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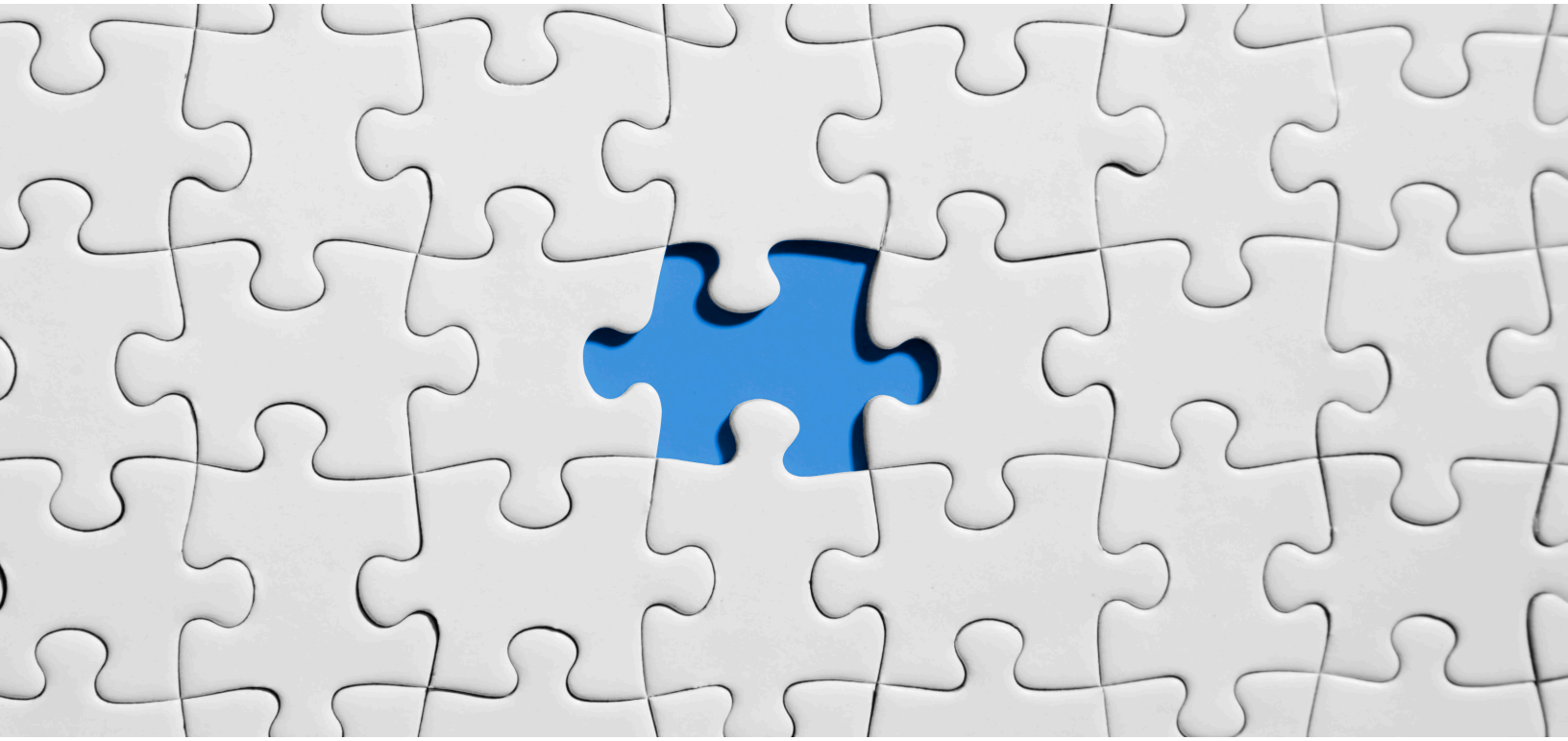
INTELLIGENT SPACES



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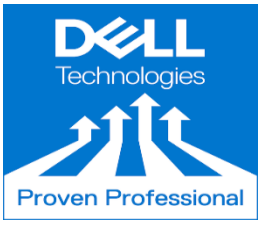

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Executive Summary

This article explores issues that arise from non-responsible use of energy resources. A brief overview is provided about how sensors and logics can make a surrounding environment smarter and more efficient. This article also looks at how data centers can be adapted from these logics and work per the day-to-day inputs.

1. Introduction

Not so long ago, the term “Intelligent Automation” was only used when it was associated with advanced manufacturing plants where a lot of robotics were used. But with advances in technology and needs of the ever-growing market where everything is expected to be smarter, more automated, more renewable and more efficient, people are looking at automation for their spaces or places where they live and work to be more intelligent. Its definitive term can now be applied to items as small as your voice assistant.

Intelligent spaces are automated with all or most of its environmental conditions handled by sensors, actuators and valves. Intelligent spaces eliminate the necessity to manage or to have a managing department/board take care of operational functions. For instance, intelligent spaces can use sensors to turn on or turn off lights in a space based on the number of people in the room or the mobility within the room or raise air conditioning temperature based on the number of people occupied in a space. Some advanced intelligent spaces even track outdoor activity such as brightening the lights when the climate is cloudy or windy outside.

2. Background

With more and more complexity being introduced to work environments and the need for immediate action or attention, a common request by users of enterprises or organizations is to have Intelligent Spaces.

Intelligent spaces can infer actions as small as automatically turning on and turning off the light or as complex as identifying an issue in the data center with the help of AI assisted cameras. Use of intelligent spaces is not only a step towards modernization or digitalization of an organization but also a step towards sustainably using available resources to conserve them for future generations.

The myth that Intelligent spaces completely eliminates human intervention by entirely automating procedures is just that; a myth. While it is true that Intelligent spaces require fewer human resources to manage the day to day operational tasks, human monitoring and managing of the systems remain a necessary task. A good example is an AI assisted camera that identifies a potential issue in a smart space and generates an alert on the screen of the monitoring admin. This enables immediate attention to the issue that has arisen that might have been delayed being noticed with a manual ,routine checkup by human effort.

Such capability gives the organization an upper hand on its day to day operation and maintenance of their site as well as moves them a step closer to Infrastructure transformation.

3. The Intelligent Spaces

3.1 Intelligent Lighting of Spaces

Most working environments and sites with machinery have employed Intelligent lighting, resulting in significant reduction in power consumption. This can be simply achieved with the help of sensors such as photoelectric detectors which operate based on environmental conditions or basic triggers that provide input to turn on and turn off lights based on the time frame set by the user.

In the case of using a photoelectric detector the light is programmed to turn on or off based on the surrounding environment. To be more precise they are equipped with a receiver that detect light falling on them; as soon as no light falls on them, it switches on the light. For example, at sunset, the light is limited on the receiver and the lights go off; at sunrise, daylight falls on it, causing the light to switch off.

Various advancements now enable systems to dim the brightness of the light before it goes off for better efficiency. In cases such as a cloudy day, it triggers the light to be on but not at its fullest brightness.

Figure 1 shows one of the most common deployments in use today.

Figure 1: Street Lamps with Light detectors on top of it
(Source: http://www.bradleystokejournal.co.uk/)

A more complex implementation of Intelligent lighting is what is deployed indoors where motion in the surroundings is detected with the help of Infrared (IR) sensors. Upon no movements in the room for a predefined timeframe the light switches off automatically helping the organization and the world minimize waste of energy resources. As soon as it senses movement in the room again it turns on the light again and keeps the monitoring period open again.

Additionally, we can even have triggers that turn on and turn off the lights based on the timeframe set on by an operator for critical areas/spaces where the lights are deployed. These spaces can be monitored in the control room over a screen.

3.2 Intelligent Monitoring of Spaces

It has become common to be constantly monitored almost everywhere by CCTV or other forms of security cameras. While we all are concerned about being secure, we are opposed to being

spied on. Also, someone who watches a security camera for hours a day might not be as alert towards the last hours as when their shift began. Nonetheless, these critical environments demand attention.

AI assisted cameras can unlock a variety of security benefits while minimizing effort of the control room operator. Take, for example, a data center where the systems are having trouble and sparks and fumes are observed from the system. An operator watching 40 splits of footage from various parts of the data center may not have his immediate attention on the footage where the issue is occurring.

AI assisted cameras can be programmed to identify suspicious conditions based on its previous conditions and notify the operator via a pop up alert for immediate attention.

Also, intelligent cameras can act as a security in disguise and restrict entry specific areas by un-authorized personnel with the help of smart locks for the door, as shown in Figure 2. This reduces a major chunk of the operator's job – to continuously monitor all the tabs; an almost impossible task – and allows time to focus on more innovations for the systems.

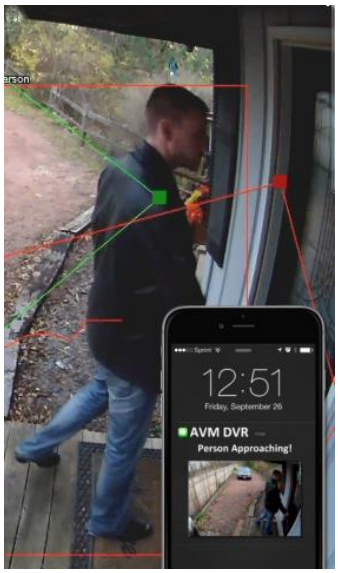

Figure 2: Smart Cameras identifying person in its range.
(Source: https://platinumcctv.com/)

Also, these can be used to track and identify people at crowded places. For example, airports are high security zones. If a person misplaces a bag or a bag is left unattended, it can be difficult and time-consuming for an operator to locate the bag on the monitor screen. An AI camera can automatically identify the unattended bag, trace back in footage, get the physical and dressing attributes of the person and track the person. This can assist the passengers better and even avoid a panic situation.

3.3 Intelligent Heat Ventilation and Air Conditioning of Spaces

Heat Ventilation and Air Conditioning (HVAC) of the spaces are one the fields where most of the enterprises in market are working on right now. Failure to maintain proper temperature at a workspace not only lowers employee productivity but also may lead to degradation or even damage to certain machinery that requires cooling, i.e. storage systems in a data center.

There are various types of HVAC. An organization may decide to use air conditioning units that work on the input of coolants into them while some may prefer HVAC that purely work on the supply of chilled water to the wired mesh through which the normal air is passed to make them cooled. The areas catered have two vents; the supply air vent and the return air vent. The blue arrows shown in Figure 3 represent supply air vent and those with green arrows represent return air vent.

Figure 3: Supply Air and Return Air Vents for HVAC

(Source: https://www.adriasecuritysummit.com/)

One of the golden logics being used in the HVAC is the balance of the air intake and supply. The space that is supplied with the air (air conditioned) has two vents; one for the supply of the air and other for the suction of the air back into them. The air that is taken back is called return air. In this, 70% is return air and is held back while 30% is disposed. From the external environment we take back the 30% fresh air and mix with the 70% return air with the intent to add freshness and send it back through the metal tubes filled with chilled water to supply cold air into the space.

This can be best explained with an example of temperature. If the outdoor environment is 33-degree Celsius and the chilled air supplied now is 22-degrees, the return air obtained from that room will be roughly 24-degrees. It is simpler to throw out 30% of this 24-degree air and add 30% of 33-degree outdoor air and cool them back to 22-degrees so as to supply to the space again rather than taking 100% of 33-degree fresh air from the outdoor and cooling it again.

This increases the cooling efficiency of the space being catered and increases the savings multi-fold for the same catered area.

There is also other minimalist deployment of automated air conditioning where there is a use of air conditioners that use coolants. In such cases the room automatically adjusts the temperature up or down based on the number of people present in the room. The logic that is observed here is detection of heat in the environment and setting predefined values for the same.

3.4 Intelligent Alarming of Spaces

With more and more large areas of site location for machinery and other similar products the need for safety also increases. Every step towards safety counts when working in a large site

environment. A major safety among them is fire safety. The fire safety systems are rigged in such a way that in case of fire all the vents for air supply from that area are shut down to the other area so that the smoke doesn't spread to the other areas as well and mitigates panic.

Smart fire alarms trigger the alarm such that as soon as the area which is under fire is identified the sensors automatically open the return air vent to 100% and runs the fan to throw the smoke to the outdoor environment. In this condition, no percentage of air is retained; the entire 100% is thrown outside.

Simultaneously, it triggers all the other fans to supply chilled air at 100% to support the shut down of fire in the specific area. This results in a more controlled environment that can be observed with minimal human panic and asset damage.

4. Benefits of Intelligent Spaces

Transformation of spaces to intelligent spaces offers a number of benefits:

- Effective use of energy and natural resources.
- Evident savings in Power and Cooling expenditures.
- Reduced risk of errors or caveats.
- Quicker visibility to issues and hence, the actions as well.
- Centralized monitoring of all the Intelligent resources.
- Reduced effort in day-to-day operation and maintenance.
- AI-based activity monitoring and control.
- Reduced time to issue resolution.

5. References

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