*Reprinted with permission from the Jan/Feb, 2022 issue of ...*

MANAGEMENT

# Smart Manufacturing Technologies for Today's Smart Factory

**By Suraj Patil, Assistant Manager (Technology Research & Advisory), Aranca**

The challenges left in the wake of the global pandemic offer manufacturers many opportunities to become more resilient and resourceful. Companies have embraced digitalization and this integration of the latest technologies in processes is paving the way for smart factories.

Digitalization makes operations more efficient, flexible, and less prone to error due to incorporation of accurate data. By integrating artificial intelligence (AI) algorithms in an Industrial Internet of Things (IIoT) infrastructure, industrial machinery can be trained and automated to observe, learn and operate more intelligently.

Data from IIoT devices can be employed gainfully by being fed into AI-powered computing models to obtain significantly better results and achieve optimization of processes.

## IIoT

IIoT, the Industrial Internet of Things, is a term open to interpretation. Put simply, it refers to a platform where software and hardware systems work in combination for the monitoring, management, and control of connected machinery and devices.

IIoT is the backbone of the Industry 4.0 framework and comes in three categories: cloud-based, edge, and hybrid. In a cloud-based system, data storage and computing is done on a cloud server. This system is cost-effective, has a smaller power footprint and centralized management.

Edge IIoT facilitates the processing of data closer to the source and enables real-time processing in low-bandwidth conditions.

**IIoT is the backbone of the Industry 4.0 framework and comes in three categories: cloud-based, edge, and hybrid.**

Hybrid IIoT combines the advantages of both and processes data at the edge, which is then stored and analyzed in the cloud. Data processing can be fast at edge level, even in a low bandwidth condition, and the output can be transferred to the cloud for further storage and analysis under good connectivity.

Hybrid IIoT platforms are best suited for predictive maintenance and to optimize the performance of industrial/manufacturing assets.

## AI and Machine Learning

AI is the intelligence demonstrated by computing systems, similar to the natural intelligence observed in humans. Machine learning (ML) is a subset of AI that encompasses computing systems that can learn and adapt by application of algorithms, statistical models, and analysis of past data.

A study by a leading business and IT consulting firm discloses that the top two drivers for implementing intelligent automation solutions are improvement in productivity and minimization of manual errors. The two major areas where integration of IIoT platform and AI and ML solutions will likely have the greatest impact in manufacturing are predictive maintenance and automated inspection.

According to another study, approximately 30 percent of AI implementation in manufacturing is associated with predictive maintenance. While IIoT facilitates data capture and connectivity for predictive maintenance, AI enables intelligent processing to ensure predictive maintenance is accurate and automatic.

Besides processing real-time data, AI predictive maintenance also includes use of historical data to analyze the root cause of failure of machines. Patterns can be recognized and, based on past record, predictions can be made. This can help in reducing machine downtime and thereby improving overall equipment effectiveness (OEE), lowering maintenance cost, and avoiding unplanned interruptions.

AI-powered visual inspection or automated optical inspection is applicable across multiple industries for detecting visual defects, such as scratches, cracks, burrs, dents, and leakages. Deep learning, an aspect of ML technology, is based on artificial neural networks. Deep learning-based visual inspection systems can detect complex defects quickly and accurately. These solutions can help in improving productivity, reducing damages, and dependence on human judgement.

## Challenges

IIoT and AI-powered manufacturing solutions are increasingly being implemented across industries either in equipment or in processes. The technology is highly capable of facilitating connectivity and transmission of data with enterprise level systems such as manufacturing execution system (MES), enterprise resource planning (ERP) or with other nodes of supply chain for optimization of production.

However, the challenge lies in ensuring security and standardization in exchange of data between devices, machines, services, and enterprise level systems. The current international standard for the integration of enterprise and control systems (ISA-95) does not address the digital integration requirements, which could enable IIoT platforms to exchange data across the enterprise, customer, and supply chain in a standardized manner.

Initiatives to update MES systems for integration with modern IIoT platforms are underway and soon more standardized solutions may be available for manufacturers. IIoT and AI-powered connected manufacturing solutions can drive gains in productivity and revenue. Manufacturers should adopt these systems quickly to stay competitive in the realm of Industry 4.0.

*Contact:* Aranca US, Inc., 100 Park Avenue, Suite 1600, 16th Floor, New York, NY 10017
☎ 212-880-6426 E-mail: suraj.patil@aranca.com ❐