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LIGHTING INDUSTRY ASSOCIATION

Guide to IoT Lighting Applications

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THE LIGHTING INDUSTRY ASSOCIATION

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Foreword

This guide provides a high level overview of how lighting systems will support the Internet of Things (IoT) and impact on smart buildings and other applications. It will look at a variety of scenarios providing guidance on each along with insights into some of the benefits and challenges associated with the development of connected lighting.
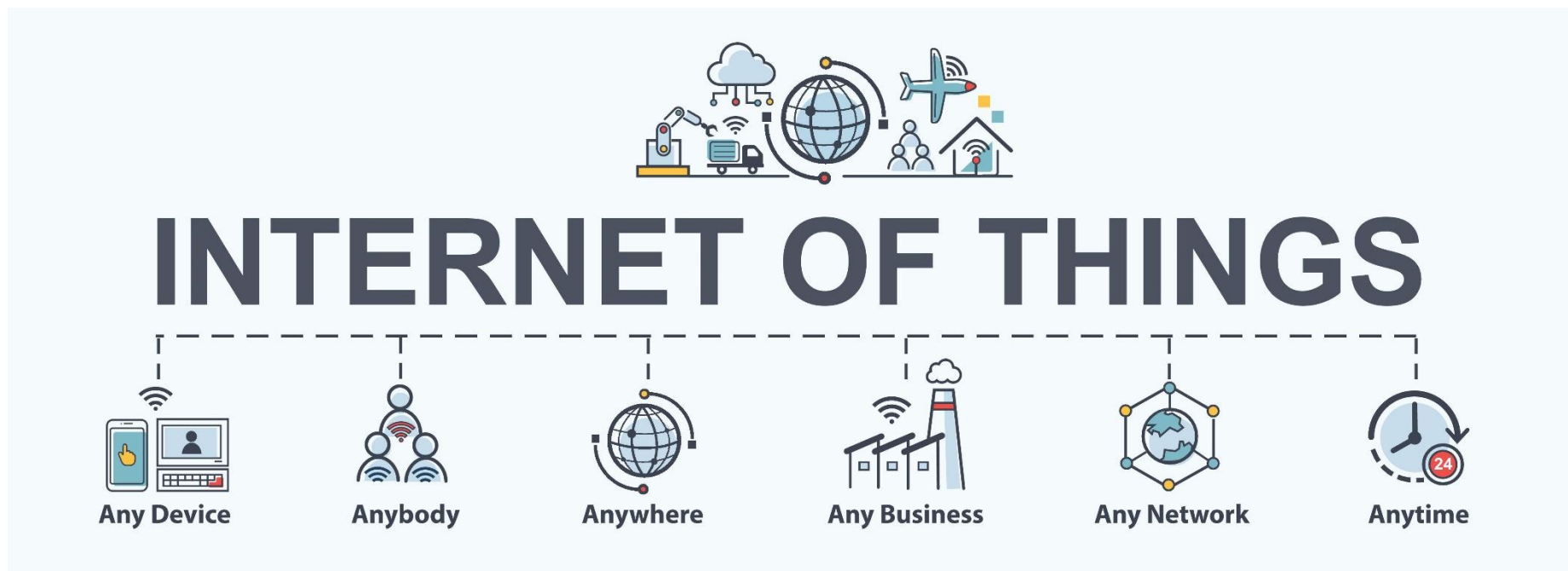
Opportunities

Connected devices are everywhere; the demand for them is increasing at an exponential rate and is estimated to have already reached 30 billion devices.

Lighting is going through a transition with many smart wireless devices being offered for the home that allow us to connect to an intelligent light, thermostat or camera. It is worth mentioning that controlling several smart lights in a domestic environment, often a single room, is very different to the connection of multiple wireless points in a commercial building.

This new technological revolution will bring countless benefits, and will create new industries, which brings us back to lighting. Wherever there are people there is light, and this will open incredible new opportunities for lighting manufacturers, installers, integrators, and all the adjacent industries they service.

GLOBAL SMART LIGHTING CONTROL MARKET

Source: MRFR Analysis
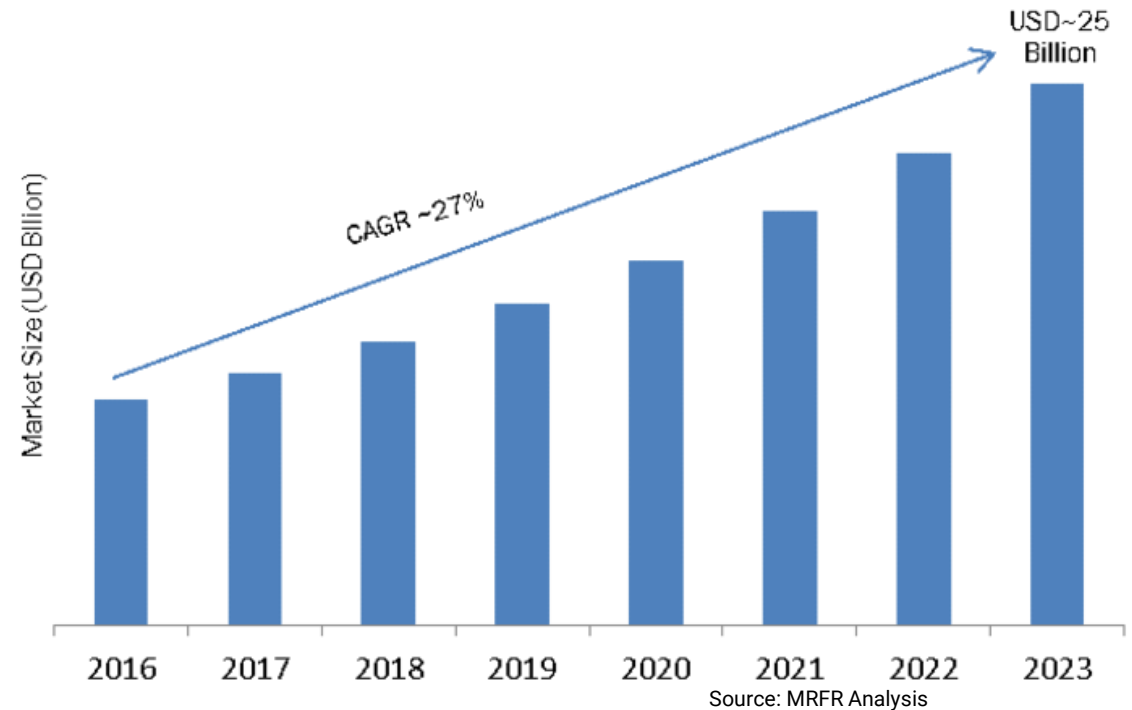
Introduction

Lighting systems are already deployed for simple energy management based on presence detection and daylight harvesting. They offer a backbone for data gathering that is distributed throughout every space.

Distributed intelligence in lighting systems provides a framework which allows us to use smart luminaires to collect data, which can be harvested, giving valuable insights into building operations and produce actionable data.

IoT is basically a means to gather, share and analyse data to provide additional value that could not have been realised with isolated systems.

Smart Office

A smart office is a flexible space that is energy efficient, but that is optimised for building performance and more importantly occupant comfort.

A typical office consists of individual desks, shared workspaces, private offices and meeting rooms.

A smart office needs to be able to adapt to the needs of individuals, of multiple occupancy in the same space, as well as different tasks, such as a presentation using A/V media in a meeting room.

All while optimising for energy efficiencies across multiple building services: lighting, heating, ventilation, air quality,…

Smart Office

- Optimised Energy Performance by easily sharing data with other building services

- Space Utilisation further improves energy efficiencies based on predictive use of spaces

- Scalability of Lighting Systems in size, number of devices and capabilities

  - E.g.- Start with a sensor and a control module, then add additional control points and layer of software for data analytics and management

- Improved Occupant Comfort

  - Personal Control

  - Dynamic and Adaptive Lighting

  - Connection to the Outdoors

  - Visual Comfort
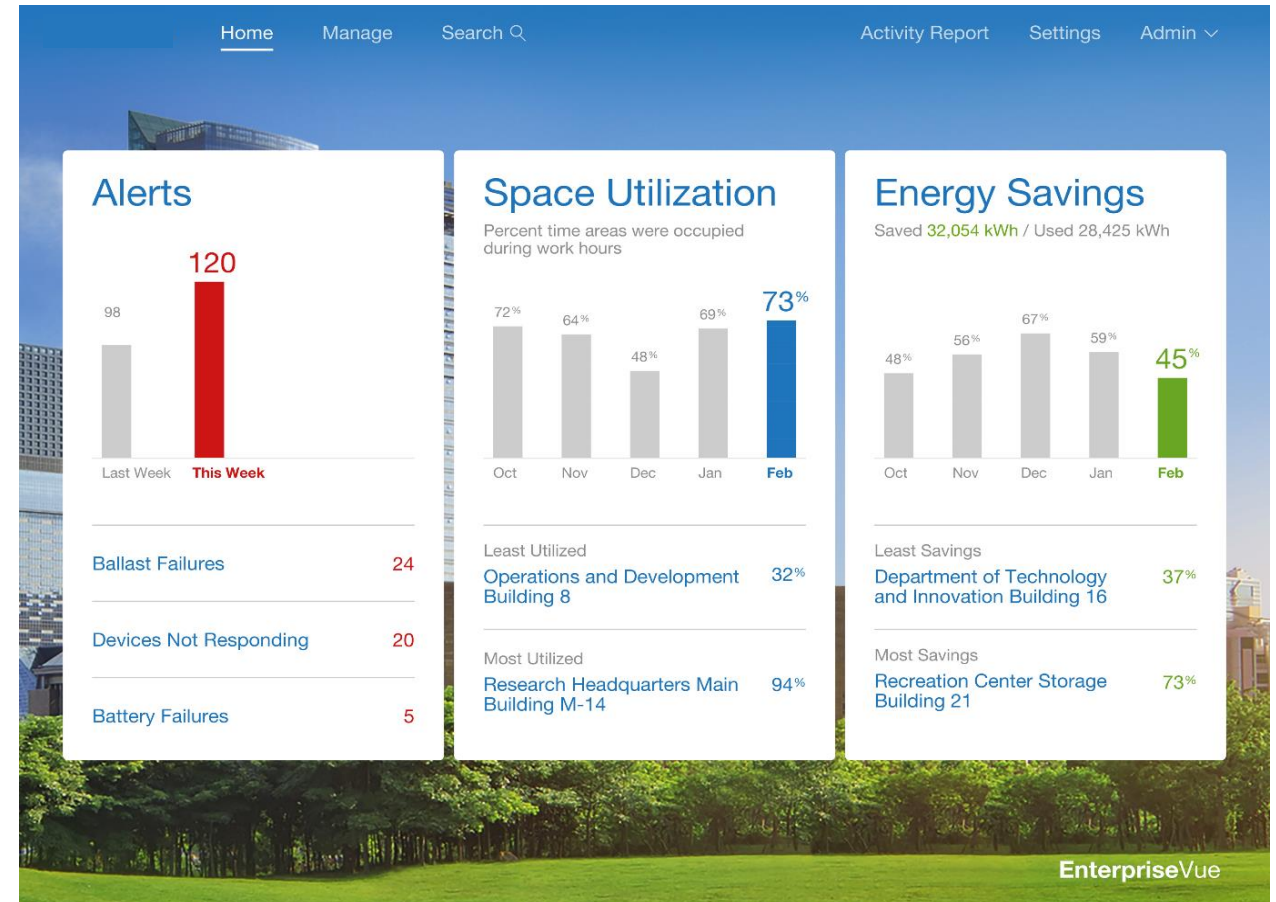
Education

A typical school consists of classrooms, corridors, common areas, meeting spaces and private offices.

For schools, the added value comes from improved attention span achieved by improving the visual environment.

Here dynamic and adaptive lighting is essential. Typically schools have a large daylight contribution. Therefore managing both artificial and natural light is of the essence if we want to optimise for learning.

Increasingly, schools are being used outside of normal school hours for community projects, evening classes, social gatherings, etc… Therefore smart schools need to be able to adapt to the different uses of each space.

Education

- Dynamic and Adaptive Lighting

- Daylight Harvesting

- Window shading control to avoid glare and maximise connection to the outdoors

- Integration with other building services

- Personal control for teachers or lecturers

- Presence detection for energy savings, but also for security and personal safety

- Increasingly, IoT will improve student access to learning environments that before were only available to a select few

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Smart Healthcare

- Healthcare is one of the most complex and critical applications. It requires the integration of multiple systems working together to optimise performance and well-being.

- IoT facilitates the sharing of data between these very expensive, technically complex and specialised pieces of equipment.

- IoT enabled lighting can help connect these systems together, provide valuable sensory data thus delivering unique benefits.

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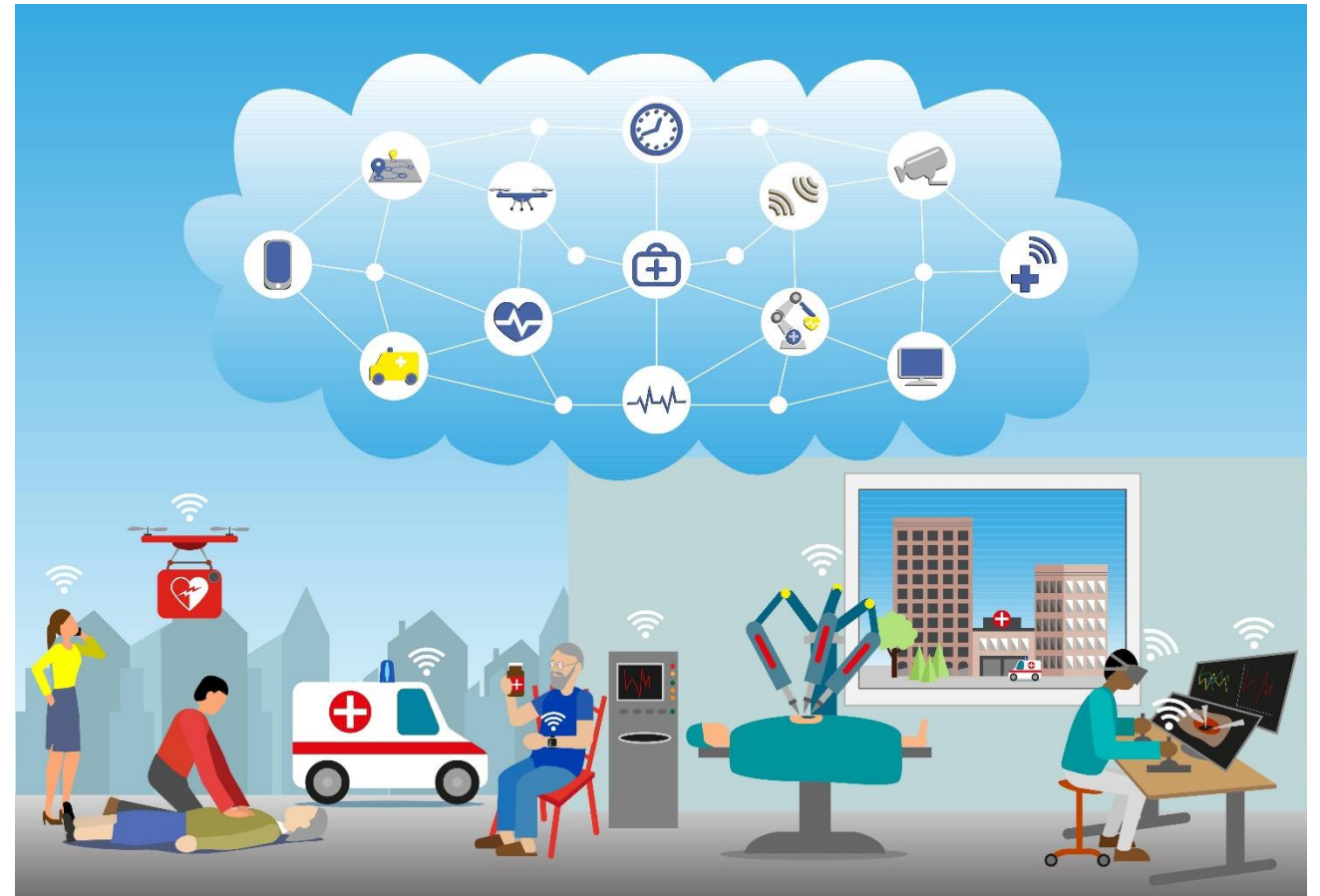
Smart Healthcare

- Sensor networks present in lighting systems can help detect unusual patterns in behaviour, and alert health services.

- High usage areas require a high degree of maintenance and cleanliness, but are difficult to access. IoT enabled lighting systems can help predict the opportune moment when traffic is low.

- Data gathering through sensor networks can help determine the success of treatment and operational efficiencies.

- IoT enabled lighting can guide the public more effectively in the event of an evacuation, guide the response teams towards patient in need or emergencies and locate and track essential equipment easily.

Industrial and Warehousing

- An IoT-enabled connected lighting system can do more than just maximise energy savings.

- Sensing is becoming more versatile as we move beyond simple presence detection.

- Environmental sensors, CO_2, temperature, tracking and beaconing are just some examples which need to work together in this application.

- Data can be real time or time scheduled reports to be used for order picking/fulfilment, asset management, etc.

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Outdoor lighting & Smart Cities

What does this IoT lighting infrastructure allow?

- Communication across networks we may not own

- Public interaction

  - Creates interest and attracts people

  - Interactivity and participation

  - Parking availability

- Traffic management, security, environmental detectors

- Local authority growth and revenue

- Ease of troubleshooting and maintenance

  - Locating and monitoring faults

Outdoor lighting & Smart cities

Street lighting is provided for us, the people, to show our way about, provide a visual indication and awareness of the immediate surroundings and to provide some aspects of feeling safe. But the column itself, it's positioning and structure allows "attachments" to further enhance this humble column.

Examples are:

- EV charging point
- Location services
- Surveillance
- Parking
- Data Capture
- Drone parking / charging
- Gun shot and scream detection
- Flood detection
- And provide light

All of the above sensing and equipment can be retrofitted into existing column infrastructure, care must be taken to ensure and maintain system security.

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Smart Retail

Retail spaces have become larger, moving from supermarkets to hyper-markets and beyond, allowing more product of a wider variety to be held within a single floor space.

This however has come at a price. For a customer navigating the space and locating what they need has become harder, and from the perspective of the retailer ensuring that customers see special offers and loss-leaders has become more difficult. But keeping the shelves stocked has also become an issue with visibility of stocking levels less obvious.

Smart Retail

- Indoor Positioning via store app
  - Guided Shopping
  - Traffic flow
- Promotions
  - The location of the customer within the store is known therefore nearby special offers can be highlighted drawing attention to the store promotions, promotions which can be tailored to the customer demographic and shopping profile.
  - Scan items in-store to find out more information
- Re-stocking
  - Shopping lists created by customers can be used to predict stocking needs of the store.

Emergency Evacuation

Evacuation within a building may need to cover more than the risk of fire, therefore intelligent systems could now safely guide people to the most appropriate exit based on data from other smart devices.

- Adaptive systems link between hazard identification, alerts and assist evacuation.
- People with reduced mobility as well as growing complexity in building structures generate new requirements where dynamic signage can assist.
- Development of systems to cover risks which may have been difficult to manage.
- Types of threats will dictate the routes out of a building

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Emergency Evacuation

Adaptive Evacuation

- Sensing capabilities allow to detect hazards and link it to the emergency lighting system and the floorplan of the building.

- Adaptive systems engineering technology allows the adaptation of "escape routing" by taking into consideration changing developments of a hazardous situation.
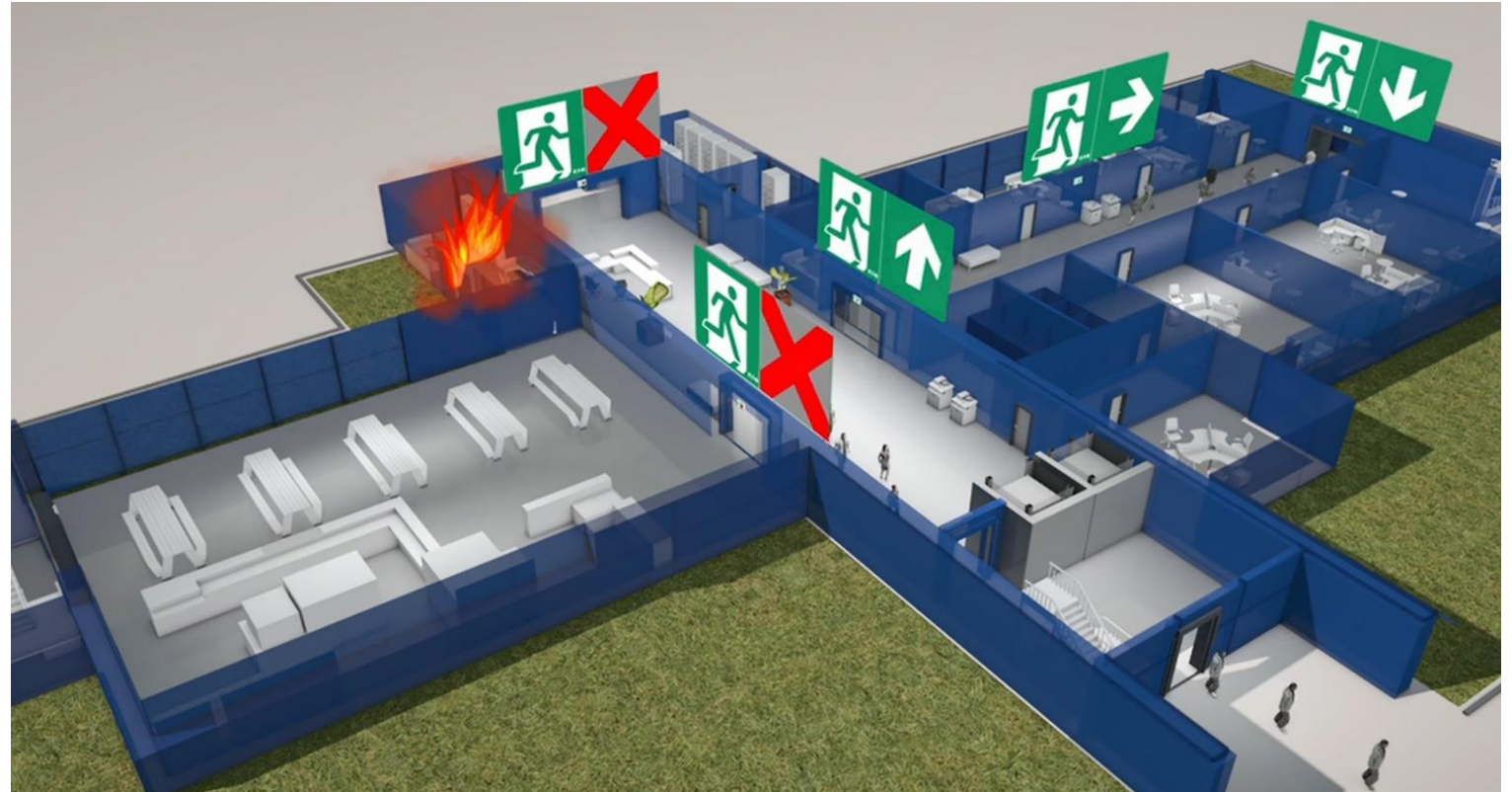
The shortest escape route is not always the safest one.

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Residential

A home is smart when it enhances the lives of its occupants. Technology connects devices with the purpose of making the home more energy efficient and convenient.

Proven wireless technologies in combination with smart phones have made these solutions reliable and affordable.

Smart home platforms (Apple HomeKit, Amazon Alexa, Google Assistant, IFTTT,…) have made it possible to bring different systems together, without sacrificing performance.

Residential

- Use geofencing to alert your smart home system when you are arriving or leaving.

- For security purposes lights can be turned on to simulate occupancy.

- Get alerts from security systems.

- Monitor behavioural patterns for safeguarding the vulnerable and alerting care services.

- Smart home platforms can be used to combine a number of inputs and outputs to create desired behaviours, like A/V integration with your lighting system.

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Security

OVERVIEW

Our increased reliance on smart technology means we need to ensure that we keep our data and systems safe.

Consider the security of the complete system and therefore prevent any unauthorised access or damage to the connected devices or data.

Use products and systems from reputable manufacturers (such as LIA members) that take your security and data privacy seriously.

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Security

IMPLEMENTATION

Security is a process. It is never finished, and requires continued updates and evaluation, it is only as good as the weakest link.

It does not matter how secure a door is if others have the key or you did not lock it.

Always use **Secure by Design** recommendations.

Software, and especially the user interface, will define the ease with which a system can be configured and if the security is in place then a key or certificate needs to be provided to allow the system to recognise the device.

Just because you can connect your system to everything, it does not mean you should, especially when it comes to security and data privacy.

Best practices – Commissioning

Always set up your system to your client specifications, and consider:

- Control strategy
- Integration
- Flexibility and future needs
- Access and Security
- Maintenance Schedule
- Back up and recovery systems
- Documentation
- Proving and sign-off process

Best practices – Commissioning

Commissioning and Maintenance are major considerations. You need to be able to link all the devices together, set all functionality, update software and set up the security. Practical methods should be proven in previous applications. They must allow easy location, identification, addressing (if applicable) and selection of individual devices and groups.

These need to be proven against the specification and functionality. Reporting and interoperability needs to be checked and performance proven before handover. These should be checked against your list and specification as well as the control philosophy.

Always back up any software and configuration files and keep a copy of warranty/software support terms. Completion certification should be provided, and performance testing should be witnessed, and signed off by all relevant parties.

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Best practices – Continual review

- It is important that at least an annual review is made of the current use, requirements, energy consumption, maintenance and security.

- A client feedback group and update loop which includes the user is essential to maximise savings and performance of the system and the building's users. The increasing demand for on-going contractual service performance and cost, plus future proofing must also be reviewed.

- To ensure secure operation, maintenance, software (including patches and bug fixes), potential threat, resilience and system security must also form part of your reviews.

- Most companies offer service agreements to keep systems current with the latest standards – make sure you have one!

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This guide was produced by members of the Connected Lighting Technical Committee (CLTC) of the Lighting Industry Association.

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