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Industrial Internet of Things - A brief reflection on the benefits of its use in the production process

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ABSTRACT
The Internet of Things applied in an industrial context has given rise to a new concept, the Industrial Internet of Things. The objective of this article is to develop, through a bibliographic research, a brief reflection on the benefits of the use of the Industrial Internet of Things in the production process. It is concluded that the benefits encompass aspects such as: better monitoring of resources involved (physical and human), regular control (24 hours a day), improvements in decision making, increased security, cost reduction, optimization, simplification and acceleration of the various operations involved.

Keywords: Internet of Things, Industrial Internet of Things, Production process, Industrial engineering.

INTRODUCTION

The production process can be understood as a set of tasks, or activities, necessary for the manufacture of a particular product. They range from the design and conception of the product to its availability to the end customer. It is an integrative process at several levels, so we fully agree with the words of the authors PEREIRA & PACHECO (2015, p. 4), when they argue that "The production process encompasses activities where the interaction of raw material, labor, method, measurement, machines, environment is necessary in order to guarantee products and/or services as a result".

Naturally, the stages that make up a production process, regardless of its type (continuous production, intermittent production, etc.), vary according to aspects such as the activity carried out by the company and also the raw materials needed to design the final product. For example, the production process of a car is necessarily different from the production process of olive oil or the production process of cement, they encompass completely different resources (machines, raw materials, employees).

Historically, there has been a significant evolution of methods and techniques. *Lean Manufacturing* (Toyota), TPM - *Total Productive Maintenance* and TQM - *Total Quality Management* were some of the philosophies widely applied in numerous activities, whose objective was the general improvement of the production process.

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In the face of these developments, Industrial Engineering, which constitutes "(...) a branch of engineering that deals with the optimization of complex processes, systems, or problems." (COSTA, 2018, p. 42), has had to adapt over time.

The advent of industry 4.0, it can be said, "(...) emerged with the increasing automation of production processes, together with the technological advancement of the internet and the development of intelligent objects (products and machines)" (COLOMBO & LUCCA FILHO, 2018, p. 80) and brought innovations with enormous application potential, namely IIoT – Industrial Internet of Things.

Also in the context of Industry 4.0, SANCHES *et al*. (2018, p. 51) speak of advanced manufacturing, suggesting that "(...) The association between robotics and elements of other technologies, such as robots controlled via the internet and that in addition to performing their activities provide information to the production line, has given rise to advanced robotics and has maximized the quality of products and services, the health and safety of employees and the reduction of energy and resource consumption."

Bearing in mind that sudden stoppages in production can cost a lot of money (PRAJAPATI *et al*, 2019, p. 978), it is necessary to develop appropriate strategies that increase the efficiency of production processes.

Considering that the IIoT – Industrial Internet of Things is increasingly addressed in the context of production processes, it is justified to prepare a study that evaluates the benefits of this use.

IOT (INTERNET OF THINGS) E IIOT (INDUSTRIAL INTERNET OF THINGS)

Before addressing the subject of IIoT, it is necessary to start by starting some considerations about IoT - Internet of Things, an approach with increasing application in the most diverse areas of society.

In terms of origin, for RODRIGUES *et al*. (2016, p. 37) "The term Internet of Things (IoT) was first used by British researcher Kevin Ashton in 1999."

Within its scope, sensors endowed with various functionalities play a fundamental role, it is based on them that information is obtained to improve processes.

The authors SEHRAWAT & GILL (2019, p. 524-525), presented a classification that elucidates well the enormous variety of sensors that are available today: Proximity, Position, Occupancy, Motion, Velocity, Temperature, Pressure, Chemical, Humidity, Water Quality, Infrared, Gyroscope, Optical.

For FACHINI *et al*. (2017, p. 86), "IoT has several applications, which can range from a smart cafeteria controlled by the cell phone to sensors that predict and analyze the "health" of the operation of machines in a factory".

This last part of the reasoning of the previous authors leads us to the concept of IIoT - Industrial Internet of Things, which can be seen as an extension of IoT to the industrial context (WÓJCICKI *et al*.,

2022, p. 11; SEKONYA & SITHUNGU, 2023, p. 361; NIMMY *et al*., 2022, p. 244), in which various industrial devices (machines, computers, vehicles used in the movement of goods, etc.) are connected to the internet.

De acordo com RÜßMANN *et al*. (2015, p. 4), "(…) with the Industrial Internet of Things, more devices - sometimes including even unfinished products - will be enriched with embedded computing and connected using standard Technologies".

The applications of IIoT are numerous, for example, among others, in Manufacturing, Agriculture, in the context of Ocean of Things, among others, as JAIDKA *et al*. argue. (2020, p. 4).

It is also important to note that IoT and IIoT differ from each other, especially in terms of security. This is the opinion of SKLYAR & KHARCHENKO (2019, pp. 1046-1047), who presented in the form of a table a systematization of these differences in several sets: focus, priority, device implications, reaction to threats, updates, device life cycle, and conditions of use.

OBJECTIVE

This article seeks to understand the benefits of using the Industrial Internet of Things in the production process.

METHODOLOGY

To achieve the proposed objective, a bibliographic research was used, which, according to (PRODANOV & DE FREITAS, 2013, p. 54), is "(...) elaborated from material already published, consisting mainly of: books, magazines, publications in periodicals and scientific articles, newspapers, bulletins, monographs, dissertations, theses, cartographic material, internet, with the objective of putting the researcher in direct contact with all material already written on the subject of the research".

RESULTS DISCUSSION

The adoption of IIoT in the production process brings numerous benefits. It should be noted that, according to MISRA *et al*. (2022, p. 83415), "Industrial Internet of Things (IIoT) aims to achieve higher operational and management efficiencies by bridging machinery, equipment, human resources, and all other actors involved in an industrial environment".

Taking into account that IIoT obtains relevant information during the production process through low-cost sensors and wireless networks (SHI *et al*., 2020, p. 1263), in operational terms, a more effective monitoring of the various resources involved is achieved. For example, it is possible to determine in real time the amount of raw materials needed throughout the process, as well as to predict future quantities more accurately depending on the pace of production. In other words, "(...) the products are automatically

directed through the production process, including the raw material, to the extent that there is a demand made by the machines themselves" (PERINI, 2018, p. 20). This implies significant improvements in terms of cost determination, *stock management* and even the fluidity of storage.

Still in the sense of resources, the use of IIoT also allows a better management of the various human elements involved, more easily they can be adjusted to the most suitable jobs, or for which they demonstrate greater aptitude or professional experience. Savings in human resources are generated, as suggested by the authors LEVINA *et al*. (2020, p. 5). It can also be mentioned that, if these human resources are allocated to the functions that are best suited to their profile, the consequence is an increase in their satisfaction and productivity.

This control of production processes based on IIoT meets the conditions to be applied 24 hours a day. In order for it to develop quickly and fluidly, it can be developed through fixed devices, but essentially mobile, such as *tablets* and *smartphones*. It is possible to access information in real time and make the necessary adjustments at various points in the process, which results in greater efficiency. In CONWAY (2016, p. 13), "Inputs include tablet entry and a link to secure files through QR codes from the instrument label (using a Smartphone/tablet QR reader)". In the study by DOS SANTOS *et al*. (2022), which consisted of the development of an IIoT process in the monitoring of electric motors, the use of desktop and *mobile devices was used*. The authors considered that "(...) the professional, with this tool in hand, can obtain the necessary information from different formats and locations" (DOS SANTOS *et al*. (2022, p. 6).

It is important to highlight the perspective of those who make decisions within the company, so we agree with the opinion of DA SILVA VIEIRA (2019, p. 24), when they argue that "IIoT contributes a lot to the agility of decision-making by providing real-time data, (...)". As such, IIoT is an approach capable of providing the manager/decision-maker with relevant information that better supports the choices they make in their day-to-day, as well as in the production planning process itself.

From another perspective, the issue of safety in the production process should be addressed, which is a critical aspect to be taken into consideration. IIoT, through the realization of adequate forecasts, ensures the minimization of accidents (e.g. temperature sensors that reduce the risk of fire), detects equipment failures in a timely manner (e.g. sensors that warn of the overproduction of a given machine), among other examples.

On the other hand, we agree with ROSA & ALVES (2022, p. 35), when they state that "(...) IIoT makes it more feasible to perceive errors, thus reducing unnecessary expenses that could be generated by them, facilitating the improvement of continuous improvement (...)". Cost reduction is implicit not only in the perception of errors, but in the entire process. Many of the above considerations result in a reduction in costs, a crucial aspect in increasing the competitiveness of companies: unexpected breakdowns that are

detected in a timely manner, avoiding unnecessary expenses; adjustment of human resources so that it is not necessary to hire workers at times of sudden increases in production; Predicting stock-outs in advance means that it is not necessary to purchase raw materials at excessive costs, etc.

To conclude, it can be said that the previous considerations allow, in general of the production process, an increased level of optimization, simplification and acceleration in terms of its various operations.

FINAL CONSIDERATIONS

This article, through a bibliographic research, aimed to reflect on the benefits of the use of the Industrial Internet of Things in the production process within the industry.

It has been found that IIoT is a new world of opportunities with very significant impacts on the industry. In the production process, the benefits include better monitoring of resources (physical and human), regular control (24 hours a day), improvements in decision-making, increased security, cost reduction, optimization, simplification and acceleration of the various operations involved.

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