

Introduction to Industry 4.0

Industry 4.0- Internet of Things (IoT) and Industrial Internet of Things (IIoT)

MSc Industry 4.0 Advanced Manufacturing (I4W)

Module Code: ACPA7004

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Date- 31st March 2022

Abstract- Internet of Things (IoT) also known as Internet of Everything (IoE), it came with new technologies, sensors, software, etc. using these technologies; devices connect and exchange data and also communicate with each other. Industrial Internet of Things (IIoT) is a sub branch of IoT which works on the same principle as IoT. In this short study we can see couple of examples of IoT/IIoT from the business and their benefits. It also describes challenges and opportunities of the IoT/IIoT.

Introduction

History of Industrial Revolution

In the old days (before First industrial revolution), we all were mostly depended on agriculture, their goods, and small business (like handicraft) which did not have included any machineries or technologies.

The First Industrial Revolution bloomed in the end of the 18th century with the use of steam power, water power and the form of the mechanisation. Because of mechanisation, agriculture and handicraft started to be replaced with industry as a main source of income/economy (Howard, 2018).

The Second Industrial Revolution came in the late 19th century and 20th century with the discovery of electricity, mass production and assembly line production (Howard, 2018).

The Third Industrial Revolution began in the second half of the 20th century and introduced partial automation using memory-programmable controls and computers (Institute of Entrepreneurship Development, 2019).

The Forth Industrial Revolution (Industry 4.0/I4.0)-

We are currently in the fourth phase of Industrial Revolution. It is not completely fresh beginning/start but constructs on the evolution of the Industrial 3.0 i.e. automation and internet. Those machineries and production technologies which were working before with automation technology now diversify with network connection and connect with digital twin on the internet to communicate (Institute of Entrepreneurship Development, 2019).

In other words, I4.0 is based/focused on increasing in digitisation and interconnection of products, machines, industries, etc. by using several/combo/integration of technologies, whereas the Internet of things (IoT) and its sub branch the Industrial Internet of things (IIoT) are the main characteristic of I 4.0.

- The internet of things (IoT)
- The industrial internet of things (IIoT)
- Cyber-physical systems (CPS), Cyber security
- Smart manufacture
- Smart factories
- Cloud computing & big data
- Cognitive computing
- Artificial intelligence
- Advanced robotics
- Additive manufacturing
- Augmented Reality (AR) and Virtual Reality (VR)

Background Research

What is the Internet of Things (IoT)?

At the present time, we all uses internet and connects to other devices, equipments, system through the internet and we also share the data, information to other devices, system and people by using internet this technology is nothing but the IoT. Vailshery (2021) mentioned in their statics

study of IoT active devices in the world with more than 13.8 billion units connected to IoT in current date and there will be sharp jump by 2025 from 13.8 billion to 30.9 billion.

What is the Industrial Internet of Things (IIoT)?

Industry 4.0 is aiming by using IoT technology to make/build smart factories/industries and global connectivity. Furthermore, IIoT helps to the industries, businesses become faster, smarter and advanced with wireless network, sensors connectivity. In that way network interconnectivity and communication will possible in between global networks, systems, software, machines, factories. Together with, can transfer the information, data and control the machines, their actions, and results (Gilchrist, 2016, p. 195).

On this case, the couple of processes and technologies of Safran group (Safran Seats GB) are highlighted as below,

Background

At the present time, world is continuously growing and changing due to this reason many industries (mostly all- small, medium and large scales) have already accepted advanced technologies and processes. Though there are different reasons behind this, namely, rapid change in the technologies, change in the consumer's demand, safety purpose, economy development, sustainability, competition, future endeavour, etc.

In the same way, if we see couple of years back, there were some different scenario particularly in the manufacturing industries namely mechanical, automobile, and aerospace, etc. During the pandemic (or I would say because of pandemic), a lot has changed especially in engineering/design sector.

In other words, a few years back most of the mechanical engineers never used to do work from home (WFH) on regular basis or it wasn't the part of their job profile/policies, but now the situation has changed completely and now we are living in the different and smart world.

Presently, I'm working with the same organisation where I used to before pandemic happened. So on the positive side; I can see the huge difference (before and after) in the field of engineering, technologies, industries as well as the way of working, etc. Since then all design engineers of my organisation have been working from home/remotely.

Surprisingly, since all our meetings, communications, discussions, reviews, Obeya have been conducting through web/apps/chats/video conferencing. We never had this thought before that we can work from home so efficiently and patiently. Just because of/on the basis of internet technology, machines, software, advanced digitalisation, economic growth and this is nothing but IIoT. This is the power of smart technology. We are the witnesses of the I4.0 and we can see the Industrial revolution around us.

Hybrid work culture

Another key point/moreover, due to all changing circumstances most of the organisation (including my organisation) accepted and introduced hybrid way of working (50% onsite, 50% WFH). Once everyone has laptops with remote connection, anyone can work remotely from anywhere. This is called the smart move and utilisation of the smart technologies/internet of things (such as internet, wireless networks, data and insights, cyber security, cloud computing). On the whole, this is the win-win situation for everyone who is evolved and beneficiary in the business.

One PLM (Product Lifecycle Management)- One system, one process (One PLM One Safran)

Definition- PLM is a solution/system/a tool which manages product, product data and their all activities and process at each stage from beginning to end (from concept design through design and manufacturing). It stores all data and manages its life cycle. Similarly, PLM also combines staff, teams, various departments, process, data, and business systems and provides whole product development/data/information on a centralised system/structure for everyone i.e. whoever the part of the system/business (Johannson, n.d).

Currently we are using Smarteam (ST) as a PLM system. SmarTeam allows managing all information of the product/process throughout whole product lifecycle.

In detail, if someone initially start the work on any part/product and save and check-in their work into the ST, then that work will locked/freeze on his/hers name. After that anyone can access, edit (check-out), save, release this data from anywhere with Safran ST network. Same way we can put this data into the ST workflow so it will go through each team/department for checking and approval process so we can release this data error free for purchasing and manufacturing.

Now our business strategy has changed. We have been moved towards globalization and modernization. We have already started the work with other branches of our organisation and with the sister's company which are situated on the different part of the globe. Furthermore, we have 'One PLM' system so we are working together just like a single organisation/team.

Just because of one system (ST) everyone one in the Safran group and extended Safran business (sister company/Safran's branches located in different locations) can work efficiently and cost effectively. Furthermore, due to ST, we use the time difference zone of other countries to plan and complete our task. We can coordinate/communicate our work. Everyone can share their ideas through ST to anyone in the industry.

Pandemic is the best example where we can see importance and benefits of PLM/IIoT system. Since pandemic, Safran team has been working from home, by using all these technologies, IIoT-PLM, we accepted the change and worked so efficiently and clog-free.

Benefits of PLM (SmarTeam)-

- It improves efficiency and coordination of the team and product.
- It allows us to work from anywhere and anytime.
- It allows us to better utilization of the resources.
- It reduces the design time and entire process time of the product.
- It allows scope for innovation.
- It accelerates release and change process cycle.
- It gives clear and reliable information of modifications and process cycle and so the real time visibility.
- It reduces production rework and scrap.
- It reduces the rework design time by providing accurate status of the product to everyone because of centralise system.
- It allows foolproof process so everyone gets same result.
- It reduces the documentation and paperwork.
- It helps to meets our organisation standards as well as authority standards such as, ISO, Boeing, Airbus, etc.
- It allows smooth workflow.

- It allows searching anything as per requirements (It has capacity to provide intelligent search result).
- It allows us to take various and accurate reports.

Bottom line

Overall PLM is a reliable and import business approach for the industry. It reduces the chance of failure, risk and offers smooth flow operation. Mainly it provides quality, reduces time and cost (Francis, 2017).

If anyone wants to be modernised, global reach and globalised then ones should be harmonious, compatible and having same systems, goals and technologies with others. Due to the PLM- IIoT technology with cloud computing it is effective and efficient way to work together with global team.

Conclusion

Altogether, the industrial fourth revolution, which not only technology or machinery need to be smart but we are also the important share of I4.0. So it clears that as a human being with smart technology around us we should be absolute flexible, adaptive, positive in nature and then we all can go hand in hand towards development and achievements.

Indeed, I4.0 is incredibly beneficial for the world, by all means, no one can deny that everyone is so dependent on today's technology for example, ultra high speed wireless internet, sensors, smart phones, smart watch, smart TV, smart security system, smart home, smart/connected appliances, smart factories, smart farming, healthcare system, etc.

Another key point, I4.0 is not only digitisation and IoT technology simultaneously; it is faster, versatile, wide and its growth/development is just like a tsunami (Schwab, 2017, pp. 10-11).

In the final analysis, as a human and as an important part of the revolution/process, we have to be more prepared, flexible, adaptive, faster, skilled, and cognizant so we can go hand in hand with Industry 4.0/technologies/machineries.

Impacts

As Schwab described, the I4.0 possess four major impacts on business across industries:

- customer expectations are shifting
- products are being enhanced by data, which improves asset productivity
- new partnerships are being formed as companies learn the importance of new forms of collaboration, and
- operating models are being transformed into new digital models.

(Schwab, 2017, pp. 29-30)

Opportunities

- Fourth Industrial Revolution has provided many opportunities just like previous three. Such as,
- Better work condition for employee/human beings.
- Human and machine can work and communicate together efficiently with the IoT/IIoT.
- Factory runs smoothly and continuously with advanced intelligence and sensors
- Further improve the productivity and efficiency with optimization and automation.
- Sensors enhance the safety features and prevent from accident.
- Up skilled work force perform confidently and efficiently.
- Modern consumer will get attracted towards business due to the customisation.

- Real time visibility will make it possible to review supply chain effectiveness immediately.

Challenges- I4.0 with IIoT

There are many challenges in I4.0 which categorised in three areas:

- Technical and Security challenges- Data sensitivity, cyber security, secure data storage and management/handling data growth
- Operational challenges- High cost/investment of failure and change, connectivity outage
- Educational/Academic challenges- Jobs, gap in technical skills, skilled and knowledgeable employee, high level of education, analytical skills with latest technology.

Recommendation-

In this era, we already saw many more and major changes and developments in the industrial field with Industry 4.0. Even it is ongoing process; it is going to be progressive and versatile. We are the witnesses of how technology has changed and it is constantly changing and will continue to change.

Adapt Agile approach- Industry, employer as well as employee should adapt Agile nature.

Education system- Education should be practical, analytical, wide and versatile just like modern technology.

Upgrade knowledge and skills in the field of latest technology and software.

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