INFRARED LIGHT (IR) IN RETAIL

SAVING ENERGY AND TIME

Infrared light is a fast and energy-saving technology, with numerous applications in different industries – from communication to medicine to astronomy. This powerful technology is used in wireless digital labels.

What we think of as "light" is really electromagnetic waves that our eyes can see. Infrared as well as radio waves, x-rays and gamma rays are also all forms of electromagnetic waves. Infrared light works exactly like ordinary light except the human eye cannot perceive it since our eyes are capable of seeing only a very narrow region of the electromagnetic spectrum.

Using instruments to explore and use electromagnetic waves is one of the most powerful techniques available to science and industry. Infrared or IR portion of the spectrum is used for applications such as optical fiber-communication, active night vision and spectroscopy.

Communication by infrared light

In industrial communication applications, a narrow part of the infrared band is used. Infrared light uses less energy than visible light and a longer wavelength. There are many advantages: low energy capabilities and robust diffusion. Other important advantages are that the spectrum is not crowded and that its diffusion is local, ie does not penetrate walls.

It is called "near infrared light" with wavelengths of 700-1000 nanometer.

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Joseph Kahn, Professor Electrical Engineering at Stanford University, has studied the use of infrared light for high-speed, short-range wireless digital communication. He has compared the advantages and drawbacks of the IR media to those of radio and microwave media.

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Information transfer to digital labels

The "near IR technology" has been a key factor in the development of Electronic Shelf Label (ESL) systems. To make it work in a store, transmitters are installed in the ceiling. The transmitters transfer information to the digital labels by rapid flashes. Every label has a photo sensor that reacts to the signals and answers / acknowledges with a quick flash of light that the message has been received.

The transmitters in the ceiling can send out two types of messages:

○ **Broadcasts**, a general command that addresses all the labels. It can be a command to show stock levels. This information is updated daily and stored in every label and can be displayed on command or outside of store hours.

○ **Directed messages** for a specific label. This is possible because every label has a unique ID. The second the transmitters in the ceiling send data, all the labels react. If the message is for them, they wake up and receive the data, for example a price change. Otherwise they fall asleep again.

Fast and energy saving technology

A 100 W light bulb consumes as much energy as all ESLs and the communication in a hypermarket.

A major advantage with IR technology is its high speed and energy-efficiency. This is the biggest difference between infrared and radio. In active mode, an infrared transceiver consumes around 50 uA (microamps) compared to a radio transceiver which consumes around 10 mA (milliamps)—a difference of more than a 100 times. Since infrared light consumes very little energy it is possible to build a faster, more responsive system. The photo sensors in the labels can poll, looking for an IR-signal, every second while the energy consumption is almost zero.

The speed is not only about how often the labels can receive data but also

[FACTS 1:]
Infrared light

Infrared (IR) is invisible electromagnetic waves that are longer and have less energy than those of visible light. Extending from the nominal red edge of the visible spectrum at 700 nanometers (frequency 430 THz) to 1 mm (300 GHz). Most of the thermal radiation emitted by objects near room temperature is infrared. Discovered in 1800 by astronomer Sir William Herschel, infrared radiation is used in industrial, scientific and medical applications.

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how much data they can receive. Infrared light is fast in both retail requirements. This is important when big changes are made in the store, such as sending large price updates, stock levels or other sales data. Full information label update speeds can reach almost 100 000 segment labels per hour or 20 000 graphic labels per hour.

No disturbance from other signals

In retail, available bandwidth is becoming constrained. Interference is not a problem for an infrared system compared to a radio system that needs to be immune to a number of other systems competing for the available bandwidth.

This is especially critical in stores where radio signals are becoming more and more common, both in the shoppers´ smartphones and in the in-store systems. At 2.4 GHz there is WiFi, ZigBee and Bluetooth equipment together with microwave emissions such as ovens emitting strong noise in this band. At the sub-GHz region there are other short-range devices, like cordless audio, smart metering and alarms. Also, modern mobile communication will most likely cause interference.

A radio solution needs to cope with these obstacles. Some retailers have forbidden the use of unlicensed radio frequencies as they cause too much disturbance to critical networks such as WIFI.

Safety and security

There are no regulations for IR technology since it is safe and does not affect people. Countries have imposed radio regulations limiting the maximum output power for safety concerns. These can range from 10 mWatt maximum output power for Japan to 100 mWatt in European countries to 1 Watt in North America, South America and several Asian countries.

Regarding security, IR cannot be listened to outside the store because the light signals do not travel through the walls, as opposed to radio that can be eavesdropped or hacked from outside.

This also ensures total control for the retailer. When a label responds to a signal, it means that it is in the store, and not in a box or in a pocket.

Robust and long-lasting system

Pricer has equipped the world's leading retailers for almost 25 years with IR to power their digital pricing system, while most of their competitors, present and past have chosen unlicensed radio frequency.

"*Pricer today has installed as many stores as the entire competitive landscape and this is due to our technology choice,*" says Nils Hulth, CTO at Pricer. "*The technology is scalable and very robust and is not disturbed by noisy environments*".

Furthermore, this is a long-lasting system. The battery-saving technology enables the labels to last up to ten years and the transmitters in the ceiling can last for decades once they are installed.

"*Infrared light has shown to be a winning technology in the Pricer store system and it is a technology with a bright future. With the fast development of "Internet of Things"—where a large amount of the communication uses radio—it is a big advantage to use infrared light*", says Nils Hulth.

Positioning – a new breakthrough application

The system can provide real product positioning in the store by 'triangulating' or more accurately by 'trilaterating' the IR signals.

A fundamentally new approach to IR communication is underway. Basically, the system can provide real product positioning in the store by 'triangulating' or more accurately by 'trilaterating' the IR signals.

Other existing positioning solutions are not applicable for retail because of important power considerations, heavy costs and size barriers. Only IR can function on a low power system which is the in-store shelving requirement.

This breakthrough technology in product positioning has important business applications from in-store navigation to planogram compliance, to stock control and inventory.

How does it work ?
The positioning of labels is done by pinging every label and measuring the strength of the response received by all transceivers in the store.

By oversampling the signal and storing all the measurements in a database and applying advanced algorithms, a system can calculate the position with a rather high accuracy.

This is used by retailers to find out exactly which products they have in the store and where. For headquarters, it is also a way to control planograms.

Above all, this makes it possible to detect changes on the store shelves. To put it simply—IR technology makes it possible to position labels with great accuracy.

[FACTS 3:]
Infrared light
TRUE or FALSE

"*The labels must have line-of-sight to the transmitter to see the light signal.*"
FALSE. Light bounces and diffuses, just as the lamp in the livingroom can light up under the sofa table.

"*The light isn´t strong enough to reach everywhere*"
FALSE. This isn´t like a remote control where you might have to press the button once or twice to make the TV switch channel. The light in the transmitter is much stronger – like a spotlight.

"*A 100 W light bulb consumes as much energy as all the labels and the communication in a hypermarket.*"
TRUE. Using infrared light consumes an incredibly small amount of energy.

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