

Industry 4.0 and Industrial IoT with MPS Digital

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Introduction

The Industrial Internet of Things (IIoT) is transforming the landscape of modern manufacturing. By connecting physical assets and systems through a network of sensors, actuators, and data analytics, businesses are gaining unprecedented insights into their operations, leading to increased efficiency, productivity, and profitability.

But what is IIoT, and how can it benefit your business? This white paper will provide you with a comprehensive overview of IIoT, its components, benefits, and how MPS Digital can help you implement this powerful technology in your own organization.

Basic Internet of Things (IoT)

The Internet of Things (IoT) refers to the network of physical devices embedded with sensors, software, and other technologies that collect and exchange data through the internet. From smart homes and wearables to connected cars and cities, the potential applications of IoT are endless.

Extending IoT to Industry: Evolution of IIoT

The Industrial Internet of Things (IIoT) is a specific application of IoT within the industrial sector. It leverages the power of connected sensors, devices, and data analytics to optimize industrial processes, monitor equipment performance, and gain valuable insights for improved decision-making.

Operational Technology (OT) and Information Technology (IT) Synergy in Industry 4.0 and IIoT

IIoT lies at the heart of Industry 4.0, the fourth industrial revolution characterized by the fusion of physical and digital worlds. This fusion necessitates a close convergence between operational technology (OT), which manages industrial processes, and information technology (IT), which handles data and information systems.

Parameters Monitored by IIoT Systems

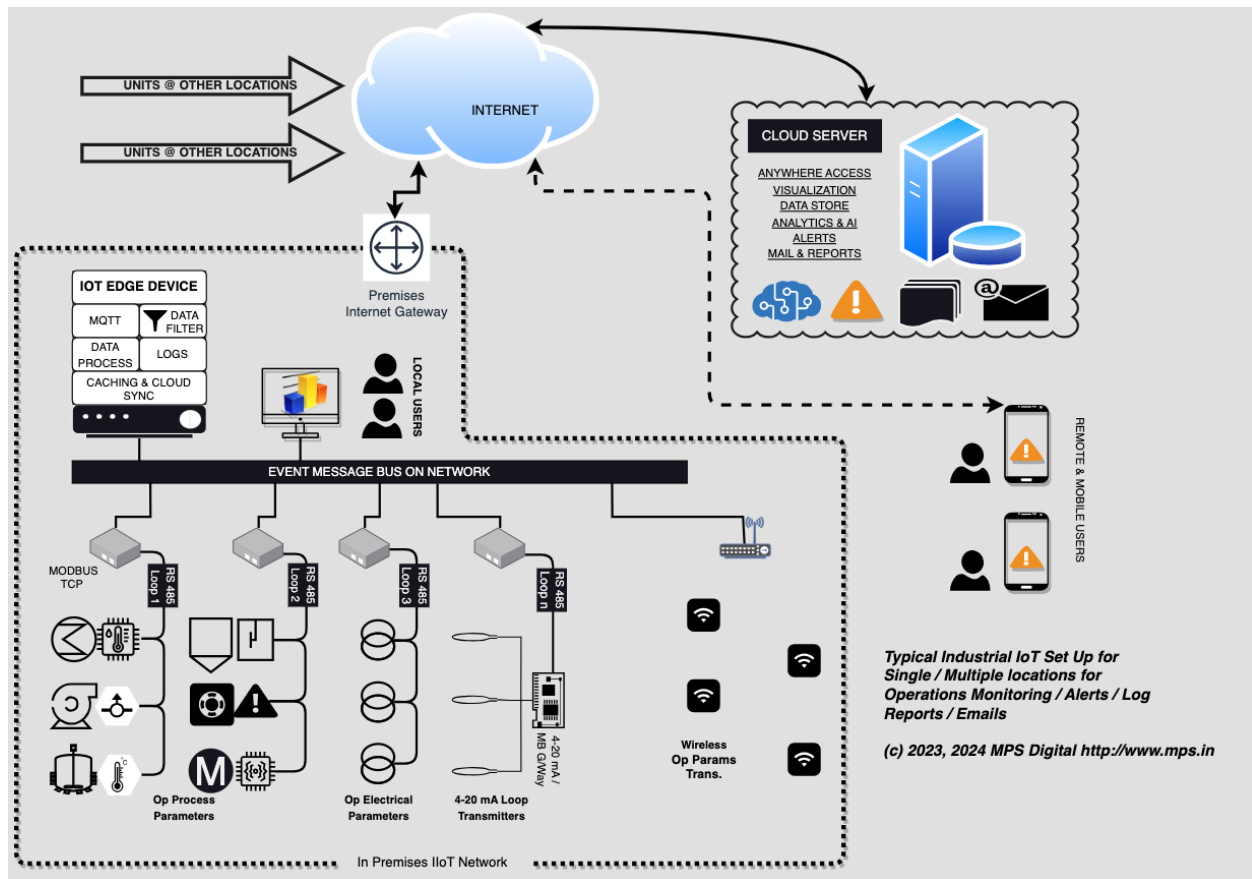
IIoT systems collect and analyze a vast range of parameters from industrial assets, operation and events. Some of which are:

- **Analog Process Parameters** like Temperature, Pressure, Flow rate, Weight, Volume,

- Level, Density, Distance etc
- **Electrical Parameters** like Energy consumption, Supply Voltage, Load Current, Current Load, Power factor
- **Parameters related to maintenance** Vibration, Temperature, Lubrication
- **Events** like Count, Open Closure of Valves, Doors, etc
- **Safety related parameters** and events like, Obnoxious gas concentration, O2, CO2 Levels, Fire events and other such hazardous conditions

Typical IIoT Architecture

A typical industrial IOT set up has been outlined below. It is important to note that as per the requirements, the exact deployment architecture may change on a case to case basis and so are the sub systems therein. However, the core concept remains the same as outlined.



A Typical IIoT Architecture

IloT Components

- **Sensors:** Collect data from physical assets and convert it into digital signals.
- **Transmitters:** Send sensor data wirelessly to gateways.
- **Actuators:** These perform action on machines and devices. E.g. Valves, Relays, Switches, etc.
- **Gateways:** Aggregate data from multiple sensors and forward it to network devices.
- **Protocol Converters:** Translate data between different communication protocols.
- **Edge Computing Devices:** Perform real-time data processing and analytics at the source.
- **Cloud Systems:** Store and analyze large volumes of data, enabling sophisticated insights and decision-making.
- **In-Premise Computers:** Provide local access to data and control systems for operators.
- **Mobile Devices:** Facilitate remote monitoring and alerts, allowing operators to stay connected anytime, anywhere.

IloT Protocols

IloT systems rely on various communication protocols for data exchange between devices and systems. Some of the most common protocols include:

- **MODBUS:** Widely used for industrial automation applications.
- **MQTT:** Lightweight and efficient for communicating sensor data.
- **OPC UA:** Offers open standards for interoperability between various industrial systems.
- **4-20 mA:** This is used by legacy PLC systems and can be integrated in IloT using protocol converters

Integration with Legacy Technologies

One of the key benefits of IloT is its ability to integrate seamlessly with existing industrial infrastructure. This allows businesses to leverage their investments in legacy technologies while still reaping the benefits of modern connectivity and data analytics.

Edge Computing in IloT

Edge computing brings data processing and analysis closer to the source, enabling real-time insights and faster decision-making. This is crucial for applications requiring quick

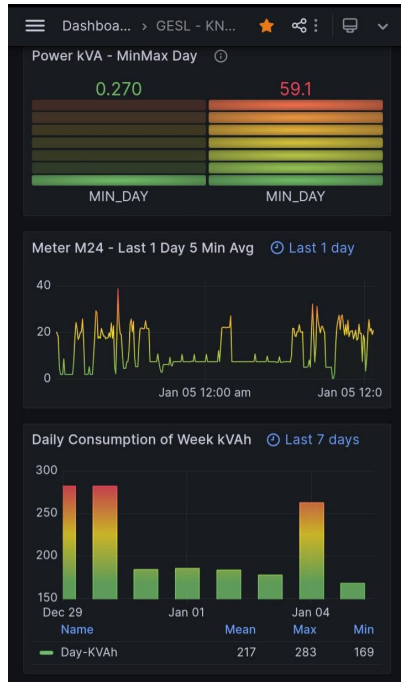
responses, such as predictive maintenance or process control. Edge computing device is set up in the proximity of the process of which parameter is to be monitored. This device performs a number of functions including sanitization of data by removing spurious data points, doing basic aggregation to reduce the data size while preserving the variance of data for analysis later. At the same time, it is also capable of identifying issues in processes in real time and communicating the same. Basic objective of edge computing devices is to gather the useful data while rejecting not-so useful data and maintain a cache. Repository of edge devices is usually small. The data is continuously synchronized with the cloud server. The above functions of edge devices result in real time response as well capability to push data for long term and subsequent analysis to cloud server.

Cloud Computing in IIoT

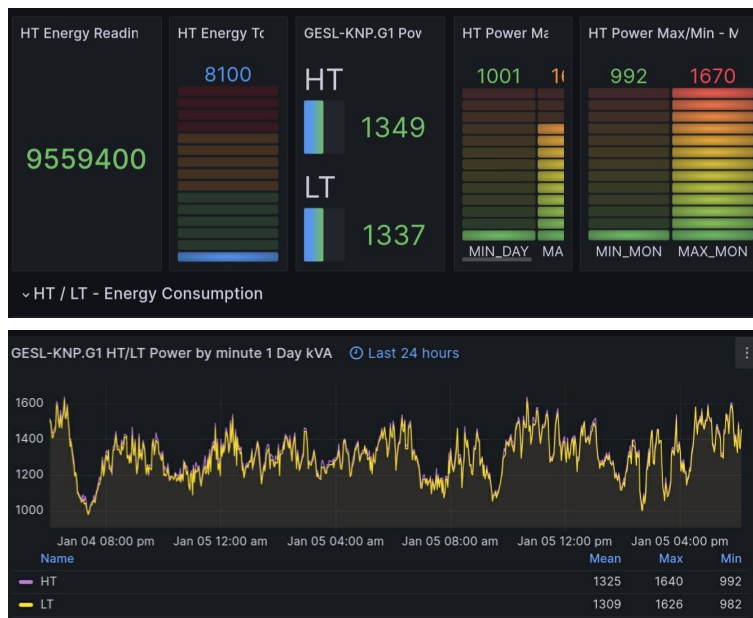
Cloud computing offers a scalable and cost-effective way to store and analyze vast amounts of data generated by IIoT systems. Cloud-based platforms provide access to powerful analytics tools and resources, allowing businesses to generate insights that can improve their operations. As cloud computing devices are scalable and usually more powerful, these are able to perform statistical analysis over a large period of time, in contrast to edge devices which are primarily useful for instantaneous data, This computing power coupled with large data set also makes it ideal to perform AI (artificial Intelligence) algorithms, detailed statistical analysis over a wider time frame and at the same time enable Machine learning enabling the system to learn about patterns (training). This training later enables the system to identify anomalies and is often used for predictive analysis to forecast the troubles and rectify the problems before they result in downtime or failure of equipment.

Visualizations, Reports and Remote Monitoring

IIoT systems enable real-time and remote monitoring of industrial assets, the edge computing system and extensive cloud based systems enable presenting real time as well as historical data with stunning and quickly understandable stunning visuals in form of charts, graphs, gauges with markers for in-range and out-of-range parameters and derived computations. Not only this, the system also permits to query historical logs, reports and automatically mail these to concerned personnel.



Sample Visualizations on Mobile



Sample Visualizations on Desktop

Electrical Energy (KVAH) Consumption Chart Date: 04/04/2024								
M No	Gp	Description	Read 07:00 hrs	Read 19:00 hrs	Read 07:00 hrs	Nett kVAh (Day)	Nett kVAh (Night)	Nett kVAh (Total)
GROUP-1 (Plant, Utility)								
M1	G1	Main HT	9511100	9529000	9544600	17900.0	15600.0	33500.0
M2	G1	Main LT	9883337	9900987	9916344	17650.0	15357.0	33007.0
M2	G1	M2 KWH	0	9757710	9772868	0.0	15158.0	15158.0
M2	G1	M2 MDI (KVA)	0	1700.94	1700.94			1701.0
M2 PF (KWH/KVAH)								
M2	G1	M2 Total Kwh EP(-)	0	137	137	0.0	0.0	0.0
Net M2 (Total KVAH-Total Kwh EP-)								
M3	G1	PCC1 Incomer Discom	5151039	5161740	5170800	10701.0	9060.0	19761.0
M4	G1	PCC1 Incomer DG 1500KVA	242559	242559	242559	0.0	0.0	0.0
Import Total SI.3-4								
M5	G1	Out Feed to Unit 1 PCC Incomer	1444238	1446968	1449400	2730.0	2432.0	5162.0
M5	G1	M5 Total Kwh EP(-)	0	33771	33771	0.0	0.0	0.0
Net M5 (Total KVAH-Total Kwh EP-)								
M6	G1	Out Feed Ext PCC	256908	257226	257545	318.0	319.0	637.0
M7	G1	Out Feed 1&2 MCC	470851	471270	471288	419.0	18.0	437.0
M8	G1	Out UPS1 Input	1638404	1639705	1640837	1301.0	1132.0	2433.0
M9	G1	Out UPS2 Input	215021	215550	216162	529.0	612.0	1141.0
M10	G1	Out UPS3 Input	1640554.12	1641800.25	1642874.25	1246.1	1074.0	2320.1
Sub Import Total SI.8-10								
M11	G1	Out Feed Korea Crimp MCC	0	0	0			0.0
M12	G1	Out Feed Power DB LT Room	0	0	0			0.0
Export Total SI. Net M5-M12 & M23								
16482.1								
GROUP-2								
M13	G2	UPS Out Elect & Adm	24705.7	24782.5	24802.3	76.8	19.8	96.6
M14	G2	UPS Out Thermopack 40 LKC						0.0
M15	G2	UPS Out Unit1 UPS PCC	3700236	3701267.5	3702251.25	1031.5	983.8	2015.3
M16	G2	UPS Out Thermopack 40 LKC MCC (TF Pump 10HP)	171578.7	171837.5	172083.3	258.8	245.8	504.6

Sample Automated Email Report from IIoT System (partial)

Alerts, Analytics, Trends and Predictive Analysis - integration of AI with IIoT

Alerts notify operators of critical events or potential problems, ensuring timely response and minimizing downtime. With real time availability of performance data coupled with historical data allows to track performance, identify potential issues, and take corrective action before problems arise. Performance analysis helps identify trends and patterns in data, enabling proactive maintenance and improvement of processes. Trend analysis provides insights into long-term trends in data, allowing for strategic planning and decision-making. With the long term or medium term historical data, it's possible to incorporate Machine Learning (ML) and Artificial Intelligence (AI) to visualize potential future problems and enable the user to fix issues and reduce potential losses.

Key Industry Sectors adopting IIoT

Various sectors in industries can benefit from technologies if IIoT or Industry 4.0. Some of the major sectors which are adopting to digitization of processes and synergising OT and IT

are:

- Manufacturing Industry
- Chemical and Process Industry
- Energy sector including Solar
- Agriculture and Food Processing
- Healthcare
- Logistics and Warehousing
- Pharmaceutical Industry
- ... and many more

Benefits of IIoT

Implementing IIoT solutions can bring a multitude of benefits to your business, including:

- **Cost Reduction:** Optimize resource utilization, reduce energy consumption, and minimize downtime.
- **Quality Improvement:** Monitor and control processes in real-time to ensure consistent product quality.
- **Predictive Maintenance:** Anticipate equipment failure before it occurs, preventing costly downtime and repairs.
- **Increased Efficiency:** Streamline operations, improve throughput, and optimize production schedules.
- **Enhanced Decision-Making:** Gain valuable insights from data analysis to make informed and data-driven decisions.
- **Improved Safety and Security:** Enhance safety protocols and monitor for potential hazards to ensure workforce safety.

Growth of IIoT in India

The Industrial Internet of Things (IIoT) is rapidly transforming industries across the globe, and India is no exception. Some indicators of market growth of Industrial IoT are:

- **Market Size:** The Indian IIoT market is expected to grow at a CAGR of 6.7% over the 2021-2026 period. (Source: MarketsandMarkets)
- **Revenue Growth:** The Indian IIoT market is expected to generate revenue of ₹9.08 billion in 2023, with a projected CAGR of 18.37% between 2023 and 2028. (Source: Statista)
- "Digital India" and "Make in India" initiatives provide incentives and support for businesses implementing IIoT.
- Emerging applications include smart agriculture, connected healthcare, and predictive maintenance.
- Drivers of Growth are increasing demand for efficiency, growing awareness, affordable sensors and connectivity and Government support for technology adoption

How can we help?

The Industrial Internet of Things (IIoT) is revolutionizing the industrial landscape, offering unprecedented opportunities for businesses to improve their efficiency, productivity, and profitability. By leveraging the power of IIoT, organizations can gain valuable insights into their operations, make data-driven decisions, and unlock new levels of performance.

MPS Digital has been doing extensive work on IIoT solutions especially for MSME sector and has successfully implemented the solutions for Electrical Energy monitoring, as well as processes incorporating process parameters like Temperature, Humidity as well as discrete events such as lighting, human presence and movement sensing and surveillance. We offer a comprehensive suite of services, from consultation and planning to implementation and support, to help you achieve your IIoT.

Ready to begin your journey for transformation to Industry 4.0? Please contact us today at rt@mps.in or visit <https://www.mps.in> for contact details.