

# Sustainably Powering Up The Future of Automated Temperature Tracking For The Food & Beverage Industry

Compliance & operational efficiency through the use of IoT to maintain standards and reduce waste.

In partnership with  
Foresolutions.



# How to comply with the requirement to monitor the temperature of food and beverage refrigerators whilst minimising environmental impact

## Introduction

IoT sensors are becoming ubiquitous, they can be used to monitor the location of goods, people moving through transport hubs, the performance of machinery and manufacturing equipment, enable Smart offices and Smart homes; the potential applications and use cases appear endless. The value this information delivers helps improve efficiency, reduce costs and deliver convenience for both the public and businesses alike.

There is an ever-growing range of sensors available and the functionality of smart systems on offer is expanding all the time. The vast majority of these sensors are powered by primary batteries and this presents two challenges; what happens when the battery runs out of charge and the sensor ceases to function and transmit data and what is the environmental impact of the billions of batteries that will be required to power all of these sensors in a connected IoT world?

Temperature is a physical condition we can all relate to as it influences the clothes we wear and many aspects of our life. It is also an important parameter when it comes to controlling the environment in a building (hence having air conditioning in hot climates and central heating in colder climates), the performance of machinery, the lifetime of our food; to name but a few.

## A study of temperature sensors

All of our readers will have come across a temperature sensor at some time in their life, the simple mercury or alcohol thermometer is the most basic of temperature sensors and is still widely used today as it is simple and provides an instantaneous reading. However, there are many other technologies used to measure temperature including; thermistors, thermocouples, infrared sensors, fibre optic sensors, resistive temperature detectors, bimetallic temperature sensor and resistance temperature detectors (RTDs). Each of these different technologies have pro's and con's and have been developed for measuring temperature in

specific environments and conditions to the required accuracy and precision. For application in the world of IoT there is an added requirement, that being the ability to wirelessly transmit the temperature reading to a smart system so that an appropriate action can be taken as a consequence of the specific temperature.

If the device can both communicate and be powered wirelessly this offers the additional benefit of ease of installation and the resulting reduction in associated costs.



## Let us look at one use case:

**Monitoring of the temperature in the open food refrigerators that are found in supermarkets and food outlets.**

Knowing such refrigerators are at the correct temperature is important to retain the quality of the produce on sale and also

to comply with regulations. Up until now, the retailers ensured they were compliant with the Food Safety Regulations by having one of their staff take a physical temperature measurement of each food and beverage refrigerator at regular intervals. This works fine, provided that the protocols and procedures are followed, however, in busy periods when serving a growing queue of customers there is always a risk that the temperature monitoring task is the one that gets forgotten or delayed.

**Wouldn't it be more efficient and reliable if the temperature was monitored automatically, the temperature stored on a computer and if out of specification an alarm raised?**

**This solution is now possible.**

# Use Case Exploration: High Street Food & Beverage Retail: National Chain & Local Independent Outlet

## Automated temperature tracking in action

The market for convenience foods, coffee shops and food on the move is growing, and we can all see the evidence of this on our high streets. Have you ever considered how such stores ensure the foods they sell are stored and presented, in fact to be compliant with the food standards regulations salad, fruit and vegetables must be chilled at +5° C to +8° C and dairy and delicatessen, snacks such as sandwiches at 0° C to +5°C.

Is there a better system for coffee shops and fast food outlets to ensure they are compliant with the regulations? This white paper explores the application of a battery free wireless temperature sensor.

## The National Coffee Chain Proof of Concept Case Study

The brief from the coffee chain was to evaluate the performance and reliability of an autonomous wireless temperature sensor system in a selected number of outlets. The solution included a temperature sensor with bluetooth connectivity to transmit the temperature readings every 1-2 seconds via a gateway to a computer which could both store the data and also send an alert if the temperature drifted out of specification. It was decided for ease of installation and to reduce ongoing maintenance requirements and cost of ownership, to use a sensor powered by the light in the fridge, thus delivering an environmentally friendly and sustainable alternative to batteries. A proof of concept was completed across 50 stores.

## The current situation: Manual fridge temperature checks throughout the day.

No real-time visibility | Food wastage as a result of late detection | Substantial staff hours to execute | Inefficiencies in refrigeration due to door openings for the checks | Delayed management information



# 1

### Live Temperature Tracking:

Sensors installed in coffee shop fridges transmitting readings every 1-2 seconds via Bluetooth gateways.

# 2

### Fully Hosted IoT Solution:

Data stored in Foresolutions' Microsoft IoT Azure environment.

# 3

### Store Level & HQ Control:

Custom dashboards for each store configured to send alerts should temperature veer outside compliant range.

# The application of wireless temperature sensors & associated benefits

## The outcome of the national coffee shop chain proof of concept

- Staff time now freed up to serve customers
- Temperature checks do not get missed during busy periods
- Store managers and central head office teams can now have peace of mind that they will be notified the instant any irregularities in temperature occur, therefore minimising any impact on spoiled food and associated wastage
- Now manual checks are no longer required, fridge doors do not need to be opened to perform the checks which was impacting the regulation of temperature as a result.
- Live dashboards can be used to get up to the minute management information without relying on multiple store updates

## 'Drift' Local Outlet

"We were looking to see how we could cut out time consuming manual checks and reduce food and energy wastage by using sensors to keep track of our fridge temperatures. The food and drinks industry is coming under increasing scrutiny from health and safety compliance procedures (and rightly so), and the time felt right to invest in technology to make us more responsive to fluctuations in temperature caused either by faulty equipment or staff not closing doors properly for example.

Food wastage costs us both from a financial angle, and of course no-one likes to be throwing away food with the sharp increase in food poverty across the country.

Another issue is that if fridges are running too cold we're also using excess electricity to run them – not great as we all strive to operate more sustainably. Foresolutions are an established expert in tracking and temperature monitoring and proposed a solution that uses temperature tracking sensors powered by indoor light harvesting. So not only did it tick our operational boxes to reduce food and energy wastage, but we're also not drawing on any more non-renewable energy sources to actually power the solution."



This paper has showcased the benefits of wireless temperature sensing in food and beverage refrigerators, but there are many more use cases where temperature must be controlled within limits, for example in manufacturing and processing industries where the temperature of machinery can be monitored for predictive maintenance and in agriculture to optimise growing conditions.

The Corona Virus pandemic has highlighted the importance of air quality in our homes, offices and public spaces. Ensuring good air quality is a challenge, but the first step is to be able to monitor the temperature, humidity and CO2 level. For more advanced understanding the concentration of airborne particles, pollen, VOCs

and other contaminants can deliver health benefits. IoT sensor systems are available that can measure and monitor these key constituents and thereby report on air quality to a Smart home or Smart building system to enable appropriate actions to be taken.

If there is a light source present, whether that be from indoor LED's or natural daylight, then light energy harvesting is a viable method for powering such sensors.

*You can read more about the different methods of energy harvesting and sustainability benefits in our white papers, [Breaking the Battery barrier](#) and [Powering Sustainable IoT](#).*

# Green Power + IoT Solution Integrators = Sustainable Operational Efficiencies

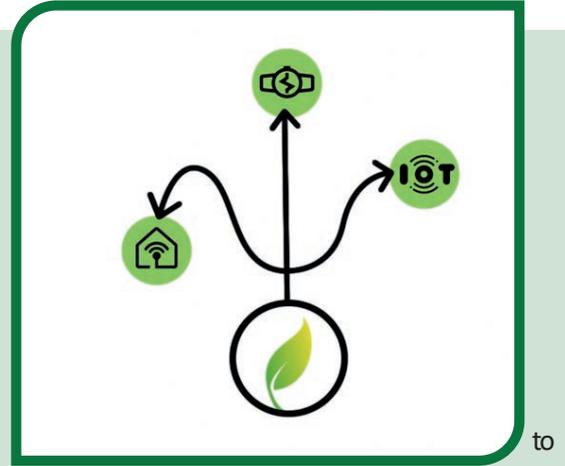
## Lightricity Photovoltaic (PV) technology

Our technology is the world's most efficient indoor PV technology (though it works outdoors too). It converts indoor light sources to energy with approximately 30% efficiency – a more than six-fold improvement on conventional PV, as validated by the UK's National Physical Laboratory.

A panel the size of your fingertip will power your IoT device forever. Even in extremely low indoor light. Our technology can be sealed in the device and operate at temperatures from -40 +200 degrees, opening possibilities to power devices not previously thought possible with indoor IoT.

We offer two solutions. For those designing new connected devices, our customisable PV panels can be integrated into any low-power IoT device as an alternative to batteries. For IoT systems integrators, we offer off-the-shelf, easy-to-integrate, PV-powered sensors for many common measurement and tracking applications.

[www.lightricity.co.uk](http://www.lightricity.co.uk) | [info@lightricity.co.uk](mailto:info@lightricity.co.uk)



## Impartial IoT Solutions

Foresolutions helps business operations professionals join the dots between people, processes and data to improve performance through the use of technology. By focusing on delivering a great experience, not just products and services, their vision is to make technology better for businesses and the people using it.

The information collected can be used to improve decision making, solve a business problem or optimise a process or an asset. IoT technology does this through measuring things in the physical world (often using sensors) and generating data that can be processed, interpreted and presented in a useful way. Businesses can benefit across a wide variety of areas from an IoT solution. From small businesses looking manage a single site right up to enterprise level, a solution can be designed to suit. Use cases include managing assets, condition monitoring, misuse of spaces, temperature monitoring and people counting.

## Working in Partnership with Lightricity

The pioneering technology of Lightricity perfectly aligns with our ambitions to help businesses embrace technology that has reduced impact on the environment. We can help establish proof of concept for ESG strategy and measurement with our quick start IoT Accelerator.



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