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NPTEL ONLINE CERTIFICATION COURSES

IIoT Applications: Oil, Chemical and Pharmaceutical Industry

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IoT and the Industry

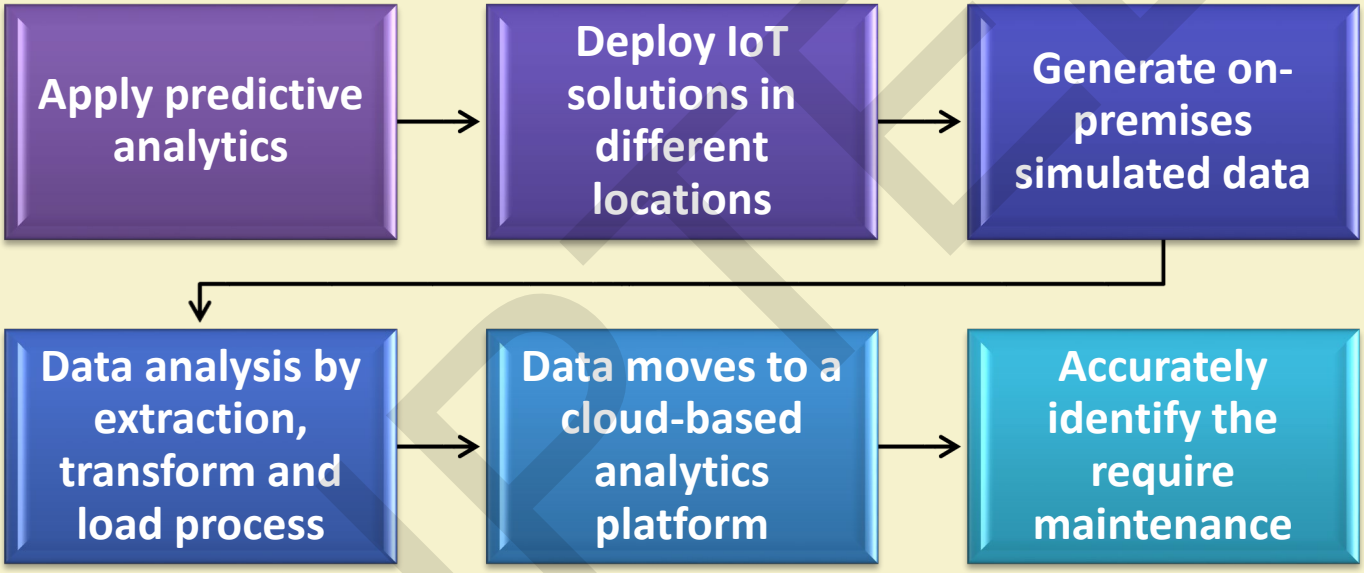
- Industries add extensive value by integrating IoT strategies for transforming the business
- Industries need to become more efficient and reliable
- Maximize profit by the predictions
- IoT cloud slash cost

IoT in Oil and Gas Industry

Oil and Gas Industry

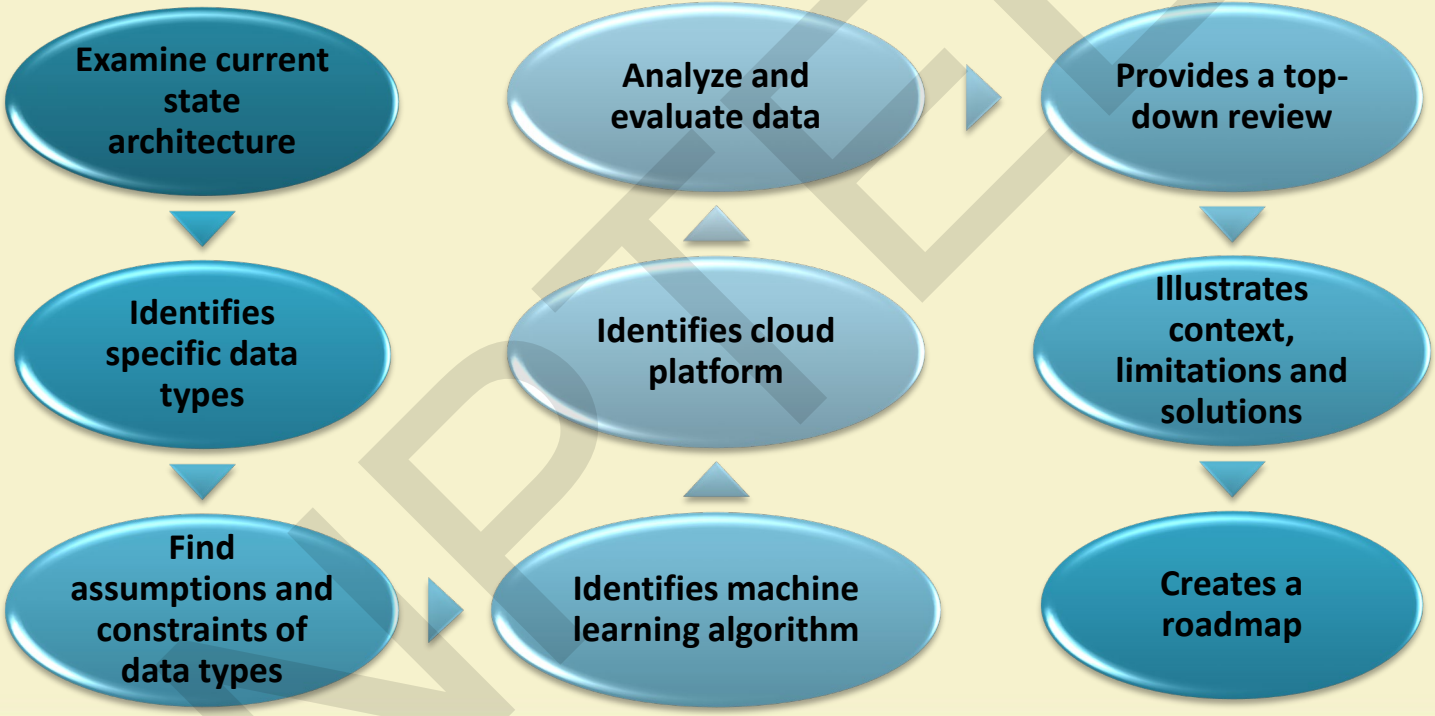
"lies not in helping oil and gas companies directly manage their existing assets, supply chains or customer relationships–rather, IoT technology creates an entirely new asset: information about these elements of their business," Deloitte

Oil and Gas Industry Work-flow



Reference: https://blog.equinix.com/blog/2017/12/06/how-the-oil-and-gas-industry-is-powered-by-the-iot-machine-learning-and-cloud/

Machine learning and cloud services



Improve operational Excellence

- Predictive maintenance
- Location Intelligence
- Pipeline and equipment monitoring
- Monitor
  - Sensor integration
  - Real time machines
  - Fleet operations

Reference: https://dzone.com/articles/usage-of-iot-in-oils-and-gas

IoT increases customer loyalty

- Connects business and car
- Smart application
- Energy consumption profiles

Reference: https://www.allerin.com/blog/whats-iot-doing-in-oil-gas

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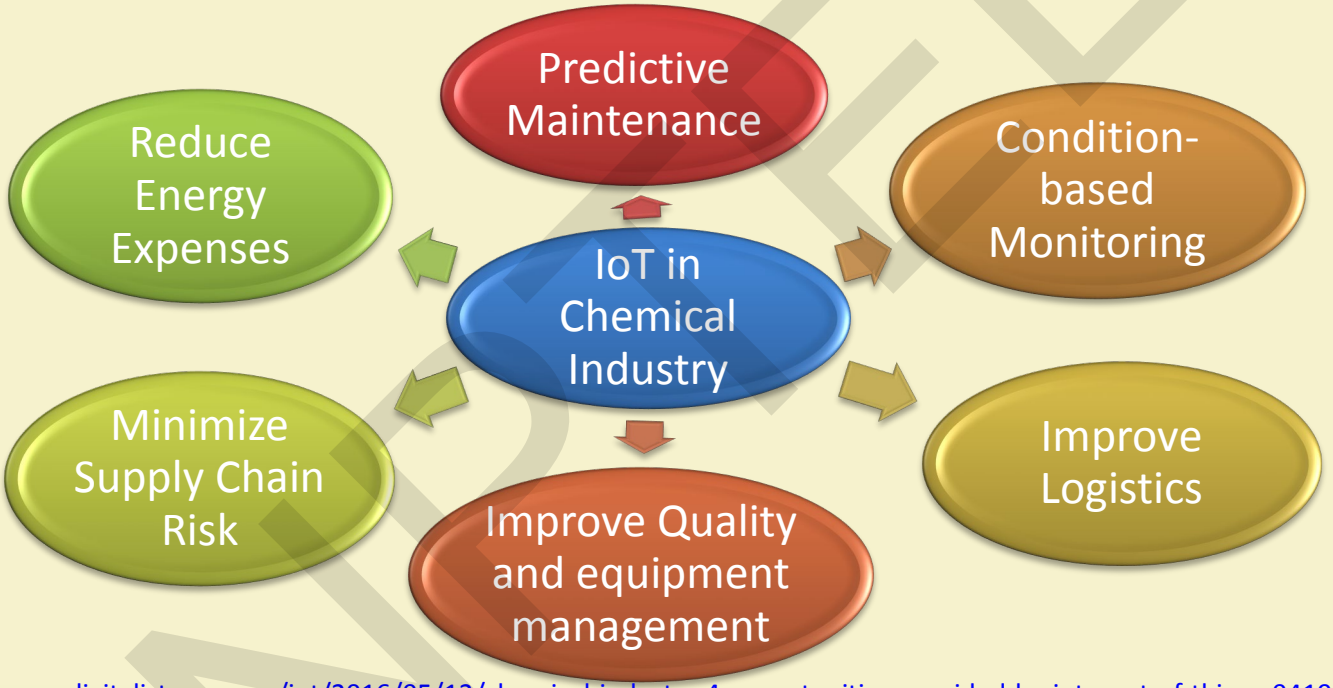
Benefits of using IoT in Oil and Gas Industries

- Increase production efficiency
- Save cost and time
- Improve asset maintenance
- Enhance
  - Production
  - Work safety
  - Supply chain planning

IoT in Chemical Industry

IoT helps in Chemical Industry



References: https://www.digitalistmag.com/iot/2016/05/12/chemical-industry-4-opportunities-provided-by-internet-of-things-04196654
https://altizon.com/industries/chemical/

Predictive maintenance

- Address real time issues
- Reduce equipment breakdown
- Efficient and effective maintenance
- improve quality by efficient IoT analytics programs
- improve service

Condition-based monitoring

- Predict quality by continuous monitoring
- Water, nutrients, and pesticides analysis
- Analytics predict weather and its impact on farming
- Adjust the amount of required material
- Pricing model with the profit margin

Improve Logistics

- Ensure product location through sensors or RFID tags
- Track assets to prevent loss
- Detection of contamination or attacks
- Alert notification
- Warehouse monitoring

Reduce Energy Expenses

- Energy usage and regulatory control
- Analyze real time data
- Improve
  - Usage pattern
  - Inefficiency

Minimize Supply Chain Risk

- Chemical manufacturers can response immediately to the required process
- Real-time monitor in supply chain:
  - Equipment
  - Material
  - Process
  - Environment
  - Workers

IoT in Pharmaceutical Industry

Use of IoT sensors in Pharmaceutical Industry

- Deployed in production areas
- Access huge data of different manufacturing departments
- Real time monitoring
- Able to control the areas remotely
- Proper utilization of equipment
- Reduce
  - Production cost
  - Wastage

IoT Application in Pharmaceutical Industry

- Examine drugs
- Detect:
  - Adverse Drugs Reaction (ADR)
  - Effects of pharmaceutical excipients
  - Allergies
  - Other complications

IoT Application in pharmaceutical Industry (Contd..)

- Quality control by real-time monitoring
- Safe and secure drug delivery
- Deploy to connect different technologies:
  - Manufacturing
  - Monitoring
  - Controlling
  - Distribution

Improve logistics

- Track the movement of pharmaceutical goods
- Improve warehousing
- Optimize routing
- Maintenance of machines and equipment
- Inspects the maintenance of medicine and vaccines

Reference: https://www.entrepreneur.com/article/305272

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[2] Cognizant 20-20 Insights. Online. URL: https://www.cognizant.com/whitepapers/the-internet-of-things-the-new-rx-for-pharmaceuticals-manufacturing-and-supply-chains-codex2437.pdf

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Thank You!!

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IIoT Applications: UAVs in Industries

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UAVs are Connected to IoT

- Deployable to various locations
- Capable of conveying adaptable payloads
- Measure the required data from different locations
- Re-programmable

Source: Why Drones Are the Future of the Internet of Things, Skylogic Research Drone Analyst

UAVs Applications in Industry

- UAVs gather integration of the measurements using IoT sensors
- UAVs have an end-to-end connection via wireless, from user to controller
- Communicates directly to an industrial control system such as the SCADA
- UAVs are capable of taking aerial imagery, visual imagery, thermal imagery and also radio-frequency imagery of factory stations and substations.

Source: Drones for Industrial Applications, Plant Automation Technology

UAVs Technology Generations:

First Generation	Fundamental Remote Control UAVs of different forms
Second Generation	Static design, fixing camera mount, still photography, video recording, and manual steering control
Third Generation	added two-axis gimbals, essential safety models. HD video, assisted guiding
Fourth Generation	Transformable designs, 1080 HD video or higher value instrumentation, three-axis gimbals, improved safety modes, autopilot modes.
Fifth Generation	Transformable designs with 360° gimbals, high quality video or higher-value instrumentation, improved piloting modes.
Sixth Generation	improved safety and regulatory, platform and payload adaptability, automated safety modes, intelligent piloting models and full autonomy, airspace awareness.
Seventh Generation	enhanced intelligent piloting models and full autonomy, full airspace awareness, auto action (takeoff, land, and mission execution)

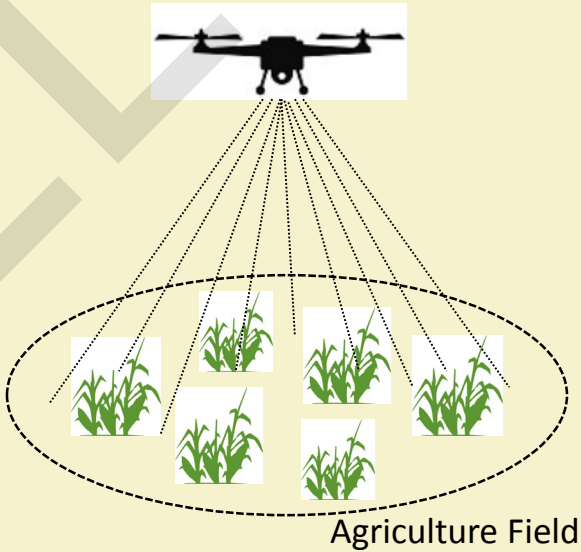
Source: Drones Racing up the Industrial Futures, The IoT Magazine

Application Fields

- Agriculture
- Construction Sites
- Mining
- Energy Management
- Telecommunication
- Delivery / Healthcare
- Oil and Gas
- Warehousing and Inventory
- Forestry
- Entertainment

Application in Agriculture

- Increase effective yields:
  Precisely estimate the field characteristics
- Save time:
  Help farmers in scouting their crops
- Optimized inputs:
  Optimize use of seed, fertilizer, water
- Crop health monitoring:
  - Fertilization dispersal to different areas as per needed
  - Monitor crop stress factors (like over fertilization or drought)



Source: Use cases: The many IoT applications of drones, RCR Wireless News

Application in Agriculture (Contd..)

- Other information:
  - Find the field borders for flight pattern
  - Soil quality, plant counting, plots size
- Low-cost camera platform :
  - Integrated software covers maximum areas of growing yields
  - Take effective images by planning their flight path
  - High quality and high precision real time images

Source: Six Ways Drones Are Revolutionizing Agriculture, MIT Technology Review

Application in Construction Sites

- Survey:
  - Quick survey of required job areas
  - Build maps
- Monitoring job sites:

  Monitor progress, works, and safety standards
- Inspecting structures:
  - Take continuous complex readings instead of lots of workers and heavy softwares
  - Inspect infrastructures and constructing roadways and forest roads

Construction Sites Monitoring

Source: Use cases: The many IoT applications of drones, RCR Wireless News
Image source: “building the lift construction site”, PhotoMIX-Company/ Creative Common CC0/, Online: https://pixabay.com/en/building-the-lift-construction-site-1804030/

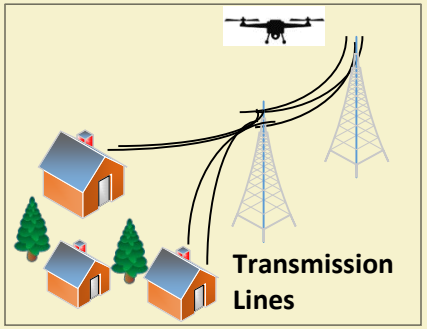
Application in Construction Sites(Contd..)

- Showing clients progress:

  Show clients work progress when they are far away from job sites

- Require less time, save energy and money
- Monitor shoreline erosion

Energy Management



Solar Panels Monitoring

- Inspections without climbing power poles
- No need to get close to dangerous wires
- Observe miles of transmission lines in a single flight
- Damage from storms
- Inspect large boiler at power plants
- Monitor solar panels of the farms
- Inspect of wind turbines
- Inspect bridges, dams

Source: Top 5 Industrial Applications For Drones, OpTo Blog
Image source: “solar roof panels farm house shed”, RosiePosie/ Creative Common CC0/,
Online: https://pixabay.com/en/solar-roof-panels-farm-house-shed-776563/

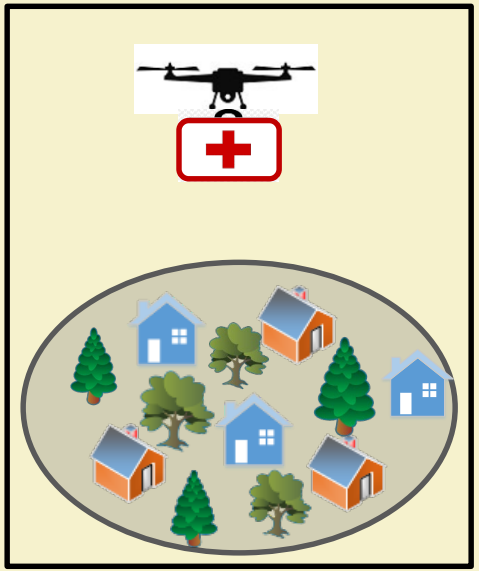
Application in Mining

- Regular surface survey for optimized blast design
- Identify misfire and wall damage
- Manage stockpiles
- Helps in grading control
- Site exploration
- Safety and surveillance

Mining Sites Survey

Source: Top 5 Industrial Applications For Drones, OpTo Blog
Image source: “open pit mining carbon coal mining”, herbert2512/ Creative Common CC0/, Online: https://pixabay.com/en/open-pit-mining-carbon-coal-mining-3559209/

Application in Delivery and Helthcare

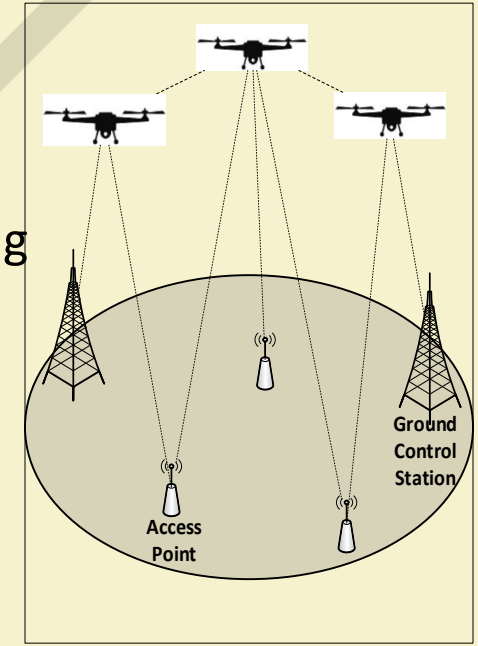


Healthcare Delivery

- Delivery of medicines, vaccines, defibrillators, snake bite serum
- Delivery to the hospitals and remote areas
- Transport blood samples to laboratories for testing crucial diseases
- Research is being done on drones with manipulator arms that can help the senior population

Application in Telecommunication

- Tower inspection by UAVs:
  - Monitor towers from any angle and height
  - Maintenance and repairing by continuous monitoring
- Deployed on demand
- Re-deployed with changing purposes
- Testing networks:
  - Network coverage and stability
  - Covers wide areas with less cost



Application in Telecommunication (Contd..)

- Broadcasting live events
- Provides internet services in rural areas
- Increase work safety

Application in Oil and Gas

- Data collection:

  Collect videos and thermal imagery of oil and gas fields, fed to the industry for analyze

- Pipeline monitoring:
  - Detect leakage of oil and gas pipelines
  - Oil spill detection and damage assessment

Application in Oil and Gas

- Construction planning:

  Information gathered by elevation mapping, watershed analysis

- Reduce manpower requirement and increase safety:

  No need of industrial mountaineering with risk and high cost

- Monitoring work progress
- Tracking asset usage

Application in Warehousing and Inventory

- Scans a huge number of items in a warehouse
- Check the missing items
- Monitor full inventory in a day

Application in Forestry

- Forestry survey:

  Show information about the forest species including the humans around the forest

- Precision forestry and canopy mapping:

  Measurement of canopy height, density and volume estimation

- Wildland fires tracking
- Protecting endangered species
- Save time, manpower and resources

Application in Forestry (Contd..)

- Forest management:
  - Manage forest plantations and evenly distribute seedlings sprinkling fertilizer
  - Control forest density
- 3D mapping of carbon storage in the forest:
  - Measure the carbon storage in biomass by remote sensing
- Resist deforestation and increase security

Application in Entertainment

- Cheaper and exciting:
  - UAV-based light displays are cheaper and more exciting than traditional firework display
  - Entertains as a flying light show
  - Controlled by single computer that consumes manpower
  - Reusable
- Film industries for capturing frames in a cost effective way

Source: Drones as Entertainment: what's ahead for this emerging application?, Unmanned Systems source

Shipping and Delivery

- Shipping and delivery by drone in different companies
- Save manpower and resources
- Save time by avoiding unnecessary road traffic

Source: 10 stunning applications of drone technology, Allerin

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Case Studies for Industry 4.0 & IIoT

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Why are Case studies necessary?

- Case studies provide in-depth knowledge and clarity of concepts regarding the research topic.
- Case study
  - enables a researcher to closely examine the data
  - within a specific context
  - follows certain procedures
  - provides quantitative and qualitative analysis of the data

Why are Case studies necessary? (contd.)

- Case studies explore and investigate real-life phenomenon through detailed analysis of related events.
- Generally, in a case study, a small geographical area or a very limited number of individuals, are selected as the subject matter.

Different Case Studies

Points to ponder … (for all case studies)

- Transformation of existing processes for Industry 4.0 adoption
- Assessment of existing processes
- Target objectives
- Transformation project management … setting objectives, schedule, budget
- Sensors, actuators, networks, interoperability, automated fault detection & maintenance, feedback control,

Points to ponder … (for all case studies)

- Sensors, actuators, networks, interoperability
- automated fault detection & maintenance
- feedback control
- analysis of data (real time & non-real time)
- reduction of health hazards of workers
- improvement in overall efficiency

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Thank You!!