

Retrofitting Billingsley Company office spaces in Dallas, TX

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Introduction

To showcase the capabilities of Bluetooth mesh lighting networks in different types of office spaces, Silvair together with Murata have implemented a wireless control system at Billingsley Company office building in Dallas, TX.

Murata was one of the first companies to join the globally interoperable Bluetooth mesh ecosystem. Earlier this year, the Japanese tech giant launched production of occupancy and ambient light sensors with Bluetooth mesh connectivity enabled by Silvair Firmware. Silvair has also developed advanced commissioning tools that were used to set up a wireless lighting control system at Dallas office.





Adopted in July 2017, Bluetooth mesh networking is the first low-power wireless technology designed for professional lighting applications.

By introducing multiple innovative concepts, from a fully decentralized information-centric architecture to a highly efficient publish-subscribe communication model, it allows for building complex wireless lighting control systems that provide wire-like reliability. The specification covers a wide array of lighting models that enable seamless implementation of advanced lighting control strategies.

Office spaces at 4100 Midway road, Dallas, TX

The first stage of the retrofit project covered several different spaces that are used by Murata employees on a daily basis. The goal was to show how flexibly a Bluetooth mesh lighting network can be set up to address different lighting needs within the office environment. A wireless lighting control system developed by Silvair was installed in the following rooms:



Products

As part of the retrofit, 23 recessed 2x4 **LED fixtures from Finelite [1]** were installed. Bluetooth mesh connectivity is enabled by fixture-integrated **Murata sensors [2]**. These are qualified Bluetooth mesh products that offer much more than just occupancy and ambient light sensing capabilities. They include smart modules with Silvair Firmware installed onto them. Dedicated for lighting component manufacturers, the firmware allows them to easily incorporate the Bluetooth mesh technology into their products. In addition, energy harvesting wireless switches from **EnOcean [3]** were installed in some of the rooms to enable manual on/off and dimming capabilities. These are also commercially available products that can communicate with lighting devices featuring Silvair Firmware.







In the lighting control system implemented at Dallas office, Murata sensors act as controllers. This is because Bluetooth mesh puts a software controller into each luminaire. Such controller allows luminaires to understand sensor messages and adjust the light level accordingly. The inclusion of the controller within a luminaire eliminates the need for a central control box that governs the entire installation. With an integrated software controller, luminaires themselves are intelligent and form a complete lighting control system.

Commissioning

The system was configured using Silvair Commissioning, a set of tools for setting up and managing Bluetooth mesh lighting networks. The first stage of the process (planning) was carried out using a cloud-based web app. It enables the user to import actual floor plans, as well as specify desired zones and lighting features, using a library of customizable lighting control scenarios. Desired light levels were also specified and timers were set for occupancy-based automation. The second stage (implementation) was carried out using a tablet with Silvair Commissioning app installed. Luminaires were automatically grouped into zones and lighting control features selected earlier were automatically implemented.

The following sequence presents how the implementation stage is carried out with Silvair Commissioning:



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Using the RSSI filter, narrow down the list of visible luminaires and sensors to those that are nearest



Fine-tune the selected scenario and desired operational settings



1 Walk into a room with a tablet / smartphone



3

Identify which devices you want to add to a given zone. The network is formed and all relationships are configured automatically. The app implements the lighting control scenario you selected during the planning stage

Silvair Commissioning has been designed from the ground up to streamline and accelerate the commissioning of commercial spaces. Instead of using the one-by-one approach, typical for existing smart systems, the solution implements desired groups, lighting control scenarios and sensor associations all at once for multiple devices within a particular zone. As this happens, a number of automated networking processes take place in the background. These include establishing the network, configuring security keys, or assigning addresses to devices. This all allows for achieving a fully operational lighting zone, with features such as occupancy sensing and daylight harvesting, with just a couple of seconds spent on each fixture.

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To optimize lighting conditions and energy consumption across different types of spaces, slightly different lighting control scenarios were implemented in individual rooms. The section below describes precisely what lighting features were enabled in specific locations.



Executive meeting room with windows

Lighting control features

- occupancy sensing
- area control with manual dimming
- scenes (meeting, presentation)
- high-end trim
- Sequence of operation

Person enters the space

The light turns on automatically as soon as occupancy is detected.

Space is occupied

Automatic control:

The general light level is automatically adjusted in response to daylight availability in order to maintain 300 lux across the space.

Manual control:

The light can be switched off manually at any time. An occupant can also select one of two custom scenes (meeting and presentation) to set the predefined light levels for each luminaire.

Space is vacant

daylight harvesting

low-end trim

The lights automatically switch to the prolong mode (200 lux) fifteen minutes after the last occupancy detection. If the space remains vacant for another ten minutes, the lights turn off.



Small meeting room without daylight

Lighting control features

- occupancy sensing
- scenes (meeting, presentation, workshop)
- high-end trim

Sequence of operation

Person enters the space

The light turns on automatically as soon as occupancy is detected.

Manual control:

Space is occupied

The light can be switched off manually at any time. An occupant can also select one of three custom scenes (meeting, presentation and workshop) to set the predefined light levels for each luminaire.

Space is vacant

The lights automatically switch to the prolong mode (15%) fifteen minutes after the last occupancy detection. If the space remains vacant for another ten minutes, the lights turn off.



Network operation center without daylight

Lighting control features

- occupancy sensing
- high-end trim

Sequence of operation

Person enters the space

The light turns on automatically as soon as occupancy is detected.

Space is occupied

Manual control: The light can be switched off manually at any time.

Space is vacant

The lights automatically switch to the prolong mode (15%) ten minutes after the last occupancy detection. If the space remains vacant for another five minutes, the lights turn off.



Lighting control features

- occupancy sensing
- high-end trim
- zone linking

Sequence of operation

Person enters the space

Space is occupied

When occupancy is detected in a particular zone, the light turns on automatically in that zone, as well as in the neighboring zones (to the default light level of 300 lux). The light level is maintained at 60% as long as the space remains occupied.

No manual control.

Space is vacant

The lights automatically switch to the prolong mode (15%) ten minutes after the last occupancy detection. If the space remains vacant for another five minutes, the lights turn off.

Linked space is occupied

The light in the hallway is maintained at the default level (60%) as long as the neighboring meeting room or network operation center are occupied.



Lighting control features

- occupancy sensing
- area control with manual dimming
- scenes (auto, maintenance)
- high-end trim
- daylight harvesting

- zone linking
 - all zones within the open space are linked so they can be controlled with a single switch (on/off, dimming, scenes)
 - individual zones are linked to each other when occupancy is detected in one of them, the luminaires in the neighboring zones also turn on

Sequence of operation

Person enters the space

When occupancy is detected in a particular zone, the light turns on automatically in that zone, as well as in the neighboring zones (to the default light level of 300 lux).

Space is occupied

Automatic control:

The general light level is automatically adjusted in response to daylight availability in order to maintain 300 lux both in the occupied zone and the neighboring zones.

Manual control:

All lights in the open space can be switched off manually at any time. The maintenance scene can be triggered with a wall switch to reduce energy use, while at the same time enabling throughout cleaning and safe repairs.

Space is vacant

Both in the occupied zone and the neighboring zones, the lights automatically switch to the prolong mode (200 lux) fifteen minutes after the last occupancy detection. If the zone remains vacant for another ten minutes, the lights turn off.

Monitoring tools

In addition to advanced lighting control capabilities, Bluetooth mesh lighting networks can provide multiple additional features and services. Silvair Monitoring is a set of software tools developed to take advantage of these possibilities. It provides valuable insights not only into a lighting control system powered by the Bluetooth mesh technology but also into processes taking place across a given space. Following the retrofit, Murata can use the Silvair Monitoring software to access fine-grained occupancy and energy consumption data for individual rooms. This data can be displayed in a convenient visual form (heatmaps).

Below is a screenshot from Silvair Monitoring. It provides valuable insights not only into a lighting control system powered by the Bluetooth mesh technology, but also into processes taking place across a given space.



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