Traceability in a digital world: using intelligent printing to increase security through the supply chain

A White Paper by Richard Scott, European Product Manager, SATO

Globalisation and the rise of digitalisation is changing our business priorities. Survival depends on decreasing development and product lifecycle costs, while at the same time improving product quality and customer satisfaction. As a consequence, the traditional business model of offering a product is being replaced with a new approach based on added-value service and lifecycle support. In this scenario, traceability is the key to continuing competitiveness. Data that can aid optimisation throughout the lifecycle must be constantly updated and available all the way along the process supply chain.

In this white paper, SATO considers how the role of labels and printers is evolving to help organisations make their processes and products fully traceable in the digital world.

When it comes to competing in the global market, optimisation is the Holy Grail for every business: whether you are involved in manufacturing and logistics, automotive and aerospace, retail or healthcare, the pressure to be as efficient and profitable as possible while delivering products and services of the highest quality is the same.

In order to achieve these goals, we need to be able to track every component through every step of the process in order to collect, interpret and apply meaningful data. This data could be related to how long a component takes to produce, how many staff are involved in a process, the cost of materials or transport, and component performance during service – as well as associated information like energy consumption and environmental impacts.

In some contexts, there may also be chain of custody or regulatory requirements to be considered in relation to the gathering and exchange of data. Examples include hospitals and prisons, where the movement of people and their personal records needs to be carefully synchronised; pharmaceuticals, where security of supply and the prevention of counterfeit drugs are key drivers; and food manufacturing, where customers are increasingly concerned to know that every ingredient can be traced to its original production source.

Towards two-way communication

This drive towards optimisation is revolutionising the role that labels and printers play, particularly in the context of the Internet of Things (IoT) and the evolution of ‘smart’ tools.

In order to track and trace an item through the process supply chain, the item needs to be clearly identifiable and capable of communicating information. This traceability is required because

without it the trustworthiness, understandability and appropriate reuse of the information cannot be guaranteed at the point of use.

2D barcode labels are an early response to this need for a label to contain more than just a product name, a price or a country of origin. Their early adoption in logistics and retail environments reflects the benefits of time-saving and inventory control that barcoding delivers.

However, this type of ID has limited capacity and can only communicate one way. The barcode holds 'one-time' information that was correct at the time the label was printed and it can communicate this data via a barcode reader, but it is not capable of accepting new data or acting upon new information received. Updating the information – and therefore the status of the item – requires production of a new label, with all the inherent risks of inaccuracy, misapplication and human error that this may entail.

The evolution of RFID (Radio Frequency Identification) technology has helped to overcome many of these limitations. The electronic chip that holds essential data is easily incorporated within different media such as labels, tags or wristbands, which means that RFID is more flexible in its application and can be applied to a wider range of objects in the supply chain. This in turn means more objects can communicate data using the same 'language', enabling data collected by independent businesses along the supply chain – such as the manufacturer, the distribution company and the end customer – to be pooled and interrogated.

Clinical trial of UHF RFID tags

SATO is currently conducting the first clinical study of ultrahigh frequency (UHF) RFID tags in Japan jointly with Mie University Hospital. The existing barcode system that the hospital employs for administration of medication and collection of blood samples uses 3-point verification to cross-check data. However, this system has drawbacks; such as disturbing sleeping patients at night and occasional read errors caused by smudges or deformations of wristband barcodes.

UHF RFID tags from SATO Healthcare allow data to be read from a distance, making physical contact with the reader unnecessary. In tests conducted before the launch of the official study, data could often be read even with obstructions such as blankets coming between the chip and the reader. This is expected to simplify the process and improve overall speed of data validation for hospital staff, as well as greatly reducing the need to disturb patients in order to gain access to their wristband. The clinical study, which will establish that the low-power (250 mW) 920MHz handheld RFID readers have no effect on defibrillators and pacemakers and assess the benefits of applying this technology in the field, is due to complete at the end of 2018.

Because the data is in an electronic format as opposed to barcode format, RFID data collection can be done downstream without the need for dedicated workers scanning barcodes with direct line of sight considerations. By supporting common communication within the process supply chain, RFID can deliver benefits including reduced overall reworks, fewer returns / mis-shipments, more accurate inventory control, more sales due to reduced out of stocks, greater supply chain visibility and earlier payments due to fewer delivery disputes.

Clearly, RFID is delivering a genuine step-change in labelling technology, but there is more to come. The next communications revolution is coming in the form of Near Field Communications (NFC). This technology allows NFC-enabled items to communicate directly with each other without the need for any intermediary (such as a computer or database) and interact based on

the information exchanged. On a simple level, this could mean that a wrench can interact with the component it is attaching so that it applies exactly the right amount of torque. In future, we could see entire production lines being capable of reconfiguring themselves in response to whatever customer order is being processed.

Think print

The quest for traceability has not only stimulated developments in labelling technology; it also demands some serious evolution of our printing hardware.

Within the traditional business model, the printer is a passive instrument. It accepts information from a bigger information system, often via a PC, and transfers the information supplied to a label. In this case the printer has no active role in the collation or processing of the data required to produce the label. Nor does the printer have any ability to check if the information has appeared correctly, or to warn if there is a problem (such as a lack of ink). In the digital world, this passivity is simply no longer acceptable, because it means that the printer is not adding any value to the process.

Redefining the role of the printer is at the heart of SATO's business philosophy. It is not enough to simply make printers capable of printing higher volumes more quickly. We asked ourselves what contributions it would be useful for a printer to make within the context of traceability in the digital world. How could a printer contribute efficiencies and add value to the supply chain? The answer: make the printer an intelligent object too.

Effectively, this means applying the principles of traceability: giving the printer an identity within a larger communications system and enabling it to not only receive information but also relay information to other objects. SATO calls this Application-Enabled Printing (AEP).

An application-enabled printer can print without the need to connect to a PC. It can pull information from sources such as the Cloud or a customer database in order to compile the information required. It also has its own internal processing power - so it can connect to other devices such as weighing scales, a handheld barcode scanner, or a keyboard. One advantage is self-checking, where the connected barcode scanner can be used by the printer to check that the barcode content on the label has been produced correctly.

AEP devices are also easily programmable. Unlike 'smart' printers which can only hold one program at a time, new applications can be added to an existing AEP, as you might add multiple apps to an iPhone or Android smartphone. For example, in a manufacturing and logistics environment an app could be downloaded to automatically calculate and print thaw and use-by labels – relying on the printer's internal real-time clock. Another app might use its internal product and price database to correctly calculate and clearly print mark-down labels to clear older stock.

Not only does this mean that you could start with a printer with one function, then add others as the needs arise, it also means that the printer can be customised to include exactly the right set of applications for a given purpose. The product more accurately fits the user's needs, yet at the same time it also means fewer components in the chain – fewer devices to look after, fewer interconnections to manage, and fewer things to go wrong.

AEP devices can be powered by batteries, so they can operate free of connection to a PC and do not need a mains power supply. Printing can therefore be located where it is required; such as

on a trolley or a table in the centre of a warehouse and away from any power sockets, not where the infrastructure dictates. These intelligent printers are also self-diagnostic and capable of automatically ordering new stocks of labels as supplies run low, or flagging a need for maintenance because a part is wearing out.

Future developments

Traceability is a fundamental requirement of digitalisation. Every object, person and component in the supply chain has to be clearly identifiable and capable of interactive communication for processes to become fully optimised.

It is therefore more important than ever before that the information being assigned via a label or electronic tag is accurate – both first time and in real time. In response, companies like SATO are achieving major step changes in labelling and printing technology which will enable intelligent printers to be fully integrated into the process supply chain and play an active role in collating, applying and interrogating data. The resulting improvements in data accuracy will in turn help to deliver the supply chain security required, particularly in sensitive applications such as pharmaceuticals, healthcare and food processing.

Further reading

Traceability Of The Development Of ‘Information Objects' In The Engineering Design Process
http://www.designsociety.org/publication/32289/traceability_of_the_development_of_%E2%80%98information_objects%E2%80%99_in_the_engineering_design_process

Ensuring RFID’s Bottom Line Pay-off, SATO White Paper
http://www.satoeurope.com/uk/resource-library.aspx

Key Considerations For Transitioning From Manual to Automated RFID, SATO White Paper
http://www.satoeurope.com/uk/resource-library.aspx

Images and captions

ST7456a - RFID technology represents a step change in the ability to link objects, people and data and trace them through a process in real time.

ST7456b - Application-enabled printers like SATO's NX Series are improving traceability by playing an active role in collating, applying and interrogating data.

The Last Inch®

Unleashing the Power of IoT

ST7459c - Traceability is a fundamental requirement of digitalisation. SATO's ambition is to close the last inch in the supply chain using intelligent printing and labelling innovations.