VELIS
REAL ESTATE TECH

IoT Sensors in Real Estate: 18 Practical Examples and Use Cases

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IoT Revolution

The Internet of Things, or IoT as it is commonly known, refers to a network of interconnected devices that can collect and transmit data with no need for human intervention over a wireless network. It is a concept where interconnected items can collect, exchange, and process data directly or indirectly via the web.

It is no secret that the Internet of Things has revolutionized the real estate sector. The technology has allowed businesses to reduce building costs significantly. Moreover, it enables real estate companies to build greater relationships with tenants and generate bigger revenue - goals we are all shooting for!

THROUGHOUT THIS EBOOK, WE WILL PRESENT YOU WITH EIGHTEEN EXAMPLES OF IOT-BASED REAL ESTATE APPLICATIONS DIVIDED INTO FIVE CATEGORIES:

1. Sanitary Installations
2. Preventive Systems
3. HVAC Systems
4. Warehouse Equipment
5. Commercial Real Estate and ESG Reporting

Stand-alone IoT sensors are not fully valuable to customers, even though they can track and collect real-time data. One of the key advantages of CAFM/CMMS systems like Singu FM is that the software reflects the building or building portfolio structure.

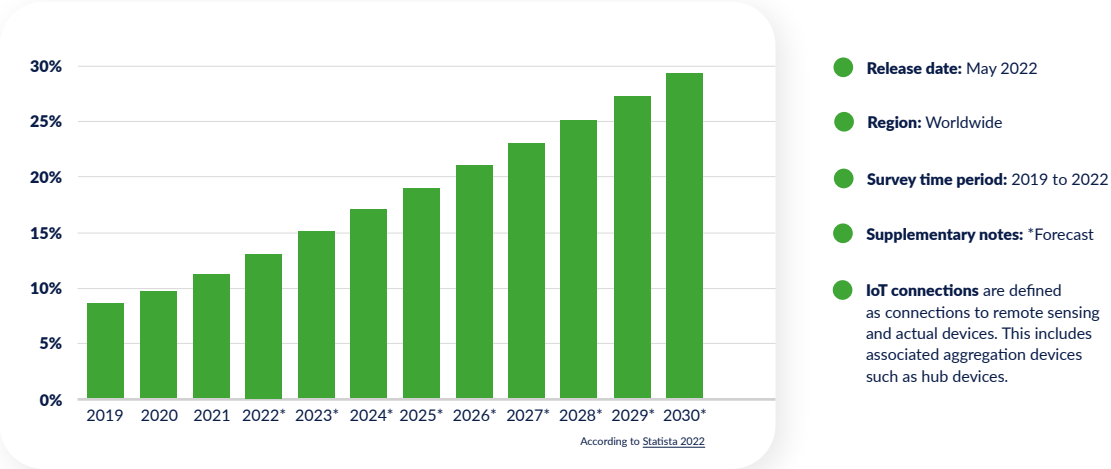
Integrated with IoT sensors, the software offers multiple valuable features, such as dedicated user privileges, triggers, and alarms. To make it even more useful, it also relates to other modules, such as reactive maintenance or planned and preventative maintenance. The only way to provide real value to managers and building teams is by combining IoT data with this type of software. We have it down to a science!

We hope this eBook will help you discover the full potential of these powerful sensors integrated with **Singu FM - facility and building maintenance management software.**

1. Benefits of IoT

According to Statista, these impressive statistics demonstrate that the number of IoT-connected devices will grow in billions from 2019 to 2030.

NUMBER OF INTERNET OF THINGS (IOT) CONNECTED DEVICES WORLDWIDE FROM 2019 TO 2021, WITH FORECASTS FROM 2022 TO 2030 (IN BILLIONS)



Based on Deloitte Research, "Using digital and analytics to revolutionize tenant experience, tenant experience is of utmost importance to **75%** of commercial real estate firms. Using IoT sensors and artificial intelligence are among the most influential factors affecting tenant preferences (**52%**)."

Fortune Business Insights predicts a **26%** annual increase in the global IoT market by 2029, which will reach almost **$2.5 trillion**.

The data confirms that IoT technology will have a significant impact on almost every aspect of human life in the near future. Everyone will benefit from these advances.

Let's review the key reasons implementing IoT in real estate is a wise decision.

BIG DATA COLLECTION AND ANALYSIS CAN BE AUTOMATED AND DIGITIZED

The Internet of Things can manage equipment. Sensors transmit information about the status of a device automatically. In addition, all parties can access the data immediately in digital form. By automating the data collection process, building services save time and money across the board. Normally, they would need to spend a few hours working on what they would have to do manually. With the help of many IoT sensors, it is possible to collect a large amount of data that can streamline building operations and make better decisions more efficiently.

INCREASE SERVICE EFFECTIVENESS AND FIRST-TIME FIX RATES

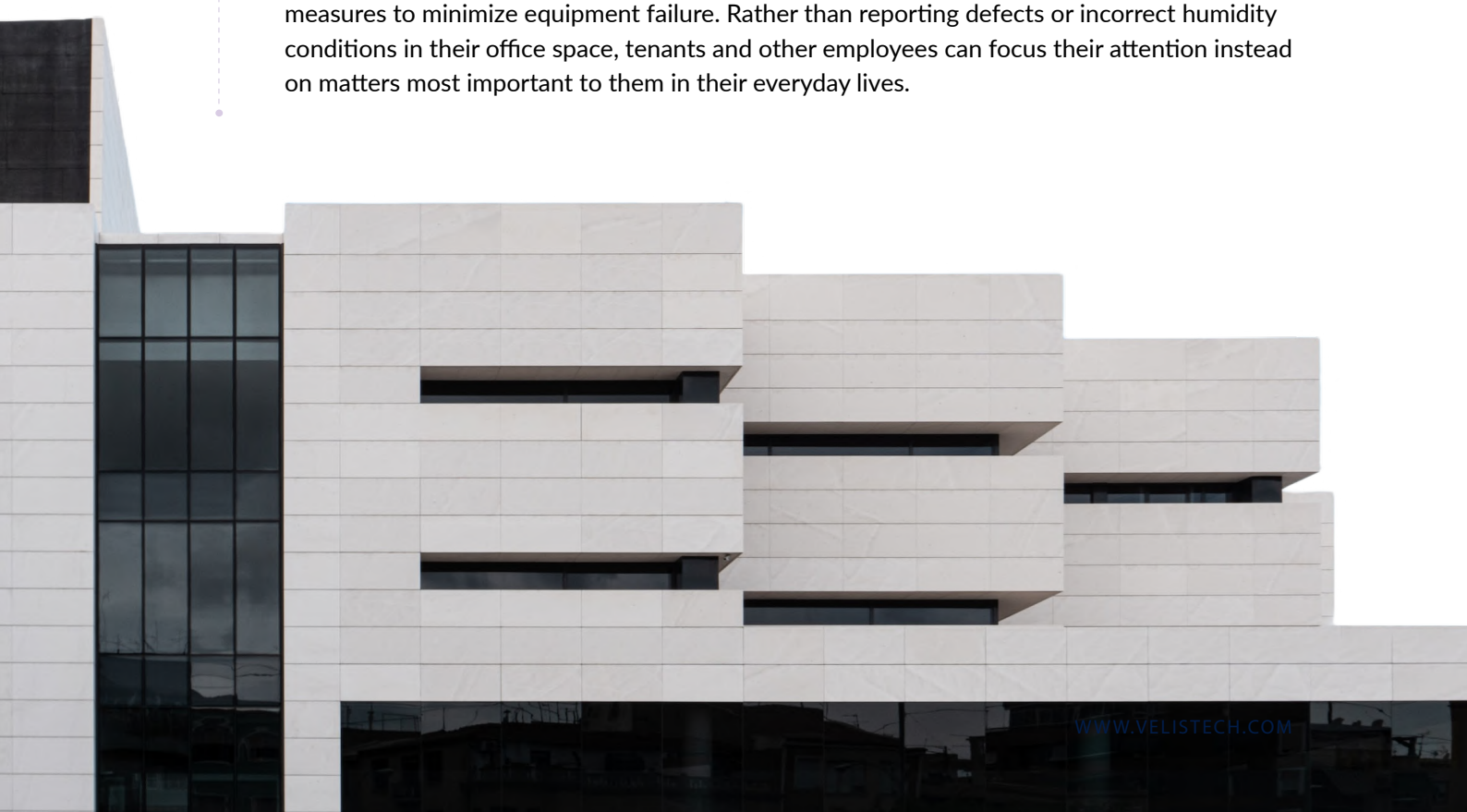
Using the sensors and monitoring their condition continuously, we have a much better understanding of the equipment's operation, so technicians can solve problems even before they occur. A network-connected piece of equipment can be set up to generate alarm signals if they exceed certain parameters. In addition to maintenance history data, technicians can also access customer information, warranty details, and other information with the right software, saving valuable downtime for the customers.

IMPLEMENTING PREVENTATIVE MAINTENANCE TO REDUCE UPKEEP COSTS

Because of multiple IoT sensors, service technicians can gain a better understanding of how the assets work in real-time, enhancing availability and extending failure-free operations because continuous monitoring allows service work to become more proactive than reactive, ensuring technicians can respond to alarms before hardware failures occur, ultimately saving everyone time and money.

ENHANCING TENANT AND BUILDING USER WELL-BEING

With various sensors and automatic data transfers, we can monitor and adjust parameters like room temperature, availability of conference rooms, and the need to add toilet hygiene measures to minimize equipment failure. Rather than reporting defects or incorrect humidity conditions in their office space, tenants and other employees can focus their attention instead on matters most important to them in their everyday lives.

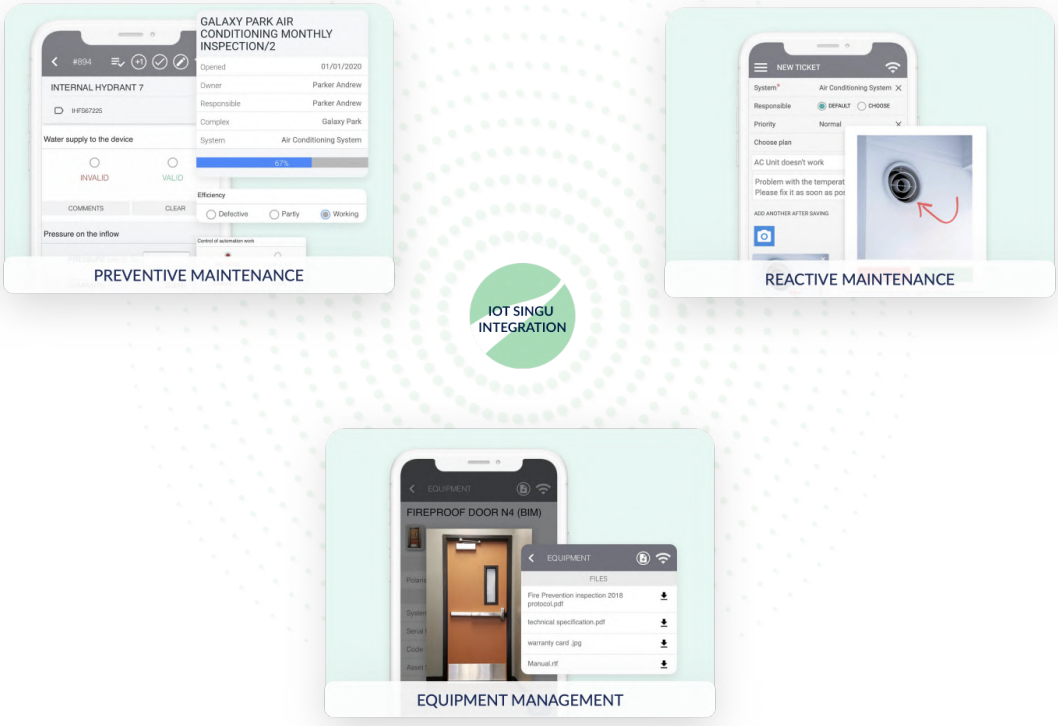


2. Which Singu FM Modules are Powered by IoT Sensors?

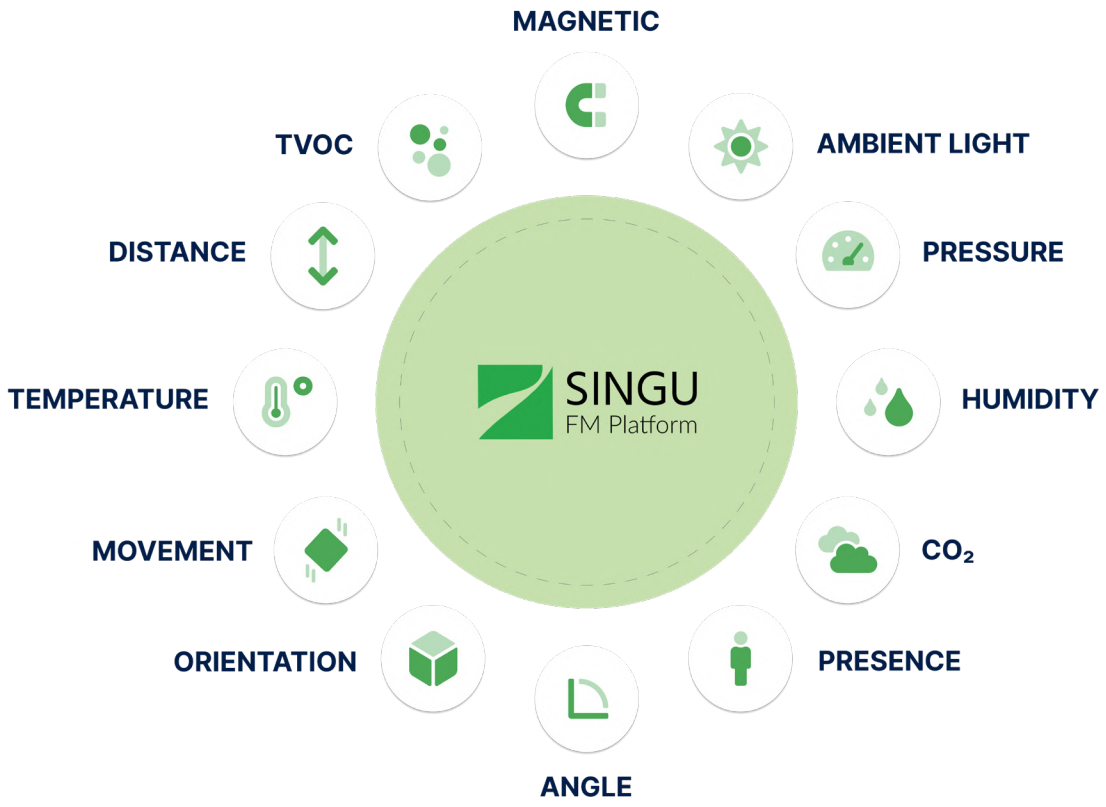
Before we discuss specific examples of IoT usage, let's highlight some major modules that can leverage IoT technology. Integrating IoT sensors into the Singu FM platform mainly focuses on three modules:

- Reactive Maintenance (Helpdesk)
- Preventative Maintenance
- Equipment Management

IoT sensors automate the process of adding tickets to the Helpdesk module by recording parameters. We can detect anomalies more quickly and support the maintenance process with the Planned and Preventive Maintenance modules (PPM). It is easy to add the IoT sensor to the Singu application and map it within the Equipment Management module.

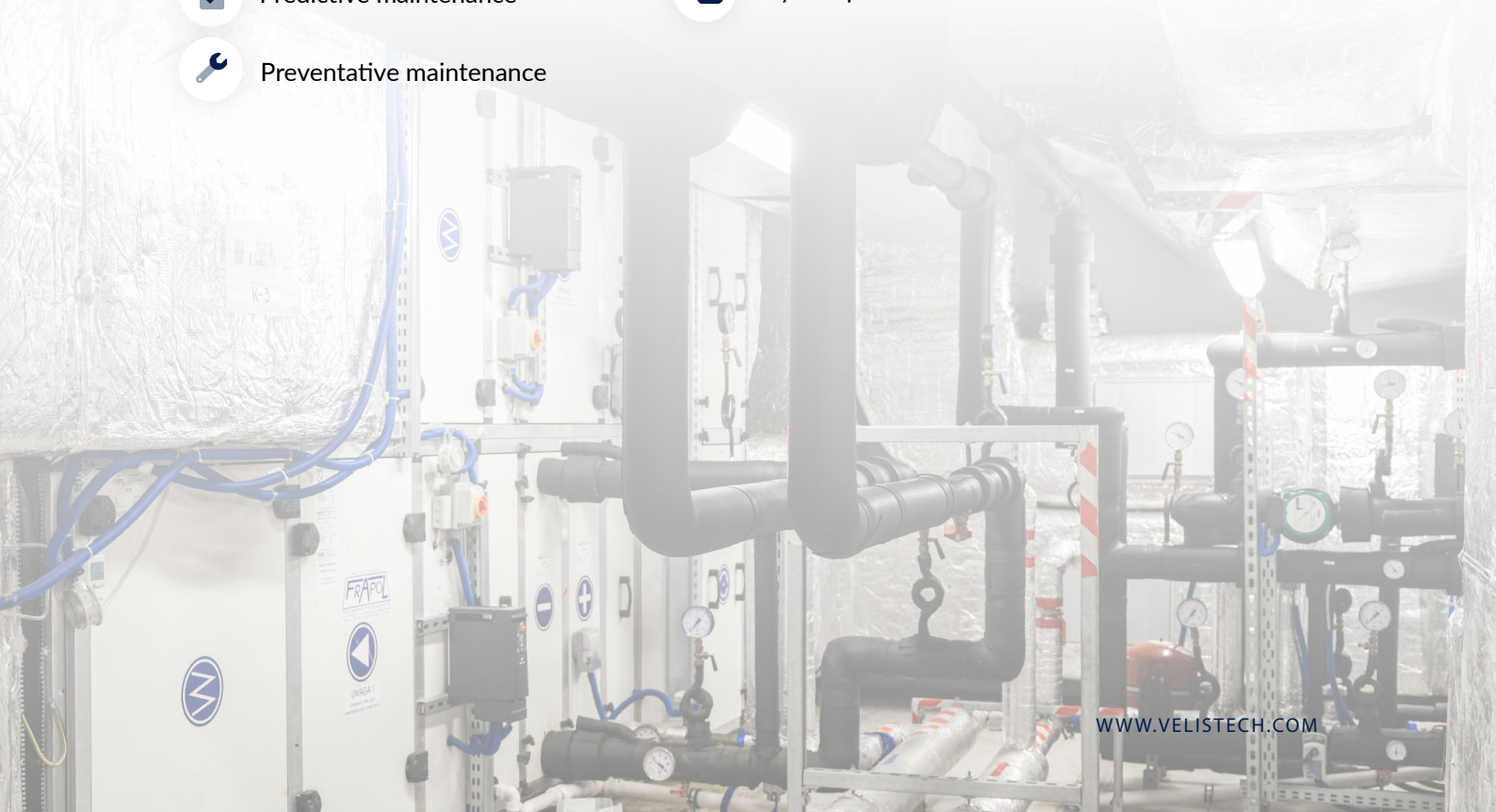


Through the integration of IoT sensors into the Singu FM app, it is possible to constantly monitor equipment performance, allowing us to spot anomalies quickly. When extreme values are exceeded, a ticket is automatically created in Singu. We can stay proactive and on top of things in real time!



SINGU FM CAN BE INTEGRATED WITH VARIOUS IOT SENSORS THAT MONITOR PARAMETERS, SUCH AS:

- Mechanical wear
- Predictive maintenance
- Preventative maintenance
- Cleaning on-demand
- Physical parameters - environmental conditions

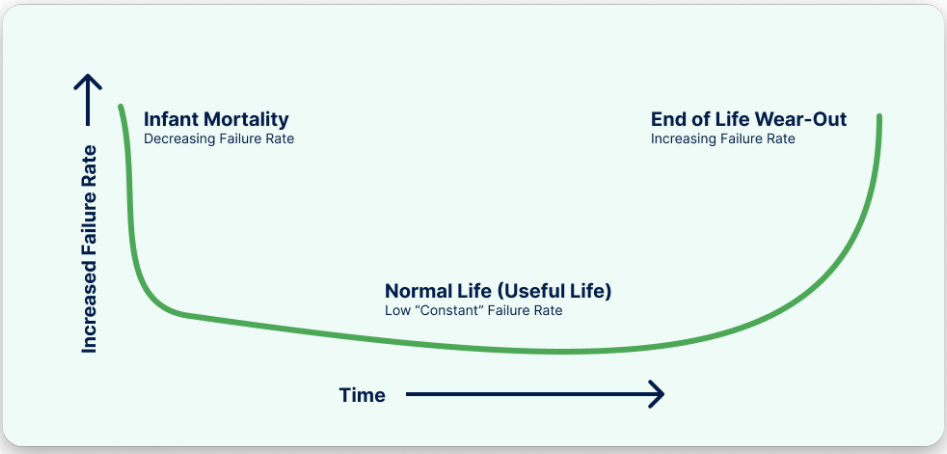


3. The Importance of Data

Data collection and analysis is a critical part of building management. IoT infrastructure generates an enormous volume of data from sensors installed in crucial assets.

Sensors around your building collect data automatically in real time. Singu FM can analyze it and trigger call-to-action tickets for inspecting any observed abnormal equipment behaviors.

THE BATHTUB CURVE - HYPOTHETICAL FAILURE RATE VERSUS TIME



The bathtub curve illustrates the relative failure rate of equipment over time. It is common that some units will fail relatively early (infant mortality failures), others will last until they wear out, and some will fail relatively late during a relatively long period described as "normal life."

A failure during infant mortality is highly undesirable, and it is always caused by defects or blunders: a defective material, an incorrect design, an incorrect assembly, etc. There is no way to prevent wear and tear, whether caused by fatigue or material depletion like lubrication depletion in the bearings. Short-lived components limit the useful life of a product. It is the manufacturer's responsibility to ensure that all specified materials are adequate for the intended use of the product.

If the equipment begins to operate incorrectly earlier than expected by the manufacturer, it should be repaired immediately to extend its service life.

Vibration

Clearances
Bearing damage

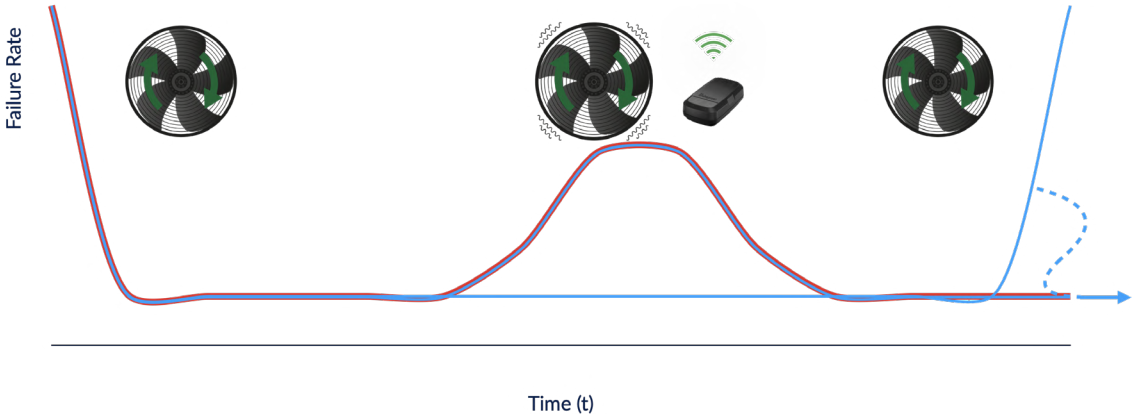
Temperature

Friction increase

Leaks

Damaged seals
Lubricating nodes leaks

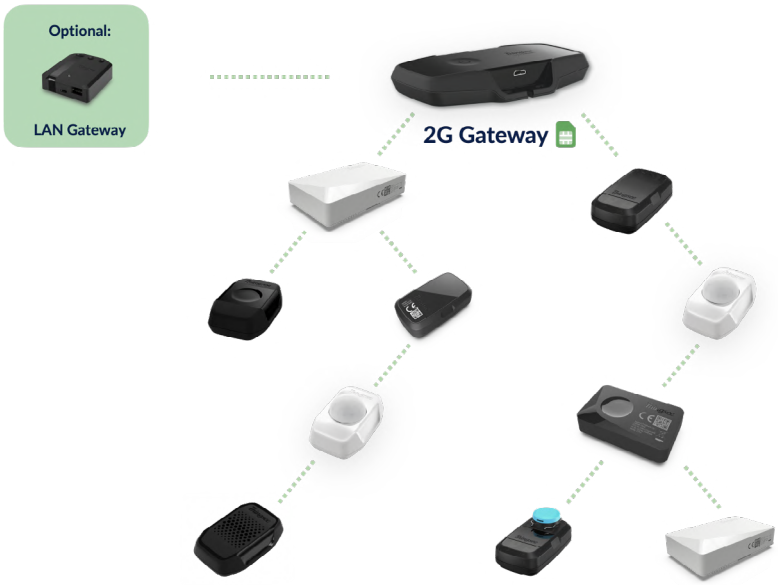
Mechanical equipment works by transmitting two types of motion between components: rotary motion (such as a fan) and linear motion (such as an actuator). Each movement in a machine or mechanism has certain characteristics and a corresponding range. If a machine or mechanism works incorrectly, physical phenomena such as increased vibration, machine limping, an increase in the device's temperature, or leakage of lubricating fluids are transmitted to the entire device.



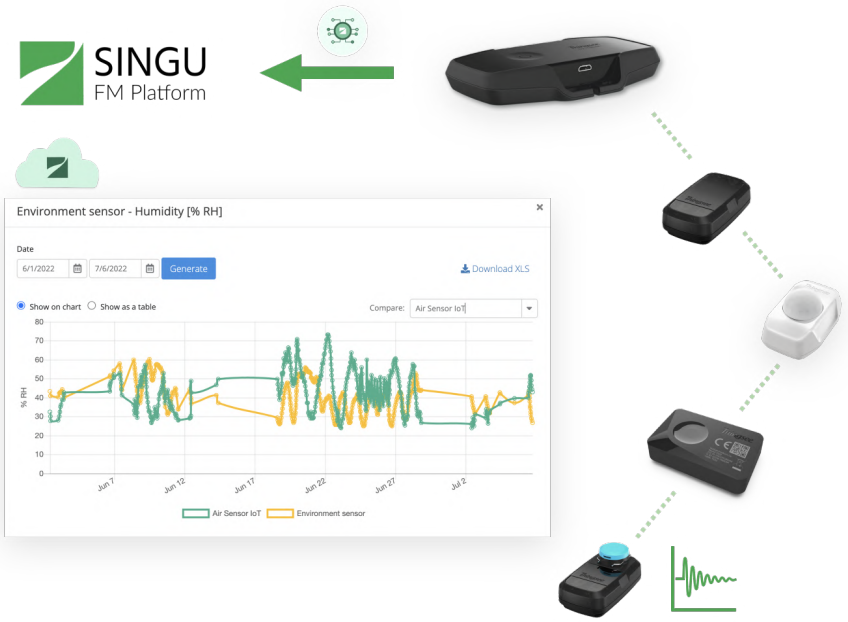
Using IoT sensors, we can determine if a piece of equipment's operating parameters are outside the intended range. As long as we recognize that this is happening before any signs indicate the device is breaking down, we can repair it and extend its lifespan. Vibration or overheating of the equipment can lead to irreversible damage that cannot be repaired if the equipment vibrates excessively or overheats. Being preemptive is crucial.

4. System Architecture

The system architecture is based on a network structure, where the main Application-Sensors relay is the Gateway. It connects wirelessly to successive sensors. Sensors among themselves also connect wirelessly, thus forming chains of IoT sensors, relaying data among themselves to the nearest Gateway.



The signal from the farthest sensor transmits to the Gateway indirectly through the other, closer sensors.

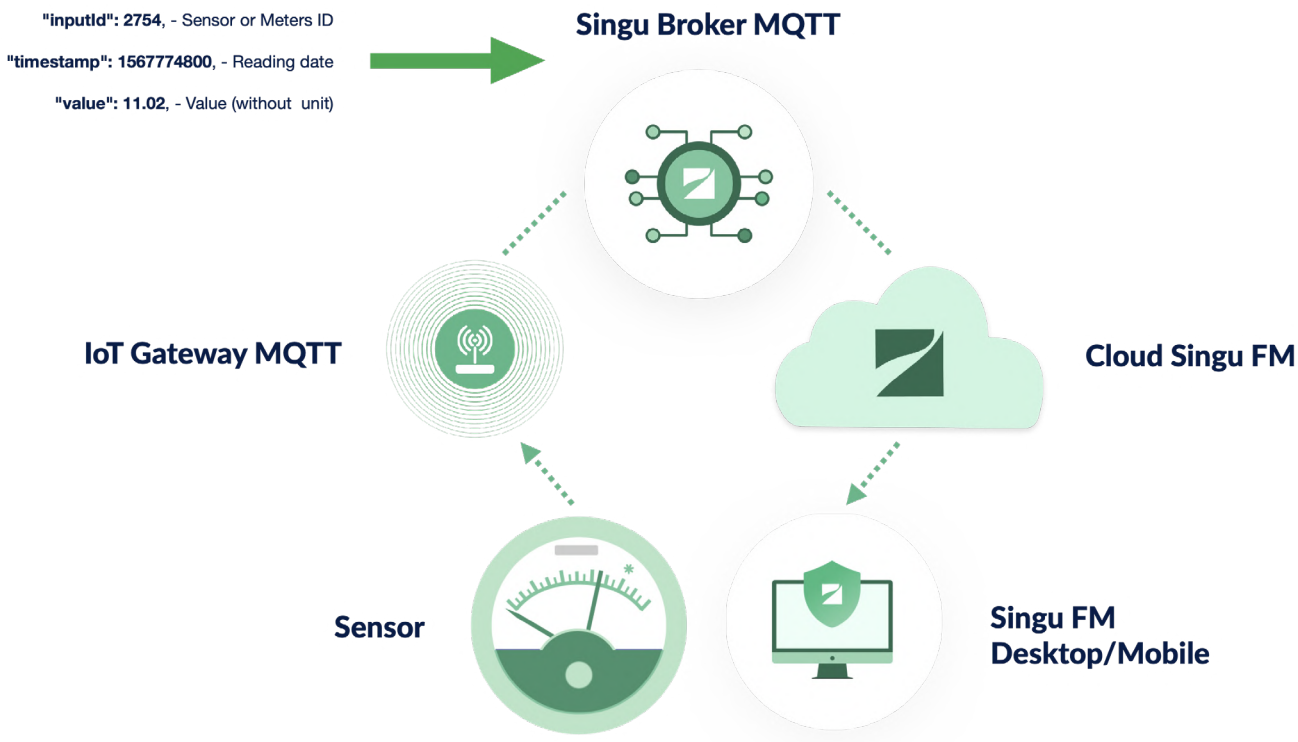


The Gateway retrieving data from the sensor transmits it via GSM network or, optionally, network (LAN) to the server (Broker) in the universal **MQTT format**. This allows the Singu application to easily collect data in the appropriate format.

MQTT stands for **Message Queuing Telemetry Transport** and is used for machine-to-machine communication. Singu FM uses this protocol for data transfer. Through the global standard, it is possible to connect many IoT sensors, smart meters, or equipment directly to Singu and read their operating parameters.

The MQTT protocol, which we use for Singu FM applications, provides customers with the opportunity to integrate other data into the system. Such an example would be an integrated BMS (Building Management System) with a meter reading. If the data in the specified form can be exported from the BMS in accordance with the MQTT protocol, then it will be possible to transfer the data to the Singu FM application, thus creating a batch of data, for example, for the ESG report. This is an extremely useful feature.

COMMUNICATION SCHEME OF IOT DEVICES

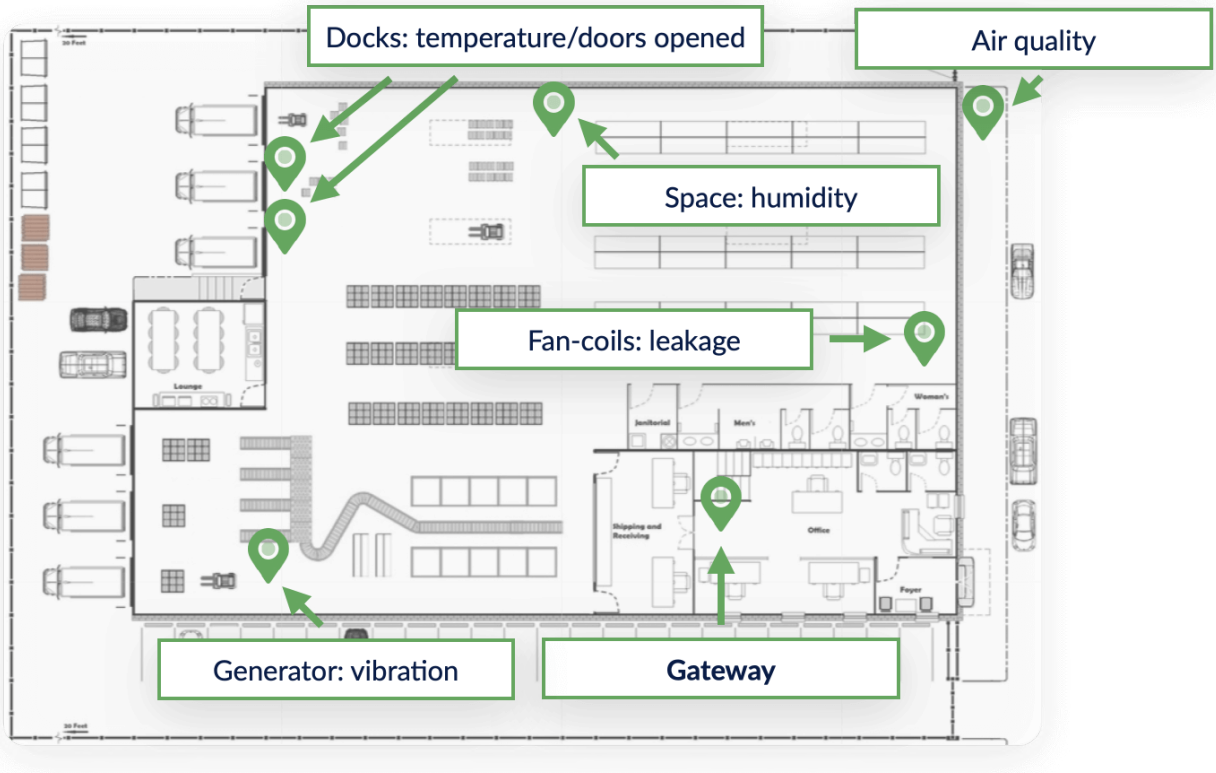


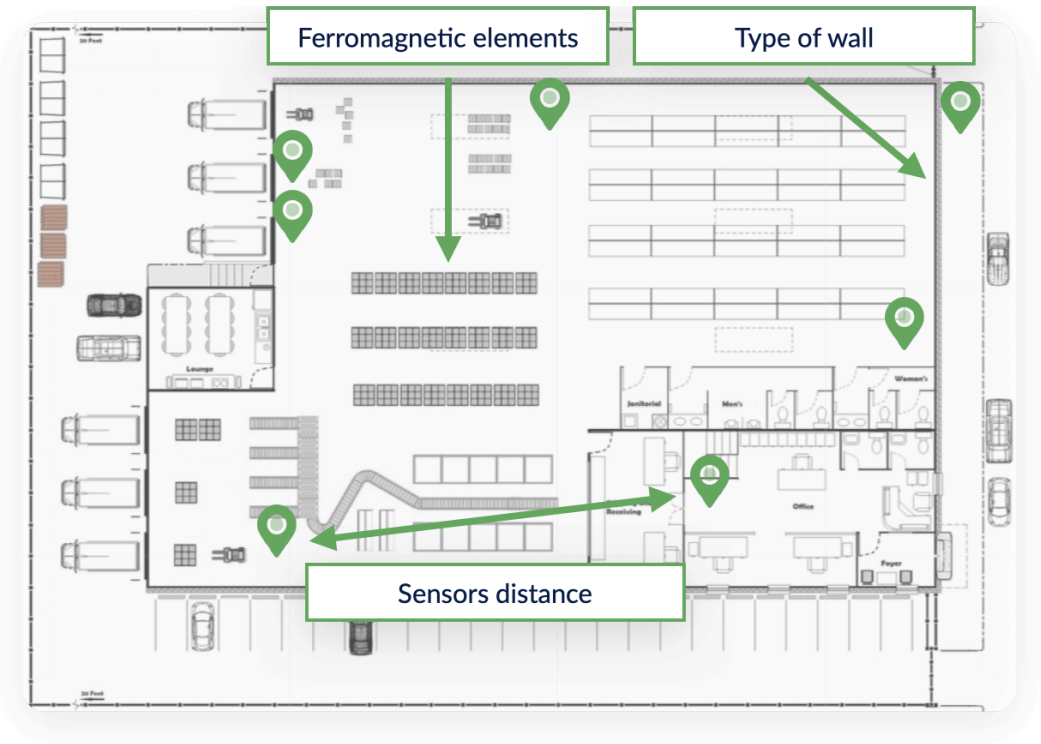
5. IoT Sensors Deployment

The location of IoT sensors and gateways should be carefully considered when deploying IoT sensors. When determining the equipment on which IoT sensors will be installed, it is necessary to determine the distance between them and keep in mind additional elements that could interfere with signal transmission, which could be significant.

Factors affecting the lack of signal between sensors or between the connection between the sensor and the gateway are:

- The thickness and wall layout
- The type of walls (wall reinforcement)
- The overall distance between sensors
- Ferromagnetic elements causing interference with signal transmission



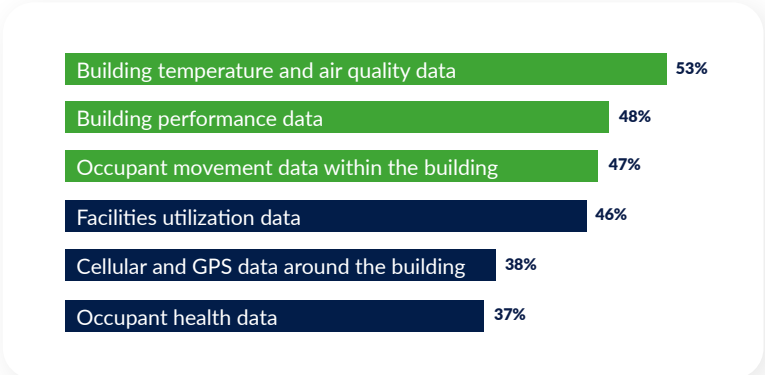


6. Examples of IoT Sensors Usage

According to Deloitte's report, among the most common types of data collected by IoT Sensors are building temperature and air quality, building performance, and occupant movement data.

It is time to put theory into practice. This part of the eBook will show how different types of IoT sensors can benefit across various industries. The following eighteen examples and use cases will help you better understand how specific sensors can benefit your real estate.

WHICH OF THE FOLLOWING TYPES OF IOT SENSOR DATA ARE YOU CURRENTLY USING OR DO YOU PLAN TO USE?*



*According to Deloitte's report.

6.1. Sanitary Installations

Sanitary installations are one of the main areas where IoT integration with the PropTech solution can be beneficial. Generally, sanitary installations include everything inside a building such as pipes, tubes, water circuits, and wastewater collection systems.

EXAMPLE 1 - CENTRAL HEADING NODE (VIBRATION AND LEAKAGE SENSORS)

Pumps are the main equipment related to central heating nodes and are characterized by rotary motion. A non-working device will experience increased vibration and leakage. Sensors that monitor vibration and leakage are the most useful in this case.

Measurement: **Vibration**
Pump vibration monitoring

Measurement: **Leakage**
Fluid leaks detection

EXAMPLE 2 - SANITARY MEDIA: BOILER ROOMS, PUMPING STATIONS (ANGLE SENSORS)

Handle valves are the standard valves used for gas installations in Europe. With a special sensor, it is possible to measure the position of the valve to determine the angle of the opening.

Measurement: **Angle**
Valve opening monitoring

EXAMPLE 3 - LEAKAGE OF SANITARY INSTALLATIONS (LEAKAGE SENSORS)

Sanitary installations have many expansion and buffer tanks in the piping lines. The leakage of such equipment can flood other equipment including electrical devices, posing an extreme danger.

Usually expansion tanks are high up, while tenants' common areas are beneath them. In the case of a leak, the lobby and reception can get flooded. These sensors are invaluable.

Expansion tanks

Buffer tanks

6.2. Preventive Systems

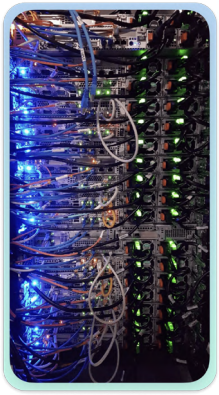
Preventive Systems are installed in every building to ensure the safety and security of workers and the building itself. Thus, it is extremely important to ensure that all equipment of this type is functioning properly. You're right - IoT can help!

EXAMPLE 4 - AUDIBLE WARNING SYSTEMS AND SERVER ROOMS (MULTIPLE SENSORS)

Another premises where key equipment is located, and which should also be monitored with IoT sensors, are special rooms with audible warning systems and server rooms. Critical infrastructure equipment must operate under appropriate conditions. The voice alarm system generates a great deal of heat, so it's necessary to maintain a low room temperature (air conditioning). If the air conditioner stops working, the equipment may overheat and shut down, causing severe damage. In addition, they cannot be flooded as they are electrical devices. We can install multiple sensors in this case in order to monitor adequate ambient temperature and humidity to protect against flooding or vibration sensors.

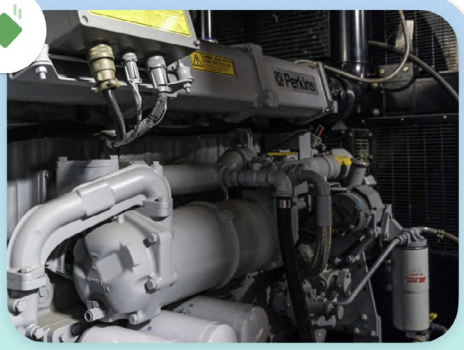
- Adequate ambient temperature
- Protection against flooding
- Specified room humidity





EXAMPLE 5 - POWER GENERATING UNIT (VIBRATION SENSORS)

Whenever the building's backup generator is running, it means the primary power source is unavailable for some reason. Vibration sensors will be helpful in this case. Vibrations above a certain level may show that the weekly inspection of the unit hasn't taken place or that the equipment isn't working correctly - things you need to know!



Measurement: **Vibration**
Operation monitored by vibration sensors
Application: maintenance, engine start/stop

EXAMPLE 6 - HYDRAULIC FLUID LEAKAGE ALARMS (LEAKAGE SENSORS)

It is difficult to see all the components of power generators because of their size. Equipment leakage sensors can help detect potential leaks, for example, hydraulic fluid leakage.

Measurement: **Leakage**
Hydraulic fluid leakage alarms

EXAMPLE 7 - SMOKE EXHAUST & EMERGENCY FLAPS (DISTANCE & POSITION SENSORS)

By installing IoT sensors that monitor the change position when the flap is opened, we can identify whether the flaps were opened in an emergency, as part of an inspection, or because there was an emergency in the building, in order to keep you updated.

Measurement: **Distance**

Measurement: **Position**

6.3. HVAC Systems

HVAC means heating, ventilation, and air conditioning. The HVAC systems cover the heating, cooling, and moving of air between indoor and outdoor areas. Installation and maintenance of HVAC systems are priorities for tenants' convenience. In addition to high installation costs, these systems are also costly to operate, which makes it imperative to use IoT sensors to monitor their performance.

EXAMPLE 8 - FAN COILS (LEAKAGE SENSORS)

If the pump does not drain water from the fan coil, it may flood the equipment as well as electrical and integrated components. A water leak may indicate a fault in the system or a broken drain pump. This is another example of the use of a leakage-type IoT sensor. Using these sensors could prevent a disaster.

Measurement: **Leakage**
Water leak may indicate a fault in the system or a broken drain pump

EXAMPLE 9 - CHILLERS & DETECTION OF INCREASED VIBRATION (VIBRATION SENSORS)

A heat exchanger (chiller) is a large segment often mounted on a building's roof. They are mounted on racks that carry loads. Vibrations increase the load on the racks over time, which may indicate increased operation of the equipment or a possible defect.

Heat exchanger
Measurement: **Vibration**

Compressors
Measurement: **Vibration**

EXAMPLE 10 - ICED WATER GENERATORS (VIBRATION SENSORS)

The iced-water generator illustrated in the picture is characterized by using two pumps that operate in cycles and as a backup unit. By detecting vibrations generated by the unit's operation, you can determine which pump is working, when, and in what manner.

Generators
Measurement: **Vibration**

Pumps
Measurement: **Vibration**

6.4. Warehouse Equipment

The next area where IoT sensors can be applied is in the warehouse sector.

EXAMPLE 11 - SPRINKLER SYSTEMS (VIBRATION AND LEAKAGE SENSORS)

The sprinkler system operates at critical moments when there is a risk of fire. If the alarm system detects one, the installation activates to eliminate the danger. The operation of a sprinkler system detected by vibration or flooding IoT sensors creates a record that the installation has been activated, informing additionally in which segment of the hall the installation is operating. The vibration and leakage sensors that activate the sprinkler systems can save valuable property and even lives.

Measurement: **Vibration energy and leakage**

Monitoring system operation via leak and vibration detection in the sprinkler system

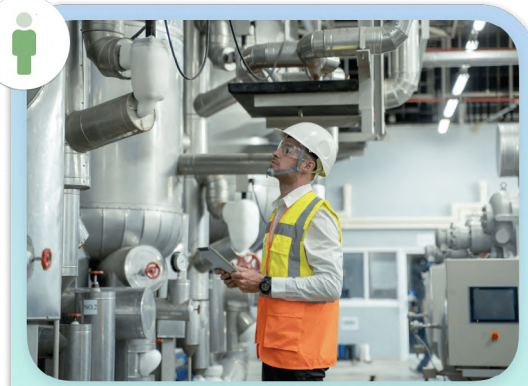
EXAMPLE 12 - ADJUSTING BRIGHTNESS CONTROL ONSITE (AMBIENT LIGHT SENSORS)

Using a sensor that measures ambient light, you can record and determine why and how much electricity is required. As a result, it may generate additional savings.

Measurement: **Ambient light**
Brightness/lighting control on-site

EXAMPLE 13 - PEOPLE PRESENCE CONTROL (PRESENCE SENSORS)

There are some areas within facilities to which not every individual should have access, while other parts of the premises should be protected constantly (for example, server rooms and archives). By using a presence detection IoT sensor integrated with the FM system, it is possible to quickly receive a notification if someone is in the room. It simplifies security and keeps a record of when exactly the door was opened, therefore heightening your facility's security.



Measurement: **Presence**
People presence control

EXAMPLE 14 - MONITORING TEMPERATURE (TEMPERATURE SENSORS)

The Labor Code clearly defines the minimum and maximum temperature in the facility at which an employee can work. It can be especially crucial for those employees that work in machinery areas. This is because large areas can heat up quickly in summer and become difficult to heat in winter, so proactive temperature monitoring is essential.

Measurement: **Temperature**
Monitoring temperature

EXAMPLE 15 - LOADING DOCK OPENING (DISTANCE SENSORS)

In warehouse halls, loading docks are sensitive to temperature changes. This poses a significant risk of cold air getting in through them and reducing the facility's optimal temperature. Monitoring open/closed loading docks allows us to determine whether heat leaves our areas primarily through the loading docks, or if there are other sources of heat loss causing great financial costs.

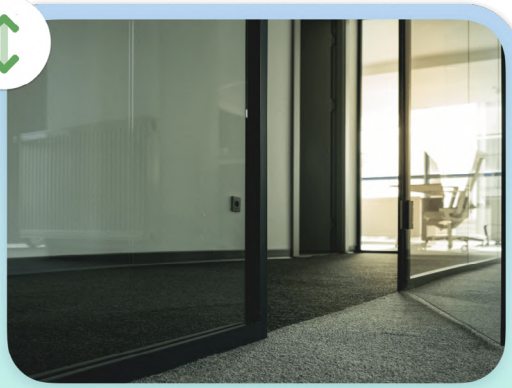
Measurement: **Distance**
Dock doors opening

6.5. Commercial Real Estate and ESG Reporting

Finally, IoT sensors can also apply to commercial real estate, such as office buildings. IoT sensors offer a great deal of advantage for non-financial reporting. A combination of IoT sensors with FM software that supports ESG reporting is a win-win situation for everyone!

EXAMPLE 16 - MONITORING OF DOORS & WINDOWS OPENING/CLOSING (DISTANCE SENSORS)

Without an integrated Building Management System or Facility Management Software in your property, you cannot fully control whether the windows at night, during storms, or hot weather are closed. In this case, distance IoT sensors can alert staff when doors and windows are not closed after tenants have finished work.

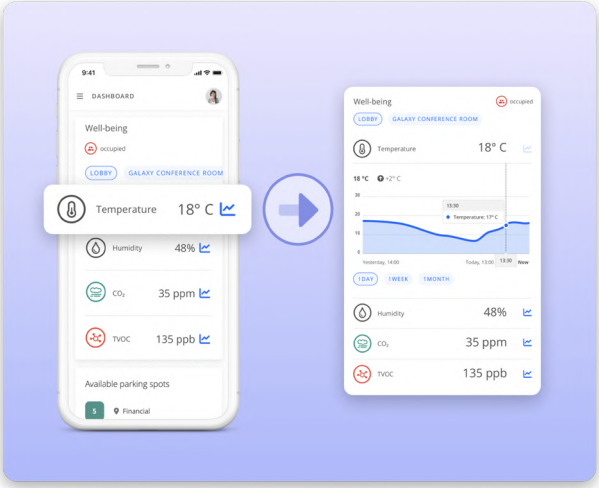


Measurement: **Distance**
Doors and windows opened/closed

EXAMPLE 17 - CRUCIAL PARAMETERS FOR TENANTS

A special software for occupiers, for example, Singu Tenant App, can provide tenants with vital information about the environmental parameters of the spaces they rent. The IoT sensors allow tenants to compare, for instance, available conference rooms in real time and book the right meeting room based on the temperature or sunlight.

- Humidity
- Ambient light
- Air quality TVOC
- Air quality CO2
- Adequate ambient temperature

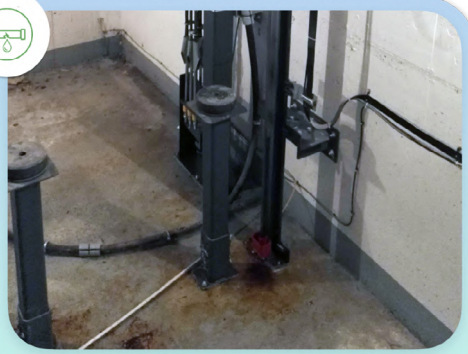


EXAMPLE 18 - LEAKAGE DETECTION IN LIFTS (LEAKAGE SENSORS)

Inherent in commercial buildings are elevators. Hydraulic elevators are designed for given types of building. However, they are characterized by a limited ability to operate under certain conditions. If the temperature in the engine room of the lift (a separate room usually placed near the first floor, basement, or outside the building) is too low, then the lift will be disabled.

However, hydraulic and electric cranes often leak or flood, which is a very common problem. The location of lift pits is hidden, making it difficult to verify if flooding is occurring. In this case, the only solution is to install a leakage IoT sensor that detects fluid leaks.

Measurement: **Ambient temperature**
Temperature thresholds for hydraulic lift operation

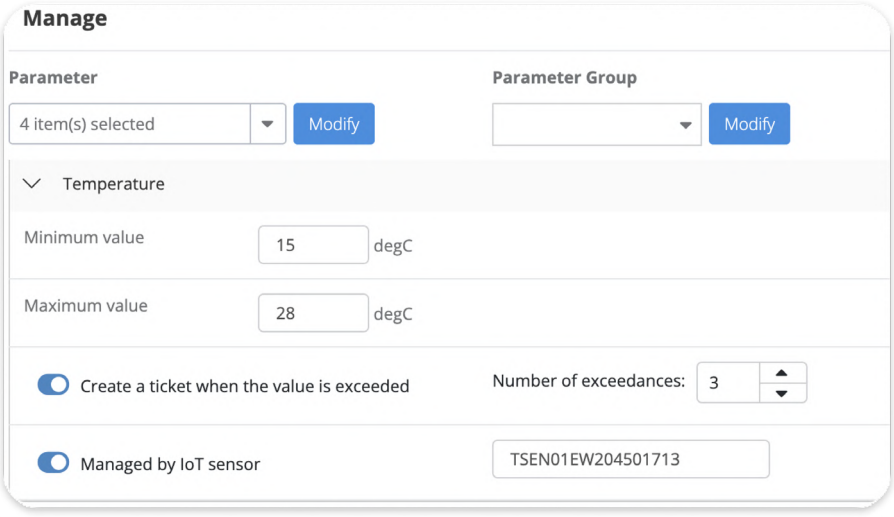


Measurement: **Leakage**
Hydraulic fluid/water leakage detection to immobilize lifts

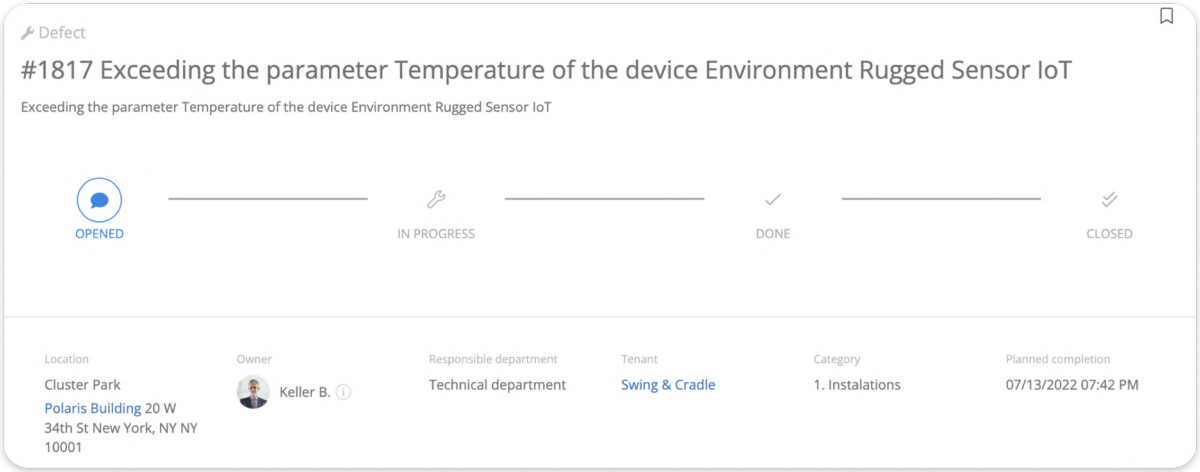
7. How IoT Sensors Integrated with Singu FM Work

We can outline seven steps to explain how IoT sensors integrated with Singu FM work—from installing them, setting minimum and maximum values, to recording parameter readings and then responding appropriately in case of created tickets whenever the set norms are exceeded.

For each measured IoT parameter, you can set maximum and minimum values. If any of the values are exceeded, the Reactive Maintenance module creates an automatic ticket after a defined number of breaches.



The created ticket will be connected to the equipment (a sensor). Access to this ticket will be granted to persons responsible, for example, to the Facility Management department.



What's more, it is also possible for the tenant to receive a personalized email and a notification that the sensor has exceeded a safe parameter value.

8. Key Benefits of Singu FM Integration with IoT Sensors - Areas Supported by IoT Sensors

8.1. Preventive And Predictive Maintenance - Failure Prevention by Early Anomaly Detection

Cyclic inspections are just regular checks to make sure the equipment is functioning properly. Unfortunately, we are not aware of what happens to the equipment between inspections during its regular operation. By integrating IoT sensors with Singu FM, we can continuously collect and monitor equipment operation data, which allows us to perform real-time analysis based on actual measurements. Therefore, we stay constantly informed.

8.2. Energy Savings - Processing Data and Identifying Energy Waste

We can also use IOT sensors to identify areas where we can continuously improve results in terms of electricity consumption and heat loss. In the event a tenant does not turn off the air conditioning when leaving the office for the weekend, it will generate an alert to the maintenance staff, who will be able to enter the room and turn off the AC, which the tenant will greatly appreciate.

8.3. Remote Meter Readings - Monitoring Parameters from Anywhere

Thanks to permanent access to the cloud, we can check the monitored parameter from anywhere and be informed about every anomaly. Remote meter readings generate some key benefits:

- **Quick access to current readings of different utilities (e.g., energy, water, gas)**
- **Easier control and data analysis; more efficient property management**
- **Key technological requirement for achieving high ESG certification score**

9. Summary

The big advantage of using the Singu platform and integrating IoT sensors is that it provides an integrated solution. Because of the universal standards applied, you do not have to use dozens of applications or order a custom-made BMS system. By choosing Singu FM integrated with IoT sensors, Tenant App, ESG reporting, and other fully functional modules, you can access data across different departments and systems for a holistic view of your real estate operations - a comprehensive user-friendly solution. Our software does the heavy lifting for you!

About

VELIS REAL ESTATE TECH

Velis Real Estate Tech creates technology for buildings that transforms the way you operate in them. We do this by automating the management of commercial and industrial properties. All under one umbrella brand - Singu, combining both our own designed software and hardware. Our solutions, provided for property and facility managers as well as owners and tenants, are based on the newest technology, including Internet of Things sensors.

The Singu brand offers three main products – Singu Facility Management, Singu Guestbook and Singu Smart Security Desk. Each product is battle-tested, engineered in house and developed closely with our customers. By following our core values, the technology we've developed has drawn in talented real estate managers, disrupted the industry and has been implemented in over 30 countries across five continents. Thanks to advanced technology, we create frontline solutions supporting companies in fulfilling Industry 4.0 scenarios.

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