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Shaping Ecological Spaces Through the Integration of Artificial Intelligence and Green Building Certification Systems

Muhterem M. Hoser

Abstract

This research examines the contributions that artificial intelligence can achieve in the context of green building certification systems, especially to the evaluation and optimization of indoor environmental quality (IEQ) criteria included in the LEED (Leadership in Energy and Environmental Design) system. Within the scope of the study, the role of artificial intelligence in the classification and analysis of the basic elements in the IEQ category of LEED, such as air quality, lighting efficiency, sustainable material selection, acoustic performance and ergonomic design, was investigated. The research was carried out with a hybrid methodological approach that combines qualitative content analysis of existing LEED-certified projects with a conceptual simulation model based on artificial intelligence-supported decision-making algorithms. The model simulates how the capabilities of artificial intelligence tools, such as real-time data processing, pattern recognition, and predictive analysis, can be used in the certification process. Data sources include LEED v4 documentation, artificial intelligence software used for environmental simulations, and expert interviews with sustainability consultants and architects. The findings reveal that artificial intelligence integration can significantly increase efficiency, objectivity and accuracy rates in the evaluation of indoor quality criteria. It has been observed that artificial intelligence systems can identify optimization opportunities for complex balance points between energy use and user comfort, which cannot be detected by traditional manual evaluation methods. In addition, the potential of artificial intelligence to reduce subjective interpretations in the evaluation process and to accelerate the general certification process was emphasized. This study contributes to the artificial intelligence-supported sustainable design literature by providing a concrete methodology and reveals the transformative effect of artificial intelligence on ecological interior architecture. The results obtained indicate that artificial intelligence-based evaluation frameworks can be standardized in green building certification systems that will come around the world, not only specifically for LEED.

Keywords: Interior Design, Artificial Intelligence (AI), Green Building Certification System, LEED

Introduction

As in all living things, man has felt the need to interact with nature in order to continue his life since his existence. However, today, consumption-oriented growth forms have caused the depletion of natural resources and the deterioration of the ecological balance (Yıldız, 2019; Cigan & Yamacli, 2020). In this context, green building certification systems (LEED, BREEAM, etc.) developed in line with sustainability principles aim to produce environmentally friendly and energy efficient structures (Doğan et al., 2018). Although these systems encourage ecological design, current practices are still largely based on manual evaluations and fall short of integrating with emerging technologies. Studies conducted in recent years reveal that artificial intelligence is effectively used in the architectural discipline in areas such as energy modeling, structural optimization and material analysis (Zhang et al., 2023; Zhang et al., 2024). However, the integration of these technologies with the interior design criteria of green building certification systems is still limited. There is not enough research on the role of artificial intelligence in the evaluation of user-oriented criteria such as indoor air quality, natural and artificial lighting, acoustics, ergonomics and material choices.

This study aims to remove the gap in question. The main questions of the research are:

1. How can artificial intelligence applications be integrated into green building certification processes?
2. How does this integration improve in the evaluation of indoor environmental quality criteria?
3. How can artificial intelligence support user comfort and spatial sustainability?

In this direction, a mixed approach has been adopted. The contributions of the system to the interior performance criteria were examined by using content analysis of LEED v4 certified projects and conceptual simulations based on artificial intelligence-supported decision algorithms. The findings show that artificial intelligence can overcome the limitations of manual evaluations by increasing accuracy, speed and objectivity in evaluation processes. In addition, it has been revealed that indoor atmospheres can be optimized more effectively by considering user health and comfort. This study provides an original methodological framework for the integration of artificial intelligence into green building evaluation processes and proposes a new technology-based opening in architectural designs targeting ecological sustainability.

Literature Review

Green Building Certification Systems

Problems such as increasing drought due to global warming, thinning of the ozone layer and environmental pollution have made the construction of structures that are sensitive to nature and have low environmental impact a priority goal (Erdede & Bektaş, 2014). In this context, the "green buildings" that emerge in this context are structures that optimize the use of natural resources and aim to improve user health and well-being with criteria such as natural light and clean indoor air quality (Celik, 2009). These buildings, which do not harm the environment after demolition and can be brought back to nature by recycling, are called today with different names such as "sustainable", "ecological" or "environmentally friendly" and are evaluated throughout the entire life cycle of a building (Erdede & Bektaş, 2014). Green building certification systems are rating systems that evaluate these structures according to objective criteria. Not only does it measure building performance, but it also encourages investors and designers to consider environmental impacts throughout the process (Mutlu et al., 2019). Although these systems differ according to the climate, geography and socioeconomic structures of the countries, some globally accepted standards come to the fore. Among the most widely used systems are: LEED (USA), BREEAM (UK), CASBEE (Japan), Green Star (Australia), SBTool (Canada), and DGNB (Germany) (Celik, 2016).

In this study, LEED and BREEAM systems were specifically discussed in the context of indoor environmental quality (IEQ). These two systems evaluate the performance of structures based on criteria such as indoor air quality, natural and artificial lighting, acoustic comfort, thermal comfort, ergonomics, material selections and effects on user health. However, most of these criteria are still evaluated with manual measurements, certification expert interpretation, or standardized but stationary procedures, which results in subjectivity, temporal delays, and evaluation discrepancies. The contribution that artificial intelligence can provide at this point is to ensure that the evaluation becomes more objective, more data-oriented, faster and sustainable. In the literature, there are examples in which artificial intelligence applications are used, especially in areas such as building energy modeling (Namlı, et al., 2018), user behavior estimation (Yan, et al., 2023) and optimization of indoor environments with smart building systems (Bajwa, et al., 2022). However, most of these applications focus on outer shell performance and energy efficiency; research on the evaluation of indoor environmental quality criteria with the

support of artificial intelligence remains very limited. The aim of this study is to investigate how artificial intelligence technologies can be integrated in the evaluation of indoor quality criteria within the scope of LEED and to develop a data-based model proposal that can provide solutions to the methodological deficiencies of existing certification systems. Thus, it is aimed to contribute to the design of more optimized, healthy, and environmentally sensitive interior spaces in terms of both architecture and user experience.

LEED (Leadership in Energy and Environmental Design)

LEED (Leadership in Energy and Environmental Design) is the world's most popular green building evaluation and certification system developed by the US Green Building Council. It has 5 levels with 'Certified', 'Silver', 'Gold' and 'Platinum' levels, which represent better environmental performance. If a building is certified by passing the LEED evaluation, it will receive benefits such as less energy consumption, water consumption and operating costs. LEED is the first green building rating system launched in 1995 and used in 91 countries. It is predicted that LEED will become more widespread in the future and will be adopted as a global standard for green building. For a greener world, LEED's impact is great (Gorgun, 2012).

The LEED (Leadership in Energy and Environmental Design) certification system consists of a set of criteria and criteria aimed at negatively affecting the outlook and ensuring sustainability protection. It was created by the US LEED Green Building Council (USGBC) and is widely recognized worldwide. The system, which is suitable for different project types and expectations, is divided into 4 different categories Arslan, (2015).

- Building Design and Construction (BD+C)
- Interior Design and Construction (ID+C)
- Building Operation and Maintenance (O+M)
- Neighborhood Development (ND)

Each category is evaluated with specific criteria and buildings score according to a specific scoring system. According to the total score, buildings can receive a LEED certificate. LEED certification contributes to energy saving, sustainability and human health by increasing the environmental performance of buildings (Ertugrul, & Altin, 2022).

Table 1

LEED Certification Parameters (Ertugrul & Altin, 2022).

Sustainable Site Selection	Water Efficiency	Energy and Atmosphere	Materials and Resources	Indoor Environmental Quality
Site selection and development	Water-efficient equipment	Improved energy efficiency	Sustainable materials	Ventilation and filtration
Climate control, transportation, and accessibility	Irrigation and land management	Use of renewable energy	Waste management	Thermal comfort
	Rainwater management	Atmospheric emissions	Indoor air quality	Lighting

Note. The table summarizes the interior quality criteria of LEED, clarifying the areas where artificial intelligence can provide improvement. In this aspect, it forms the basis for the study.

The LEED (Leadership in Energy and Environmental Design) certification system is the most widely accepted and applied green building evaluation system in terms of assessing environmental performance and promoting sustainable design worldwide. Built to be suitable for different types of projects, LEED offers a comprehensive evaluation framework that focuses on interior environmental quality (IEQ) criteria, especially with the Interior Design and Construction (ID+C) category. This category includes extremely critical criteria for user health and comfort, such as indoor air quality, thermal comfort, ventilation, lighting and material-induced emissions. However, most of these criteria are still evaluated with manual, stationary and sometimes subjective methods. This creates limitations in terms of consistency, speed and objectivity in the certification process.

For this study, the LEED system is extremely important both in terms of providing a concrete operational framework for artificial intelligence integration and in terms of identifying deficiencies in existing evaluation methods. The main goal of this study is that artificial intelligence contributes to data-based, real-time and objective evaluation processes by integrating it with the interior criteria determined by LEED. Therefore, in this research, LEED is not only considered as an example system, but also as a critical application ground where sustainable interior design and artificial intelligence technologies meet.

Methodology

This research analyzes the LEED ID+C (Interior Design and Construction) category in the LEED certification system via ChatGPT, known as two artificial intelligence-based chatbots, and Leonardo Ai programs that allow text to be photographed from text to image. The most important factor in the selection of materials related to artificial intelligence programs selected in this analysis process is due to the popular preference in the world.

Within the scope of this research, the output obtained after asking questions about LEED to ChatGPT, the chatbot, will be analyzed according to the LEED ID+C category after the answers received are written to Leonardo Ai, who is artificial intelligence from the text to the image. All data on this will be obtained by referring to the two open-source artificial intelligence programs ChatGPT and from Leonardo Ai. Then, the main principles on LEED ID+C will be tabulated and evaluated.

Interior Design and Construction (ID+C)

LEED's classification of "Interior Design and Construction (ID+C)" helps to achieve environmental goals in projects aimed at reshaping or modernizing the interiors of completed buildings. This certification category can be applied to various building types such as offices, retail stores, restaurants, hotels and residences (Ertuğrul & Altın, 2022).

The main goal of the LEED ID+C system is to increase the environmental performance and energy efficiency of buildings. In line with this system, structures are evaluated in the following six basic categories:

- Sustainable Location Selection
- Water Efficiency
- Energy and Atmosphere
- Material and Resource Utilization
- Interior Quality
- Innovation and Regional Priorities

Under these subheadings, the concept of Indoor Environmental Quality (IEQ) is of great importance. IEQ refers to the sum of environmental factors such as air quality, lighting, thermal comfort and acoustics that directly affect the health and comfort of people living and working in a building. A quality interior environment significantly increases people's health, productivity and quality of life (Öktem, 2020).

Criteria such as indoor air quality, lighting, material selection, acoustic comfort and ergonomics, which are within the scope of the LEED certification system, play a critical role in terms of user health and indoor comfort. While indoor air quality aims to reduce health risks through the control of volatile organic compounds (VOC) and other pollutants (U.S. Green Building Council [USGBC], 2021), natural and energy efficient lighting solutions both reduce energy consumption and positively affect user psychology (Reinhart, 2019). Preferring low-emission, recyclable and locally sourced products is encouraged in material selection, which both contributes to indoor air quality and reduces environmental impact (Liu et al., 2019). Acoustic comfort is critical to increasing employee productivity, especially in open office designs, and requires detailed planning in terms of sound insulation and echo control (Bluyssen, 2013). Ergonomic design, on the other hand, increases the accessibility and functionality of space for individuals of different ages and physical capacities (Attaianese & Duca, 2012). All these criteria can be optimized with artificial intelligence-supported analysis and automation systems, which makes it possible to go beyond manual evaluation processes.

Text to Image Artificial Intelligence

Artificial intelligence is a technology that mimics the cognitive functions that humans associate with the human mind, such as learning and problem solving. It is used in many fields from marketing to banking and finance, from agriculture to health and safety, from space research to robotics and transportation, from chat robots to artificial creativity and production. In recent years, artificial intelligence applications have become an integral part of the city by managing transportation systems, restaurants and shops and repairing the urban infrastructure (Bayrak, 2022).

Artificial intelligence is a set of technologies and algorithms that allow computers to perform certain tasks like human intelligence. Artificial intelligence algorithms specialized in a branch called natural language processing (NLP) can be used in tasks such as analysis and interpreting of texts. It usually uses one or more of machine learning, deep learning, or natural language processing techniques (Reviriego & Merino-Gómez, 2022). The process of creating an image or image from text data can be used to transform the text-based description or story into a realistic image. Artificial intelligence, which usually works with deep learning techniques, provides learning on data sets, creating artificial neural networks that can then be processed with new data. Generative Adversarial Networks (GAN) algorithms developed in recent years have provided a great improvement in text-to-image tech-

nologies. Recently, with the self-improvement of computer science, many artificial intelligence-based programs have been made from text to image. Today, there are many examples of these systems such as DALL·E 2, Craiyon, Nightcafe, Midjourney, Starry Ai, Pixray, Leonardo Ai and Shutterstock Ai (Ece, 2022).

Leonardo AI

Leonardo AI is a system that uses an artificial intelligence infrastructure called Stable Diffusion. Founded in 2021, this artificial intelligence initiative has created a large community of more than 200,000 professionals and seven research centers worldwide. Thanks to open-source principles, this community has access to the most up-to-date research and is working on artificial intelligence models that offer revolutionary advances in many areas of scientific research (Stability, 2024). The collaboration with Amazon Web Services has made it possible to use the Ezra-1 UltraCluster, the world's fifth largest supercomputer, thus paving the way for significant developments. The application development process on Stable Diffusion's open-source platform has been quite effective. For example, just one month after the release of SD 2.0, four of the 10 most popular applications on the Apple App Store started working with Stable Diffusion support. In addition, Stability AI's external applications, including Stable Diffusion-based applications such as Lensa, Wonder and NightCafe, have reached more than 40 million users and this number is growing (Stability, 2024). Stable AI CEO explains these developments with the following words:

"Our goal is to create the foundation that will activate the potential of humanity." (Stability, 2024)

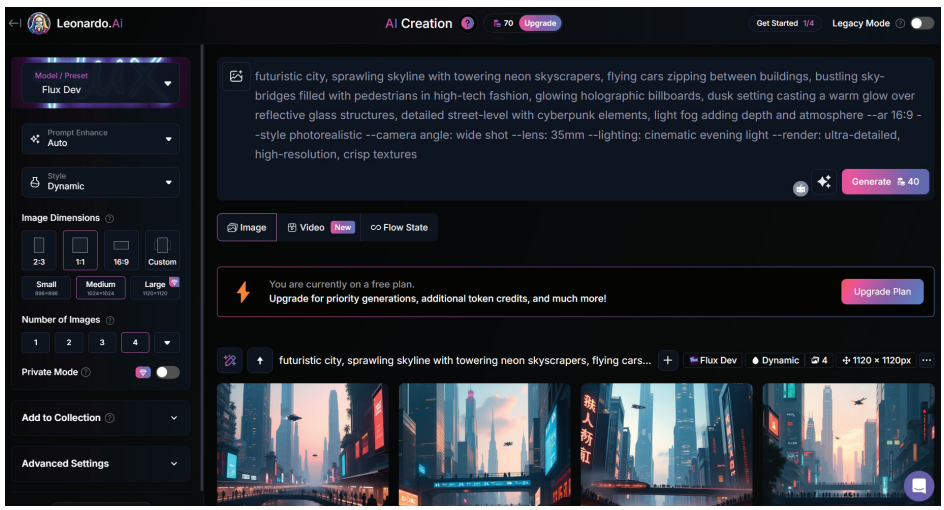
With its user-friendly interface and fast visual production, Leonardo AI offers effective solutions especially in the fields of architectural visualization, interior design and art. Thanks to this system, realistic, detailed and artistic digital images can be created based on text inputs (Leonardo AI, 2025).

Use cases are supported by the result images taken from the Flux Dev interface and evaluated according to LEED criteria. (Leonardo AI, 2025).

Usage samples were supported by the result images taken from the Flux Dev interface and evaluated according to LEED criteria.

Figure 1

Result views from Leonardo Ai's Flux Dev (Leonardo AI, 2025)



This image of the Leonardo.Ai interface shows how artificial intelligence-supported visualization tools can convert high-resolution and aesthetically consistent content using user-given text inputs (prompt). Complex, multi-layered and detailed descriptions given as input are processed by the system with style, composition, ratio and resolution settings and photorealistic urban scenes are obtained. Such interfaces have great potential for interior architecture and green design applications, especially in terms of creating architectural design scenarios of the future, testing interior atmospheres and moving conceptual ideas to the visual plane.

Text-to-Text Artificial Intelligence

Text-to-Text AI is a system that uses natural language processing (NLP) technology to translate text written in one language into another. This technology aims to eliminate communication barriers between people who speak different languages and increase translation accuracy. When a company needs to communicate with customers in different countries, it can be used in many areas, such as language learning and training, automation of classification processes, or responding to customer e-mails. However, artificial intelligence systems that work from text to text are not perfect. They may have difficulty, especially in complex texts that contain very meaningful or vague cultural references. Despite these limitations, artificial intelligence technology, which works from text to text, is considered an impor-

tant development that transforms the way we communicate between languages. These systems, which are constantly developing and improved, are becoming an increasingly valuable tool to overcome communication barriers and support global understanding (Erul & Isin, 2023).

ChatGPT

ChatGPT is a conversational AI system developed by OpenAI that uses advanced natural language processing algorithms to produce human-like responses to user queries (OpenAI, 2025). It is based on the GPT-4o architecture, which uses deep learning techniques to produce responses that are both relevant and consistent. It is designed to be highly flexible and customizable, and its ability to produce responses that are virtually indistinguishable from those of a human is impressive. ChatGPT is currently used in a variety of applications, including customer service, virtual assistants, and language learning. It has the potential to revolutionize the way we interact with machines by making it easier and more natural for us to communicate with technology. While technology still has some limitations, ChatGPT represents a breakthrough in the field of conversational AI.

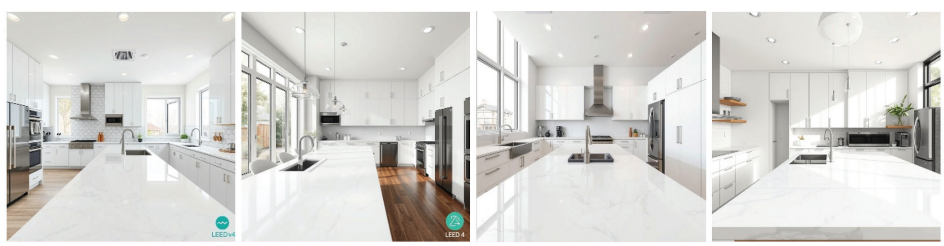
Findings

To write a prompt that can be used in artificial intelligence from text to image to ChatGPT, a text has been prepared and sent to the chat robot. I want you to act as a fast engineer. You will help me write information prompts for an artificial intelligence art generator named Leonardo Ai. I'm going to provide you with brief content ideas, and your job is to detail them in complete, clear, consistent prompts. Prompts include explaining the content and style of images in a short and accurate language. It is useful to use references to LEED v4 for Interior Design and Construction and home to be open. Your focus should be on names and adjectives. I will give you some sample prompts for your reference. Please identify the camera that should be used exactly. Here's a formula for you to use (enter content names here) (medium: enter artistic medium here) (style: add references to genres, artists, and popular culture here) (reference to lighting, lighting here) (colors reference color styles and colors) (palettes here) (composition: reference cameras here, specific lenses, shot types and positional elements). When giving a warning, remove square brackets, speak natural language and be more prominent, use precise and understandable language. Always send me four different full prompt options. Sam-

ple prompt: Wet Shamrock Armored, green ray saber, Aleksi Briclot's portrait of the Celtic Jedi Sentinel with bright wet dramatic illuminat.

The answer received is as follows, Prompt 1: A LEED v4 certified kitchen in a residential home that showcases sustainable design elements such as quartz countertops, energy-saving devices and a recycling station. Medium: Digital 3D creation. Style: A stylish, modern aesthetic reminiscent of the clean lines and functional design of Bauhaus architecture. Lighting: Natural light fills the room through large, energy-efficient windows supported by LED recessed lights. Colors: A monochrome white and gray palette with stainless steel accents. Composition: The kitchen island captured by a wide-angle lens is in the foreground and directs the eye to the cabinets and household appliances in the background. When this prompt is written to Leonardo Ai, the images that appear are as follows.

Figure 2



Prompt 2: A LEED v4 certified residential bathroom that showcases sustainable design features such as low-flow fixtures, recycled glass tiles, and a double-siphon toilet. Medium: Digital 3D creation. Style: A spa-like aesthetic that reminds you of the calm interiors of Japanese ryocans. Lighting: Warm ambient lighting emphasizes the sustainable features of the bathroom while creating a relaxing atmosphere. Colors: A relaxing palette of earth tones, along with green bangs from indoor plants. Composition: Captured by a wide-angle lens, the bathtub is in the foreground and directs the eye to the dressing table and shower area in the background. When this prompt is written to Leonardo Ai, the images that appear are as follows.

Figure 3

Result views from A LEED v4- Prompt 3



Prompt 3: A LEED v4 certified home office that showcases a sustainable workspace with a reclaimed wooden table, ergonomic furniture, and a vibrant green wall. Medium: Oil paint. Style: Inspired by the calm, minimalist interiors of Japanese architect Tadao Ando. Lighting: A soft, diffused light filters through energy-efficient roof windows, creating a calm working environment. Colors: A calming earth tones pale where the vibrant greens of the vibrant wall are the focal point. Composition: When viewed with a standard lens, the office is neatly framed with a table in the middle and a green wall in the background. When this prompt is written to Leonardo Ai, the images that appear are as follows.

Figure 4

Result views from A LEED v4- Prompt 4



Prompt 4: A LEED v4 certified residential interior with an open concept seating and dining area with sustainable design elements such as bamboo flooring, low VOC paints and energy-saving devices. Medium: Digital 3D creation. Style: A modern farmhouse aesthetic reminiscent of cozy, rustic interiors designed by Joanna Gaines. Lighting: Natural light flows through large, three-bay windows supported by LED pendant lamps. Colors: A soothing palette of whites and grays with green bangs from natural wood tones and indoor plants. Composition: The living space captured with a wide-angle lens is in the foreground, and the eye is directed to the

dining area and kitchen in the background. When this prompt is written to Leonardo Ai, the images that appear are as follows.

Figure 5

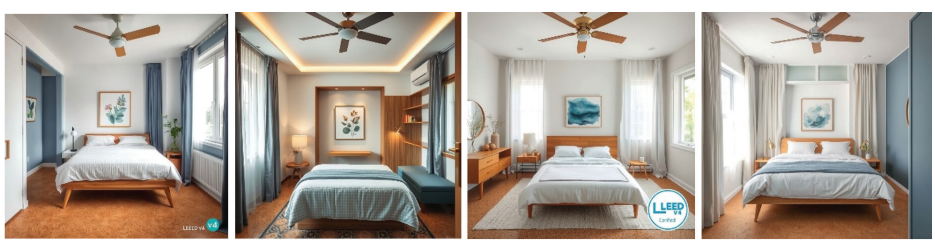
Result views from A LEED v4- Prompt 5



Prompt 5: A LEED v4 certified bedroom in a resident home with sustainable elements such as a cork floor, low VOC paints and energy-efficient ceiling fan. Middle: Watercolor painting. Style: A Scandinavian-inspired design that focuses on simplicity and functionality, reminiscent of Arne Jacobsen's works. Lighting: Soft, diffused light filters passing through energy-saving curtains create a comfortable and inviting atmosphere. Colors: A calming palette of blue and white with natural wood tones. Composition: When viewed with a standard lens, the bed is neatly framed in the middle and the window and table area is visible in the background. The prompts were generated by AI. When this prompt is written to Leonardo Ai, the images that appear are as follows.

Figure 6

Result views from A LEED v4- Prompt 6



Evaluation

Table 2

Evaluation of AI-Generated Interior Images Based on LEED-Inspired Indoor Environmental Quality Criteria

	Indoor Air Quality			Lighting			Materials			Acoustic		Ergonomics and Design		
Figure 2	Indoor Air Quality	Green Cleaning & Maintenance	Ventilation	Natural Lighting	Energy Efficient	Lighting Quality	Low-Emission Materials	Durable Materials	Recycled Content	Fast / Flexible	Noise Control	Acoustic Comfort	User Control	Ergonomic Design
	X	X		X	X		X	X					X	X
Figure 3	Indoor Air Quality	Green Cleaning & Maintenance	Ventilation	Natural Lighting	Energy Efficient	Lighting Quality	Low-Emission Materials	Durable Materials	Recycled Content	Fast / Flexible	Noise Control	Acoustic Comfort	User Control	Ergonomic Design
		X		X	X	X		X	X	X		X	X	
Figure 4	Indoor Air Quality	Green Cleaning & Maintenance	Ventilation	Natural Lighting	Energy Efficient	Lighting Quality	Low-Emission Materials	Durable Materials	Recycled Content	Fast / Flexible	Noise Control	Acoustic Comfort	User Control	Ergonomic Design
	X		X	X	X			X		X		X		X
Figure 5	Indoor Air Quality	Green Cleaning & Maintenance	Ventilation	Natural Lighting	Energy Efficient	Lighting Quality	Low-Emission Materials	Durable Materials	Recycled Content	Fast / Flexible	Noise Control	Acoustic Comfort	User Control	Ergonomic Design
	X	X	X	X		X		X	X		X	X	X	X



Figure 6

Indoor Air Quality	Green Cleaning & Maintenance	Ventilation	Natural Lighting	Energy Efficient	Lighting Quality	Low-Emission Materials	Durable Materials	Recycled Content	Fast / Flexible	Noise Control	Acoustic Comfort	User Control	Ergonomic Design
X	X	X	X		X	X		X		X	X	X	X

For Figure 2, It is seen that importance is given to indoor air quality in this place. User health is supported using green cleaning products and effective ventilation systems. The effective use of natural light and the preference of energy-efficient lighting systems increase the sustainability of space. Materials containing low volatile organic compounds (VOC), durable building elements and recycled ingredients show that the choice of materials is made with environmental sensitivity. Noise control is included for acoustic comfort, and the user experience has been optimized with user control and ergonomic design elements. In this respect, both environmental sustainability and user-oriented design have been successfully achieved.

For Figure 3, this interior meets the LEED criteria in terms of both air quality and material use. Especially natural ventilation, green cleaning applications, and natural light use contribute to the health and comfort of the space. Energy efficiency is ensured in lighting, and low emission, durable and recyclable materials are included in the choice of materials. In addition, sound insulation was provided for acoustic comfort and an arrangement was made that allows user control. This space is compatible with both functional and environmentally friendly design principles.

For Figure 4, this space stands out especially in terms of lighting and material use. In addition to natural light, interior balance is achieved with energy-saving lighting. Low emission and durable materials are preferred. In addition, the use of fast renewable materials contributes to environmental sustainability. While air quality is protected with ventilation and green cleaning applications, acoustic comfort is provided with voice control. User comfort has increased with ergonomic arrangements. This area has established a good balance between aesthetics and functionality.

For Figure 5, this design successfully reflects the interior principles integrated into nature. It complies with LEED standards, especially in terms of air quality, use of natural light and energy efficiency. Durable and recycled products with low VOC

are preferred in material selection. Sustainability has increased by using fast renewable materials. Noise control, acoustic comfort and user control are provided, and the physical comfort of the users is prioritized with ergonomic arrangements. This place also coincides with the principles of biophilic design.

For Figure 6, this interior shows high performance in all categories. Indoor air quality is supported by green cleaning, ventilation and natural light; energy efficiency is provided in lighting. Low emission, durable and recycled materials and fast renewable resources are preferred. Voice control and echo reduction are provided in terms of acoustic comfort; user comfort has increased with ergonomic furniture and controllable arrangements. This space is an ideal interior example in terms of both environmental sustainability and user experience.

Result

The joint address of green building certification systems -especially LEED- and artificial intelligence technologies opens the doors of a new era in sustainable architecture. Although the advantages of artificial intelligence in design, construction and operation processes attract more and more attention, the full integration of these technologies into the green building processes still faces some technical, ethical and structural limitations. Existing artificial intelligence systems are heavily dependent on data quality and may lack contextual understanding in complex, user-oriented indoor environments. In this study, indoor environmental quality criteria such as indoor air quality, lighting, material selection, acoustic comfort and ergonomics were evaluated with artificial intelligence-supported methods. The findings show that artificial intelligence can provide highly detailed and precise analyses in line with LEED standards, thus making it possible for certification processes to become more objective and efficient.

However, human control is a must for these technologies to be used effectively. Especially when it comes to ethical, aesthetic and contextual decisions, it is not enough to act with algorithms alone. For this reason, interdisciplinary cooperation between architects, environmental engineers, data scientists and decision makers is of great importance. Future research should focus on the development of hybrid systems that combine expert opinion with artificial intelligence algorithms; these systems should be configured in a transparent, auditable, and user-friendly way. In addition, standard data sets that can be used in the field of sustainable design should be created, and education models compatible with LEED and similar sys-

tems should be developed. As a result, artificial intelligence should be seen as a complementary tool instead of replacing human expertise. When integrated correctly, artificial intelligence can contribute to the creation of more livable and sustainable spaces by making green building certification processes more responsive, scalable, and adaptive.

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