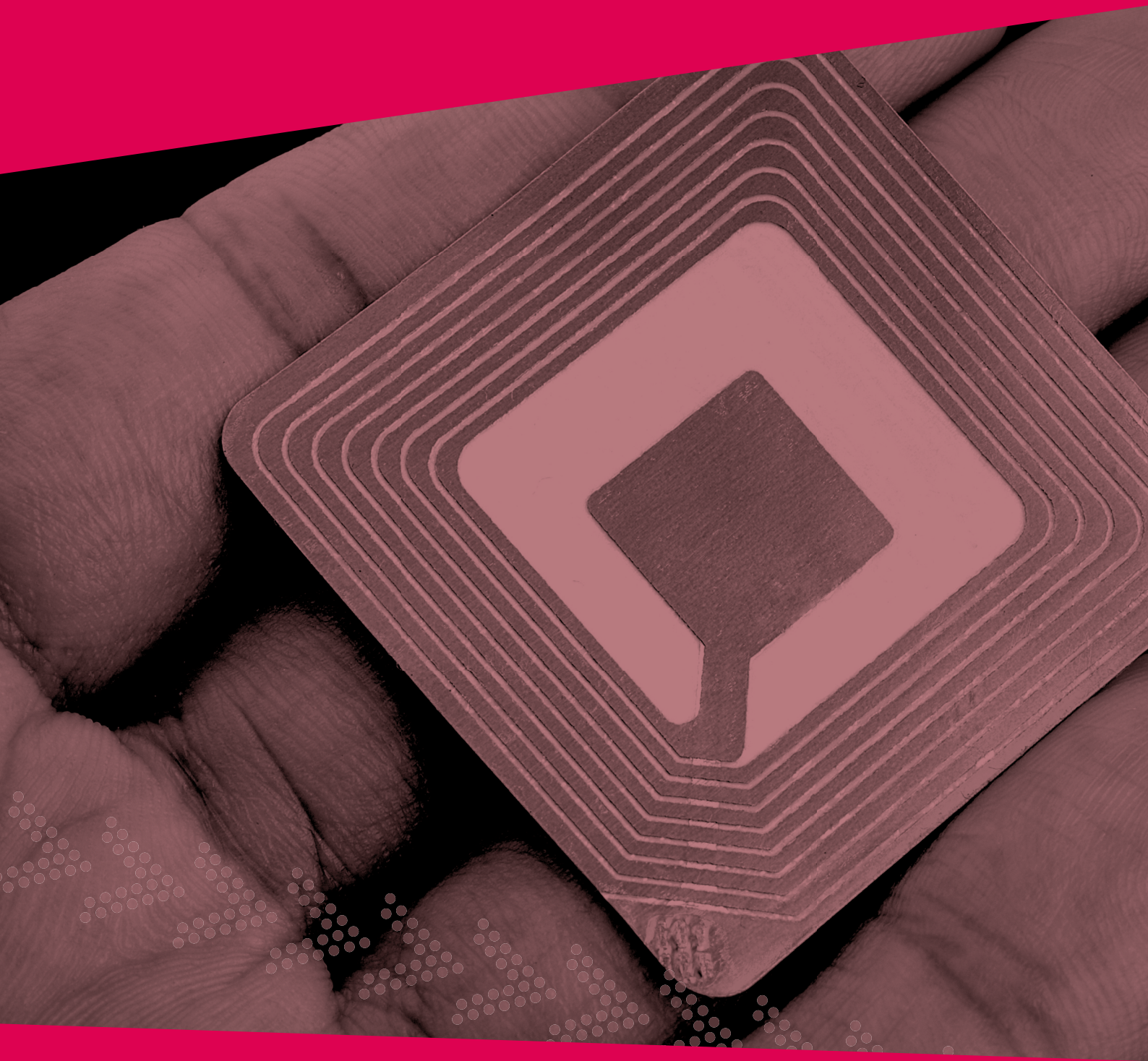
The real benefits of RFID for industry



euautomation

What do the jerrycan, the jet engine, penicillin and Radio-Frequency Identification (RFID) have in common?

They were all developed during world war ii and, unlike many other inventions of the time, are still commonly used today.

RFID is the technology that allows data to be transmitted via radio waves on the electromagnetic spectrum, with the purpose of automatically identifying and differentiating physical objects.

In this industry report, obsolete automation parts supplier EU Automation takes a look at the exciting and sometimes eerie applications of RFID and the real benefits the technology holds for industry, particularly in the fields of retail, logistics and manufacturing.

1. The technology

From spies to retail
One of the most fundamental reasons for RFID's success is the straight-forward technology it relies on. In fact, RFID is so far-reaching that most of us use it in our daily lives. From our sophisticated smart phones and mobiles, to something as simple as electronic passports, automatic toll booths or even our car keys, RFID has found its way into almost every aspect of daily routine.

The fundamental technology that underpins RFID has its origins in the espionage tactics of World War II, when Russian inventor Leon Theremin created what is considered to be the predecessor of RFID technology. His 'clandestine listening device' remained passive until activated by radio waves from an outside source, in much the same way that some RFID tags still work today. Similarly, during the Second World War, aeroplanes were fitted with transponders that would reply to interrogation signals, identifying the machines as friend or foe.

Although RFID is still used in the aerospace and defence sectors, it has long since crossed the boundary into other segments of society, including security, retail and the supply chain.

In fact, as long ago as 2003, the largest retailer in the United States, Walmart, made it a requirement that it's top one hundred suppliers begin using RFID tagging on the cases and pallets they shipped to the business.

RFID tags – the new barcodes?
An RFID system consists of two parts: a transceiver or reader that transmits and receives signals, as well as a small transponder or a tag. The tag is made of an antenna that intercepts signals and a minuscule chip, typically able to carry 2,000 bytes of data or less.

It's fair to say that RFID tags are a bit like barcodes on steroids. Just like barcodes, they hold information about physical objects, like products or parts. However, RFID tags are significantly more sophisticated and practical, given that they don't require a direct line of sight with the reader.

In fact, they can be read at much greater distances, of up to 300 feet, can be interrogated simultaneously and offer real time information. RFID tags are also more rugged, because they are protected by a plastic cover and some have significantly higher capabilities than barcodes.

Not all RFID tags are created equal
Over time, and as the ambition of technology companies has increased, different types of RFID tags have been developed. Depending on the power source, tags can be passive, active or battery-assisted passive.

Traditionally, tags are passive components and don't require batteries. Instead, the power is supplied by the reader. The tag's coiled antenna forms a magnetic field when it encounters a radio wave sent by the reader. The RF radiation provides the energy source for the RFID tag to activate and communicate the information encoded in the chip's memory.

The main pitfall of passive RFID tags is that they function only at short distances, often just a few feet. On the other hand, they have a particularly long life span, of twenty years or more. This can be both an advantage, if they are used in longstanding applications, like tracking vehicles, for example, or a disadvantage, when they remain active in a product even after purchase.

Apart from resilience, the two main advantages of passive tags are cost and size. The cost of a passive tag can be as low as $0.15, while an active tag could set you back anywhere between $15 and $100. Also, since there is no need for a power source, passive tags can be as small as a grain of rice, making them much less intrusive.

Passive tags will normally host data that identifies the asset and provides information about it, such as the manufacturer, current location, serial number and intended destination.

Active tags, on the other hand, possess a power source - like a battery - and transmit ID signals periodically, regardless of whether a RFID reader is in range or not. Finally, battery-assisted passive tags have a small battery on board, which is activated only in the presence of an RFID reader.

The main advantage of active RFID tags is that, because they use high frequency, they work for distances of over 100 feet, which significantly broadens their application scope. In addition to being more powerful, the battery allows active RFID tags to also host sensors that use electricity. An active tag used in an automotive plant, for example, could specify the paint colour for a car body as it enters the spray area in the production line.

Taking one step further, the latest generation of active RFID tags has a range of truly impressive features, including the capability to perform independent monitoring and control, initiate communications or perform diagnostics.

Despite their superior capabilities, active tags also have a few drawbacks, including the obvious inability to function without a battery, thus limiting their lifespan. Other drawbacks include higher production and maintenance costs and a larger footprint.

2. Applications

RFID is commonly used for a multitude of applications across sectors, from asset identification to tracking, access control and management. By implementing a complete RFID system, it's easy to have real-time, accurate visibility of all assets within the radio frequency range, which creates endless possibilities for data monitoring and acquisition.

No doubt about it, there is huge potential for RFID. However, before it can be effectively utilised for any application, the system must be able to communicate with other hardware and software devices. In the Internet-of-Everything and smart factories, the ultimate goal of RFID technology is for equipment to be able to act independently on the information it receives via the technology.

In the next section, we will look at more specific existing and potential applications of RFID technology.

Retail
Perhaps the most interesting part of Walmart's RFID experience is the enormous potential the giant retailer saw in the technology. As discussed, in 2003, Walmart required its top 100 suppliers, including companies like Procter & Gamble and Hewett-Packard, to apply RFID tags on all pallets and cases sent to Walmart's distribution centres.

After only three years, Walmart began putting pressure on all its suppliers to get on board and create the world's most intelligent supply chain, with flawless just-in-time delivery.

However, Walmart's dream didn't materialise. Its suppliers protested against what they saw as excessive costs and modest benefits of RFID technology.

Almost a decade later, retailers are still exploring the benefits of RFID, but have broadened their horizons. The technology now allows retailers to do more than identify individual items or cases and get basic information about each one.

In the competitive world of online shopping, RFID also enables fast and frequent inventory, which results in accuracy both in store and on the web. For example, via a simple RFID scan in a clothes shop, the user instantly has access to an accurate list of sizes and styles that need to be replenished. The technology also allows retailers to keep a minimum number of items in the stockroom.

Apart from inventory shrinkage, RFID tags have an entire array of benefits for retailers. For instance theft prevention can be improved by simply implementing a real-time security system that detects when RFID tagged items leave an area without payment. Furthermore, RFID can also help streamline the check-out process using its ability to scan multiple items at the same time.

Logistics
Even before an item gets to a store, it has to be transported and handled by a complex - usually global - supply chain. The main benefit of RFID for logistics and the supply chain is that it keeps products, pallets or vehicles from getting lost. And it does so without fault.

Believe it or not, human error is one of the biggest problems when recording or processing logistic data. With RFID, the resulting information is much more trustworthy and useful for a warehouse management system or an enterprise resource planning system.

Another use of RFID is ensuring products are moved from one step of the process or location to the next as soon as possible. There are many stages in the logistics chain in which a pallet, for example, could get lost; especially if its final destination is halfway around the world.

On an international scale, RFID helps logistic chains achieve perfect timing and guarantees items aren't forgotten in shipping docks or warehouses for days on end. This makes the logistic chain leaner, while also significantly reducing costs and losses.

Once a pallet has safely travelled to its final warehouse destination, it can be recorded by the RFID systems as having arrived and each product can automatically be logged in. The advantage of this real-time automated data capturing system is it makes asset management much easier.

For years, supply chains have been using RFID to track and manage returnable product containers, for yard and warehouse management. In fact, the benefits of RFID in the retail and logistics sectors have made it more interesting for other industries, which traditionally have a slower pace when adopting new technologies.

Manufacturing
One sector where RFID is still in its infancy is manufacturing. For the technology to work in industrial automation and control environments, RFID receivers need to be able to communicate with existing hardware devices like programmable logic controllers (PLCs), programmable automation controllers (PACs) and input/output (I/O) systems.

The move towards these increased levels of connectivity on the plant floor has been facilitated by the growing popularity of Ethernet as a connectivity solution. The advantage of Ethernet over competing communication mediums is its ability to go beyond the plant floor and link levels of automation and IT architecture that normally wouldn't be in contact.

(continued)...2. Applications

Thanks to the Ethernet networking interface, any computer or portable device can easily access equipment on the plant floor and send or receive production data in real time. PC-based control and data acquisition are crucial parts of the Industry 4.0 megatrend, which looks at the creation of cyber-physical manufacturing systems characterised by adaptability, resource efficiency and ergonomics. In essence, Industry 4.0 refers to smart factories.

Current technology allows RFID readers to send the data they get from tags to the computers that control existing manufacturing equipment. Perhaps the next step towards the smart factory is creating a direct link between the RFID system and the manufacturing equipment itself.

For example, RFID tags can include instructions for a controller, basically allowing machines to communicate with each other without the need for a human interface. The controller would be able to access the information in the RFID reader and give the appropriate instructions to the operational equipment it is in charge of.

In a manufacturing environment, an RFID tag could identify a part, distinguish it from similar parts and provide instructions for the next stage of the process. For example, a robotic screwdriver could receive torque specification instructions from a tag located in a mobile phone case, a car stereo or any other product the screwdriver might help assemble. This system would allow for more flexible manufacturing and would facilitate the simple and cheap creation of batches of one.

Finally, another benefit of using RFID in industry refers to validation and regulatory compliance. One example comes from the pharmaceutical industry, where the Food and Drugs Administration in the US requires pharmaceutical manufacturers to keep electronic records of the entire process. This procedure provides a reliable trail for drugs and proves that raw ingredients are stored in the correct conditions.

By fixing a smart RFID tag into a batch of ingredients, for example, and integrating it with the device used to monitor the refrigerators, the manufacturer can ensure the correct temperature is maintained at all times and, should something go wrong, mark the batch as inappropriate.

Further considerations

Although most of the technology required for smart factories exists, there are still several hurdles to overcome before most manufacturers will be able to efficiently implement the concept.

Perhaps one of the biggest issues when it comes to new technologies is the cost of implementation, maintenance and training. Few manufacturers are ready to completely revamp their manufacturing facilities, even if it could lead to increased return on investment in the long run.

Another challenge for companies considering the implementation of RFID technology is standardisation. The frequencies used in the US, for example, are incompatible with those used in Europe or Asia. Unfortunately, the emergence of a universal standard has yet to take place.

Standards are normally developed and issued by industry-specific and national or regional bodies like EPC global, the International Electrotechnical Commission or the International Standards Organisation. A great deal of work has been going on over the past decade to develop standards for RFID frequencies and applications, but until a general set of rules is agreed on and implemented, the motivation for companies to adopt the technology will most likely stagnate.

It is also worth noting that several concerns regarding RFID technology focus on security and privacy. Whether it's the issue of illicit tracking, payment or e-passports, RFID systems are vulnerable to skimming and eavesdropping. Unauthorised readers could theoretically use RFID information to track or possibly intercept products.

Conclusion

Despite its drawbacks, RFID holds real benefits for sectors like manufacturing, retail and logistics. Education and awareness are always a big part of adopting a new technology and, although RFID has been around for well over half a century, it is still relatively unknown to many individual engineers.

One of the difficulties RFID still needs to overcome is convincing enough people - from C-Level executives, to plant managers, operators and general management - of the real value of the technology and its potential as something more than an asset-tracking technique.

Whether it's intelligent factories, keyless ignition for your car or moisture-sensing diapers, RFID technology has huge potential for both consumer and business environments. In industrial automation, control and data acquisition systems, RFID has the potential to become a hugely useful and widespread technology and complement existing control and data acquisition systems.