OCCUPANCY, ENVIRONMENT & FACILITY USE

Understand how spaces are used, and what conditions people experience while using them

How occupancy, people counting, temperature, CO_2 and environmental sensing come into common room and zone context — and how a building answers facility questions without collecting more about the people in it than the question requires.

Buildings are operated according to schedules. People do not follow them. A meeting room is booked and empty. A common area fills unexpectedly. A hotel room stays vacant for hours after its conditioning period begins. A classroom is full while ventilation stays where it was. An event space gains a hundred people and the environmental load that comes with them. A corridor or amenity space consumes energy though almost nobody uses it.

Traditional operation runs on assumptions — the building is open so the space must be occupied; the room is reserved so people must be there; the HVAC schedule is active so conditions must be acceptable; the sensor reports a temperature so the space must be comfortable. Those assumptions are often good enough to run a building. They are not the same as knowing what is happening.

SCOPE

This application explainer owns the space-operations layer: presence, occupancy state, people counting, utilization, temperature, humidity, CO_2 and supported environmental measurement, room and zone context, alerting, and portfolio facility-use analysis. Connection and normalization belong to Connectivity & Integrations; control authority to Protected Control & Resilience; the operating response to Energy, HVAC & Lighting. Capability depends on the sensing deployed — see Current availability at the end.

FIRST, THE TERMS

Presence, counting and utilization answer different questions.

These get used interchangeably in this market and they should not be. Conflating them is how a deployment ends up unable to answer the question it was bought for.

Presence	Is someone in the space? A binary or state-oriented question.
Occupancy count	Approximately how many people are present? Matters where load or capacity does.
People flow	How many entered, exited or passed through? For entrances and circulation.
Utilization	How consistently and intensively is the space used over time? A historical question.

Environmental condition	What conditions exist while the space is in use — temperature, humidity, CO_2 and other supported measurements.

A building may need one of those answers, several, or none. The sensing method should follow the operating question rather than the other way round.

PRIVACY BY DESIGN

The building usually needs less about people than the sensing technology can provide.

This application senses people, which makes privacy a design input rather than a compliance afterthought. Handled well, that is also an architectural advantage: a building that answers facility questions with the least detailed information the workflow requires has less sensitive information to govern, secure and justify to employees, customers and other stakeholders.

Start from the question, not the sensor

For most operating workflows the building needs to know occupied or vacant, or roughly how many people are present. It does not need to know who they are. “How many people are in the event space?” is a different question from “who are they?”, and “is the room occupied?” is different from “which employee is in the room?”. Most workflows in this document are satisfied by the first of each pair.

That distinction should drive sensing selection, processing location and what is retained. The best way to reduce sensitive-data exposure is often to avoid retaining or distributing information the operating workflow does not require.

Derive the state; limit the evidence

Where sensing produces more than the workflow needs, processing can occur close to the source so the application receives a derived operational state rather than richer underlying evidence. An occupancy workflow may need occupied or vacant — or states such as recently occupied, temporarily vacant or unknown — rather than raw imagery, radar returns, device identifiers or detailed access histories. Where the deployed sensing and processing support that architecture, the application does not need broader access to the source evidence simply because the sensor can produce it.

The architectural objective is to minimize sensitive-data exposure by limiting what is retained and distributed to what the operating workflow requires. Distributed Intelligence explains why some processing may appropriately remain at the building edge.

Purpose should govern access

LEXI’s data-governance architecture is intended to expose occupancy-derived information according to the approved application purpose and scope rather than treating access to occupancy information as a general entitlement. For example, an application using occupancy state for an HVAC workflow should not thereby acquire authorization to use that information for unrelated behavioral or employee-

monitoring purposes. The specific purpose-binding, access-control and inference restrictions enforced in a deployment depend on the platform release and configured policy.

Where platform policy supports it, application access can be scoped to the operational capability required rather than to the underlying source data. Utilization analysis, for example, can be designed around aggregate space-use information without requiring individual movement records. Exact restrictions on access duration, data combination and secondary inference depend on the platform release and configured policy.

Retention and deployment policy

Retention should follow the operational purpose. Raw sensing evidence, derived occupancy state and long-term utilization information have different operational value and privacy implications. What is retained, for how long and at what resolution should therefore be defined for the sensing technology, application, customer requirements and applicable deployment policy rather than inferred from the fact that occupancy sensing is present.

Privacy, employment and data-governance requirements vary by deployment and jurisdiction, so the same facility-use objective may be implemented differently in different locations. Facility-use applications should be designed so individual identification is unnecessary unless the application specifically requires and authorizes it. Specific consent, consultation, access-control, retention, withdrawal and other obligations should be established for the deployment with the appropriate customer and legal stakeholders. Connectivity & Integrations describes the broader data-governance boundary.

> **Workplace sensing can be legally and organizationally sensitive, and requirements vary by jurisdiction and deployment. The architectural position is to answer facility questions without identifying individuals unless the application specifically requires and authorizes it. The sensing approach, processing path, access policy, retention and any required consent or consultation should be established for the deployment with the appropriate customer and legal stakeholders. Connectivity & Integrations covers the broader governance boundary.**

COMMON SENSING APPROACHES

Different sensing methods illustrate why the operating question should determine the technology.

Different technologies answer different questions and carry different coverage, placement, accuracy, commissioning and privacy characteristics. In some system designs, several sensing types can contribute evidence to one occupancy state rather than any single source owning it. The table below describes common sensing approaches relevant to occupancy and facility-use design; it is not a list of sensing products or interfaces supported by every LEXI deployment. Current supported devices and integrations are defined by deployment and product documentation.

Approach	Answers well	Cannot do	Privacy profile
Passive infrared	Motion-based presence in a defined field of view. Inexpensive, low power.	Count people, or detect a stationary occupant — the classic failure is a room going "vacant" with someone sitting still in it.	Low. Motion only, no identifiable data.
mmWave radar	Presence including stationary occupants; coarse count and position in some configurations.	Identify individuals; give precise counts in dense or cluttered spaces.	Low to moderate. No imagery, though fine-grained position traces warrant care.
Camera-based analytics	Count, direction of flow, dwell, queue length — the richest data of any approach.	Operate unnoticed. Placement and sightlines dominate accuracy.	High. Imagery may carry significant privacy obligations. Local derivation without retaining or distributing source imagery can materially change the data profile.
CO_2 and environmental	Coarse occupancy trend in enclosed spaces; ventilation adequacy.	Respond like direct occupancy sensing; CO_2 is a lagging environmental indicator and does not directly count or identify occupants.	Low. No person-level identity data is inherent in the measurement.
Device association (BLE, Wi-Fi)	Presence and coarse count using infrastructure that already exists.	Separate people from devices — one person may carry three — or see anyone without a device.	Higher privacy sensitivity. Device identifiers can be associated with individuals and movement patterns.
Badge and access control	Authoritative record of who entered a controlled door.	Know who is still present, or account for tailgating.	High. The source data is identity-linked by design.
Booking and calendar	Expected use, capacity intent, and the reservation baseline to compare against.	Confirm anyone actually arrived.	Identity-linked through organizer, attendee or reservation information where those details are included.

Two consequences follow. First, sensor choice changes what can honestly be claimed: a presence sensor does not produce an accurate count, a people counter does not establish who is present, a CO_2 sensor does not count occupants, and a reservation describes expected use rather than confirmed presence. Applications become unreliable when a proxy is silently treated as ground truth.

Second, the privacy column is a design lever rather than a disclosure. The same facility question may be answerable by more than one approach, and privacy should be considered alongside coverage, accuracy, cost and commissioning requirements when selecting the sensing method.

Richer sensing requires a different data decision

Camera-based analytics and other sensing technologies capable of producing richer source information require explicit decisions about processing location, what derived information is exposed to the building application, whether underlying source data is retained, and whether it leaves the local

environment. A facility-use workflow may require only a count, occupancy state, direction of flow or another derived condition. Where the deployed sensing system supports local derivation, the application does not need the richer source evidence merely because the sensor was capable of producing it. Exact processing and retention behavior is determined by the deployed sensing solution and integration.

THE OPERATING LOOP

Observe, contextualize, interpret, alert, act, learn.

1 · Observe

Start with what the use case requires: presence as an occupied or unoccupied state; count or flow from supported counting technologies; room, zone or environmental temperature; relative humidity; CO_2 as an indicator of occupied-space ventilation when interpreted appropriately; and other supported environmental measurements such as particulate or air quality where deployed equipment provides them.

2 · Contextualize

A sensor reports Occupied = True. The application needs Conference Room 204 · occupied — and, depending on the workflow, Floor 2, Building A, served by VAV-2-14, temperature 74.2 °F, CO_2 1,050 ppm, scheduled capacity 12. Occupancy and environmental data are associated with the building hierarchy from portfolio down to sensor, and that same room context is then reused by energy, HVAC, facility-use and reporting applications.

The room is the common reference. The occupancy sensor knows someone is present; the thermostat knows it is 75 °F; the CO_2 sensor knows concentration is rising; the HVAC controller knows its operating state. The room model establishes that all four describe the same physical space, and that is where facility intelligence starts.

3 · Interpret

A space condition is usually a relationship rather than a point value:

Space occupied · HVAC in setback	Operating mode may not match actual use.
Space empty · HVAC or lighting active	Schedule or control behaviour may be worth reviewing.
High count · temperature rising	Environmental load on the space is increasing.
Room reserved · physically unused	Scheduled demand and actual use differ.
High CO_2 · substantial occupancy	Ventilation conditions may deserve attention.
Rarely occupied over time	The use pattern may matter for planning, cleaning or leasing.

None of those proves a fault. They create better operating context — and occupied is not the same as comfortable. An occupied room is not necessarily comfortable, an empty one does not need

conditioning to the same level as a full one, and temperature alone does not describe the experience of a space. This application supplies that context; Energy, HVAC & Lighting defines the operating response.

Where count matters rather than presence — event and conference spaces, entrances, retail and public areas, cafeterias, classrooms — count data supports understanding of peak use, time-of-day patterns, entry and exit flow, and how environmental conditions change as population does. A counting installation should be commissioned against the physical environment it operates in rather than treated as a generic sensor drop.

4 · Alert

Not every occupied room and not every environmental change deserves attention. Alerts arise from an environmental threshold being exceeded, a condition persisting long enough to matter, an occupancy and environment relationship worth reviewing, a material mismatch between physical occupancy and expected schedule, a required sensor going quiet, or a monitored space reaching a configured count or utilization threshold.

Context is what makes those useful rather than noisy. A CO_2 reading without occupancy context is hard to prioritise. A temperature condition in an empty overnight space has different urgency from the same reading in a full conference room. A count threshold in an event space matters at 18:00 and is irrelevant during setup that afternoon. The correct thresholds depend on the building, sensor and operating policy, which makes alert tuning part of application commissioning rather than something done afterwards.

5 · Act

Occupancy information can inform operations without automatically controlling them. The available responses run from notifying an operator or surfacing the condition in the building view, through remote investigation of related environmental, HVAC or equipment state, to an authorized operator adjusting a schedule, setpoint or mode through the applicable control path, to an approved application consuming occupancy state as an input to a governed workflow — or simply continuing to observe.

The presence of an occupancy signal does not itself grant authority over lighting, HVAC or any other equipment. Observation and control remain separate capabilities, and Protected Control & Resilience governs the boundary.

> **A missing signal is not proof that a space is empty. Uncertain occupancy should reduce authority, not increase it — a failed sensor must not silently become evidence of vacancy, and an expired observation must not trigger aggressive setback simply because the last positive reading aged out.**

6 · Learn

A current occupancy state runs the building; history operates the facility. Over time the data answers how often a room is used, when occupancy peaks, how long use persists, whether actual use matches

schedule, whether environmental conditions deteriorate as occupancy rises, which spaces are consistently underused, and where after-hours use occurs.

Occupied hours	How much time the space is actually in use.
Frequency of use	How often use occurs.
Peak population	Maximum observed occupancy for the period.
Average when in use	Typical loading while occupied.
Time-of-day pattern	When demand occurs.
Duration	How long use persists.
Use versus schedule	How actual use compares with planned operation.

Which measure applies depends on the facility — a hotel, classroom, office, senior-living property and event venue do not define utilization the same way. And the application supplies evidence, not verdicts. Utilization data can inform cleaning, operating schedules, space planning, maintenance priorities and event-space management. It does not by itself decide that a room should be eliminated, a lease changed or staffing reduced. Those decisions carry financial, organisational and human context that sits outside any sensor system.

ENVIRONMENTAL MONITORING

Occupancy explains part of the load. Environment describes the result.

Temperature and humidity give basic room condition. CO_2 is particularly useful in occupied spaces because concentration reflects the balance among people, ventilation and other factors, but it responds more slowly than direct occupancy sensing and should be interpreted as environmental context rather than a fast occupancy-control signal. Other supported sensors add context where a deployment needs it.

The useful questions are operational: do conditions change as occupancy increases, do particular spaces repeatedly experience poor conditions during heavy use, do problems occur only during certain schedules or events, and is an issue local to one room or visible across a floor.

> **These are operational questions. They are not medical diagnoses or certifications of health. CO_2 is context, not a complete indoor-air-quality score — and any particulate, VOC or other measurement represents the condition that sensor measured, not a declaration that a space is healthy.**

SENSING DESIGN

What you can infer depends on what you measured.

A sensor reporting every few seconds supports a different question from one sending a sparse periodic update. A binary presence sensor differs from an entrance counter. A room-level count differs from a

building-level one. A temperature sensor near a supply diffuser describes a different condition from one in the occupied zone. Sensor type, placement, coverage, sampling and reporting rate, space association and the operating question being answered all determine what the deployment can support.

> **Analytics cannot recover information the sensing design never captured.**

For the same reason, accuracy belongs to the deployment rather than to the platform. Occupancy and counting accuracy depend on sensing technology and physical installation — door geometry, sensor height, field of view, furniture, traffic patterns, occlusion, environmental conditions, and the definition of what counts as an occupancy event. Accuracy should therefore be validated against the installed configuration and intended use rather than published as one universal percentage. The same applies to environmental sensing: the application can only be as reliable as the data entering it.

WORKED EXAMPLE

An event space fills before the schedule says it will.

16:30	Scheduled event at 18:00 · count 18 · temperature 72 °F · CO_2 in normal operating range.
17:45	Count 140 and rising · temperature 74 °F · CO_2 rising · event still fifteen minutes away.
18:15	Count near configured event level · temperature continuing upward · CO_2 elevated against the earlier condition.

A schedule-only building knows the event begins at 18:00. A context-aware building knows the room began filling early, that environmental load rose with occupancy, and that the space condition changed accordingly — which supports better operator awareness and, where configured and authorized, a more responsive HVAC strategy. This application supplies the state; the HVAC application decides what to do about it.

And a second: meeting-room utilization

Room A is frequently reserved and frequently occupied. Room B is frequently reserved and often empty. Room C is moderately reserved and consistently used when booked. Room D is regularly used without any reservation at all.

The finding is not that Room B is underutilized. It is that reservation behaviour and actual facility use differ — which is evidence for workplace policy, booking practice and space planning, and which the platform should inform rather than decide.

AT PORTFOLIO SCALE

One room provides state. A portfolio provides patterns.

With occupancy and environmental information associated consistently to spaces, the questions become comparative: which spaces see the highest demand, which rooms are consistently underused, where actual use diverges most from schedule, which areas repeatedly experience adverse conditions

during heavy occupancy, which buildings see the most after-hours use, and how similar spaces compare across properties. The value is a common way of describing facility use across buildings that were never instrumented or operated the same way.

Building the business case

Occupancy and facility-use applications create value differently by building type — a workplace cares about utilization, a hotel about guestroom and event-space operation, a university about classroom use, a retailer about traffic and conditions. Rather than a generic smart-building return figure, the measurable questions are these:

Occupancy-related operating hours	How often are systems running while monitored spaces sit unused?
Utilization	How much available space is actually used, and when?
Environmental exceptions	How often do monitored spaces reach configured conditions requiring attention?
After-hours use	How frequently is the facility occupied outside expected schedules?
Response	How quickly are occupancy and environment mismatches identified and resolved?
Application reuse	How many workflows reuse the same sensing and context?

Each of those is measurable before and after, which makes the case for this application demonstrable rather than asserted.

HOW THIS DIFFERS

The value is not the sensor. It is what the building understands around it.

	Standalone sensor or point solution	LEXI occupancy and facility use
Primary view	Individual measurement, or an application-specific dashboard	Space in building context
Presence and counting	Usually one sensing approach	Sensing matched to the operating question, fused where useful
Environmental data	Device- or application-specific	Associated with room and zone context
Building relationships	Limited, or reconstructed per application	Shared property, floor, room and equipment model
Equipment context	Usually separate	Evaluated against connected building state
Historical utilization	Device- or application-dependent	Space-use patterns over a common hierarchy
Privacy boundary	Sensor- or application-dependent	Architecture can separate derived operational state from richer underlying evidence; access is governed by deployment policy.

	Standalone sensor or point solution	LEXI occupancy and facility use
Application reuse	Usually narrow	One sensing layer supporting several applications
Physical authority	Usually none, or application-dependent	Observation stays distinct from governed control

The differentiation is not that LEXI invented occupancy sensing. It is that the information becomes part of the same connected building model the rest of the platform uses — and that privacy is treated as an architectural design input rather than only a policy statement.

WHAT THIS MEANS

For the people operating and using the space.

Facility and building operators	See which spaces are in use, what conditions exist, and where occupancy and building operation have drifted apart.
Building owners	Understand facility-use patterns across properties and portfolios, with a defensible position on what is and is not collected.
Energy and sustainability teams	Use occupancy and environmental context to interpret performance and find where schedules and actual use diverge.
Systems integrators	Deploy sensing against a defined operating question, and reuse the resulting room and zone context across applications rather than per project.
Workplace and hospitality teams	Use actual facility-use evidence alongside schedules, reservations and operational judgement — without turning space management into personal monitoring.

CURRENT AVAILABILITY

Capability depends on the sensing deployed.

Current capabilities support occupancy and people-counting applications, environmental sensing, room and zone context, dashboards, alerts and related building workflows where the required sensors and integrations are deployed. Information available varies by sensing method: a presence sensor, a people counter, a temperature sensor and a CO_2 sensor are not interchangeable.Historical resolution, retention, sensing accuracy, supported environmental measurements and available workflows vary by device, installation, Gateway configuration, application and software release. Privacy and data-governance behavior likewise depends on the sensing solution, configured processing path, platform release and deployment policy. Specific retention periods, source-data handling, application access and jurisdiction-specific obligations should be confirmed for the deployment. More advanced sensor fusion, inference and occupancy-driven automation depend on the deployed sensing and platform configuration.The objective is not to claim

> **the building always knows exactly how many people are everywhere; it is to give operators better evidence about how spaces are used and what conditions exist while they are in use.**

THE CORE IDEA

A schedule says how the building was expected to be used.

Occupancy says what is actually happening, and environmental sensing says what conditions people are experiencing while it happens. Observe the space. Associate the information with the room. Interpret occupancy and environment together. Alert when actual use and building operation stop aligning. Use the result in authorized workflows. Learn from the patterns over time.

> **The result is not more sensors. It is a building that understands when people are there and how the space is being used — while collecting and distributing no more about those people than the operating question requires.**

Sensing capability, accuracy, retention, environmental measurements and supported workflows vary by device, installation, Gateway configuration, application and software release. Physical actions remain subject to configured permissions, equipment limits and operating policies.

Related · Connectivity & Integrations · Energy, HVAC & Lighting · Protected Control & Resilience · Managed Edge · Equipment Monitoring & Diagnostics · Distributed Intelligence