Iiot and Industry 4.0

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Abstract-Industry 4.0 is a newly introduced strategic initiative by the German Government. The aim of the project is to transform global production by digitizing and leveraging the potential of emerging technologies. Thus, an Industry 4.0 production system is flexible and allows for individual and customized products. The aim of this paper is to present and facilitate an understanding of the concepts of Industry 4.0, its drivers, enablers, goals and constraints. They describe building blocks and present smart factory concept. A RAMI4.0 model of reference architecture and the role of standardization in the future implementation of the Industry 4.0 concept are addressed. The current status of the German companies' readiness for Industry 4.0 is outlined and commented. Finally, whether Industry 4.0 is truly a disruptive concept or simply a natural incremental development of industrial production systems is discussed.

Keywords: IIOT, Industry 4.0, Industry, Smart operation, Cyber-Physical system (CPS).

1. Introduction

They describe building blocks and present smart factory concept. A RAMI4.0 model of reference architecture and the role of standardization in the future implementation of the Industry 4.0 concept are addressed. The current status of the German companies' readiness for Industry 4.0 is outlined and commented. Finally, whether Industry 4.0 is truly a disruptive concept or simply a natural incremental development of industrial production systems is discussed. Technical aspects of these criteria are discussed through the introduction of the Cyber-Physical Systems (CPS) and Industrial Internet of Things (IoT) generic concepts to the industrial production systems[12]. Hence Industry 4.0's 'execution system' is based on CPS building block connections. These blocks are embedded systems with decentralized control and advanced connectivity that collect and exchange information in real time to identify, locate, track, monitor and optimize the production processesIn addition , extensive software support based on the decentralized and adapted versions of Manufacturing Execution Systems (MES) and Enterprise Resource Planning (ERP) is needed to integrate manufacturing and business processes seamlessly. The third critical factor is the processing of a vast volume of data from the systems , devices and goods obtained. The data is usually stored in a cloud database.

This data involves comprehensive analyses that contribute to valuable insights from the 'original' data and, ultimately, to practical steps that enable a cycle of efficient and constantly self-optimizing industrial development. Because of the importance of this transition for a country's position in a global market, some government-led initiatives have been introduced to support the transition all around the world. As the first such initiative and inspiration for other initiatives, Industry 4.0 comes from Germany and will be discussed in detail in this paper. In the continuation, similar concepts which were initiated

in other countries will be presented shortly. In late 2012 the General Electric company brought up the concept of Industrial Internet in North America. It is seen as a tight integration of the physical and digital worlds combining analytics of big data with the Internet of Things. The concept assumes a much wider application field such as Industry 4.0 which includes electricity generation and distribution, healthcare , manufacturing, public sector, transport, and mining. It has been estimated that 46 per cent of the global economy can benefit from the Industrial Internet within the Industrial Internet consortium founded by General Electrics and some other companies. In France, the term 'Industrie du futur' has been adopted as a cornerstone of the French economic strategy of the future[2]. It is based on industrial and scientific cooperation, and is built on five pillars

1) Cutting edge technologies, including manufacturing additives, virtual plants, IoT and augmented reality;

(2) Support for the adaptation of French businesses , especially small to medium-sized ones, to new technologies;

(3) Extensive training of the workers,

(4) Strengthening international industrial cooperation and

(5) Promoting the future of French industry. Next similar 'Made in China 2025' initiative was introduced in 2015. It was initiated in cooperation with numerous experts from the China Academy of Engineering by the Ministry of Industry and Information Technology, China. The key goal of this project is to update the Chinese industry comprehensively by taking direct inspiration from the idea of Industry 4.0 in Germany and applying it to China's needs. The processed fabrication should be driven by innovation. It also considers other elements such as sustainable development and green energy. It defined ten focus sectors beginning with information technology, robotics and automated machine tools. The long-term targets are to overhaul China's manufacturing sector, move from the high number of low-cost goods to high-quality products, and take over Germany and Japan 's manufacturing domination until 2035, to grow into global powerhouse sector by 2049[3].

This paper would concentrate on the idea of Industry 4.0 launched by the government of Germany, targeted at industrial development systems. Concept background, development plan and current state will be tackled. Some software technological background issues will be presented which reflect essential aspects of the concept of Industry 4.0. The paper is laid out as follows. The second segment describes the central concept of Industry 4.0, its roots, aims and concepts as well as Industry 4.0 (smart factory) development system. Support for IT / software is also addressed. A Reference Architecture Model RAMI 4.0 is defined in the third section which sets the basis for standardization activities. In the fourth section the readiness of companies is discussed for Industry 4.0 and a concrete example of a company that has already adopted most of the elements of Industry 4.0 is presented[1].

2. Literature survey

The paper is laid out as follows. The second segment describes the central concept of Industry

4.0, its roots, aims and concepts as well as Industry 4.0 (smart factory) development system. Support for IT / software is also addressed. A Reference Architecture Model RAMI 4.0 is defined in the third section which sets the basis for standardization activities. In the fourth section the readiness of companies is discussed for Industry 4.0 and a concrete example of a company that has already adopted most of the elements of Industry 4.0 is presented[1]. The work of the original Industry 4.0 platform, set up by associations ZVEI, VDMA and BITKOM, has been extended to a higher level and has a broader political and social base[1].

That this project is a more innovative or a more advanced development than the current ideas is also by no means definite in terms of methods, production, and consumers of emerging technology. However, it is generally accepted that new technologies and corresponding new concepts need to be introduced, if the respective business process challenges are well managed (Alatoibi 2016) and if increased quality and flexibility are to be addressed in an environment of increasing complexity and with possible solutions to demand problems and volatile markets (Cheng et al . 2016).

The many contributions made by academics and practitioners have been made by the meaning of the term (Bauernhansl et al . 2014) and Industry 4.0 has become a top priority for companies seeking a way to their future. The idea 's key proponents, the "Industry 4.0 Working Group" and the "Internet Industry 4.0," define the dream, the core technology, the goals of the project as well as several chosen scenarios (Kagermann et al . 2013; Internet Industry 4.0 2014).

Nevertheless a clear definition is still needed. Although some efforts are being made to provide a fundamental definition, a generally well-accepted definition of Industry 4.0 has not yet been published (Bauer et al. 2014).

While some of the researchers focus on digitization, others consider the communication aspect that dominates the fabrication structure. The others strive for systems knowledge and flexibility by being Business 4.0's key features. A few others also focused on generating a so-called dark factory.

Due to innovations in sensors , devices, unmanned air vehicles (UAVs), information networks, optimisation, and machine learning, robotics and automation are now progressing rapidly. Well-recognized universities realize this as the potential for building, healthcare, manufacturing , transport, safety and a wide range of other applications to be improved. The work therefore focuses on recent developments in Internet of Things in cloud computing, ensemble technology, big data, open source applications and industry initiatives,

Smart cities, smart factories, and Industrial Internet 4.0. U.S. As the latest advances in non-convex optimization should be accepted by the technical committee, model predictive control, partially measurable Markov decision processes, reinforcement learning, and indirect probabilistic inference carry promise to solve different problems that would be difficult earlier. Developments like cloud storage can provide access to massive databases and clusters of distributed processors for searching, modeling, refining, and exchanging data across networks to increase performance over time.

On successful implementations, the consortium aims to develop industry standards (IIC 2016). RTI (2014) lists the most influential US corporations on the "Internet of Things." Different programs are now emerging around the world, such as Advanced Manufacturing Partnership for Southern California (AMP SoCal). They do workshops or platforms for the related components in Industry 4.0. As reported by Cooper (2017), manufacturing transformation is increasing exponentially, driven by a multitude of factors, from technological innovation and evolving customer behavior to regulatory changes and a turbulent global landscape all requiring businesses to innovate at ever-increasing speed. With the emergence of Industry 4.0, the UK government took the opportunity to position itself as a global center of excellence for advanced manufacturing and pledged a more integrated industrial strategy to help meet current industrial challenges; to tackle the UK economy 's competitiveness by concentrating on initiatives that will boost productivity and drive growth driven by innovation.

Similarly, EEF (2017) published a report.

53 firms took part in this initiative in 2015. In 2016 this number will reach over 140 (Nishioka 2016). This initiative supports the development of collaborative scenarios and the use of connected manufacturing cases (some meta models) among different companies based on a loosely defined standard, and provides and manages a repository of loosely defined standard models that can be continuously changed in accordance with unexpected future requirements.

Bertacchini et al . (2017) also planned a virtual experience in which the robot performs actions with the recipient. This is a perfect example of an association between Man and Machine.

Kim et al . (2018) studied a robotic excavator with different hardware and software modules including a task planner, environment sensors, GPS, and other sensors to acquire the status of an excavator, electronic valves, and other mechanisms.

Villani et al . (2018) addressed robotics benefits, stressing how integrated approaches are meant to boost machine performance where little human interaction is needed. Similarly, Mourtzis et al . (2017) have proposed an augmented model of reality to support robot maintenance. They validated their model in a case study that took place in real life.

Xu et al . (2015) is introducing computer vision technology research to generate real-time robots tracking capabilities.

3. Current state of industry 4.0 and IOT

When contemplating the present state of Industry 4.0, it is important to recognize the preconditions that must be met in order to incorporate a new paradigm into industrial development framework. The following must be fulfilled, at least:

• Production stability must be ensured during the transition phase, too.

• Step-by - step investment should be possible, since the majority of industrial processes can not bear large one-time investment.

• Preservation of strong know-how is important. The cyber security problem is closely connected.

Moreover, the concept of the industry is not limited to the production system alone, but includes the entire value chain (from the suppliers to the customers of one company to the 'Connected Word' of all companies) and the functions and services of all companies. It is obvious that the fulfillment of these criteria is not easy, therefore there are currently only some 'islands' of the concept of Industry 4.0. The German organization 'Verband Deutscher Maschinen- und Anlagenbau' has carried out a study on the readiness of German companies for Industry 4.0 to assess the current state. Assessed the following six dimensions,:

• Strategy and organisation (investment, management of innovations),

• Intelligent factory (equipment and IT systems , data collection and use, digital modelling),

• Clever operation (value chain integration, cloud storage),

• Intelligent products (physical parts, virtual identity),

• Data-driven tools (ICT accessibility, market performance modeling and optimization),

• Human resources (Skills of the employees, ongoing education).

A survey of 268 Indian companies with more than 20 employees, was conducted. Results revealed that 56.5 per cent of all participating businesses do not meet any criteria for preparation for Industry 4.0. In fact, it is projected that 20.1 percent of businesses are at Level 1 (beginner), which means that the organization is active in Industry 4.0 by pilot projects in different divisions and acquisitions. However this is limited to a single region and The systems only support only a few processes. Only 0.3 per cent of companies (8 out of 268 participating companies) are ranked at Level 5 (top performer). That means they have already implemented the Industry 4.0 strategy and have adequately addressed all six dimensions evaluated. The German company SEW Euro drive from Baden-Württemberg is one of the few companies that has already implemented the Industry 4.0 concept. Their strategy is focused on so-called 'desktop assistants' to supply logistics. The mobile assistants are autonomous mobile platforms that carry material, half-products and tools through the shop floor. Mobile assistants also carry all information relating to the required production processes in the attached Radio-Frequency Identification (RDIF) chips. When a new customer order arrives, the mobile assistant gathers the required content and autonomously moves it from the workstation to the workstation according to the direction of the relevant production processes. The mobile assistant attaches to the computer at the workstations that are cyber-physical devices, and provides the requisite details.

4. Future scope

In a number of industries, the industrial Internet of Things is a driving force behind connectivity demands and their adoption is likely to continue to increase. Over the next decade or so, we can make industry revolution better. Those are the imminent potential changes: new technologies must accelerate improved security rollouts in the next 12 months. The Industrial Internet of Things (IIoT) app development programs will outgrow / outpace

consumer IoT app development by 2020. The challenges of IoT talent recruitment will encourage private companies to fund secondary education programs in order to foster the next digital workforce. Millions of smart IoT products will be added on networks that use the protocol 802.11 ac (HaLow) by December 2017, moving it into the IIoT standard. By 2020, the expected increase of IIoT apps for utilities and electricity markets will rise to over 1.5 billion units.

5. Conclusion

IoT 's outlook has changed almost everything. IoT 's major applications are path breaks and added to the many benefits. The applications are very helpful and through constant monitoring and analysis are reducing the human intervention. The automation has made monitoring very simple especially in industries. The different examples in this paper are testimony to the fact that IIoT is heading for major revolution and will soon be a trillion dollar economy. It is therefore unavoidable, and will only create much more space for research and employment.

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