

Irisys technology adds intelligence to “smart buildings”

Exploring what is meant by a smart building and how infrared detectors are being used to make buildings more intelligent



Introduction

Globally, the demand and the manner of use of commercial real-estate is changing. Occupiers and owners are expecting more from their building assets and in the face of ever increasing energy costs, that they are operated and managed more cost effectively.

The picture in the United States for example, showed in the first quarter of 2012, there was a significant slowdown in the recovery of the commercial real estate market. Most notable was the office market, which absorbed less than 1 million square feet, substantially less than the 8.6 million square feet averaged over the six previous quarters, according to investment management firm Jones Lang LaSalle.

With lower occupancies, changing work patterns and the way that commercial buildings are used, comes a greater scrutiny of operating costs. Building managers therefore need to focus on efficiency for owner occupiers and landlords to retain current tenants, and also to attract new ones.

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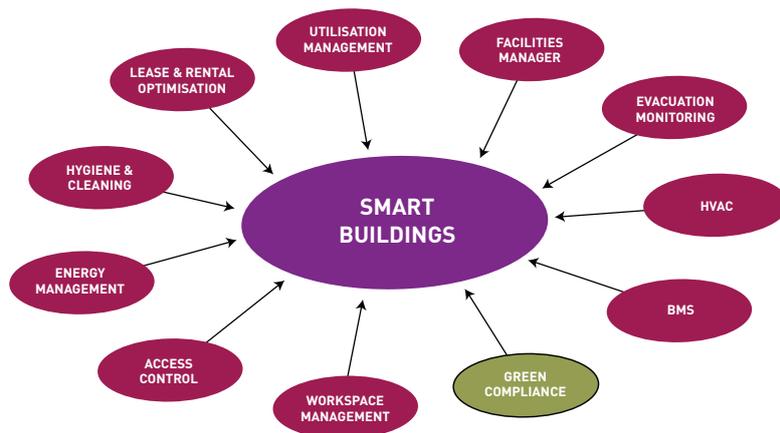
Within industry, automation has resulted in huge increases in production capacity, quality and reductions in manufacturing costs. In fact, since emerging in the 1960's, automation has also made a significant impact within buildings and has increased in complexity and capability ever since. We can therefore expect in the future, automation aligned with increased levels of intelligence produced from new technologies to have further beneficial impacts upon the way buildings are operated. At that point, we can then anticipate the true emergence of the real 'smart or intelligent building'.

This white paper is intended to explore and prompt debate regarding some of the aspects around what we could understand to represent a smart building and what contribution we can make within that environment.

The topics covered are:

- Defining what the smart building represents
- New technologies for application in the smart building
- Space and utilisation management
- Aligning building use to energy management
- Cleaning and hygiene management
- Security and evacuation control

We hope you find the white paper interesting to read and possibly suggest opportunities to advance the smart building concept within your own or your client's organisation.



What actually is a smart building?

One could argue that the definition will vary depending upon your view derived from your professional involvement, corporate services, business activity or possibly academic research of the subject. There are therefore likely to be a number of definitions, all relevant and related to the above. However, let's first get back to basics and review what we should understand as an appropriate meaning of 'smart'?

Smart: (of a device) Programmed so as to be capable of some independent action
Source: Oxford dictionaries.com

Smart: Capable of making adjustments that resemble human decisions, especially in response to changing circumstances
Source: The free dictionary.com

Interesting, now let's now place 'smart' in the context of buildings and see what those in industry and academia regard it to mean:

Take this selection of contributors to, 'Smart buildings: what exactly is a smart building?', *Smart Special, Engineering and Technology Magazine*, 7(6), 18th June 2012

"A smart building is a building with changeable characteristics that can respond with minimum human interference to change in the external and internal environments for the benefit and comfort of the occupant, taking into consideration the financial perspective and reduction in energy use".

Source: Dr. Amin Al-Habaibeh, PGCHE, BSc, MSc, PhD, CEng, MIET, Reader in Advanced Design and Manufacturing Technologies, Nottingham Trent University.

You will hear more from Dr. Al-Habaibeh later in various sections of this white paper.

"A smart building should be one that works with its occupants rather than for them. That means more visibility in what control systems are doing plus more opportunity for building occupants to engage in refining how the building operates. For me, smart buildings imply those [buildings] that look after themselves against changing parameters rather than set parameters".

Source: Simon Robinson CEng MIET MCIBSE, Technical Director - WSP Group.

“A smart building should have the ability to integrate automated building controls and optimise operations to lowering both cost and energy usage compared to the conventional buildings”.

Source: Dr Tony Sung CEng, FIET, FCIBSE, CIBSE, Chairman, Electrical Services Group.

“Use of technology and process to create a building that is safer and more productive for its occupants and more operationally efficient for its owners”.

Source: www.AutomatedBuildings.com - What is an intelligent building?

So for our purposes, we now have some appropriate definitions. But, a further question arises; what’s the purpose and benefit of investing in technologies, processes and resources to make buildings smart?

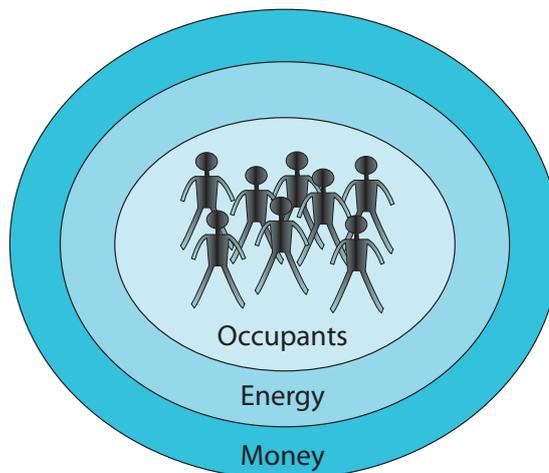
One key objective that readily comes to mind is the topic of energy consumption. There is a significant amount of available information concerning the current and expected consumption of energy within residential and commercial buildings. For example within developed regions, buildings now represent around 40% of all energy consumed. IBM informs us that by 2025, buildings will use more energy than any other category of consumer, so being the largest emitters of greenhouse gases on the planet. Representing up to 30% or more of a building’s operating costs, it’s therefore not surprising that energy efficient buildings are very high on many people’s agendas.

One sensible objective to making a building smarter should therefore be the reduction in energy consumption and so the reduction in running costs, but are there other objectives? Many believe there are and this therefore suggests the expansion of what a smart building needs to represent.

Dr. Al-Habaibeh from Nottingham Trent University: *“The occupant’s safety and comfort are also a priority for smart building technologies, followed by energy consumption and financial restrictions”* (see diagram below).

“...what’s the purpose and benefit of investing in technologies, processes and resources to make buildings smart?”

“...by 2025 buildings will use more energy than any other category of consumer...”



Priorities of smart building technologies



Dr. Al-Habaibeh states smart buildings can be categorised, based upon four levels:

1. Limited or no intelligence
2. Segmented intelligence
3. Integrated intelligence
4. Adaptive intelligence

“Most modern houses and buildings fall within the segmented intelligence category. The limited or no intelligence is a building which would require the occupants to take every decision in relation to all aspects of the building management including temperature level, light intensity, etc. Segmented intelligence is the common category where independent intelligent systems would function such as security systems, building management systems, heating systems, lighting systems, etc”.

How is technology currently being used in buildings?

The term smart building has been used by some to describe buildings that utilise a Building Management System (BMS) or Building Automation Systems (BAS) to control how they function. However this term is somewhat misleading, as by definition 'smart' means being able to make human-like decisions or have intelligence.

Building Management Systems have been around since the 1960s. These systems include technology for optimisation and compensation of heating systems and control systems that assess trends for both external and internal temperatures before deciding on activation times. Lighting that potentially turns itself on when it gets dark is a simple automation to achieve, as are doors that open when someone approaches and both have been around since before the 1970s.

A fire alarm system that monitors its condition and can track the path of a fire from its source, is yet a further example of building automation and systems of this nature have been available since the 1980s.

The introduction of Keycards has assisted in bringing another layer of control and data into a building, by providing access control and delivering simple footfall information.

So it could be regarded that the first stage in the building becoming smart has arisen from the application of a BMS. In addition, as pressure continues to grow for buildings to become more energy efficient, the demand for increased control and appropriate automation will continue to grow.

However Dr. Al-Habaibeh points out: *"Because in most cases different companies and sectors operate in different areas, it has been difficult so far to develop the necessary integration standard for such systems in order to provide a truly integrated intelligence where systems of different types could communicate to provide optimum performance to the occupants and reduce energy consumption. Therefore there is a need, in order to develop a truly intelligent building, of a standard of communication and open systems architecture to enable different technologies from different suppliers to communicate and achieve integrated objectives as necessary"*.

Standards and methods of technology integration will therefore be an important consideration as buildings evolve and new technologies are added.

“...the demand for increased control and appropriate automation will continue to grow”.

Adding further intelligence

What can be done or is available, that can be added to enhance the operational capabilities of a BMS? Alternatively, what new information can be provided to the new breed of Facilities Management (FM) solutions, to bring more intelligence to building and estate managers?

We believe the answer lies in two parts:

1. Introducing new and innovative technologies which increase awareness and deliver data of value.
2. Incorporating the above into an application that can analyse and deliver appropriate information to other platforms (e.g. FM or BMS) enabling suitable actions and measures to be undertaken.

One such technology is infrared detection which provides the ability to measure how a building's occupants use their environment. Infrared technology is well proven and been used in many applications from night vision in defence and security systems, planned maintenance in plant, to building energy surveys.

Irisys is a pioneer in infrared technology, increasing the number of applications possible by bringing down the cost of infrared detection. As a result, new applications have emerged including highly accurate people counting for retailers and predictive queue management for supermarkets to manage staff and customer service. More recently, developments and trials for healthcare applications have commenced such as in assisted living and infection prevention by monitoring hand washing at patient bedsides.

Infrared technology is perfect for the above environments and also for buildings because the technology is exceptionally reliable and possesses an extremely low cost of ownership, it is discrete and unobtrusive, and very importantly being non-video, has no privacy issues.

With the deployment of new technology such as infrared detection, it is now possible for buildings to inform decisions based on past and real-time data, and so by using this information progress from being responsive to also being predictive.

This added ability to measure, manage and potentially predict, has many major positive advantages for those tasked with maximising a building's efficiency.

Examples of how this ability can be employed include:

- Reducing cost of space requirements and optimising building usage
- Identifying and predicting usage, then managing energy demand to suit
- Eliminating tailgating for increased security
- Introducing evacuation monitoring
- Increasing cleaning and hygiene standards

This white paper has been written for the consideration of Facilities Managers, Property Management companies, and anyone who is responsible for the lease, maintenance, cost and smooth running of a building.

“...infrared detection which provides the ability to measure how a building's occupants use their environment”.

Optimising utilisation: how can technology drive changes to achieve and maintain an effective and cost efficient working environment?

One of the largest overhead costs for any business is the provision of office space, which can be measured by a cost per worker/workstation appropriate to the location of your office building.

With today's changing working patterns involving increasing numbers of mobile workers, for many companies the provision of adequate working space vs. over capacity is a real concern.

For example, modern working practices now feature more staff working from home with infrequent visits to their office. This therefore means that offices possess more shared working spaces or workstations, such as in the practice of hot-desking.

The active monitoring of the use of these shared working areas therefore becomes necessary to ensure there are sufficient numbers, they are being fully utilised and they are available when needed. Monitoring usage and space management also permits for potential energy saving initiatives in those areas of infrequent or sporadic use.

“By actively monitoring people flow data it is possible to identify how a building, floor, zone or even a meeting room is being used...”

The distribution of tenants is not always equal throughout a building, particularly those affected by the commercial real estate slump, so identifying floors not fully occupied creates a more specific map for optimisation. Strategic occupant distribution and consequently high degrees of utilisation, are therefore key drivers to improving a building's operational success.

So how is it possible to assess how effectively your building is being used and what steps are then required to monitor and manage your building to ensure you are maintaining a cost efficient facility?

By actively monitoring people flow data it is possible to identify how a building, floor, zone or even a meeting room is being used compared to capacity. This therefore illustrates how people actually use their working space on a daily basis. This very important information can then help drive changes in space usage to maximize utilisation.

Gathering and analysing data of this type will allow asset managers to:

- Highlight if there is excessive space and so enable potential departmental or company consolidation and create space for other purposes
- Sub-let work space identified as excessive to requirement
- Reduce rental or lease overheads
- Plan actions to take at peak times of occupancy
- Perform high level energy management activities
- Produce a strategic asset review

Essentially this is all actionable information that can be used during lease and rent reviews, and also help you plan and pro-actively manage workspace and deliver more effective utilisation.

These are therefore a series of objectives, but in practice how can this be achieved? You need to start with implementing a technology to measure and monitor occupant presence and flow throughout your buildings; this technology is a fully integrated people counting solution.

Workplace consulting groups, as well as facilities management and building services companies, assert that any people counting technology used in buildings must be accurate, reliable, non-intrusive and capable of rapid deployment. A thermal detection-based technology is well-suited to meet these requirements, with the added benefits of extremely low cost of ownership, maintenance and power consumption.

A very important differentiator is that an infrared based technology avoids privacy issues that arise with video-based systems.

Deployed throughout a building, the people counting system can increase intelligence by evaluating a building's utilisation as a function of its effective operational capacity, compared to everyday usage.

The analysis can begin with the building as a whole, then expand the picture to illustrate separate floors, zones within floors, to meeting rooms and communal areas such as staff restaurants. Analysis could even be taken right down to the occupancy of individual workstations, if necessary.

While learning the behaviour and patterns of the building's occupants, the system can determine how frequently and hence effectively, certain areas and facilities are used.

Once analytics are compiled, it's time to implement changes. Continued analysis then enables management, a BMS and the environment, to constantly evolve to fluctuating occupancies and lower overhead costs through reduced energy usage and carbon footprints.

“A very important differentiator is that an infrared based technology avoids privacy issues that arise with video-based systems”.

The evolution from reactive to pro-active and the ability to apply predictive management & control to energy requirements

Anne Harris states *“If smart buildings are to deliver the energy savings that are hoped for they will need to evolve from their present reactive state and become truly predictive”*.

Source: ‘Smart buildings: what exactly is a smart building?’, *Smart Special, Engineering and Technology Magazine*, 7(6), 18th June 2012

Another input concerning the evolution of building intelligence comes from Dr. Al-Habaibeh: *“Adaptive Intelligence is when the building has the capability of self-learning using artificial intelligence techniques in order to be able to respond as would a human being do to the change in the internal or external environments. This will be beyond an established set of rules to more adaptive algorithms with given levels of priorities”*.

Building use changes and evolves, as we are all aware. With these changes, some of which come within the bounds of everyday use by its occupants, comes changing energy requirements. If the everyday changes and use can be monitored and learned, then it should be possible with the application of an appropriately intelligent system to predict future energy demand.

Simon Robinson CEng, MIET, MCIBSE, Technical Director, WSP Group: *“I think we need more visibility in intelligent building control systems because people engage more if they know what is happening and why”*.

Source: ‘Smart buildings: what exactly is a smart building?’, *Smart Special, Engineering and Technology Magazine*, 7(6), 18th June 2012

A BMS or building control system is therefore a logical point at which to assess future energy demand. However, this extremely beneficial data could also be used by other building or facilities management platforms, to achieve real cost savings and assist businesses to effectively forecast for their energy budgets.

Everyone wants to save money and also to be ‘green’, but effectively achieving that distinction can be difficult. It can also take valuable resources and time to manually monitor a building’s energy usage and match this to building usage.

A solution to monitor building usage and therefore provide utilisation analysis, can streamline energy usage. Data gathered can be integrated into the overall building management or facilities management system, to initiate potential changes in energy consumption.

Energy efficient and efficiently energy managed buildings, are far more attractive to potential tenants - that’s perfectly obvious. However, buildings (and landlords) that offer these capabilities reinforce the loyalty of current occupants, which is critical support for customer acquisitions and retention in today’s competitive commercial real estate environment.

How can technology improve hygiene, maintain and minimise cleaning costs?

Hygiene and cleanliness have always been a concern, but the ability to make improvements and maintain standards is now actively influencing behaviour within buildings. The ability to monitor and manage activities concerning hygiene and environmental cleanliness is therefore clearly beneficial to a buildings staff and occupants, and therefore can form part of the smart building infrastructure.

Bringing intelligence to cleaning operations

An intelligent Washroom Management Solution provides the cleaning management contractor or Facilities Manager with real time washroom usage data, allowing better local management of cleaning resources to meet demand or requirements. These statistics allow optimisation of staff schedules and minimisation of associated resource costs, in addition to providing a better customer experience.

The core of the system is the capability to measure the actual use of individual washrooms and to align this with specific trigger points that summon action. This capability is used for two main purposes:

- Instructing in-building cleaning supervisors where and when to deploy cleaning staff as required
- Maintaining centralised records across a building and across an estate allowing the contractor and client (if required) to review cleaning compliance, schedule cleaning staff and tailor resources to suit demand

The solution achieves the above through the following functions:

- Accurately and reliably measuring footfall into individual washrooms, so that cleaning effort can be tailored to match washroom requirements
- Storing and reporting footfall to allow estate wide records of washroom usage and cleaning compliance
- Using footfall data to determine when washrooms should be cleaned - based upon footfall metrics agreed with the client
- Providing feedback to the in-building supervisor and/or cleaning staff (either via mobile device and/or web based dashboards) regarding the cleaning status of the complete building, down to each washroom, allowing the supervisor to direct cleaning staff according to needs
- A pro-active alerting capability (e.g. SMS) to notify supervisors and cleaning staff when a washroom requires cleaning to ensure compliance with agreed metrics and standards
- A system allowing cleaning staff to record arrival and departure from each washroom
- A management reporting tool to report on actualities vs. agreed cleaning metrics

“...the ability to make improvements and maintain standards is now actively influencing behaviour within buildings”.

Supplementing washrooms, how can smart buildings further improve standards in hygiene, for example within the Healthcare Industry?

The World Health Organisation (WHO), reports that although healthcare facilities around the world have taken seriously the need to improve hand hygiene practices at the point of care, 35% of more than 2,100 facilities surveyed, were found to be inadequate according to WHO standards.

Currently, methods like direct observation and self-reporting are employed to enhance hand hygiene compliance, but results are known to be inherently flawed. Therefore, healthcare facilities are increasingly turning to technology to measure, report and boost compliance. However, some methods that track hand wash behaviour assume averages or exclude significant groups - meaning findings are equally lacking accuracy. Furthermore, some methods can also cause stress for healthcare workers and patients who see such systems as intruding on privacy.

Irisys' Intelligent Handwash Monitor (IHM), a high-tech thermal solution that measures and increases hand hygiene compliance to help reduce healthcare associated infections.

Developed and deployed by Irisys, the IHM monitors the movement of physicians, nurses, technicians and other healthcare workers to identify key hand wash opportunities that arise at the point of patient care - including those identified by the WHO and Centres for Disease Control, and compares those opportunities to actual hand wash occurrences.

Non-intrusive thermal detection sensors installed at critical points throughout the healthcare facility monitor workers' behaviour. The system delivers comprehensive data to achieve a simple desired effect: boost hand wash compliance and help prevent the spread of healthcare associated infections.

Approaching the practice of hand hygiene across an organisation - from management to personnel - demonstrates high expectations, from unit to unit and beyond. The Irisys solution, combined with communication/education and reporting systems, results in an affordable, discrete technology that could cut infection rates - and save lives.

By allowing for seamless integration into hospital operations, data interfaces and systems to enhance patient safety and quality care - all while providing 24/7 surveillance and support - Irisys' IHM thermal technology could very well be the way of the future.

“The system delivers comprehensive data...”

Improving security within my organisation's buildings?

Access control systems allow permitted individuals to control access to specific areas in a facility. This is usually controlled by swiping a card or using an electronic key to gain access. The problem with most access control systems is that they cannot control the number of people who enter the secure premises. This can seriously weaken the security system. When permitted personnel enter through an access control point, it is very easy for a person without a card or key to follow them inside. This is known as tailgating.

Tailgating means that that access control systems are largely rendered ineffective, leaving secure areas open to being infiltrated by unauthorised personnel. Thermal detection sensors solve this problem by ensuring that only one person per keycard swipe is allowed to pass through, as the sensor can be fully integrated with the access control system. This leads to a significant increase in access control security.

Another area where security and management could hold an opportunity for improvement is the case of emergency evacuation. In such environments as high capacity, multi floored and multiple access point buildings that may not possess muster points, it can be difficult to know for sure that everyone is out of the building.

Integrated with the security/BMS to deliver real time information to a site control room and off-site disaster management centres, high capability thermal detection-based people counters to monitor emergency evacuation numbers can therefore be a highly valuable part of the smart buildings infrastructure to assist in managing major incidents.

The stage is set

There is no doubt the smart building revolution has begun. The truly intelligent building is however still a way off, but it is now clear that the ongoing monitoring, managing and interlacing of data regarding how the building is used, is a key piece towards that evolution.

The condition of the commercial real estate market has not made anything easy, and building and facilities managers are looking for innovation to help overcome it.

Thermal technology can be part of that innovation to make buildings smarter, more intelligent and more operationally efficient.

We hope you found this white paper interesting and useful. If you would like to find out more about Irisys and what they could do for you, please do not hesitate to contact us.

“...high capability people counters to monitor emergency evacuation numbers can therefore be a highly valuable part of the smart buildings infrastructure”.



About the author

David Hume has worked for Irisys for nearly 11 years performing roles within their Sales and Project Management Departments. He has been involved in the development of the Company's global People Counting business and managed the roll-out of the Irisys queue management solution into Tesco's UK Metro stores and also all their Superstores in Ireland. David is now Business Development Director within the Irisys People Counting Division and is charged with growing business within their partner channel network, developing new global markets and implementing new applications for Irisys products and solutions.

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About Irisys

Irisys is a global innovator in award-winning technologies that make a significant, measurable impact on business efficiency and improve the quality of people's lives. Irisys is the global leader in people counting technologies and real-time checkout management solutions. Its infrared thermal detection based solutions are used by some of the world's leading retailers to boost customer service, operational efficiency and profitability. Irisys pioneered the introduction of low cost thermal imaging cameras for industrial applications and its security technologies are predicted to transform the intruder detection market. Irisys healthcare solutions aim to make hospitals safer and cleaner, and help enable people to live safely and independently at home. Learn more at www.irisys.co.uk

InfraRed Integrated Systems Limited

Park Circle Tithe Barn Way Swan Valley Northampton NN4 9BG UK

Tel: **+44 (0) 1604 594 200**

Fax: **+44 (0) 1604 594 210**

Email: **sales@irisisys.co.uk**

Web site: **www.irisisys.co.uk**