IoT Use Cases

IoT

Transformative Use Cases

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IOT USE CASES

50+ Internet of Things Use Cases
based on industry

iot for all

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Introduction

The Internet of Things (IoT) has the potential to transform the way we do business and live our lives, across a huge range of industries and verticals. From ensuring worker safety on potentially dangerous job sites in construction and mining operations, to tracking equipment in hospitals to lessen the time it takes for staff to respond to emergencies, to granting greater visibility into the performance of our machinery and our staff, IoT will be vital to the digital transformation of nearly every company.

We put together this eBook to share some of the most transformative use cases in IoT today to give you ideas for how your business or industry can better leverage this technology to improve ROI and increase operational efficiency across the board. If after reading this, you have questions or think we might be missing something, reach out - we'd love to chat.

Agriculture

Industry

Crop Health Management

Industry
Agriculture

Application
Quality Management

Overview

Crop health management solutions employ smart farming technology, like IoT-enabled sensors and drones, to monitor crop health and track critical environmental factors, allowing improved efficiency and decreased response time to potentially damaging conditions.

In the United States, 20-25 percent of all crop yields are lost due to pests, crop disease, or post-harvest losses. Traditional monitoring methods rely heavily on manual inspection of individual crops which is not only costly, but highly prone to human error as signs of pest infestation or crop illness may be easily missed.

While crop health management solutions require a higher upfront cost, they are easier to scale and provide a much more reliable long-term solution for monitoring crop quality.

Key Benefits

1. Reduce the human labor required to monitor the condition and health of crops.
2. Maintain accurate records of environmental factors.
3. Receive real-time alerts for pest infestations or crop disease.
4. Decrease response time to destructive weather events such as freezes or floods.

Crop Irrigation Management

Industry
Agriculture

Application
Quality Management

Overview

Crop irrigation management uses IoT-enabled sensors to monitor precipitation and humidity levels and automatically adjust irrigation schedules to reduce waste and improve crop yield and quality.

Current methods for irrigation are highly inefficient, usually resulting in overwatering in some parts of fields and underwatering in others. This method is not only wasteful, it's extremely costly - it takes 27,154 gallons of water to deliver one inch of water to a one-acre field. That's a lot of water.

Crop irrigation management systems utilize precision farming methodologies to minimize waste and optimize growing conditions. In a European study, smart crop irrigation management systems reduced water consumption by 25 percent.

Key Benefits

1. Reduce costs associated with wasted water consumption.
2. Prevent over- or under-watering of crops to increase crop yield and quality.
3. Lower long-term costs of human labor to monitor and adjust manual irrigation systems.

Livestock Management

Industry
Agriculture

Application
Animal Tracking

Overview

Livestock management, also known as livestock monitoring or precision livestock farming, uses IoT-enabled collars or tags to track and monitor the health of livestock, most commonly cattle.

In a trial at the Meat Animal Research Center in Clay Center, NE, 68 percent of steers studied showed signs of past respiratory infection, likely illnesses that were missed by traditional monitoring.

Livestock management systems monitor the temperature, blood pressure, and heart rate of animals; track animals that graze in larger areas to prevent the loss of livestock; and alert farmers to optimal times for mating.

Key Benefits

1. Monitor the health and vitality of livestock in real-time, enabling farmers to quickly treat animals and prevent the spread of illness or disease.
2. Track grazing animals to prevent loss and to identify grazing patterns.
3. Monitor readiness to mate or give birth, preventing the loss of new calves and optimizing breeding practices.

Automotive

Industry

Automotive Fleet Management

Industry	Application
Automotive	**Fleet Management**

Overview

IoT fleet management solutions provide insights into how a logistics fleet is performing on the road, including vehicle performance and driver safety, as well as monitoring maintenance needs.

Lost efficiency due to idle time, unscheduled maintenance or vehicle loss can be extremely costly. IoT-enabled solutions for fleet management can provide insights to reduce maintenance downtime, increase driver safety, and measure the performance of vehicles. All of these features lead to increased efficiency, cost savings, and increased revenue.

Through the use of fuel-level monitoring systems and remote diagnostic monitoring services, fleet management solutions can send predictive alerts for maintenance to ensure that vehicles are running at their best.

Key Benefits

1. Reduce overall transportation and staff costs by increasing efficiency and reducing idle time.
2. Manage fuel costs and vehicle efficiency.
3. Monitor and improve driver safety.
4. Remotely diagnose maintenance requirements.

Dealership Inventory Management

Industry
Automotive

Application
Vehicle Tracking

Overview

Dealership inventory management utilizes sensor and tracking technology to provide car dealerships with the tools to remotely track and monitor inventory. Also called smart inventory management or lot tracking, these solutions reduce the manpower needed to maintain vehicles on the lot and prevent theft and misuse of inventory.

The average new car/truck dealership sells more than 1500 new and used cars in a year. Totaling millions of dollars in inventory, these vehicles are constantly moving around the lot as they're maintenanced, test-driven and sold.

Dealership inventory management solutions provide dealership owners a way to remotely monitor and track inventory, collect metrics on usage, and maintain cars while lowering the labor cost of running diagnostics and inventory management. This can mean alerting staff when a car needs a new battery or oil change, or sending automated updates when a car leaves the lot or is checked out for a test drive.

Key Benefits

1. Receive alerts when vehicles need maintenance or upkeep.
2. Track vehicles on and off the lot to prevent misuse or theft.
3. Collect usage data to see exactly which cars or models are seeing the most test drives, even if they're not being purchased.

Driver Behavior Management

Industry
Automotive

Application
People Management

Overview

IoT driver behavior management solutions monitor driving practices in order to increase safety and efficiency in the operation of a vehicle. Driver behavior management is primarily used in the operation of logistics fleets or in usage-based insurance plans.

Fuel costs account for up to 60 percent of a logistics fleet's budget, meaning that it is often where fleets look to save money. Driver behavior, such as rapid acceleration, inefficient braking, or excessive idling, can influence fuel efficiency by up to 30 percent.

Driver behavior management solutions allow supervisors to remotely monitor the performance of drivers, optimizing their performance to reduce fuel costs and increasing the safety of their drivers on the road.

Driver behavior management solutions can be configured to identify and track sudden acceleration or braking, speeding, high-speed turning, frequent stopping and slow driving on a per-driver basis. Supervisors can use these reports to track individual driver's performance, identify fatigued drivers and flag unsafe driving practices.

Key Benefits

1. Detect and identify fatigued drivers before an accident occurs.
2. Ensure that drivers are performing at their best to increase safety on the road.
3. Optimize driving performance to increase fuel efficiency and lower fuel costs.

Fuel Level Monitoring

Industry
Automotive

Application
Fill Level Monitoring

Overview

IoT-enabled tank monitoring solutions allow users to remotely track tank levels and usage. Sensors in tanks can measure fill-level, location and monitor for predictive maintenance.

In commercial applications, tank level monitoring systems allow users to closely monitor the logistics involved in storing, transporting, and delivering product, enabling the optimization of those processes.

Key Benefits

1. Reduce the cost of the logistics involved in storage, distribution and delivery of gas.
2. Remotely monitor and track supplies in real-time, preventing loss of product and increasing efficiency in delivery.

Reconditioning Process Tracking

Industry
Automotive

Application
Vehicle Tracking

Overview

Reconditioning process tracking solutions automate the management and communication involved in the reconditioning process of used cars for sale with the goal of reducing time-to-line (T2L).

On average, used cars in a dealership's inventory cost $42 per day to stock, not including the cost of preparing the car to sell.

The most effective way for dealerships to increase revenue on used car sales is to optimize the reconditioning process. Reconditioning process tracking solutions identify and reduce operational inefficiencies to decrease as used car's time to market.

Through tracking devices, reconditioning solutions can automatically send updates on a car's process through the reconditioning process, based on its physical location, and allow sales staff to easily check-in on the status of cars entering the market and instantly locate them.

Key Benefits

1. Identify inefficiencies in the reconditioning process to reduce T2L.
2. Manage and monitor maintenance staff performance.
3. Eliminate inefficiencies and human error involved in seeking and reporting vehicle status updates.

Tire Pressure Monitoring

Industry
Automotive

Application
Remote Management

Overview

Tire pressure monitoring systems (TPMS) use wireless sensors in commercial or consumer tires to measure tire pressure and alert drivers when tire pressure reaches potentially unsafe levels.

In 2017, 738 total motor vehicle traffic fatalities were caused by tire-related crashes. Besides danger to human life, unsafe tire pressure can cause costly downtime to logistics fleets.

TPMS eliminates the need for drivers to manually check tire pressure. Besides saving in efficiency, these systems ensure that tire pressure is always at safe levels and reduce the risk of accidents on the road.

Tire pressure monitoring systems are either direct, using a sensor that measures the actual air pressure in a tire, or indirect, using a sensor that measures the speed of the tire rotation. Both systems wirelessly send an alert to the driver if tire pressure belows a safe threshold.

Key Benefits

1. Provides constant monitoring of pressure levels to ensure safe driving conditions.
2. Eliminates human error in monitoring tire pressure levels.

Construction

Industry

Construction Crew Management

Industry	Application
Construction	**People Tracking**

Overview

Construction crew management leverages IoT-enabled devices, such as wearables, to monitor crew members and to instantly communicate alerts to hazards or events.

In 2017, the average cost of construction site injury requiring medical attention was $39,000, not including the cost of property damage or citations. The average cost per fatality was $1.15 million.

Construction crew management solutions can provide insights on crew behavior when a supervisor isn't present - helping to support the cohesion to safety guidelines and quickly alert supervisors to dangerous conditions or accidents.

Key Benefits

1. Stay informed on where crew members are working and quickly get a headcount of how many people are on a site.
2. Send and receive real-time alerts to unsafe conditions or accidents.

Construction Equipment Tracking

Industry	Application
Construction	**Equipment Tracking**

Overview

Construction equipment tracking uses IoT-enabled tracking sensors, usually GPS, to monitor the location and usage of heavy construction equipment in real-time.

The National Equipment Register (NER) estimates that $300 million to $1 billion in construction equipment is stolen every year in the United States.

Construction equipment tracking solutions allow construction managers to ensure the security of equipment, preventing loss or damage, and monitor information on usage and maintenance in order to better utilize equipment.

Key Benefits

1. Monitor equipment status and utilization to improve efficiency and optimize preventative maintenance schedules.
2. Track equipment in real-time to prevent loss or to find missing equipment.
3. Receive immediate alarms for unauthorized use and theft.
4. Improve billing based on actual engine run-time.

Consumer

Industry

Child Location Tracking

Industry
Consumer

Application
People Tracking

Overview

Child location tracking solutions use GPS and mobile data to allow parents or guardians to monitor and communicate with children remotely. Child monitoring solutions can be attached to a child, via their clothing or backpack, or can be worn around the wrist, resembling a smart watch.

Child tracking solutions allow parents or guardians to monitor the location of their children, in real-time or at regular intervals. In case of an emergency, these devices can also act as a way for kids to quickly seek help, even if they don't have a phone.

Most child tracking solutions utilize GPS and/or WiFi to track children indoors and out. Wearable options allow for two-way calling and SMS to allow parents to communicate with children, listen in on their surroundings, or send alerts; as well as a panic button that automatically calls the child's trusted contacts; and geofencing alerts that send SMS or email alerts to parents if a child enters or leaves a preset area.

Key Benefits

1. Always know the location of your child.
2. Listen in on a child's surroundings without relying on them to pick up a phone call.
3. Children have a way to instantly call for help, regardless of a phone's battery level.

Indoor Home Gardening

Industry
Consumer

Application
Home Automation

Overview

IoT-enabled home gardening solutions increase the efficiency and autonomy of small-scale home gardens. Similar to applications in agriculture and smart farming, smart gardening solutions monitor soil and weather conditions, automate the watering process, and check in on the health of plants to improve plant health and yield.

IoT home gardening solutions save homeowners time in the daily management and upkeep of their gardens. Like their large-scale counterparts, home garden irrigation systems can decrease water waste and, ultimately, save users money.

Home gardening solutions can cover a wide range of applications including monitoring of plant health and environmental conditions, watering or irrigation, and controlling the climate of greenhouses or other indoor gardening spaces.

Key Benefits

1. Reduce costs associated with wasted water consumption.
2. Prevent over- or under-watering of plants to increase the health and quality of a garden.
3. Autonomously regulate temperature and climate in an indoor gardening environment.

Smart Home Management

Industry	Application
Consumer	**Home Automation**

Overview

Smart home management solutions enable IoT devices to communicate, automate processes and be controlled from one source, such as a smart assistant or mobile phone. Smart home managers streamline the process by which users can control and monitor aspects of their home.

Smart home managers can enable users to set up automated processes, for example turning on lights and lowering the thermostat when they unlock the door, and control multiple smart home devices from one device or interface.

Key Benefits

1. Enable smart home devices from different manufacturers to communicate.
2. Set up processes or schedules that engage multiple devices.
3. Access different devices from one interface.

Smart Home Security

Industry
Consumer

Application
Home Automation

Overview

Smart home security is a collection of IoT-enabled products that allow users to monitor and manage the security of their home including surveillance of the home and property and who has access to the doors.

With the introduction of IoT, the home security market is expected to grow to 75.76 billion USD by 2023. Smart home security systems allow users to remotely monitor and manage their home in real-time. Unlike traditional home security systems, smart security systems continue to monitor and send alerts, even when disarmed.

Smart home security systems can include smart doorbells, which allow users to find out who is at their door (and why) before they unlock it; smart locks, which control access to your home; and smart security cameras, which are activated by motion and can be accessed remotely.

Key Benefits

1. Manage and monitor the security of your home from anywhere, ensuring that you don't have to worry whether or not your doors are locked when you're away.
2. Receive alerts of attempted access or motion around your home, even when the system is disarmed.
3. Identify and communicate with visitors without unlocking your door, even when you're not home.

Smart Lighting

Industry
Consumer

Application
Utility Management

Overview

Smart lighting uses IoT-enabled sensors, bulbs or adaptors to manage lighting. Smart lighting solutions can be controlled through an external device, like a smartphone or smart assistant, set to operate on schedules, or to be triggered by sound or motion.

Smart lightbulbs are almost exclusively powered by LED, rather than incandescent. The average household (with 20 lightbulbs total) can save approximately $76 annually by switching to LED bulbs. While these savings are nice, they can be achieved by purchasing regular LED bulbs and most buy smart lighting solutions for the convenience and customizability.

Smart lighting solutions can be built in a couple of ways. Smart bulbs are WiFi-enabled bulbs that can be controlled individually by a smart assistant or mobile app. Most have the ability to change color or dimness. Smart light switches operate as an adapter for regular light bulbs and can control groups of lights.

Key Benefits

1. Save money by switching to more energy-efficient LED bulbs.
2. Set schedules to ensure that lights are off when they aren't needed - or control lighting schedules remotely as a security measure when you're away from home or out of town.
3. Adjust the color or dimness of lights in different rooms or individual bulbs.

Smart Locks

Industry
Consumer

Application
Home Automation

Overview

Smart locks are IoT-enabled keyless entry devices that allow users remote access to door locks through their smartphone. Smart locks allow users the convenience of unlocking their door without a key, increased control over and the ability to issue access to guests remotely.

According to a 2019 report by Parks Associates, one in four U.S. broadband households intend to equip their home with a smart door lock in the near future.

There are two types of smart locks: locks that provide additional functionality to existing locking mechanisms and locks that completely replace the locking mechanism on doors. While smart locks must be powered, many allow a physical key to serve as backup in case of an outage.

Many smart locks are compatible with other IoT devices or smart assistants, allowing for additional automated functionality - for example, your lights and thermostat switching on when your door unlocks.

Key Benefits

1. Make sure your door is locked from anywhere.
2. Give and revoke remote access to visitors, like dog walkers or trusted friends.
3. Receive notifications whenever the door opens and closes.

Energy

Industry

Gas Tank Level Monitoring

Industry	Application
Energy	**Fill Level Monitoring**

Overview

IoT-enabled tank monitoring solutions allow users to remotely track tank levels and usage, eliminating the need for manual assessment and allowing managers a high-level understanding of depletion rates.

Manually inspecting gas tanks for fill-level and maintenance can be time-consuming and costly, but unexpected shortages of fuel can completely halt operations, making fuel monitoring a necessary part of many businesses.

Tank level monitoring systems allow users to remotely gather data from multiple tanks across buildings or across state lines, with the same high level of accuracy every time, eliminating surprises and equipping managers with the information they need to improve efficiency.

Key Benefits

1. Reduce the cost of the logistics involved in storage, distribution and delivery of gas.
2. Remotely monitor and track supplies in real-time, preventing loss of product and increasing efficiency in delivery.

Solar Energy Management

Industry	Application
Energy	**Utility management**

Overview

Solar energy management solutions utilize IoT-enabled sensors to collect and manage data from solar farms, monitor the status of equipment and optimize the collection and distribution of energy.

According to a report by Forbes, solar PV capacity in the U.S. is expected to double by 2025 and as solar energy farms scale to meet growing worldwide energy usage, manual management will become unwieldy. According to Gartner, 30 percent of energy management systems will leverage IoT by 2020.

IoT solar energy management systems allow hundreds of individual solar panels to be monitored and managed from one central location, allowing managers to quickly respond to issues and make faster, better informed decisions.

Sensors measure the energy production of individual panels, alerting operators to issues with panels before they affect overall systems. Energy management systems can react in real-time to changing weather, adjusting the output and distribution of stored energy.

Key Benefits

1. Reduce outages and downtime by locating and responding immediately to issues.
2. Improve efficiency in energy production and distribution with predictive analytics and real-time optimization based on environmental conditions.
3. Scale quickly, whether you're adding one hundred or one thousand new devices.

Field Service

Industry

Field Service Fleet Management

Industry	Application
Field Service	**Fleet Management**

Overview

Field service fleet management solutions automate back office processes and collect data on dispatches to increase efficiency and overall performance in field service businesses.

Field service fleet management systems allow businesses to automate time-consuming processes, like inventory and assignment, and monitor and communicate with deployed technicians.

IoT-enabled field service management solutions automate back office processes, including assignment and dispatch of service requests, equipment and inventory management, and billing and collection. Solutions also monitor the location and performance of equipment, track efficiency of employees, and can give customers real-time updates on requests.

Key Benefits

1. Monitor and track employee performance.
2. Save time by automating time-consuming operational tasking.

Government & Cities

Industry

Air Pollution Monitoring

Industry
Government & Service

Application
Quality management

Overview

Air pollution monitoring uses stationary or mobile sensors to map and monitor the air quality in large geographical areas, enabling cities to better regulate air pollution and make more informed decisions.

According to the World Health Organization, 90 percent of the global population breathes harmful air, leading to 7 million deaths per year. While cities can regulate emissions and encourage the population to utilize more environmentally-friendly alternatives, the cost prohibitive nature of existing solutions make it difficult to see if those efforts are actually making a difference.

Smart city air pollution monitoring solutions offer a more cost-effective and complete way for cities to measure and track changes in air quality.

Air monitoring solutions utilize stationary sensors, installed into smart street lights, for example; mobile sensors, like those that might be attached to cars or bicycles; or anonymized cell phone data, which provides data on the air quality an average city-dweller might encounter throughout the day.

Key Benefits

1. Better inform and monitor the impact of regulations to control air quality.
2. Plan the placement of vulnerable facilities like hospitals and schools to reduce asthma in children and improve the outcome of sick patients.
3. Empower city residents to make more informed decisions to limit their exposure to harmful air pollution.

Municipal Fleet Management

Industry
Government & Cities

Application
Fleet Management

Overview

Municipal fleet management utilizes sensors to track, monitor and manage municipal fleets to increase operational efficiency, optimize maintenance schedules, lower insurance premiums, and ensure the safety of drivers.

As many municipal fleets begin the transition to more fuel efficient, or even electric, vehicles, fleet managers seek other ways to lower the cost of maintaining the thousands of vehicles maintaining our cities. And they're not alone - the global smart fleet management market is projected to top $565 billion by 2025.

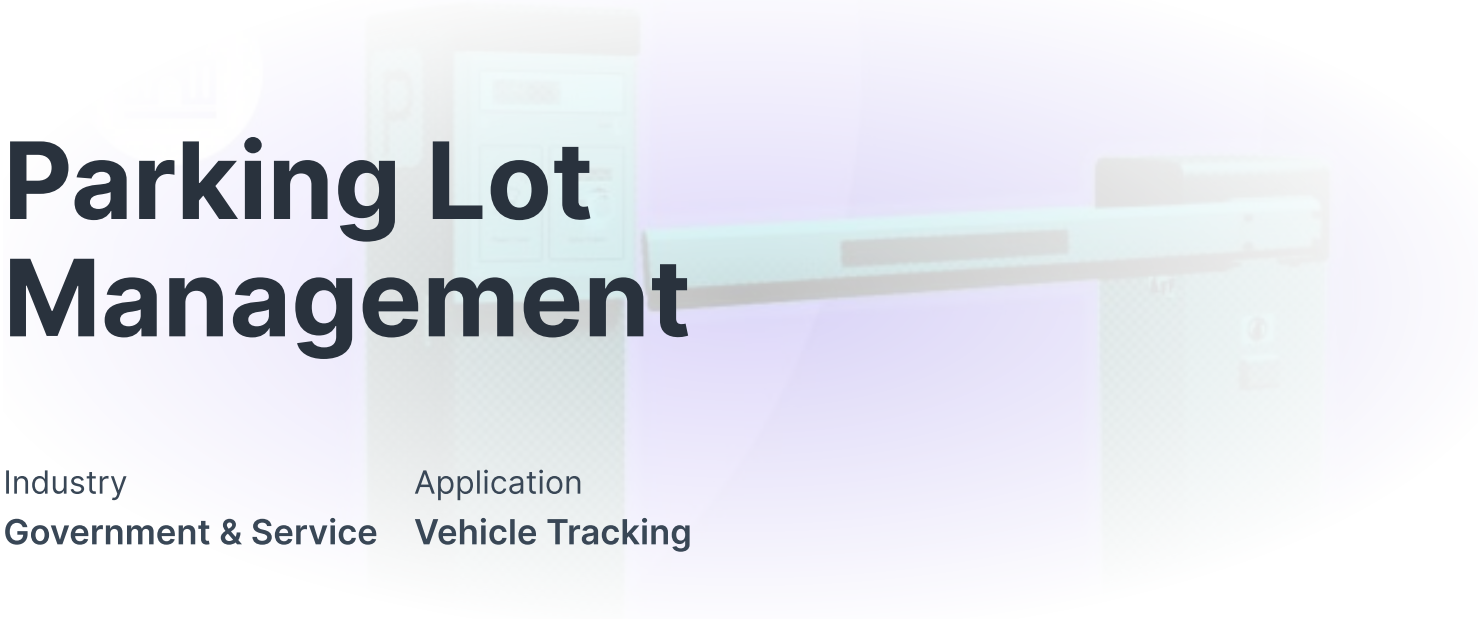
Fleet management solutions can improve gas efficiency by more than 30 percent; optimize schedule for preventative maintenance, allowing for the improved performance of vehicles; and improve driver safety, reducing liability and repair costs.

Fleet management solutions work by monitoring gas levels and usage, tracking driver behaviors for risky driving or fatigue, monitoring the location of vehicles, and monitoring overall vehicle performance.

Key Benefits

1. Increase operational efficiency by optimizing routes and automating dispatch.
2. Enhance productivity and safety by monitoring and tracking unsafe driver behavior, such as sudden braking or accelerating.
3. Monitor vehicle efficiency and perform proactive maintenance to prevent unnecessary vehicle downtime or losses in efficiency.

Parking Lot Management



Industry
Government & Service

Application
Vehicle Tracking

Overview

Parking lot management solutions utilize occupancy sensors and smart parking meters to automate the management of paid parking, lowering costs and providing users a more frictionless parking experience.

According to a 2017 report by Inrix, Americans waste approximately 17 hours per year looking for a parking spot, at a cost of about $345 per driver in wasted time, fuel and emissions. This frustration isn't felt solely by consumers, either, with 34 percent of Americans admitting that they had abandoned a trip because of the stress of parking and 63 percent saying that they avoid specific shopping and leisure centers due to difficulty trouble, businesses feel that lost revenue as well.

While parking lot management solutions can't create more parking spots, they can drastically decrease that frustration users experience while looking for parking, all while providing parking lot managers greater insight into peak traffic hours, user behavior and revenue trends.

Parking lot management solutions utilize magnetic of motion-sensing occupancy sensors to monitor individual parking spots. By monitoring occupancy by-spot, parking lots can implement solutions like guided parking, spot reservation and remote meter management.

Key Benefits

1. Identify and ticket instances of overstay in short-term parking, without human intervention.

2. Monitor peak traffic times and automatically adjust rates accordingly.

3. Digitize processes to reduce labor costs, eliminate human error, and increase operating efficiency.

Traffic Congestion Monitoring

Industry
Government & Service

Application
Vehicle Tracking

Overview

Traffic congestion monitoring uses IoT-enabled sensors or drivers' mobile phones to track and predict traffic patterns, in order to reduce overall traffic congestion.

Idling in traffic jams are costly and terrible for the environment and as the population grows, infrastructure struggles to keep up. In 2018, American drivers lost 97 hours sitting in traffic, costing the country $87 billion in time and gas at an average of $1348 per driver.

Traffic congestion monitoring solutions allow cities a high-level view of traffic congestion trends, enabling them to better plan solutions or changes to infrastructure.

Traffic congestion monitoring solutions can use cameras and AI or machine learning technologies to count cars on the road and identify traffic congestion. Much like existing navigation products, solutions can use apps on drivers' smartphones to identify concentrations of users.

Key Benefits

1. Monitor congestion patterns to identify changes and track improvements against infrastructure and policy changes.
2. Better inform decisions on road and infrastructure improvements.

Healthcare

Industry

Asthma Management

Industry
Healthcare

Application
Medical Devices

Overview

Asthma management uses devices like smart inhalers to monitor the rate and environmental factors around asthma attacks to better inform users as to how their asthma is being managed, decrease nonadherence to treatment and help users discover the cause of their asthma attacks.

According to the Center for Disease Control and Prevention, one in thirteen Americans suffer from asthma. Nonadherence to long-term asthma treatment plans is between 30 and 70 percent, meaning that many Americans are not monitoring their asthma.

Asthma management devices like smart inhalers help asthma sufferers monitor the rate and environmental conditions surrounding their asthma attacks and remind them to take their medications. In more than 15 clinical studies, the Propeller smart inhaler showed a 50 percent increase in medical adherence, leading to a 79 percent reduction in asthma attacks.

Smart inhalers use bluetooth to detect inhaler use and record usage to a mobile app, to allow users to monitor their asthma. Some devices measure air quality in real-time, sending an alert to users to warn them of potentially dangerous conditions, and recording the environmental factors surrounding asthma attacks.

Key Benefits

1. Receive notifications when you accidentally leave your inhaler behind.
2. Monitor the frequency and causes of asthma attacks.
3. Receive notifications when your inhaler is used improperly or ineffectively.

Hospital Equipment Tracking

Industry
Healthcare

Application
Equipment Tracking

Overview

Hospital equipment tracking, also known as a medical Real Time Locating Solution (RTLS), is a subset of asset tracking, which uses active/passive RF-based tags and sensors to monitor the location and utilization of hospital equipment to increase efficiency and deter equipment theft or loss.

According to a survey of 1000 nurses, nurses spend up to 40 hours per month looking for equipment that has been lost or misplaced.

Equipment tracking solutions ensure that, no matter where equipment is left, hospital staff can find and utilize it - eliminating the need for duplicate equipment rental, saving hours of time spent searching, and allowing staff to spend more time with patients.

Hospital equipment tracking solutions tag medical equipment to track its location and monitor usage, not only ensuring that equipment can be found when it's needed, but to predict future needs and identify inefficiencies in hospital processes.

Key Benefits

1. Allow medical staff to find equipment in emergencies, even when it hasn't been returned to its rightful place.
2. Track and automate the inventory process.
3. Identify and correct inefficiencies in hospital process - for example, tools stuck in sanitization or otherwise in disuse.

Medical Facility Access Control

Industry	Application
Healthcare	**Keyless Entry System**

Overview

Medical facility access solutions use keyless entry technology to control access to restricted areas, such as supply closets and labs. These solutions ensure the safety of patients and staff; prevent loss of equipment and inventory; and increase efficiency of providing and restricting access, implementing new security protocol and response in case of emergency.

Medical facilities have a security problem. Managing what members of staff have access to what secure areas, changing keys when employees leave, and ensuring that the doors between valuable inventory and equipment remain secure takes a great deal of administrative oversight and manpower, especially considering that hospital turnover in 2018 was at 19 percent.

Medical facility access control solutions enable facilities to ensure that their equipment and supplies are secure and protected, while saving money on the operational processes involved in distributing and revoking access as staff comes and goes.

Access control solutions utilize much of the same technology as keyless entry solutions, relying on a bluetooth or NFC signal to alert the system to unlock the door. Because each device identifies separately in the system, access control solutions can track who's coming and going through specific doors; remotely revoke or grant access, eliminating the need to copy or retrieve physical keys; and even dictate when an individual user has access to a specific door.

Key Benefits

1. Remotely manage which staff have access to specific doors.
2. Track entrances to particular doors to determine peak traffic times or to track employee location for accountability.

Remote Patient Monitoring

Industry
Healthcare

Application
People Management

Overview

Remote patient monitoring allows care providers to collect a wide range of data from patients to monitor chronic illnesses and to better engage patients in their own healthcare.

Chronic illnesses account for 80 percent of all hospital admissions, but cost 3.5 times more to treat.

Remote patient monitoring solutions allow greater levels of communication between healthcare providers and patients, ensuring that they receive the information they need before patients experience adverse effects. Through the use of remote patient monitoring solutions, the University of Pittsburgh Medical Center reduced the risk of hospital readmissions by 76 percent and maintained patient satisfaction score over 90 percent.

Monitoring programs can collect a wide range of data including vital signs, weight, blood pressure, blood sugar, oxygen levels, heart rate and electrocardiograms through wearable devices or prompts that request patient information, to be filled out at a convenient time and place by the patient.

Key Benefits

1. Collect additional information on patients without overburdening care teams.
2. Increase efficient treatment and management of patients by automating data collection.
3. Educate patients by increasing engagement in their healthcare, resulting in lower rates of readmission.

Hospitality

Industry

Hotel Crew Efficiency

Industry	Application
Hospitality	**People Management**

Overview

Smart hotel management solutions utilize IoT technology, like automated check-in and scheduling software for smart lighting and appliances, to create improved guest experiences, monitor lone workers such as housekeepers or security staff, and increase operational efficiency.

Hotel operations are highly time-consuming for hotel staff, which a great deal of time spent standing by and waiting to be of service. Smart hotel management solutions automate operations and communicate with staff instantly to create seamless guest experiences that improve efficiency and increase guest satisfaction.

Hotel management solutions can automate the assignment of service requests like housekeeping or repair, alerting staff when guests check out so they can reset rooms and perform maintenance immediately, minimizing downtime. Many mobile apps monitor the location of staff, allowing them to share their location and ask for help instantly.

Key Benefits

1. Automate processes like room assignment and status update for housekeeping and maintenance staff.
2. Create seamless check-in and check-out processes that get guests settled in faster.
3. Optimize temperature and energy usage to save utilities costs and to ensure that rooms are always comfortable when guests arrive.

Insurance

Industry

Usage-Based Vehicle Insurance

Industry	Application
Insurance	**Vehicle Tracking**

Overview

Usage-based vehicle insurance (UBI) uses individualized data to determine insurance premiums, rather than the traditional approach, which leverages statistics to determine the risk factor of a particular driver. UBI systems monitor a driver's adherence to safe driving techniques and account for the number of miles a car is regularly driven to calculate premiums, often with large rates of savings for drivers.

UBI offers drivers more control over their insurance premiums, incentivizes safe driving and generates opportunities for vendors to generate customer loyalty through regular contact. As telematics (the hardware and software used to monitor driving activity) become more affordable, the global usage-based insurance market is expected to reach $190 billion in US dollars by 2026.

UBIs work by installing a telematics device - that either plugs into the insured vehicle or is loaded as an app onto the driver's smartphone - to measure the number of miles driven and to monitor the driver's behavior. By monitoring things like sudden acceleration or braking, hard turns or collisions the system can flag unsafe driving behavior, end alerts in the event of an accident, and track the car in case of theft

Key Benefits

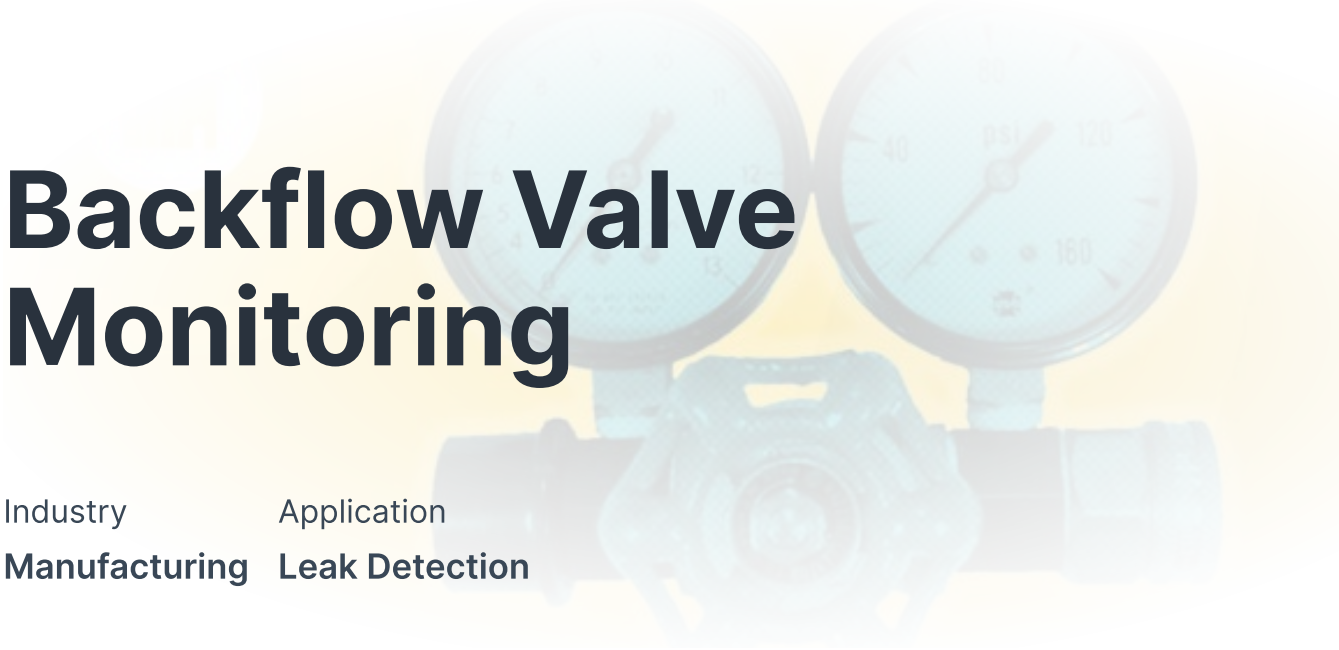
1. Gather precise data to support the assessment of claims, reducing fraud and driving down costs.

2. Enhance customer loyalty through regular contact.
3. Open up possibilities for sales channels and opportunities to generate revenue through partnerships with other businesses (like reward programs for safe driving).

Manufacturing

Industry

Backflow Valve Monitoring



Industry	Application
Manufacturing	**Leak Detection**

Overview

Backflow valve monitors track the position of backflow valves and send alerts in case of valve failure, allowing users to immediately assess and correct the problem, preventing property damage and costly fines.

Traditional backflow valves must be manually checked for failure, usually indicated by discharge. Because of the typical placement of backflow valves, indications of failure may not be noticed before an annual assessment, causing dangerous contamination or property and equipment damage if left unchecked.

Backflow valve monitors can be built into backflow prevention devices, or can be attached to legacy ones. Using sensors to detect and identify the backflow valve's position, the system monitors for failure or abnormalities and can send real-time updates and alerts to managers or owners.

Key Benefits

1. Receive real-time alerts to backflow valve failure.
2. Monitor multiple backflow valves with one online dashboard, eliminating the need for manual audits.

Environmental Chemical Leak Detection

Industry	Application
Manufacturing	**Leak Detection**

Overview

Environmental chemical leak detection uses IoT-enabled sensors to detect chemical leaks in chemical manufacturing facilities to identify, manage, and prevent environmental pollution.

A 2013 study by the National Research Council found that, in the United States, more than 126,000 groundwater sites had been contaminated by industrial processes.

Chemical leak detection systems allow companies to identify chemical leaks before they become dangerous, managing their cleanup and preventing environmental pollution and life-threatening conditions. Ari Goldfarb, CEO of leak detection system Kando, claimed that the use of Kando reduced the cost of treating pollution by 40 percent for its users in its first year of use.

Through the use of infrared lasers, chemical leak detection systems can detect invisible chemical gas leakages in real-time and use machine learning techniques to develop insights on pollutant spread.

Key Benefits

1. Immediately detect leaks of dangerous, invisible chemicals like methane or CO2, before they become dangerous.
2. Predict the spread of pollutants to better manage cleanups.

Factory Automation

Industry	Application
Manufacturing	**Process Automation**

Overview

Factory automation uses IoT-enabled sensors and robotics to automate manufacturing processes, monitor equipment performance, ensure product quality, and increase on-site safety for employees.

Factory automation saves manufacturing companies money by identifying process inefficiencies, ensuring product quality, and increasing safety for employees on-site. The use of advanced robotics, like those that autonomously assemble products, have shown to reduce conversion costs for factories by 15 percent.

Sensors in factory equipment monitor the performance of machines, alerting staff if errors occur or maintenance will be needed soon, preventing the need for unexpected outages or emergency maintenance. Automating repetitive tasks also helps prevent employee fatigue, increasing employee satisfaction and reducing the number of on-site accidents or injuries.

Key Benefits

1. Generate data that can help identify inefficiencies or bottlenecks in processes.
2. Increase product quality by eliminating opportunities for human error.
3. Optimize processes, reducing waste in inventory requirements and reducing variability in operations.
4. Increase safety due to decreased potential for human error and reduce worker fatigue by removing employees from repetitive or fatiguing tasks.

Factory Equipment Management

Industry	Application
Manufacturing	**Equipment Tracking**

Overview

Factory equipment management uses IoT-enabled sensors to monitor and track the performance and location of manufacturing equipment to optimize processes, reduce theft and misuse, and prevent unscheduled downtime.

Unexpected downtime in manufacturing can be costly - resulting in the loss of not only product, but wages, utilities, and then the cost of emergency maintenance to downed equipment. The average outage costs companies $17,000. And although equipment failure is a major contributor to unexpected downtime, a 2017 survey found that 70 percent of companies lacked a complete awareness of when equipment was due for maintenance or upgrade.

Factory equipment management solutions allow for a more complete understanding of manufacturing equipment's performance and utilization. Alerting companies when equipment is due for maintenance or under-performing and enabling them to schedule maintenance before the need is urgent and prevent an outage.

Using RFID of Bluetooth low-power, factory equipment management solutions can track the performance and location of manufacturing equipment. Retrofit kits and sensors allow companies to track performance without replacing legacy equipment.

Key Benefits

1. Eliminate human error in equipment tracking.
2. Optimize maintenance schedules to minimize downtime.
3. Monitor equipment performance to optimize processes.

Industrial Plant Leak Detection

Industry	Application
Manufacturing	**Leak Detection**

Overview

Industrial plant leak detection uses IoT-enabled sensors to detect leaks in manufacturing facilities' systems to identify, manage, and prevent environmental pollution, as well as to ensure worker safety and to reduce the costs associated with leaks, like loss of product or system damage.

Industrial plant leaks are responsible for some of the greatest industrial disasters in history, including the Bhopal disaster, a toxic leak that resulted in the deaths of more than 7,000 within the first three days, and has been responsible for the health problems of more than 500,000 more.

Preventing and identifying leaks like these can be an extremely labor-intensive and costly process, requiring regular rotations of employees to manually inspect and monitor system performance and environment. IoT-enabled industrial plant leak detection systems automate that process by constantly monitoring for leaks and sending immediate alerts in cases of unexpected readings.

Leak detection systems allow companies to identify leaks before they become dangerous, managing their cleanup and preventing environmental pollution and life-threatening conditions. Ari Goldfarb, CEO of leak detection system Kando, claimed that the use of Kando reduced the cost of treating pollution by 40 percent for its users in its first year of use.

Through the use of infrared lasers, chemical leak detection systems can detect invisible chemical gas leakages in real-time and use machine learning techniques to develop insights on pollutant spread.

Key Benefits

1. Immediately detect leaks of dangerous, invisible chemicals like methane or CO2, before they become dangerous and receive alerts as soon as a leak is detected.
2. Predict the spread of pollutants to better manage cleanups.
3. Automatically notify nearby workers if a dangerous leak occurs to prevent on-site injury or danger to staff.
4. Eliminate the cost of manual, labor-intensive monitoring for potential leaks.

Steam Trap Monitoring

Industry	Application
Manufacturing	**Building Automation**

Overview

Steam trap monitoring utilizes IoT-enabled sensors to monitor and alert administrators to steam trap failures, preventing equipment damage and loss of product.

Manual steam trap monitoring involves employees physically checking each steam trap in a facility, a costly and time-consuming process that often means that steam traps are checked only once a year. A 2013 study by Emerson found that failure rates of steam traps is between 15 and 20 percent each year, with failures resulting in danger to employees, potential damage to equipment, and damage to product.

Steam trap monitoring solutions offer facilities a cheaper and more reliable way to ensure that steam traps are functioning properly. By monitoring a steam trap's performance every fifteen seconds, through a probe or sleeve over the trap, monitoring systems can send immediate alert to administrators - so they can be corrected immediately, rather than when the next manual audit occurs.

Key Benefits

1. Receive an immediate notification in case of steam trap failure.
2. Identify and correct failed steam traps before they become dangerous or costly.

Wine Quality Management

Industry	Application
Manufacturing	**Quality Management**

Overview

Wine quality management uses IoT-enabled sensors and devices to monitor and manage wine production both in the vineyard and cellar to improve the efficiency of processes and create ideal conditions for grapes to grow and wine to age.

Grape quality in vineyards is highly dependent on environmental conditions like temperature, soil quality, and humidity, with unexpected weather changes even causing the loss of large percentages of entire harvests. Every year, environmental factors like frost, hail, floods, heat, drought, and fires cost wineries worldwide a loss of more than 10 billion in USD.

Wine quality management solutions enable wineries and vineyards to closely monitor and manage the conditions in which grapes are grown and wine is stored and aged. These precisely controlled environments allow for maximum yield of vineyards and an overall increase in the quality of production. Pago Aylés, a Spanish winery, saw a 25 percent increase in wine quality following the implementation of IoT solutions in their vineyard.

Wine quality management solutions use precision farming in vineyards to measure and environmental factors like humidity, temperature, and moisture levels, and adjust maintenance schedules to increase efficiency and optimize growing conditions. Similarly, sensors in cellars can measure and control environments to ensure the best possible conditions for wine to age.

Key Benefits

1. Monitor growing conditions in vineyards like humidity, soil quality, moisture levels, and temperature.
2. Receive real-time alerts to potentially harmful changes in growing environments like temperature or pests.
3. Monitor and control environmental conditions in wine cellars to improve wine quality.

Maritime

Industry

Consumer Boat Management

Industry	Application
Martime	**Boat Tracking**

Overview

Consumer boat management solutions allow boat owners to monitor and track their boats from anywhere, using IoT-enabled sensors to monitor performance and give real-time updates on a boat's status and location.

On average, consumer boats are utilized fewer than 20 days per year. Allowing for about 345 days for boat owners to wonder if their boat is safe and in good operating condition.

Consumer boat management solutions allow boat owners to check-in on their boat from anywhere. Rather than wonder if their boat has been tampered with, or if they remembered to turn off the lights, or if the battery needs to be changed, owners can instantly check in and manage systems remotely.

Sensors on the boat monitor performance and alert owners of issues like breaches or low batteries before they become a problem. GPS tracking allows boat owners to log their outings and ensure that their boat is exactly where it's supposed to be, even if they can't make it to the dock or marina.

Key Benefits

1. Receive alerts if a boat leaves a geofenced area, like a dock or marina.
2. Keep automated logs on past trips.
3. Monitor equipment performance and receive notifications when maintenance is needed.

Maritime Fleet Management

Industry	Application
Maritime	**Fleet Management**

Overview

Maritime fleet management uses IoT-enabled sensors to monitor and track the performance and location of maritime fleets in order to optimize maintenance schedules, plan and adjust routes and streamline communications.

With regulations to reduce carbon emissions affecting global maritime fleets, many companies are looking for ways to reduce their fuel consumption and lower emissions of pollutants. According to a 2018 report by Inmarsat, 65 percent of surveyed maritime companies were already using IoT-based solutions to monitor fuel consumption, but that number is expected to rise to 100 percent by 2023.

Maritime fleet management solutions enable fleet managers to closely monitor individual vessel performance to identify and correct operational inefficiencies to result in better fuel efficiency and optimized equipment maintenance schedules.

Sensors measuring the vibrations, sound and temperature around individually pieces of equipment can monitor performance and diagnose issues, alerting managers before they cause a disruption in operations

Key Benefits

1. Minimize fuel consumption by monitoring equipment performance and optimizing routes.
2. Monitor equipment for performance issues and schedule maintenance to prevent unexpected downtime.

Pets

Industry

Pet Location Tracking

Industry	Application
Pets	**Animal Tracking**

Overview

Pet location tracking solutions use IoT-enabled collars or devices to monitor the location and status of pets both indoors and outdoors. Tracking collars or collar attachments allow pet owners to check in on their animals when in the care of strangers, like dogwalkers, or to locate their pets should they go missing.

Within a five year period, 14 percent of dog owners lose their pet. The fear of missing pets is so great that many have turned to microchipping to increase the chances of being reunited, should a pet go missing. The global pet microchip market is expected to grow to 460 million US dollars by 2025.

Unlike microchips, which are only effective if the pet is found and taken to a vet or shelter, pet tracking collars give owners a more active role in finding their pet. In addition to tracking a lost animal, pet tracking collars enable owners to monitor their pet's activity levels and receive alerts if a pet leaves a pre-set area or geofence.

Key Benefits

1. Keep an eye on caretakers, like dog walkers or pet sitters.
2. Track and find lost pets.
3. Receive instant notifications if your pet escapes or wanders.

Property Management

Industry

Space Reservation & Utilization

Industry
Property Management

Application
Animal Tracking

Overview

Space reservation and utilization solutions use IoT-enabled occupancy and motion sensors to monitor how office space is used. Office and property managers can use this information to better dedicate and utilize space.

As companies increasingly embrace remote working and collaborative work environments, employees spend less and less time at their desks. In fact, 40 percent of office space paid for by companies is left empty as employees work out of the office or spend time in common spaces.

Space reservation and utilization solutions allow companies to measure exactly how office space is currently being used and optimize space utilization to lower costs and boost productivity.

Occupancy sensors can monitor whether or not a room is being used, allowing systems to automatically update room bookings, turn off lights when rooms are not in use, and monitor which rooms are being under-utilized.

Key Benefits

1. Reduce energy use by turning off lights and electronics when rooms are not in use.
2. Reduce real estate costs by adjusting underutilized space to better meet needs.

Rail & Railways

Industry

Smart Railroad Management

Industry
Rail & Railways

Application
Remote Management

Overview

Smart railroad management uses data gathered by IoT-enabled sensors on railroad trains, switches and rails to optimize maintenance schedules and monitor train performance to prevent downtime and minimize delays.

Train delays, both passenger and freight, are a widespread and costly problem. One third of Amtrak trains experienced delays in 2018, costing $41.9 million per year. Even a five percent improvement would see $8.2 million in reduced costs and an additional $3.9 in increased revenue.

By implementing smart railroad management solutions, companies can predict and optimize maintenance schedules to minimize downtime and prevent unexpected equipment failures, as well as alert conductors to potential hazards or considerations.

Smart railroad management solutions work by tracking timing, vibrations and currents to monitor the performance of railroad equipment and sending alerts to things like rail defects and unexpected train behavior to bring human attention to potential performance issues.

Key Benefits

1. Monitor for unexpected train behavior, like changes in speed or braking.
2. Track train performance to identify potential issues with equipment before it causes delays.

Retail

Industry

Precise Customer Tracking

Industry	Application
Retail	**People Tracking**

Overview

Precise customer tracking uses stationary sensors or leverages customers' mobile phones to track their route through brick and mortar stores. Customer tracking solutions allow stores to optimize floor layout, product positioning, and measure the success of promotions and in-store campaigns.

Brick and mortar stores still account for more than 88 percent of total sales, but are handicapped in their knowledge of their customer. Whereas ecommerce stores have access to a potential customer's browsing history, basic demographics and past exposure and interaction with ads, physical retailers only collect information at the point of sale - usually through loyalty programs.

Precise customer tracking solutions allow retailers to, not only collect information on overall patterns of traffic, but analyze individual customer journeys to see where customers dropped off or made the decision to purchase.

Customer tracking solutions consist of either stationary sensors, like cameras, to measure general traffic patterns and gather a headcount of customers in the store or use customer's smartphones (usually via GPS or Wifi) to track customers' progress through a store.

Key Benefits

1. Learn how customers navigate your store, which aisles or sections are most popular, and where in-store navigation or directions are failing potential customers.

2. Learn the demographics of your customers - including when during the day and week they're most likely to come to your store.
3. Measure and monitor the success of store organization and in-store promotions and advertisements.

Retail Crew Efficiency

Industry	Application
Retail	**People Management**

Overview

Retail crew efficiency solutions utilize IoT-enabled technology, like cameras and sensors, to monitor the location and behaviors of retail staff in order to increase efficiency and improve the overall customer experience.

According to a 2018 report by Adyen, long lines in retail stores cost US retailers $37.7 billion in sales each year, as customers abandon their purchases for wait times more than five minutes.

Retail crew efficiency solutions allow companies to refocus their staff's time in order to create seamless customer experiences that increase satisfaction and sales.

IoT retail solutions can accurately monitor and predict waiting times, preventing some of the frustrations customers face when waiting for checkout or customer service. Through cameras and systems designed to recognize facial expressions, systems can spot lost or dissatisfied customers and immediately send help.

Key Benefits

1. Improve customer satisfaction by reducing wait times.
2. Increase operational efficiency to free up staff to spend more time helping customers.

Retail PoS Management

Industry	Application
Retail	**Point of Sales System**

Overview

Smart retail PoS systems go beyond processing transactions. Operable anywhere there's a WiFi connection, smart PoS systems track customer behavior, update inventory, and complete transactions anywhere in the store.

Smart PoS systems provide companies greater insights into what customers are buying, what they're returning, and what customers are worth earning the loyalty of. They allow companies to track their busiest hours and automate operational processes like taking inventory and tracking returns, allowing staff to focus on providing great customer experiences.

When a smart PoS system processes payment for a transaction, it automatically updates inventory and alerts management if something is nearly out of stock. Smart PoS systems gather data on the most popular items as well as the rate at which items are returned to help companies gain insight to optimize the retail floor.

Key Benefits

1. Complete transactions from anywhere in the store - preventing long queue lines during peak hours.
2. Automatically update inventory and receive notifications when items are nearly out of stock.

Smart Retail Floor Management

Industry	Application
Retail	**Indoor Navigation**

Overview

Smart retail floor management uses IoT-enabled sensors to track employees, monitor customer service performance and ensure customers a frictionless experience in brick-and-mortar retail stores.

As ecommerce stores offer more customized experiences, consumers bring those heightened expectations back to retail spaces. 73 percent of consumers say that good customer experiences encourage them to spend more money than they intended and 57 percent said that they would be willing to spend more on a product or service if they knew it would come with an excellent customer experience.

Smart retail floor management solutions allow companies to monitor the performance of customer service staff including the amount of time it takes for a customer inquiry to be resolved, traffic patterns in the store, and insights to adjust schedules and ensure that there are always enough staff on-site.

Key Benefits

1. Automate collection and reports on staff performance.
2. Receive automatic updates to optimize staff schedules.
3. Enable customers to call for help without having to flag down an employee somewhere else in the store.

Store Foot Traffic Monitoring

Industry	Application
Retail	**People Tracking**

Overview

Store foot traffic monitoring measures the number of potential customers that enter a store, where they go, and how long they stay. Foot traffic monitoring solutions help retail managers understand why customers may not be converting (if they can't find what they're looking for, for example), what customers see and when a store's busiest times are.

To earn repeat business, consumers expect a quality, customized customer experience. Despite the fact that brick and mortar stores still account for 88 percent of total sales, they're highly disadvantaged in knowledge about their customers. Ecommerce retailers can tap into user's browsing history and basic demographics, relying on large stores of personal data to inform their user experience.

Store foot traffic monitoring solutions allow retailers to learn more about their audience and use that data to tailor the customer experience to maximize ROI.

Traffic monitoring solutions use sensors to monitor the number of customers that pass through the doors, or use IoT-enabled cameras or heat sensors to track customers' movement through the store. Some solutions can utilize data from customer's smart phones when they opt-in via a retailer's mobile app or connect to the local WiFi.

Key Benefits

1. Monitor high-traffic days and times to determine when your customers are most likely to be in the store.

2. Track store traffic over long periods of time to measure the growth of your audience month-by-month.
3. Measure how long customers spend in your store and where they spend most of that time.

Science & Technology

Industry

Laboratory Equipment Tracking

Industry
Science & Technology

Application
Equipment Tracking

Overview

Laboratory equipment tracking, or asset tracking, solutions use IoT-enabled sensors such as RFID to monitor the location and usage of laboratory equipment in order to prevent loss and increase productivity through utilization.

Laboratory equipment is often used across multiple departments or offices and mistakes in tracking, check-in, or check-out can lead to unnecessary purchases, replacements, and downtime as labs struggle to work around missing equipment. As many labs are under strict budgeting constraints, when an expensive piece of equipment goes missing, they may not be able to replace it at all.

Laboratory equipment tracking solutions enable labs to quickly locate missing equipment, saving time spent looking for it; monitor equipment utilization; and optimize maintenance and calibration schedules to minimize downtime and increase productivity.

Most laboratory asset tracking solutions use water-resistant RFID labels to identify and track equipment as it moves through or between labs. These tags are used to check equipment in and out of labs or, if it goes missing, will register on a handheld device that can locate the asset and direct a user to it.

Key Benefits

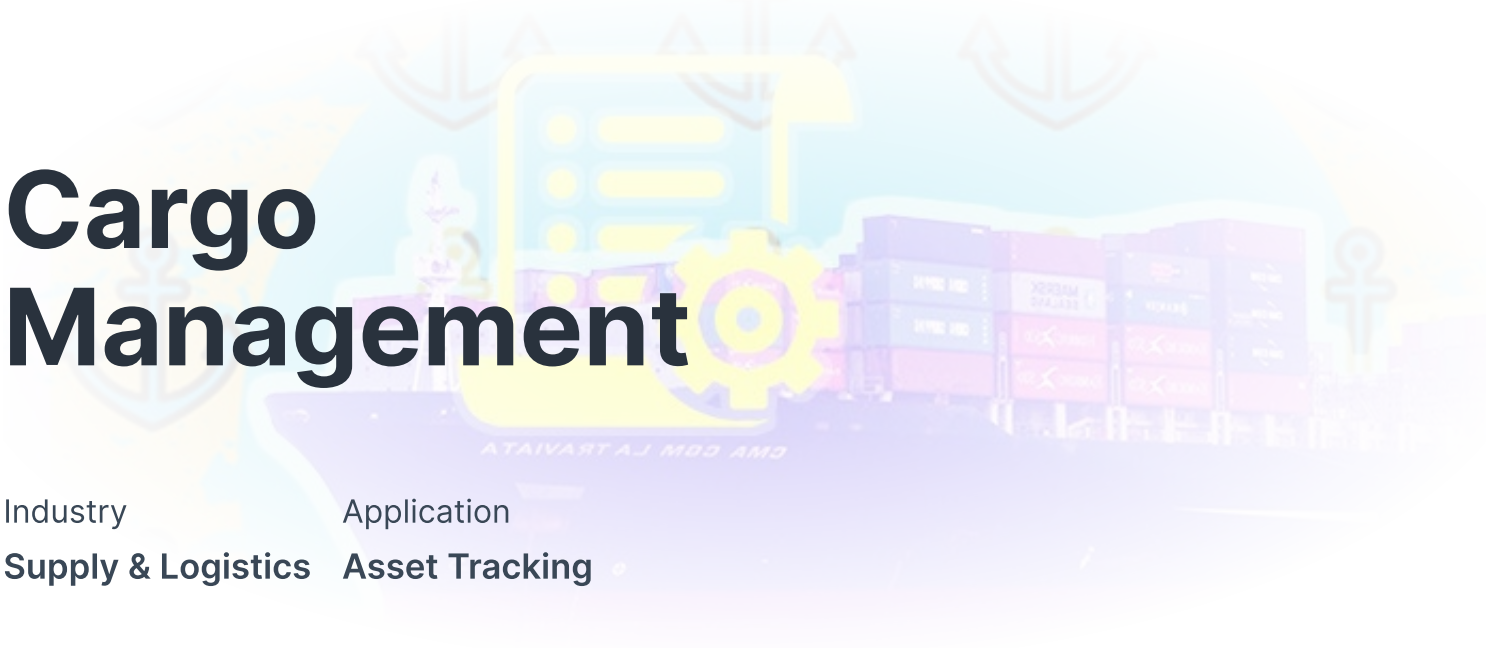
1. Eliminate time spent looking for lost equipment.
2. Receive proactive updates on upcoming maintenance or calibration to optimize maintenance schedules and reduce downtime.

3. Completely inventory reports and ensure compliance.
4. Automate and optimize processes to reserve lab equipment and return leased equipment.

Supply Chain & Logistics

Industry

Cargo Management



Industry	Application
Supply & Logistics	**Asset Tracking**

Overview

Smart cargo management solutions utilize IoT-enabled sensors to monitor and manage the conditions for freight in logistics fleets. These solutions ensure the quality and safety of cargo and seek to increase efficiency to lower expenses.

Food is some of the most difficult cargo for fleets to transport and up to forty percent of the US's food goes to waste between harvest and delivery, costing fleets millions in insurance claims and lost revenue.

Cargo management solutions ensure the safety of high value cargo, like electronics, and the quality of delicate or perishable cargo, like food or medicine. These solutions also enable fleets to maximize efficiency in cargo load, fuel, and loading and unloading time.

IoT cargo management solutions track cargo and can automate communications to customers and loading crew; track and measure idle time and underutilized capacity; monitor the shock, tilt, humidity and pressure of a shipment; and send alerts when cargo is accessed.

Key Benefits

1. Prevent waste by spoilage and prevent damage to cargo in transit.
2. Ensure ideal conditions for cargo and receive automatic alerts when conditions are not met.
3. Prevent restricted access to cargo.

Cold Chain Management

Industry	Application
Supply & Logistics	**Supply Chain Management**

Overview

Cold chain management solutions utilize IoT-enabled sensors to monitor and manage temperature-sensitive packages to prevent spoilage as they move through the supply chain.

Cold chain management is costly and difficult, requiring the precise monitoring and tracking of packages, as any delay could mean expensive losses. Manual solutions are not always effective, contributing to the $218 billion in food that goes straight from harvest to landfill.

Cold chains management solutions keep all stakeholders in the loop, allowing customers and fleet managers to track shipments in real-time, receive alerts to any delays, and check in on the condition of packages. By utilizing precise temperature sensors, cold chain management solutions can alert drivers of potential issues with a shipment immediately, allowing swift response before the situation becomes critical or any inventory is lost.

Key Benefits

1. Receive alerts to errors with refrigeration equipment or delays.
2. Always know exactly where your shipment is with remote tracking.

Food & Beverage Supply Chain Management

Industry	Application
Supply & Logistics	**Fleet Management**

Overview

Food and beverage supply chain management manages the logistics in moving food and beverages from the manufacturing and packaging site to shelves. IoT solutions in cold supply chain management monitor the environmental conditions of cargo, like temperature and humidity, and track the shipment to ensure minimal loss of product due to spoilage.

As traceability and waste becomes top-of-mind for general consumers, the IoT for food and beverage market is expected to grow to $8.43 billion by 2025. Food and beverage supply chain management solutions enable companies to act fast to prevent spoilage if their inventory falls below safe temperature or is delayed.

Food and beverage supply chain management solutions employ sensors to detect humidity, temperature, tilt, and impact. The system uses this data to automatically adjust conditions for optimal storage and can alert the driver and customer if errors occur or if the inventory is in danger of spoilage. In addition to environmental factors, the system tracks the location of the cargo, sending automatic updates to the customer to ensure that all stakeholders know exactly where their cargo is.

Key Benefits

1. Maintain and monitor environmental conditions of inventory, ensuring the highest possible level of food safety.
2. Reduce waste, cost, and risk associated with all stages of food processing and packaging.
3. Track inventory and automate shipments based on predictions of need.

Transportation & Mobility

Industry

School Bus Tracking

Industry
Transportation & Mobility

Application
Fleet Management

Overview

School bus tracking solutions use sensors to track the location and performance of school busses to increase efficiency and ensure the safety of children riding to school. School bus tracking solutions fall under the umbrella of municipal fleet tracking and utilize much of the same technology.

In 2011, it was estimated that $21.7 billion is spent annually on bussing elementary and middle school children to public schools. Many counties have started to charge for bussing services as public education budgets face worsening constraints.

School bus tracking solutions provide a solution, not only to better ensure the safety of students, but to increase the efficiency of bus services and lower operating costs significantly.

Bus tracking solutions include many of the features of other fleet management solutions, such as fuel level monitoring and management, vehicle tracking, and driver behavior monitoring. Additionally, bus tracking solutions can track stops where students board and exit the bus, allowing for monitoring of both bus load and the presence of individual students.

Key Benefits

1. Monitor the performance of individual vehicles, optimizing maintenance schedules.

2. Balance bus loads by tracking where students get on and off the bus.
3. Track bus ETAs and share with parents or school administrators.
4. Maintain compliance with applicable state and federal regulations.
5. Monitor drivers for dangerous driving behavior or to receive alerts of driver fatigue.

Trucking

Industry

Truck Yard Management

Industry	Application
Trucking	**Trailer Tracking**

Overview

Truck yard management uses IoT-enabled sensors and technology to monitor, manage, and automate the processes involved in loading and unloading trucks in the truck yard or docks.

Manual monitoring and scheduling of gates, trucks, and trailers is costly both in manpower and in time. Organizations performing manual yard checks often do so on pen and paper, spending hours comparing new reports to previous findings.

Truck yard management solutions seek to increase efficiency of dailly truck yard operations, tracking trucks and trailers, automatically assigning docks and time slots, and monitoring yard access and movement in real-time to increase operating efficiency.

Key Benefits

1. Minimize truck downtime with automatic shipment rescheduling.
2. Reduce yard congestion and time spent queueing at the gate by optimizing delivery schedules and dock assignment.

Utilities

Industry

Utilities Equipment Management

Industry	Application
Utilities	**Equipment Management**

Overview

Utilities equipment management uses IoT-enabled sensors to remotely monitor the performance of utilities equipment, allowing companies to better optimize maintenance to minimize downtime and prevent unexpected outages.

Utilities management requires frequent and time-consuming manual inspection to ensure high performance of equipment. IoT-enabled utilities asset management can free up manpower and eliminate human error involved in manual audits, increasing operational efficiency, and lowering costs.

Utilities equipment management solutions can track and record equipment's age, usage, and maintenance history. By providing managers a top-down view of how equipment is performing, they can schedule maintenance before equipment starts to fail and predict the long-term needs of equipment and systems.

Key Benefits

1. Performance predictive maintenance to maximize equipment lifetime and minimize risk of equipment failure.
2. Reduce cost of manual equipment inspection.

Water Metering Management

Industry	Application
Utilities	**Utility Management**

Overview

Smart water meters use IoT-enabled sensors to monitor water usage and identify leaks to reduce waste and operating costs for utilities companies and cities.

As the population of the United States rises, rates of water consumption threaten unsustainable levels. Of the 204 water basins that currently supply most of the United States with freshwater, as many as 96 could fail to meet growing demand by 2071.

Water meter management solutions can reduce water usage, instantly alert consumer and utility companies to leaks or system damage, and increase efficiency in operating processes. A study by Sydney Water showed that the use of smart meters decreased water usage by 6 percent in residential systems, a reduction that was maintained for two years after the study period.

Smart water meters work by utilizing a IoT-enabled sensor that measures water usage and ambient temperature in the system, updating at regular intervals. These meters can be monitored remotely, eliminating the need for utility agents to manually take readings and sending immediate updates if signs of a leak or tampering are detected.

Key Benefits

1. Prevent water waste by immediately identifying leaks and issues in metering.
2. Lower labor costs and eliminate the need for utility agents to manually take readings from residential water meters.
3. Predict consumption patterns to better prepare for increased need or reduced supply.

Waste Management

Industry

Municipal Waste Management

Industry	Application
Waste Management	**Waste Management**

Overview

Smart waste management uses IoT-enabled sensors in waste receptacles to monitor conditions like fill-level, temperature, and tilt to optimize waste collection.

City municipalities spend around $300 per capita annually to collect and manage waste levels. Much of that collection happens manually, based on a schedule - meaning that mostly-empty receptacles are still serviced on a weekly or bi-weekly basis.

Smart waste management solutions use predictive analytics and real-time sensors to optimize collection routes and ensure that recyclables are processed and sorted correctly. Solutions like Sensoneo claim to be able to reduce waste collection costs by 30 percent and lower carbon emissions by 60 percent.

Smart waste management solutions use sensors to monitor the fill-level of receptacles, to automatically compress waste or to optimize pickup schedules.

Key Benefits

1. Save on fuel by only collecting full receptacles.
2. Improve the efficiency and accuracy of the billing process.

Retail Waste & Recycling

Industry
Waste Management

Application
Waste Management

Overview

Retail waste and recycling solutions use IoT-enabled sensors to monitor receptacles' locations and fill-levels to optimize collection schedules and routes.

Smart waste collection solutions allow haulers to service receptacles only when needed, reducing operating costs and optimizing routes, to save on fuel and time. By switching to a flexible collection schedule, waste collection companies stand to save up to 28 percent on operating costs alone. It's no wonder the smart collection technology is anticipated to become a $223.6 billion market by 2025.

Smart waste collection solutions work by employing sensors to measure receptacles' fill-level, temperature, tilt and weight. When a bin becomes full, the company receives an alert and it is added to an upcoming route - meaning that, instead of servicing every customer and emptying dozens if not hundreds of half-empty bins, companies only drive to sites where bins are full.

Key Benefits

1. Increase operational efficiency by optimizing collection routes - reducing fuel and labor costs.
2. Reduce costs associated with waste collection and pickup for retail locations.
3. Eliminates retailers' concerns about overfilling waste receptacles and associated waste management fees.