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Challenges and Countermeasures associated with Internet of Things in Manufacturing Industrial

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Abstract

A prospective development for the era of industrial is known as "Industry 4.0," and it also refers to the connection of intelligent, hardware, and material things that are connected digitally. It speaks of how the manufacturing industry uses the Industrial Internet of Things (IIoT). Manufacturers have already begun implementing both new and outdated informational and operative technology in an effort to adapt to this transition. The Internet of Things (IoT) is a relatively recent idea for companies, and it is providing an excellent potential in assisting companies to run more securely and effectively while enhancing productivity and lowering costs. The purpose of this paper is to look into the potential of IIoT in the manufacturing industrial, to evaluate the several IIoT challenges, and to determine how to address the challenges. Secondary information was obtained from internet sources and publications in order to determine challenges and countermeasures to IIoT implementation in manufacturing industries.

Keywords: IoT; manufacturing industrial; challenges; countermeasures; IIoT

1. Introduction

The "always connected" approach is becoming more and more prevalent in modern culture. The accelerated rise of new technologies, particularly the most current and well-liked "Internet of Things," (IOT) has altered human lifestyle. It is a fast-developing concept in which multiple elements are connected so they can communicate with one another online. Industry 4.0 standards state that cyber-computer technologies inside formation theory intelligent manufacturing systems performs a crucial part in analyzing and supervising evolutionary functions by implementing automated and decentralized actions to improve the production process (Kannengiesser & Muller, 2018). A key component in achieving this objective is the IIoT functional infrastructure, wherein conceptual systems interacting and cooperate in concurrent timing to execute all of the forms of smart manufacturing systems, administrative operations, and operational procedures necessary for concluding the manufacturing process (Banafa, 2018). By 2025, it is anticipated that every person on the planet will have six devices (other than a computer and a smartphone) hooked up to the internet, which connects every aspect of the real world. This situation increases demand for IoT-enabled equipment and machinery. To address this need, many manufacturing sectors must implement an IIoT environment and produce IoT-enabled products. IIoT is an advancing technology for the sector in manufacturing that offers the chance to run a corporation more securely and effectively. The IIoT offers several options to expand production and totally transform it into the manufacturing sector of the future. All industry's manufacturers and engineers now have a big chance to not only observe but also automating many of the intricate manufacturing processes. The IIoT technology offers manufacturers complex concepts that was difficult to access in previous systems. The goal of this study is to the possibilities of IIoT in the manufacturing sector, assess the various IIoT obstacles, and evaluate how to deal with the issues.

2. Literature Review

According to a recent executive study by Forbes Insights, the reliability of IoT technology is the largest obstacle to extending IoT possibilities. Finding automated processes for obtaining the best efficacy is a challenge for many organizations using IIoT (Raj Ven, 2018). One of the surefire methods to compete in the global in the industrial of manufacturing is to embrace IoT technology, which also contributes to the creation of market valuation (Toya Peterson, 2016). According to a press statement from (IoT Analytics, 2018), manufacturers are integrating a variety of technologies as part of the fourth IR 4.0 to fulfil important use cases for enhancing productivity, generating income, and lowering threats. By 2023, it is expected that the IR 4.0 market for services and products would reach $310 billion. According to a study of 1400 business owners done by Accenture, Business Insider, and SAP in 2015, 60% of manufacturers globally will employ smart gadgets to evaluate and enhance workflows. Only 7% of corporate

executives are capable of putting IIoT into practise. Additionally, it was discovered that by 2020, manufacturers would invest $70 billion in IIoT, resulting in a 50% reduction in the cost of product development and manufacturing.

2.1 Resemblances Between IoT and IIoT

IoT and IIoT utilize the same notion of smart device networks and distributed technologies to construct an always-online technology that collects information to and forth to make knowledgeable decisions. As an outcome, users no longer ought to manage domestic appliances, and corporations no longer ought to recruit thousands of individuals to manufacture items that machinery could do. Alternatively, users can devote time to employment, families, or skills enhancement. In terms of corporations, they can disperse their employees in various skill areas to increase corporate value. When evaluating IoT vs IIoT, take into account the observable commonalities:

i. Cloud computing infrastructure is essential for both IoT and IIoT.
ii. A low-cost, high-speed wireless internet access is a must-have component for IoT and IIoT.
iii. It requires Internet of Things (IoT) technologies and tools to create applications or services, whether to utilize IoT in industries or residences.
iv. HD webcams, beam-forming mics, GPS, geofencing tech, sensors of temperature, and sensors of water droplets are prominent I/O technologies used in IoT and IIoT.

2.2 The Distinctions Among IoT and IIoT

Despite IoT and IIoT share similar technology, such as cloud services, sensors, accessibility, machine-to-machine connections, and data analytic, they serve distinct functions. IoT systems instantly connect devices in a variety of industries, including agricultural, healthcare, corporate, retail and utilities, governmental, and communities. IoT systems include smart appliances, fitness trackers, as well as other technologies that, in most cases, do not result in an emergent crisis if something goes wrong (Sandeep Raut, 2017). In contrast, IIoT technologies integrate equipment and devices in industrial like gas and oil, utilities, and manufacturing. Software glitches and disruption in IIoT installations might result in circumstances that could be harmful or even fatal. IIoT solutions are also predominantly aimed on improving efficiency and safety or wellness, in contrast to IoT applications.

3. Methodology

The manufacturing sectors are currently undergoing a significant transition because to IIoT. (Jeffrey Lee, 2017) predicted that by 2020, there will be 20 billion linked gadgets, up from 8 billion in 2017. The development of novel economic models like autonomous concurrent time making of decision or service products is made possible by this new connection of gadget model. Derivative information was gathered from online resources and publications in order to determine the potentials and the difficulties of the IIoT adoption in the sectors of manufacturing in order to meet the goals of this study.

4. The Potential of IIoT in Manufacturing Industrial

Inventory and Asset Management in Real Time: IIoT devices assist in locating and monitoring essential assets, tracking and tracing inventories, occurrences across the distribution chain, and informing consumers of any substantial variations from planning. Digitalization provides undiscovered possibilities for optimizing manufacturing costs and adaptability by providing a comprehensive perspective of logistics, stock levels, competitive conditions, and so on (Rekha Kodali, 2018). Applications for the IIoT enables inter-channel insight onto supplies, allowing manufacturers to make reliable estimations of material available, estimated time of arrival of fresh material, and the progress of work. This approach helps to reduce common costs throughout the chain of production and optimization of supplies.

4.1 Streamlining the Manufacturing Process

Industrial IoT sensors enable constant observation of the assembly line from beginning to end. This allows the operator to delicate the production system indefinitely, conserving both money and time.

4.2 Supply Chain and Inventory Regulation

The provision of components and raw materials makes or breaks manufacture. RFID (radio frequency identification) tagging and similar systems provide constant, real-time monitoring of materials and commodities from site to site, allowing for consistent stock management and compensating modifications.

4.3 Packaging Evaluation

Industrial IoT sensors enable manufactures to evaluate the integrity of packages throughout storage and transit as well as examine how consumers usually engage with it, allowing for changes in design.

4.4 Manufacturing Data in Real-Time

IIoT gadgets can provide providers with legitimate operational information, enabling rapid modifications and remote access of industrial units.

4.5 Data Services

Whenever errors arise and maintenance is essential, IoT equipment can transmit out signals. Equivalent signals can indeed be generated in reaction to operational difficulties, including such greater operating temperature changes or excessive stress, which may signify an imminent equipment breakdown. Such signals have evident benefits in that they permit servicing to be arranged in early, reducing disruption and the likelihood of accidents. Such information, when paired with safety and health databases, can significantly enhance overall safety.

4.6 Quality Assurance

IIoT data from many resources, such as providers, manufacturing operations, and end-users, can indeed be merged to permit comprehensive enhancements in product production and design.

5. The Challenges

Supportive technologies which including manufacturing processes, drones, integrated and virtual environments, collaborative automation, and linked computer vision are crucial aspects of Industrial revolution 4.0. Manufacturers and industrialists face numerous obstacles while adopting these systems in organizations, which are outlined underneath.

5.1 Security Concerns

The main difficulties for IIoT systems are security. Dr. Irene Petrick, which is the Director for Intel's IoT team of Industrial Innovation, claims that the fast expansion in intelligent devices like interconnected devices, truly global computing infrastructure, robotic systems, intelligent gadgets, and concurrent time information analytic in the significantly bigger in manufacturing anticipated from the IIoT must confront potential challenges and vulnerabilities concerns in deployment. The absence of comprehensive cyber security measures is the basic challenge facing the largest manufacturing sectors. The biggest concern is that the attacks affect both people and industries, leaving them open to operational and financial issues. Due to their extensive usage of IIoT technologies, manufacturing industrials are susceptible to security issues, digital threats relating to the integration of informational technologies and operative technologies, and malevolent insiders. If IIoT system does not have a strong security feature, using it will be challenging.

5.2 Integration of IIoT

Integrating information technology and the operational technology would be another key difficulty that organizations confront when using IIoT. To ensure that data is provided without interruption or threat, precaution ought to be taken when integrating these technologies. The development of IIoT incorporation is costly, and several operating industries cannot use it due to technical limitations. Typically, IoT systems are built initially as standalone systems and then incorporated further into the manufacturing process in order to be a component of the whole system. However, there is a lack of proper synchronization and linkage between operational and information technology.

5.3 Visibility and Connectedness

Some other difficult obstacle throughout IIoT installation is the absence of connection between multiple elements and machinery operations. Synchronization issues are frequently brought on by technical and manual errors, electrical outages, and internet outages. As a result, connected computerized network equipment are disconnected, disrupting the overall manufacturing systems and requiring more money for repairs. It is vital to monitor linked equipment and machinery in real - time basis, and manufacturers must assure that those units are operating at maximum potential. Intending to identify deviations and address the challenges before they could arise, it is also crucial to monitor the machinery's lifespan and get insight into it. IIoT will pose new challenges as it spreads more widely.

6. The Countermeasures

Today's IIoT difficulties for manufacturing organizations may appear intimidating. The IIoT difficulties can be resolved by using top-notch IoT technologies and making significant investments in organizational framework and the IIoT architecture, opening up new options for companies to increase growth and constructive in certain industries. Organizations that use contemporary smart data processing and analytical technologies in a systematic way would benefit more from the IIoT, claims (Joseph Zulick, 2018). IoT devices integrated into both newer and older machines in sectors connected by an Internet Protocol address provide outcomes with security alerts in the IR 4.0 (Joseph Zulick, 2018). Manufacturers and developers are currently confronted with a particular challenge which is identifying significance and communicating the perks of IIoT technologies acceptance for users and businesses. The preceding are numerous perspectives on how the manufacturing industries might handle the obstacles of IIoT.

6.1 Activity Decentralization

As part of the move from older IIoT systems to more modern ones, machine equipment handles a variety of tasks such service delivery, production management, completion, and equipment maintenance. Manufacturers will have to spend some time estimating, assessing, and examining whether IoT systems can be incorporated in order to allow more time for other duties. Manufacturers can deal with the difficulties of IIoT by decentralizing management. Tasks like creating software scripts to prevent harm, switching machines, defining frameworks, and creating user-friendly layouts can all be concentrated during the decentralization phase.

6.2 Market for Edge Computing

Edge computing operates on nodes of the network in devices referred to as intelligent or edge systems to execute computations (Rohan Shrama, 2017). By sending data at the network's edges, it aims to limit transmission costs, congestion, and failure turnaround time, as well as enhance the user's experience. Edge computing speeds up data flow and provides real-time data processing. Increasing the demand for edge computing is a latest approach that answers the challenge of IIoT concerns via concurrent time reporting. Rather than transmitting mass data to the cloud, it transmits useful data. During the process of computing, a cluster of gateways is built by connecting a group of gateways, resulting in distributed edge computing.

6.3 IoT Gateway Clustering

Clustering the IoT Gateway ensures the continuation of cloud connectivity and data storage while assisting in the resolution of issues that cropped up during the convergence of OT and IT systems.

6.4 Observation, Interface, and Networking Component Integration

By adopting the "Trusted Observation, Networking and Interface Component," manufacturers can address security challenges. According to (Rohan Shrama, 2017), data-centric security technologies like web-based firewalls, secure web gateways, and application delivery controllers, among others, can be used to convey encrypted information.

7. Conclusions

Manufacturing industry accomplishes a significant stage of evaluation breakthrough with the IoT services. Despite IIoT provides substantial advantages, manufacturers face numerous hurdles when integrating it in their sectors. This paper will assist industries in comprehending the challenges of IIoT deployment and provide ways to solve them. Manufacturers must take the required measures to distinguish their products in the marketplace and confront price competition in order to establish a competitive advantage in the marketplace. In addition, quality items produced with Industrial IoT technologies are required in the Industry Revolution 4.0. This paper will pave the way for future research

into topics such as the obstacles experienced by IIoT service providers, the recognition of challenges encountered by company employees throughout the execution of IIoT in the industry sectors, and the research of manufacturing system competence following the implementation of IIoT.

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