



Ai1 – All-in-One Deep Learning-based Solutions

✉ info@fi-corp.com

☎ (+82) 10-3968-6098

📍 Seoil Bld. 703, Sapyeong Dae-ro 353, Secho Gu, Seoul, South Korea

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Ai1 – All-in-One

Concept

A computer vision-based system is made of many different components to be selected case by case during the feasibility process (camera, optics, illumination, computer, controllers, software...).

The traditional approach is to choose, buy and assemble all the components separately.

Problems

- The integration requires many different skills and expertise.
- The BOM contains dozens of components.
- The assembly and maintenance cost are high (time consuming).
- The software integration has too many levels of complexities (computer vision, algorithms, network, peripherals communication, drivers' compatibilities and so on)



Figure 1. Basic components required for a vision system.

Our solution is to cook for you all the needed components assembled, tested and ready to use in a compact and flexible system that we call SmartPC-Ai1.

Ai1 stands for **All-in-One**, while simultaneously highlighting its powerful **AI** capabilities.

Easy to set up like a smart camera, but powerful like a computer, this innovative solution has many key advantages:

- Fully automated and easily monitored process. *
- Approaches a zero-downtime integration. *
- Scalable.
- Very High value/cost - Save Time and Resources.
- Easy after sales support and maintenance.
- Software Deep learning-based with **no-code** approach (fully graphical).
- One-man integration (a single person can handle the whole integration).

Ai1 – All-in-One

Example

The possibilities are endless, but we translated a few of the most requested and difficult to integrate applications into ready to use, plug-and-play marvels of product design and engineering.



Figure 2. example of All-in-One systems with 360 degrees inspection capabilities using multi-mirrors systems, hypercentric lenses or pinholes

SmartPC-Ai1 All-in-One Solutions

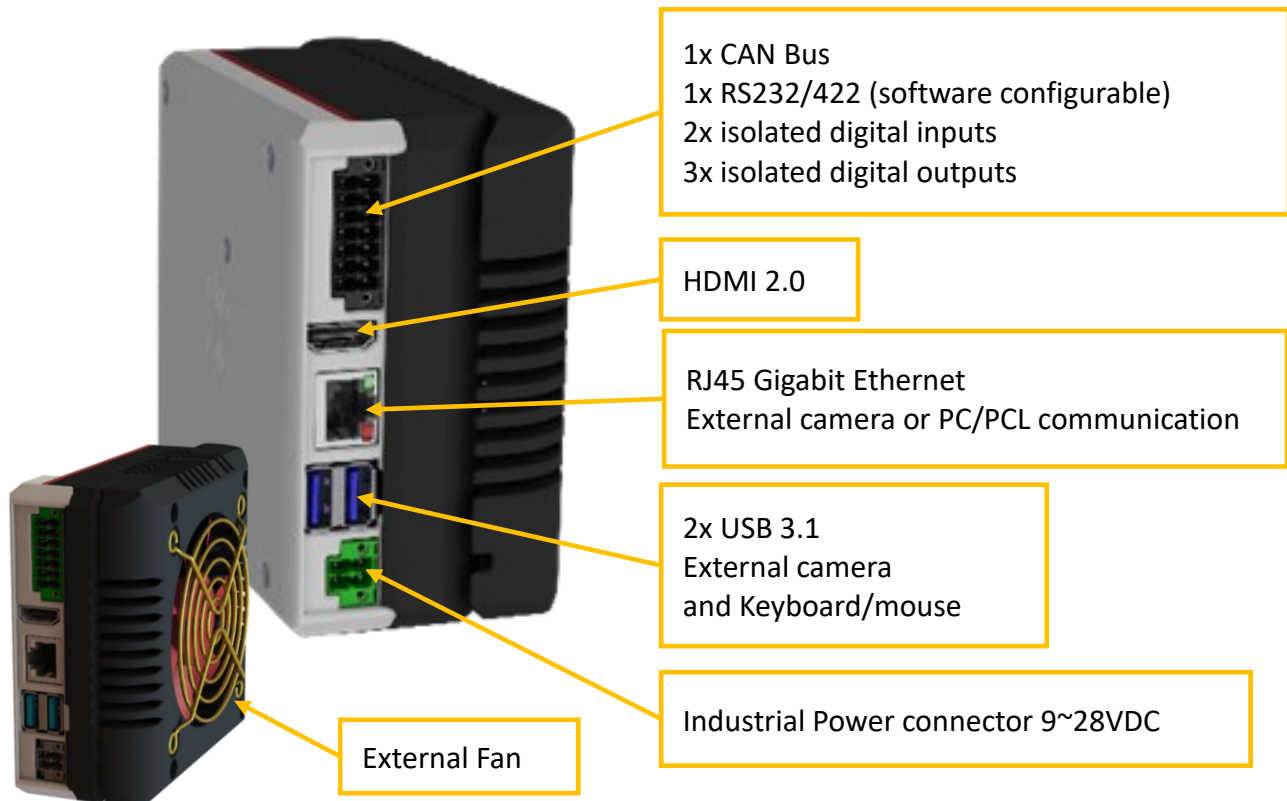
Standalone

Introduction

At the heart of the Ai1's systems there is the standalone **SmartPC-Ai1**, an edge device with highly optimized built-in software, enhancing operational efficiency in edge computing.

It can transform any system into a state-of-the-art deep learning-based solution in a few minutes.

Innovative	No-code Deep Learning-based software included. Acquisition-> Labeling -> Training -> Prediction all GUI based.
Robust	rugged hardware with industrial compliant connectors and opto-isolated GPIO.
Fast	based on AI Supercomputers in 2 different configurations 8-cores and 12-cores.
Compact	made to fit impossible places.
Scalable	One-Man integration (replace an entire vision system team)



SmartPC-Ai1 All-in-One Solutions

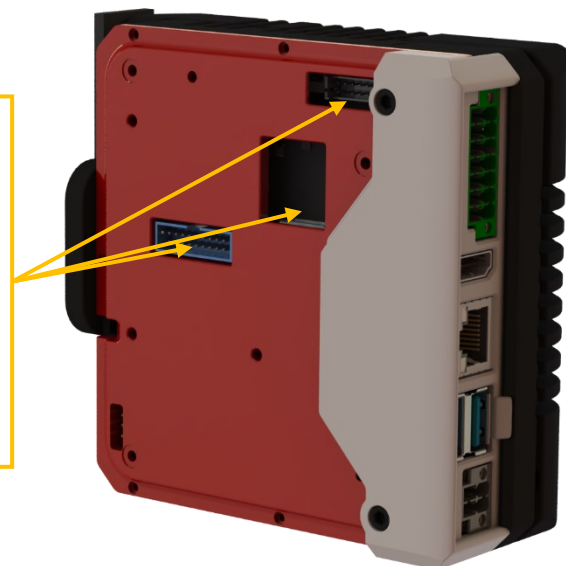
Standalone

Models and Specifications

	Model		
	SmartPC-Ai1-AGX64-10Gb	SmartPC-Ai1-AGX64	SmartPC-Ai1-NX16
SOM	Jetson AGX Orin 64GB		Jetson Orin NX 16GB
AI Performance	275 TOPS		100 TOPS
GPU	2048-core NVIDIA Ampere architecture GPU with 64 Tensor Cores		1024-core NVIDIA Ampere architecture GPU with 32 Tensor Cores
GPU Max Frequency	1.3 GHz		918MHz
CPU	12-core Arm® Cortex®-A78AE v8.2 64-bit CPU 3MB L2 + 6MB L3		8-core Arm® Cortex®-A78AE v8.2 64-bit CPU 2MB L2 + 4MB L3
CPU Max Frequency	2.2 GHz		2 GHz
DL Accelerator	2x NVDLA v2		
DLA Max Frequency	1.6GHz		614MHz
Memory	64GB 256-bit LPDDR5 204.8GB/s		16GB 128-bit LPDDR5 102.4GB/s
Storage	NVMe 512Gb		NVMe 512Gb
USB	3x USB 3.1 Type-A (Full Speed, 1x internal) 2x USB 3.1 19 pins connector (Full Speed, internal)		
Networking	2x Gigabit Ethernet 1x 10Gigabit (SFP+Based)	1x Gigabit Ethernet	
WiFi/LTE/5G	on board	on request	on request
Display	1x 8K60 multi-mode HDMI 2.1		1x 8K30 multi-mode HDMI 2.1
Interfaces	1x CAN Bus		
	1x RS232/422/485 (software configurable)		
	2x Digital Input, 3x Digital Output		
Power Supply	12~32VDC (15W - 60W)		9~28VDC (10W - 25W)
Mechanical	110mm x 110mm x 43mm		110mm x 110mm x 34mm
	External Dissipator with Fan		External Dissipator with Fan

Additional ports available inside for embedded applications!

- 1x USB 3.1 Type-A (full speed)
- 2x USB 3.1 19 pins (full speed)
- 4x CSI Connectors (2x 2-lane, 2x 2-lane or 4-lane)
- Serial Communication Connector (1x I2S, 1x I2C, 1x SPI)



Standalone

Setup Example

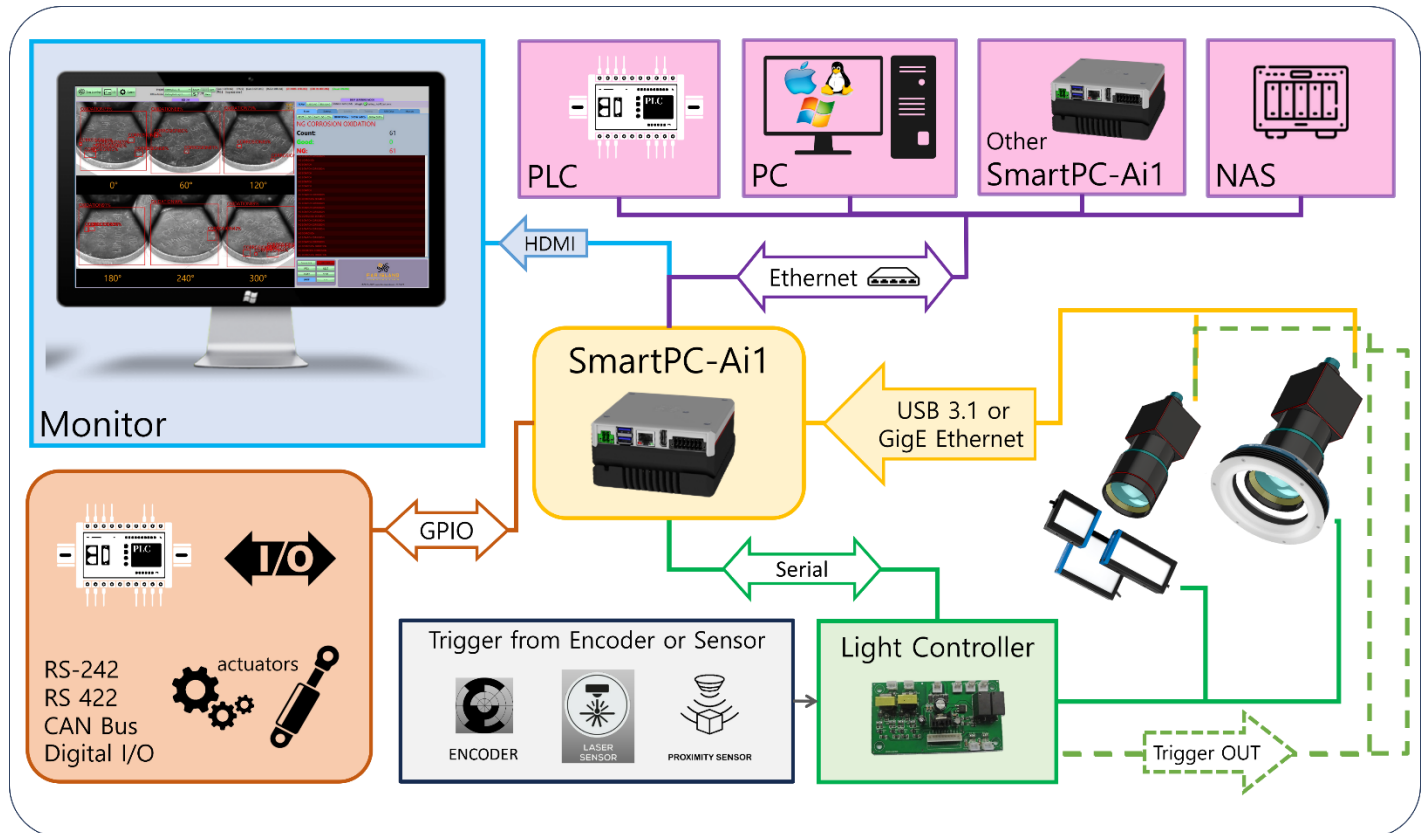


Figure 3. SmartPC-Ai1 is a Plug and Play solution able to manage the entire vision system (and not only). You just need a monitor and a mouse to choose your settings. Ethernet for PLC, RS-232, RS-422, serial and opto-isolated GPIO for the communication and interaction with the external world is already included and selectable in the GUI.

Standalone

Alternative Setup - API

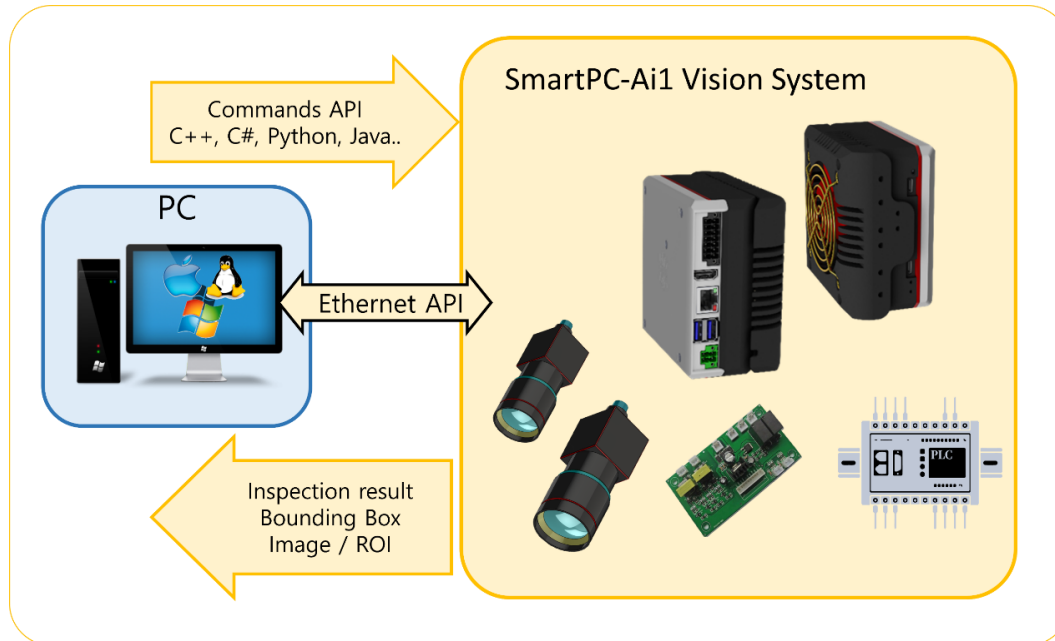


Figure 4. **SmartPC-Ai1** can be used as a software DLL from the user's own developed software. The result of the inspection that can be integrated in your own GUI.

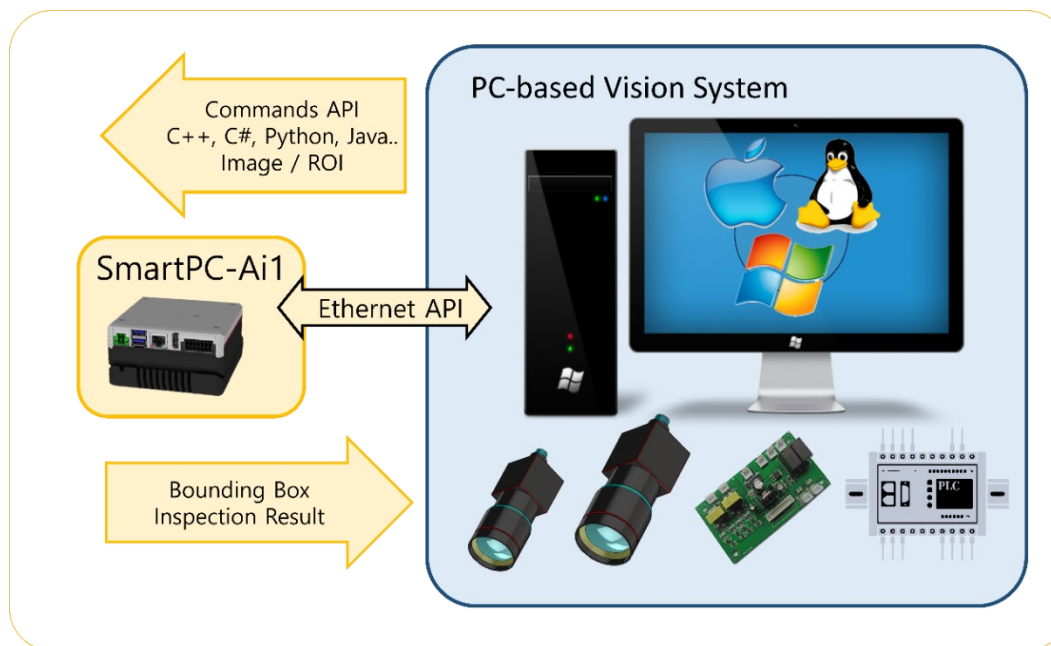


Figure 5. **SmartPC-Ai1** can be used to upgrade existing lines to AI capabilities. Through software API it can exchange images, results, bounding boxes or settings for the system management.

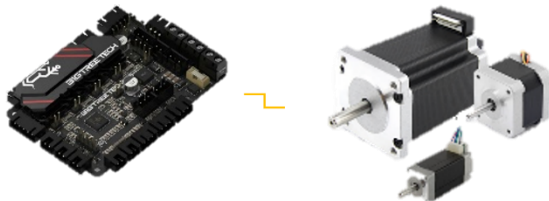
Standalone

External Add-Ons

Thanks to its rich hardware interfaces the **SmartPC-Ai1** can communicate in a huge variety of ways (GPIO, Ethernet, USB, RS-232, RS-422, CAN bus) and directly control actuators, triggers and illumination through our ADD-ONS using USB, Ethernet or RS-422.

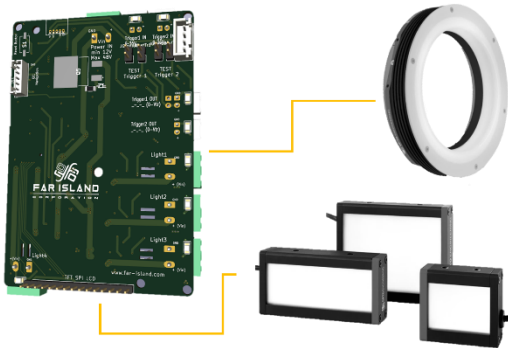
ADD-ONS

Stepper Motor Controller 4 Drivers (stackable)



- 4.75~29V
- Current adjustable via software

High Power Illumination Controller 4Ch (stackable)



- 2 Triggers IN at 9~40V
- 2 Triggers OUT 12V
- 4 independent channels at V_{in} (12~60V)
- Pulse duration configurable by GUI
- Continuum Pulse mode

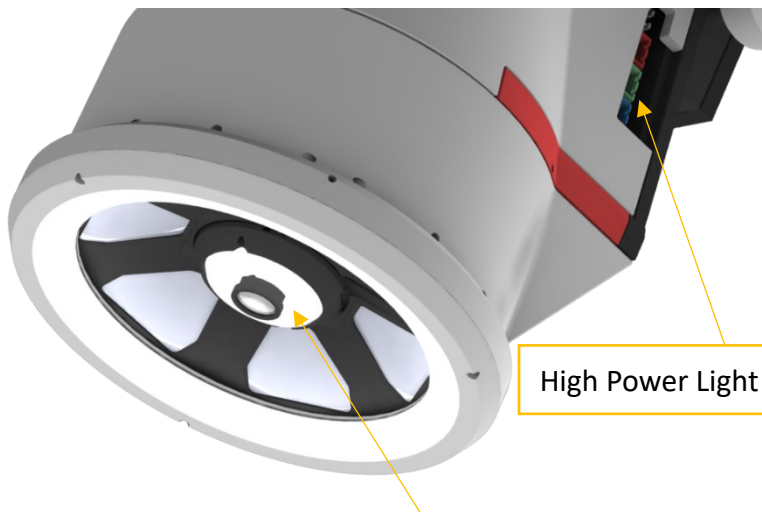
Multi-Mirrors Systems

Introduction

TCMM360-Ai1 is a total vision solution for inspection and quality control of objects from multiple views using a single shot.

TCMM360-Ai1 includes all the components for the vision solution, including the software

Industrial Edge Device from NVIDIA.
5Mp, 20Mp or 26Mp camera.
0.11x ~ 0.3x FOV Telecentric lens.
Mirrors system (variable angles from ~25° to 55°).
High power illumination.
High power Light controller.
Aluminum clamping.
Linear stage Z axis ($\pm 20\text{mm}$)
Software deep learning based.
PLC, triggering, encoders communication ready.
Customizable GUI (Logo, colors).
Protective windows (Sapphire).
Second camera in the center on request.

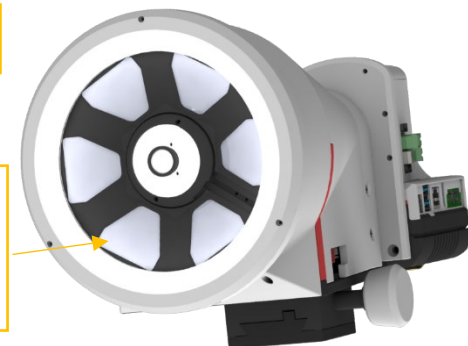


High Power Light Controller



A second 1.6Mp camera at the center is available on request.

Protective Windows in **Sapphire glass** anti-scratch with internal AR coating help to keep the mirrors box clean and extend the setup possibilities in tough environments.



SmartPC-Ai1 All-in-One Solutions

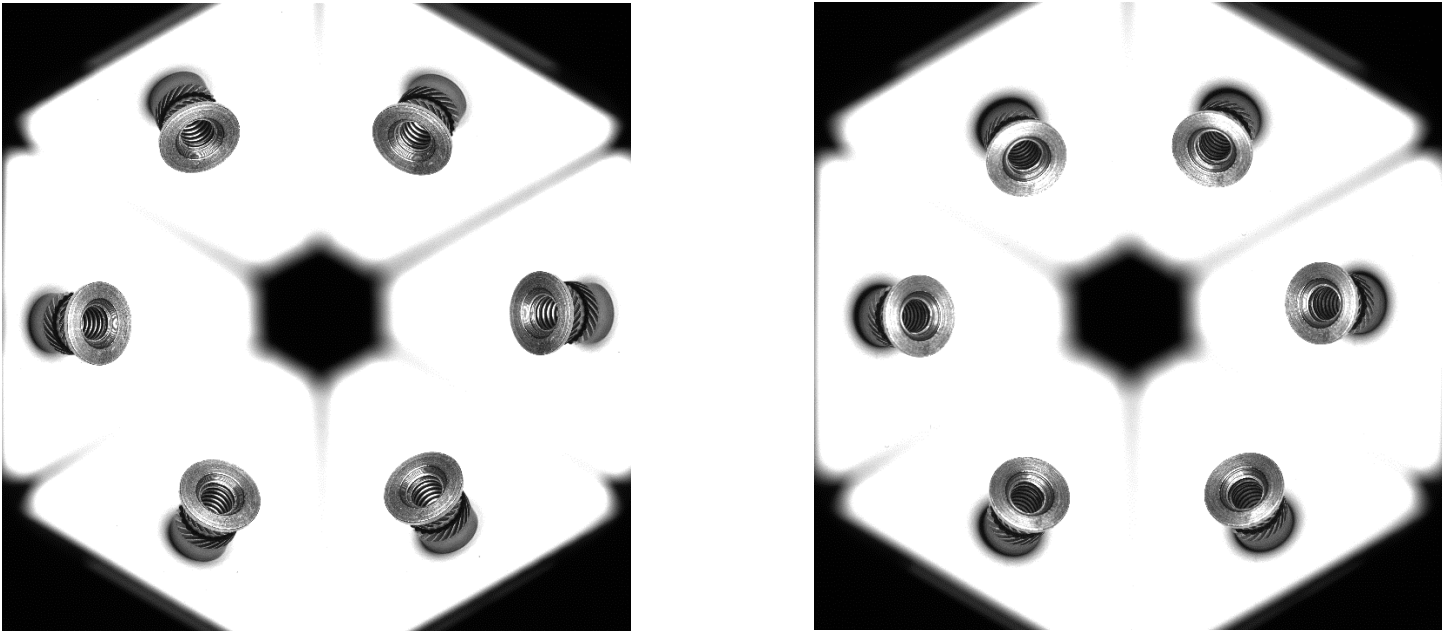


Figure 6. On the left a picture taken with TCMM360-26M-02 at angle of $\sim 45^\circ$, on the right at $\sim 30^\circ$. It shows the flexibility of the changeable angles feature of the TCMM360 system.

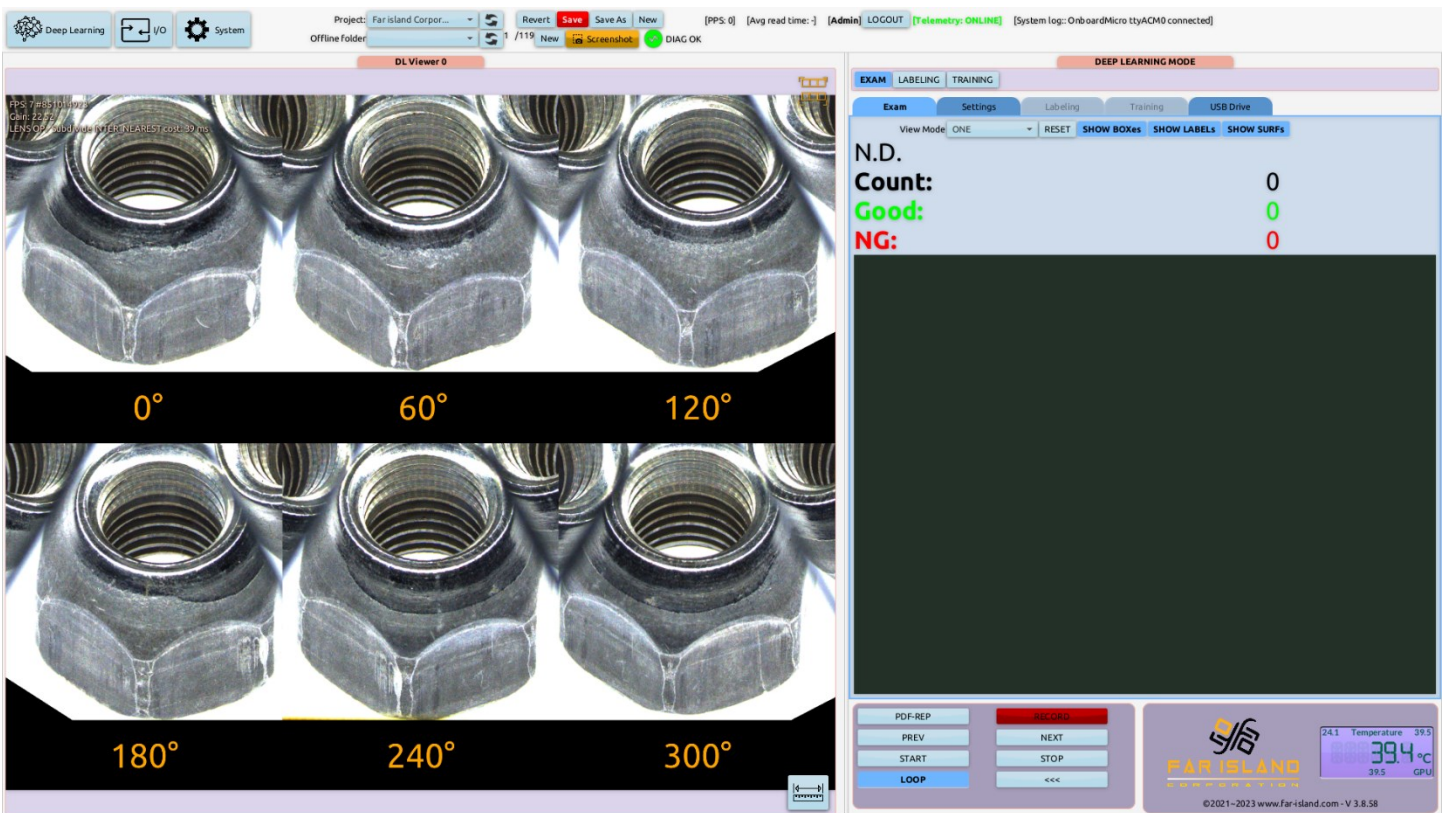


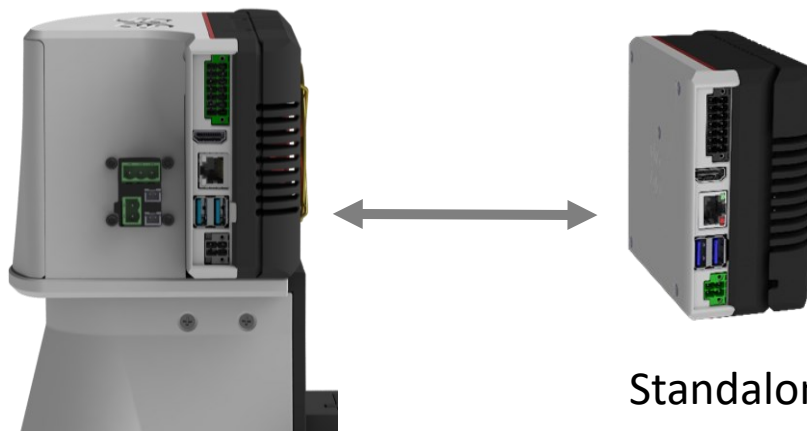
Figure 7. Telecentric optics allow inspection and measurement of the samples. In the picture highlighted the ROI cutting and geometrical transformation features of the integrated software.

Multi-Mirrors Systems

Models and Specifications

5Mp Camera								
Model	FOV Camera	Mag	DOF (mm)	Angle	WD (mm)		Camera Specs	
TCMM360-5M-011	~ Ø 61.5mm	0.114	30	25°~55°	Close	~5	Resolution	2448×2048 (2/3")
					Nominal	~50	Frame Rate (fps)	36 or 79
TCMM360-5M-02	~ Ø 35mm	0.2	11	25°~55°	Far	~75	Pixel Size	3.45µm
							Spectrum	Color or Mono
20Mp Camera								
TCMM360-20M-01	~ Ø 61.7mm	0.2	8	25°~55°	Close	~5	resolution	4504×4504 (1.1")
					Nominal	~50		
					Far	~75	Pixel Size	2.74µm
TCMM360-20M-025	~ Ø 49.3	0.25	5	25°~55°	Close	~5	Spectrum	Color or Mono
					Nominal	~50		
					Far	~75		
TCMM360-20M-03	~ Ø 41mm	0.3	3.9	25°~55°	Close	~5		
					Nominal	~50		
					Far	~75		
26Mp Camera								
TCMM360-26M-01	~ Ø 64mm	0.2	7	25°~55°	Close	~5	resolution	5120×5120 (1.1")
					Nominal	~50		
					Far	~75	Pixel Size	2.5µm
TCMM360-26M-025	~ Ø 51mm	0.25	4.5	25°~55°	Close	~5	Spectrum	Color or Mono
					Nominal	~50		
					Far	~75		
TCMM360-26M-03	~ Ø 42mm	0.3	3.5	25°~55°	Close	~5		
					Nominal	~50		
					Far	~75		

Modular Design for easy maintenance



Standalone

Software

Introduction

The software is divided into modules available to buy separately based on the users' needs.

The possible applications go from machine vision to 3D reconstruction, from satellite to medical image processing and much more.

Its new approach to no-code development in an intuitive GUI makes it ideal for the **direct use of the system by end users**, but it also **solves the problem of scalability for system integrators and machine builders**.

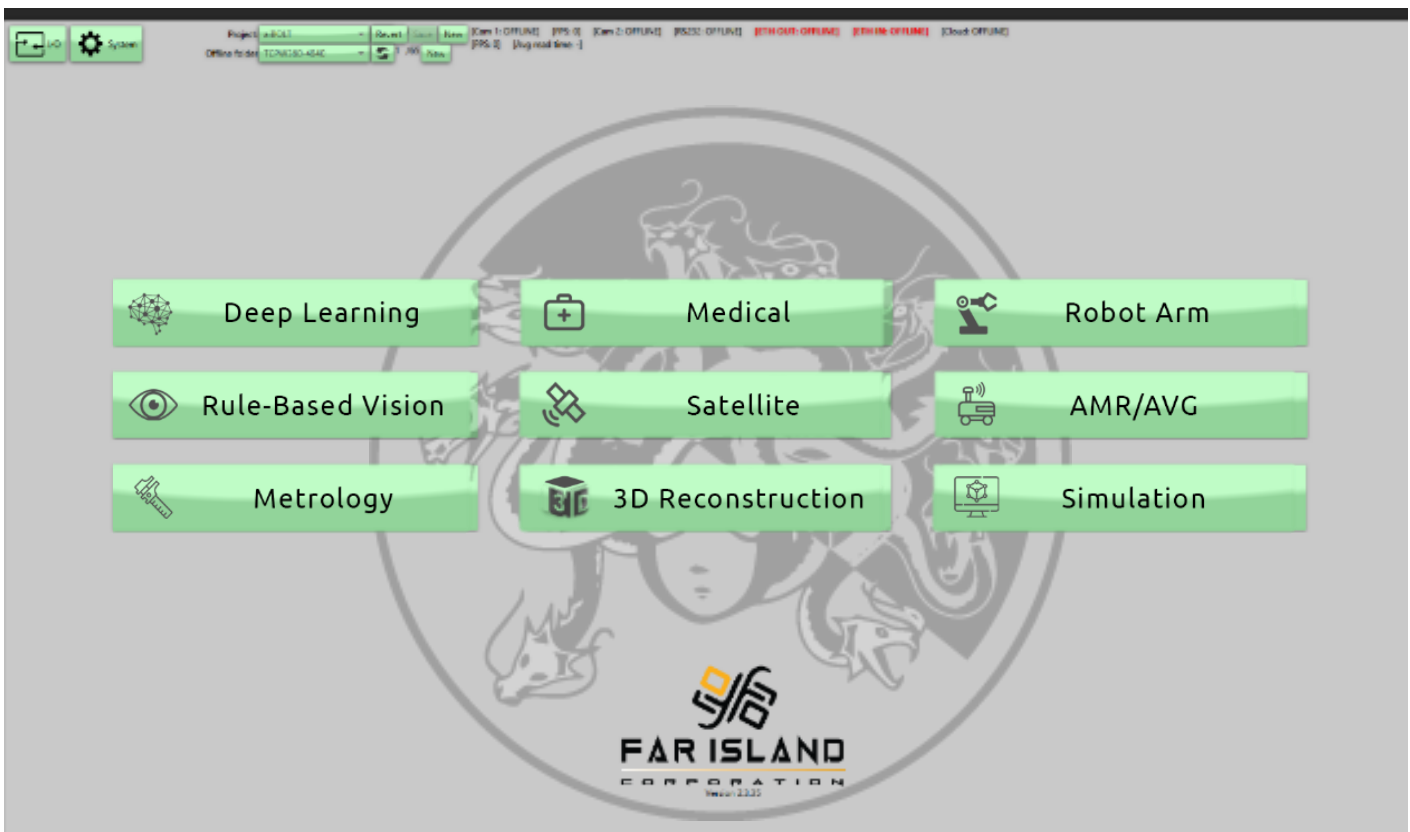


Figure 8. Modules available for all Ai1 systems.

Software

Deep Learning Module

The standard software included in the SmartPC-Ai1 has on-device everything needed to develop the vision solution on any possible optical system.

CCTV, Telecentric, Multi-Mirrors, Hypercentric, Catadioptric, pinhole, probes, are selectable from the GUI. This includes adjustments for the ROI size, position, the number of mirrors, unwrapping tools, and more. Additionally, the GUI integrates all necessary hardware peripherals and communication interfaces for interacting with the external world, ensuring a ready-to-use experience.

The fully GUI-based approach requires no coding skills and empowers anyone with state-of-the-art tools to develop a Deep Learning-based inspection solution in a few hours.

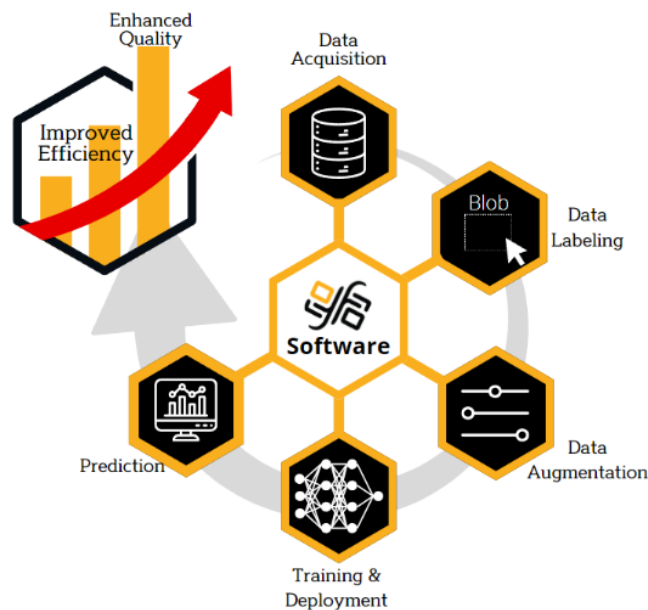


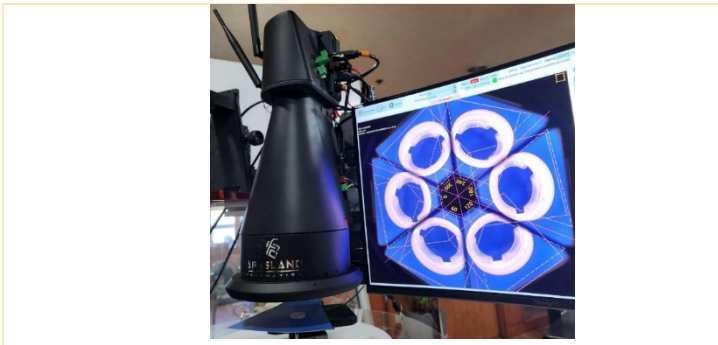
Figure 9. workflow of the development process

Brief Overview

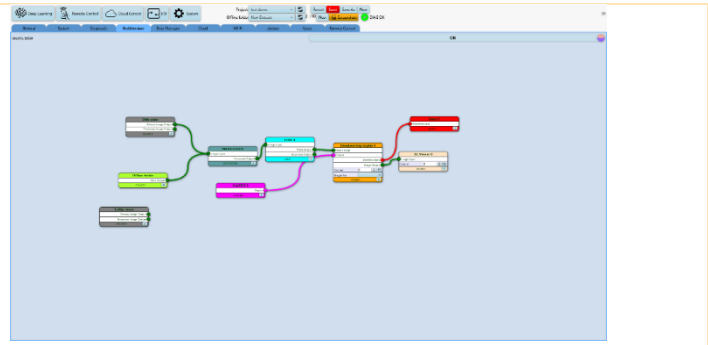
Rule-Based Preprocessing Tools	These include image enhancement, geometric transformations of the ROI, Color Space Conversion, Morphological operations, and others.
System Architecture Builder	A visual no-code workflow builder for selecting input channels (such as cameras, on-device offline folders, or external servers), applying preprocessing, cutting ROIs, and assigning classes and models. It supports multi-model inference on a single picture or individual channels of an RGB camera, for example.
Communication Management	Manage through hardware GPIO and Serials to directly control sensors and actuators or use Ethernet for communication with external devices like PLCs, computers, or other SmartPC-Ai1 units.
Illumination Control	The software includes an integrated high-power 48V, 4-channel controller with independent settings for pulse duration and an auto-strobe mode that emulates continuous acquisition with all the advantages of the pulsed mode.
Management Tools	Each software version comes with remote desktop, model backup, firmware updates via FTP or USB, and functions for saving images to external drives or NAS. Subscription to the System Integration or Far Island Partner program unlocks additional tools for online remote management (over the internet or intranet), mass deployment of models to multiple machines, and more.
Deep Learning Tools	<p>The highlight is the AI toolset, which is GUI-based and streamlines the workflow in 4 steps: Data acquisition, Labeling, Training, and Model deployment/prediction.</p> <p>Training can be performed on Far Island's cloud servers or directly on the edge device.</p> <p>Training directly on the edge device is slower but absolutely unique in the whole computer vision industry.</p> <p>Subscriptions offer additional options such as purchasing training time, popular choice for end-users, or dedicated GPU or Servers for SI and partners' Companies who wish to be fully independent or generate revenue by offering training subscriptions to their clients.</p>

SmartPC-Ai1 All-in-One Solutions

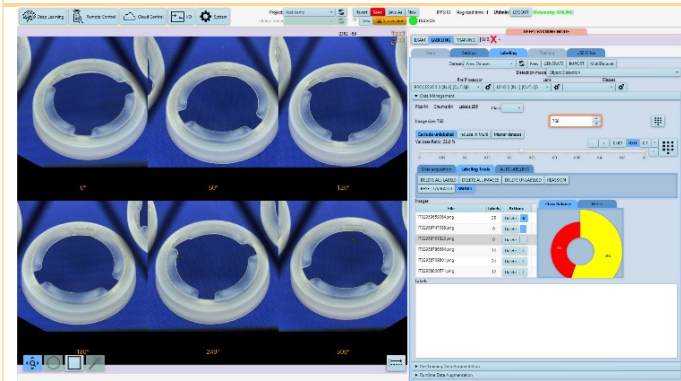
Workflow of the GUI-based DL



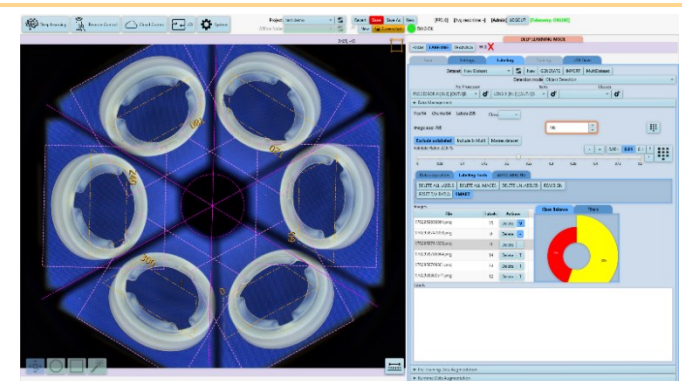
0. Setup of the system - Hardware



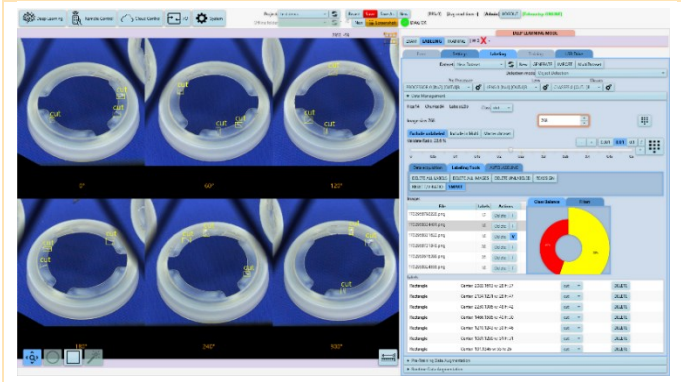
0. Setup of the system - Architecture Builder



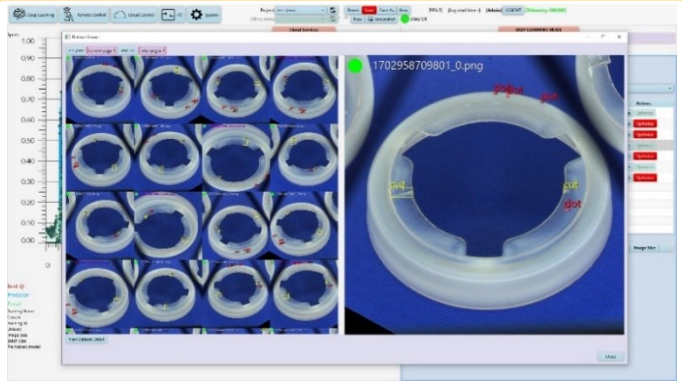
0. Setup System - ROI & rule-based enhancement



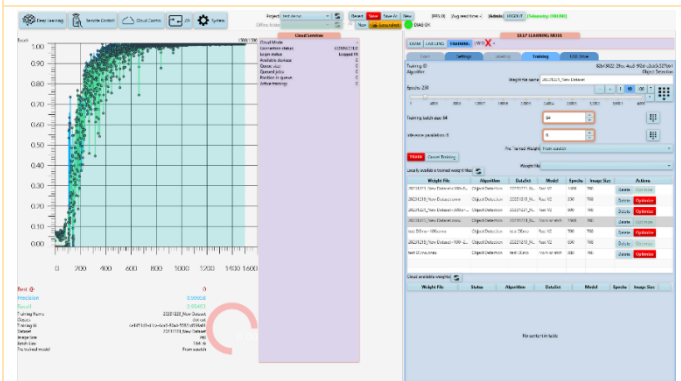
1. Data Acquisition



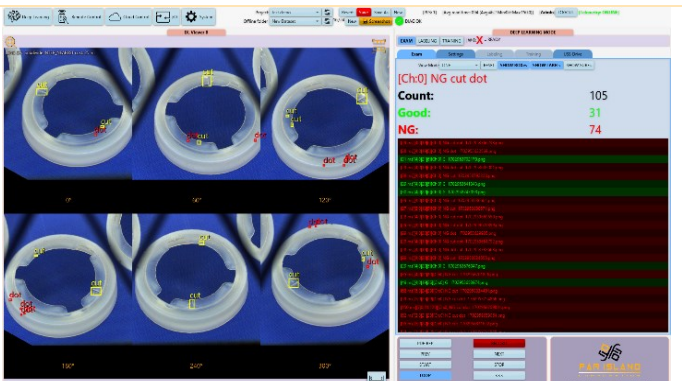
2. Data preparation - Labeling



2. Data Preparation - Augmentation



3. Training



4. Real-Time Prediction

