Chapter 5 — AI Autopilot (Lane-Keeping Between Two Lines)

[DIAGRAM — LANE KEEPING CONCEPT]

Left Line | Robot | Right Line
Robot camera → sees both lines → AI centers robot between them

1. Overview

AI Autopilot allows your Rosmaster R2 to follow a path between two lines. The camera sends images to the Jetson Xavier NX. The AI model estimates whether the robot is too far left, too far right, or centered, and adjusts steering automatically.

2. How the AI Predicts Steering (Simple Explanation)

• Camera takes a picture of the ground.
• AI looks for the left and right boundary lines.
• AI checks: “Am I too close to the left? Too close to the right?”
• If too left → steer right.
• If too right → steer left.
• If centered → go straight.
• This repeats many times per second, giving smooth control.

3. Starting the Lane-Keeping System

Run the AI autopilot program:

rosrun r2_ai lane_follow.py

This node listens to the camera and publishes steering commands.

4. Loading Your AI Model

Place your trained model file into:

~/r2_models/lane_model.pth

Start the autopilot with:

rosrun r2_ai lane_follow.py --model ~/r2_models/lane_model.pth

5. Speed Control (VERY IMPORTANT)

Set speed to a safe indoor value:

0.15 m/s (recommended)

This makes steering smooth and prevents overshooting. Your autopilot may include a throttle option such as:

--speed 0.15

6. Lane-Keeping Steps

Step 1 — Start bringup:
roslaunch r2_bringup minimal.launch

Step 2 — Start camera:
roslaunch r2_camera camera.launch

Step 3 — Start AI autopilot:
rosrun r2_ai lane_follow.py --model lane_model.pth --speed 0.15

Step 4 — Place robot between two lines.
Step 5 — Robot steers itself and stays centered.

7. How to Improve Lane-Keeping

• Ensure lines have good contrast.
• Avoid harsh shadows.
• Keep camera angle consistent.
• Make sure lane width stays constant.

8. Override Rules

• Move joystick → AI gives control back to you.
• Release joystick → AI takes over again.
• Press stop button → robot halts immediately.
• AI stops automatically if camera feed is lost.

9. Safety Notes

• Always test at low speed.
• Keep hands away from wheels.
• Use wide, clear lines for best performance.
• Stop the robot if it drifts too far.