MACNICA

Macnica Robotics Solutions

Sensing, Compute and Connectivity for Robotics and Physical AI

Macnica Helps Turn Robotics Requirements Into System Architecture

Robotics design brings together sensing, AI, control, power, connectivity, safety, and security in one tightly connected system. Macnica helps engineering teams address these challenges by bringing together technologies from leading suppliers across the robotics stack and helping identify the right building blocks for the application.

The **Capture. Process. Communicate.** framework organizes those technologies around the three fundamental functions of a robotic system - understand the environment, make intelligent decisions, and connect those decisions across the machine and beyond.

	CAPTURE	PROCESS	COMMUNICATE
	Give the robot a reliable view of the physical world.	Turn real-world data into intelligent, deterministic robotic action.	Move data reliably across the robot, fleet, and connected environment.
Core functions	• Image and video acquisition • Depth, distance, and proximity sensing • Object and defect detection inputs • Localization and navigation inputs • Motion and position feedback • Environmental and system monitoring • Multi-sensor synchronization	• Computer vision and perception • AI inference • Sensor fusion • Localization and mapping • Path and motion planning • Real-time motor and actuator control • Safety monitoring and decision logic	• Sensor and subsystem connectivity • High-speed data transport • Robot-to-robot communication • Fleet coordination • Telemetry and remote diagnostics • Software and firmware updates • Cloud and edge connectivity
Key design requirements	• Image quality, resolution, frame rate • Dynamic range • Sensor fusion • Latency • Interface bandwidth	• AI performance • Deterministic latency • Compute density • Memory bandwidth • Power efficiency • Thermal design • Functional safety	• Bandwidth • Latency • Deterministic networking • Interoperability • Wireless performance • Cybersecurity • Reliability

Macnica helps robotics teams evaluate these functions together so technology choices across the architecture support the performance, safety, security, and reliability requirements of the complete system.

CAPTURE

Give the Robot a Reliable View of the Physical World

Robotic decisions start with the quality of the data being captured. Cameras, depth sensors, motion feedback and physical sensing allow the system to identify objects, measure position, understand its environment and monitor interaction with people or equipment.

The right sensing architecture depends on what the robot needs to detect or measure, as well as operating conditions such as motion, lighting, vibration, range and mounting constraints. Sensor synchronization and calibration become especially important when multiple inputs must work together for perception, navigation or control.

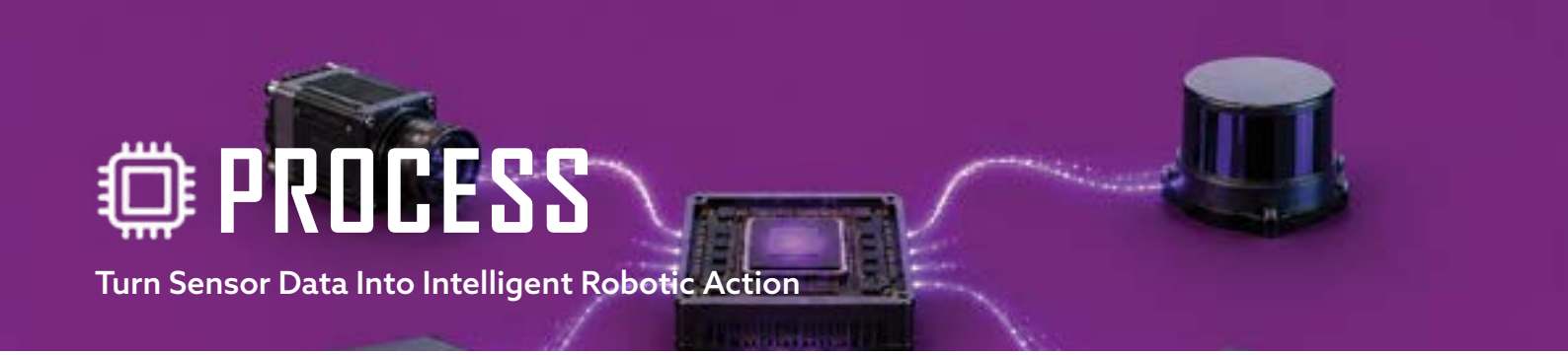
Architecture Priorities

- **Match sensing to the task:** Select imaging, depth, radar or physical sensing based on what must be detected or measured.
- **Design for operating conditions:** Account for motion, vibration, glare, dust and changing light.
- **Synchronize inputs:** Align timing and coordinate frames across sensors.
- **Plan the data path:** Resolution, frame rate and sensor count drive bandwidth and compute needs.
- **Optimize placement:** Field of view, optics, distance and mounting affect perception quality.

Macnica Solutions for Capture

FUNCTIONS	SUPPLIERS	TECHNOLOGIES
Imaging & Machine Vision	Canon, SONY	CMOS image sensors for inspection, recognition, navigation and high-speed image acquisition.
3D & Spatial Sensing	Infineon, NAMUGA, PROPHESEE	Time-of-flight, LiDAR and radar technologies for depth measurement, obstacle detection and environmental awareness.
Force & Strain Sensing	STREAL	Embedded microstrain sensing for tension, compression, bending, torque and shear measurement.
Embedded Vision	iENSO	Camera modules, embedded vision platforms and imaging design support for application-specific sensing architectures.

The right optics are critical to reliable image capture. Macnica works with 10+ leading lens manufacturers worldwide to match lens performance to each application, from wide-angle industrial vision to precision medical imaging.



PROCESS

Turn Sensor Data Into Intelligent Robotic Action

Once sensor data is captured, the robot must interpret it and respond within the timing constraints of the application. Processing architectures support computer vision, AI inference, sensor fusion, localization, planning, motor control and safety functions.

Different workloads place different demands on the compute architecture. AI inference may prioritize performance per watt, while sensor interfaces and control loops require predictable latency. The challenge is matching each workload to the right processing technology while staying within power, thermal and form-factor limits.

Architecture Priorities

- **Partition by timing:** Assign AI, vision, control and safety functions based on latency needs.
- **Match compute to workload:** Balance CPU, FPGA, NPU, GPU and MCU resources.
- **Manage data movement:** Sensor bandwidth and memory access can create bottlenecks.
- **Stay within power limits:** Compute must fit thermal, battery and enclosure constraints.
- **Keep control predictable:** Safety and motion functions require deterministic response.

Macnica Solutions for Process

FUNCTIONS	SUPPLIERS	TECHNOLOGIES
Edge AI Acceleration	AXELERA	High-performance, power-efficient AI acceleration for real-time vision, perception and other inference workloads at the edge.
FPGA & Real-Time Processing	LATTICE SEMICONDUCTOR	Low-power FPGAs for sensor connectivity, real-time processing, and flexible control in robotics and industrial systems.
Vision AI	Ambarella, iENSO	Power-efficient vision SoCs and embedded AI platforms for multi-camera perception and intelligent vision.
Control, Power & Safety	Infineon, NSSHNBO	MCUs, motor control, power and functional-safety technologies for real-time robotic systems.

COMMUNICATE

Connect the Robot to the Machine, Fleet, Factory or Display

Robots must exchange information across sensors, processors and controllers while also connecting to operators, other robots and factory systems. Communication enables coordination, telemetry, diagnostics, software updates and fleet-level visibility.

Fixed systems may require deterministic wired interfaces for machine control, while AMRs depend on reliable wireless connectivity as they move through a facility. The architecture must support the required bandwidth and latency while maintaining interoperability, security and reliable operation.

Architecture Priorities

- **Match network to data:** Control, sensor, telemetry and update traffic have different requirements.
- **Choose wired vs. wireless:** Fixed systems favor determinism; mobile robots require reliable roaming.
- **Bridge legacy systems:** Support protocol conversion between installed and modern equipment.
- **Design for resilience:** Plan for interference, packet loss and network outages.
- **Build in security:** Protect identity, access, communications and update paths.

Macnica Solutions for Communicate

FUNCTIONS	SUPPLIERS	TECHNOLOGIES
Wireless Connectivity	Infineon, ESPRESSIF	Wi-Fi and Bluetooth technologies for AMRs, robotic platforms, service access and connected devices.
Wired Connectivity	Infineon	Ethernet, low-latency networking, CAN and interface technologies for robot subsystems, controls and factory networks.
Security	Infineon	Device authentication, protected communications and secure system connectivity.
HMI/Displays	MACNICA, SONY	Industrial displays and touch interfaces for robot status, alarms, diagnostics and operator interaction.

What If Your Robot Could Feel What's Happening Inside?

Give robots true force and load awareness from the inside out

Traditional wrist and load-path sensors can miss local events happening inside the robot structure, such as micro-deflection, slip, and overload. STREAL embeds semiconductor-grade microstrain sensing directly into joints, links, grippers and frames to reveal force, torque and structural loads where they occur.

Turn Hidden Strain Into Digital Data Your Controller Can Act On

STREAL integrates strain sensing, amplification, ADC, temperature sensing and a digital SPI interface into one compact sensing platform. It delivers clean strain data directly to the controller without bulky external signal-conditioning hardware.

Macnica supports STREAL evaluation, sensor placement, calibration and system integration.

Explore STREAL for Robotics

Macnica Robotics Solutions

1 AUTOMOTIVE AND MOBILITY

2 AUTONOMOUS MOBILE ROBOTS (AMRS)/ AUTOMATED GUIDED VEHICLES (AGVS)

3 DRONES AND UNMANNED AERIAL VEHICLES (UAVS)

4 VISUAL INSPECTION ROBOTS

5 HEALTHCARE ROBOTICS

CAPTURE.
PROCESS.
COMMUNICATE.

Bring the Right Technologies Together for Robotics

Macnica connects robotics engineering teams with leading technologies across sensing, AI and embedded compute, control, connectivity, power, safety, and security.

Whether the design challenge is perception accuracy, edge inference, deterministic control, power efficiency, or reliable communications, Macnica can help identify the technology building blocks that fit the application and system requirements.

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