International Journal of Latest Trends in Engineering and Technology
Vol.(9)Issue(3), pp.303-306
DOI: http://dx.doi.org/10.21172/1.93.51
e-ISSN:2278-621X

INDUSTRIAL INTERNET OF THINGS AN ELEMENT OF INTELLIGENT MANUFACTURING

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Abstract-A term, Industrial internet of things(IIOT)an element of intelligent manufacturing, was coined in Germany, has totally changed the modern manufacturing world. IIOT empower the organization in producing specialized products with improved quality. IIOT is considered as integral part of smart manufacturing. IIOT is the term generated from internet of things (IOT). IOT keep technology advanced computers systems, manufacturing machines and customers connected, while working with real time information. IIOT is supposed to create industry revolution of coming century. Number of industry around the globe has started working on IIOT for designing factory of futures.In this paper author has discussed IIOT as concept, literature related to it, developed a framework for it andits benefits in manufacturing industries.
Key words: Industrial internet of things (IIOT), IOT, Intelligent manufacturing, Factory of future.

1. INTRODUCTION

Industrial revolution has been divided into four generations. The first generation covers the steam power generation and utilization (1750-1800). Second generation covers the electricity production and use of electricity in production (1850-1900); third generation is NC, DNC, and CNC ages of manufacturing using small computer systems (1960-75). Fourth industrial revolution (1992-till date) have been shaped by artificial intelligence and internet for automation and connecting elements of manufacturing system.These days a term smart factory connects its elements like smart production and business facility, innovative technology and trained workforce and achieves the better product life cycle, managed supply chain and satisfied customers. Vaidya et al. (2018) stated that smart factory have nine elements;big data analytics, autonomous robots,simulation,integrated system,IIOT,cyber security, cloud based information storage platform, additive manufacturing and enhanced reality.IIOT is one of key element of smart or intelligent manufacturing.

IIOT connects advanced machines, simulation capabilities and trained manpower together. By development of IIOT many new advanced technologies are working together for smarter planning, manufacturing and timely delivery in market.IIOT is transforming the modern manufacturing facilities to smarter and intelligent manufacturing. Sharing of real time information about production helps in 100% utilization of plant capabilities.Organization using IIOT have cost saving bypredictive maintenance, improvement in safety, and efficient operations both within an enterprise and in the extended enterprise. Top management can better plan and execute their decisions by having real time information from shop floor to executive rooms.On other hand connecting all facilities of plant by single network is a challenging task. There are always risk of security & compatibility issues between devices and machines. Author has developed a framework on IIOT in manufacturing industries as shown in Figure 1.There three main parts of framework such as functions leveraging IIOT,IIOT itself and its benefits. Under functions leveraging IIOT there are different elements such as manufacturing automation, online quality checks, product performance sensors, supply chain markers and skilling of manpower. Under benefits author has taken responsiveness, agility of organization, improved product life cycle management, improved supply chain logistics and improved customers satisfaction.

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1.1 Functions leveraging IIOT Benefits

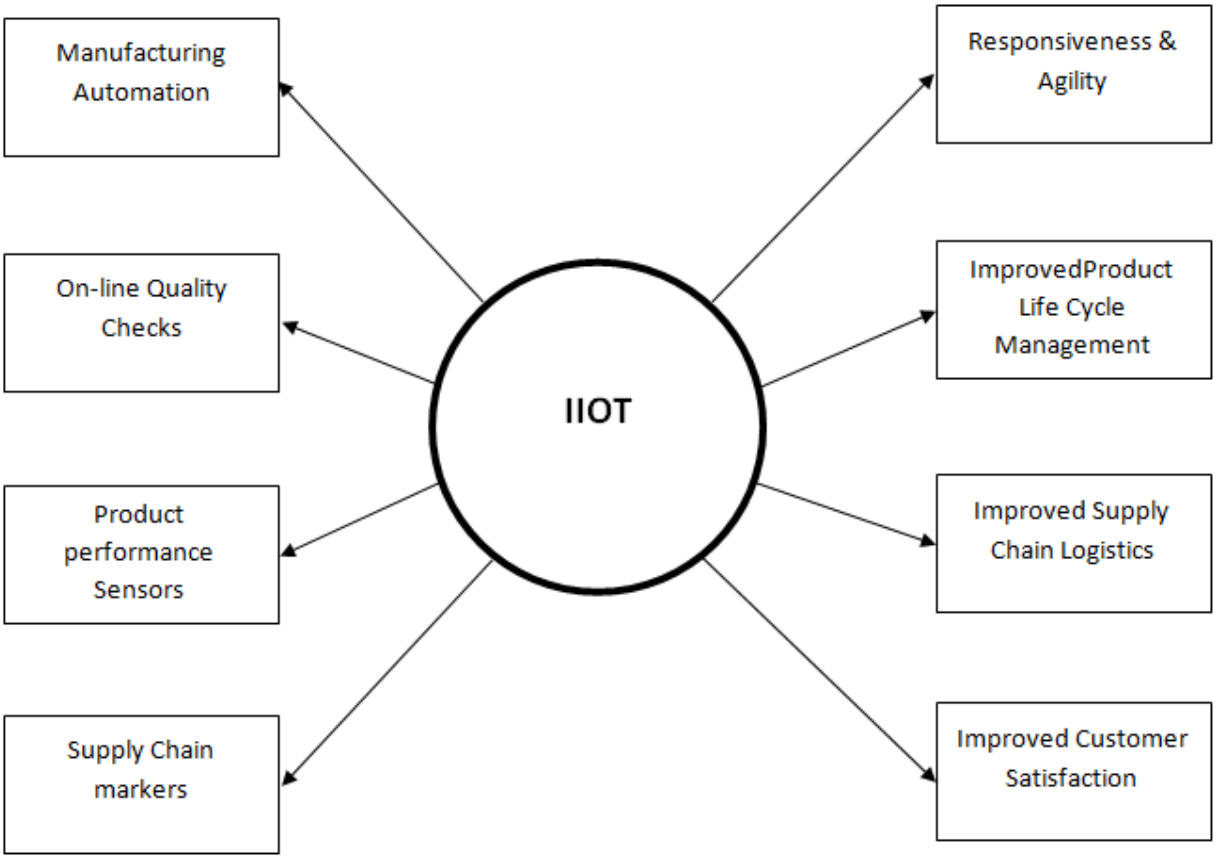

Figure 1 Framework of Industrial Internet of Things in Manufacturing

SKILLING

Manpower up-skilled to manage IIOT based equipment & operations

2. LITERATURE REVIEW

Ramakrishna et al. (2017) stated that intelligent manufacturing is combined effort of communication and computing technologies,digitally connecting all members ofsupply chain and get intelligent coordination of demand and supply.Smart manufacturing make manufacturing more agile and responsive, reduce equipment downtime and by efficient operations helps in cost reduction.Tjahjono et al. (2017) studied the impacts of industry 4.0 on manufacturing supply chain. Collaboration between suppliers, manufacturers and customers is crucial to increase the transparency in supply chain. Authors observed that, due to digitalization and automation of processes, the whole supply chain management becomes efficient. New technologies add new opportunities and threats for all members of supply chain.

Industrial internet of things is a combination of software and hardware in multiple layers. Firstly it has sensors for collecting data for all processes. In second step all collected data is passed to cloud computing, through many types of hardware. On cloud computing platform all collected data is analyzed by using many computation techniques and finally used to enhance resources utilization.IIOT have ability to integrate information from customers in real time with production facilities and software of ERP,CRM. Xu (2014) stated that with traditional application elements of industry 4.0 are also used for, business process management, supply chain management, enterprise resource planning and workflow management.

Tjahjono et al. (2017) stated that big data, IOT and artificial intelligence (AI) are elements of industry 4.0. Authors further stated that by using IOT practices, machines in industries can be connected by minimum human interference. This networking in supply chain effect all partners of chain.Neirotti et al. (2018) studied that new technologies like IOT and big data analysis put pressure on resources of SMEs. Authors also studied that large organizations are devoting resources on new technologies as compared to SMEs. With financial, there are technological and cultural issues also for SMEs in implementing new technologies. Type of ICT application depends on type of operation such as efficient resource planning, production planning, production control, SCM and customer relation management.

Lin et al.(2017) studied that it is important to spread awareness about technology in organization by organizing training and discussions. Awareness among employees about new technologies and new trends increase their participation. Secondly, by

linking the new technology adoption with employee's welfare also motivates them. This all can be achieved by using intelligent manufacturing techniques. IOT will change management approach of geographically separated members of supply chain. In IOT product with a unique code will be linked toinformation about their cradle, use, and future address. Product and its flow details will be interconnected and can be tracked in its value chain (Buckley and Strange, 2015). Haddud et al. (2017) stated that internet of things (IoT) has changed the supply chain management (SCM).

3. DISCUSSION AND CONCLUSION

Existence of IIOT on manufacturing platform cannot be predicted without its key elements such as cloud and data analytics. As shown in Figure 1 graphically. From different sensors date is collected on cloud, analyzed analytically and help in making decision process more agile.

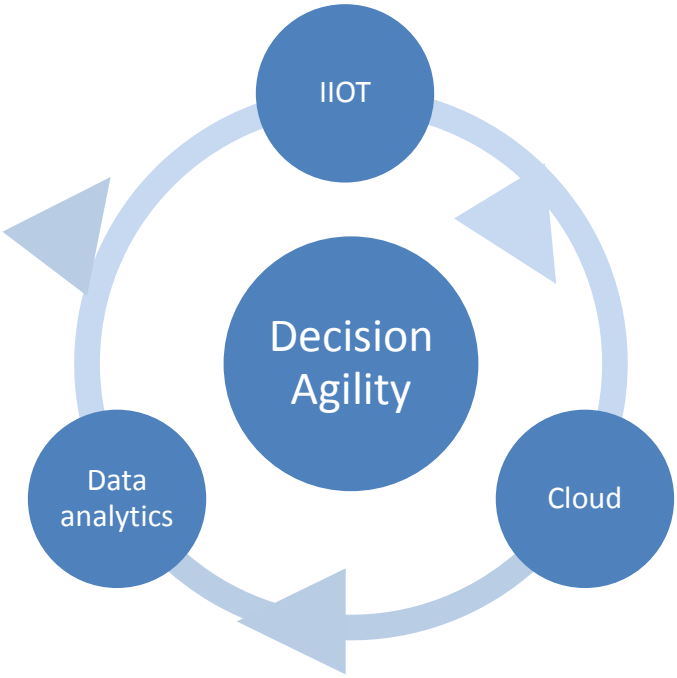

Figure 1.Key elements of IIOT

Data collected from sensors is converted and stored as information, it become knowledge in application and finally collectively shows its existence as artificial intelligence (AI) in future. (As shown in Figure 2).

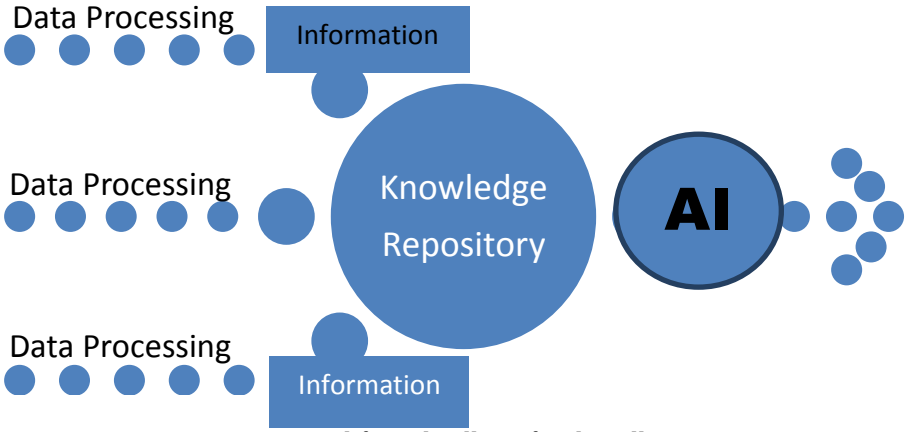

Figure 2 Data life cycle till Artificial Intelligence

In this paper author developed a frame work on IIOT in manufacturing. There are few factors which give leverages to IIOT functions. In manufacturing section automation and connection of each manufacturing machines with server is very important. Facilities of online quality checks, checking finished products on performance parameters with sensors, interconnecting function of supply chain and skilling of manpower play very critical role in IIOTfunctioning. There are two sides of benefits of manpower reskilling, first improve their worth not only in the eyes of employers but also improve their self-esteem and confidence. It also fosters healthy competition among individuals, among functions and between factories. Use of IIOT in manufacturing make production process more responsive, agile and help in product life cycle management.

On supply chain front it improves supply chain logistics and customers satisfaction.Commonly identified benefits of the IIOT in Manufacturing are:

- Improved Efficiency-New advanced technologies application give accurate update about processes and products. Real time sharing of data helps in decision making and efficiency improvement.
- Improve flexibility and responsiveness-these days' customers are demanding and products have short life cycle. IIOT allow decision making on new designs, facilities, and products fast and accurate. It makes whole process responsive and track able.
- Improvement in safety and risk mitigation capabilities-In IIOT it is easy to identify the attention seeking areas, which leads to timely maintenance. Irregularities can be easily tracked and corrected.

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