Smart Packaging

An IDTechEx publication
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An Introduction to Smart Packaging

by Dr Peter Harrop, IDTechEx

Although in its infancy, smart packaging is already saving lives, preventing sickness, reducing costs, errors and crime, and reinvigorating brands. It can be electronic, electrical, mechanical or chemical. Electronic and chemical types are the most important and will remain so, with electronic smart packaging growing fastest of all in the year to come.

All types of packaging can become smart

Smart packaging can involve primary, secondary or tertiary packaging that becomes smart. Examples include primary packaging that automatically lets the bad gases out to preserve meat; secondary packaging that is radio tagged for automated traceability and data capture; and tertiary packaging, radio tagged as an automated tamper alert.

Making one product perform many tasks

Smart packaging can make a product perform more than one function, such as the new Harpic PowerJet disinfectant container from Reckitt Benkiser (2003) that can also blast away a sink blockage. Another example is the Clear-vu magnetically locked DVD cases in Blockbuster in the US that prevent the anti theft tag within from being removed, not just the DVD. Well applied multiple smarts leverage the benefit. Two and two really can equal five.

Monitoring behaviour – saving lives

Smart packaging may greatly enhance a product such as the blister pack that records when each tablet is removed. Cypak of Sweden, Bang & Olufsen Medicom of Denmark, Information Mediary of Canada and, this year, DDMS of the US can demonstrate those. They will improve the integrity of drug trials and become more generally useful as costs reduce.

Packaging is available that indicates if certain pathogens are present, even specific bacteria and, experimentally, viruses. Other packaging only lets certain gases in or out, thus preserving food.

There are many applications for speech and even voice recording by packages. Gift packs record your voice and play it back to the recipient. In the US, some pharmacies put a radio tag under the printed instructions on medication so the sight-impaired patient can hold a gadget nearby that speaks out all the details, thanks to ScripTalk of EnvisionAmerica. However, many pharmacies are too busy to do this, so, in September 2003, the Scottish Universities of Strathclyde and Dundee announced a "Tele-eye" that can see the instructions on the packaging of medicines, food etc and read them out. As costs come down, such smart packaging and accessories may benefit large numbers of people.

Transforming the human interface

Eventually, we shall have large numbers of packages that speak out their details when you simply touch them or display large, clear, even self-lit moving colour images. The UK National Institute for the Blind estimates that a massive 20% of the UK population is sight impaired.

Error prevention and cost reduction

Error prevention, preferably with digitally recorded evidence that the correct procedure was followed, is a hot topic in healthcare. Lawsuits must be defended and patient care improved. Thanks to AstraZeneca, over 25 million radio tagged syringes have completely eliminated errors that used to occur with anaesthetic doses. Errors with blood sampling and transfusion in hospitals were on the increase in some areas, so radio tagging of samples and blood bags is being rapidly adopted in the US, France, the UK and Germany. The 32% of cost of the US healthcare system that is administration can be halved with automatic data capture and handling, smart packaging playing a part, say the experts.

Anti theft and RFID

Radio tags consist of the primitive Electronic Article Surveillance EAS anti theft tag that sets off an alarm to Radio Frequency Identification RFID tags that

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send back an identification code and sometimes more. Most of the six billion antitheft tags sold every year are in packages: they reduce theft by up to 80%. Checkpoint and Tyco ADT (Sensormatic) are the leaders here. EAS antitheft tags and RFID tags in packages can even increase sales in many ways. For example, there are less stockouts, where the customer walks out in frustration before their desired product is found.

Sudden rapid adoption

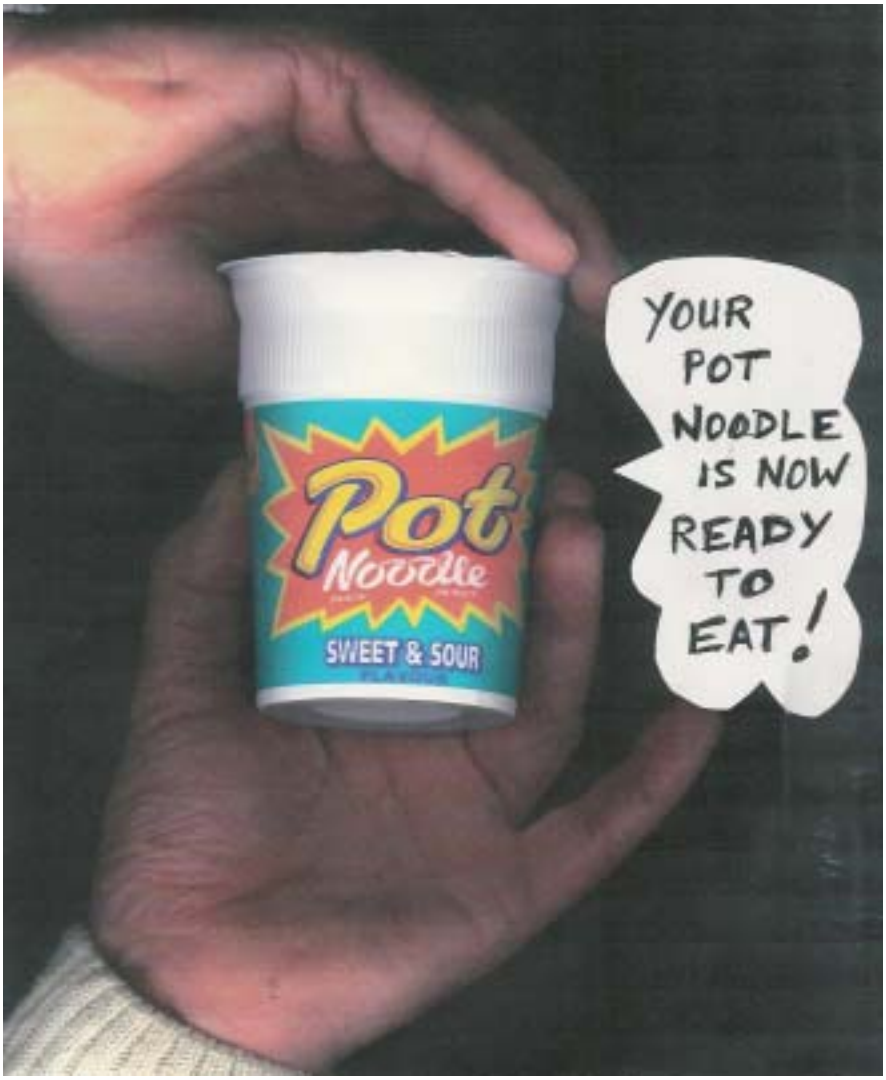
It took fifty years for one billion basic (no battery) RFID tags to be sold but that figure is now being repeated in one year and sales of tens of billions yearly are in prospect, overtaking anti theft tags. RFID is the use of radio frequencies or thereabouts to electronically read information on small tags with few problems of obscuration or orientation. Indeed, with RFID you can read up to 1000 tags at a time in stark contrast to barcodes, and they can be buried in the packaging or product.

The packaging not the product

The packaging is the favoured location for radio tags because they could affect the working of the product itself, and it is not feasible to tag food, drink, medicines, chemicals and seeds directly. Indeed, consumers with privacy concerns are pleased to throw away the package and thus the tag after purchase.

Transforming the supply chain

RFID is increasingly used in the supply chain, starting with vehicles and conveyances such as pallets, totes and crates but progressing to multipacks, expensive packaged goods and finally everything on supermarket shelves, replacing barcodes with something more reliable and versatile - the RFID tag. The widespread RFID tagging of multipacks and expensive packaged goods may occur in two or three years time, when the tag price for billions reaches 5 cents or so.



The Auto ID Centers in the US, UK, Japan, Australia and China have been set up by 105 sponsors to promote use of a new "EPC" numbering system and method of using the internet to interrogate vast numbers of tags with unique identification numbers, unlike barcodes. This provides more detailed information than barcodes and it is automated. Barcodes too often involve unreliable readers with moving parts and unreliable people on the end of them.

Massive cost savings and service improvement

It is believed that supply chain parameters from stocks to time to market (e.g. the time it takes metal cans and water to appear on a shop shelf as cola) and integrity of recalls, can be improved by a factor of ten, saving industry and consumers hundreds of billions of dollars yearly and improving safety, quality of service and much more besides. AT Kearney find that supply chain information efficiencies alone cost $40 billion yearly worldwide, or 3.5 percent of total sales in certain Consumer Packaged Goods (CPG) and the US Food and Drug Administration estimates that up to 20% of perishable goods have expired on arrival at retailers.

The Efficient Consumer Response (ECR) initiative of major CPG suppliers estimates that 1.5-2% of sales are lost from shrinkage worldwide. This term encompasses theft by staff, consumers and others, misplacement and damage before sale, all prime targets for today's RFID programs. That translates to $60 billion yearly worldwide that can be reduced. We can scarcely argue that the world's supply chains are under control!

Healthcare everywhere

RFID in packaging will help in the third world as well, where 32 million children under the age of five die every year of food related illness according to The

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World Health Organisation. Low cost packaging with simple indications of danger and low cost RFID tracking would greatly assist. Even the US has 80 million food borne infections yearly resulting in 5000 deaths. The direct cost to the US healthcare system is $6 billion yearly according to CDC Atlanta. There are even reports that the US figure is rising now 20% of meals are taken in cars.

In packaging, RFID tags with sensors already monitor blood and vaccines in transit, saving costs and lives. RFID can also help with counterfeiting, where 15% of perfume worldwide is counterfeit, 10% of car and aircraft parts and 6-10% of pharmaceuticals, with a figure of 30% of pharmaceuticals in the third world (World Health Organisation).

Commercial restaurants become safer and more efficient

Several major companies, including Electrolux in Germany, are developing smart refrigerators and freezers. They will help commercial restaurants to save money and reduce errors; they will monitor the RFID tags in the packs inside to make sure they are used before expiry and they never run out. Proponents believe that the payback on commercial smart fridges and freezers will be rapid, though the case for the equivalent in the home is less clear.

Testers and tear-offs

Billions of battery testers in the primary or secondary packaging of batteries have increased sales and permitted premium pricing. Tear-offs from packaging will soon be really valuable, including sophisticated video games, libraries of books on something the size of a postage stamp, colour changing wristwatches, even disposable paper cellphones are under development. The possibilities are vast, the progress is accelerating.

Imminent new technologies make much more possible

Dramatic new smart packaging technologies will soon be available. They include disposable moving colour displays that glow. These are called Organic Light Emitting Diodes (OLEDs) and they have already appeared in 2003 on cellphone displays, as have transparent laminar loudspeakers from NXT that give a superb quality of sound. Both are deposited on glass but the race is on to deposit them on common packaging materials at a cost where they can be disposable.

Printed transistor circuits called Thin Film Transistor Circuits TFTCs are being developed by 30 companies that can be deposited on paper or low-grade plastic film, and are safe enough to be eaten, like the two-cent paper batteries that are already appearing in paper calculators in writing books, timers on hair-dye and sensing RFID smart labels. Paper is the toughest challenge because it is so uneven, but Infineon in Germany and ACREO, a Swedish consortium of TetraPak, Stora Enso and others have already demonstrated basic capabilities. We shall have “origami electronics” where the electronic smart package can be reconfigured after use to become something different that is useful or amusing.

Big opportunities that will arise in packaging, such as the self adjusting sell by date that senses when you opened something and how long you let it warm up and speaks clearly to you and flashes if you are in danger. Indeed Arla Foods, European number two in dairy products has been developing a milk carton that says in a deep voice "Put me back in the fridge" if you leave it out too long! This is something of an interim product but it shows how large, serious companies are seeking to bring a much higher level of safety and ease of use to their consumers.

Many uses

Much clearer human interfaces will also save lives, not just amuse and make life easier, but they first appear in humbler applications. Already some packs speak to announce prizes and Dow Chemical put the world's first disposable moving colour display on Marks & Spencer’s Valentine cards in 2003. Packaging comes next. Increasingly, the disposable pack can flash, vibrate and talk loudly to you. That could indicate when to take your pills and how many to take. Similar things may happen when a valuable package is stolen but with shrill alarms and flashing messages.

Environmental and merchandising gains

We shall have the pack that is not thrown away because it is an electronic

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dispenser for the product or is a valuable other product such as a proximity alarm or solar powered garden light, leveraging the brand. This sort of thing is best done with related products - the package for the school pens is a calculator and so on.

The package becomes part of the product

Brand managers will increasingly make the package a part of the product, not with the tired old disciplines of colour and shape, but by showing the food is safe, is cooked and so on. Packs will entertain and inform in dramatically new ways and eventually even the moving television advertisement or the training video will move to the outside of a throwaway package.

Coping with the demographic time bomb

Drug packs will no longer have micro printed instructions inside that few people, least of all the elderly, can read. Statistics demonstrate that we usually take more pills in the last year of our lives than in all the preceding years put together. The proportion of the population that consists of dependent elderly is now sharply increasing in most nations.

Thanks to smart packaging, blister packs will no longer shatter the tablet or shoot it across the room, traumatising the patient desperate for relief. The outside of medicines will scroll a moving colour image in a large font, providing an unprecedented amount of information in readable form. Yet all this is nothing compared with the fruits of creative marketers and technologists now seeing what they can do with the new toolkit of capabilities.

Ignore it at your peril

Those not keeping up with the subject of smart packaging imperil their business. Their products and usage of products will quickly become outdated to the point of embarrassment. They will be commoditised when they could be premium priced. Others will provide great social services. The ignorant will be left behind. Too late, they may become aware of new laws making certain types of smart packaging mandatory for the benefit of mankind.

For more read:
Smart Packaging by Dr Paul Butler and **Electronic Smart Packaging** by Raghu Das – both new in 2004

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The IDTechEx Report Program on Smart Labels and Smart Packaging

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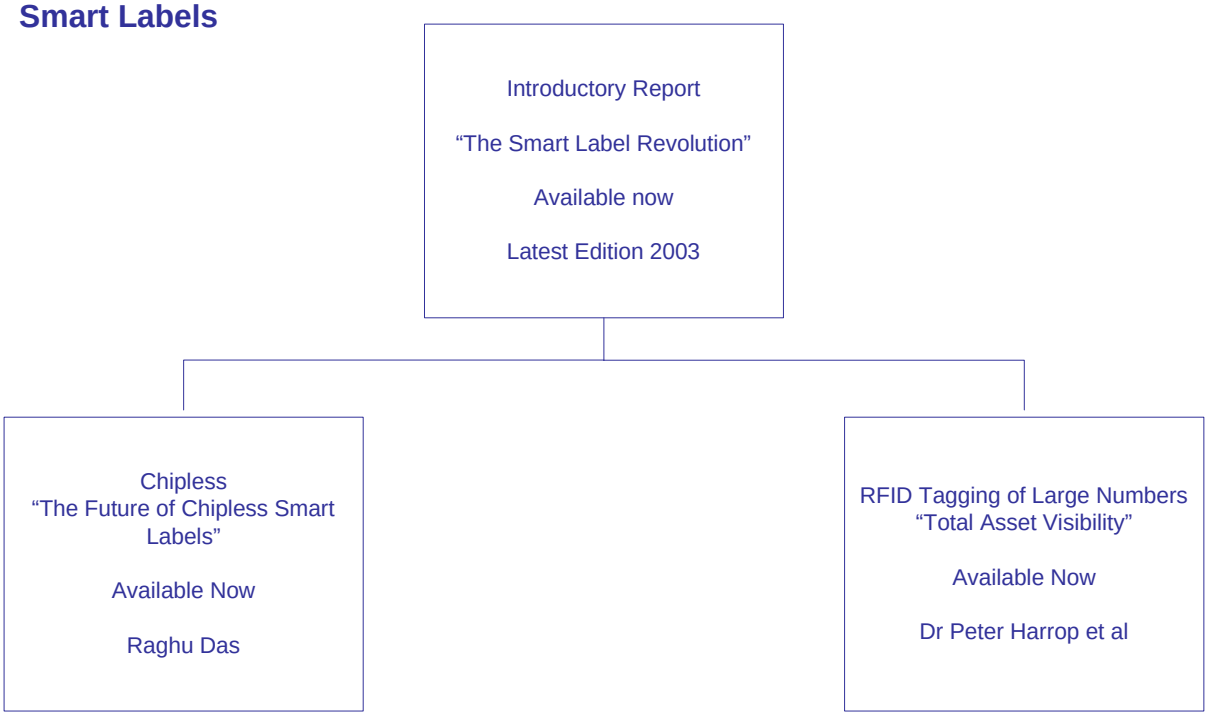

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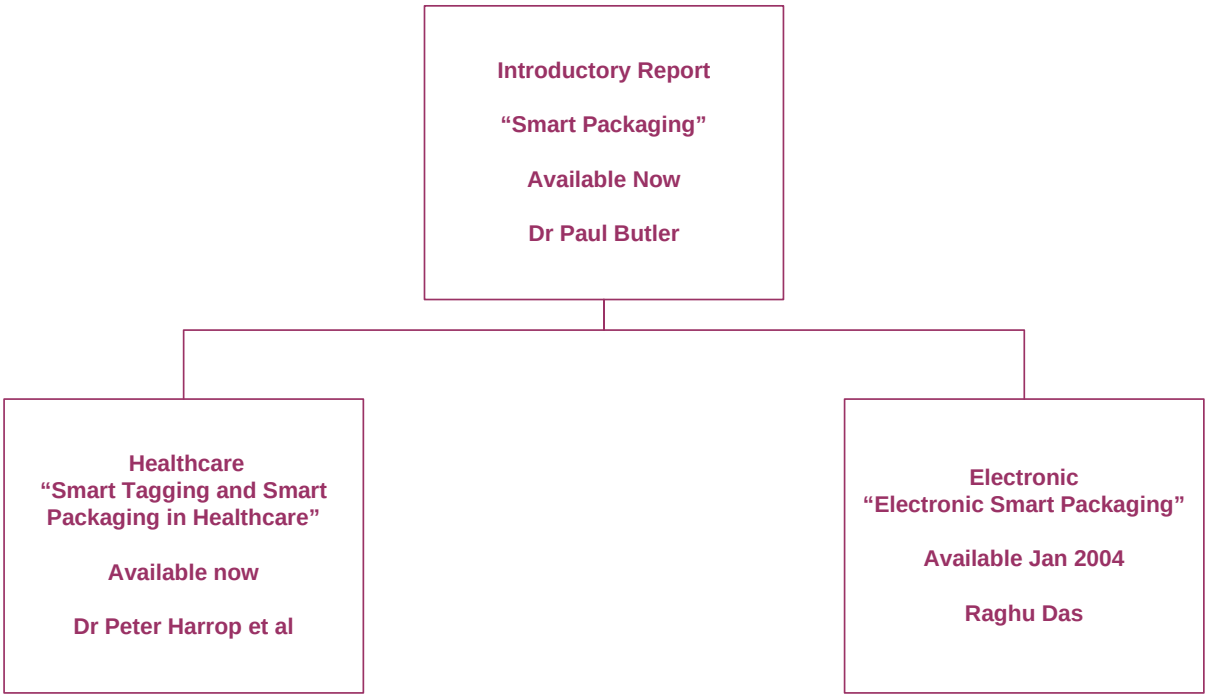

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By Dr Peter Harrop and Emma Napier MRCVS (Cantab)

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The Complete Introductory Report in low-cost RFID and beyond

The Smart Label Revolution

By Dr Peter Harrop and Raghu Das, IDTechEx

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Over 60 international case histories and company profiles from: Australia, China, Japan, Eastern Europe, Singapore, South Africa, USA and Western Europe

In Depth on Chipless

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By Dr Peter Harrop and Raghu Das, IDTechEx

Forecasts by technology etc to 2010 Latest new products and inventions
271 pages Over 105 detailed tables and figures Extensive sales leads

This report expands on The Smart Label Revolution, by looking in far more detail at chipless tags, including a much wider range of technologies. These have enormous market potential. They are usually ultra low-cost from 0.1 to 10 cents each, even in modest quantities. This second report also analyses how the silicon chip and even batteries in conventional RFID will become printed, to lower cost and improve ruggedness so eventually most forms of low cost RFID become "chipless".

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