

The importance of combining sustainability and technology in the interior space

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Abstract Sustainable buildings depend on creating a relationship between the building, the user and the environment to achieve a positive impact on the health of users and residents. To make the interior space of the house more comfortable and luxurious, by providing several criteria, including indoor air quality, lighting quality, thermal comfort, getting rid of pollutants, getting rid of noise, and achieving material and resource efficiency. Good interior space design achieves continuous efficiency in the relationships between the spaces used such as movement paths, building configuration, wind direction, solar radiation, mechanical systems, and building technology. This enables the house to be characterized by ease of use, quality of construction, and beauty of form. This research is concerned with explaining the concept of sustainability and how to achieve it within the interior space, which requires combining technology and ancient methods of construction with the use of environmentally friendly materials to ensure that the space achieves the highest levels of luxury and internal quality standards as part of reducing energy consumption. The search results show the importance of employing the concept of sustainability in interior architecture, as technology has succeeded in making homes smarter and achieving luxury and thermal comfort, in addition to relying on building materials, paints, and furniture made of environmentally friendly materials.

Keywords: sustainability, technology, the good design, indoor air quality, thermal comfort.

1 Introduction

Sustainability is important for the continuity of the circle

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of life in our natural environment, and important for preserving water sources and natural resources. We cannot ignore environmental standards in our practices of building, construction, manufacturing, extraction, etc., which cause severe environmental damage, such as climate change, impact on the atmosphere, global warming, carbon dioxide emissions, and other environmental problems. According to the U.S. Environmental Protection Agency, residential and commercial buildings and structures.

2. Sustainability

Sustainability is: creating urban environments capable of assuming their environmental responsibility, and achieving the principles and concepts of preserving the environment by relying on renewable energy sources that do not pollute the environment.

2.1. Sustainable buildings

A sustainable building is a building that has little negative impact on the built environment and the natural surroundings. It depends on creating a relationship between the building, the user and the environment by achieving the principles of sustainable design. This type of construction generally provides better thermal comfort and a positive impact on the health of users and residents due to the use of less toxic components and materials. Such as bricks from raw earth, hemp, straw, fiber wood, sheep wool, cellulose filler, as well as energy savings obtained by good insulation and the use of renewable and natural energy such as passive solar energy, solar panels, solar water heaters, wind turbines Hydraulic power (hydraulic turbines, water mills).

The idea of sustainable building includes a set of strategies during the design phase, where the use of green architecture building materials and products is one of the important strategies in building design.

2.2. Basic principles of sustainable buildings

Sustainable buildings are environmentally friendly buildings because they consume less amounts of energy

and water, and the resident inside them remains in good health and abundant production due to the presence of plenty of natural lighting, good ventilation, and few toxic paints and adhesives. Among the most important principles of sustainable buildings: Energy, climate adaptation, reducing the use of renewable resources and new materials and applying these principles reduces the negative impact on the natural and built environment in terms of buildings and their immediate and regional surroundings. A sustainable building based on these principles is defined as building practices that seek integrated quality (economic - social - environmental).

2.3. Pillars of sustainable building

The concept of (sustainability) is based on three interrelated and integrated pivotal dimensions, which are social development, economic development and environmental development.

Sustainable social development: It is the development that guarantees the cohesion of any society and its ability to help its members work together to achieve common goals, while at the same time providing the needs of its members such as health, well-being, nutrition, adequate shelter, cultural expression and political involvement, through understanding sustainable development within institutions Social and understanding of community participatory systems.

Sustainable economic development: Economic development is represented in developing the economic structure and achieving justice in the distribution of resources, which is necessary to achieve urban development as it leads to raising agricultural productivity, ensuring an adequate supply of water in addition to increasing economic efficiency and growth.

Sustainable environmental development: in order to preserve the environmental heritage and natural resources for future generations, therefore renewable solutions must be found economically to reduce resource consumption, stop damage to environmental elements, and wise use of natural resources.

3. The relationship between sustainability and technology

Technology is represented in smart architecture, and it is one of the specializations of sustainable architecture, but it is characterized by its exploitation of external and internal variables and the reformulation of spatial conditions. It can be controlled by means of autonomous means or remote-control devices. By employing computer technologies, means of communication and knowledge in integrating building systems to rationalize use and energy. For (self-powered) design, for example, preserving water inside the building is of great importance, as it is used for drinking, bathing, cooking food, watering gardens, beautifying the building, and moisturizing it through fountains, water basins, and waterfalls. A quantity of water is lost during the journey

of the water in the pipes from the purification plant until it reaches the building, especially in the event of damage to the pipes and water leakage from them, and here comes the role of smart architecture in the use of technology and environmentally friendly digital faucets and infrared radiation as a great way to preserve and reduce water consumption. and digital temperature control settings.

The use of the smart home is not limited to luxury and comfort only, but it is also a distinctive and effective way to reduce your expenses and the costs of your monthly spending on several issues, including electricity, water and fuel expenses, as it is by means of smart sensors that all machines related to energy sources stop as soon as the user leaves the house or as soon as it senses that there is no need It has such as the improvement of the weather, so you turn off the heater or the radiator, or the sun rises, so you turn off the light or reduce its intensity, and other similar things, and this of course has another benefit, which is to make your lifestyle more environmentally friendly by the fact that using less clean energy means less pollution, in addition to that many of these The systems are now directly dependent.

Example: Bee'ah building in the UAE, the most sustainable building in the world

Bee'ah Building is the first integrated environment-friendly workplace in the Emirate of Sharjah; taking into account the Leadership in Energy and Environmental Design system standards, minimizing carbon emissions, reducing water consumption in operations, and reducing material consumption during the construction process, normal operations and the building

Its design takes into account the harmony with the nature of the site, as it provides the highest levels of comfort to its users while maintaining the lowest levels of energy and resource consumption.

Bee'ah's building contains many environmentally friendly elements such as, dunes equipped with solar photovoltaic panels to generate solar energy. A central oasis in the heart of the building containing shaded courtyards, and through natural ventilation introduced, the health, safety and well-being of the building's occupants are enhanced by ensuring Easy daylight access, exterior view, adequate light, interior and exterior lighting and temperature control consistent with best practices for visual comfort, interior ambient noise levels and soundproofing, interior finish and fixture levels, VOC emissions reduction, indoor air quality, indoor air quality levels Appropriate thermal, drinking water supplies, and sustainable water systems.

The building depends on: providing potable water, through rainwater recycling, wastewater treatment, gray water recycling and purification, and reducing irrigation water, in addition to that building materials have a low environmental impact, and materials are recycled

through waste management facilities operations. For the company, reduce the number of times materials are replaced by protecting vulnerable parts of the building and using recycled aggregates, and by providing designated warehouses for recyclable and compostable waste.

Intelligent systems in the "Be'ah" building: The launch of the "Tanfeed" fleet equipped with a smart environmentally friendly system. The "Be'ah" smart system is characterized by the addition of some new electric vehicles, the first of its kind in the field of waste management in the country. It also launched smart waste containers equipped with wireless internet. It is the first of its kind in the Middle East. To ensure optimal use, the company has adopted a system equipped with GPS maps that offers the option of sending vehicles upon request, by sensing the level of waste inside the containers, which contributes to reducing the carbon emissions of vehicles.

Converting waste into energy: This is done through a process called "gasification", which is known as one of the most environmentally friendly means of converting waste into energy, and is internationally recognized as one of the highly efficient solutions and as a more sustainable alternative to traditional fossil fuels that cause pollution, where waste is collected. It is divided into dedicated sections within the building's waste management, to be transported later to central sites for treatment and recycling.

The architectural design of the "Be'ah" building: It was designed to simulate sand dunes in a curved shape that sparkles in the heat of the desert. The materials that cover it were carefully chosen to reflect the sun's rays and help control the heat of the building from the inside. The heat emitted from the air conditioners is used to heat the water.

4. Sustainable interior design

Interior design is defined as: a process of planning and innovation to create a specific space to perform a specific function or several functions with minimal effort, and this includes floors, walls, ceilings, and fixtures.

4.1. Successful interior design concept

In order to create a successful interior design, certain concepts must be employed that work to group the parts of the room together to create an enjoyable relationship between the various objects. "These concepts are: unity, scale and proportion, balance, harmony and frequency, focus, texture and pattern, and color."

Interior design is also defined as "the process of shaping the interior spaces of architecture and the good and appropriate treatment of the elements of interior architecture in those spaces such as walls, ceilings, floors, furniture, lighting...etc.; which gives these spaces

different implications for the recipient and user of those spaces. It gives them the qualities of fun and release, as in recreational buildings, for example, or the qualities of comfort and tranquility, as in therapeutic institutions, or the religious and spiritual qualities of religious places." Green interior design is defined as "a design in which all systems and materials are designed with the purpose of minimizing negative impacts on the environment and on the building's occupants and maximizing positive impacts on the environment, economic systems, and social systems over the life cycle of the building."

4.2. The importance of the role of the interior designer:

The importance is represented in the impact on the environment, "people spend 90% of their time in the interior spaces (according to the US Agency for Environmental Protection and Consumer Products Protection), and the continuous increase in the amount of built-up space increased the amount of time that people spend in the interior space, and thus increased from the need to understand how buildings affect the depletion of natural resources and humans as users of interior spaces. Even more important is the need to understand and document the role of interior designer decisions on sustainability."

And the interior designer achieves the concept of sustainability by employing the elements of the interior space practically and aesthetically, taking into account environmental considerations, which are represented in indoor air quality, temperature, natural and artificial lighting, noise reduction, in addition to choosing environmentally friendly building materials, finishing and furniture in the sense that they are derived from the environment itself and it does not have a negative impact on the environment or the occupants of the space. The goal of green design is to reduce energy consumption, minimize harmful effects on the environment and use renewable and recyclable raw materials.

5. Interior requirements for sustainability

Sustainability requires the provision of several factors, including: indoor air quality, good lighting, thermal comfort, ventilation and cooling quality, pollutant disposal and water conservation with the use of environmentally friendly materials and going towards the use of renewable energy.

5.1. Air quality

The indoor air quality is improved through several means, including: the mechanical ventilation system, which brings fresh air into the building and extracts the air from the room to the outside and recycles it. This leads to providing a comfortable and healthy environmental atmosphere, controlling the temperature

and humidity level inside the building. Adjusting the difference in temperature between the inside and outside air, so that the inside air remains suitable and comfortable on an ongoing basis, and the removal of fumes, heat, odors and pollutants from inside the building.

The mixed system is also used in ventilation, and this is done by means of: automatic control systems in windows and Windows that can be opened and closed, such as (mashrabiyas) Whereas, controlling the system of opening and closing windows automatically makes it easier to avoid exhausts and dust and to preserve the air of the interior space.

Using plants to improve indoor air quality They absorb carbon dioxide and release oxygen through the process of photosynthesis, increase moisture through the process of water transpiration from the pores on the surface of leaves and roots, and can also absorb pollutants on the outer surfaces of leaves and the plant root system. But plants are usually used for their looks and ability to survive with simple care.

Use of HVAC systems controls humidity, airflow and air purification Cools, heats, ventilates and air purifies through temperature sensors for inputs, controls flow for output (water flow or air flow), filters, CO2 monitors and dust filters are also used High quality dry cleaners remove dust, particles and microorganisms from compressed air.

5.2. Good lighting

The role of the interior architecture designer comes in developing design solutions that provide the greatest amount of natural lighting, such as: using ceiling windows or skylights, distributing windows and choosing their places carefully to obtain the largest amount of natural light, especially reflected, while trying to avoid direct light, allocating some open spaces (For example, the courtyards) in the building allow a person to benefit from the violet rays, taking into account the privacy factor, and to obtain natural light, it is required that each room have two windows, as far as possible, distributed on two walls, in order to avoid the phenomenon of dullness.

Among the smart solutions is the use of smart glass, light sheds, solar panels, photovoltaic cells, and light tubes, which is a technology through which sunlight is transmitted through winding or straight tubes to places that light does not reach (indoor rooms - basements -) or to increase the amount of light This technology relies on reflections in mirrors and lenses, which concentrates the light and transmits it to the required places. Light shelves and sun refractors are also used to control the natural light.

Then comes the role of technology in providing environmentally friendly industrial lighting by using LED lamps, which are characterized by emitting small amounts of heat during operation and maintain a

moderate temperature, reduce the risk of global warming, do not contain toxic mercury, and consume less energy to produce light. Which contributes to reducing carbon emissions and greenhouse gases emanating from power stations. Fiber fibers are also used, which are characterized by transmitting light over long distances without decreasing or changing its characteristics, in which it is possible to control the distribution of light quantities to the required, accurate and wide scale, and the ability to Determining and directing the light, where it falls, the quality and quantity of the light emitted from it, and the ability to create special effects by means of various filters. It is easy to change the color of the lighting to different colors by means of color wheels that are placed in front of the lighting source, with temperatures of up to 800 degrees Celsius, which facilitated the collection of sunlight and its focus with mirrors. And the lenses to be inserted into the tip of the fiber.

5.3. Heat comfort

There are many design solutions and materials that are used to achieve thermal comfort. As for the facades, solar breakers are used in different horizontal, vertical and composite forms. Spider glass is also used, which has different conductivity of heat and smart glass, which controls the amount of light and heat, which reduces noise and energy consumption and achieves sustainability.

Balconies are also used for shading, plant facades to block sunlight, perforated facades, umbrellas, berms, and solar screens with planting roofs of buildings that cool the whole building.

As for the ceilings, the solutions vary according to the design. The ceiling can be designed double. The ceiling is constructed from two separate tiles so that it allows air to pass between and the passage of air between the two layers works to reduce the heat gained by a great extent, which reduces the internal temperature, or the design of the ceiling is curved so that the sun rays disperse. It can also be insulated with inorganic insulation materials, painted in light or reflective colors, or covered with a truss made of plastics such as polycarbonate, which is also an insulator of heat and electricity.

In the walls, it is easy to use insulating materials such as airgel and polystyrene, or binding with wood panels. Materials that resist high temperatures and help moisturize the place are used, such as ceramics, porcelain, marble, and environmentally friendly plastics such as vinyl and epoxy floors. On the contrary, in cold places, wooden floors, carpets, and rugs are used from manufactured plastics. environmentally friendly.

5.4. Ventilation and cooling

Natural ventilation depends on the direction and speed of the wind and the position of the building. As for industrial ventilation, air conditioners, fans, hoods,

plants and heat exchangers can be used to transfer cold heat from exhaust air to fresh air. Mashrabiya, as in the Arab Institute in Paris, or Al-Malqaf, which is a tower above the building to catch the air, as in Masdar City.

5.5. Maintaining water quality

Refraining from the use of toxic materials and detergents in bathrooms and kitchens to preserve water quality and the possibility of reusing and recycling it in what is known as gray water. Rainwater purification and filtering and removal of materials that may lead to pollution in preparation for reuse. The use of sanitary and modern devices and connections that contribute to the rationalization of water consumption, such as touch and infrared devices. The use of low-flow equipment such as toilets, sinks, showers, taps and drinking fountains that reduce consumption. The equipment is provided with a spray jet head to perform the same as the high-flow devices. Employment of infrared sensor toilets. Using sprinklers with automatic shut-off systems for garden irrigation.

5.6. The use of environmentally friendly materials

Bamboo is considered one of the sustainable solutions as a finishing material for floors, and it is low cost compared to wood. It is also environmentally friendly, helps to moderate the ambient temperature, multi-colored and easy to shape, in addition to its hardness and ability to withstand temperatures. Cork is an environmentally friendly interior finishing material. It is obtained from the bark of the cork oak tree. High-density pressed boards are used as flooring, while less dense boards are used as sound and thermal insulation tiles. Bamboo furniture is one of the environmentally friendly materials as it is from a renewable resource. It is fast and enjoys strength and durability. Bamboo wood is a sustainable material that can remain as it is for nearly 100 years, as it is less affected by weather factors such as heat and humidity, and its colors range between brown, sugar and yellow. The panels made of wheat sticks are LEED certified and classified as a friendly material. For the environment because it can be recycled and manufactured, and does not negatively affect human health and the environment.

5.7. Going towards the use of renewable energy

Using solar energy: Paying attention to obtaining natural lighting in architectural spaces to maintain the health of the residents of the green building. Optical sensors can be used and the use of light tubes to increase light, which is a technique through which sunlight is transmitted through winding or straight tubes to places where the light does not reach, the use of solar energy. Photovoltaic solar panels to obtain natural light (e.g.: monocrystalline, polycrystalline, hybrid, thin film, use of lucarnes in relation to the facade with less sunlight to

allow natural light without direct sunlight. The use of the Light Bandit device for transmitting sunlight is a device that It is installed on the window, and it captures sunlight and transmits it using optical fibers to anywhere in the room. These tubes can be connected to any lamp to illuminate it with sunlight.

Wind energy: Energy extraction through wind turbines is one of the ways to secure clean and renewable energy for homes and institutions. Devices must be installed to store energy equally efficiently so that electricity is available regardless of wind direction and climatic conditions. The World Trade Center in Bahrain is an example of a building that generates electricity using three Giant windmills, each 29 meters long.

Use of rain water: it is necessary to provide channels and bridges to collect rain water and control its course and store that water for use in irrigation or other purposes. As for the humidity, the plants surrounding the building can be sprayed, using water basins or fountains, and placing them in the wind path.

6. Results

Employing the concept of sustainability in interior architecture has become of great importance to reduce energy use, reduce spending, and preserve the environment and natural resources.

Advanced technology achieves sustainability goals and makes the interior space of the residence and buildings smart and more comfortable for use, as it raises the level of luxury.

Good interior design contributes to achieving sustainability when construction, finishing materials and furniture are based on environmentally friendly materials that live for a long time.

Buildings that use renewable energy help reduce the use of electricity and water, and successful design solutions help achieve thermal comfort for the user instead of using air conditioners and heating.

7. Conclusion

The research presents the requirements of sustainability within the space and how to provide several factors such as indoor air quality, good lighting, thermal comfort, ventilation and cooling quality, disposal of pollutants, water conservation using environmentally friendly materials, and the trend towards the use of renewable energy to achieve thermal comfort and less energy consumption.

Technology requirements do not conflict with sustainability, but they require intelligence and skills from the interior architecture designer.

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