INDUSTRY 4.0 - 'TOWARDS EMBEDDED FUTURE'

Jibin N [1]

ABSTRACT

The progressions in the field of interoperability between physical and virtual world has led the experts comment about the arrival for Fourth Industrial revolution, Industry 4.0. It is currently one of the most discussed topics in academia and training. Mobile supercomputing, intelligent robots, Self-driving cars, Neuro-technological brain enhancements, Genetic editing are the evidence of dramatic changes all around us and it is happening at exponential speed. The key is to up-skill and re-skill relentlessly to stay relevant in the futuristic world. Today we are in the fourth industrial revolution that was started by the progress of Information and Communications Technologies (ICT). Its technological basis is smart automation of cyber-physical systems with distributed control and advanced connectivity (IoT functionalities). This paper discusses the importance of embedded and futuristic technologies that are spearheading the wave of Fourth Industrial Revolution. This paper also discusses the importance of the upcoming technologies like, Artificial Intelligence, Virtual Reality, Internet of Things Robotics and Drones and Assistive Technologies.

Keyword : Industry 4.0, IoT, Cyber-Physical Systems, Robotics, Assistive Technologies, Augmented Reality, Virtual Reality.

[1]Assistant Professor, Department of MCA, MES Advanced Institute of Management and Technology, Kochi , jibintcr@gmail.com,

I. INTRODUCTION

The first Industrial Revolution initiated in Britain in the last quarter of the 18th century with the mechanization of the textile industry, harnessing of steam power and the birth of the modern factory [1]. The second revolution began approximately a century after the first and peaked at the beginning of the 20th century, embodied in Henry Ford's creation of the moving assembly line that accompanied mass production. Factories could create limitless numbers of like products quickly and cheaply (Electricity Driven) [2].

The third industrial revolution, start of 1970, was digital- and applied electronics and information technology to processes of manufacture. Mass customization and additive manufacturing- the so-called '3D printing' - are its key concepts, and its applications, yet to be imagined fully, are quite overwhelming. The fourth industrial revolution builds upon the third, which is primarily touching the physical & virtual world [4]. There were no fizzes during the first two industrial revolutions, but there have been far too many in the third [3]. A lot of the models are just not maintainable, or are waiting for a big disruptor to come along. For example, the music industry turned on its head with the Apple iPod, and the chances are the smartphone industry could be wiped away by the next big thing in tech, which could be just about anything [6].

Industry 4.0 is a combined term for technologies and concepts of value chain organization. Within the modular structured Smart Factories of Industry 4.0, Cyber Physical System (CPS) monitor physical processes create a virtual copy of the physical world and make decentralized decisions. Over the IoT, CPS communicates and cooperates with each other and humans in real time [5]. Via the Internet of Service (IoS), both internal and cross- organizational services are offered and utilized by contributors of the value chain.

2. Industry 4.0 'Towards Embedded Future'

The world is frequently changing and growing at a rapid rate, this has affected many companies and the entirety of their supply chain comprising all of its actors. This dynamic nature has put force on companies to innovate, collaborate and to redesign business processes that fit their business best, hence, this calls for assimilation of various technologies and integrated enterprise solutions to manage complex and convoluted processes. With the beginning of Internet of Things (IoT) it is important to understand how Information and Connectivity will transform tomorrow's world [6]. Today as we are in the fourth industrial revolution that was triggered by the development of Information and Communications Technologies (ICT) [8]. Its technological basis is smart automation of cyber-physical systems with decentralized control and advanced connectivity (IoT functionalities). The consequence of this new technology for industrial production systems is reorganization of classical hierarchical automation systems to self-organizing cyber physical production system that allows flexible mass custom production and flexibility in production quantity [7].

2.1 Ubiquitous computing

Ubiquitous Computing is a branch of computing that emphasizes interconnected and communicating devices, carefully combined into the objects we interact with in our day-to-day lives. These objects can be whatsoever, right from your garments to your toasters and coffee mugs. Smartphones and tablets are currently the obvious targets for applications aiming at ubiquitous computing, but in the future, don't be astonished if your game console talks to your smartphone's calendar about how "busy" you are today[8]. The term Ubiquitous Computing (Ubicomp), also known as Pervasive Computing, was invented around 1988 by Mark Weiser when he was heading the Xerox Palo Alto Research Center (PARC).

2.2 Intelligent devices

Intelligent devices are devices that have the capability to think, or "things that think". These devices use a mixture of technology, algorithms and embedded hardware to replicate what was once thought to be high-class activity pertaining to living beings with brains. Today, there are machines that can do your intelligence for you. MIT Media Lab is employed on this "Things that think" idea and aims at producing environments that enable this way of thinking[9]. Whether it is a simple device such as iLumi (a brainy light bulb that can be operated via an Android app to create different lighting environments) or a device as complex as PETMAN (an anthropomorphic robot that can perceive any chemical leaks in its costume - useful for testing chemical protection clothing), intelligent devices will soon be everywhere[10].

2.3 Internet of Things

The Internet of Things is a technology uprising that began just a few years ago. It is gradually encroaching upon our lives and will soon be a reality. Introduced by Kevin Ashton from Procter & Gamble in 1989, Internet of Things or IoT is a concept that comprises connecting the internet to physical devices such as home appliances and manufacturing machines[11]. With cloud computing and growing access to fast speed internet ubiquitously around the world, the Internet of Things will soon be more than just a concept.

2.4 Context-aware devices

Context awareness, in terms of computing, was familiarized by Bill Schilit in 1994. Anind Dey from Carnegie Mellon University defines background as any information related to the situation of an object at an instant of time. Context awareness is an added layer of intelligence to ubiquitous computing and aims at creating devices more aware of their surrounding environments[12]. Context-aware machines provide ways by which businesses can understand their customers better by facilitating an observable context, knowledge about the world around and social values. Sensing is a critical phenomenon associated with context awareness. Sensing can be external where visual tracing and location systems are used to collect the context wherein sensors which are embedded within the user devices generate context-rich information. Consider a situation where a doctor has a device that senses its proximity to a particular patient and shows the patient records automatically, saving time for search and retrieval of such information. Or a device that routinely alerts you when it is about to rain and covers your clothes drying in the sun by a shade using humidity sensors [13].

2.5 Transport systems using Artificial Intelligence

Imagine transport systems that are smart enough to understand the situation they are in and act accordingly. Reminds you of some sci-fi movie from the 90s? Well, it is not sci-fi anymore[16]. Organizations such as Google, Audi and Toyota are into R&D of intelligent transport systems that can increase the safety and comfort of drivers and are involved in the plans of releasing them for commercial purposes in the near future [14]. New technologies are also used in Aeroplanes these days, which send data about how each component in the aircraft is doing to a central computer for better tracking and management. Autonomous vehicles are designed to drive on their own by understanding their surrounding and act accordingly. Implemented with technologies like GPS, advanced Computer Vision, lidar, these vehicles can identify the correct paths and lanes in a city and navigate without hitting obstacles and follow correct traffic rules. BMW has been doing R&D and is all set to release an autonomous vehicle [15]. Google has already released some videos of the driverless car system that they have been working on since 2005 and has got some positive reviews.

3. Conclusion

Presently companies have to function in a highly competitive environment where the quality of their processes, services and products mainly controls their economic success, market share and future [1]. In this paper, the author presented the major concepts of Industry 4.0 for quality management and how they are

influencing us. In this paper we also discussed the importance of embedded and futuristic technologies that are spearheading the wave of Fourth Industrial Revolution. This paper also discussed importance of the upcoming technologies like Artificial Intelligence, Virtual Reality, Internet of Things Robotics and Drones and Assistive Technologies. The aim of the paper is to provide a solid basis for further research in this area by formulating research challenges which can be used by academics to raise concrete research questions for future research.

4. References

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