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Review of Technologies in Industry 4.0Revolution

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Abstract—The aim of this paper is to give a brief review on latest technology called industry 4.0 which stands for fourth revolution of industry and to understand technologies involved in it. It expresses the essential feature of industry development trends to achieve more smart manufacturing process. To build the smart factory it adopts both physical and cyber technology. By implementing industry 4.0 in industries helps to increase in productivity and it has control over the entire life cycle of products in manufacturing process. This advancement of industries by industry 4.0 include cyber physical systems, Industrial internet of things IIoT, machine to machine (M2M) communication, cloud computing, big data are embedded with manufacturing process. The smart factory increases the production, marketing and it has controllability over production process.

IndexTerms— Industry 4.0; Industrial Internet of Things (IIoT); M2M communication; CPS; Cloud; manufacturing execution system (MES).

I. INTRODUCTION

The industrial revolution stages from manual work towards industry 4.0 concept can be introduced as a path through the four industrial revolution. The four revolutions in industry till now; this development in industry is depicted in figure 1. The first industry follows introduction of water and steam powered with mechanical production machines in 18th century. First revolution improves the quality of life it was the main change. The iron and textile industries plays central roles in first revolution. The second industry follows introduction of electrically powered with mass production in 20th century. In second revolutionthe industries were grown and also expansion of new industries, such as steel and oil by using electric powered mass production [1].

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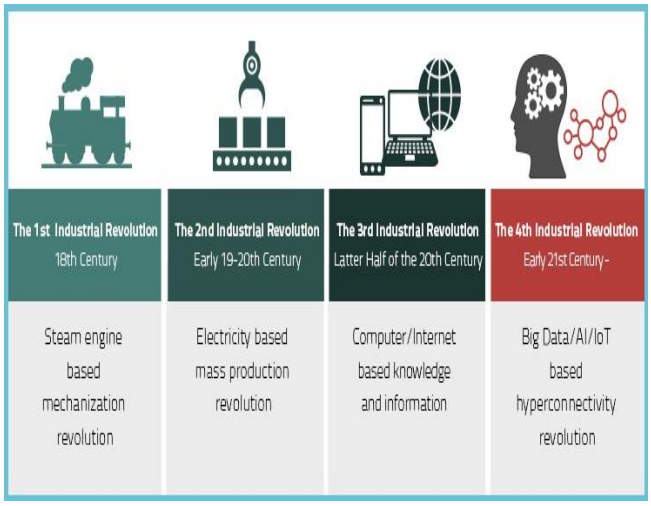

Figure 1: Four Industrial Revolutions.

The third revolution uses electronics and IT to achieve automation in manufacturing in 20th century. The first programmable logic controller (PLC) used in third revolution, it facilitates flexible production in production lines with programmable machines [3]. Today we are in the fourth revolution called industry 4.0 which is mainly based on cyber physical systems (CPS). The CPS are physical systems and engineered systems whose operations are monitored, coordinated, controlled and integrated by a computing and communication core.

The ability of CPS, human and machine to connect and communicate with each other by internet of things and it also have the capability of collecting data and analyze data and provide the accurate information immediately. Cyber physical system allows flexible mass production and flexibility in production quantity

II. LITERATURE REVIEW

Industry 4.0 is linked with a supply chain and manufacturing process with connects to Internet of Things (IoT). As the real world and virtual world grows rapidly together with internet of things, this inspired organization to start journey towards industry 4.0. There is a need for the adoption of Industry 4.0 in various industries (manufacturing) to study the impact of the improvement on the outcome of a company [4]. The industry 4.0 uses the CPS to connect all physical systems to internet and operations are monitored, coordinated, controlled and integrated by a computing and communication [15]. Technologies involved in industry 4.0 are CPS, IoT, big data, cloud computing.

The idea behind Industry 4.0 is to create a social network where machines can communicate with each other, called the Internet of Things (IoT) and with people, called the Internet of People (IoP). The WSN is a wireless computer network

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communication which is distributed by automatic devices, the use of these sensors monitors environmental conditions in different physical locations such as temperature,sound, vibration, pressure, motion [7]. The Industrial Wireless Sensor Networks representthe expansion and promotion of the existing wireless communicationtechnology intended for industrial applicationand they lead to the revolution of measurement and controlmode in the traditional industrial field. In the meantime,the deployment of industrial networks has become flexible,reliable, and low-cost [2].By using industry 4.0 the machines can communicate with each other and with the manufacturers to create what we now call a cyber-physical production system (CPPS). This helps industries to integrate the real world into a virtual one and enable machines to collect current data, analyze them, and even make decisions based upon them. But in the present system it is not possible to communicate between one machine to another.

A. **Cyber physical systems (CPS)**

Cyber physical system (CPS) can efficiently integrate both cyber and physical components through the modern communication technologies. In CPS cyber means sensing, computing, communication technologies to efficiently monitor physical components, physical means physical components in real world which monitored and controlled by cyber and systems means interconnecting network, complexity and diversity [11]. A cyber physical system is the integration of the sensors, actuators, communication networks and control centers. It combines both the physical and cyber to connect communicate between human and machine through internet of things. By this it has a goal to make monitor and control of physical components more secure and efficiently.

B. Internet of Things (IoT)

Internet of Things (IoT) can be viewed as a three layer structure as depicted in figure 2. The three layers are physical layer, network layer and application layer. The physical layer has he physical devices sensor and actuators which is typically used for sensing and actuation. In network layer it has the gateways servers to collect the data from the physical layer and gives the output which actuates the process by communicating it through servers. He application layer has storage, processing, analytics and management. The data collected from the first two layers are stored in cloud and it controlled and managed in this layer. These three layer architecture of IoT allow from sensing to analyzing and to actuation. By this way we can monitor the condition of machines [13].

Application Layer	- Cloud / Data Servers - Storage, Processing, Analytics, Management
Network Layer	- Internet Infrastructure | Fog Servers - Gateways, ISPs etc. | Servers for pre-processing etc.
Physical Layer	- Physical Devices - Sensors and/or Actuators

Figure 2: Three Layer IoT Structure

C. Big Data Analytics

The rapid growth in the internet creates a huge data it cannot be managed by the tradition tools. The technology which efficiently manages the huge data which is collected called as big data analytics [10]. The data from the beginning to the end of manufacturing process of product should be collected, managed and protected for the efficient product supply chain. It is possible or allowed by big data.

D. Cloud Computing

Cloud computing store and access data and program over the internet instead of computer's hard drive. It plays a key role towards enabling industry to digitalization. As we discussed in big data there will be huge data to store this we require large data base hence, we store in cloud with the internet access, this can be accessed easily anywhere, anytime [8]. It facilitates real time exchange of data digital collaborating and integration. These helps to improve process monitoring in real time

III. METHODOLOGY

Firstly the data will be collected or acquired using data acquisition from the PLC and sensors through HMI and is stored in data base of server called MES. Then the MES will monitor and controls the manufacturing execution systems and data flows that take place on a line as depicted in figure 3. The data contains about the present state of the machines like operator ,about model, operator information, productivity, problems regarding machines, defects in machine, part issues etc.. The data collected from the machines will be monitored and controlled by the MES and enterprise resource planning (ERP) server then it will be displayed on the dashboard.

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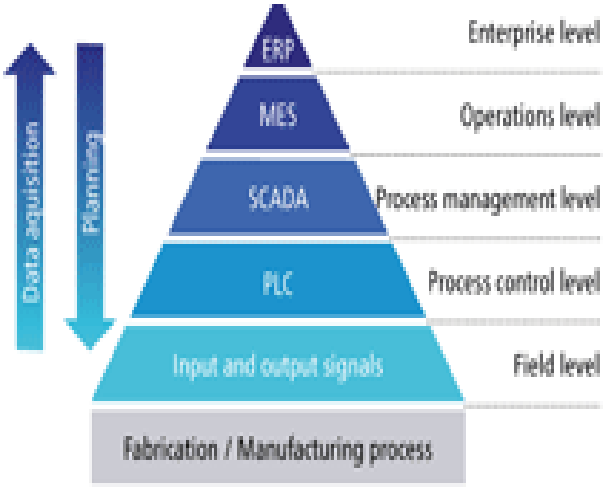

Figure 3: Process Levels in Industry 4.0

Inthis the business process and manufacturing execution process cannot manage seperatly in integrated plants where various production process exist. As depicted in figure 3. Every process is related to each other, so every decicision is important. Hence the manufacturing execution system is used to monitor , connect and to control the manufacturing systems and data flow in plant and enterprise resource planning is used for resource planning in business like financial. Hence the integration of Manufacturing execution system(MES) and enterprise resource planning(ERP)becomes requirement. To achieve automation there are 5 levels as shown in figure,

Level 0 is the lowest and first level where all the hardware components like, sensor, actuator present. These devices are connected to control systems in the next levels these devices respond to the signals they receive and they generate feedback signals. Level 1 is the second level and it is called as operational level. This level is also called as automation control because programmable logic controller(PLC), CNC and DCS will be present in this level. The basic operations were controlled in this level it is crucially important for a successful production.

Level 2 is a third level and is called as supervisory level. I this level the input and output data management, process management, data acquisition managemnt, learning, reporting will be monitored and controlled . This level as the connection between MES and ongoing process in shop.

Level 3 is fourt level and is also called as the manufacturing execution system(MES) level. It doesn't not focos on only on machine or one production it focus on all machines in plant and gather all information and it will share and communicate with all machines in plant. It has a functionality like quality management, product management and it's main goal is to increase production by icreasing the traceability of production status in real time. Level 4 is the last level and it is also called as enterprise resorce planning level. This level is connected to the level 3 which is MES they communicate with each other.Iit focus on the finance, accounting and human resource which are not directly connected to shop floor activities

IV. CONCLUSION

Industry 4.0 will change the entire manufacturing system. By implementing industry 4.0 gives the fusion of the reality and the virtual world and is very affordable for a majority of industries. By this way the supply chain can be digitized and integrated. By implementing industry 4.0 in industries helps to increase in productivity and it has control over the entire life cycle of products in manufacturing process. It minimizes the quality losses and it makes process more flexible. It increase product quality, efficiency, and it reduces the energy consumption. In future industry5.0 can be introduced. The research is already started on fifth revolution of industry it will mainly focus on cooperation between human and machine and workers should be up skilled to provide value added tasks in manufacturing of products.

REFERENCES

[1] SaurabhVaidya, PrashantAmbad, SantoshBhosle " Industry 4.0 – A Glimpse" Saurabh Vaidya et al. / Procedia Manufacturing 20 (2018) 233–238
[2] Baotong Chen, JiafuWan , Lei Shu, Peng Li, Mithun Mukherjee, and Boxing Yin, "Smart Factory of Industry 4.0: Key Technologies, Application Case, and Challenges" 2169-3536 2017 IEEE.
[3] AndrejaRojko "Industry 4.0 Concept: Background and Overview" iJIM – Vol. 11, No. 5, 2017
[4] Raja Sreedharan.V ,AparnaUnnikrishnan , "Moving Towards Industry 4.0: A systematic Review" Volume 117 No. 20 2017, 929-936
[5] JoãoBarata,Paulo Rupino da Cunha, AnandSubhashchandraGonnagar,Mateus Mendes, "A Systematic Approach to Design Product Traceability in Industry 4.0: Insights from the Ceramic Industry" 26th International Conference On Information Systems Development (Isd2017 Cyprus)
[6] VishwasDohale, Shashank Kumar "A Review of Literature on Industry 4.0" September 2018
[7] Chun-Tai Yen*, Yu-Chi Liu, Chih-Chieh Lin, Chih-Chiang Kao, Wen-Bin Wang , Yu-Rong Hsu "Advanced Manufacturing Solution to Industry 4.0 trend through Sensing Network and Cloud Computing Technologies" 2014 IEEE International Conference on Automation Science and Engineering (CASE) Taipei, Taiwan, August 18-22, 2014
[8] Roland Petrasch, Roman Hentschke "Process Modeling for Industry 4.0 Applications" 2016 13th International Joint Conference on Computer Science and Software Engineering (JCSSE)
[9] Jie Lin, Wei Yu, Nan Zhang, Xinyu Yang, Hanlin Zhang, Wei Zhao "A Survey on Internet of Things: Architecture, Enabling Technologies, Security and Privacy, and Applications" IEEE INTERNET OF THINGS JOURNAL, VOL. 4, NO. 5, OCTOBER 2017 1125
[10] MertOnuralpGökalp, KeremKayabay, Mehmet Ali Akyol, P. ErhanEren, "Big Data For Industry 4.0:A Conceptual Framework" 2016 International Conference on Computational Science and Computational Intelligence
[11] Paolo Bocciarelli, Andrea D'Ambrogio, Andrea Giglio, Emiliano Paglia "A BPMN extension for modeling Cyber-Physical-Production-Systems in the context of Industry 4.0" 978-1-5090-4429-0/17/$31.00 c 2017 IEEE
[12] C. H. Li1 and H. K. Lau2 "A Critical Review of Product Safety in Industry 4.0 Applications" Proceedings of the 2017 IEEE IEEM
[13] Khurram Shahzad, Mattias O' Nils "Condition Monitoring in Industry 4.0 – Design Challenges and Possibilities: A Case Study" 978-1-5386-2497-5/18/$31.00 ©2018 IEEE
[14] GiulioD'Emilia, AntonellaGaspari, "Data validation techniques for measurements systems operating in a Industry 4.0 scenario" 978-1-5386-2497-5/18/$31.00 ©2018 IEEE

doi: 10.32622/ijrat.76S201936