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A brief discussion on the trends of habilitating technologies for Industry 4.0 and Smart Manufacturing

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Abstract

Industry 4.0 refers to the integration of a multiplicity of technologies and agents for the common goal of improving the efficiency and responsiveness of a production system. This integration has the potential to revolutionize the manner in which business are planned and conducted. Smart Manufacturing represents the implementation of Industry 4.0 on the manufacturing floor. The Internet of Things, Big Data, Cyber Physical Systems, Machine Learning, Additive Manufacturing, and Robotics are only some of the elements that are associated with this revolution. This article discusses trends in some of the habilitating technologies of Industry 4.0.

Keywords: Industry 4.0; Smart Manufacturing; Cyber Physical Systems; Machine Learning

1. Introduction

The term Industry 4.0 was coined to describe a system that evolved from a computer controlled automated facility (Industry 3.0), into a system that gathers and analyzes data from the floor to make intelligent decisions in an automated manner. In this context, Industry 1.0 corresponds to the first step in industrialization, in which steam powered machines replaced human and animal powered machinery in production facilities during the 18th century. The appearance of mass production in the 19th century, with its hard automation, is dubbed Industry 2.0[1].

The convergence of new sensor technologies at affordable prices, with the ever increasing capacity of the information systems to store and analyze vast amounts of data, are key elements of Industry 4.0. The ease of accessibility to these data, and more importantly, the analysis of trends and behaviors that these data represent, are revolutionizing the manner in which decisions are made. New business models and ways of improving the quality of products and services are direct outcomes of Industry 4.0

Smart Manufacturing is closely related, and could be thought of as the deployment of Industry 4.0 for the case of manufacturing. On line bidding, part tracking for quality monitoring, process health monitoring, distributed manufacturing are examples of new paradigms for customer – supplier interaction. Technology improves their ability to share information and knowledge, for the final goal of improving product quality productivity, energy efficiency and safety.

The special issue of Manufacturing Letters on Industry 4.0 and Smart Manufacturing presents some excellent examples of what is happening at present, as well as the future needs of industry in this area and some discussion about the directions that industry may take. In preparation, this paper discusses the habilitating technologies and some of the trends that are related to the implementation of Industry 4.0 in manufacturing. As seen in Figure 1, there are a multiplicity of technologies and elements that are integral to this revolution. Four of these are chosen for discussion in this work: the Internet of Things,