Casambi Whitepaper

Wireless lighting control for: **Hospitals and Healthcare Facilities**

CASAMBI

Introduction

Today's modern healthcare facilities are evolving from exclusively clinical environments into welcoming, empathic destinations for patients seeking care. Hospitals are modifying their spaces and infrastructure to become more patient-centric yet easily adaptive to new processes and technology. Research [(1)] shows that a physically and psychologically informed environment supports the healing process of patients, resulting in shorter-than-average hospital stays. Rethinking design aspects such as room layouts, visibility of medical equipment, music, access to daylight, and quality of indoor lighting can yield significant improvements [(2)].

A large amount of lighting-focused research is proving the direct connection between human health and lighting. It is now known that our circadian system is controlled by the intensity and spectral composition of light. The human body's ability to produce the natural hormones needed to balance sleep/wake rhythms - melatonin and cortisol - is determined by the circadian system. For healthcare facilities, it is especially important to provide as much natural or dynamic simulated daylight as possible to keep this balance. A lighting design that is aligned with the circadian rhythm promotes well-being not only for patients but also for the rotating staff on 24/7 schedules.

There are also new emerging trends in healthcare. With an aging global population, healthcare facilities must now meet the different needs of older people, such as better-lit spaces, easier navigation, or uniformity in lighting. Versatility is also essential. A single space must cater to a wide range of uses - each with its own unique lighting requirements. Hospital wards should simultaneously support patient resting, medical inspection, and cleaning without disrupting patients' sleep/wake rhythms.

Elderly Care

Senior care facilities are in higher demand as population aging continues. Presently, in more than 70 countries the ratio of elderly citizens (65 years and older) now exceeds 10%, signaling a global phenomenon [(3)]. According to the UN, the number of older persons is expected to reach 1.5 billion by 2050 – a trend that will soon see more older people than younger people inhabiting this world.

When it comes to space utilization and lighting in nursing and retirement homes, older people may have specific requirements, especially those requiring persistent care. Ease and safety of movement around a space are essential while factoring in wake/sleep cycles is also important [(4)].

With age, the lens of the eye gradually becomes less transparent, therefore an elderly person may require almost four times as much light as their younger counterpart for performing the same visual task. Additionally, a reduced ability to adapt to glare or changes in light and a deteriorating ability to identify all parts of the chroma (purity of color) can hinder daily activities. Uniform and sufficient levels of illumination for all circulation and socializing areas are important. For multi-use areas such as social rooms, an easily controllable lighting system with preset scenes for socializing, reading or relaxing can help support each daily task.

Special attention should also be given to transition areas, with sufficient levels of lighting and uniformity to ensure safe movement.

Sleep disturbance and deficiency are also common issues for the elderly. Research carried out in a retirement home in Hüfingen, Germany, between 2007 and 2009, showed that a circadian lighting scheme helped to maintain balanced sleep/wake cycles for the residents. The study showed that residents' quality of sleep under circadian lighting improved after just eight weeks. Ten months later, nursing staff reported that 75 percent of nights were significantly quieter. Another 25-week clinical trial in the United States also showed that a regular circadian-effective daytime lighting intervention can improve sleep at night and reduce depression and agitation in patients with dementia [(5)].

Research conducted by the Lighting Research Center in New York revealed that people with Alzheimer's and other dementias living in long-term care facilities can suffer under inadequate lighting that is not bright enough during the day and oftentimes too bright during the evening.

Hospitals

In hospitals, good lighting is key for the well-being of both patients and staff. For inpatients, lighting should be customizable to suit personal preferences and multiple tasks such as resting, reading or medical inspection. Light can significantly affect mood and well-being, therefore providing a feel-good atmosphere for patients is also essential. It is not only artificial lighting but also daylight that should be designed to contribute to recovery. Research [(6)] has shown that there is a direct correlation between better indoor daylight conditions and a reduced average length of stay (ALOS) for inpatients.

The small form factor of Casambi modules and not having to use any control wires makes Casambi the perfect solution for placement inside bedhead trunking systems. Casambi Ready wireless "out of bed" sensors inside the trunking system or an easy nurse call interface that is connected to the nurse station ensures patient safety at all times. Multiple light scenes controlling Casambi Ready luminaires inside the room give patients more control over their lighting. Additionally, a smart lighting system that incorporates wireless daylight sensors and automatic control of blinds or shutters maintains good daylight conditions while preventing any disturbing glare.

For the hospital staff, lighting should support a multitude of tasks with sufficient illuminance, good glare limitation and good color rendering. A well-designed and easily adjustable lighting installation is of key importance for medical tasks such as diagnostics and surgery. To match the high lighting performance of medical LED luminaires, Casambi provides unique functionality to adjust dimming curves according to the light source, thus precise dimming and light control without losing on the light quality.

Medical staff working round the clock occasionally suffer from disturbances in sleep-wake rhythms. Human-centric lighting can help to boost alertness and activity levels without causing any damage to health.

As facilities that operate 24/7, efficiency is also key for hospitals. Smart lighting control strategies combining occupancy detection and daylight-responsive controls help reduce energy use; and contribute to the reduction of heat dissipation. Additionally, data generated from the Casambi network can be used by the facility managers to plan predictive maintenance and reduce operation and maintenance costs.

Asset tracking systems are now widely deployed in hospitals to allow staff to locate medical equipment in real-time. Each Casambi device comes with embedded iBeacon functionality. This allows the lighting system that is spread out throughout the hospital to locate medical devices within their proximity and inform the users through a third-party platform.

Doctor's offices & waiting rooms

Doctor's offices are multi-purpose rooms that serve multiple tasks such as patient interviews, medical examinations or regular office work. Lighting should be easily adaptable to suit this variety of tasks. Medical examinations that involve a monitor or ophthalmology examinations where special lighting is used both require different light settings that should be easily adjustable by the doctor or staff. Indirect lighting complemented by a high-intensity medical luminaire, that can be controlled separately and dimmed down is often the best way of illuminating a doctor's office.

Maintaining a feel-good atmosphere in the waiting rooms and treatment rooms through the use of colored light and dynamic light scenes can also help improve the patients' mood and reduce anxiety. Several research studies show that chromotherapy plays a pivotal role in anxiety reduction before and during certain treatment procedures [(7)] [(8)].

Sustainability

Hospitals and healthcare facilities are some of the most resource-intensive buildings in terms of energy consumption. They have the highest energy intensity of all publicly funded buildings and account for over 4% of global CO2 emissions [(9)], and must therefore be designed for maximum efficiency and cost-effectiveness. Longer maintenance intervals or the possibility to run predictive maintenance significantly reduces the cost of sustaining a large facility, as well as reducing the workload of technical staff.

There are several ongoing projects that aim to reduce the carbon footprint of healthcare facilities around the world. The National Health Service in England was the first public health system to commit to achieving net zero by 2045 including both its direct emissions and those of its supply chain. The actions include increasing the contribution of renewable energy, reducing energy consumption and adopting more sustainable procurement strategies to favor products with low carbon footprint. Proven to yield energy savings of up to 70%, many healthcare providers are enacting measures to ensure LEDs are taken into use across their facilities. Smart lighting control strategies combining occupancy detection and daylight-responsive controls help reduce energy use further; and can contribute to the reduction of heat dissipation, which in return allows further energy savings with climatization.

In addition to energy-saving functionality, Casambi brings unprecedented simplicity to lighting controls. The elimination of control wires and extremely reduced hardware complexity translates to reduced material use and less embodied carbon throughout the building.

How Casambi can help

Casambi offers a great solution to meet the modern healthcare facility's lighting control needs.

Casambi's mesh technology provides lighting designers and manufacturers with the ability to wirelessly link devices together enabling the creation of customizable smart lighting networks that are configured and controlled using the Casambi App. The solution is based on BLE (Bluetooth Low Energy), which is the only low-power wireless technology found in all modern smartphones, tablets, and even smartwatches. The same technology is embedded into hundreds of luminaires and devices from all the major lighting manufacturers. With a vast array of Casambi Ready products available, the benefits of smart lighting can be enjoyed in a facility without the need for special wiring, or complex hardware requirements.

Thanks to its simplified system architecture and user interfaces, Casambi is easy and fast to specify, install, commission, and use.

Application highlights

Occupancy detection
Sensors can detect motion to indicate the presence of a person and automatically turn on lights only when they are needed.

Daylight harvesting
Adjustable lighting strategies can be programmed and implemented – such as daylighting, whereby automated controls can adjust the lighting or window blinds to maintain a target level, reducing energy costs.

Human-centric lighting
As light can affect human circadian physiology, smart lighting can be programmed to follow staff/patient sleep cycles to positively affect health, alertness, and productivity.

Intuitive interface on mobile devices
Luminaires can be turned on and off remotely, and easily reconfigured and recommissioned from a mobile phone. Changes in control groups or light scenes can be applied at any time by facility staff.

Environmental monitoring
Connected lighting can be used as an onramp for other applications such as air quality control, dangerous gas leak detection, or noise pollution monitoring.

Scheduling and timers

It is possible to create time-based scenes that turn on, off, or dim selected luminaires to preset levels according to bespoke needs.

Task tuning

Lighting can be adjusted to the optimal level for individual task areas improving worker safety and saving energy across a site.

Non-disruptive installation and rapid commissioning

Wireless lighting can be installed without the need for surface reconstruction or the pulling of wires and commissioned remotely from an app.

Wireless emergency lighting

If emergency services are called for, lights can be swiftly and remotely controlled to shine at maximum brightness for increased visibility. Such systems include automated testing and reporting to ensure full working order.

Open platform to monitor energy savings and control assets

The Casambi Cloud API allows software developers to integrate Casambi networks with third-party Building Management Systems (BMS) - in doing so, opening the doors to remote monitoring of Casambi networks, with access to sensor, diagnostics, and usage data.

How it works

Casambi's solution forms a mesh network, which enables encrypted device-to-device wireless communication inside a lighting network. Mesh networking is essentially a low-latency, low-power mesh network protocol, which translates to a super-fast, battery-life-extending, and highly reliable connection. Bluetooth Low Energy (BLE) is used for communication between a mobile phone or the control device and the Casambi network.

Casambi's mesh topology is self-healing, which means that if a device fails, the signal flow automatically reroutes through other devices, increasing reliability through multiple nodes and redundancy of nodes. Therefore, there is no single point of failure because no single critical element that stores the information is needed for the proper functioning of the network or part of it.

No special wiring for lighting controls is needed and all hardware complexity is reduced to a minimum. This is because no central units such as routers, controllers, or gateways are needed for the operation of a Casambi network. A Casambi network can contain up to 250 devices and each one is independent and has a backup of the entire network, i.e., all nodes of the mesh network carry the complete system intelligence.

Figure 1 - Casambi stand-alone mesh network

All system configurations and end-user controls are managed via the Casambi App, which is available for free on iOS and Android.

The Casambi network operates without an internet connection. However, an internet gateway can be added to gain remote control over the network or to interface with building management systems via a cloud connection.

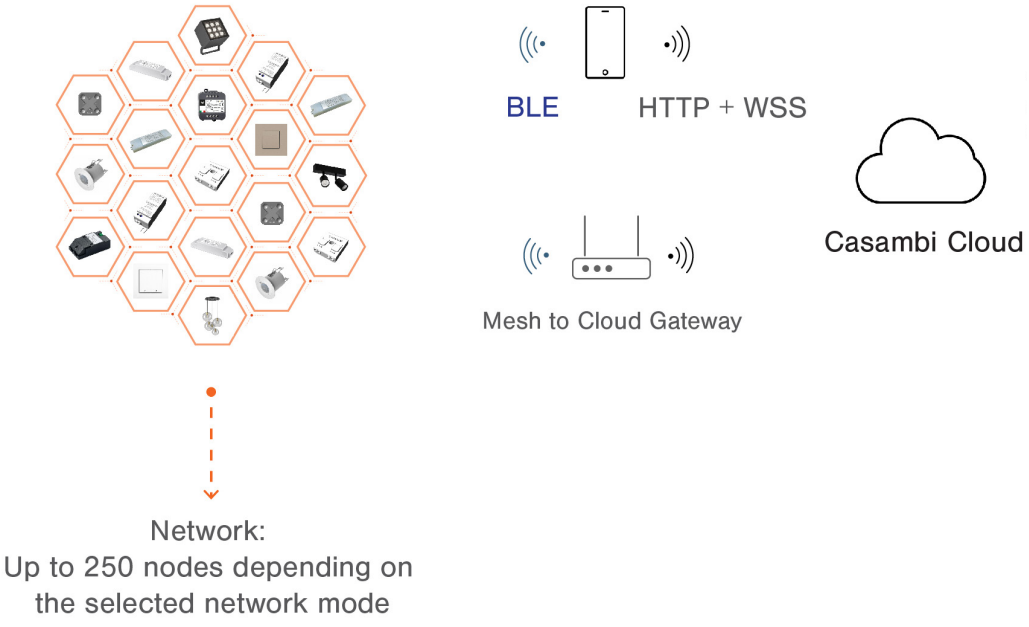


Figure 2 - Casambi to Cloud

Use of Casambi in sensitive environments

Casambi is deployed in highly sensitive environments, such as in hospitals, factories and airports, where reliability and security of communication are critical. Such cases bear testimony to the hardiness of the technology and supporting services. The system is robust in design and has been certified as cyber-secure in accordance with global standards.

In 2022, Casambi received ioXt Alliance cybersecurity certification for its system, affirming its ongoing commitment to network security for customers and stakeholders. Casambi's wireless lighting control system tested positively against the alliance's eight guiding principles: the provision of secured interfaces, proven cryptography, security by default, verified software, automatic security updates, a vulnerability reporting program, security expiration dates, and no universal passwords.

Mythbuster: Interference with Sensitive Medical Equipment

Bluetooth Low Energy is a popular communication technology for portable medical devices. In fact, the uptake of BLE-enabled medical equipment is expected to double by 2026 (Source: 2022 Bluetooth®Market Update, Bluetooth Alliance). Anxiety over potential interference with portable medical monitors or other sensitive equipment is one of the biggest barriers to the uptake of BLE lighting controls in healthcare facilities. This is a concern that Casambi is keen to dispel. The BLE bandwidth (2.402 GHz to 2.480 GHz) is spread into 40 channels of 2MHz, 37 channels for data communication and 3 channels for advertising.

Casambi networks do not use the standard BLE radio channels (i.e. Standard BLE Channel 0: 2.404 GHz, Channel 1: 2.406 GHz, ..., Channel 39: 2.480 GHz), which means it is much less likely that a BLE standard medical device will operate on the same radio channel as a Casambi network and cause interference. In case there is another BLE device within close proximity that is using the adjacent or a similar channel, the radio channels used in the Casambi network can be manually configured from the app to avoid interference.

Casambi has been installed and used in a number of hospitals and is proven to work nicely alongside sensitive equipment such as MRI, CT Scanners, X-Ray, or Ultrasound. *Please see the Ulster Hospital case study for further information.*

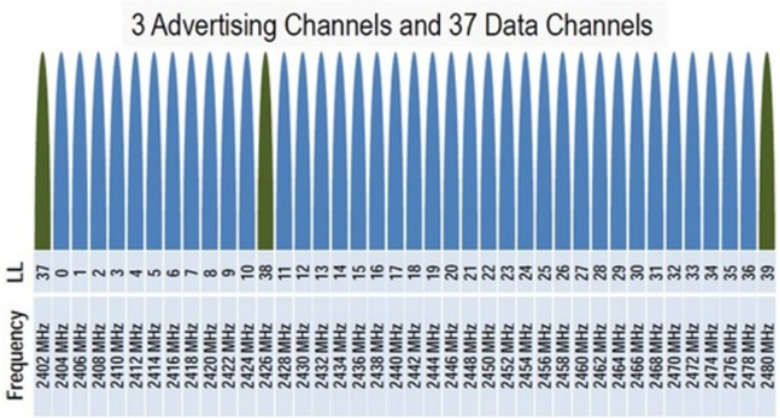


Table 1: Bluetooth Low Energy Frequency Channels, Source: Sevier, Seth & Tekeoglu, Ali, 2019, Analyzing the Security of Bluetooth Low Energy. 1-5. 10.23919/ELINFOCOM.2019.8706457

Casambi benefits for hospitals

A great retrofit solution to achieve energy efficiency with minimal disruption to daily operation.

Healthcare services run 24/7. Offering round-the-clock services, hospitals and healthcare facilities are some of the most resource-intensive buildings in terms of energy consumption. Therefore, maximizing energy efficiency is of paramount importance. Further energy savings are made possible through daylight-responsive lighting, presence detection or time-based scenes. For renovations, Casambi presents the simplest way of upgrading existing installations. Luminaires with integral drivers, decorative fixtures with LED lamps, or even existing wall switches can gain wireless connectivity with the addition of a Casambi Bluetooth Unit (CBU).

An existing lighting installation can be upgraded to wireless to achieve dynamic control functionality and further energy savings. It is not necessary to install new wiring or reconstruct surfaces to configure a wireless lighting network. The addition of wireless sensors and switches from the Casambi Ecosystem unlocks further energy savings in existing installations, with minimal disruption.

Ref.	System	Element	Component	Recommendation	Energy Savings
A1	Lighting	Internal lighting	Lighting type	LED luminaires offer the most cost-effective solution in all hospital areas. Replace existing fluorescent units with LED lighting at end of life.	
A2	Lighting	Internal lighting	Dimming type	LED luminaires can be non-dimming or dimming (e.g. Dali driver). Dimming luminaires can be dimmed during building commissioning to the minimum lighting level required by the applicable Lighting standard, thus saving energy.	
A3	Lighting	Internal lighting	Dimming controls daylight harvesting	Particularly for staff areas (examination rooms, nurse stations, offices, corridors) and public spaces (waiting areas, reception). Add daylight lighting controls to any space within 4.5 m of an outside window. Daylighting controls dim perimeter lighting when daylighting in a space is high enough as measured by local daylighting sensors.	
A4	Lighting	Internal lighting	Presence lighting controls - General	Consider presence control sensors in general in addition to or instead of auto/timed OFF luminaires in all areas as possible. Switching on may be manual or automatic.	
A5	Lighting	Internal lighting	Luminaire Circuit Configuration	Daylighting control and presence controlled luminaires require circuits that separate internal and perimeter lighting to create a more cost-effective control of luminaires.	
A6	Lighting	Exterior lighting	All other exterior lighting	Exterior lighting should also use LEDs. Exterior lighting should be controlled by daylighting sensors and turn down automatically to 0% when daylight is sufficiently bright.	

Table 2: Energy efficiency opportunities with lighting systems in hospitals and healthcare facilities (Source: Energy and Resource Efficiency in Hospitals and Healthcare Facilities, ARUP, 2021, Available online from: https://e5p.eu/public/upload/media/Healthcare.pdf)

Improved efficiency for facility management

When compared with traditional wired installations, the operational and maintenance costs for a Casambi system are significantly lower. No controllers nor any special software licenses are required to use Casambi control. The active control of lighting levels helps to extend the luminaires' lifespan, which translates to fewer lamp replacements and labor maintenance savings – saving on the time and effort it takes to climb up and switch out the lamp.

Through its modern API, Casambi networks can also be integrated into third-party dashboards and applications. This enables network monitoring and the usage of collected data from a lighting installation. It's possible to monitor and visualize all data from a Casambi network, such as energy consumption, failure states, occupancy patterns, or air quality. Using real-time data, it's possible to run functional analysis on capacity, predictions and even run predictive maintenance. This significantly reduces the cost of sustaining a large facility as well as reducing the workload of technical staff.

Casambi also supports environmental monitoring. Connected lighting can be used as an onramp for other applications such as remote air quality control or noise pollution monitoring.

The Casambi App has been designed by user interface experts with one core principle; regardless of technical proficiency, anyone can use it. Luminaires can be remotely controlled, easily reconfigured and recommissioned from a smart device.

Human-centric lighting for wellbeing

On a day with clear skies, the color temperature of daylight ranges between 2000K to 6500K. Customized circadian light scenes that follow the changes in daylight can be used to synchronize the body clock of patients or residents to the day. A sample light scene for a hospital patient/care home resident room is shown below. From the Casambi App, users can set customized circadian profiles based on their preference and create preset scenes that turn up/dim down light levels based on the time of day.

TIME	CCT (KELVIN)	LIGHT INTENSITY (%)
SUNRISE	4000 K	80 %
09:00	5000 K	85 %
12:00	6000 K	95 %
15:00	5000 K	75 %
18:00	4000 K	70 %
SUNSET	3000 K	65 %
21:00	2700 K	45 %
24:00	2700 K	25 %

Table 3: Light scene settings for a hospital patient/elderly home resident room. The light scenes differ in light intensity and color temperature throughout the day, following the common characteristics of daylight on a clear day. Higher illuminance is proposed in the morning as it is found to be more beneficial to residents/patients than when provided in the afternoon[6].

Access to daylight also has a great impact on the recovery duration and the general well-being of patients. Research[6] has shown that there is a direct correlation between indoor daylight conditions and the average length of stay (ALOS) of patients. ALOS of patients residing in southeast-facing rooms of a hospital was found to be shorter by 16-41% than of those residing in northwest-facing rooms.

Direct daylight exposure may also mean exposure to disturbing glare during certain hours. With Casambi, in addition to daylight-responsive interior lighting, blinds and shutters can also be made daylight responsive in order to minimize the disturbance from any glare caused by direct sunlight.

Hospital patients or residents of care homes can also benefit from personalizing the lighting inside their rooms. Preset scenes befitting different tasks/preferences can be stored and activated at the touch of a button. When Casambi was installed in Ulster Hospital, in Belfast, Northern Ireland, six different lighting scenes were created for the patient rooms - all of which can be activated using intuitive Casambi Ready wall panels.

Case studies

Ulster Hospital, Belfast, Northern Ireland

Casambi wireless lighting controls are used in all areas of Ulster Hospital's Acute Services Block, a newly constructed eight-story building with over 31,000m^2 of floor space. A prime objective of the new facility has been to promote better patient well-being. Casambi's system was deployed on account of its ability to fulfill this brief.

From the outset, there were two key objectives in the lighting project brief. Estates Facility Services Manager for the South Eastern Health and Social Care Trust (under which Ulster Hospital falls), Sam Greer, said, "We wanted a wireless solution, which we saw as advantageous in changing lighting controls and lighting strategies, with minimal disruption to the occupants and the daily activities. This was in the interest of improving patient wellbeing."

During the design phase, the Trust was convinced that the new building should feel less clinical and more welcoming, like a hotel. This meant that such things as the luminaires needed to be inconspicuous in size and endowed with the ability to program appropriate lighting scenes. The system also needed to be highly resilient, meaning that there would be minimal disruptions in the event of a power outage.

A particular function that Casambi provides is in the patients' bedroom, where several sensors monitor such things as "out of bed movement" (alerting nurses if a patient is out of bed) and daylight, which in turn adjusts the lighting accordingly. The bedrooms' lights can also be controlled from the nurse's station in such events as an emergency. Additionally, many of the bedrooms' scenes provide, via a bedside handset, different scenes for such things as reading or watching TV.

The Casambi control solution was used for all hospital lighting, namely the bedrooms, nurses' stations, corridors, plant rooms, offices, and all exterior lighting around the perimeter and the roof.

Key functionality

- 'Nurse Call' interface by patient bed and at Nurses' workstation
- Battery-free wireless EnOcean switches in all areas
- Patient rooms: six different scene settings, daylight harvesting, "out of bed" sensors
- Circulation areas: time-based light scenes and dimming based on presence and daylight
- Scene settings in offices, public areas, cafeteria
- Presence detection for further energy savings in medical rooms, offices, back-of-house areas and bathrooms
- Exterior lighting: 'Dawn to dusk' scene

Areas with Casambi

- Patient rooms, 2-4 bed bays, Ambulatory Care Wards
- Nurse stations/Staff bases
- Corridors, stairwells, waiting areas
- Entrance lobby, reception, main entrance
- MRI, CT Scanners, X-Ray rooms, ultrasound
- Restaurant, servery
- Changing rooms, public/staff toilets
- All stores, cupboards, hold, utility & bays.
- Kitchen area, hub kitchens
- Office, consultation, report, multipurpose, management, staff, control, interview, therapy, treatment rooms
- Plant rooms, hub rooms
- Exterior lighting

Casambi for Elderly Care

A human-centric lighting scheme backed by smart lighting controls can help meet the specific needs of the elderly in a number of ways, as summarized in the table below:

Age-related difficulties and problems	How to prevent accidents and create comfortable environment(s)?
Reduced ability to adapt to glare stimulation	In order to reduce glare and reflections, uniform brightness needs to be produced by direct and indirect lighting by using right optic and light sources.
Reduced social participation, insecurity and anxiety. Sleep-wake disruption.	Introducing circadian-effective lighting and establishing a positive atmosphere will enhance patients' well-being, reduce nursing workload, and the need for sleeping pills.
Inability to identify all parts of the chroma and taking longer to adapt to changes of light.	Tuning light for different tasks provides flexibility and responsiveness. It increases visual capabilities and orientation.
Mobility impairment	The right lighting and higher illuminance prevent accidental falls supporting independence. The use of larger and illuminated switches can help eldery and dementia patients find their way around easily.
Distance perception changes	At nighttime, presence-based control can reduce main lighting levels and provide orientation lighting for safety.
High energy costs	Customizable lighting control systems provide only the right light, at the right time, in the right place. This provides greater comfort and convenience at lower cost.

Table 4: How a well-designed lighting system backed by smart lighting controls can help create a comfortable and safe environment for the residents of elderly care homes

Social / Communal Spaces:

CONTROL TYPE	FUNCTIONALITY
Manual Control	Staff can easily switch between preset lighting scenes, dim lights down/up, adjust the color temperature from the Casambi App or usingwireless smart switches. Scenes: Daytime General– Daytime Craft/Work/Reading - Evening – Night
Daytime Scene	During the day, it is important to cater to the needs of house-bound patients by providing daylight-like lighting indoors. In the **Daytime General scene**, the color temperature (K) of ambient lighting follows a customized profile that runs automatically based on the time of day i.e. running smoothly from 4000K to 6500K from sunrise until noon, 6500K to 2400K from noon until the end of the day. It is recommended to provide illuminance levels higher than the normative requirements i.e. 1000lx instead of 200lx for ambient lighting. Light intensity differs between 80% and 95% from sunrise until noon and is gradually dimmed down to 25% at night. **Daytime Craft/Work scene** is used for tasks that require high attention and visual acuity, therefore higher illuminance is provided by turning lights up to achieve the required levels. Color temperature can follow the circadian profile as programmed in the Daytime General scene, or can be fixed at 4000K.
Evening Scene	Warm color temperatures below 3500K and a significantly lower ambient lighting level (less than 500lx) gradually prepare the body for night.
Night Scene	Since the visual adaptation of an elder person's eye requires more time for transition, presence detection is not applied in social areas during the daytime or evening. A 'Night Scene' together with presence detection can be used during late hours, when residents are mostly asleep. Occupied: Run Night Scene (2700K 25%) Unoccupied for 10 minutes: Turn off lights

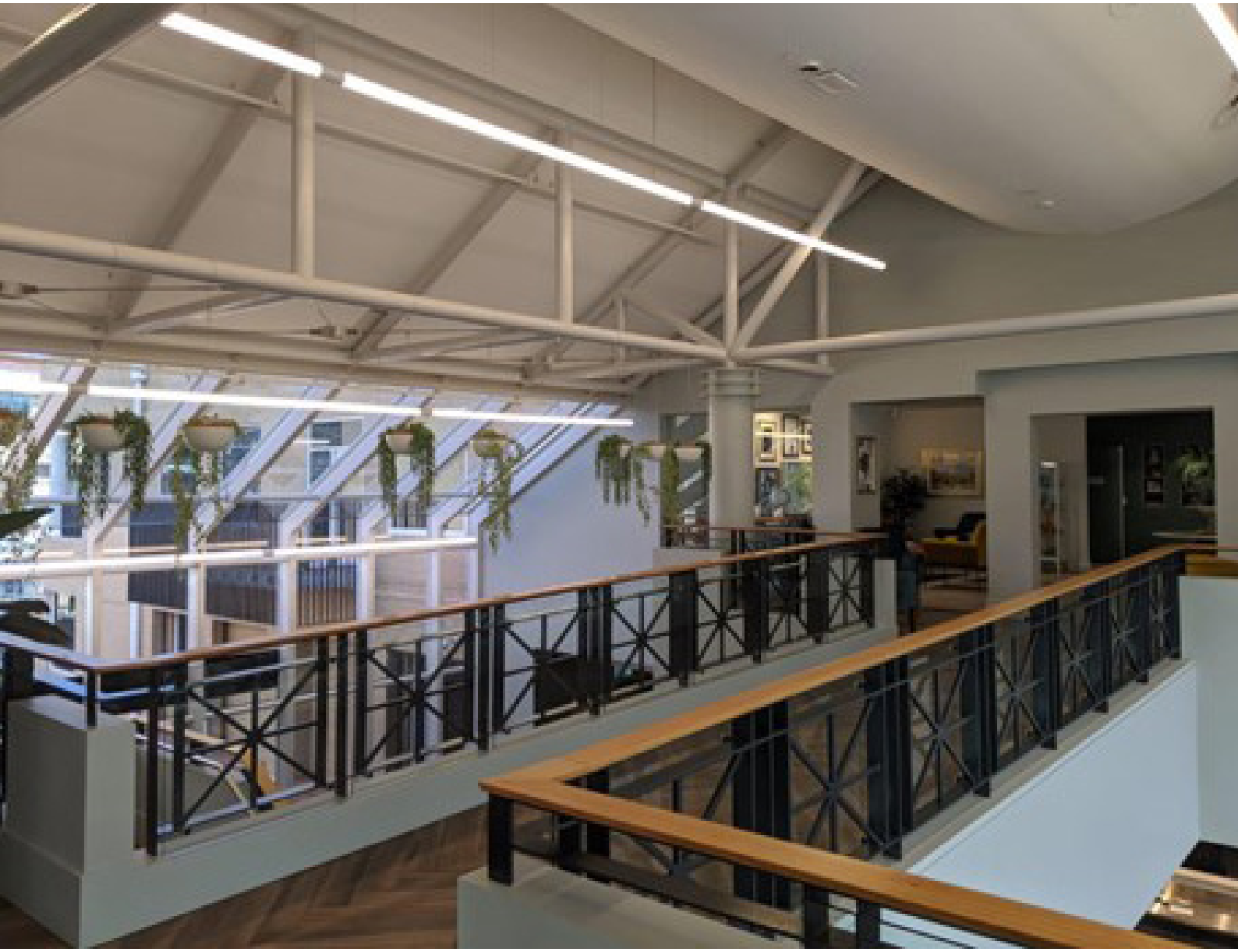
Connecting Spaces / Circulation Areas:

CONTROL TYPE	FUNCTIONALITY
Motion Detection (Presence)	Since the visual adaptation of an elder person's eye requires more time for transition, presence detection in connecting spaces should be applied carefully i.e. by triggering a presence scene in a corridor when movement is detected in the adjacent space connecting to the corridor. Again, lighting levels well above the normative levels are suggested to ensure safe passage. Occupied: Run scene Unoccupied for 10 minutes: Turn lights off

Greenway Views, Canberra, Australia

Greenway Views is a purpose-built seniors' living village in Canberra, Australia, that has been designed to be a self-contained community with over 380 purpose-built apartments, cafes, bars and a care hub. It has been designed from the outset to be a showcase of the latest in health and building technologies. Casambi is a central component of the suite of technologies that are integrated into the village and is used to control every single light fitting from the street lights, interior public area lighting, apartments and back-of-house areas.

Casambi provided a cost advantage to the construction stage as the electrical contractors did not have to run switch wiring instead only requiring one circuit for all the lights. This saved time and cost in terms of componentry and labor. Comprising over 5000 lighting points without the need for wiring and dedicated lighting control "black boxes" made the deployment of this state-of-the-art lighting control system unnaturally fuss-free.



It is the myriad features and inherent flexibility of the distributed computing nature of the Casambi lighting control system that really adds value to the rollout. With a full suite of ecosystem products - such as sensors and wireless switches - easily accessible, Greenway Views is able to provide its residents with very customizable lighting scenarios.

The use of movement and light level sensors further enhances Casambi's value to the project. With the project being able to easily integrate daylight harvesting, circadian rhythm lighting along with sensor-activated corridors. Sensors in particular played a great part in creating a more intuitive living space for residents with cognitive difficulties.

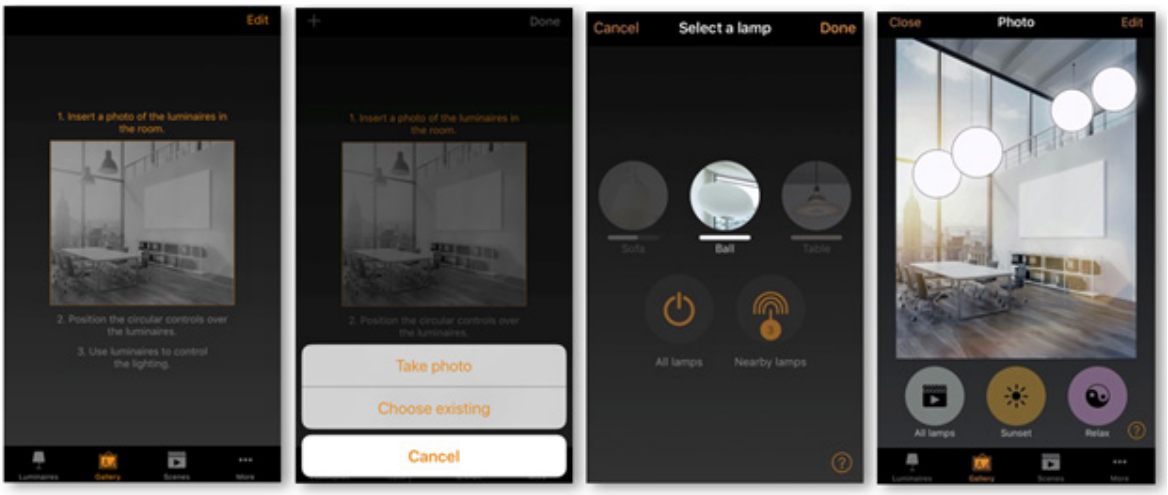
Key functionality

- Daylight harvesting for an improved indoor atmosphere
- Circadian lighting
- Wireless switches with multiple scene settings
- Energy savings through daylight harvesting and presence detection
- Presence detection for easy navigation of residents with cognitive difficulties

Casambi for Doctor's offices & waiting rooms

A flexible lighting system that accommodates different scenes and easy customization is essential for doctor's offices. Through its wide ecosystem, Casambi offers multiple ways of manually controlling a lighting installation such as wireless control plates that offer preset scene selections, dimming and color temperature adjustment, or rotary dimmers and push buttons. It is also possible to make manual adjustments or scene selections using the Casambi App.

The Casambi App's Gallery feature allows the user to take or upload photos of a space or a floor plan and mark the positions of the luminaires within these images. This helps to visually identify and intuitively interact with them. The user can change light settings by simply touching the luminaires on the photo inside the app.



Augenspezialisten Saar Eye Clinic, Germany

Constantly changing lighting conditions are part of everyday life in an ophthalmologist's office, having a big influence on circadian rhythms. The primary goals for the refurbishment of eye clinic, Augenspezialisten Saar in Püttlingen, Germany, were to implement complex control tasks for the end-user in a simplified form and artificially match the dynamics of daylight. The new lighting control solution also needed to be tailored to the needs of an ophthalmology practice, especially regarding the procedures for medical examinations with the ophthalmologist's slit lamp.

It is imperative for this kind of practice that the ambient brightness can be reduced to a minimum to give the doctor sufficient visibility inside the patient's eye. Additionally, since all the rooms at the clinic are uniformly adjusted to daylight as per human-centric lighting, the illuminance should then return to the same levels as all other rooms after the examination.

Lighting designer, Tobias Link first tried to design the lighting control system classically via KNX–DALI. Still, it was subsequently determined that a KNX solution would have been three times more expensive compared to the Casambi solution. Aside from the dramatic cost difference, Casambi was chosen for ease of use and the fact that the system can be viewed and programmed simultaneously by an installer and the light planner. Casambi also proved easy to integrate into the examination room slit lamps and the wireless Xpress switches in the practice rooms.

The user now has a dynamic lighting concept that synchronizes highly complex medical processes with a daytime dynamic lighting climate and the logistical processes of an ophthalmology practice. The doctors are very happy with the outcome and have high praise for the beneficial effect of the HCL concept, which makes them more relaxed at the end of the day and makes them feel closer to the seasons and times of day than was the case with the old lighting.

Both staff members and patients benefit in particular from lighting that changes according to the rhythm of light throughout the day, as demonstrated in the refurbished offices of the eye consultants, Augenspezialisten Saar, in Püttlingen.

Conclusion

The increasing capabilities of wireless smart lighting control are expanding the possibilities to go greener, evolve businesses to become more efficient and to improve health and safety in the workplace. Hospitals and healthcare facilities can also harness the healing power of light with smart control to improve the well-being of their patients too.

When lighting is connected to the cloud, it also enables a world of data services. Facility lighting becomes Industry 4.0-ready, unlocking the potential in indoor positioning services for heatmapping, asset tracking or simply real-time energy consumption monitoring. And it all starts with wireless lighting control.

Casambi's smart lighting functionality brings new dimensions to design and total freedom to create: color temperature, lighting colors, dimming, human-centric lighting, and individual tuning. Together with its ecosystem partners, Casambi is dedicated to supporting lighting planners and designers throughout their lighting design projects.

Casambi is an open ecosystem of truly interoperable devices. We are a neutral partner for all the industry players.

Our technology is integrated into fixtures, drivers, modules, switches, sensors, and different kinds of control modules.

Data and control access through the Extension interface and Cloud API.

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