Flow:

1. Main content with key definition

2. Contact our experts

3. Major Services about particular industry (Manufacturing)

4. Counts

5. Solutions for the particular industries

6. Product features

7.Development process

8. FAQ

9. Contact form

10 Recent blogs.

11. Locations

**1. Automotive:**

<https://www.ptc.com/en/technologies/application-lifecycle-management/automotive-embedded-software>

**2. Education**

<https://appinventiv.com/education-app-development/>

**3. Industrial automation:**

### 1. OUR CORE SERVICES

#### 1. **Custom Embedded System Design**

We design tailor-made embedded systems optimized for performance, real-time control, and environmental durability.

* Microcontroller/Microprocessor selection
* Low-power embedded design
* Sensor and actuator integration
* Custom PCB design and enclosure prototyping

#### 2. **Firmware Development**

We write efficient, real-time firmware for embedded devices that control machinery, collect sensor data, and communicate securely with industrial networks.

* Bare-metal or RTOS-based development
* Communication protocol stacks (Modbus, CAN, RS-485)
* Edge processing and real-time algorithms

#### 3. **Industrial IoT (IIoT) Integration**

Transform your machines into intelligent, connected systems. Our IIoT services connect embedded hardware to cloud platforms for remote monitoring and analytics.

* MQTT, OPC UA, and HTTP REST integrations
* Edge-to-cloud connectivity
* Data logging and visualization
* Predictive maintenance setup

#### 4. **Human-Machine Interface (HMI) Solutions**

We build embedded HMIs that are intuitive, rugged, and fully customizable for factory floors or field operations.

* Touchscreen and graphical display design
* Linux or RTOS-based HMI systems
* SCADA & dashboard integration

#### 5. **Testing, Validation & Certification**

We ensure your embedded solutions meet industrial standards for performance, safety, and electromagnetic compatibility (EMC).

* Functional testing & validation
* Environmental stress screening
* CE, RoHS, ISO 13849, and IEC 61508 support

#### 6. **Legacy System Modernization**

Upgrade aging automation systems with embedded replacements to improve reliability and enable data-driven operations—without replacing entire infrastructures.

* Reverse engineering
* Protocol bridging
* Custom retrofitting solutions

## 2. HARDWARE AND TOOLS IN EMBEDDED INDUSTRIAL AUTOMATION

Embedded industrial automation systems rely on a mix of **specialized hardware** and **software development tools** to deliver real-time control, reliability, and connectivity in manufacturing and process industries.

### Key Hardware Components

#### 1. **Microcontrollers (MCUs)**

* Low-power, cost-effective control units.
* Common choices: **STM32**, **PIC**, **AVR**, **TI MSP430**
* Used in sensor interfaces, motor control, and simple automation tasks.

#### 2. **Microprocessors (MPUs)**

* More powerful than MCUs, often with embedded OS (like Linux).
* Ideal for complex tasks like HMI, edge computing, and multi-tasking control.
* Examples: **ARM Cortex-A**, **NXP i.MX**, **Intel Atom**

#### 3. **Field Programmable Gate Arrays (FPGAs)**

* Reconfigurable hardware for real-time and parallel processing.
* Used in **high-speed control**, **machine vision**, and **signal processing**.

#### 4. **Sensors and Actuators**

* **Sensors**: Temperature, pressure, proximity, optical, vibration
* **Actuators**: Relays, solenoids, motors (servo, stepper, DC)

#### 5. **Human-Machine Interfaces (HMIs)**

* Touchscreen panels or industrial PCs for operator control and visualization.
* Often run on embedded platforms like **Raspberry Pi**, **BeagleBone**, or x86-based systems.

#### 6. **Industrial Communication Modules**

* Ethernet, **Modbus**, **CAN bus**, **Profibus**, **EtherCAT**, **OPC UA**
* Enable device-to-device and device-to-cloud communication.

#### 7. **Power Management & Protection**

* Embedded systems require stable power: DC-DC converters, EMI filters, watchdog timers, and fail-safes.
* Industrial-grade **UPS** systems for critical applications.

#### 8. **I/O Modules (Digital/Analog)**

* Interface embedded controllers with external sensors and machines.
* Provide electrical isolation and signal conditioning.

#### 9. **Embedded Boards & SoMs (System-on-Modules)**

* Pre-built hardware platforms for rapid deployment.
* Examples: **Toradex**, **NVIDIA Jetson**, **Arduino Industrial 101**, **Raspberry Pi Compute Module**

### Software & Development Tools

#### 1. **IDE & Compilers**

* **Keil**, **IAR Embedded Workbench**, **STM32CubeIDE**, **MPLAB X**, **Eclipse**
* Used for writing, debugging, and compiling embedded C/C++ code.

#### 2. **RTOS (Real-Time Operating Systems)**

* Provide deterministic behavior and multitasking.
* Examples: **FreeRTOS**, **Zephyr**, **VxWorks**, **QNX**

#### 3. **SCADA & HMI Development Platforms**

* For industrial monitoring and control.
* Examples: **Ignition by Inductive Automation**, **Wonderware**, **LabVIEW**

#### 4. **PCB Design Tools**

* Hardware design for embedded boards and interfaces.
* Examples: **Altium Designer**, **KiCad**, **EAGLE**, **OrCAD**

#### 5. **Protocol Stacks & Middleware**

* Embedded software stacks for Modbus, CANopen, MQTT, OPC UA, etc.
* Enable seamless communication and interoperability.

#### 6. **Simulation and Modeling Tools**

* **MATLAB/Simulink**, **Proteus**, **LTspice** for simulating control algorithms or circuits before implementation.

### 🧰 Testing & Debugging Tools

* **Logic analyzers**
* **JTAG/SWD programmers**
* **Oscilloscopes**
* **Multimeters**
* **In-circuit emulators (ICE)**
* **Boundary scan tools**

### 📦 Industrial-Grade Hardware Standards

* **IP-rated enclosures (IP65, IP67)** for dust/water resistance
* **Conformal coating** for corrosion protection
* **EMC compliance** for electromagnetic noise resistance
* **Temperature-tolerant components** for harsh environments

4. Healthcare

<https://appinventiv.com/healthcare-software-development/>

5.Manufacturing

<https://appinventiv.com/manufacturing-it-services/>

<https://www.travancoreanalytics.com/industries/manufacturing-and-automation/>

6. Agriculture

7. SaaS

8. E-commerce