

# Stage 3 Checklist: Raspberry Pi Integration (RPi 3 B+ Prototype)

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### ■ Objective

- Integrate Raspberry Pi 3 B+ as high-level control node.
- Run ROS 2 Humble on Pi 3 B+ to test serial communication, teleoperation, and odometry bridge.
- Prepare for seamless migration to Raspberry Pi 5 in future.

### ■ Preparation & Hardware Inventory

- ☐ Raspberry Pi 3 B+ available and tested
- ☐ MicroSD card (16–32GB recommended)
- ☐ USB cable for Arduino Nano 33 IoT connection
- ☐ Stable power supply for Raspberry Pi (5V 2.5–3A)
- ☐ Optional: Wi-Fi/Ethernet setup for SSH access

### ■ OS & Software Setup

- ☐ Flash and install Ubuntu 22.04 Server (ARM64) or Raspberry Pi OS 64-bit Lite
- ☐ Update packages (sudo apt update && sudo apt upgrade)
- ☐ Install ROS 2 Humble (using official repo)
- ☐ Set up ROS 2 workspace
- ☐ Test core commands:
- ros2 topic list
- ros2 run demo\_nodes\_py talker
- ros2 topic echo /chatter

### ■ Arduino Integration

- ☐ Connect Arduino Nano 33 IoT via USB
- ☐ Verify serial port on Pi (ls /dev/ttyACM\* or /dev/ttyUSB\*)
- ☐ Test serial connection with minicom, screen, or cat
- ☐ Ensure Arduino firmware:
- Streams odometry data over serial
- Accepts velocity commands over serial

### ■ ROS 2 Node Development (RPi 3 B+)

- ☐ Create ros2\_serial\_bridge package
- ☐ Node functions:
- Open serial port to Arduino
- Parse odometry messages
- Publish /odom topic
- Subscribe to /cmd\_vel
- Send velocity commands to Arduino
- ☐ Test node end-to-end:
- Simulate /cmd\_vel inputs
- Validate /odom outputs

### ■ Communication Protocol Design

- ☐ Define message format:
- From Arduino → Pi: odometry (ticks, speed)
- From Pi → Arduino: velocity commands
- ☐ Include header/checksum if needed
- ☐ Document protocol for future upgrades

### ■ Teleoperation Testing

- ☐ Install teleop package:
- ros2 run teleop\_twist\_keyboard teleop\_twist\_keyboard
- ☐ Control robot via /cmd\_vel

- ☐ Observe robot response

#### ■ Visualization and Logging

- ☐ Install and test ros2 bag recording
- ☐ Record /odom and /cmd\_vel topics during runs
- ☐ Transfer bag files for analysis on laptop
- ☐ Optional:
  - Plot odometry with PlotJuggler
  - Remote RViz on laptop for visualization

#### ■ Documentation

- ☐ Record OS and ROS 2 installation steps
- ☐ Save bridge node code with comments
- ☐ Document serial message formats
- ☐ Archive test logs and plots
- ☐ Note all working configurations for migration to Pi 5

#### ■ Future Upgrades (RPi 5 Ready)

- ☐ Install ROS 2 Humble on Raspberry Pi 5
- ☐ Move serial bridge node seamlessly
- ☐ Add ROS 2 Nav2 stack for autonomous navigation
- ☐ Integrate SLAM Toolbox or Cartographer
- ☐ Add camera node for vision tasks
- ☐ Enable full teleop, mapping, and planning over Wi-Fi

#### ■ Milestone

Completion of Stage 3 means your robot is integrated with ROS 2, supports teleoperation and odometry monitoring, and is ready for