

Need of Smart Automation, IOT and Secured Network in Industry 4.0

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Article Info

Page Number: 1944 - 1951

Publication Issue:

Vol 71 No. 3 (2022)

Abstract

The Industry 4.0 is totally based on the innovative technologies such as IOT, IIOT, Machine Learning, AI, Business Analysis technologies. Data plays most important to get results, to apply industry 4.0 we must identify the data to start any process. In the last research work we have mentioned about following a process designed by us, to start the same we need to input data. The sensors of IIOT require a key program to manage specific applications. The necessary data will naturally depend on specific type of industry we ideally want to implement industry 4.0. Currently, data security remains a considerable concern for all the industries. To comply with standards set by Industrial Authorities in India some programs have been designed and produced to provide Network Connectivity, Data Transmission, Network Security, Data Security, Threat Alerts, Threat Detection, Network flow. In this study we showcased a survey propagated with experts from different industries which are into business of producing Automobiles, Automobile Parts, Shipping vessels and Cargo, Railways Parts, Clothing Industries, Electronic chips & circuits, Recycled products. The survey is based on a set of questions which have help to understand the Past practices, present trends and future scope in the industry by introducing cutting edge technologies, Latest machinery and Fully Equipped Systems.

Article History

Article Received: 15 June 2022

Revised: 25 July 2022

Accepted: 14 August 2022

Publication: 21 September 2022

Keywords: Industry 4.0 · Data Security · Network Architecture · Industry Automation.

I. INTRODUCTION

The Internet of Things (IoT) has the flexibility and capacity to quickly adapt to its surroundings. Because of the programs that are employed on them, the environment becomes intelligent. IoT is superior than M2M connectivity, GSM, GPS, microcontrollers, processors, GPRS, 2G, 3G, and 4G networks. Software and hardware would both be used in the Internet of Things . IoT's primary goal is to make devices functional and always connected to one another through a network. Machine-to-machine connectivity gave rise to the Internet of Things (M2M)[1].

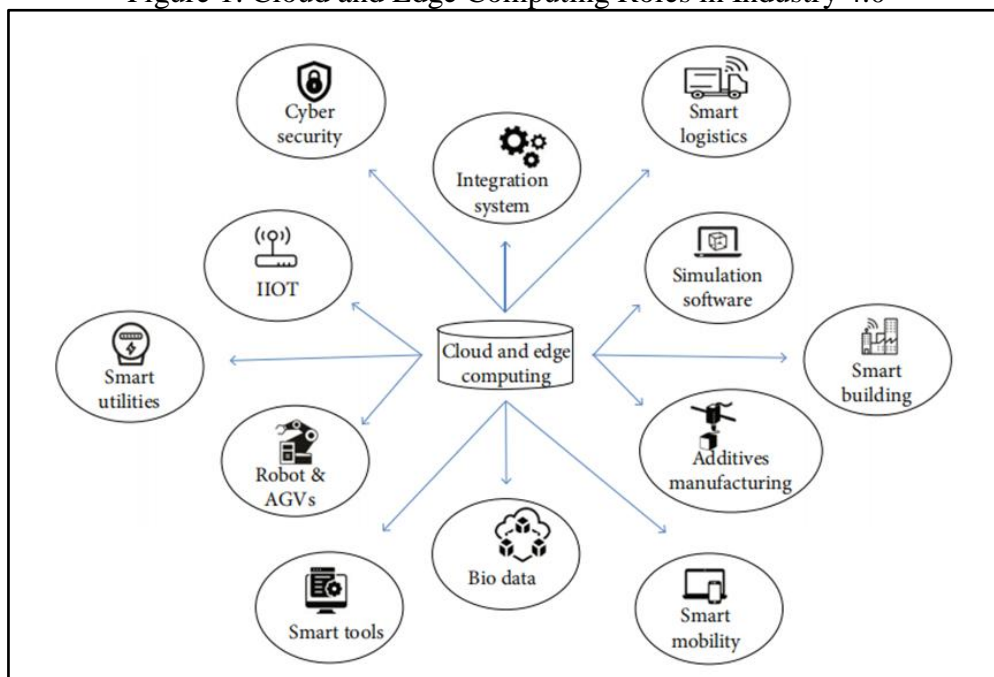
The dominant technologies of the contemporary period are artificial intelligence and its resilient advances. Over the years, there has been a tremendous amount of development and advancement in this subject. The industry creates and promotes a number of new technical items almost every day. Smartwatches, mobile phones, and smart apps all receive recent information relatively quickly. New functions and services are often added. [2] The industry offers the capabilities and advantages already before the consumer is aware of a need for the service. The driving force behind these developments is the enormous expansion in artificial intelligence (AI)-related adaptive processes.

Deep learning technology, which is a segment of machine learning, operates on the multi layer model idea. Huge amounts of data are frequently used in the automation process in the industrial setting . Virtual sensor networks (VSNs), wireless sensor networks (WSNs), and wireless sensor actuator/actor networks (WSANs) are some of the linked devices that produce a lot of data.[3,4] These data may be used to build a customized service when the proper data analytic approach is used. Industrial Internet of Things operations would be completed by doing comprehensive data analysis on the sensor data (IIoT).

II. IoT IN MANUFACTURING

In India, 4500 enterprises offer automation. Industrial automation promotes uniformity during the micro and macro-level operations across industries while increasing output quality and efficiency. Numerous automation options, including SCADA, DCS, PLC, HMI, and others, are included in industrial control systems.

Figure 1: Cloud and Edge Computing Roles in Industry 4.0



a) Need of Iot & IIoT in Industries

Industries and organizations must now develop automation systems due to COVID-19. According to a survey, automation usage has increased dramatically from 60% to 90% when compared to the previous ten years. The COVID 19 (Corona virus) outbreak has had a severe impact on the healthcare infrastructure and treatment systems in practically all of the impacted nations. To address a variety of issues associated to this viral outbreak, numerous advanced technologies must be introduced. The fourth industrial revolution, or "industry 4.0," uses cutting-edge manufacturing and information systems to quickly meet the specialized needs of various facets of the human person. In order to improve automation, these technologies offer wireless communication in the industrial and service sectors. utilizing the information gathered by cutting-edge technology. In Industry 4.0 plants, sensors and wireless communication help systems work. These sensors are coupled to a framework that is able to see entire production line, keep records of it, and make decisions by itself. To deal with the shortage caused by the COVID-19 disease outbreak, industry 4.0 uses intelligent production techniques to produce things that can be thrown away. During such a crisis, it has set up

a smart supply chain for medical supplies and equipment so that patients can get the important medical supplies they need rapidly. Industry 4.0 is a smart system that uses the real-time data offered by artificial intelligence (AI), the Internet of Things (IoT), as well as other smart technologies as a flexible manufacturing line for nearly all manufacturing operations. Any healthcare item is quickly designed and developed using cutting-edge design software, and the necessary pieces are then printed utilizing digital manufacturing technologies like 3D printing.[5-7] Being the resources & services available for automation adaptation in India. There is a need of sharing knowledge, spreading awareness, training humans, increasing the availability of skilled humans, updating the systems. A detailed questionnaire set has been developed based on the extensive literature reviews. These set of questions were later used as a tool for survey of various sectors of the industries where the industrial revolutions has been observed in the past decades.[8-10]

Today India has turned into a start-up hub, with the schemes and programs launched for corporations. The need of industrial revolution was encapsulated in the survey wherein it was observed that, various requirements have forced the need like reduction in energy consumption, to increase the efficiency and accuracy of the production in the organization by reducing the time devotion and downtime of the machinery due to several part changing processes in the flexible automation systems. Furthermore, the cycle time of each individual process has reduce to an extent by positioning the inventory, just in time and monitoring into a system requirement alignments without compromising the quality aspects, maintain the standards of the validating institutes and customers. The flexible automation has enriched the industrial automation for customization of products as per need with change in design by market reviews and technical requirements. Multiple locations and remote control of the production planning and executions can be possible done with IIOT techniques. [11-13]

Furthermore in an another report of the survey associated with shipping industry it has been observed that, planning and execution using the software like SATLINK regulation of information can be easily conveyed for business purposes. Later, for adding, removing or reviewing a job in the process, similar PMS task reports plays an important role in further job scheduling.[14,15]

b) Adaptability of Production Modules and Periodic Maintenance

Moreover, in the past few years of development of Industrial 4.0 periodic maintenance has become a matter of ease where the predictive techniques based on AI-ML technologies were implemented. The standard maintenance strategies are corrective maintenance, preventive maintenance, condition based maintenance and predictive based maintenance. Such advanced predictive maintenance has increased the life of the mechanical parts of machines. Software analysis has reduce the breakdown of mean time between failures and increase the efficiency and productivity resulting in lower production cost of units. But these predictive maintenance and requires a skilled persons for understanding the network architectures. Intensive 5 years of periodic training are required.compiling compilations for production planning, rejection stocks, inventory control, closing stocks, and dispatching quantity in the plant. The study of the Traff tractor production module has revealed that the machinery heating and spinning have been resolved by synchronization of the sequential flow. Wastage was seems to be reduced and improving the quality.[16-19]

In the maritime industry, passage planning modules that include the details of no-go zones (depths, shallow paths and underground waters) are in need of automation. rerouting, auto navigation and advanced vessel collision protection systems by implementing cutting edge technologies of artificial intelligence and machine learning models. Not limited to these but extending the planning modules to Auto Route - Manual intervention is involved for Accuracy, Navigation actual running, Main

Engine Controls, Navigation, RADAR, AIS (Automatic Identification system) Computer system is needed, alarm monitoring system, parameters, getting information of engine, Monitoring, Real Time- Position. In this AIS Uplink systems are more reliable networks and systems. With the introduction of these planning modules in the system, there is a need of protection of the system from cyber security. [20]

c) Parameters to analyze efficiency of Industry 4.0

In the recent trends of industrial evolution, large size data is created and it's very important to evaluate and analyze them to identify the various beneficial outcomes in improvising the production, assembly line faults, smart inventory management, raw material and production planning etc. It has been observed that various steps are involved in data processing for accurate outcomes. Commencing from starting and refining questions, driving towards the exploration of the data, using statistical models interpretations of results are done. In this process parameters or indices of evaluation and analysis are featured out. It has been observed in a survey from industry that most important parameter of efficiency depends on humans' work and mistakes. These can be reduced to a large extent by training and skill development of unskilled workers.[21]

d) Product Validations

The validation of the production improvements can be validated by Quality Management Team (QMT). In involvement of IoT can validate more profoundly with 100% inception of the production effectively and accurately with the help of sensors and actuators. These have been observed in Indian industries, but it is still a big gap in marine industries, where data collection and analysis is a crucial and cumbersome task. [22]

e) Logistic Scheduling

The ways that products, clients, manufacturing, and services firms are linked are affected by the techniques of Industry 4.0. Digitization improves the efficiency, flexibility, and customer relations of supply chain applications. The digital production line will be made possible by promising techniques like smart logistics and warehousing and advanced material analysis. Because these coordinated logistics infrastructures are getting more complicated, they need new algorithms that can address their NP-hard optimization issues.

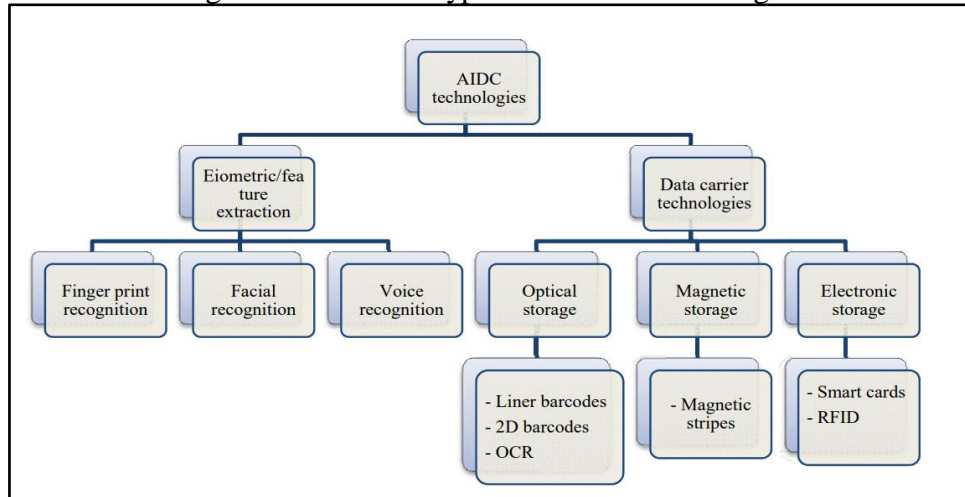
At the moment, more than a third of the energy used for transportation around the world (38%) comes from moving freight. Two-thirds of this energy comes from trucks, 11% from ships, and 3% each from rail and pipelines. So, research needs to be done in order to make sure that transit activities fulfill their function in the economic business process of commodities while reducing the negative externalities that come with them. It is also very crucial to understand why, how, and where transit activity happens, in addition to understanding what kind of facilities and policies are needed to meet the growing needs of businesses and households in terms of logistics. From the survey, it's clear that the marine industry cares more about how accurate the data is, how well it works, how much it costs to run, and how vibrations wear out parts.[23]

f) Identification of Traceability of Logistics.

Automatic identification and data capture (AIDC) systems employ numerous latest technology and work on different fundamentals to analyze information. Most of them use bar codes, radio-frequency recognition, voice recognition, optical character recognition, infrared recognition, etc. RFID technology is becoming more and more important in our daily lives. The greatest advantage of this system is without a doubt that it can track and recognise individuals and items in real time. Another benefit is that an RFID tag and an RFID gate don't need to be in the same range of sight. At

this point, we can say that it can be utilized in almost every part of life. But logistical challenges is the best place for it to be used. In this situation, there are several questions about how well recognition of commodities could work. One of most important factors that affect whether or not emerging innovations can be used in operational strategy. In addition to these important things, the implementation of new technologies should be done in a fair way. [24]

Figure 2 : Different types of AIDC Technologies



Smart Factory is an important part of Industry 4.0, which is the next generation of industry. The Smart Factory Visibility and Traceability Platform (iVTP) uses theIoT to identify different manufacturing objects. In particular, radio frequency identification (RFID) devices are used to turn different resources into Intelligent Manufacturing Objects (IMOs), and one's interactions can show how production works and behaves in real time. Using a laser-scanner on the shop floor, iVTP can show in real time how different IMOs are moving and what their states are by combining this data with real-time RFID data. A cloud-based system architecture that lets all facilities be packaged and implemented in the cloud makes it easy for end users to describe their production logistics, download useful services, and build their own personalized service. Several example scenarios are given to show how iVTP can make it easier for a smart factory to make decisions, make products, and handle logistics.[25]

III. CONCLUSION

The manufacturing industry is endeavoring to invest in research and development and utilities to give them an edge in the international economy. So, sophisticated technological advancements in manufacturing processes to make information more visible and make it easier to control the systems. Keep in mind that sensors, data, and IIoT frameworks may be present in physical industries, but they are not as tightly connected as they are in the IoT. Industry 4.0 is a new initiative that aims to improve the way things are made by bringing in a new production of CPS for smart manufacturing. IoT sensing gathers a significant amount of data from real-world manufacturing systems. To get the most out of IoT for smart manufacturing, improved analytical methods need to be developed.

With the survey conducted among various manufacturing and service industries, smart manufacturing requirements and amendments have been discussed where it has been found that with the development and deployment of IIoT and IoT with cutting edge technologies the economic strategies are getting strengthened but still the cost of technologies need to keep in the view point of

considerations. Is India still be present at the edge of deployment of huge technologies where still the man power and machines are struggling for employments? The answer is still in the point of economy of scale.

Acknowledgment

Without the extraordinary assistance of Mr. Arabinda Ghosh, General Manager Plant Head, Kumi India Industries Pvt. Ltd., Mr. Rushank Baweja, Technical Superintendent, Meiji Shipping Group, and Mr. Sanjay Khanna, CEO, Pyramid Abrasives Pvt. Ltd., this paper and the research supporting it would not have been possible. Their passion, expertise, and meticulous attention to detail have inspired others and maintained the project on schedule. They made a highly excellent contribution to the drafting of this report and actively participated in the survey that was done.

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