

Tracking and tracing museum artefacts



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The silver screen 'glorifies' art theft with beautiful women or rich men skilfully beating high-tech security systems to steal the priceless artefact. In reality of course these people do not exist – most art crime is carried out by common criminals. The high-tech security systems on the other hand do exist, but most museum and gallery security departments are not allocated sufficient budget to install the latest gadgetry.

Perimeter security systems are installed as the first line of defence to protect against break-ins when the museum is closed, so now the thieves walk straight through the front door during visitor hours. This presents a different challenge for the security department – how to secure the art but still make it aesthetically accessible to the viewing public. CCTV cameras and gallery invigilators cannot do the job alone, so the objects themselves and the display cases that house them now require protection. The often 'listed' status of older museums and galleries restricts the installation of new alarm cables so wireless solutions are preferred as they do not damage the fabric of the building.

Wireless systems also offer greater flexibility for displaying art. Museums and galleries are fluid environments – art is constantly on the move either to be redisplayed in a different location or to conservation or to storage. Keeping manual records is susceptible to human error and manual audits are time-consuming and expensive.

There are four distinct categories for wireless track and trace systems: passive RFID, active RFID, Wi-Fi and GPS. RFID, or radio frequency identification, has been available for decades in various guises, but the last ten years has delivered improved functionality, smaller form factors and longer battery life – each a key requirement for the art market.

As a basic guide, passive RFID is short-range identification of an object. Hand-held or portal readers 'wake up' (or energise) passive tags to respond with their stored data. Most passive tags come in a label format. Passive systems have begun to replace bar code systems for collections management. They should not be used for security purposes due to their short range (1-3 metres) and they can be easily defeated.

Active RFID means the tags are powered, usually by small lithium batteries, and can therefore transmit data up to 50 metres or more inside a building. Frequencies for these systems are allocated by government agencies – they have standardised on the 433MHz and 868MHz frequencies so portable tags can



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cross national borders. The power output and transmission intervals are restricted so that systems on the same frequency can co-exist in the same building without interference. 433MHz in particular is excellent at penetrating building fabric such as plaster, wood, glass, and brickwork. 433MHz systems even allow tags to transmit from inside 'radio-hostile' environments such as the metallised base structure of display cases.

Active RFID is the best choice for museum security and tracking systems because tags now last over five years on fast transmission intervals: museum staff are busy individuals so constantly changing tags or batteries is not on their agenda. These tags also have the best form factor for artworks – slim tags, often the size of credit cards, are used to protect paintings and even smaller tags are used to protect display cases or sculptures and ceramics. The RFID readers are inexpensive items so enough can be installed throughout a facility (without killing the budget) to provide sufficient coverage to track objects on the move. Depending on the number of readers installed, 'zonal' tracking can be achieved or indeed five meter accuracy using triangulation techniques. Readers are normally installed above ceilings, behind walls, at equidistant locations throughout the building – their location is not governed by walls and rooms.

Choosing the best RFID hardware is tantamount to a successful system, but the most important consideration for active RFID systems is its management software. It must be stable and tested for the appropriate environment – larger collections generate literally thousands of tag messages every second, and yet alarms, tracking and other functionality must be instant. A UK company called ISIS leads the field with installations in national galleries and museums all over the world.

Active RFID has been embraced by the museum industry because of the multitude of benefits it delivers. As a security tool motion-sensing tags send alerts the second an object or display case is touched or the tag is tampered; when integrated with the building's other security systems such as CCTV, access control, radios or pagers, the alarm information can be quickly verified for action to be taken. These systems record the last known location of an object every few seconds, so as an audit tool they quickly justify the investment. The tags can be linked to other security sensors such as pressure-sensing technology, or proximity technology, or a new breed of laser scanners.



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Active RFID tags now also contain temperature and relative humidity sensors with management software alerting if thresholds are breached – security and the preservation of artefacts is not just about theft.

The higher up the radio spectrum – for example 2.45GHz is the frequency that Wi-Fi systems operate – the more hostile the building fabric becomes to radio waves, and so more transceivers are required. There has been a limited roll-out of Wi-Fi tagging systems in the healthcare market for tracking medical equipment, but to track with any degree of accuracy requires two or three times more WLAN access points than that

required for a standard WLAN. Wi-Fi systems are generally not used for high security applications.

Tracking objects outside a building is a different challenge. GPS systems work by the tracker tag receiving transmissions from a minimum of three satellites, calculating its global co-ordinates, and then transmitting this data to a terrestrial network (typically the GSM or GPRS cellular telephone networks). The network then forwards the data to the host application. It is nearly impossible to use this technology to track stolen artworks. First the tags are much larger when they include a battery, as they have to transmit over long distances to the nearest cellular mast. A large tag cannot be hidden on a painting or frame, and its battery would only last a few hours anyway. But most important of all it can be defeated by hiding it inside a metal container killing the signal from the satellites.

GPS is used in conjunction with active RFID to improve visibility of art in transit. The lorry trailer is fitted with active RFID receivers that

record the presence and status of RFID tags. If a tag goes missing or is tampered with, this information is sent via the GPS system to the host application, normally a web interface. To conclude, there are a lot of tracking technologies available but it is important to decide what you want to achieve before committing and understand the limitations.

About the author

Roger Noakes has advised national museums in the UK on security issues.

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