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# Smart Technologies and their Reflection in the Design of Sustainable Interior Spaces (ME Dubai Hotel as a case study)

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#### Abstract

With the continuation of technological development and what has been demonstrated by the massive expansion in modern technologies, we now need to ensure that this expansion does not cause a huge increase in the consumption of energy and resources, and that it does not have a negative impact on the environment and human health, as modern technical developments provide pioneering opportunities. To monitor and protect the environment, in addition to preserving the general health of the planet, by harnessing it in the most appropriate manner, modern technologies can be directed to enhance ecological design in order to preserve the environment and humans. Through this, the research problem is revealed by the following question: What is the role of smart technologies? What is its impact in the designs of sustainable interior spaces? While the importance of the research study contributes to highlighting the importance of preserving the environment through the use of smart technologies and the selection of environmentally friendly building materials. While the current research aims to reveal the role of smart technologies and the clear reflection they achieve in the designs of sustainable interior spaces, the research study also included the axes of the theoretical framework as well as the research study included extracting the most important Results, conclusions, recommendations and future proposals.

Keywords: smart technologies, design, sustainable interior space.

#### 1- Introduction

Smart technologies are a design integration between building systems and technology. This is because the integration of smart technologies into the design of sustainable interior spaces was created to serve the user and his comfort in order to make his life easier. Therefore, smart technologies in designing sustainable interior spaces have become a common concept used to achieve the highest levels of control over various design standards, thus determining the health of the environment inside the building. Smart technologies also enhance productivity and well-being and help in achieving resource efficiency as well as studying cost and flexibility. As well as the ability to adapt to the internal environment. Therefore, smart technologies have recently become intertwined with the concepts of sustainability, in addition to their impact on the main aspects of the building, such as functional and structural aspects, as well as the formal aspects, as the latter is considered one of the most important influential aspects of a sustainable building, especially if the form is linked to smart technologies in spaces. The interior of the building or smart materials and other matters affecting the design.

#### 1-1 Research problem :

One of the most important factors that interior and architectural design must pay attention to is providing a healthy environment for future generations by focusing on studying smart technologies in order to apply them in sustainable interior design so that a large portion of design problems can be overcome, including, for example, energy consumption inside buildings. This is done by relying on smart design techniques in order to preserve the environment, where the building is part of the environment and not a burden on it, in addition to studying the economy and rationalization of the consumption of resources, including materials and water. The interior design must also achieve a significant impact in reducing harmful emissions in buildings and thus maintaining health. The user and the environment. Sustainable interior design provides many environmental treatments for interior spaces so that it provides comfort to the user now and in the future through the use of smart technologies and the reflection they achieve in the design of interior spaces, in addition to studying the guiding standards that can be followed by the interior designer. Accordingly, the research reviews some techniques. Smart, energy-saving technologies that the interior designer uses in designing interior spaces, which are linked to sustainable design. Through this, the research problem is revealed by the following question: What is the role of smart technologies? What is its impact in the designs of sustainable interior spaces?

# 1-2 The importance of research:

- 1- The research study contributes to clarifying the role of smart technologies in designing sustainable interior spaces while studying the extent of their importance in reducing energy consumption in order to promote sustainable development.
- 2- Enhancing the importance of the role of the interior designer in designing sustainable buildings in a thoughtful manner for all design aspects
- 3- Highlighting the importance of preserving the environment through the use of modern technologies and the best selection of environmentally friendly building materials.

#### 1-3 Research objective:

The current research aims to: reveal smart technologies and the clear impact they achieve in the designs of sustainable interior spaces

### 1-4 Limitations of the research:

- 1- Objective limit: smart technologies and their reflection in the designs of sustainable interior spaces
- 2- Spatial boundaries: Determinants of the interior space of the Mai Dubai Hotel.
- 3- Time limit: 2016-2022.

# 1-5 Definition of terms:

- **Technology**: It is the specific scientific method that individuals practice to obtain certain results, or it may be represented by a set of methods used through the use of some tools or materials to obtain certain results (The Philosophical Dictionary, 1983, p. 330).
- Intelligence: The concept of intelligence is considered one of the most widely used concepts among specialists in psychology and educational sciences, because the word intelligence has more than one meaning and connotation, which makes it difficult for those in this field to give a unified definition of intelligence (Habbal Yassin, 2017, p. 18).
- Intelligence also defined, according to Gardner, as a set of independent abilities that people possess in various fields, such that each ability operates separately from the other. While (Hanafi Jawad) defined intelligence as a human ability that is capable of progress, development, flexibility, as well as increase, and growth, and in his view it is a learned ability. Intelligence also represents the ability that represents the ability to integrate experiences and what a person learns in order to produce new, and therefore intelligence carries the meaning of novelty and creativity. (Mona Hashem Muhammad Taha, 2017, p. 5)
- **Reflection:** It is a visual, intellectual, or psychological transfer on the pictorial surface, leaving an aesthetic effect (Najla Muhammad Kazem, 2004, pp. 8-9).
- **Design:** (It is that plastic innovation, which contributes to the creation of beautiful and enjoyable things, or it is also the creative work that achieves its purpose, and the design process may depend on the designer's ability to innovate because he exploits his culture and imaginative ability in creating a new work or developing a previous work, (Abu Hantash (2000 AD, p. 28).
- Inner space: (It is that closed space that is separated from the outer space by a group of physical elements and determinants represented by (vertical and horizontal determinants). Inner space also represents part of the infinitely extended space, in addition to the fact that it represents the coordination of the closed space, (Hassan Najmi, 2000 AD, p. 32).
- Sustainability: is an environmental term that describes how biological systems remain diverse and productive over time, while sustainability for humans means the ability to maintain the quality of life they live in the long term, and this depends on how to preserve the natural world with responsible and optimal use of natural resources (Al-Ramini, 2015, p. 6).

# 2- Theoretical framework

#### 2-1 Smart technologies in sustainable interior space designs

Technology is considered part of the development of human society, because it represents the application of information during continuous work to achieve it, i.e. a skill (Mohamed 2004, p. 21). Technology is also defined, according to the opinion of the Egyptian scientist Ibrahim Bayoumi, as a set of principles or means that help to accomplish something or achieve a goal. These means are based on scientific and precise foundations, and they also mean art and industry, and they may differ from science in that their purpose is work and application (Ibrahim, 1983, p. 53).

While technology, according to Marcuse, is what transforms things into tools in order to exploit them for social and cultural purposes. Technologies are also considered to be the link between the intellectual content and the resulting form. Technology works to translate ideas into tangible material materials, or in other words, it is the crucible in which it takes place. Transforming principles into designs, and using them makes designers more creative and productive. Smart technologies are also reflected in interior designs and thus improve the quality of the design and the quality of the environment (Munawwara 2004, p. 15), which includes the smart building envelope technology, which contributes to determining the environment of the interior space related to thermal comfort and visual comfort. , thus affecting the reduction of the use of non-renewable energy in indoor spaces (2012 p. 437-464, Hoseini & others).

As well as smart glass technology, this glass is considered to be a treatment used to reduce temperatures and also treat the building envelope, which is reflected in the interior space (8 Murad & others, 2017). There are also technologies based on solar energy, including technologies that depend on exploiting positive solar energy, such as using panels. Photovoltaics and solar thermal collectors, with the use of mechanical and electrical equipment, or by relying on photovoltaic cells, as they can be used in multiple ways, either on the roof or on the facades or through the use of breakers, or they may be used as an alternative to

walls for glass curtains, to become part of the composition of the cover, So that it integrates with it to perform its function of converting sunlight into other useful sources of energy (IPEC Building Energy Efficiency – 2018), see Figure No. (1).



Figure (1) shows the smart technologies used in sustainable interior design (designed by the researchers)

#### 2-2- Employing smart technologies in sustainable interior design:-

Sustainable interior design represents a highly efficient system that is compatible with its biological surroundings with minimal collateral damage. Sustainable interior design in interior spaces also depends mainly on employing smart technologies by dealing with the environment in a better way that integrates with its determinants, so that it is possible to benefit from the phenomena of this. The environmental environment and its exports (Kadas 2006p8), while studies indicate that sustainable buildings are achieved through designing an efficient internal space through the use of smart technologies while studying natural data effectively through harnessing solar energy with the optimal use of available natural resources with the least possible damage (yeang & Hamzah, 2001, p. 67).

One of the priorities that designers are interested in in the field of sustainable interior design is the use of lighting technology in the design of interior spaces, whether natural or artificial light. The process of employing smart lighting, for example, should be well in the sustainable interior space, which It generates an important reflection for the user because it represents an important factor for him that is reflected in his behavior and job performance (Al-Bayati, 2005, pp. 133-134).

The use of lighting is also an effective and important element as it is one of the elements of visual attraction in the interior space, making it a specific relationship between the light source and the target to be illuminated in the interior space. Designers' awareness of the role that smart lighting plays in sustainable interior spaces is achieved by giving a psychological impact on Interior scenes and their indication of upcoming events, which prompted them to employ lighting with different techniques and methods to serve their diverse purposes and design requirements (Al-Muhandis, 1990, p. 25). Therefore, some interior designers have focused on employing natural light to determine the points of activities within the sustainable interior space (Stegers, 2008, p.52)

Smart technologies contribute to sustainable design on the environmental adaptation of indoor spaces, which is represented by studying the thermal comfort of indoor spaces, which depends on indoor air quality. The factors affecting thermal sensation depend mainly on four physical variables, which include: air temperature, air speed, relative humidity, and average radiant temperature. Variables include clothing and activity level, as satisfaction with the thermal environment in indoor spaces is a complex response to various interactions and tangible variables (Al-Naim, 2016, p. 23), see Figure No. (2).



Figure (2) shows the factors affecting thermal sensation (researchers' layout)

The environmental adaptation technique in sustainable design is also based on the designer's study of sound and noise in the sustainable interior space, as the propagation of sound in interior spaces differs from its propagation in other places of interior spaces. The propagation becomes more complex, but most of the determinants of interior spaces partly reflect and partly absorb and may Energy is transferred partly through these determinants, and all of this depends on the interior designer's study of the nature of the materials, their surfaces, their density, as well as their thickness and porosity, in addition to studying other physical properties such as the modulus of elasticity and the method of fixing them (Hamada, 1996, p. 143).

In addition, there are environmental treatments that have contributed greatly to achieving adaptation and compatibility between the building and the surrounding environment to form a sustainable interior space, which is represented by employing and harnessing the environment for the benefit of the interior space through the following: (Ramadan and Ali, 2018, pp. 47-48)

- 1. Treatments of interior wall designs in terms of using smart insulation techniques by choosing appropriate building techniques and materials to achieve good insulation, as well as the sense of color and awareness of its value through its aesthetic effect and visual pleasure.
- 2. Special treatments through the diversity of roof designs in terms of the use of white roofs and roofs of buildings that include solar panel technology in order to provide electrical energy from nature, as well as the use of green surfaces for thermal insulation.
- 3. Treatments for opening designs: double glazing technology, reflective glass technology, smart window technology, and misleading glass technology to achieve misleading openings.
- 4. Treatments for the quality of indoor spaces in terms of providing the indoor environment with a healthy and comfortable atmosphere. This is done by increasing the effectiveness of natural ventilation and increasing the effectiveness of daylighting, while controlling the sources of pollutants inside closed spaces, perhaps including noise, echo, etc.

#### 2-3 Indicators of the theoretical framework

- 1- Modern smart technologies represent one of the most important foundations of sustainable interior design because they contribute to preserving the environment as well as improving the design quality of interior spaces by making them spaces compatible with the environment. In addition, this technology provides designers with great design capabilities due to the use of new smart materials based on... Development of construction methods. Perhaps among the most prominent smart technologies used in sustainable interior design that achieve comfort for space users by conserving energy are the following technologies: smart building envelope, smart glass, and solar energy.
- 2- Lighting is considered one of the smart technologies in sustainable interior spaces because it plays an important role in confirming the function of the interior space, which generates a reflection on the behavior and functional performance of the user of the interior space. In addition, it works to attract the attention of the recipient in order to confirm the presence of important places and pieces in the interior spaces.
- 3- Thermal comfort in sustainable indoor spaces is that comfort represented by the air quality inside sustainable spaces, which depends on physical factors and includes: air temperature, air speed, relative humidity, average radiation temperature, in addition to human factors such as studying the types of clothing and the activity level of the recipient.
- 4- Acoustic treatments within internal spaces vary depending on the function of the internal space and its constituent elements, depending on the nature of the sound within the space. This depends on the designer's study of all of: (the nature of the materials, their surfaces, their density, thickness and porosity) in addition to the designer's study of other physical properties such as the modulus of elasticity and method. Installation of these audio processors.

5- Environmental treatments within the parameters of the interior space are those treatments that include treating walls using smart technologies, including insulation techniques, appropriate building materials, and colors, in addition to treating roofs that are done using solar panel technology, green surfaces, as well as treating openings that are done using glass techniques (Such as double, reflective, smart windows, and misleading windows), with attention to addressing the quality of the interior environment of the space by using natural ventilation and daylighting techniques, as well as controlling sources of acoustic pollution such as noise and echo.

# 3- Search procedures

# 3-1 Research methodology and procedures:

Due to the nature of the research, the researchers adopted the descriptive analytical method (case study), which is one of the scientific research methods, in order to reveal the role of smart technologies and the clear reflection they achieve in the designs of the sustainable interior spaces of the ME Dubai Hotel (a model). This is because this study requires knowledge of all its details, based on the degree The basis is on the theoretical framework to achieve a comprehensive achievement of the research objective.

#### 3-2 The research community and its sample:

The research community and its sample were included in the study (ME Dubai Hotel as a model).

This sample was selected according to the following justifications:

- The selected sample was thoughtfully designed at the interior design level, as smart technologies demonstrated their good design capabilities for sustainable interior space designs based on the diversity of modern smart technologies at the level of interior design, as well as the diversity in the use of many technologies through diversity in the way Implementation.
- The sample was selected based on the design image, which is rich in details and its motivating effects on the recipient, through the selection and selection of smart techniques for interior design designs, as well as the selection of appropriate materials and building techniques, taking into account the multiplicity and sequence of visual scenes, as well as the character of visual suitability for the designed shapes.

#### 3-3 Validity of the research tool:

For the purpose of confirming the validity and comprehensiveness of the analysis tool, as it is one of the most important conditions that must be met in the tool adopted by any research study, the validity of the tool used was verified after completing all research tools, and then the analysis axes form was presented to a group of experts<sup>1</sup> with experience in the field The internal design to express their opinions about its validity in light of what was presented from their sound scientific observations, and after expressing their opinions in terms of the validity of the paragraphs and identifying what needs to be modified, the researchers determined the axes of the analysis, and after discussion, the necessary amendments were made to some of the wordings according to the opinion of the experts on the form, and then it was returned to Experts again, and there was consensus on the validity of its paragraphs by 100%, as in Table No. (1):

Subtitles	Secondary vertebrae
Smart technologies used in sustainable interior design that conserve	Smart Dual Cover Technology
energy	Smart glass technology
Adopting smart lighting technology in sustainable interior spaces	Solar technology
depends on	
	Natural lighting technology
Thermal comfort and its impact on sustainable interior spaces	Industrial lighting technology
	Practical ability to study air quality
Studying audio processing techniques through	Advanced adaptive filtration of indoor air
	The nature of materials, their surfaces, density, thickness and
	porosity
Smart technical diversity with environmental treatments	And the sustainable technical action it reflects
	At the levels of internal determinants

# 3-4 Description and analysis: ME Dubai Hotel

# First: General description

The ME Dubai Hotel is considered one of the finest and most luxurious hotels in the world, and is located in the United Arab Emirates. This location is also strategic, as the hotel is located in The Opus Tower, which was designed by the Iraqi architect Zaha Hadid, in the heart of the Burj area. Khalifa in Downtown Dubai, which extends over an area of 2 million square feet. The hotel also includes a group of restaurants, other entertainment facilities, offices and accommodation facilities. In addition, the ME Dubai Hotel has unique external and internal designs characterized by design creativity.

# <sup>1</sup> Specialized experts:

Prof. Salah Al-Din Qadir Ahmed: Ph.D. Interior Design / College of Basic Education / Al-Mustansiriya University. Lect. Dr: Ammar Taha: Ph.D. Interior Design / Design Department / Institute of Fine Arts / Ministry of Education Rusafa

Lect Dr. Wijdan Hussein: Ph.D. Interior Design / Design Department / Institute of Fine Arts / Ministry of Education Rusafa

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Through this, the general description of the interior space showed its connection with the exterior design of the building. The designs of the hotel suites are characterized by an elegant modern character with sharp and wide angles, as well as the use of luxurious materials that reflect the unique touch of the designs of the architect (Zaha Hadid). This hotel also combines in its designs between luxury and comfort, to ensure For users to relax and rejuvenate, in addition to that, its design reflects an elegant shape with an aesthetic nature in all its design details, as this design evokes the splendor of the city of Dubai with its natural lights through the design of its glass windows extending from floor to ceiling with its distinctive design in amazing desert color shades as well as overlapping The calm blue of the night because the spacious design is inspired by golden sand dunes, and the design of the city of Dubai, which in turn form an ideal interface for discovering the city. The hotel's suites also feature colorful designs with soothing shades of blue, as well as spacious spaces that transport guests to a world of calm and tranquility. ME Dubai Hotel is also committed to providing the latest luxury technologies to its guests, as it is keen to equip all suites with advanced electronic screens and smart sound and LED lighting systems.

# Second: Analysis

Main axis: Smart technologies and their reflection in the design of sustainable interior spaces (for ME Dubai Hotel) Modern smart technologies have contributed to preserving the internal environment as well as improving the quality of design of the internal spaces of the ME Dubai Hotel by making them spaces compatible with the environment. This is due to the designer's study of new smart technologies that bring comfort to space users by conserving energy, which are the smart double envelope technologies for the building. Smart glass and solar energy by employing it in all the internal determinants of hotel design. See Figures (1) and (2). The interior designer's study of smart lighting also contributed to the sustainable interior spaces of the hotel by confirming the function of the interior space, which is a reflection on the behavior and functional performance of the user. Interior space In addition, it works to attract the attention of the recipient in order to confirm the presence of important places and pieces in the interior spaces, by employing artificial lighting in the designs of walls and ceilings, relying on a series of LED lighting units integrated with sustainable, energy-saving lighting techniques, with the interior designer accrediting to Natural lighting during the day, through the design of curtain windows with smart glass within the designs of ceilings and walls, which made artificial lighting technology a complementary aesthetic element with natural lighting. See Figures (2), (5).

The interior designer intended to provide thermal comfort, which is represented by the practical ability to study the air quality in the hotel spaces, relying on advanced air conditioning purification of the indoor air by employing clean, sustainable energy through studying the physical factors, represented by studying both air temperature and air speed, as well as relative humidity, in addition to studying The average radiation temperature, in addition to studying human factors such as the type of clothing and the activity level of the recipient, made the hotel's interior spaces enjoy appropriate thermal comfort, see Figure (2). The interior designer's ability to clearly employ techniques based on acoustic treatments within the parameters of the hotel's interior spaces was also demonstrated, according to the function of the spaces. The interior and its constituent elements, which are represented by the designer's study of: the nature of the materials, their surfaces, density, thickness and porosity, so that they had a clear and deliberate impact on the nature of sound in the hotel's interior spaces.

See Figures (5) and (6). The interior designer also sought to pay attention to employing... Smart technologies with environmental treatments within the parameters of the hotel's interior spaces and the sustainable technical action they reflect include treating wall designs using smart insulating glass and appropriate building materials, as well as using nano-paint and colors because of their effective role in thermal insulation, as well as emphasizing the achievement of treating designs. Roofs made using solar panel technology, noting that the designer did not adopt green surfaces, in addition to treating openings within the wall and ceiling designs through the use of double and reflective glazing techniques, as well as misleading smart windows, see Figures (2), (3), (4), and (6). ).





#### 4-Results:

- 1- The interior designer had the ability to employ modern smart technologies used in sustainable interior design, which are the smart double-layer envelope technology for the building and smart glass, as well as solar energy technology within the interior specifications of the (ME Dubai) hotel, because it contributed to preserving energy and the indoor environment in addition to the use of new smart materials. This confirms the clear development of design construction methods.
- 2- The interior designer's study confirmed smart lighting in sustainable interior spaces, relying on the use of artificial lighting through a series of energy-saving LED lighting units with advanced sustainable technologies, as well as providing and achieving natural lighting through the use of curtain windows technically treated with smart glass within designs. Ceilings and walls, making artificial lighting technology a complementary aesthetic element with natural lighting during the day.
- 3- The role of the interior designer in his technical work was based on providing thermal comfort, which is represented by the practical ability to clearly study air quality through advanced adaptive purification of indoor air by employing clean, sustainable energy with reference to physical factors as well as studying the average radiation temperature in addition to studying human factors in order to Making the hotel's interior spaces healthy spaces that enjoy appropriate thermal comfort.
- 4- The designer's study of smart technologies contributed to their clear reflection in the hotel's interior spaces by employing acoustic processing techniques by achieving sound insulation within the interior parameters, according to the function used within the space, which is represented by the designer's study of all of: the nature of the materials, their surfaces, their density, their thickness and their porosity, so that they had A clear and deliberate impact on the sound quality of the hotel's interior spaces
- 5- The interior designer's emphasis on the interest in employing smart technologies with environmental treatments within the parameters of the hotel's interior spaces and what they reflect in terms of sustainable technical action, which includes processing wall designs using smart insulating glass and appropriate building materials, as well as the use of nano coatings and colors, due to their effective role in insulation. Thermal, as well as emphasizing the treatment of roof designs that are made using solar panel technology, noting that the designer does not adopt green spaces, in addition to treating openings within wall and ceiling designs through the use of double and reflective glazing techniques, as well as misleading smart windows.

# 5- Conclusions

- 1- The study of employing modern smart technologies used in the sustainable interior design of hotels is related to reaching an advanced stage of the design scene by relying on the technology of the smart double envelope of the building and smart glass, as well as solar energy technology, in addition to the use of new smart materials in order to supply the internal spaces of hotels with clean energy as well as The stability of the continuity of this energy.
- 2- The use of smart technologies in the sustainable interior design of hotels represents a process that takes an approach to assembling parts according to the overall view, within an interconnected series of visual rhythms and proportions, such as relying on energy-saving artificial lighting as well as natural lighting, which generates a reflection on the behavior and functional performance of the user. Interior space In addition, it works to attract the recipient's attention in order to confirm the presence of important places and pieces in the hotels' interior spaces.
- 3- The concept of thermal comfort represents the practical ability with clear study and implementation to achieve air quality, and this is according to the areas of shaping the designs of the interior spaces of hotels, and this depends on the choice of clean, sustainable energy in order to make the interior spaces of hotels healthy spaces that enjoy appropriate thermal comfort based on the study of physical factors. And humanity.
- 4- The study is based on the programmed employment of acoustic processing techniques through the diversity of levels of sound insulation within the interior specifications of hotels in a modern way, to constitute the result of the efforts of the design vision as wave models with intent and high knowledge to develop the sound quality in the interior spaces of the hotel, and this depends on the designer's study of each of the following: The nature of materials, their surfaces, density, thickness and porosity.
- 5- Interior design, including the employment of smart technologies with environmental treatments within the parameters of the internal spaces of hotels, is according to engineering relationships with specific laws of design requirements based on

sustainable technical action according to the levels of internal parameters according to the designer's vision and this is according to the requirements of the place.

# 6- Recommendations

- 1- The research study recommends that the interior designer be informed of the latest developments in smart hotel technologies in order to expand his intellectual horizons and mental perceptions of innovative and creative designs while benefiting from international design experiences.
- 2- The research study recommends the necessity of continuous scientific and operational research into smart technologies, according to advanced sustainability standards, because they constitute a basic basis for preserving the internal environment of hotels.

# 7- Future proposals:

- 1- Emphasis on the study: The design stimulus for smart technologies in the interior spaces (ME Dubai Hotel as a case study)
- 2- Emphasis on the study of: the smart design and technical horizon and its renewed dimension in the levels of interior spaces (ME Dubai Hotel as a case study).

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