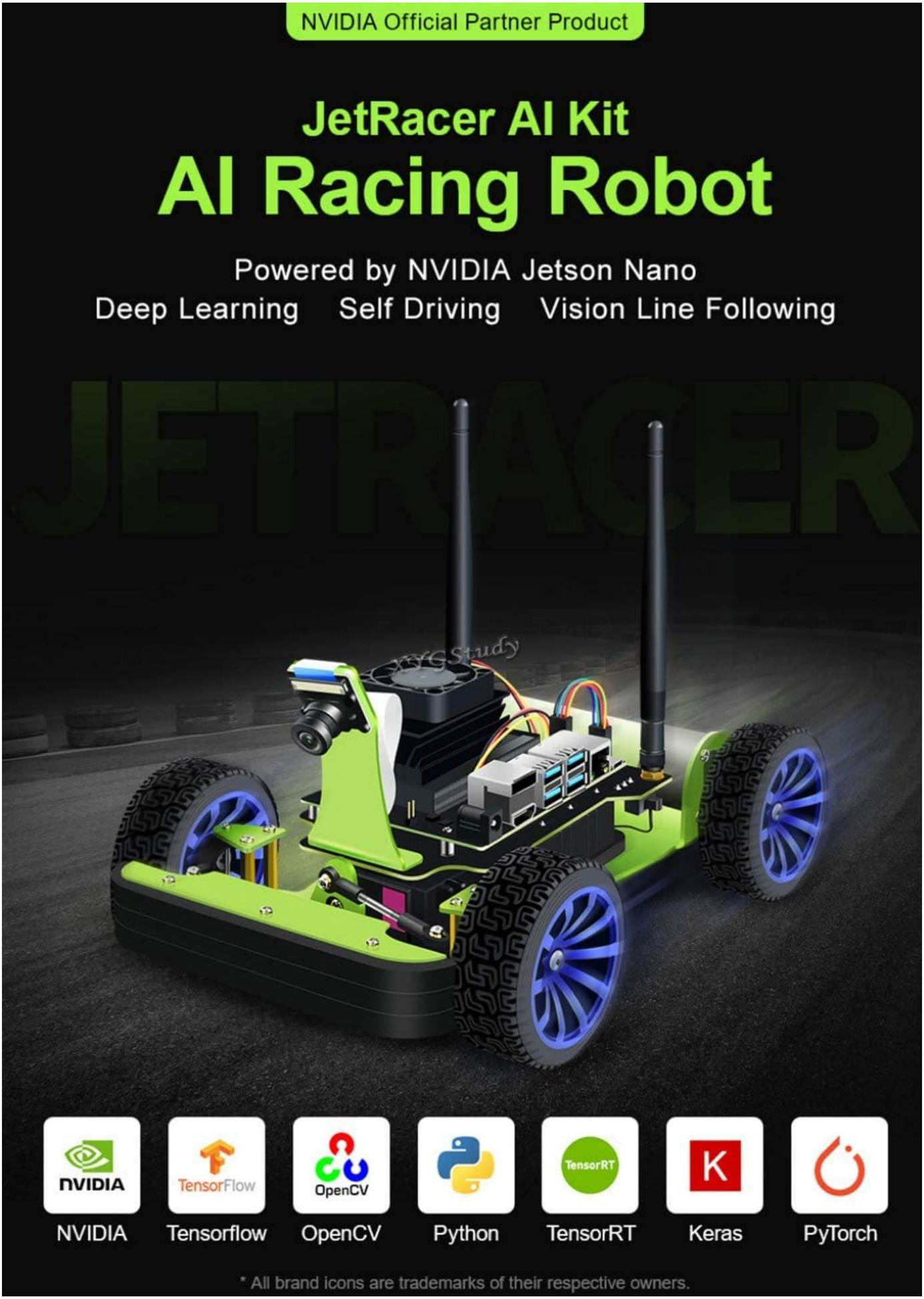


Figure 1: Overview of the JetRacer AI Kit, highlighting its AI and deep learning capabilities.

2. Package Contents

Verify that all components listed below are present in your package. Please note that the NVIDIA Jetson Nano Developer Kit and 18650 batteries are **not included** and must be acquired separately.

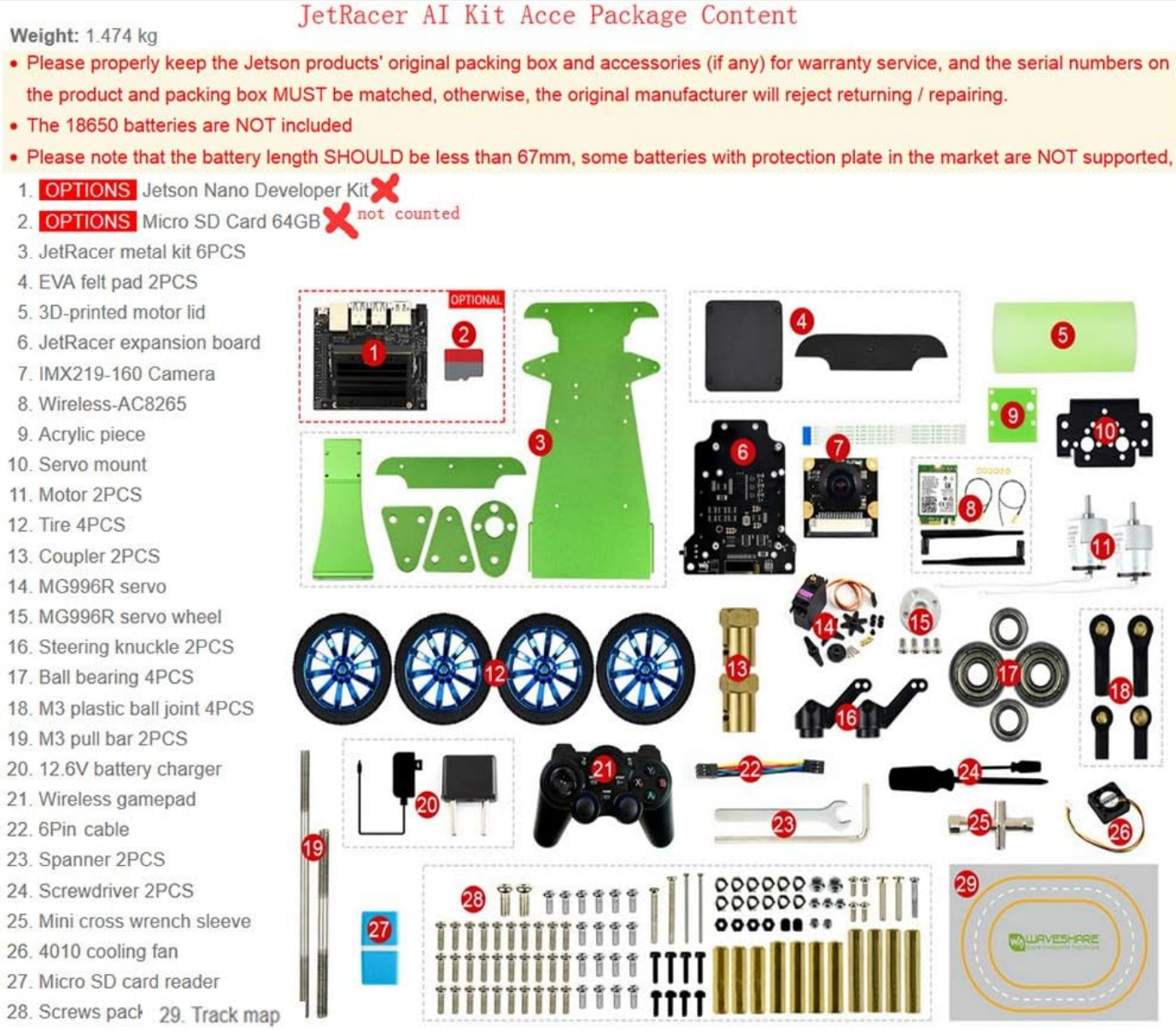


Figure 2: Detailed diagram of all components included in the JetRacer AI Kit package.

- JetRacer metal kit (6 PCS)
- EVA felt pad (2 PCS)
- 3D-printed motor lid
- JetRacer expansion board
- IMX219-160 Camera
- Wireless-AC8265 NIC
- Acrylic piece
- Servo mount
- Motor (2 PCS)
- Tire (4 PCS)
- Coupler (2 PCS)
- MG996R servo
- MG996R servo wheel

- Steering knuckle (2 PCS)
- Ball bearing (4 PCS)
- M3 plastic ball joint (4 PCS)
- M3 pull bar (2 PCS)
- 12.6V battery charger
- Wireless gamepad
- 6Pin cable
- Spanner (2 PCS)
- Screwdriver (2 PCS)
- Mini cross wrench sleeve
- 4010 cooling fan
- Micro SD card reader
- Screws pack
- Track map (digital 3m x 2m image provided)

Note: The Jetson Nano Developer Kit and 18650 batteries are essential for operation but are **not included** in this package. Ensure the battery length is less than 67mm if using 18650 batteries with protection plates.

3. Setup and Assembly

The JetRacer AI Kit is designed for simple assembly. Follow the general steps below to set up your robot car. Detailed visual instructions are typically provided with the kit or through online resources.

3.1. Core Components Integration

1. **Jetson Nano Installation:** Mount your NVIDIA Jetson Nano Developer Kit onto the designated area on the JetRacer expansion board. Ensure proper alignment and secure fastening.
2. **Expansion Board:** The highly integrated JetRacer expansion board simplifies wiring. Connect the Jetson Nano and other peripherals as indicated in the assembly diagrams.
3. **Camera Setup:** Install the IMX219-160 Camera into its mount, ensuring the lens is clear and facing forward. Connect the camera ribbon cable to the Jetson Nano's camera port.
4. **Wireless NIC:** Install the Wireless-AC8265 module for Wi-Fi and Bluetooth connectivity.

3.2. Mechanical Assembly

1. **Motor and Wheel Assembly:** Attach the motors to the chassis using the provided motor lids and screws. Secure the couplers to the motor shafts, then mount the tires onto the couplers.
2. **Steering Mechanism:** Assemble the MG996R servo, servo wheel, steering knuckles, ball bearings, plastic ball joints, and pull bars to form the steering system. Connect the servo to the expansion board.
3. **Chassis Assembly:** Connect the metal kit components to form the main chassis structure.

3.3. Power and Software

1. **Battery Installation:** Insert two 18650 batteries (not included) into the battery holder on the expansion board. Ensure correct polarity. The expansion board includes battery voltage detection.
2. **Software Configuration:** Install the necessary operating system (Linux), drivers, and AI frameworks (Keras/TensorFlow, OpenCV) on your Jetson Nano. Refer to the official NVIDIA Jetson Nano documentation and DonkeyCar project guides for detailed software setup instructions.

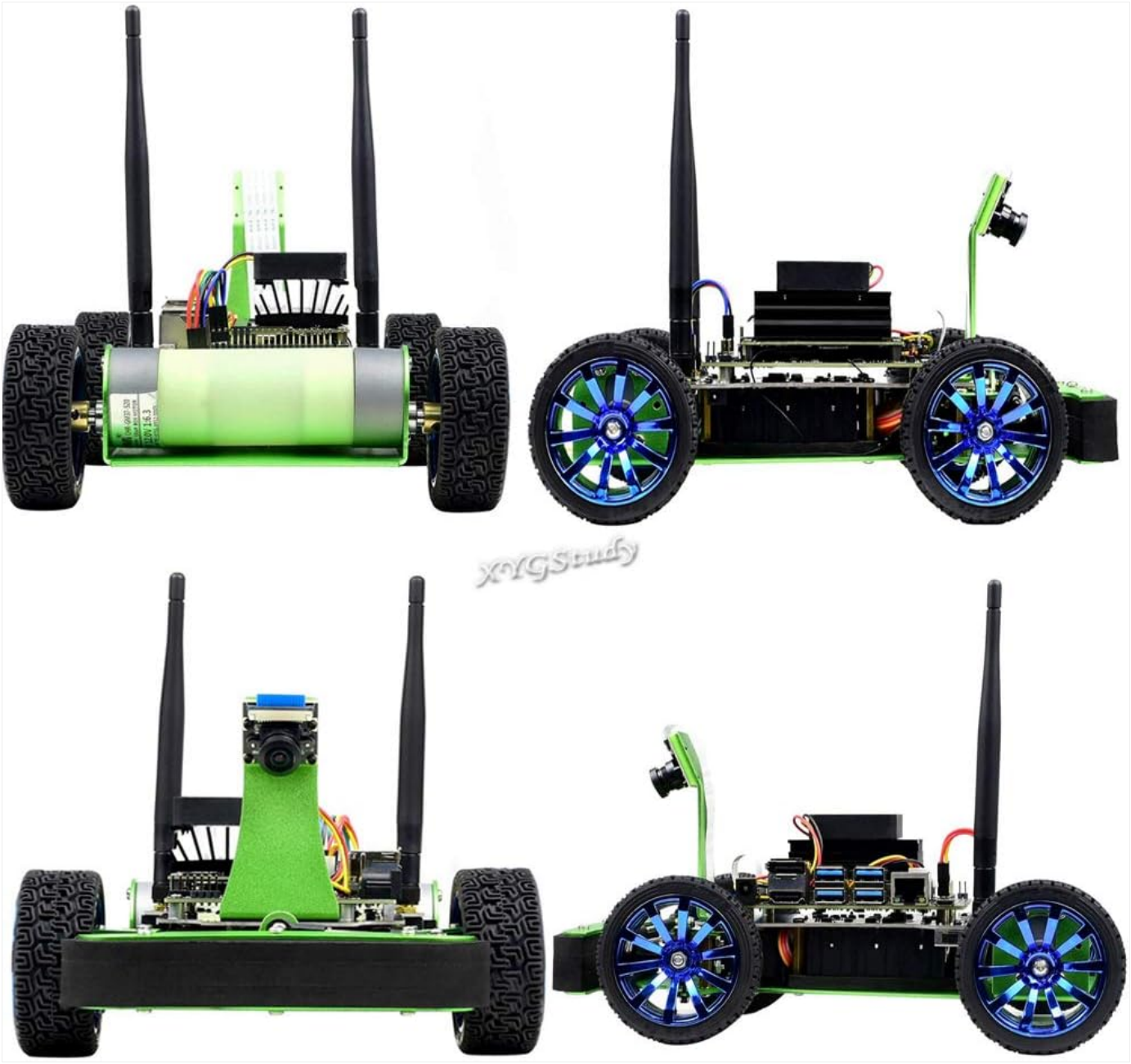


Figure 3: Various views of the fully assembled JetRacer AI Kit.

4. Operating Instructions

The JetRacer AI Kit offers multiple control methods and supports advanced AI driving functionalities.

4.1. Powering On and Initial Connection

1. Ensure batteries are charged and correctly installed.
2. Power on the Jetson Nano and the JetRacer expansion board.
3. Connect to the JetRacer's Wi-Fi network using a PC or mobile device.

4.2. Control Methods

You can control the JetRacer using one of the following methods:

- **Wireless Gamepad:** Use the included wireless gamepad for direct manual control.
- **PC Web Page:** Access the JetRacer's web interface from your computer's browser for control and monitoring.
- **Mobile Page:** Control the JetRacer via a dedicated mobile web interface on your smartphone or tablet.



Figure 4: Various control methods available for the JetRacer AI Kit.

4.3. AI Driving Functionality

The JetRacer is designed for autonomous driving through a three-step process:

1. **Data Collection:** Use the integrated camera to collect driving data (images and corresponding steering/throttle inputs) by manually driving the car on a track.
2. **Model Training:** Utilize deep learning frameworks (Keras/TensorFlow) on the Jetson Nano to train a neural network model using the collected data. This model learns to associate visual input with driving commands.

3. **Autonomous Driving:** Deploy the trained model on the JetRacer. The car will then use its camera to perceive the track and apply the learned driving commands to navigate autonomously, including line following. The torch2trt optimization ensures high frame rates for faster autonomous driving.

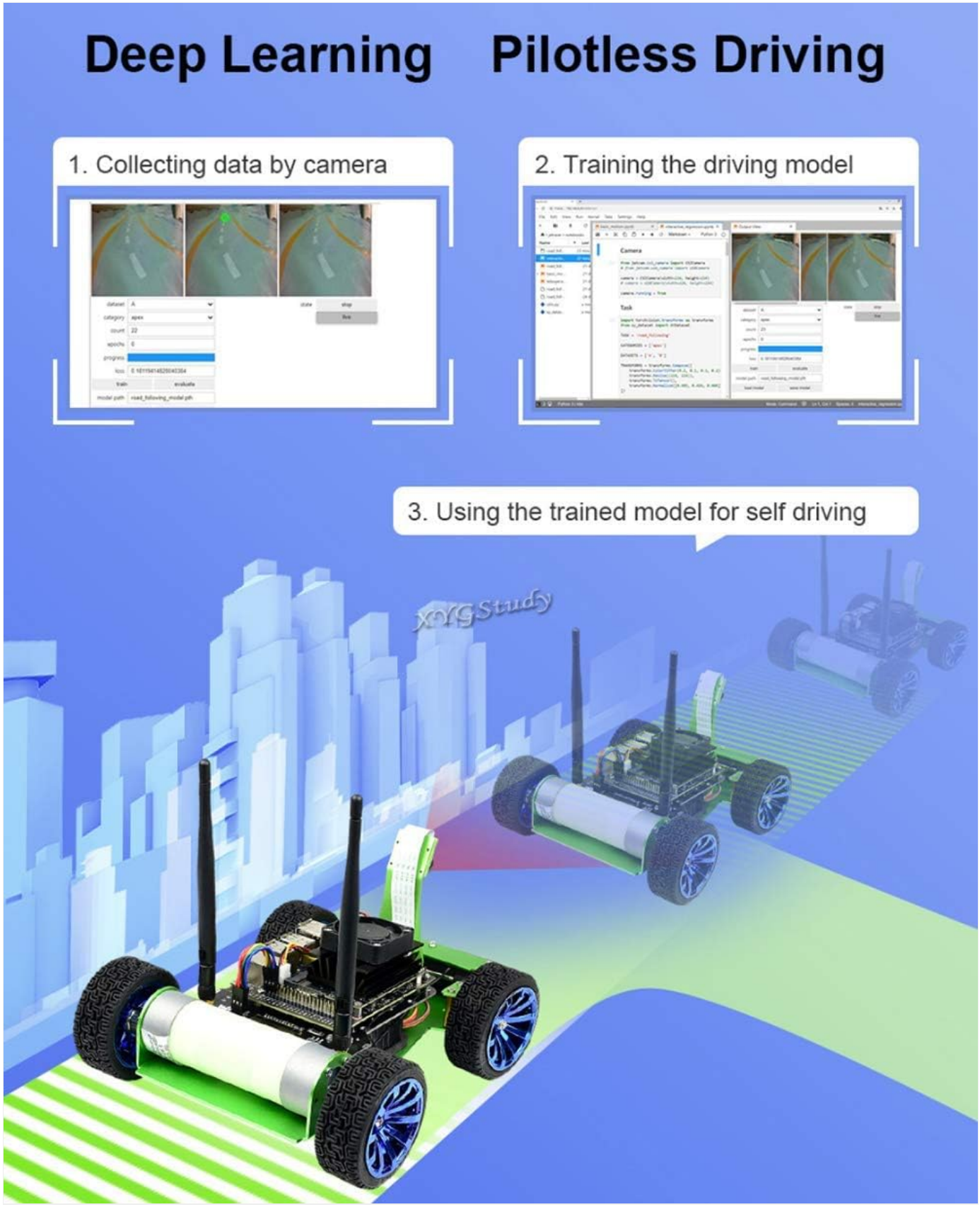


Figure 5: Deep Learning Pilotless Driving workflow.

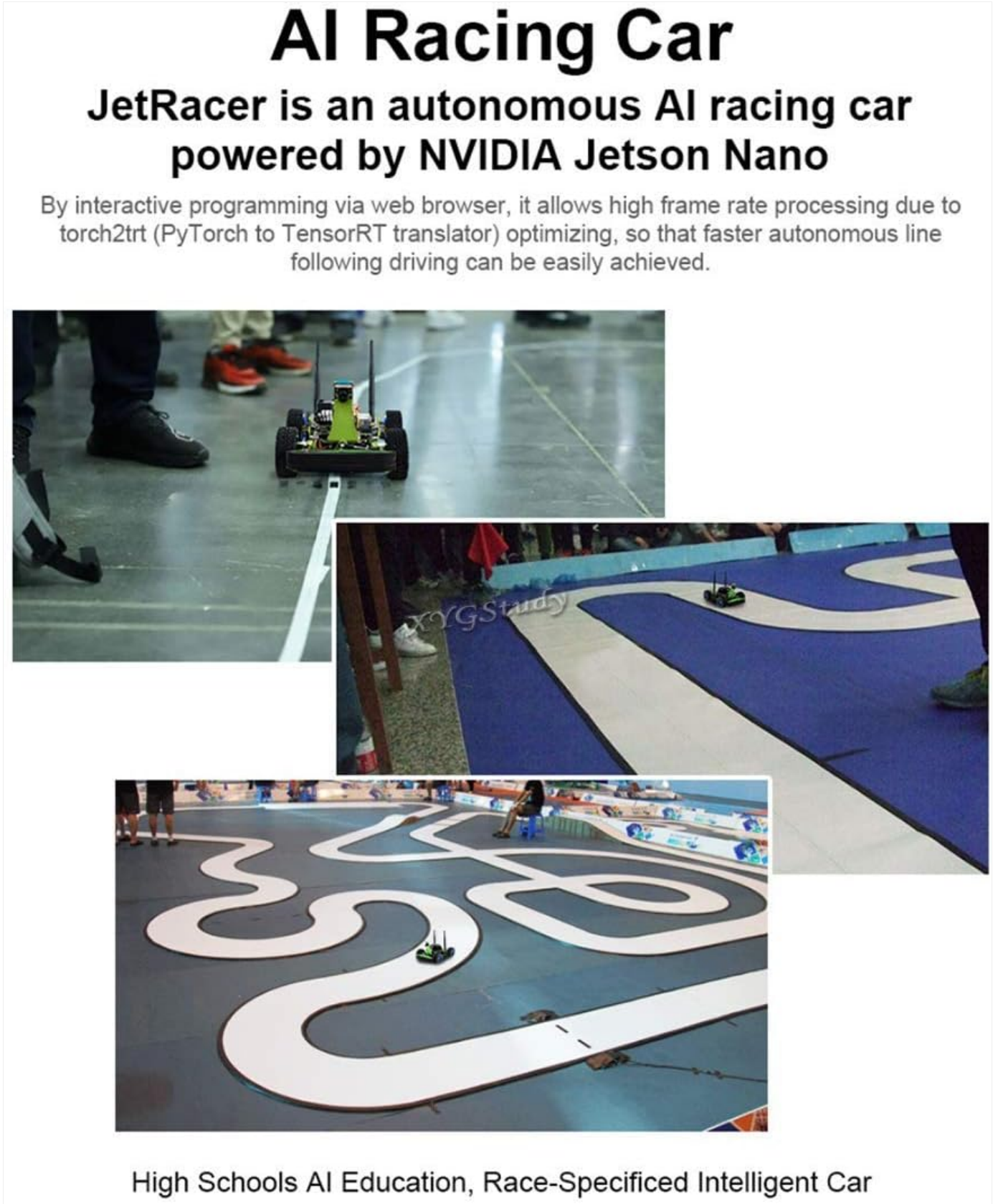


Figure 6: The JetRacer AI Car in action on a track.

5. Maintenance

Regular maintenance ensures the longevity and optimal performance of your JetRacer AI Kit.

- **Battery Care:** Use the provided 12.6V battery charger to recharge the 18650 batteries. Avoid overcharging or fully discharging the batteries to prolong their lifespan.
- **Cleaning:** Periodically clean the chassis, wheels, and especially the camera lens to ensure clear vision for AI applications.

Use a soft, dry cloth. Avoid using harsh chemicals.

- **Software Updates:** Keep the Jetson Nano's operating system, drivers, and AI framework libraries updated to benefit from performance improvements and bug fixes.
- **Component Inspection:** Regularly check all mechanical and electrical connections for looseness or damage. Ensure screws are tightened and cables are securely connected.

6. Troubleshooting

If you encounter issues with your JetRacer AI Kit, refer to the following common troubleshooting steps:

- **No Power:** Ensure batteries are charged and correctly inserted. Check all power connections to the Jetson Nano and the expansion board.
- **No Wi-Fi/Bluetooth Connectivity:** Verify the Wireless-AC8265 module is correctly installed. Check network settings on your controlling device and ensure the JetRacer's Wi-Fi hotspot is active.
- **Motors Not Responding:** Check motor connections to the expansion board. Ensure the servo and motor drivers are correctly configured in the software. Verify battery charge.
- **Camera Feed Issues:** Ensure the camera ribbon cable is securely connected to both the camera and the Jetson Nano. Check camera settings in the software.
- **AI Model Not Performing:** Review your data collection process for consistency and quality. Retrain the model with more diverse data if necessary. Check software logs for errors during inference.
- **Physical Obstruction:** Inspect wheels and steering components for any debris or physical obstructions that might hinder movement.

For more detailed troubleshooting or specific technical issues, consult the DonkeyCar project documentation or relevant NVIDIA Jetson Nano forums.

7. Specifications

Key technical specifications for the JetRacer AI Kit and its components:

Feature	Specification
Model Name	JetRacer
Brand	XYGStudy
Processor Brand	NVIDIA (for Jetson Nano, not included)
CPU Model	Core i3 (referring to Jetson Nano's ARM Cortex-A57)
Operating System	Linux (for Jetson Nano, not included)
Connectivity Technology	Wi-Fi
Wireless Compatibility	Bluetooth
Compatible Devices	Personal Computer (for control/programming)
RAM Memory Technology	LPDDR4 (for Jetson Nano, not included)
Total USB Ports	1 (on expansion board)
Camera Sensor	IMX219 (8MP, 3280x2464 resolution, 160-degree FOV)
Motor	37-520 motor, 1:10 reduction rate, 12V voltage, 740RPM idle speed

Feature	Specification
Servo	MG996R, 9kg/cm (4.8V) torque
Power	Rechargeable 18650 batteries (not included)
Display	0.91-inch OLED, 128x32 pixels
Weight (Package)	1.474 kg
GTIN	755318080328
ASIN	B0838B2YZQ

8. Support

For additional resources, technical assistance, or inquiries regarding your JetRacer AI Kit, please contact XYGStudy directly via Amazon message. They can provide further documentation, software links, and support as needed.

Warranty Information: Specific warranty details are not provided in the product description. Please contact the seller, XYGStudy, for any warranty-related questions or service requests.

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Ask about setup, troubleshooting, compatibility, parts, safety, or missing instructions. Manuals+ will review the question and use this page's manual context to help answer it.

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