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Internet of things in manufacturing: A review

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ABSTRACT

Internet of things (IoT) make a major contribution in the manufacturing industries by connecting the objects with the help of network and remotely controlled the existing network infrastructure, initiation of opportunities for integration of the manufacturing world to the computer-based systems, this results the enhanced production efficiency, product accuracy and economic growth in addition to minimum human intervention. In this review we have discussed about the modern technologies for the accomplishment of the smart manufacturing. The aim of this paper is to fulfill the objective of developing the discrete event-based system for Men, Materials and Plant & Equipment (MMP) on the manufacturing site, for that the primary focus on reviews the different ways to implement the Internet of Things (IoT) at the project site and improve the material handling, labor monitoring and tracking the plant and equipment for better productivity and efficiency of the overall project.

1. Introduction

IoT is very useful in the manufacturing environment. we can use it almost everywhere. We can use IoT on our not-production equipment like, compressors, water tanks, power inputs, power consumptions and we can also use it in all or our production equipment as well for example we have a bottling line the number of bottles that are coming down a conveyor or monitoring whether or not a machine tool is cutting [1]. We can also take data coming out of the PLCs to determine if a machine is running correctly. So, there is a lot of different places that IoT adds value in manufacturing. IoT is at its core, connecting things via a network. If we want to connect some sensors or we want to connect these sensors to a network and then we want to do something with the data [2]. To make something useful with IoT, we need to add a couple of layers above that. So, we have to have a way to contextualize this information [3]. IoT is no longer confined to theory and or hype-based notion it is no longer like this so it is being used in reality in industries different IoT solutions are being implemented in the industry for solving different industrial problems to make industrial processes manufacturing processes much more efficient than the way that it is at present [4]. The main aim of the IoT is to interconnect different things and these things are different objects on the smart objects so what is required is to globally connect these smart objects or the things so that objects are uniquely identified and they are able to interconnected between themselves so it is we know in an Internet of Things (IoT).

The cost of equipment and materials is approximately 55–65% of the total cost of the manufacturing, therefore to improve the productivity the it is necessary to keep an eye on the tracing of the material [5]. Several challenges were arising when we want to connect everything with the internet. IoT is no longer confined to theory and or hype-based notion it is no longer like this so it is being used in reality in industries different IoT solutions are being implemented in the industry for solving different industrial problems to make industrial processes manufacturing processes much more efficient than the way that it is at present [6]. In an experiment an Ultra-Wide-Band tag is provided on the helmet of the worker to derive the velocity monitored tag. With these experiments the productivity and safety of the labor was computed [7]. By using Discrete Event Simulation model to monitor real-time production operations with the use of sensors on manufacturing floor, a new methodology can be achieved. During the planning stage such types of model codifies the operation plan with resource flow and logic as the input [8].

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To identifying the all stages of machine and to creating a sate transition diagram a Finite State Machine model also used. There are many challenges for the manufacturing operations on the manufacturing site and required collaboration between different resources [9]. A method based on programmed decision making and automation was developed that can be considered a part of the Internet of Things. [10] As people are more interested in real time tracking such as status of parcel so many researchers are working on how to integrate both railway and highways to give a best tracking model system which can provide door to door service. IoT will give the potential to connect various modes of transportation in the upcoming future [11]. For better inventory control, and material coding, labeling, transportation many researches are working on the use of IoT [12].

2. IoT data protocol and architecture

MTConnect contained three main components like adapter, agent and application as shown in Fig. 1. Adapter is used to converts different data in to the MTConnect data and the adaptor is mostly used to implementation of the standard. Application gives the data to the agent and then agent translate the raw data into MTConnect compliant data. This MTConnect data transferred to the application of information processing and knowledge discovery [13].

3. Involvement of IoT in manufacturing

Industrial IoT solutions include cost reduction, shorter time to market, mass customization, improved safety etc. companies reduced manufacturing costs by using optimized assets and inventory management, reducing machine downtime, and using more efficient energy [14]. Supply chain operations require faster and more efficient manufacturing to reduce product cycle times. to increase the inventory and make it more diverse the mass customization needs to increase the produced SKUs. IoT contributed the safety of the workers at workplace. IoT paired the wearable devices, allows monitoring of health and risky activities [15].

IoT gives us an increasing ability to be connected to objects. For sometimes factory floors have the ability to interconnect machinery in a centralized data centre. This is a traditional computer integrated manufacturing machine to machine (MtoM) application [16]. The industrial internet of things is an interconnected network of sensors, equipment and people connected to processes and to the internet [17]. These connections can all be within a single factory, or could include capturing data from products in the field, like how combines or harvesting crops or operating conditions for compressor equipment [18]. A key difference between industrial IoT and more consumer-driven IoT, is the appearance and packaging of the devices. Devices created for the industrial space are focused on functional capabilities, while consumer marketed options have an appearance and feel as important driving aspect [19]. On a factory floor, IIoT devices may be ruggedized and or resemble a black box. Using an industrial IoT approach can yield multiple benefits [20]. For the consumer successive product iterations reflects customer experiences form previous launches, new product come to market faster, products can be customized without significant increases in purchasing price [21]. In manufacturing, quality issues can be caught more quickly by transforming live data into knowledge and action. Equipment maintenance can be performed in a proactive, rather than a reactive fashion. Relying on prognostics instead of diagnostics after a failure [22]. OEMs and system integrators can have increased visibility along the entire supply chain, even into parts of the supply network that are outside the organization. Production demand planning can be significantly more accurate, resulting in reduced inventory in the supply chain, reducing costs [23]. In product design, the next generation of a product can be based on live customer usage data. The interconnected nature of the IoT can feed manufacturing capabilities directly into design models, assisting in the simultaneous design of product features and manufacturing processes [24]. Using actual usages and manufacturing failure modes as live feedback to the product design process can improve performance [25]. As shown in Fig. 2, devices and Intelligent Assets give information about how a part of a machine is working to the Data Communication Infrastructure, using this information, it can find out how a machine is working [26–28](Fig. 2).

4. Conclusion

Application of IoT has enhanced every part of manufacturing sector. The manufacturing sector has accepted IoT as one of the best fits among other sectors. The quality, maintenance, human interface, inspection, market strategies have been automated with the help of IoT technologies. Industrial IoT has made every process, product and services more efficient, reliable, safer and effective and last longer. We hope that our intense and short review can help as an impetus to encourage deep and broad studies that will engross the evolution of novel IoT technologies to improve manufacturing services and optimize manufacturing systems.

CRediT authorship contribution statement

Khushbu Garg: Conceptualization, Methodology, Writing - original draft, Resources, Data curation, Software, Validation, Investigation, Formal analysis. **Chandramani Goswami:** Supervision, Writing - review & editing. **R.S. Chhatrawat:** Formal analysis, Writing - review & editing. **Shyam Kumar Dhakar:** Writing - original draft, Resources, Conceptualization, Methodology. **Govind Kumar:** Formal analysis, Writing - review & editing.

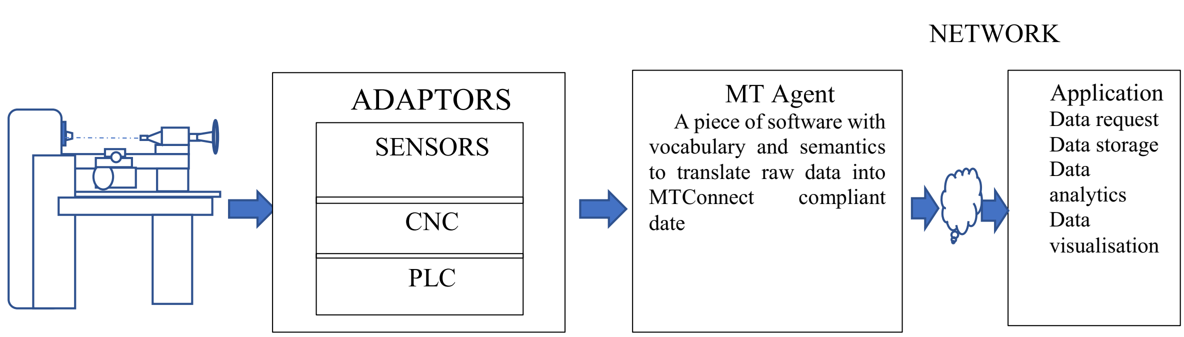

Fig. 1. An Demonstration of the Internet of Manufacturing Things Connected Standard.

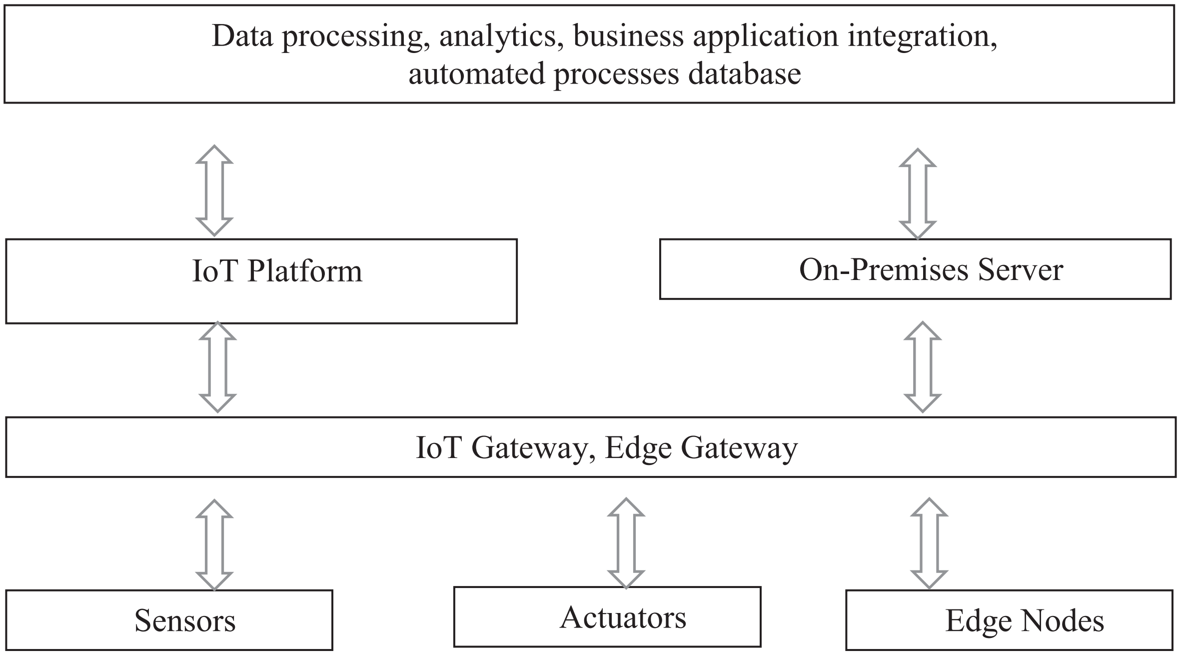

Fig. 2. IoT Infrastructure for Industry.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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