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IIoT Applications: Factories and Assembly Line

Dr. Sudip Misra

Professor

Department of Computer Science and Engineering

Indian Institute of Technology Kharagpur

Email: smisra@sit.iitkgp.ernet.in

Website: http://cse.iitkgp.ac.in/~smisra/

Research Lab: cse.iitkgp.ac.in/~smisra/swan/

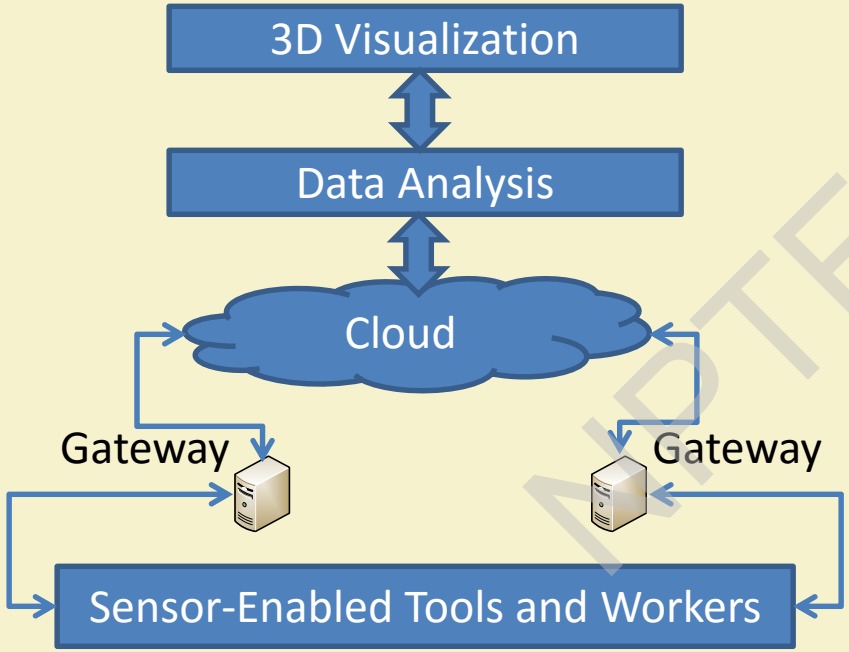
Traditional Manufacturing vs. Smart Manufacturing

- Challenges in Traditional Manufacturing
  - Unavailability of real-time data
  - Unbalanced workload
  - Longer changeover time
  - Extended production time

Smart Factory and Assembly Line

- **Smart Factory** involves machinery and equipment which improve processes through self-optimization and automation.
- Benefits of **Smart Factory**:
  - Supply of real-time data
  - Data analysis and quality control
  - Reduced changeover time
  - Reduced production time
  - Flexibility and easy management

Smart Factory



Overview of a Smart Factory

Features of a Smart Factory

- Connected
  - Continuous real-time data
- Optimized
  - Minimum manual intervention
- Transparent
  - Live metrics for quick decision
- Proactive
  - Prediction of future outcomes for taking preventive actions
- Agile
  - Flexibility and adaptability

Source: https://www2.deloitte.com/insights/us/en/focus/industry-4-0/smart-factory-connected-manufacturing.html

Smart Factory Applications: Airbus – Factory of the Future

- A European aircraft manufacturer
- Applies IoT technologies for production
- Collecting data on flights to improve in-flight experience
- Workers on factory floor use IoT-enabled devices
- Launched digital manufacturing initiative - Factory of the Future

Airbus: Factory of the Future

- Digital tracking and monitoring technology
- Tools and machines with integrated sensors
- Smart wearables
  - Industrial smart glasses
- 3D Real-time visualization of production process
- Deployed on the A330 and A350 final assembly lines in Toulouse
- Deployed for the A400M wing assembly operations in the UK

Smart Factory Applications: Kuka – IoT-Enabled Factory

- A German robotics maker
- Built an IoT-enabled factory
- The factory has hundreds robots
- Robots are connected with a private cloud
- 800 cars are produced per day

Smart Factory Applications: DeWalt – Construction Internet of Things

- A tool manufacturer
- Launched **Construction Internet of Things** initiative
  - Uses IoT Platform and Wi-Fi mesh network
  - Tracks workers and equipment
  - Monitors sites as large as an NFL football stadium

Smart Factory Applications: ABB - YuMi

- A power and robotics firm
- Operates across five continents
- Monitors robots via connected sensors
- Preventive maintenance
- YuMi Model
  - An initiative for collaboration between robots and humans

Smart Factory Applications: Amazon – Robotic Shelves

- An e-commerce company
- Uses robotic shelves
  - Robots carry and rearrange shelves
  - Automated product search
    - Robots locate and bring shelves to workers
- In 2014, the operating cost was cut down by 20% after using robotic shelves

Smart Factory Applications: Caterpillar – AR App

- A heavy-equipment maker
- Uses Augmented Reality (AR) with IoT
- AR app generates end-to-end view of the factory floor
- Machine operators detect need for tool replacement after viewing the end-to-end view
- AR app sends instructions for tool replacement

Caterpillar: IoT-Driven Ship Maintenance

- The marine division uses shipboard sensors to perform **Predictive Maintenance Analytics**
- The sensors monitor generators, engines, GPS, air conditioning systems and fuel meters.
- Analysis of the sensed data provides some useful insights
  - The power usage of refrigerated containers is linked with fuel meter readings
  - The cost of hull cleaning is correlated to performance enhancement
  - Optimized cleaning schedule saves up to $400,000 per ship

Caterpillar: Predictive Maintenance Analytics

- A machine learning technique
- Uses R, Python, and Weka
- Easier fault-correction
- Reduced downtime
- Increase profitability

Smart Factory Applications: Fanuc – Zero Downtime System

- A robotic maker
- Uses predictive maintenance to reduce downtime
- Cloud-based analytics with in-built sensors
- Predicts component failure
- The Zero Downtime (ZDT) system is the winner of the GM Supplier of the Year Innovation Award 2016

Smart Factory Applications: Gehring – Connected Manufacturing

- Makes honing machines
- Uses cloud-based analytics
- Sends real-time data of new machines to customers to confirm requirements before order placement
- Optimizes productivity

Smart Factory Applications: Hitachi - Lumada

- Offers IoT platform – Lumada
- Five layers
  - Edge
  - Core
  - Analytics
  - Studio
  - Foundry

Smart Factory Applications: Maersk – Intelligent Shipping

- A container shipping company
- Tracks assets and fuel consumption using sensors
- Uses IoT for preserving refrigerated containers
- Uses blockchain technology for supply chain optimization

Smart Factory Applications: Magna Steyr – Smart Packaging

- An automotive manufacturer
- Uses IoT for tracking assets including tools and vehicle parts
- Smart packaging
  - Bluetooth-enabled packaging
  - Tracks components in warehouses
- Employees use wearable technologies

Magna Steyr: Driverless Transport System

- Digital factory
  - A virtual image of entire factory is created
  - Virtual image provides real-time control and detects anomaly
- 3D map of digital factory
  - Driverless transport vehicles follow the 3D map to move parts along the assembly line
- IoT-based predictive maintenance
  - Data sensed by driverless transport vehicles are analyzed in cloud to detect deviations

Smart Factory Applications: North Star BlueScope Steel – IoT for Worker Safety

- A major supplier in steel industry
- Attached wearables to helmets and wristbands
- Wearables send health parameters to supervisors
- Supervisors give break to overloaded workers
- Sensors monitor environmental parameters to detect radiation and toxic gases

Some Other Smart Factory Applications

- Rio Tinto: IoT for mining
  - Driverless trucks and trains to pull ore from mining sites
  - Autonomous drill technology
- Real-Time Innovations: microgrid technology
  - Divides a power grid in to multiple distributed microgrids
- Bosch: Track and Trace Testbed
  - Locates handtools and shows specific requirements for each tool
  - Save labour and reduces errors

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Thank You!!