Case Design Sheet

1. CASE DESCRIPTION

TITLE: USITRONIC – Self-adapting production island

PARTNER	LOCATION	TIME/DURATION
CIMES	France	2010-2013

The project aims at shaping "zero defect" industrial pieces with a tool-machine equipped with miniaturized wireless sensors and geometric sensors controlling pieces and tools. A central system coordinates the whole and manages 24/7 the production of several sets of pieces. The final machine is equipped with a large capacity of different tools and materials.

2. DIGITAL TRANSFORMATION CHALLENGE

2.1. BUSINESS TRANSFORMATION

The R&D initial project gathered partners of different kinds:

- Industrial companies (Baud Industries, Pernat Emile, Productic-Espi) as end users,
- Laboratories (Laboratory SYMME, Université Haute-Savoie),
- Research centre (CTDEC).

When the different partners of the project thought about what the next solution should be, they agreed to work around several objectives that will deeply transform the way of machining and, first of all, gaining more benefits:

- Increasing machine up-time without increasing workforce needs,
- Reducing human errors while controlling,
- Spreading out the control process over time even during workforce absence,
- Avoiding long and tiring tasks for the operators.

2.2. CONCEPTUAL TRANSFORMATION

The main objective of Usitronic is to make a production cell autonomous by connecting all the production elements – hereunder mentioned – with each other in order to build a complete intelligent and self-adaptative "production island" from the raw materials to the last quality check of the finalized piece approving, or not, its conformity. This is a global solution in complete autonomy with as little human intervention as possible.

2.3. TECHNICAL TRANSFORMATION

Please find below the detailed description of the technological solution developed:

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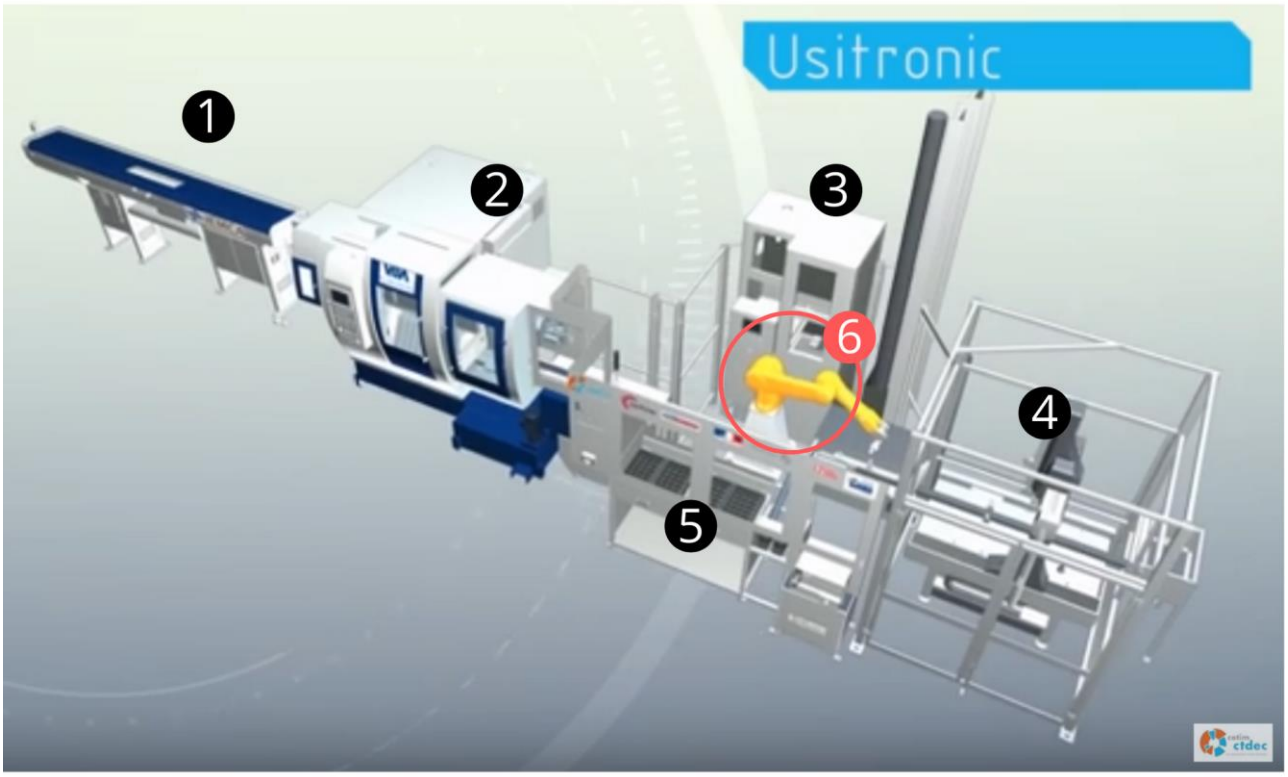

1) Barloader

This entrance line is where the raw materials are guided to the machine-tool to be worked as expected.
More than only bringing the raw materials, this part of the production chain allows to control the quality, the grade and the straightness of the bar via different digital systems. It is an important step before machining because it helps to reduce potential manufacturing defects and contributes to the high rate of performance delivered by Usitronic.

2) Numerical control machine-tool

The machine is full of sensors analyzing in real time the entire process of milling in order to secure the production of compliant pieces thanks to the geometric steering.

The machine is paired with a specific software – also called Usitronic – that can be easily adjusted according to the expectations and needs expressed by the companies and, above all, adapted with the usual design methods (CAD, CAM, traditional paper-plan…). The software can retrieve the data relatively for each piece produced to optimize them, notably regarding the dimensional tolerances that can be improved.

The analysis also concerns fatigue and breakage monitoring of the milling tools. To know when and how to change milling tools reduces the sudden and unexpected shutdowns that could have a huge impact on production and productivity.

3) Cleaning station

The first step of control is to clean the machined pieces in order to make them appropriate for the next analysis.

4) Dimension control

It is certainly the most important and significative part of Usitronic. Once the machined piece is ready after cleaning, the three-dimensional control can start based on the rating originally input into the data basis by the operator. Formerly done manually, this tedious step of control is now carried out by digital means improving the result and allowing to mobilize human resources on other tasks where their expertise is better used.

This step is much more important than only controlling the machined pieces and selecting those which are compliant. All the intelligence of the entire process is to use the collected data issued from this step to give information to the machine-tool in order to rebalance the incorrect settings. The retroactive loop facilitates and accelerates the potential changes needed and offers a large range of benefits for the companies in their production.

5) Storage

After the dimensional analysis, the machined pieces which are declared compliant with the initial ratings are stored and made available for the operator.

6) Robotic arm

The steps 3, 4 and 5 are done in an autonomous and isolated way by a robotic arm at high sample frequency.

3. SOLUTION

Consequently, the machine developed and used called upon different new solutions:

- Integration of sensors (dimensions, temperature, vibrations, efforts),
- Use of a robotic arm,
- Pairing with a specific software for designing.

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4. KEY SKILLS AND COMPETENCES

- Adaptive learning
- Automation
- Robotics
- Data monitoring
- Lean manufacturing

5. RESULTS

- Three full-scale demonstrators, two are located in industrial environment and one is dedicated to research.
- Labelling by the Alliance for the Industry of the Futur[1] as ''Vitrine'' project, highly representative of the French excellence in technological development
- New opportunities to work with differents sectors asking a high-level of precision like watchmaking

6. CONCLUSIONS AND RECOMMENDATIONS

The development of this new technological solution has allowed companies to get through some lasting challenges and gain benefits as mentioned below:

- Productivity improvement
- Time and resource saving in production (reduction of scraps)
- Better, faster and more reliable quality control
- End of repetitive and difficult tasks for the operators
- Technological solution adapted to a large range of industrial sectors

In order to continue the development of this solution, the partners are thinking about establishing a new R&D project to integrate more robotics and AI.

7. REFERENCES

- Project sheet: https://catalogue.viameca.fr/projets/usitronic
- http://www.industrie-dufutur.org/Vitrines/solution-logicielle-innovante-decolletage/
- SIMODEC 2016: https://www.youtube.com/watch?v=lnfYw-NkMJM
- Presentation of the project: https://www.youtube.com/watch?v=rB1MwXyrHF8
- http://www.journal-de-la-production.com/revue/usitronic-controle-vos-pieces

[1] Alliance Industrie du Futur (Alliance for the Industry of the Future - AIF) is created in July 2015 with the mission to « support and coordinate, at the national level, the initiatives, projects and works aiming at modernizing and transforming industry in France »[1]. AIF is the meeting point of the professional federations and unions, engineering schools, research centres, *pôles de compétitivité* and public entities involved in helping companies to innovate and invest.

- https://www.ledecolletage.com/groupe-baud-labellise-vitrine-industrie-futur/
- http://www.jautomatise.com/newsletters/numero/671/news/6058

8. APPENDICES

All charts, financials, visuals, and other related items can be placed here and referenced in the report.