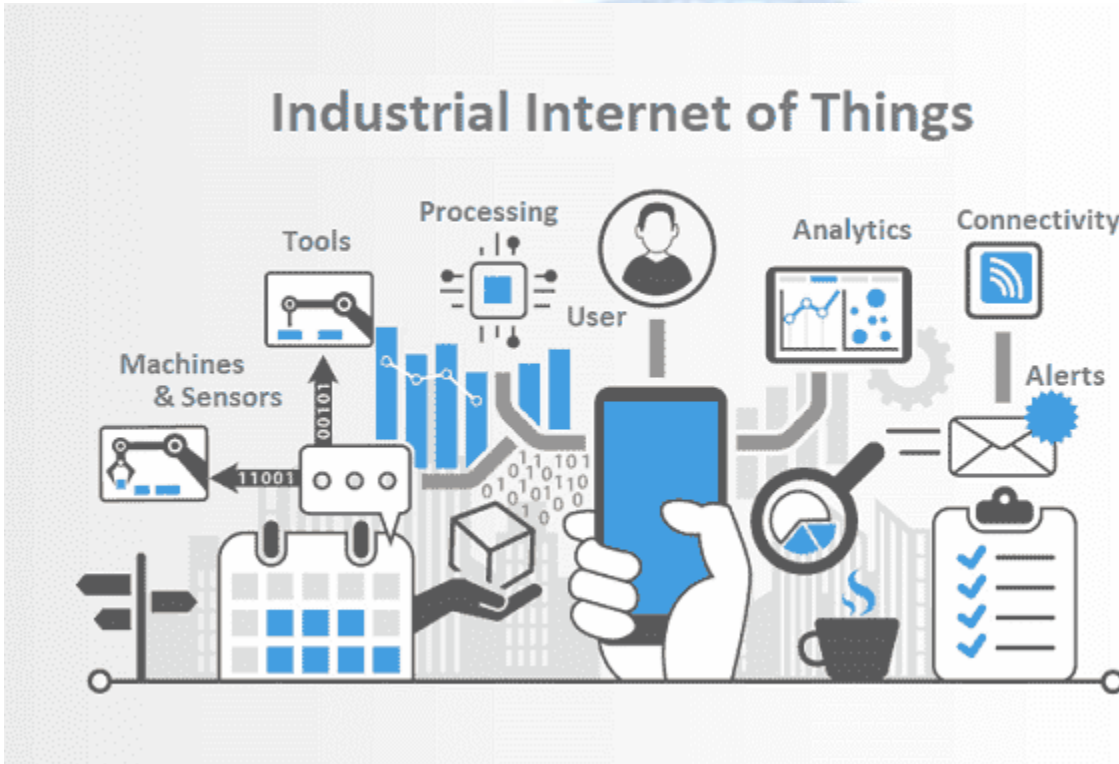# UNIT V – APPLICATIONS

IOT APPLICATIONS - IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT- A, Hydra etc. A Case Study with any one of the boards and data acquisition from different sensors.

Applications of Industrial Internet of Things (IIoT)

How does Industrial IoT work?

Industrial IoT is a system that includes smart sensors, machines, tools, software platforms, cloud servers, and applications. Smart sensors are deployed at every stage of the manufacturing floor for specific applications. These sensor networks continuously send data to the IoT gateway (acts as a hub between IoT devices and the cloud), which receives and transmits the data to the cloud application server for processing and analysis. Sophisticated application programs are developed to handle large amounts of data within a secure network, and it is accessible using Smartphone applications.

Applications of Industrial Internet of Things

1. Industrial Automation

Industrial automation is one of the most significant and common applications of the Internet of Things. Automation of machines and tools enables companies to operate efficiently with sophisticated software tools to monitor and make improvements for the next process iterations.

The accuracy of process stages can be improved to a greater level using machine automation. Automation tools like PLC (Programmable Logic Control) and PAC (Programmable Automation Control) are used with smart sensor networks connected to a central cloud system that collects huge amounts of data. Specially designed software and applications are used to analyze the data and its behavior for improvements.

Industrial automation improves accuracy and efficiency; reduces errors, is easy to control, and is remotely accessible via applications. Machines can operate in harsh environments better than humans; automation of machines and tools reduces manpower requirements for specific tasks.

Connected Factories

Connected Factory concept is an effective solution for improvements in all areas of operation. Major components such as machines, tools, and sensors will be connected to a network for easier management and access. Overview of process flow, monitoring downtime, status checking of inventory, shipment, schedule maintenance, and stop/pause a particular process for further analysis, etc., can be done remotely using industrial IoT solutions.

2. Smart Robotics

Many companies are developing intelligent robotics systems for IoT-enabled factories. Smart robotics ensures the smooth handling of tools and materials in the manufacturing line with precise accuracy and efficiency. Predefined specifications can be set for maximum precision (up to a few nanometers scale for some applications) using intelligent robotic arms.

The Man-machine interface design concept will reduce the complexity of the operation, and it will reflect in future IoT-enabled manufacturing as improved productivity.

Robots can be programmed to perform complex tasks with high-end embedded sensors for real-time analysis. These robotics networks are connected to a secure cloud for monitoring and controlling. The engineering team can access and analyze this data to take quick actions for product improvements or prevent an unexpected failure due to a machine fault.

3. Predictive Maintenance

Modern industrial machines equipped with smart sensors continuously monitor the status of each major component, and they can detect any critical issues before the system is completely down. Smart sensors will trigger maintenance warnings to the centralized system, and the alert messages will be delivered to the responsible persons/groups.

Maintenance engineers can analyze the data and plan for scheduled maintenance effectively without affecting routine tasks. Predictive maintenance is an effective solution to avoid unnecessary downtime in the production line. Unexpected failure of machines could cause damage to products, a delay in delivery, and business loss for manufacturers.

The status of each machine is stored in a cloud system on a real-time basis. The history of each machine, its performance, and the next scheduled maintenance are easily accessible remotely (on PCs, via the web interface, or smartphone applications). Performance improvements can be calculated and implemented for each machine and process stage of products using collected data analysis.

4. Integration of Smart Tools / Wearables

Integration of smart sensors into tools and machines enables the workforce to perform tasks with improved accuracy and efficiency. Specially designed wearables and smart glasses help employees reduce errors and improve safety in working environments.

Smart wearables can trigger instant warning messages to employees during emergencies like gas leaks or fires. Wearables can monitor the health condition of individuals continuously and provide feedback if not fit for a particular task.

5. Smart Logistics Management

Logistics is one of the important areas in many industries, which needs continuous improvements to support increasing demands. Smart sensor technology is a perfect fit to solve many of the complex logistics operations and manage goods efficiently.

Retail giants like Amazon use drones to deliver goods to their customers. Advanced technologies like drones offer better efficiency, accessibility, and speed, and they require less manpower. However, initial investments are huge compared to conventional methods, and implementation has limitations.

6. Software integration for Product Optimization

A smart analytics solution is one of the most important components of any IoT system, which further enhances the possibilities of the system for improvement and optimization.

Major companies are implementing customized software for deep analysis of huge amounts of data collected from large sensor networks and machines. Detailed analysis of data and understanding the behavior over time gives a much better overview of process improvement strategies for product optimization.

Improvement ideas could be directly related to product recipes or optimization of particular machinery for better performance and output. Cost-effective solutions can be achieved using the analysis of data and its behavior patterns over a period of time. Analysis of the huge amounts of data was a hard, inaccurate, and time-consuming task before the introduction of these software tools.

7. Smart Package Management

Package management using IoT technology gives a lot of convenience and efficiency for manufacturing units. Smart sensors can monitor each stage of packing and update status in a real-time manner. Embedded sensors can detect vibrations, atmospheric conditions like temperature and humidity, etc, and provide feedback if something goes wrong during transit or storage.

8. Enhanced Quality and Security

The introduction of IoT technology into manufacturing offers enhanced product quality. Continuous monitoring and analysis of each stage ensure better quality by improving process steps for optimum quality.

Integration of smart tools and software-assisted procedures offers a higher level of security. Software-controlled automation and data collection from a huge sensor network are connected to a highly secure gateway and cloud server platform.

9. Autonomous vehicles

Image source: newequipment.com

Automotive industries are using IoT to enable self-driving vehicles to supply goods and logistics management within their company premises. Smart vehicles can detect traffic congestion along their path and make a deviation to reach their destination in the shortest time. These vehicles are equipped with many smart sensors that continuously detect location data using GPS and wireless technologies for communication with the control station.

10. Power Management

IoT can offer better solutions for power management in industries. Specific sensors can detect the environment and trigger to turn-on/off control of lights, air conditioners, humidity controls, liquid flow, etc, for efficient power management.