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Museum Conservators and Lighting Designers Exhibit the Benefits of Connected Lighting

by Lois I. Hutchinson | Jun 17, 2019 | WCLI Feature Article | 1 comment

Lighting and exhibition designers, museum facility managers and conservators are at the forefront of the connected lighting revolution, exploring options beyond just LED retrofits

to enhance both preservation of artifacts and the visitor experience. LEDs eliminate UV in the beam, which greatly benefits displays of light-sensitive materials such as paper, leather, textiles, and photographs. But visible light is still problematic, so low light levels and rotating displays (to limit lux-hours) are both recommended to prevent fading or even "shatter." Such damage is difficult to assess and predict, particularly where the LED spectrum can be manipulated in color-tunable lamps. Remember that light damage is cumulative and irreversible.

Easily controllable and intelligent LED sources, sensors, and communication networks come together to create "connected lighting systems." In museums, wireless connected LED lighting, sending and receiving instructions and sensor data, has the potential to adapt to changes in the gallery space or in individual exhibits. Curators can assemble data on light exposure and other environmental factors in the space and compare it with data on the exhibits themselves, monitoring the artifact's condition via miniaturized smart sensors. Combining these analytics with the latest research algorithms and cloud computing could potentially aid in planning and preservation, promoting a data-driven "epidemiological" approach to collections care.

The lighting itself can leverage the data – e.g., daylighting, temperature, relative humidity, occupancy, and traffic patterns – to minimize damage and optimize viewing, responding automatically to other building systems, scheduling and special events cues. Connected lighting can use wireless beacons or LiFi to track a museum patron's movements. Apps offer in-depth, multimedia content – providing historical or contextual information about the location or particular exhibits – or interact with visitors then direct their attention to other exhibits, security issues or special programs and membership.

Nathan Saxton, lighting designer and exhibition specialist at The University of Arizona Museum of Art, is currently completing a building-wide conversion to LED and researching the utility of connected lighting. "In everything we do at the museum, conservation is the foundational requirement," he said. "The problem is balancing today's visitor and their ability to see and understand a work, against our visitor experience 20 years from now, 80 years from now, and our responsibility as an institution that collects historical artifacts." The primary hazards are first, security: theft and vandalism losses are "immediate, catastrophic, and often irreversible but highly unlikely and fairly easily controllable. Lighting is the more insidious damage, because you can't see the damaging effects [as they happen]. If you're seeing your objects every day, unless you're taking regular measurements of the amount of light that's on it and doing frequent condition reports, you don't see the damage."

Saxton is looking for a color-changing system that will provide dimming and automation to

maximize aesthetics, dim lighting in unoccupied galleries, and accommodate special events and changing exhibits easily. As a mid-size institution UAMA may not be a candidate for today's connected lighting. "We're right at threshold of trying to decide if it makes sense for us," Saxton said. "We're trying to decide what data connected lighting can give us back that is valuable versus just interesting." He predicts that as larger players enter the market and wireless and BMS communications protocols standardize, better solutions at lower cost will emerge.

Test, test, deploy

Following past experiments with wired DMX and then connected wireless systems with DIY controls software, the team at the Donald W. Reynolds Center for American Art and Portraiture is planning to deploy connected lighting building-wide. This building houses both the Smithsonian American Art Museum and the National Portrait Gallery. According to Alexander Cooper, head of exhibit technology at the National Portrait Gallery, the wireless pilot project in the Hall of Presidents galleries (reopened 2017) had valuable lessons. "One was that wireless technology was mature enough. At least at the bare-bones level, we could establish secure and reliable communication between access points and fixtures." Cooper and Smithsonian Lighting Designer Scott Rosenfeld have settled on a fixed-color, Bluetooth Low Energy (BLE) solution.

"It's an evolution," Cooper said. "The [DIY] controls system had a very crude interface, but the engine that drives it, we're holding onto that and we're doing what you need to do to expand that into 250,000 sqft of exhibit space." Granular control, mobile programming and extensibility (he estimates 15,000 fixtures plus sensors) were priorities for this historic

building. The wireless API published by LED light source manufacturer Xicato (an application programming interface allows different applications to communicate) lets the system send and receive instructions and information to and from gateways that control groups of sensors and luminaires by Lighting Services Inc. "In an art museum, on a track lighting system or changing exhibits once a month, I want to have a full set of options. And I want to be able to evolve as fixtures get better.... We are committing ourselves at some level, but I think we're getting more than we lose." The Smithsonian's IP-based user interface can be reprogrammed to work with different control topologies and APIs in the future, as needed.

Xicato's wireless lighting systems are currently interoperable only at the IP-gateway level. For instance, a web-based controller can send an instruction to multiple Cat 5–connected gateways (e.g., "cue cleanup scene") and then collect and utilize the data streaming from the smart lights and sensors (e.g., light output and color, occupancy, daylight, energy, relative humidity, etc.). "The gateway that takes these commands and turns them into Bluetooth signals, or wireless signals, we don't have coordination in industry there. So if I bring in a different manufacturer's fixture I have to hang gateways in my galleries and really measure and think about how that signal penetrates around. That's a real challenge right now," Cooper said.

"Certainly, with the Bluetooth SIG mesh the promise is that [one day] all this will be interoperable on a native level," said Ron Steen, Xicato's vice president of specification sales – North America, "The other nice thing... is that it's native on all of our mobile devices."

Cooper added: "We'd love to see open standards developed so that we can incorporate them into the topologies that control the various components in the control systems: the gateways, the fixtures, the databases, all that. So in the way that the Bluetooth SIG [special interest group] years ago established clear standards for BLE component and handheld use [think Fitbit], we'd like to see that in the lighting industry where manufacturers are working to common standards and to the benefit of everybody; mostly the consumer, but business, too."

Beyond occupancy, the Smithsonian system does not currently account for conservation parameters outside of lighting, such as humidity, air quality (particulates, ozone and other pollutants), movement (anti-theft), ambient temperature or heat/smoke; and has limited interaction with other building systems via a Siemens BAS (building automation system).

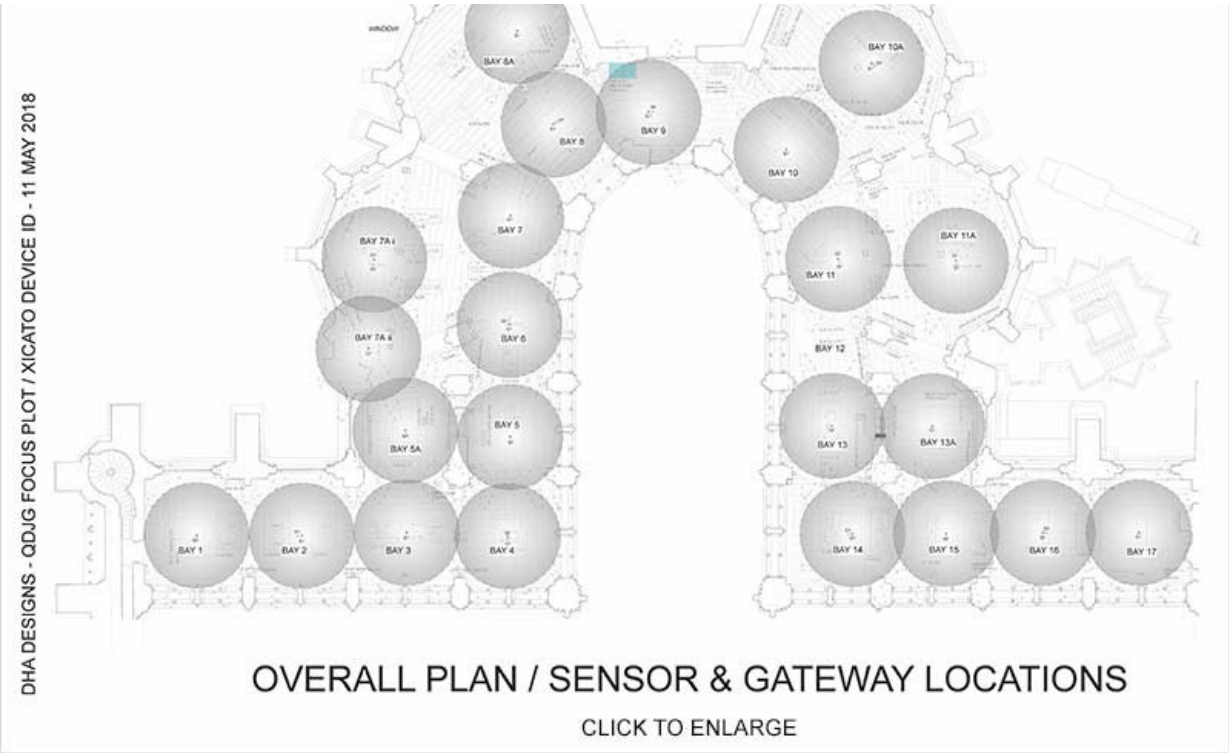
Priceless and irreplaceable

Roger Sexton, Xicato's vice president of specification sales – Europe,

explained that fading of the artist's brilliant colors was the motivator to refit the lighting system at the Van Gogh Museum in Amsterdam, which hosts many corporate events to support the museum financially. With the switch to LED, color rendition was also a priority, along with handheld commissioning. Multisensors there and at The Queen's Diamond Jubilee Gallery exhibit space at Westminster Abbey monitor lux-hours and use occupancy and incoming daylight to restrict light levels as much as possible.


The Bedroom, 1888 COURTESY VAN GOGH MUSEUM

DHA Designs worked with conservators at the Westminster exhibit to limit combined daylight and electric lighting to 50 lx or, in certain instances, even less, according to Sexton. "It's set out in a number of bays, and as you walk from one bay to another the lighting sort of follows you." The electric light in occupied sections is at top trim (or superseded by daylight), while adjacent spaces are dimmed to about 50%; transitions are smoothed to be unnoticed by patrons. "This way you get a very fine, let's say orchestration of lighting."



The historic site's 2 m–thick walls all but require a wireless mesh network where secure data packets can hop from node to node around obstacles and failure points. In addition, the multiple fixture types and sensors can be moved, rezoned and reconfigured easily to accommodate changes or refinements to the experience. Yes, smart lighting means a higher per-fixture cost. But in galleries where addressable controls are required, lighting design, installation and commissioning can be cheaper and easier than with legacy wired solutions. Interoperability opens a "future-proof" path to sensors or beacons that can enhance conservation and space planning, or add interactivity to the patron experience.

It remains to be seen, according to Steen, how this will impact current lighting distribution models. Where can manufacturers, reps and system integrators add value? "Where does this control system reside, and where does it sit in a decentralized system? I think this all part of the story."

A new suite for Sue – the pride of the Chicago Field Museum – uses a wired DMX show controller to cue the general lighting via a Xicato wireless gateway.

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About Lois I. Hutchinson

Lois I. Hutchinson is a freelance writer specializing in lighting and energy issues. She is also the content marketing mastermind behind Inverse Square LLC, a Los Angeles–based consultancy. Contact her via lightinginsider@exponation.net with your comments and any article ideas that concern the lighting community here in the Southwest.

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1 Comment

Kathy A Pryzgoda on December 18, 2019 at 10:57 am

Nice article, Lois!!

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