

Introduction to PuzzleBot

*Overview and
Specifications*

{Learn, Create, Innovate};

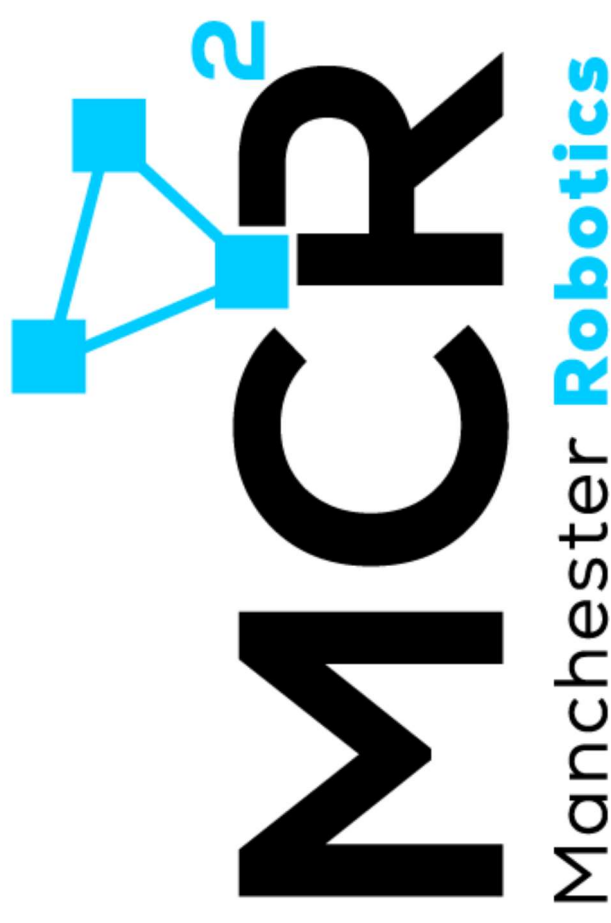
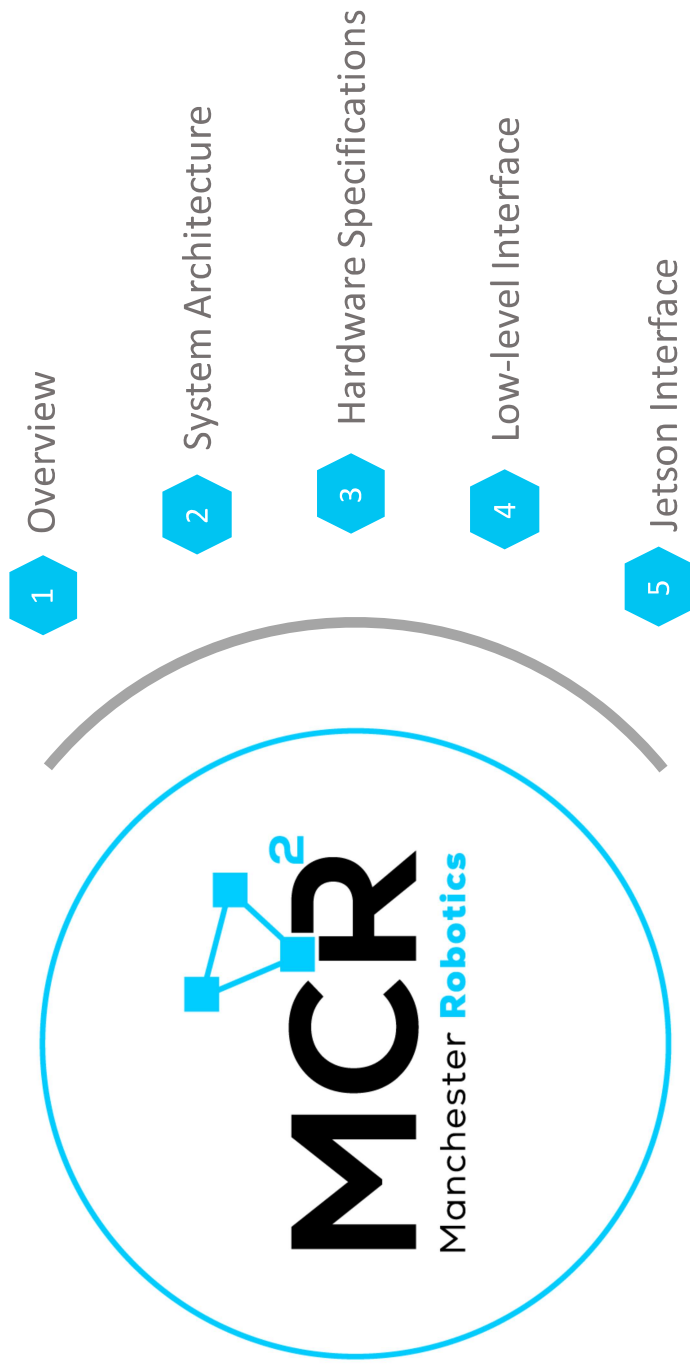
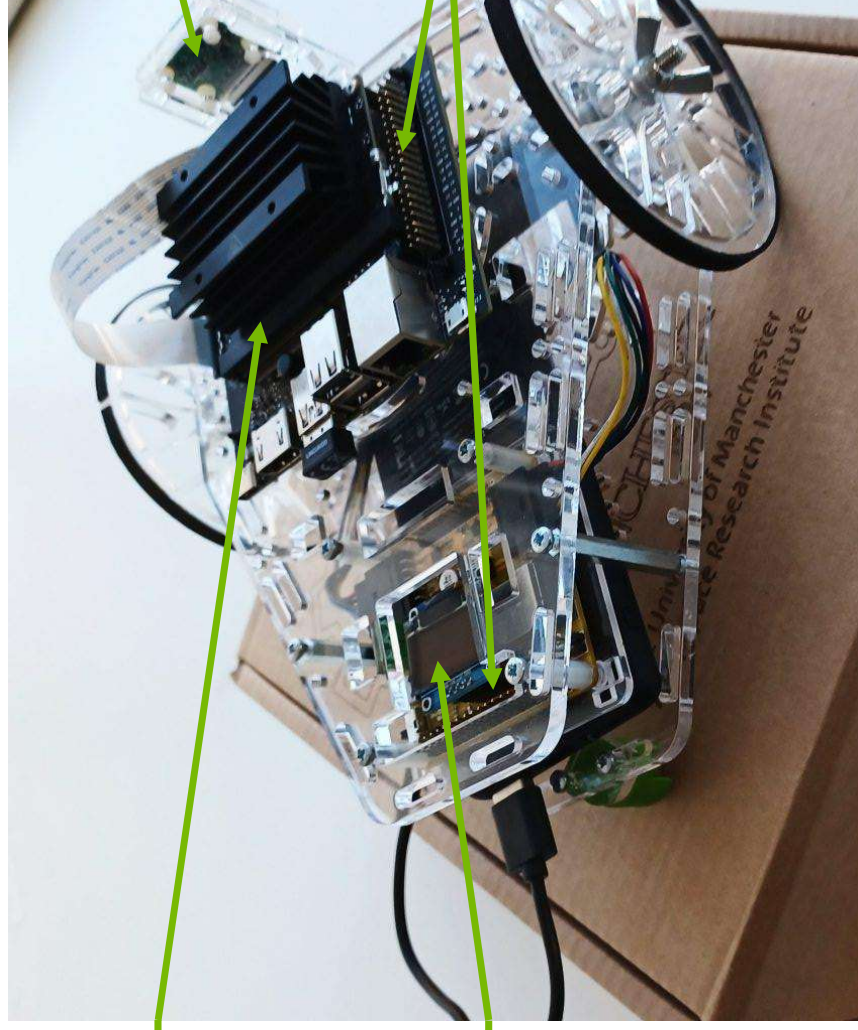




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System Overview



NVIDIA Jetson Nano

For AI and computer vision

- Higher processing power
- Time-sharing operating system
- Good for more complex, slower tasks
- Specifically designed by NVIDIA for AI applications

Hacker Board

For low-level control algorithms

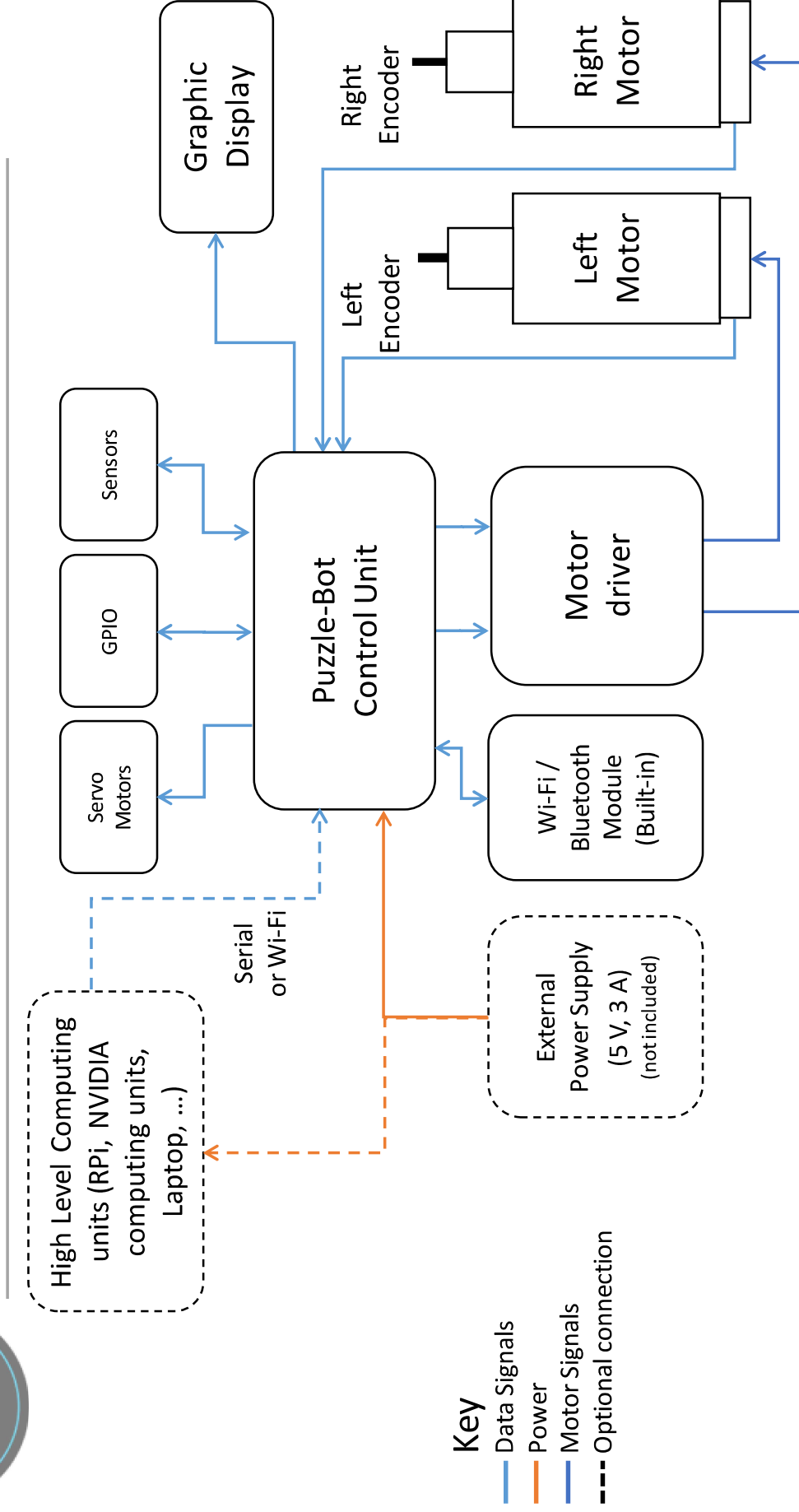
- Low processing power
- Real-time operating system
- Good for simple, fast, time-sensitive tasks

Raspberry Pi Camera

GPIO Arrays

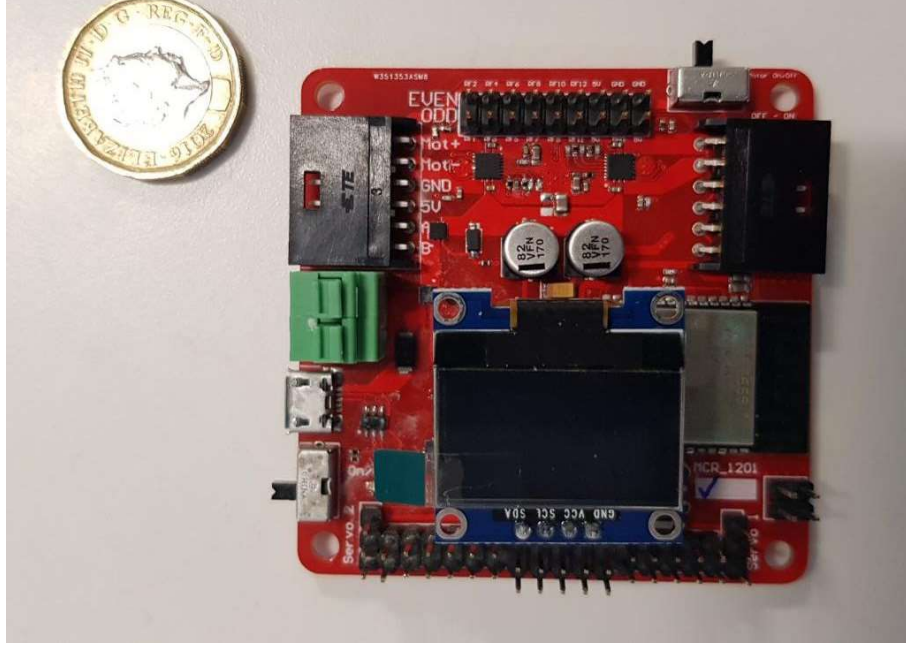
Expansion possible via the Jetson or the Hacker Board

System Architecture



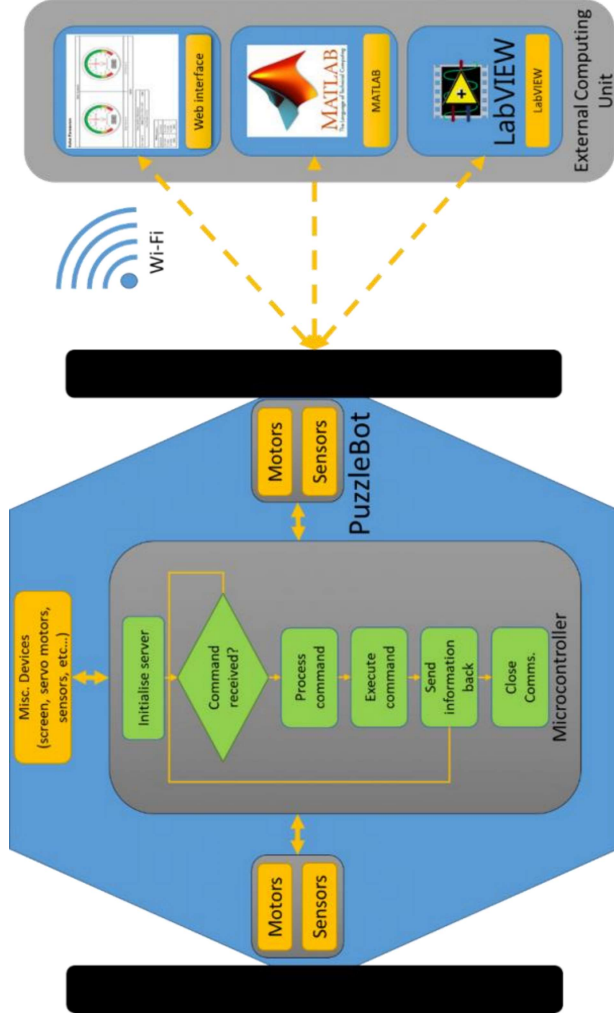
The Hacker Board

- ESP32-based Microcontroller
 - Xtensa dual-core 32-bit LX6 microprocessor
 - 520 KB of SRAM
 - WiFi & Bluetooth
- DC-DC Converter
- Motor Driver
- 0.96" I2C LCD Display



The Hacker Board

- Preprogrammed firmware including basic control, sensing, and communication libraries
- Two programming configurations:
 - **Standalone Configuration**
 - **External-Control Configuration**





The Webpage



Restart Robot



Robot Parameters

[Change Configuration](#)

Reset to Default Config

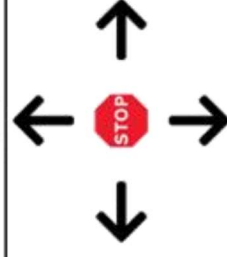
Active Modules	
Servo Motor	<input type="checkbox"/>
Time-of-flight: Sonar	<input type="checkbox"/>
Time-of-flight: Laser	<input type="checkbox"/>
Reflectance Line Sensor	<input type="checkbox"/>
LIDAR	<input type="checkbox"/>
Screen	<input checked="" type="checkbox"/>
ROS	<input checked="" type="checkbox"/>
<input type="button" value="Save"/> ?	

Network Settings	
SSID:	<input type="text" value="Puzzlebot"/>
Password:	<input type="text" value="Puzzlebot72"/>
<input type="button" value="Save"/> ?	

Wheel Parameters	
Linear Velocity (rad/s): <input type="text" value="0.0"/>	Angular Velocity (m/s): <input type="text" value="0.0"/>
<input type="button" value="Submit"/>	

Motor-Encoder Settings	
Control Mode ?	<input type="text" value="Robot Velocities (v and w)"/>
Invert Directions	Left <input checked="" type="checkbox"/> Right <input type="checkbox"/>
Motors ?	<input checked="" type="checkbox"/> <input type="checkbox"/>
Encoders ?	<input type="checkbox"/> <input type="checkbox"/>
<input type="button" value="Save"/> ?	

Robot Controls	
On-screen Controls	<input type="checkbox"/>
Keyboard Controls	<input type="checkbox"/>

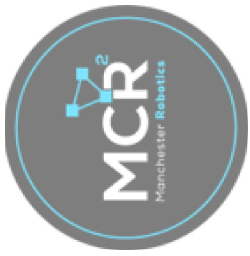


- Connect to the WiFi Network displayed on the Hacker Board
- Go to 192.168.1.1 in a browser

NVIDIA Jetson Nano, 2 GB

- 128-core NVIDIA Maxwell GPU
- 1.43 GHz Quad-core ARM A57 CPU
- 2 GB of 64-bit LPDDR4 Memory
- SD card for storage
- Ethernet & Wi-Fi
- CSI-2 Connector for Camera
- Runs a modified version of Ubuntu 18





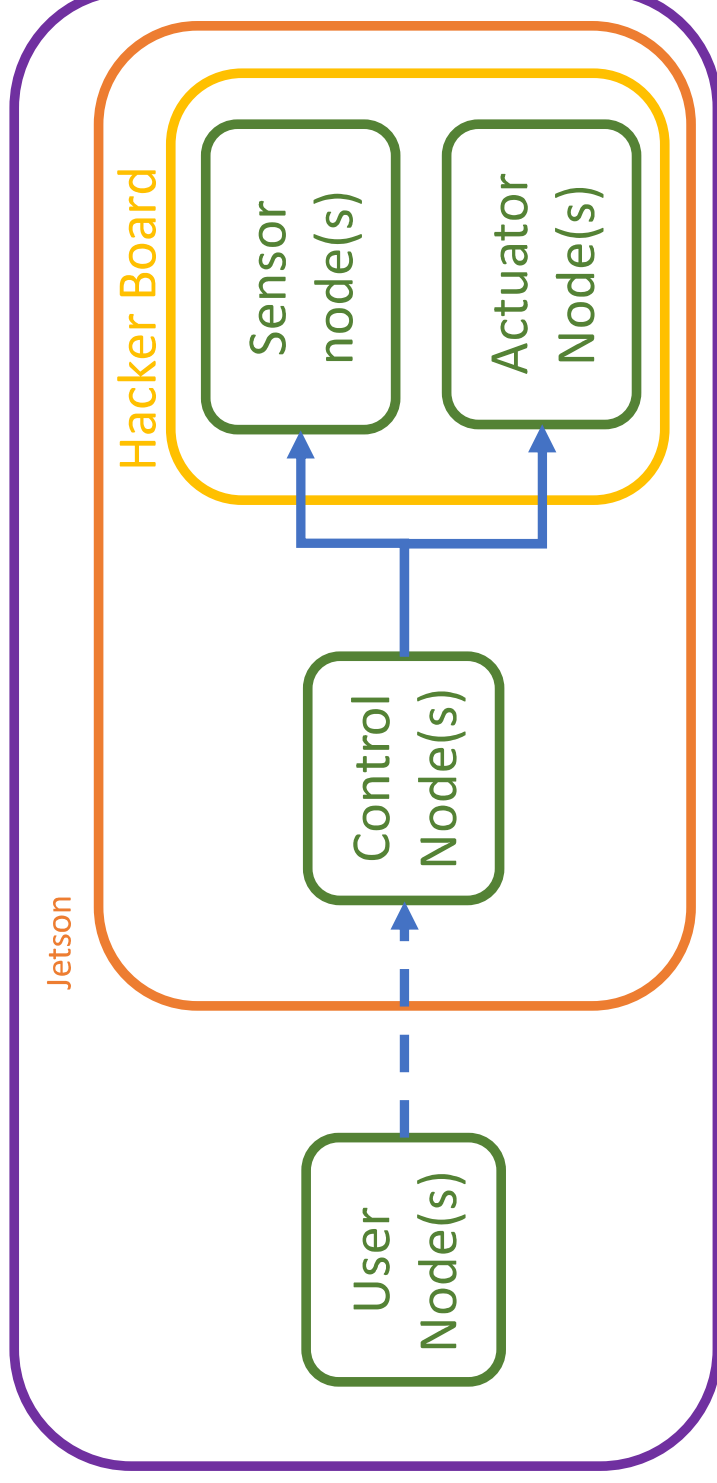
NVIDIA Jetson Nano, 2 GB



- Communicates with the Hacker Board serially via ROS
- Runs NVIDIA's own version of Linux, similar to Ubuntu
- The OS is flashed onto the SD card by a PC
- Three options for setup
 - Use the provided image in place of the NVIDIA image (recommended)
 - Run a setup bash file
 - Manual installation

The Jetson Nano with ROS

Ros Master



ROS Implementation