Technical Guide

“Introduction To Industrial Internet of Things- IIOT ”

Small and Medium Enterprises Development Authority

Ministry of Industries & Production

Government of Pakistan

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2 Introduction to SMEDA

The Small and Medium Enterprises Development Authority (SMEDA) was established in October 1998 with an objective to provide fresh impetus to the economy through development of Small and Medium Enterprises (SMEs). With a mission "to assist in Employment Generation and Value Addition to the national income, through development of SME sectors, by helping increase the number, scale and competitiveness of SMEs", SMEDA has carried out 'sectoral research' to identify Policy, Access to Finance, Business Development Services, strategic initiatives and institutional collaboration & networking initiatives. Preparation and dissemination of prefeasibility studies in key areas of investment has been a successful hallmark of SME facilitation by SMEDA. Concurrent to the prefeasibility studies, a broad spectrum of Business Development Services is also offered to the SMEs by SMEDA. These services include identification of experts and consultants and delivery of need-based capacity building programs of different types in addition to business guidance through help desk services.

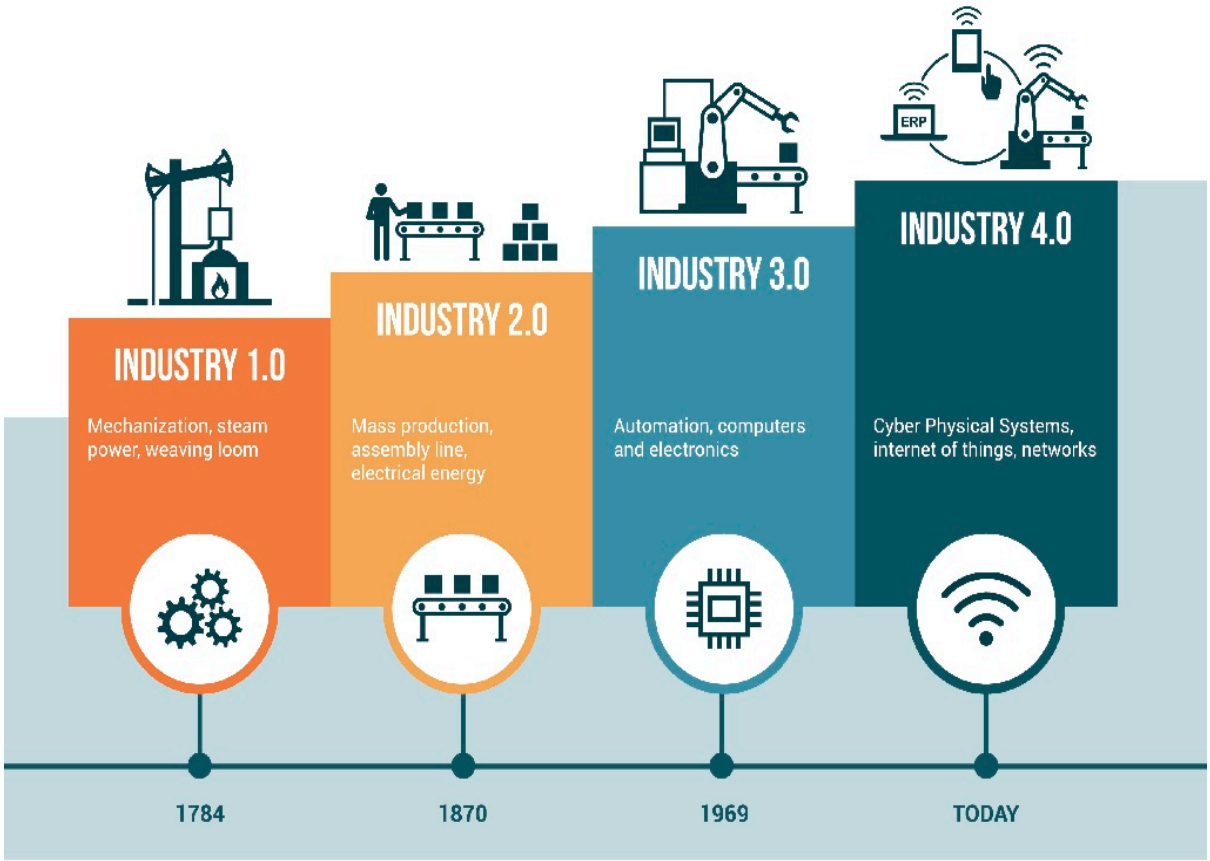
2.1 Industry Support Program

In order to enhance competitiveness of SMEs and achieve operational excellence, SMEDA established an Industry Support Cell (ISC) for provision of foreign technical support and knowledge transfer in collaboration with International Development Organizations. SMEDA's Industry Support Program (ISP) initially launched with Japan International Cooperation Agency (JICA) and actively engaged in reducing energy inefficiencies and improving production and quality of products with the support of Japanese Experts. Later on, similar activities with other international partner organizations like German Corporation for International Cooperation (GIZ), Training and Development Centers of the Bavarian Employers' Association (bfz), Germany, and United Nations Industrial Development Organization (UNIDO) were also successfully implemented.

3 Fourth Industrial Revolution

The Fourth Industrial Revolution is a way of describing the synchronization between the physical and digital worlds. It's a fusion of advancing in Artificial Intelligence (AI), Robotics, the Internet of Things (IoT), 3D Printing, Cloud Computing, Augmented Reality/Virtual Reality (AR/VR), Quantum Computing, and other technologies. While the Fourth Industrial Revolution (sometimes called the 4IR or Industry 4.0) is destined to change society like never seen before, it builds on foundations laid by the first three industrial revolutions. The dawn of the steam engine in the 18th century led to the first industrial revolution, allowing production to be mechanized for the first time, and driving social change as people became increasingly urbanized.

In the second industrial revolution, electricity and other scientific advancements led to mass production. A third industrial revolution, beginning in the 1960s, saw the emergence of computers and digital technology. This led to the increasing automation of manufacturing and the disruption of industries including banking, energy, and communications.

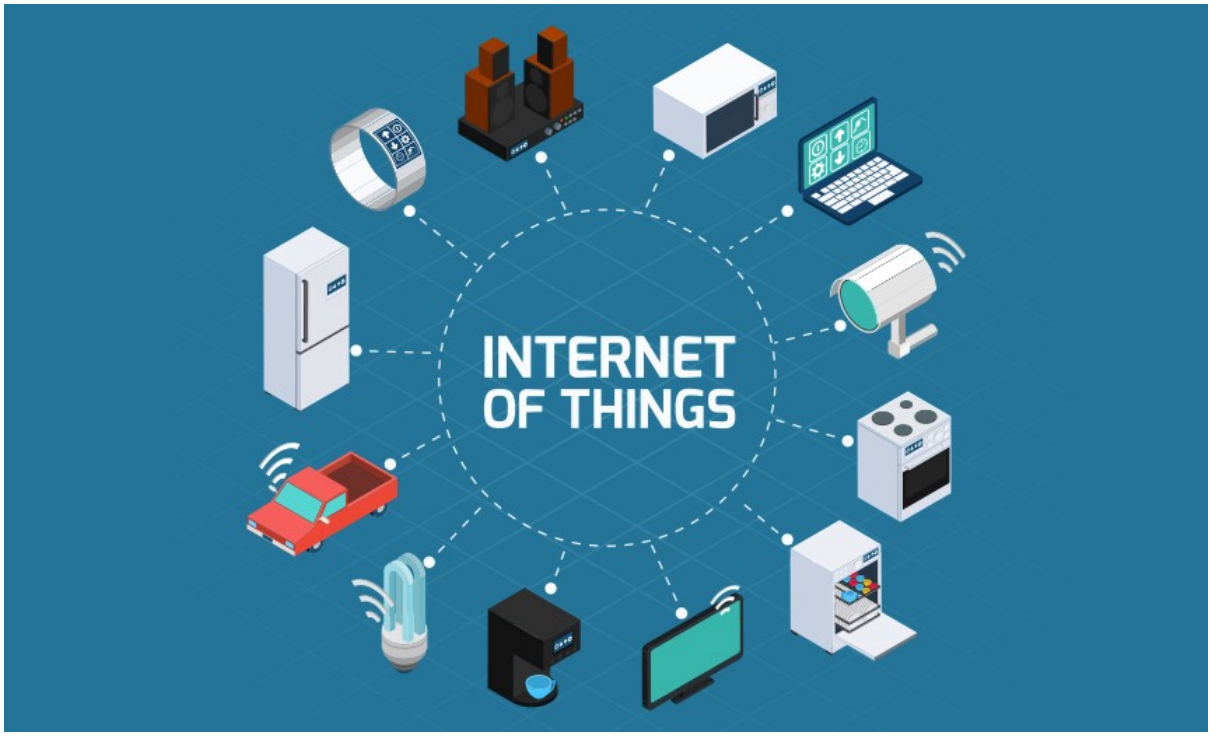


4 Internet of Things (IoT):

The term Internet of Things has become widespread that described ***the interconnection of machines with sensors, software, cloud and other technologies for the purpose of connecting and exchanging data with other machines, devices and systems over the Internet.*** Just like smart phones has connected the humans with each other, IOTs has potential to connect machines and devices with each other.

There is an extensive range of emerging IoT applications for health care, traffic control, vehicle safety, energy, agriculture, and manufacturing-to name a few. IOT spectrum includes coupling massive sensing and control with big data and analytics to accomplish advanced levels of optimization and efficiency.

Industrial automation has a history of adopting commercial technology as it becomes established and broadly available. Applying IoT technologies to improve performance and enable better integration with business systems is a natural step. The application of broadly used IoT technologies will also bring down the hardware, software, and labor costs of implementation just as the PLC did years ago.

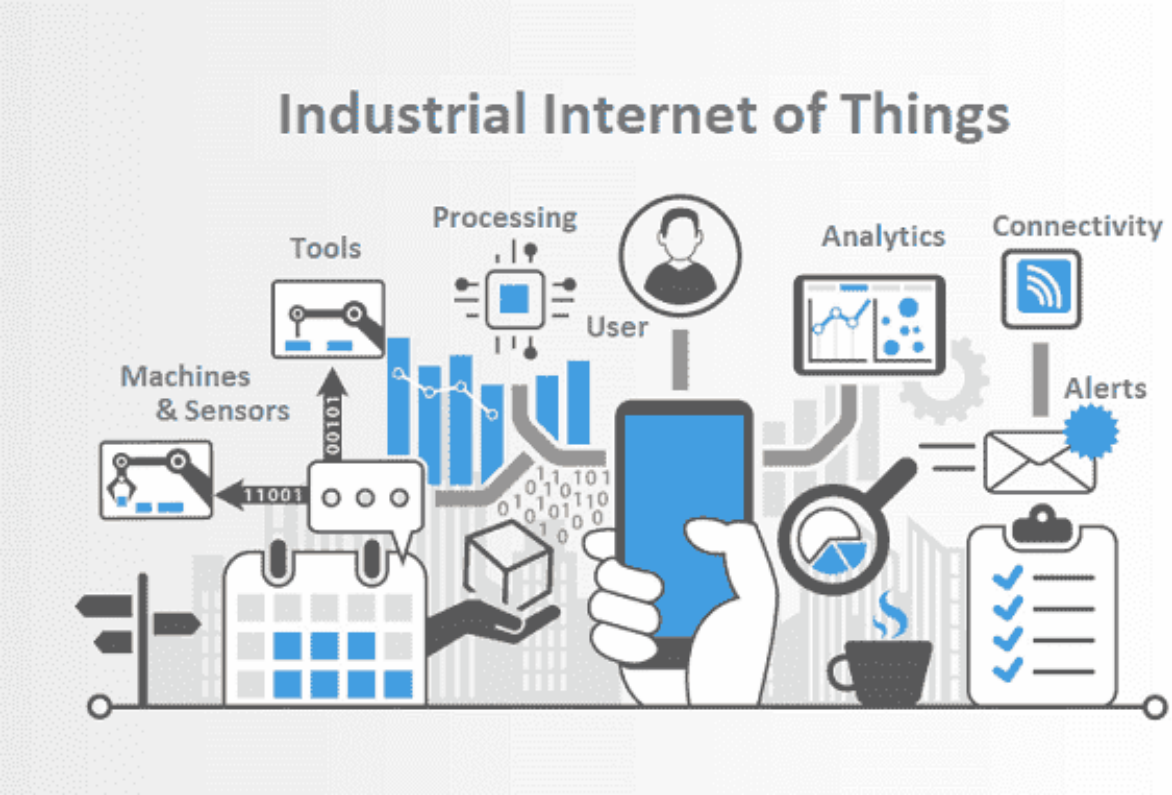


5 Industrial Internet of Things IIOT:

Internet of Things application in industry is known as Industrial Internet of Things (IIOT). Normally it is the use of smart sensors and actuators to improve manufacturing and industrial processes. IIoT uses the power of smart machines and real-time analytics to take benefit of the data that "legacy machines" have produced in industries for years. The driving strength behind IIoT is that smart machines are not only better than humans at gthering and analyzing

data in real time, but they're also better at communicating vital information that can be used for quick business decisions and made them more accurate by the use of machine learning and artificial intelligence.

Interconnected sensors and actuators enable Industries ***to reduce inefficiencies and solve problems quicker, also saves time and money***. IIoT holds great prospects for ***productivity improvement, quality control, sustainable development, environment friendly practices, Energy efficiency and monitoring, supply chain and asset traceability, and overall efficiency improvement***. In an industrial environment, IIoT is can be utilized in processes but not limited to predictive maintenance, supply chain management, energy management and asset tracking.



6 IIoT in Manufacturing and their benefits:

As discussed earlier, Industrial Internet of Things is helpful both for the manufacturers and for the consumers. Industrial IoT enables manufacturers to remotely monitor and control their equipment, machinery and products. Eventually they would have a proper insight of their business processes and create value for their customers by eliminating defects in production systems.

Worldwide, Industrial Manufacturing is taking up the prospects of the Internet of Things rapidly. Many plants are already utilizing connected control systems for procession and supervision.

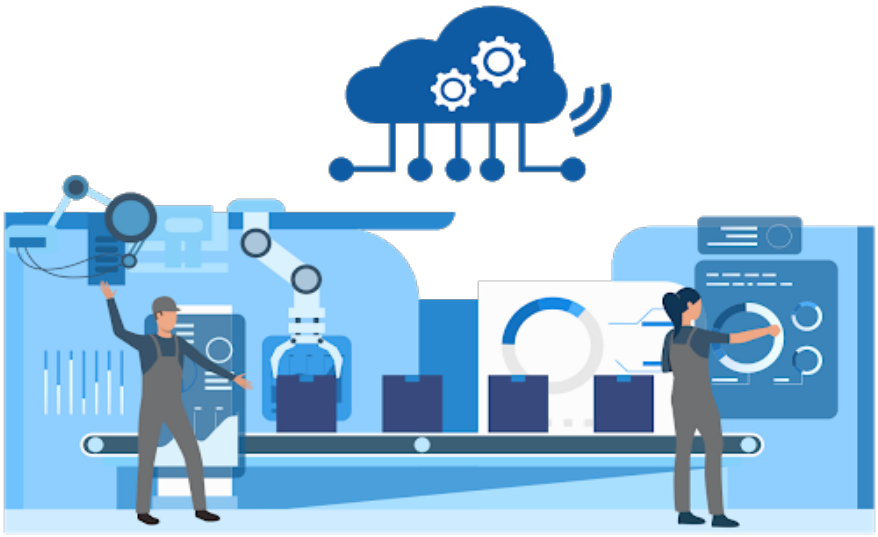
The main benefits of IoT solutions are as follows:

6.1 Predictive Maintenance

By connecting IoT-devices and gadgets that have different sensors e.g (temperatures, vibration, voltages, currents, etc.) to other devices, MQTT broker, cloud/API connected with even the legacy machines, manufacturers can obtain crucial maintenance data. This type of information allows to estimate the present condition of machinery, determine warning indications, generate alerts and activate corresponding repair procedures.

Latest machinery manufacturers are now embedded their machines with IOT system. In this manner IoT renovates maintenance into a fast-paced and automated practice, which forecasts a failure long time in advance. Moreover, it stimulates cost savings over traditional preventive measures as the actions are taken precisely when they are needed.

Obtaining useful data in time, the plant managers can identify plant machinery that needs fixing. Besides, it also helps to schedule maintenance activities thoroughly and hold systems in working condition as workforce is still performing the task. IoT can also elongate equipment lifetime, contribute to machine and plant safety and lower the dangers of accidents that affect the environment harmfully. In real terms, IoT can greatly improve your industry's predictive repairing/maintenance abilities.



6.2 Remote Production Control

Connecting legacy machines to IOT would enable an industry to convert it into smart machines by using Cloud computing models , one can collect and analyze the large-scale data sets necessary for supervising various field devices like switches, Controllers, valves and other industrial parameters.

Currently using PLC and Supervisory control and data acquisition (SCADA) systems can be utilized by coupling them with IOT sensors, the data from existing industrial automation system can be utilize by introducing cloud computing techniques to compute data and then made Machine Learning models such as regression mode, Artificial Neutral Network (ANN), Convolutional Neural Network (CNN) to optimize remote production monitoring and controlling. Telecommunications, oil and gas industries, as well as power generation, have been already reaping the benefits from IoT devices embedded into remotely control systems.

The most prominent feature of remote production control in industrial automation systems is to monitor and control its status at any time and from anywhere. It allows for the visibility and authentication of all tasks and workflows, offering detailed reports on the situation and status of finished processes, of those that are being executed and of future ones – in other words real time monitoring and controlling can be done through it.

All this makes the IoT technology be a core instrument in ensuring safe automated production, monitoring the workers, tracking the personnel location.

6.3 Asset Tracking

A very useful aspect of Industrial IOT is when IoT technology combined with the development of native web and mobile apps for iOS or Android makes it possible to obtain real-time asset information and alerts through which one can make accurate decisions.

The focal task of tracking depends on discovering and supervising such crucial assets as the components of the supply chain (raw materials, containers, and finished goods). Such applications can radically optimize logistics, keep stocks of work in progress, and disclose embezzlements and violations.

IoT-based asset tracking helps the producers calculate the usage of movable equipment elements and initiate measures to shorten idle period and enhance utilization.

6.4 Logistics Management

Enterprises that depend significantly on transportation can also benefit from IoT-based interconnection between various devices and sensors system.

Overseeing the automotive fleet via IoT-driven devices helps manufacturers eliminate or put down the risks concerning the costs related to vehicles, staff and transportation. Autonomous fleet solutions contribute to the greater efficiency of the company.

Logistics managers make good use of leveraging IoT when it comes to repairs and fuel expenditures. They optimize their tasks that cover monitoring fuel costs, smart deliveries, diagnostics, and drivers.

e.g. Trackers are currently being used in logistics, real time location monitoring of vehicle when combined with the vehicle fuel sensors and the cargo temperature sensors (if its temperature sensitive) can gives you a very detailed level insights.

Additionally, a real-time overlook of driver and vehicle performance aids to raise technicians' safety, bring down inventory damage and reduce insurance payments.

6.5 Digital Twins

Digital Twin is a digital representation of a physical object ,process or service. A digital twin can be a digital replica of an object in the the physical world .

This technology allows users to investigate solutions for product lifecycle extension, manufacturing and process improvements, and product development and prototype testing. In such cases, a digital twin can virtually represent a problem so that a solution can be devised and tested in the program rather than in the real world.

Digital twin can be divided into 3 broad types based on the time when it is used:

a- Digital Twin Prototype: This is done before a physical product in created
b- Digital Twin Instance: This is carried out once the product is manufactured and need to test the product in different scenarios or situations
c- Digital Twin Aggregate: This gather information from the digital twin instance to determine the capabilities of a product, run prognostics and test operating parameters.

7. Summary

Internet of Things in general and Industrial Internet of Things in particular has the potential to revolutionaries the world in a manner that nobody ever has seen before, IOT when combining with other Technologies i.e. Cloud computing, Cyber security, AI/ML etc. under Industry 4.0 has a true ability to create a positive disruption.

Being the developing country , early adoption of innovative technologies facilitates to our businesses to gain the extra shares in the international market by enhancing productivity, efficiencies and business intelligence.