**ASSIGNMENT - I**

**Introduction To Industry 4.0 And Industrial Internet Of Things**

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**IV –CSE-B**

**REAL TIME APPLICATIONS**

There are numerous real-time applications of Industry 4.0 and the Industrial Internet of Things (IIoT) across various industries. Here are a few examples:

**Manufacturing:**

In manufacturing, Industry 4.0 and IIoT technologies can be used to monitor the performance of production equipment in real-time. Smart sensors can be installed on machines to collect data on factors such as temperature, vibration, and energy consumption. This data can be analyzed in real-time to identify potential issues and improve efficiency. Predictive maintenance can also be implemented to reduce downtime and maintenance costs.

**Transportation:**

In the transportation industry, IIoT technologies can be used to monitor the performance of vehicles in real-time. For example, sensors can be installed on trucks to collect data on factors such as fuel consumption, engine performance, and driving behavior. This data can be analyzed in real-time to optimize routes, reduce fuel consumption, and improve safety.

**Healthcare:**

In healthcare, IIoT technologies can be used to monitor patients in real-time. For example, wearables such as smart watches and fitness trackers can collect data on heart rate, blood pressure, and other vital signs. This data can be transmitted to healthcare providers in real-time, allowing them to monitor patients remotely and provide timely interventions when necessary.

**Agriculture:**

In agriculture, IIoT technologies can be used to monitor crop conditions in real-time. For example, sensors can be installed in fields to collect data on factors such as soil moisture, temperature, and humidity. This data can be analyzed in real-time to optimize irrigation and fertilizer use, improve crop yields, and reduce waste.

Overall, the real-time applications of Industry 4.0 and IIoT technologies are diverse and varied, and their potential benefits are significant. By collecting and analyzing data in real-time, companies can optimize their processes, reduce costs, and improve efficiency and productivity.

**Industrial Automation**

Industrial automation is one of most significant and common application of Internet of Things. Automation of machines and tools enables companies to operate in an efficient way with sophisticated software tools to monitor and make improvements for next process iterations. 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 which collect huge amount of data. Specially designed software and applications are used to analyze the data and its behavior for improvements.

### Smart Robotics

Many companies are developing intelligent robotics system for IoT-enabled factories. Smart robotics ensures 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 few nanometers scale for some applications) using intelligent robotic arms. Man machine interface design concept will reduce the complexity of 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. Engineering team can access and analyze this data to take quick actions for product improvements or preventing an unexpected failure due to machine fault

### Predictive Maintenance

Modern industrial machines equipped with smart sensors continuously monitoring the status of each major components and it can detect any critical issues before the system is completely down. Smart sensors will trigger maintenance warning to the centralized system and the alert messages will be delivered to responsible persons/groups. Maintenance engineers can analyze the data and plan for schedules maintenance effectively without affecting routine task. Predictive maintenance is an effective solution to avoid unnecessary downtime in the production line. Unexpected failure of machines could cause damage to products, delay in delivery and business loss for manufacturers .Status of each machines are stored to a cloud system in a real-time basis. History of each machines, performance, and next scheduled maintenance are easily accessible remotely (on PCs, via web interface or via smartphone applications). Performance improvements can be calculated and implemented for each machines and process stages of products using collected data analysis.

### Integration of Smart Tools / Wearables

Integration of smart sensors to tools and machines enables the workforce to perform the task with improved accuracy and efficiency. Specially designed wearables and [smart glass](https://www.engineering.com/AdvancedManufacturing/ArticleID/14634/Airbus-Uses-Smart-Glasses-to-Improve-Manufacturing-Efficiency.aspx) helps employees to reduce error and improve safety at the working environments.Smart wearables can trigger instant warning messages to employees during emergency situations like gas leak or fire. Wearables can monitor health condition of individuals continuously and feedback if not fit for particular task.

### Software integration for product optimization

Smart analytics solution is one of most important component 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 amount of data collected from large sensor networks and machines. Detailed analysis of data and understanding the behavior over time gives much better overview of process improvement strategies for product optimization.Improvement ideas could be directly related to product recipe or optimization of particular machinery for better performance and output. Cost effective solutions can be achieved using analysis of data and its behavior patterns over a period of time. Analysis of huge amount of data was a hard, inaccurate and time consuming task before introduction of these software tools.

### 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 using drones to deliver goods to their customers. Advanced technologies like drones offer better efficiency; accessibility, speed and it require less manpower. However, initials investments are huge compared to conventional methods and implementation has limitations.

Airline is another major industry, which uses IoT for its daily operations at the production and predictive maintenance of airplanes in service. At the manufacturing plant, airline companies use IoT solutions to track thousands of components required for every single day at work. Centralised management of inventories helps to manage its supplies effortlessly.

Suppliers will be automatically informed if any items are required to top up. Without much human action, inventory management can be effectively implemented using IoT. Smart sensors continuously monitor airplane’s machineries, the data is collected real-time and send to the airplane manufacturer. Maintenance of any part of an airplane will be triggered, concerned team will be informed and maintenance will be carried out once the plane is landed without any delay. Manufacturers can plan and deliver spare parts efficiently based on the data shared by the system.