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Industrial Informatics

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Abstract Industrial informatics has emerged as one of the key disciplines for intelligent management and dissemination of information in today's world. It involves the study of systems that represent, process, and communicate information. It enjoys its success by effectively combining advanced computing techniques and industrial production. This paper introduces fundamental concepts and issues in industrial informatics along with some applications.

Keywords informatics, industrial informatics, industrial IT, information and communication technologies (ICT)

Introduction

The rapid development of information and communication technologies (ICT) and its intensive use in industry has led to a new branch in computer science called "industrial informatics." Informatics is the study of information and the ways information is used by human beings and social systems. It is the use of information technology to advance a domain.

Informatics is the interdisciplinary study of systems that represent, process, and communicate information. It is the study of the application of information technology to solve problems within a specific discipline [1]. It involves the practice of information processing and the engineering of information systems. It is the discipline of science which investigates the structure and properties of scientific information [2]. Informatics, when used in an industrial framework, must be predictable.

Concept of Industrial Informatics

Industrial Informatics refers to the study of design, analysis, processing, and innovation of information technology (IT) in industrial applications. It has emerged from the development of science, engineering, and information technology. It may be regarded as the field of knowledge combining IT science with industrial technologies science. The term "industrial" refers to the approach for real-world applications, while "informatics" suggests tools and techniques for the analysis, manipulation, transformation, and distribution of information. Information is manifested in different forms. It may be in the form of raw data, images, video content, speech signals, etc. Since the advent of digital computers, information is processed digitally. Industrial informatics has been defined as [3]:

Industrial Informatics = Approach for real-world problem + IT Tools and Techniques

Figure 1 shows a typical industrial informatics applied in microelectronics [4]. Several information technologies, such as Internet of things and cloud computing, have been used in industrial production, resulting in a tremendous development of industry informatics. For example. cloud computing has emerged as one of the most potential infrastructures for industry informatics to provide computing resources and services. It provides industry informatics with on-demand services that allow customers to use the cloud resources to store and process their data [5].

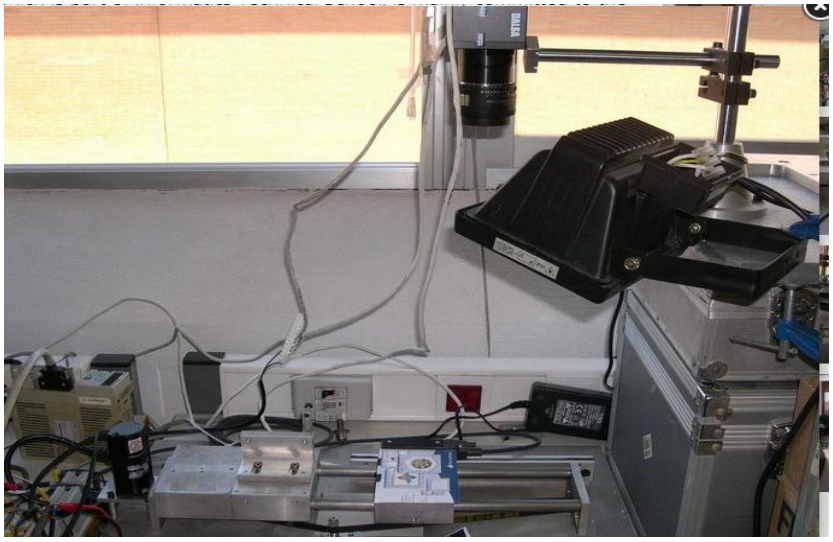

Figure 1: A typical industrial informatics in microelectronics [4].

Applications

Industry informatics is widely applied in manufacturing, coal mining, intelligent transportation, logistics companies, etc.

- *Manufacturing:* Manufacturing is the pillar of economic growth and a major source of wealth. It is currently undergoing a transition from traditional production towards knowledge-intensive service. Manufacturing informatics is the application of information technology to manufacturing. It is becoming a vital part of many control and automation engineer's jobs. Engineers should be familiar with the manufacturing science of their industries. Industrial informatics supports the integration process in manufacturing, as shown in Figure 2 [6].
- *Automation*: Industrial informatics focuses on knowledge-based automation to enhance manufacturing processes. The industrial automation is in the form of mechanical controls and switches, slowly giving way to electronic controls and signal processing. Both wired communications and wireless technologies have also been used in industrial and factory automation.
- *Chemical Industry:* The chemical industry is a significant part of the economy producing several consumer products and pharmaceuticals. The industry is facing some challenges which require decisive actions to restructure the chemical plants due to pressure from global competition. Industrial informatics has recently penetrated chemical industry and transformed the main production processes [6].

The industrial informatics also applies to a variety of areas like computer-based control systems, robotics, vision systems, data acquisition, signal processing, after-market sales, service production, sourcing, e-maintenance, etc.

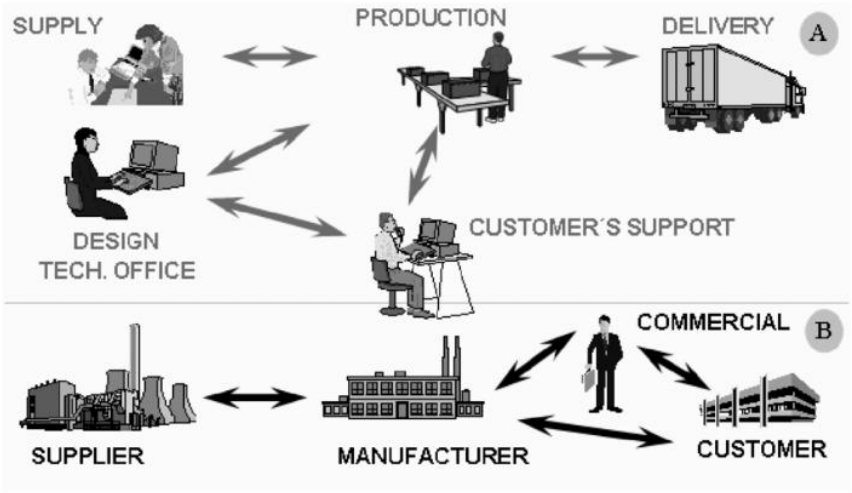

Figure 2: The industrial informatics in manufacturing [6]

Benefits and Challenges

Industrial informatics involves the application of IT techniques in data collection, data processing and data utilization to achieve a higher efficiency, effectiveness, reliability, and sustainability of organizations [7].

Although AI technologies can enhance the entire industrial systems, they also pose the security and privacy challenges in industrial informatics. Industrial informatics involves information integration, which leads to big data and may require cloud computing which offers powerful computing. In almost all the industrial settings, equipment produces inevitable electromagnetic interference (EMI) which degrades the performance of wireless devices.

Conclusion

Informatics is basically the science of information and all its aspects. Industrial informatics is a multi-disciplinary perspective which focuses on the use of information and communication technologies (ICTs) in industrial settings. It has been getting tremendous attention. The rapidly advanced IT such as big data and IoT has created several opportunities for industrial engineers and others.

Effort is being made to add industrial informatics to undergraduate engineering curriculum [9]. This is being done specifically in industrial electronics and automation engineering. The students are required to be familiar with the current technological situation that allows one to incorporate industrial informatics. The student should learn to design and develop systems by working in groups on some carefully designed mini projects. The mini projects provide students with a global view of problems [9]. Industrial informatics offers future engineers the capability to design IT systems to control industrial processes.

For more information on industrial informatics, consult the books in [10-12] and the journals that are exclusively devoted to it: *IEEE Transactions on Industrial Informatics* and *International Journal of Information Technology.*

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