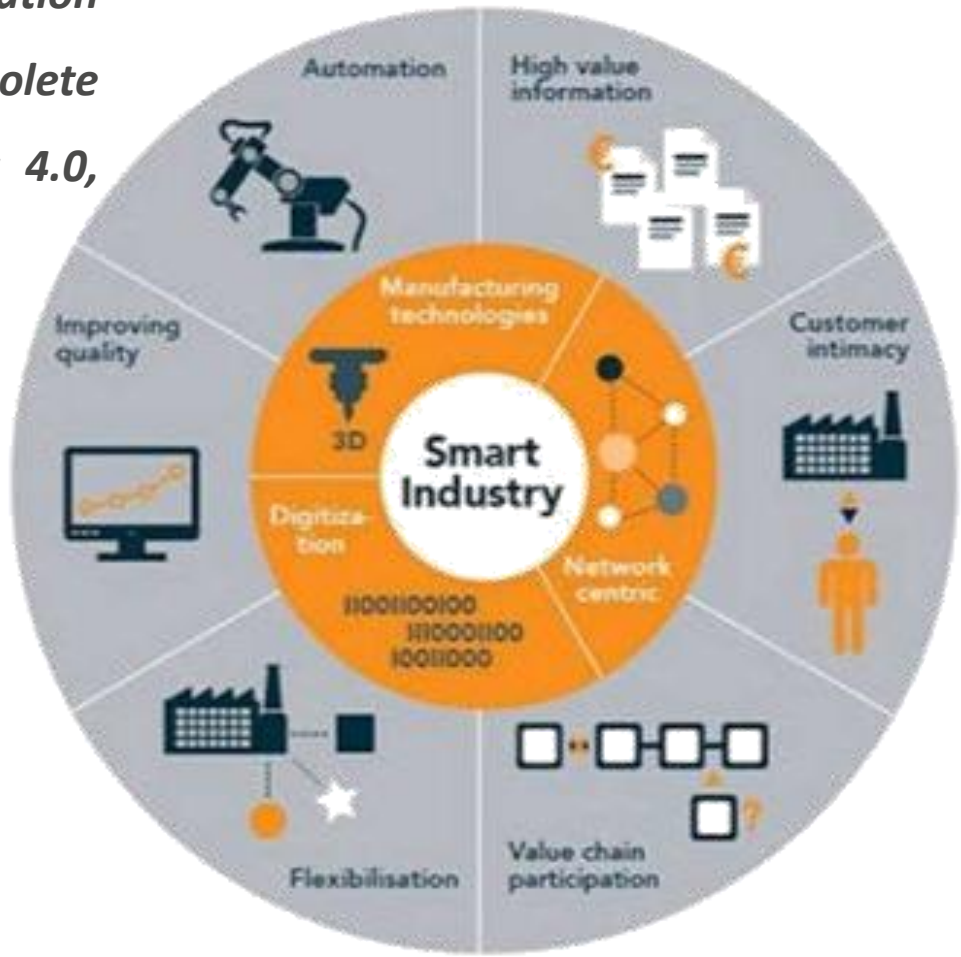

protom

TECHNICAL OBJECTIVE

DIGITURING – Digitalization low cost system for manufacturing SME

The technological objective is to introduce a low-cost digital transformation system for small and medium-sized enterprises, characterized by obsolete machines and systems, by exploiting the technologies of Industry 4.0, according to the principles of the Intelligent Factory.

An integrated system for industry 4.0, able to perform constant and automated monitoring of production assets, according to a vertical, modular, scalable and multilayer architecture, for the digitalization of quality control processes and the entire life cycle of the systems, through dedicated system made up of: sensors, hardware, firmware and software.



TECHNICAL OBJECTIVE

Technological trajectories of Industry 4.0 involved

- Simplified interfaces for using heterogeneous sensors (programmable system even by non-specialized personnel)
- IoT
- Low cost digitalization solution
- Sensorization for data collection in different standard formats compatible with the most popular system (ERP, robot, HMS, ecc.)
- Develop of AR/VR interfaces
- Computer vision

Research Area

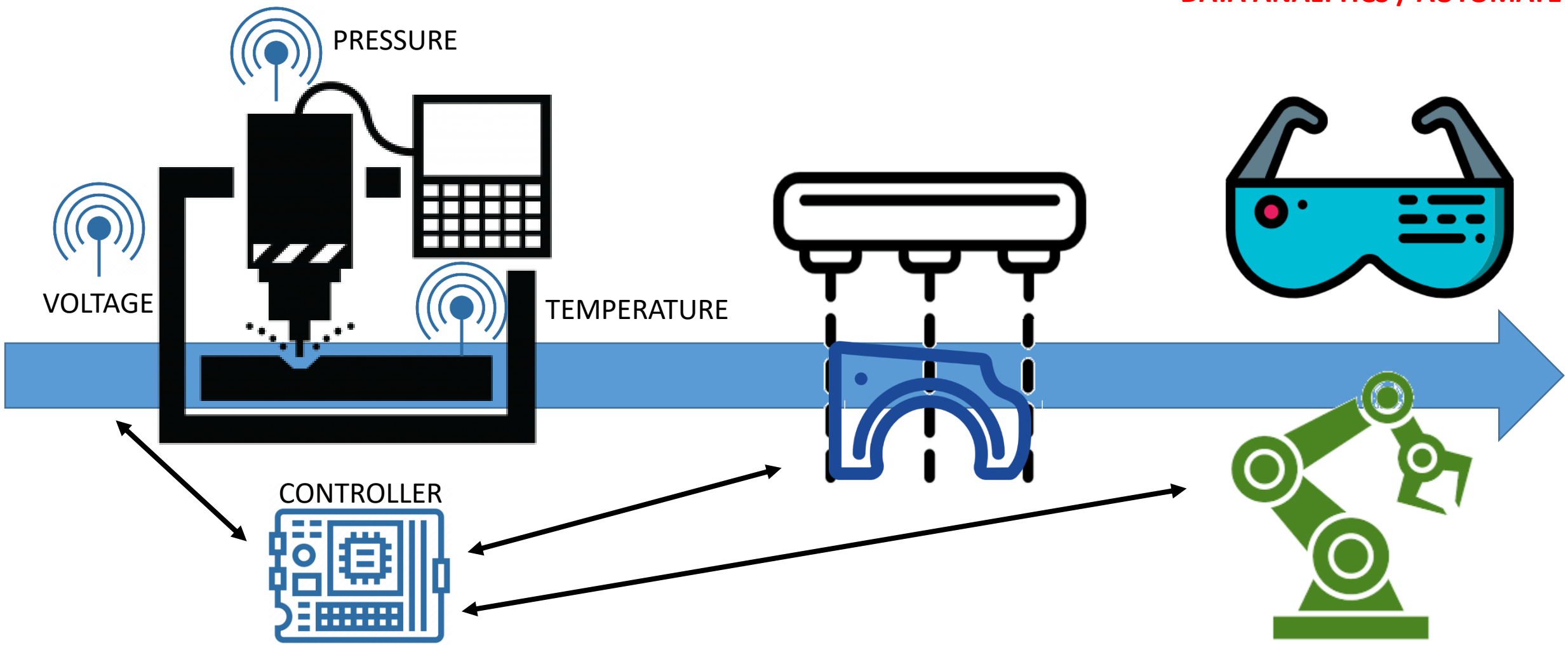
Possible research ideas can be connected to the digitization and sensitization process, to the inspection process and, finally, to the processing and presentation of the output data.

PROJECT IDEA (USE CASE: QUALITY CONTROL PROCESS)

OR1
DATA COLLECTION

OR2
NDI / VISUAL INSPECTION

OR3
DATA ANALYTICS / AUTOMATE

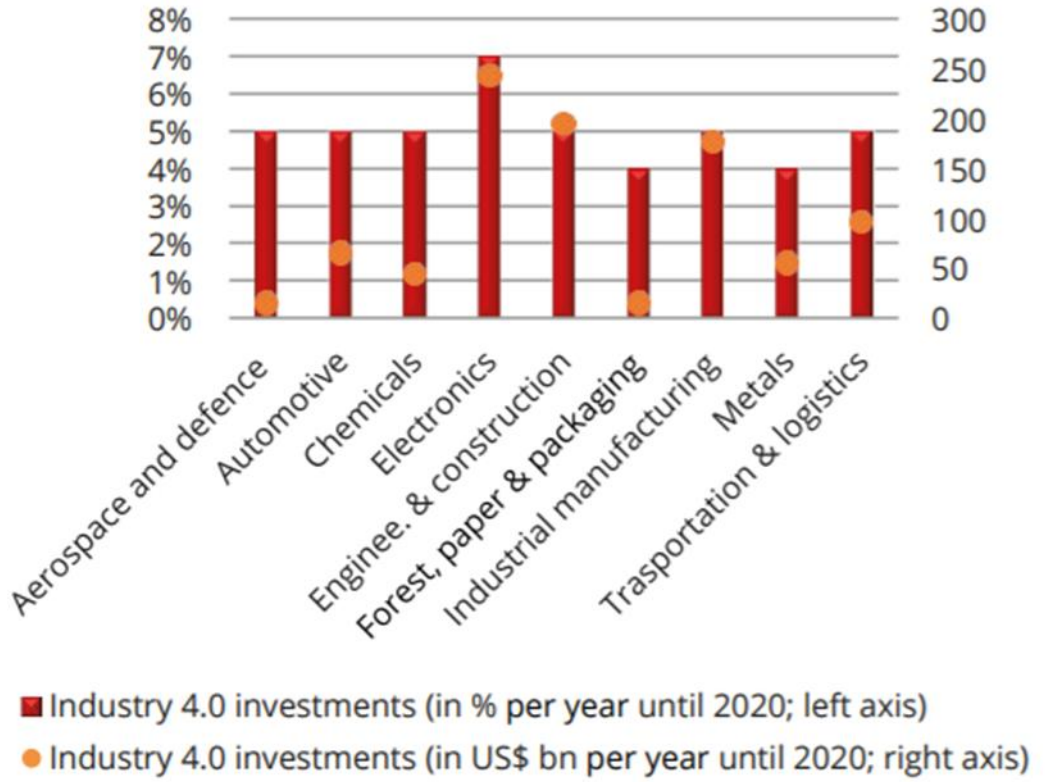


TARGET MARKET AND REFERENCE SCENARIO

- According to a 2017 report by the McKinsey Global Institute on Automation, half of total **productivity growth over the next 50** years will be driven by automation
- The World Economic Forum 2018 reiterated that **automation** will create 133 million new jobs worldwide, with different and more qualified roles and specializations.
- European industries are committed to making substantial investments in technological integration in the coming years. On average, industrial sector plan to invest 5% of their annual revenue totaling nine hundred and seven billion dollar in investments for industry 4.0 solutions.

Fig. 1.18 Planned Industry 4.0 investments by industrial sector

Source: I-Com elaboration on Pwc data (2016 Global Industry 4.0 Survey)



TOP-LEVEL LOGICAL BREAKDOWN

OR3: DATA ANALYTICS - INTERFACE I/O

OR2: INSPECTION

OR1: DATA COLLECTION & STORAGE

SOFTWARE LAYER
- HMS/Business intelligence
- Augmented Reality
- SCADA

CONTROL LAYER
- Image recognition/3D modeling
- NDT (X-ray, Ultrasonic,…)

HARDWARE LAYER
- Trasmission unit
- Storage Module

INTELLIGENT SENSORS LAYER

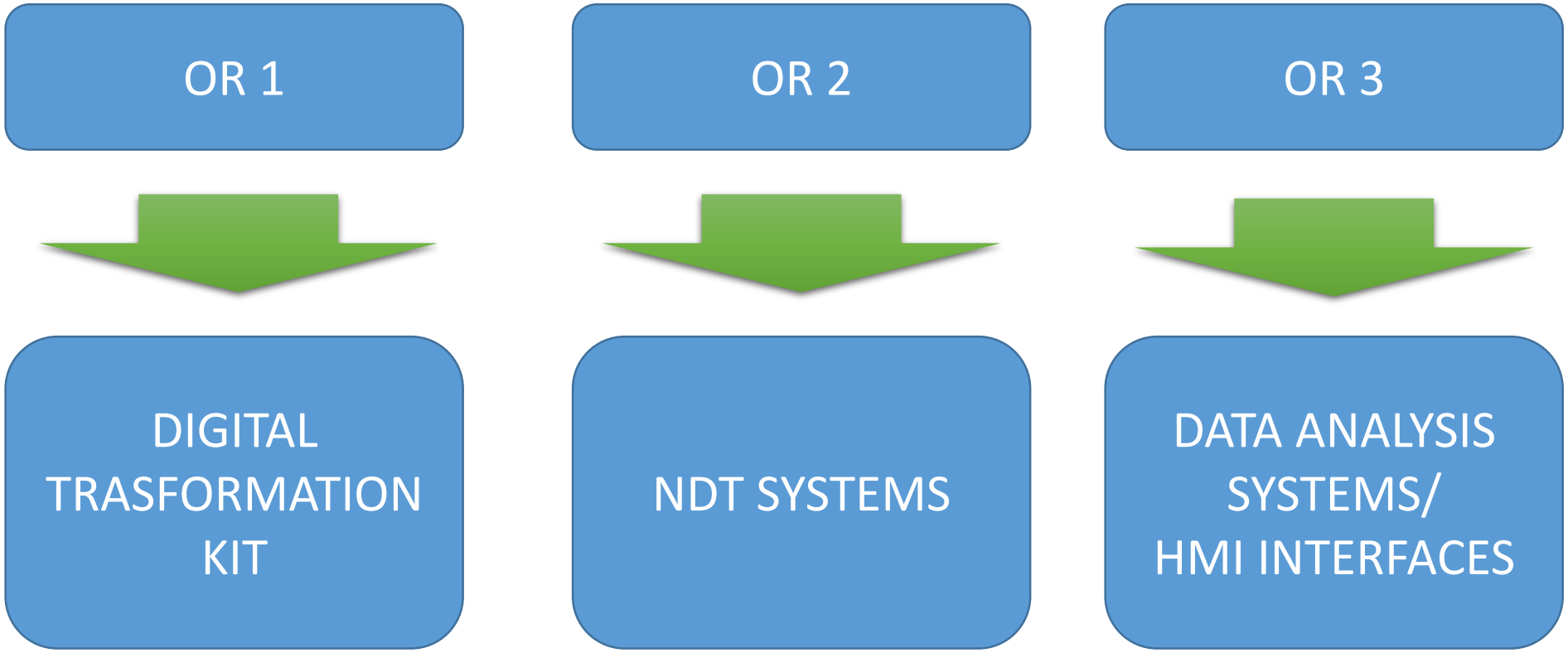
I/O

PRODUCT

PROCESS (*DTK4*)

THREE DIFFERENT SYSTEMS

The output of the project will give place to three distinct applications and to be sold separately or as a single integrated system.



TECNICAL DESCRIPTION OF MAIN PROJECT BLOCKS

OR 1 – DTK4 - Digital Transformation kit for 4.0

The previous scenario suggests that many companies still use **obsolete machines** for production processes**, far from the perspective of industry 4.0**

The DTK4 aims to modernize these processes with a **low-cost system** that captures and digitizes the work data of various industrial machines (turns, cutters, conveyor belts, custom automations) to make them usable with newest tecnologies (like **Augmented or Virtual Reality**) and systems (like **robots platforms**). The digital connection of machines would increase efficiency, productivity and promote distributed production logic.

The Digital Transformation kit is made of three major components:

Universal sensors:

Set of sensors for the acquisition of the greatest physical quantities involved in the production process, equipped with universal attacks for **compatibility with various types of machinery**.

Simplified control modules:

Controllers prepared to quickly connect different types of sensors, easily **installable and programmable even by non-specialized personnel**.

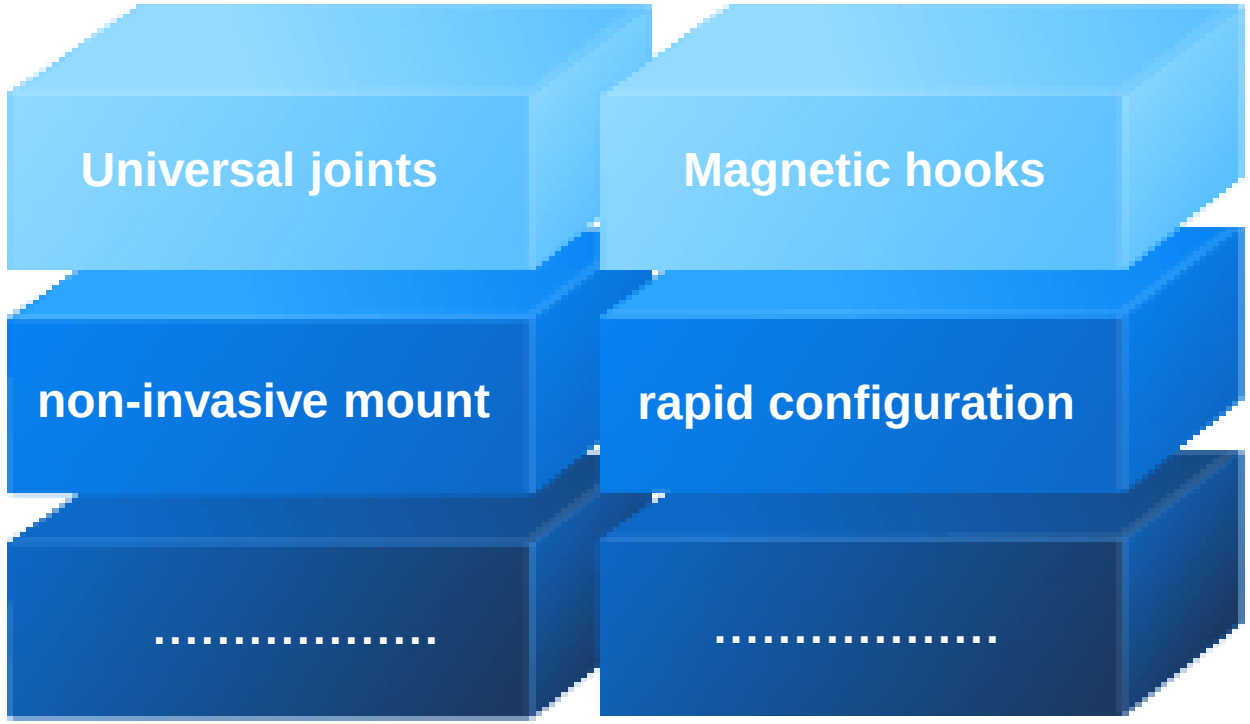
Interface cards:

External communication cards, which return data collected by sensors in different standard formats **compatible with the most popular mobile robotic platforms**.

1 - Universal sensors

Various plug and play sensors, which can be quickly integrated into the machine manufacturing process, used to collect the main physical quantities involved in the work cycle:

- Temperature
- Pressure
- Angular speed
- Linear speed
- Humidity
- Linear position
- Angular position
- Counting
- Brightness
- Magnetic field
- Electric field
- Electrical parameters
- Accelerometer
- Gyroscope
- Contact
- Infrared
- Ultraviolet
- Ultrasound



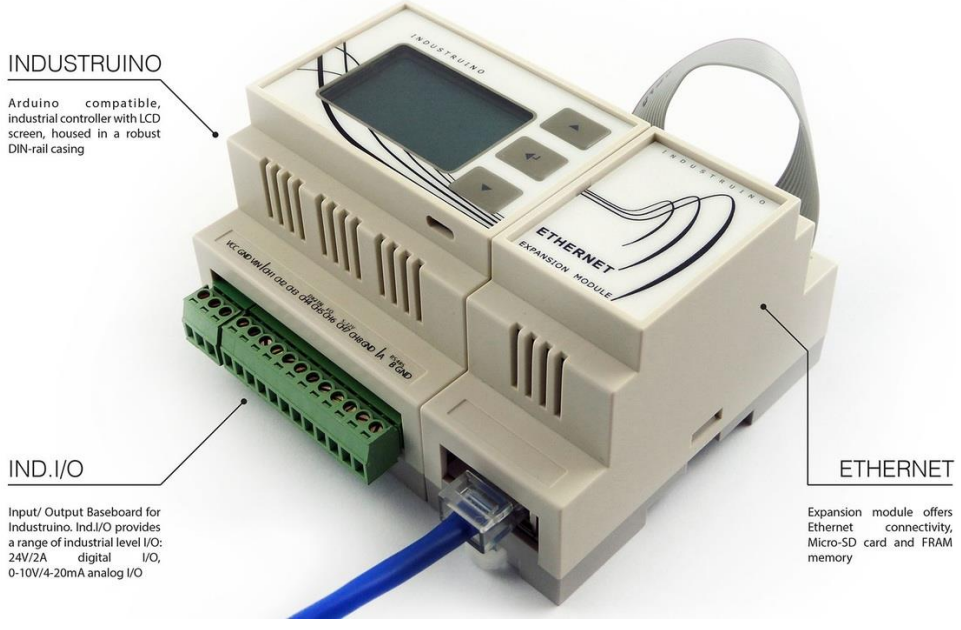
2 - Simplified control modules

A programmable controller is an industrial digital computer which has been adapted for the control of manufacturing processes, such as assembly lines or any activity that requires high reliability control and ease of programming and process fault diagnosis.

There are some Simplified programmable controllers, normally used in the research field, but are industry ready. These devices have same potential of PLCs used in the modern processes, but also have the advantage of being quickly programmable and reconfigurable..

For Example **Controllino** was developed with highest industry and electronic safety standards in mind and is fully CE-certified. This makes it perfect to use not only in prototyping scenarios, but also in final products.

Also **Industruino** is a fully featured Arduino compatible board housed in a DIN-rail mountable case to permanently install your application in no-time. Whether you use it for automation projects or data loggers applications, Industruino offers ruggedness, plenty of features and low cost.



3 - Interface cards

External communication module that return the data collected by the sensor field in various standard formats, compatible with mobile process and devices, like robots.

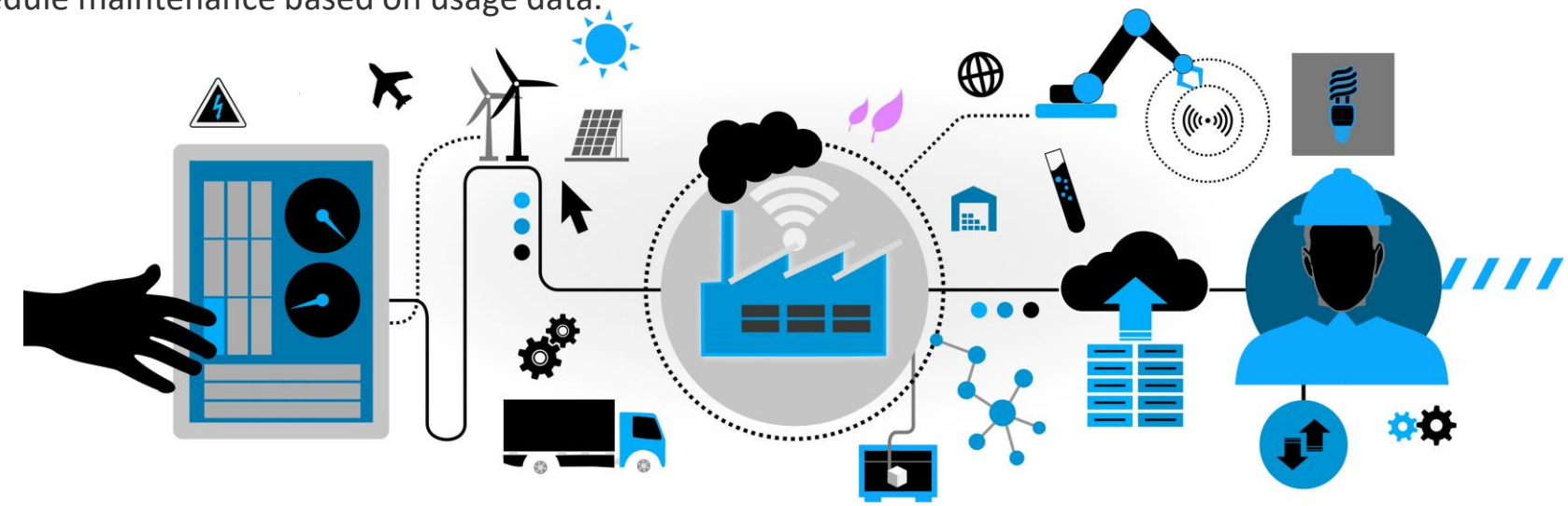
For Example, one of this is the **IOT2020**, an open and versatile gateway for Industrial IoT (Internet of Things), designed for continuous industrial activities and able to recover, process, analyze and transmit data to almost any kind of device or network. The product supports various interfaces, including Ethernet, USB and micro SD, is compatible with open source software such as Arduino IDE and Yocto Linux, and recognizes high-level programming languages such as Java, C ++ and JSON. IOT2020 is also expandable with Arduino shields and via an on-board PCIe port.

mPCIe

Benefit gained from DTK4 adoption

The widespread adoption of a digital transformation kit such as the one proposed, given the much lower costs compared to an ex-novo automation process, would allow several advantages:

- Low economic impact in the modernization of the production system in a short time.
- Greater impetus for the exchange of data between machines, as in the industry 4.0 paradigm
- Installation and use of the system not necessarily delegated to highly specialized personnel, but also achievable by personnel with low specialization.
- Optimize the production supply chain thanks to the real-time data acquired by the machines and supplied to operator remotely.
- Ability to simulate production scenarios before practical implementation.
- Better product quality and less material waste thanks to real-time production monitoring.
- Greater productivity thanks to shorter set-up times, reduction of errors and downtime.
- Ability to schedule maintenance based on usage data.



SHARING DEFINITION: OR 2 & OR 3

OR 2

The second realization goal concerns the realization of the inspection system for Quality Control (Visual Inspection) that allows a real time direct comparison between the object produced vs the specific model. The goal is to check the discrepancy of the parameters considered critical (shape, size, color, etc.) also on the basis of the information acquired by the integrated DTK, which allows immediate intervention also with the aid of a robot on the line productive (waste management, intervention, etc.)

So potential technological item on which we solicit your involvement can be:

- MODELING
- INSPECTION
- IMAGE RECOGNITION
- COMPUTER VISION

OR 3

The third realization goal is about:

- AR / VR interface usable on mobile devices which acts as integrated information viewer (alert, visual feedback, status, etc.),
- A Monitoring tool or Decision Support System, also in predictive function to machine operation,
- Control console for interaction with the machines and also possibly with a robot used in the production line
- So potential technological item on which we solicit your involvement can be:
  - AR/VR APP
  - DECISION SUPPORT SYSTEM
  - HEALTH MONITORING SYSTEM
  - PREDICTION/MACHINE LEARNING
  - ROBOT AUTOMATION

PLANNING NEXT STEPS

- TBD

Thanks