# The Internet of Things

Making Sense

Everyone knows what the Internet is, so what is the Internet of Things? The Internet of Things (IoT) describes the interconnection and data exchange of physical objects with sensors, software, or other technologies with other devices and systems over the Internet. From consumer-based applications like smart homes and wearables to industry solutions like driverless forklifts, IoT is everywhere and is changing the way both consumers and businesses interact and utilize Internet-enabled devices. When happening in a manufacturing or industrial process, it is referred to as the Industrial Internet of Things (IIoT).

It all starts with sensors. Multiple sensors can be at work collecting data depending on your needs:

✓ Motion Sensors: The most common sensors, motion sensors can detect the motion of products, people or vehicles. They may also be used to stop or start an action. Motion sensing is critical for measuring machine and spindle speeds, flow rates, and other conveyance methods.
✓ Temperature Sensors: Temperature sensors measure the current temperature of machine parts, products, or the shop environment. They can send alerts and trigger automated responses if temperature ranges move too high or low.
✓ Humidity Sensors: Humidity requirements may be condition-driven or product-driven. Humidity sensors can be programmed appropriately based on ranges.
✓ Pressure Sensors: In many cases, industries that use gas or steam require specific pressure for machine functionality. Pressure gauges may also be used in industries where the hydraulic control of machines is critical.
✓ Weight Sensors: Also known as force sensors, weight sensors control the force exerted by automatic arms, robots, auto-dispense mechanisms, and other motion components on a machine. They may also be used in metering product fill or raw material feed at the machine level.
✓ Vibration Sensors: Parts, shafts, bearings, and other parts may fail or become misaligned. Vibration sensors alert operators and maintenance when vibration ranges become too much for safe operation or when machinery needs to be repaired.
✓ Visual Sensors: Visual sensors may measure the color of material, while others are more precisely tuned to detect flaws and trigger the rejection of parts.
✓ Sound Sensors: Sound, or ultrasonic sensors, use echolocation to sense an object's location, angle, and speed.

Source: MachineMetrics

The information gathered by sensors is the first step of four components:
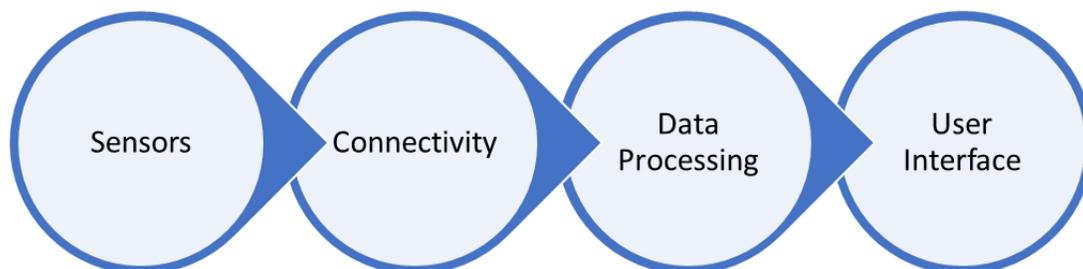
Connectivity is the next component. Once the data is collected, it is sent to a cloud infrastructure (an IoT platform) through a wireless or wired networking technology like Bluetooth, Wi-Fi, Cellular Networks, LPWAN, or Ethernet. Once in the cloud infrastructure, big **data analytics** are used to guide decision making, identify problems, monitor equipment performance, inventory levels, etc. Lastly the information from the analysis can be **sent to a user** so adjustments can be made if needed. Users can be notified by email, notifications or even texts and adjustments can be made remotely in practically real time.

Webinars, Videos or Podcasts to Check Out

- Technically Iowa Podcast, The Internet of Things with John Deere
- The Industrial Internet of Things / Industrial IoT Solution / How it Works | IoT Explained
- Beginner's guide for IoT

CIRAS Webinars on Demand:
- IoT in Manufacturing - Common Sensors and their applications

CIRAS Industry Technology Video
- Industrial Internet of Things

Public sector service providers for your businesses:

- CIRAS offers assessments and assistance with cost benefit analysis, process improvements and integration planning, among other services. CIRAS provides education and engineering support with:
    - Assessment and opportunity identification of current processes
    - High level design of IoT subsystems
    - High level system integration assistance
    - Assistance with automation hardware and sensor selection
    - Facilitated connections to system integrators who can assist with implementation.

IoT Solutions Vendors:

- Thompson, Sioux City, Ireton
- Interstates, Sioux Center
- DMC
- Pepperl+Fuchs

Disclaimer: This is not meant to be a comprehensive list of service providers

Additional Resources and Reading

- ✓ What is the industrial internet of things (IIoT)?, an article from *Trend Micro*, describes IIoT and its security challenges.
- ✓ Industrial IoT News, an online news site for articles related to IIoT; also host the annual Industrial IoT Conference.
- ✓ Industrial Internet of Things (IIoT), a short article from *TechTarget*. Includes a list of vendors. *TechTarget* also offers a downloadable IoT Implementation Guide for Businesses.

The Benefits of IoT

The goal of the Internet of Things is to make processes more efficient and productive, with multiple benefits of IoT for both businesses and consumers:

1. **Access to High-quality Data**. Companies have greater access to data related their customers and products than ever before. They can take advantage of real-time operational insights to monitor consumer or equipment behavior, deliver better products and make smarter business decisions.

2. **Better Tracking and Management**. IoT makes tracking and management easy for businesses. From inventory tracking to monitoring manufacturing floor and equipment conditions to notifications about suspicious behavior, IoT helps track and manage business assets.

3. **Efficient Resource Utilization**. Enabling machine-to-machine interaction, an IoT system collects real-time data with the help of sensors and actuators so it can be used to improve process efficiency and minimize human intervention.

4. **Automation and Control**. Since most IoT devices are connected with each other through a wireless infrastructure, they are able to operate on their own with little or no manual intervention, they can be monitored and controlled remotely.