

Thesis title: Industry 4.0: Online scheduling and maintenance

Research work

General context

For many centuries, our societies have been constantly challenged by fundamental innovations, developments and new ideas, facilitated through scientists and entrepreneurs. Part of our lives was influenced by these transformations like our culture, the humanities, politics and our work environment. It's called revolution, which turns our lives forever and for the better. Today, this revolution is cited in the literature as the "industrial revolutions" as essential foundations for our modern life. Scientists and researchers experienced three major industrial revolutions. These revolutions began in the 18th century, replacing agriculture and human work by automated, programmed and special purpose machines and robots. This transformation changes the way the world has been working, economics and products. Nowadays, the automated production and the IT describes the 4th revolution. Industry 4.0 describes this revolution which is a trend for automation and connected manufactures. This revolution aims to increase productivity and create new industrial fields which depend on data and information acquisition and share along the supply chain (Keller et al., 2014). In other words the digital world is connected to the physical world. According to (Oesterreich & Teuteberg, 2016) the increase of the digitalization, automation and communication enable the creation of a digital value chain. The big main components in this revolution were the cyber-physical system (CPS), internet of things (IoT), and big data (BD). According to (Wang et al., 2016) industry 4.0 describes a production orientated by a cyber-physical system (CPS) integrating production facilities, warehousing system, logistics and even social requirements to establish the global value creation networks. The manufacturing resources are defined as intelligent agents and implement dynamical reconfiguration to achieve flexibility. In addition CPS can be applied and play an important role in several areas such as motor vehicle manufacturing, heavy industry and logistics (Zhou et al., 2016) (Liu et al., 2017).

As for the Internet of Things 'IoT', it is the one who fundamentally changes the communication in the supply chain management 'SCM' by allowing humans and things communications (Bendaya et al., 2017). It can be defined as a network of physical objects that are digitally connected to sense, monitor and interact within a company and between the company (Bendaya et al., 2017). The SC is capable with the IoT to be agile, visible, trackable, and the information's is shared to facilitate the planning, control, and coordination of the SC process. All of the information and the huge amount of data from different sources were acquired, stored and analyzed through the Big data

(Provost & Fawcett, 2013). Big data can be considered as a new enterprise system or platform for all kinds of industries. (Addo-Tenkorang & Helo, 2016) define big data as a new generation of technology designed for organization to extract value from huge data volumes. From this components the term Smart factory appear, which is a factory that assist people and machines in their tasks (Hermann et al., 2016). Smart factory is composed of a new integrative real time intercommunication among each manufacturing resource such as sensors, actuators, machines, robots, etc. (Qin et al., 2016). Furthermore, it will create an intelligent environment to achieve flexible and adaptive processes.

Objective

This thesis proposal aims to design and validate a new framework solution for the online scheduling and maintenance. This framework has a self-configuration features and integrate several sub-systems such as online sensors and manufacturing big data to deal with disturbances in the production line and reduce maintenance cost. The ability to face unforeseen and disruptive events, which uses an efficient tolerance scheduling and immediate maintenance response, to lessen the need of rescheduling and maintenance in the face of those events. Several Industry 4.0 components were communicated to achieve real time scheduling and maintenance in the production line.

Tasks planning

Task 1: Elaborate a state of the art related to the subject Industry 4.0.

Task 2: Elaborate a state of the art related to opportunities and challenges through by Industry 4.0 in the scheduling and maintenance field.

Task 3: Design and propose a framework solution for the online scheduling and maintenance.

Task 4: Test and perform the proposed framework on a real industrial case.

References

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