GUIDE TO REMOTE SERVICE AND PREDICTIVE MAINTENANCE IN FOOD & BEVERAGE PACKAGING

gruppo tecniche nuove

SMART PACKAGING HUB
your food & beverage partners

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targets

EXPLAINING THE IMPORTANCE - FOR FOOD & BEVERAGE COMPANIES - OF DATA COLLECTION AND OF THE USE OF DATA FOR REMOTE MONITORING AND PREDICTIVE MAINTENANCE

HIGHLIGHTINGT THE KEY PARAMETERS TO OBTAIN RELIABLE AND RELEVANT DATA

PROVIDING REMARKS ON THE DIFFERENT AVAILABLE CONFIGURATIONS AND SOLUTIONS ON THE MARKET

From mechanics to mechatronics: machine digitalization and Big Data generation

Food & Beverage companies are living a deep transformation phase. The increasingly changing and globalized consumer habits impose companies a more efficient and flexible approach to production: the promptness of response to the market's demands becomes differentiating element from competitors; quality standards must become higher and higher; the traceability of products and processes a "must"; the manufacturing customization that needs increasingly small batches a plus of the offer value. Everything naturally in combination with a sustainability rise and a cost reduction that must not take place to the detriment of quality. It is not conceivable to meet this rising complexity of demands with standard machines and processes.

New challenges need new solutions, and these come from innovative machines that stem from the mechanics evolution into mechatronics: they are on-board equipped with an increasing quantity of electronic and IT components, which are interconnected with the business operating system but they are especially connected with the Cloud through the net.

Due to this interconnection, machines become part of the Internet of Things (IoT), that is an ecosystem to which they not only can communicate information about themselves – the famous "Big Data" namely the huge amount of data that sensors detect on the field – but from which they also receive information and indications on how to operate, according to the data analyses they have precisely provided. The company's ecosystem is transformed and comes to be composed by items that can communicate one another bidirectionally and optimize their operation to reach an improvement for the company in terms of higher productivity, cost reduction, quality and sustainability improvement, so that it can satisfy the market's new pressing demands in a competitive way.

Data collection, remote monitoring and predictive maintenance of machines: definitions and differences

Basic is the sensor, without which no data collection would be possible.

Sensors are essential to carry out accurate diagnostics. Sensors, opportunely positioned on the assets to be monitored, can continuously detect the data from the physical environment where they are installed – temperature, vibration, pressure, movements, consumptions and theoretically any parameter in which users are interested. Sensors for Industry 4.0 are "smart": they not only detect data but they communicate them via internet to central software that can process, analyse, compare and transform them into value for users. Moreover, they can receive information and, according to them, modify, through actuators installed on board, the behaviour of the asset on which they are placed. These two features make smart sensors enabling 4.0, that is to say all maintenance, monitoring and remote service operations that are unconceivable and unfeasible with conventional sensors.

In most cases, collected data are stored and processed on cloud, a much more efficient and flexible solution compared to "in house" servers. On Cloud there are software – a series of tools and applications like for instance software of Big Data Analysis, of artificial intelligence and machine learning – that analyse and process this data in order to provide customers with information and services.

The information drawn from data coming from the factory can, in a first stage, be used for the remote asset monitoring. Through connection via internet to the cloud where data and their processing are installed, it is possible for whatever enabled operator, "to read them" irrespective of the place where he is. Apposite dashboards allow presenting the information on the asset to the operator in a clear and structured manner, often in graphic form. Machine production performance, energy consumptions, processing times and measurement of the carbon footprint are some examples of parameters that can be read from remote and give indications of the asset operation.

If necessary, the operator can modify the necessary parameters from the dashboard and such indication will be sent via internet to the asset that will be consequently calibrated.

We are here speaking of remote assistance that, without the operator's intervention on the spot, allows modifying the machine operation, optimizing it.

Many interventions can be carried out from remote through dashboard and cloud connection: not only optimizing the operation of monitored machines, but also software updates, detection of anomalies and eventual process stop, remote installations of a new machine, guided interventions on asset and training.

In an even more advanced use of the remote monitoring, it is possible to execute predictive maintenance measurements. Constantly controlling the critical parameters for the operation of the asset itself – for instance vibration values, temperature increases, load variations and so on - forefront software that apply self-learning logics and behavioural forecast models, allow detecting significant operation deviations and so identifying the start of degenerative processes before they affect destructively the components we are monitoring. Therefore, the operator can programme maintenance measures, carried out in a targeted and scheduled manner, so avoiding emergency situations and expensive machine downtimes.

Key elements to be monitored to obtain the highest efficiency

In a sector such as Food & Beverage, characterized by high rates, huge production volumes but not necessarily high margins, the optimization of work cycles and the cost reduction are fundamental for the company's competitiveness. On the other hand, the Food & Beverage also features countless guidelines for a possible improvement of manufacturing processes, then resulting in a fertile ground for the application of digital solutions, which were conceived precisely for this purpose.

The general performances of a machine or process are described as KPI or Key Performance Indicator, such as:

- OEE (Overall Equipment Effectiveness)
- MTTR (Mean Time To Repair)
- MTTF (Mean Time To Failure)

Such indicators change from industry to industry and different companies have different KPI. Considering the Food & Beverage sector and focusing on packaging, process that requires machines' speed and flexibility, important performance indicators become the number of wrapping cycles completed in the time unit and without errors, demanded changeover times, the speed line, the times for the single wrap, the possibility of processing efficaciously and efficiently products

that differ in shape, weight and material, without making mistakes, the capability of working with new materials, such as low-thickness films and recyclable or ecologic packages, a quick reconfiguration of installations, the implementation of changeovers and the replacement of exhausted film rolls without line stops. The monitoring of energy consumptions is an important indicator of the performance of a company as well, in other words of the costs it produces.

The targeted monitoring of critical components and parameters for the asset operation is at the base of predictive maintenance. Their identification is a crucial step for a good damage prediction.

In the sector of Food & Beverage packaging, some of the common analyses to prevent damages include the infrared thermography with IR cameras to detect high temperatures or hot points in equipment; the acoustic monitoring that, through ultrasound or sound detection, shares in detecting leaks of liquid, gas or vacuum in systems; the vibration analysis, which allows monitoring variations in the vibrations of a machine; the oil analysis to check the oil conditions and to discover whether contaminants are present or leaks take place.

Required architectures, solutions and know-how

The data collected by assets and the software to analyse and process them in most cases are no longer located on “in house” servers, inside the company, but on Cloud, defined as an IT space outside the company, both physically and concerning management and maintenance. Provided with hardware and software resources, the cloud provides the company with processing resources that can be configured on demand by means of internet, enabling it to enter flexibly high-quality information services.

The solutions based on cloud architectures – the so-called Cloud-based solutions - are increasingly spreading due to the countless advantages they feature, especially for medium-small companies. The Cloud architecture for instance allows:

- The resource use at any time and wherever the user i;
- The management and maintenance of servers;
- The software update and their cybersecurity that are not entrusted to the company, which can so focus on its core-business, leaving the task of managing and keeping the system updated to the cloud-provider;
- The use of loud resources - with the countless business models that currently exist -involves lower costs and less implementation risks compared to “in house” solutions.

To enter Cloud services and to manage one’s own data and analyses, it is fundamental that the operator relies on a solution provided with intuitive and us-

er-friendly interface, permitting to represent on the most common and available devices – PC, mobile phone and tablet - in a clear and eloquent manner the data gathered from machines and the results of their analyses.

The interface is the last link of the data journey, which reach the cloud and then the operator from the sensors on machines. Ultimately, it is precisely the interface that will make the User experience with the whole system positive or negative, simple or complex, user-friendly or not. For this reason, the care of its design plays an essential role for a good use of the whole system and a good acceptance by the user.

The best solution is the one speaking the same “language” as end-users, that is to say of those who will use the software product. In the vast majority of cases, the machine operator is not an IT technician or a maintenance engineer, but he will be, for instance, a food or end-of-line technician. A good interface must speak the same language as these users and make use of words, phrases, representations and concepts with which they are acquainted, so that the information is of simple and unequivocal understanding and the interaction with the interface minimizes possible human errors.

Highlights and drawbacks of predictive maintenance in the packaging industry for Food & Beverage

Currently, industry is aware of the strict relation existing between maintenance and productivity of installations, product quality and, ultimately, company's competitiveness. Concerning this, the Food & Beverage packaging chain is not an exception: from the production of raw materials to the distribution in stores, the packaging role is fundamental for the goods' quality, especially in consideration of increasingly fast, fragmented and geographically distant supply chains.

A growing complexity of the process corresponds to an increase in the machine complexity, which become more and more performing but also involve an increasingly difficult maintenance, owing to frequent line redesigns according to the product to be packaged; work rates that change along the year, depending on the product availability; more and more frantic delivery terms. The more a management is articulated, the more it is necessary to turn to reliable resources, less subjected to operator's error or arbitrariness. Such reliability can be reached only through an automated, constant and real-time machine monitoring. The adoption of predictive maintenance policies can lead for instance to an efficiency rise by preventing unscheduled downtimes. A programmed maintenance can instead be carried out during a changeover or a planned line interval. This allows provi-

sioning spare materials at the best possible cost, not interrupting the supply to customers, always maintaining equipment in the best possible status, so that they can always operate under optimal conditions in terms of both productivity and energy consumptions.

The adoption of predictive maintenance policies is connected with non-negligible investment costs that must be evaluated according to the consequences of their missing adoption. However, it is interesting to mention here the result of a survey carried out by PMMI on the adoption of predictive maintenance solutions in Food & Beverage companies with special focus on packaging machines: today, 25% of interviewees have already adopted predictive maintenance solutions and about another one - fourth are going to do that. These numbers are self-explanatory.

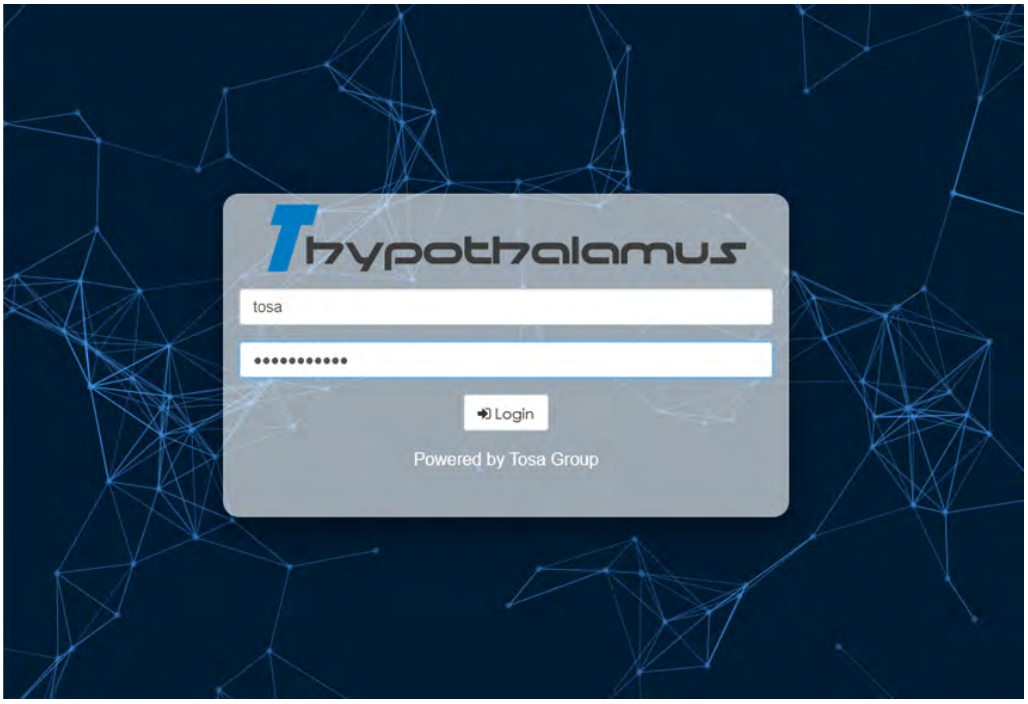
The business know - how required in the company to adopt predictive maintenance policies can be exacting as well, especially for SME. At present, however, there are some solutions on the market that allow adopting predictive maintenance logics without having necessarily to turn into IT specialists or without having "to adopt" a maintenance engineer in the company..

Available examples to face new market challenges: the solutions by Tosa Group

Among the examples of solutions that can really facilitate the adoption of remote monitoring and predictive maintenance for the Food & Beverage packaging sector, we can mention the brand-new Cloud-based platform by Tosa Group. Leader in the manufacturing of solutions for the end-of-line packaging and specialized in the production of wrapping, strapping and shrinking machines, Tosa Group offers a further service to its customers to meet their growing requirements of data collection and analysis. In partnership with a company specialized in IT solutions, it has developed T-HYPOTHALAMUS, an innovative Cloud-based solution of data monitoring.

T-HYPOTHALAMUS allows entering various indicators in real time, collected by apposite smart sensors opportunely positioned on Tosa Group's machines. These sensors communicate the collected data to the platform on the cloud and entrusted software process them, highlighting the parameters of interest to the operator through a dashboard. Parameters of production and machine performance, production speed, sizes of product and pallets, wrapping cycle times are some of the parameters analysed.

Using these analyses, T-HYPOTHALAMUS can calculate the most important key



T-HYPOTHALAMUS, an innovative Cloud-based solution of data monitoring

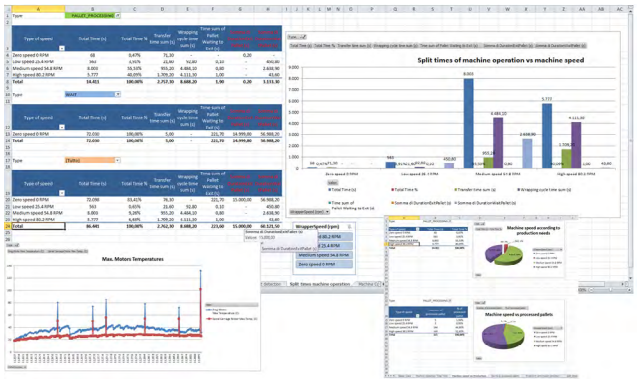
performance indicators currently used by industry, that is to say OEE (Overall Equipment Effectiveness), MTTR (Mean Time To Repair) and MTTF (Mean Time To Failure). According to such information, even from remote, the operator can understand whether the machines are working at their best and, otherwise, to act on the parameters to be optimized.

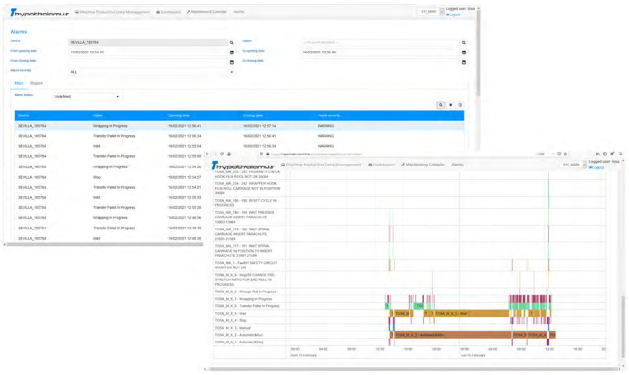
Through the registration and analysis of data concerning the machine conditions (for instance, operation time, downtimes, alarms, wait time between two wrapping cycles, overall cycle counters, failures and replacements of consumables) and the detection of significant deviations from standard behaviours, T-HYPOTHALAMUS warns the operator about the need of maintenance interventions, besides standard ones already scheduled.

Finally, with T-HYPOTHALAMUS we can also monitor energy and material consumptions and, according to them, the Customer can then calculate its carbon footprint.

This system actually upgrades the way users look at their machine's perfor-

mances. One of its most appreciated functions is the advanced troubleshooting: the software can show a graphic interface that classifies the failures that occur during the overall machine life. This is certainly a remarkable advantage compared to a simple PLC (Programmable Logic Controller), since it can file information only for a short period of time. Finally, one of the highlights of T-HYPOTHALAMUS is the user-friendly intuitive dashboard, calibrated on the language of technicians of the Food & Beverage sector at the production end of line. This assures utmost usability for Users who, therefore, will be able to manage and operate machines at the top of their performance.





Conclusions

The transformation in the production paradigms of the Food & Beverage industry needs increasingly efficient and flexible manufacturing processes. The shift to technologies 4.0 is the response to these challenges. Such evolution implies the machine digitalization and the collection of big data about their operation through smart sensors. By means of suitable software, such data are analysed and returned to machine operators as useful information to optimize production processes or to prevent damages to the same. Among the currently available software, T-HYPOTHALAMUS features characteristics that make it a user-friendly solution, so becoming a truly enabling tool for a better establishment of 4.0 technologies in packaging machines for the Food & Beverage sector.

Keypoints

- Cloud-based T-HYPOTHALAMUS solution can meet the growing requirements of data collection and analysis from packaging machines in the Food & Beverage industry.
- Due to its technical specifications, T-HYPOTHALAMUS facilitates the adoption of the remote monitoring and of predictive maintenance for packaging machines.
- The monitoring of crucial machine parameters allows achieving more efficiency, flexibility and sustainability from manufacturing processes.