# THE EFFECTIVENESS OF TECHNICAL DEVELOPMENT IN EMPLOYING SMART FURNITURE FOR CONTEMPORARY INTERIOR SPACES

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#### Abstract

In recent years, and in light of the remarkable developments of our time, development and technical progress have tended to meet the needs of society by dealing with the study of the types of technology on a large scale by studying its connection to all aspects of life, achieving cultural and cognitive growth for societies, to raise it to the level of global design competition, The technical development also contributed to increasing the effectiveness and efficiency in employing smart furniture to shorten the time and effort on the occupants of the interior spaces.

Keywords: Technical development, interaction, interior spaces, smart furniture

## **INTRODUCTION**

From the beginning of technical development until our current era called the era of smart information technologies, this revolution has become the main feature that constitutes the features of the modern technical revolution in various design fields, especially in the design of smart furniture. Which requires the interior designer to have creative expertise to reach the formal output of a creative design idea that enjoys employing smart furniture within the interior spaces. Here lies the research problem in the following question: What is the role achieved by technical development and its effectiveness in employing smart furniture in the interior spaces? While the objective of the research is to reveal the efficiency achieved by the technical interaction and the extent of their application in employing smart furniture in the interior spaces ,While the objective research limits were to study the efficiency and effectiveness of the technical development required to be implemented with regard to smart furniture within the interior spaces represented by (German international kitchen companies) in the UAE for the period from 2011 AD to 2020 AD.

While the second section included the theoretical framework of the scientific material, explaining the interaction of advanced executive techniques and the efficiency of their use of smart furniture in the interior spaces, while the third section included the research procedures, it relied on the descriptive approach in analyzing the sample models, while the research community relied on the intentional selective method, and the sample was 40% From the research community, and while the research tool used was the analysis form, it was designed according to the knowledgeable literature of the research, and the validity of the tool used was





verified, as the analysis axes form was presented to a group of experts with specialization, while the fourth chapter included extracting the results and conclusions of the research, the most important of which:

- 1. Emphasizing the depth of the importance of smart furniture and its role in smart spaces, where smart space is not complete without smart furniture that responds to the requirements of contemporary life, where modern technological methods must be used to produce digital, interactive and future furniture and use it in kitchen designs.
- 2. Smart furniture in the interior spaces achieves an important role, as it works to find more innovative solutions to give a group of functions to the user within the space through smart furniture playing more than one role or function so that it provides comfort to its users as well as responding to the life requirements to achieve the well-being of its users.

The research study also included recommendations, future proposals, and the beneficiaries of the research:

# **1. THE FIRST TOPIC**

## **Research problem**

The selection of the interior designer for the design idea and summoning it from his design imagination to a tangible reality depends mainly on studying the efficiency and interaction of the technology required to be implemented with regard to smart furniture within the interior spaces according to innovative design systems and their employment within the total output, so we find that from the beginning of technical development until our current era called the era Smart information technologies have become that revolution is the main feature that constitutes the features of the modern technical revolution in various design fields, especially in the design of smart furniture, as a result of the application and use of smart technical design sciences in all fields, so smart furniture is considered one of the advantages and aspirations of the modern era, especially with regard to its association with technologies The greatly transformed digital dimensions that are characterized by the limits of large-scale ideas, and the development of technical progress also contributed to increasing the effectiveness and efficiency in employing smart furniture to shorten the time and effort on the occupants of the interior spaces, which requires the interior designer to have creative expertise to reach the formal output of the design idea in order to Employing smart furniture within the interior spaces. Through the foregoing, the research problem can be formulated with the following question: What is the role achieved by technical development and its effectiveness in employing smart furniture in the interior spaces?

## **1.1** The importance of the research: The importance of the research lies in the following:

The research study contributes to identifying the most important technologies that contribute to increasing the efficiency and interaction of smart furniture with the user (recipient). The research study also contributes to supporting and enhancing studies and knowledge in the field of interior design, and also contributes to adding scientific benefit to designers, specialists, and





students in the field of interior design, as well as to the corresponding disciplines, especially in smart furniture designs

**1.3 Research objective:** The research objective is embodied in revealing the efficiency achieved by the technical interaction and the extent of their application in the employment of smart furniture in the interior spaces.

**1.4 Research limits:** The current research is determined by studying the efficiency and effectiveness of the technical development required to be implemented for smart furniture within the interior spaces, while its spatial and temporal boundaries include the interior spaces represented by (German international kitchen companies) in the UAE for the period from 2011 AD to 2020 AD.

# **1.5 Definition of Terms**

**1.5.1 Interaction: Linguistically**: (he did) the thing in action and the effect of his action, (he fabricated) the thing he fabricated and falsified. In grammar) a word denoting an event and its time  $(^1)$  idiomatically: interaction in its idiomatic concept denotes the mutual influence between two or more phenomena and there is harmony between them, and in the end leads to union in work  $(^2)$ , defined by "Ottaway" (1970) as: The name given to any relationship that occurs between people in groups or between groups as social units  $(^3)$ .

**1.5.2 Technique: Linguistically:** technique (mastery) \_ the matter is perfected \_ mastered the command, the most perfect (mastery) is a man who masters things and is skilled in work.<sup>(4)</sup> On accurate scientific grounds, and the foreign word is of Greek origin, which is (techno), meaning art and industry, and differs from science in that its purpose is work and application, while science aims at mere understanding devoid of practical purpose <sup>(5)</sup>, and technology is defined in design as "a group of materials." The materials, tools, machines, methods, means, and systems that enter into the design process, in order to perform a human service, and it is obvious that there are many smart technologies and differ among themselves according to the functional goals that they seek to achieve, and their final product differs according to their components and the extent of the impact of these components on the overall design process<sup>(6)</sup>

**1.5.3 Development: Linguistically:** Development is a word derived from the verb to develop, to develop, meaning a transformation from one phase to another and from one state to another.<sup>(7)</sup> The development of an industry is its modification and improvement to the better, and the development of a thing means its transformation from one phase to another, i.e. the transfer of it from one state to the best, and it may be a gradual transfer to another state, with the aim of improving it and raising its value, not an abstract change of its value.<sup>(8)</sup> **Conventionally**: Al-Qadi defined development as the ability to analyze problems and predict the quality of new designs. <sup>(9)</sup> As defined by Kr Uther, it is the change in the qualities and properties of materials as a result of the opening up of its energy to higher levels in the ladder of evolution. <sup>(10)</sup>





1.5.4 Technical development: procedurally: It is the application of modern technical skills and knowledge to prepare and produce interior designs that are characterized by renewal and modernization to transform the internal space into an aesthetic, functional and creative space. Thus, technology is one of the most powerful factors of progress and development in society

**1.5.5 Furniture: linguistically**: the belongings of the house, such as bedding and the like. Plural: furniture, which is the belongings of the house, the office, and the like, such as bedding and others, and it is what the space needs in order to become a suitable place for human living, so that it provides the comforts that a person needs in his daily life <sup>(11)</sup>. John: He knew a tool for the performance of a specific human post within a limited sense of an sensual expression, and visually creates the internal Ocean in certain forms and methods (<sup>12</sup>). And all used by man in a study of brushes and clothing. (<sup>13</sup>)

**1.5.6 Intelligence: Linguistically:** the word intelligence is linked to the verb. It gives the following meanings: - Completeness: It is the origin of intelligence in the language as a whole, and from it is intelligence in understanding: that its understanding is complete and quick. The speed of acumen: What is intelligence is an absolute matter compared to the intelligent person. (<sup>14</sup>) idiomatically: (Rushka) defines intelligence as: a mental process consisting of a mixture of mental processes such as knowledge and concentration, and production through forms, symbols, meanings and behavior, which represent various types of information and from it to production , where he lists these products with six types of units, categories, relationships, systems, transformations, and guesses. (<sup>15</sup>)

**1.5.7 Smart furniture: procedurally:** it is that furniture that needs special electronic equipment, as its design depends on integrating sensors and a data processor in its parts that are linked within central networks, made of smart materials, and one of the most important features of these materials is the ability to make variable reactions that correspond to meet its functional performance needs

# 2. THE SECOND TOPIC: THE THEORETICAL FRAMEWORK

# **2.1 Technical development in the interior spaces:**

The design output, in order to be connected to its time or contemporary, must be part of the existing civilized activity in the daily life of society, and be compatible with the present degree reached by man of knowledge from all directions of the humanities and natural sciences, and technological development that cannot be separated from design. Planning, and this is what we notice throughout the ages, was the difference in techniques in a slight way from one civilization to another until the eighteenth century, when the boom began in the factories that facilitated the productivity of pieces of furniture more quickly because they were producing one mold of the required design and then copied and repeated by the same machine.

Before that, a piece was produced by skilled craftsmen with long experience, and it used to take long hours and high skill for the piece of furniture to be designed with excellent craftsmanship and breath-taking mastery<sup>(16)</sup>. From the nature of the historical stage and from





its original standpoint that opens up new civilized horizons for society, the technical achievement must be a response to changing circumstances, and not as a request in and of itself.

This behavior falls within the realm of the tangible and falls under the concept of technology, so it denotes a set of aspects of scientific progress that are transmitted from one generation to another in one society or multiple societies. In general, and design in particular<sup>17</sup>, and strongly influences the formation of the history of civilization, so this history consists of a mutual interaction between two forces that support and dominate man at the same time. Society and its advancement at the level of individual life in particular and the social environment in general. In harmony with the clear focus on the detail of the technical feature and then the severity of its impact on the current civilization. (<sup>18</sup>)

From the foregoing, it is clear that the technical development depends on the design output, which in order for it to be connected to its time or contemporary, must be part of the existing civilized activity in the daily life of society, and be compatible with the present degree that man has reached of knowledge from all directions of the humanities, natural sciences and progress. Technology, which cannot be separated in design and planning, and this is what we have noticed throughout the ages. Therefore, technology constitutes an important and effective aspect of life in general and design in particular, and strongly influences the formation of the history of civilization.

Technologies are the link between the intellectual content and the resulting form, as they are the ones that translate ideas into tangible material materials, or in other words, they are the crucible in which principles are converted into designs, and their use will make designers more creative, and improve the quality of design and the quality of the environment. Technology will also provide designers with great capabilities and give them motivation to make their impact in the world because it will direct designers to the best choices and liberate their creativity. (<sup>19</sup>)

This is what we see is clear today from a huge technical development in internal spaces and their components of walls, ceilings, floors and raw materials as well as elevators, stairs and facades as we see progress in interaction between user, space and the environment surrounding them and the appearance of technologies What keep pace with technology and translate ideas to contribute to improving the quality of design and environmental quality.

**2.2 The physical structure of the internal space.** (<sup>20</sup>): It is given to internal space formed and its own nature and is considered to be the main determinants of space and is also included in the determinants of internal space from the walls, ceilings, floors and furniture units especially as an activity separately.



It can be clarified as follows:

- 1) Walls: The vertical level sets out space in terms of form, size and different characteristics, and the specific space of space may vary from natural space such as trees or physicals as rigid and fences Light and columns, and fabrics have an impact on the psychological impression of space as well as movement and privacy.
- 2) Flooring: The internal space base sponsors in which different activities and participates with walls in determining space, and the floors may be flat, slant or multi-level where several space can be configured within one space by multiplex.
- 3) Ceilings: The ceilings are the ones that define the space from above, and in the open spaces the sky is formed. A roof can be added to the space or to part of it for the purpose of defining the space or to give it a specific measure or a special character or for protection. Where a space can be defined by light elements and once they fade, the space disappears.
- 4) Furniture and details (equipments): Everything that can be added to the space to complement it, such as memorial statues, sculptural works, fountains, benches, light coverings, fences, stairs, guidance signs, plants, and everything that can be added inside the space are considered to be among the material components of the space. These elements play an aesthetic or functional role as well as give a human scale space and helps to form the mental image of space.

# **2.3** The electronic structure of the inner space (<sup>21</sup>):

As a result of the progress of the process of development and technical and scientific progress in a rapid and large manner, as it cannot be resisted by the human and moral foundations of man, as this development affected several aspects, the most important of which is construction and building technology from the development of various construction methods with technology developments through the ages and production and manufacturing technology where the use of the latest production methods and the use Modern devices and equipment in the process of development and manufacturing of all structural elements and advanced technology, and accordingly the electronic structure of the space is divided into:

\* Physical equipment: It consists of wires, equipment and communication units responsible for transmitting information. \* Electronic programs: It is a set of laws and programs that complete the interaction process, the process of moving and receiving orders. Therefore, the basic structure of the interactive space consists of both the physical and electronic structure of the space, each with its contents, taking into account the effects that each of them has on the other, which leads to the development of the performance of the interactive structure of the used space. It can be said that the user's activities have become distributed between these two spaces, benefiting from what each space offers in terms of capabilities and components that suit each activity.





# 2.4 Interactive designs in interior spaces:

**1. Interactive surfaces**: There is no doubt that wide flat surfaces such as walls, floors, tables and windows are always associated with aesthetic design and architectural requirements, and these surfaces are just negative surfaces and are often used to display decorative aesthetic objects such as paints, photographs, textiles. However, there are many experiments that have been carried out and are still underway to achieve what is known as home management by electronic means (Automation Home), which have resulted in the implementation of many means of achieving interactivity, as these surfaces become the same interactive interface, and are transformed from architectural elements into a smart envelope (Skin Smart can feel, control and respond to stimuli (<sup>22</sup>).One of the models of interactive surfaces, as in Figure (1), is an interactive table with a pen ((Spring wise)) in the Design Museum in New York, where the high-tech pen allows each visitor to help them explore the huge collection of digital things



Fig 1: Interactive desk with pen spring wise New York design museum <sup>23</sup>

**2. The interactive floor:** The interactive floor combines the perception of the movement of the body and the effect of this movement on the surfaces and the floor. The interactive floor transforms floor voids or unnoticed spaces into an enjoyable experience as a result of the floor's shape changing according to the movement of the person passing over it. As in Figure (2) (<sup>24</sup>)



**Figure 2: The interactive floor**<sup>25</sup>

**3. Interactive ceilings**: Interactive bishop technology is one of the ways of optical service technology, which offers an interactive experience and an impressive interactive participation as in Fig.  $(3)^{(26)}$ 







# Figure 3: Recruitment of digital screens in the ceilings that are used as an advertising

# 2.5 Smart interiors

It is represented by spaces in which special electronic systems are used to operate some of its parts and control some of the systems it contains, such as lighting, air conditioning, ventilation, power and others. It can be said that the degree of intelligence of the dwelling depends on the amount of technology it achieves, the amount of technology it uses, the amount of possibilities within which it operates, and the extent of the design field in which it operates and deals with its other components of spaces, networks, and facilities.

In general, the system of internal spaces of the smart home can be divided into three systems:

**First:** Function-specific systems (Systems Purposive) in (any dwelling) and have developed with the development of modern science and technologies, such as lighting, air conditioning, water supply, sewage, security, TV and telephone connections, and others.

**Second:** The System Structure (in any dwelling) and includes the materials and method of constructing the building.

**Third:** The Intelligent System (Smart Home), which acts as the controlling and ruling mind in the rest of the systems, which makes each system change its behavior in proportion to the changes in other systems.<sup>27</sup>

# 2.5.1 Employing artificial intelligence in the interior spaces

The idea of artificial intelligence has greatly affected the architectural formation of the various buildings, as well as the internal spaces of these buildings, through the various modern technologies used in buildings through the technical revolution that we are experiencing today and the rapid growth and spread of this revolution of the new tools and capabilities that allow its users today a world Intelligent permeates all aspects of human life.

The architecture and interior design of smart spaces depends entirely on artificial intelligence. In the interior space, as the first element affected by the human environment, as a person transfers developments and discoveries to his internal environment, and therefore it is necessary to enter artificial intelligence in interior design by employing the interior designer, the capabilities of this intelligence in providing The best for users of internal spaces, so the





integration of the work of artificial intelligence applications through the sensors that are prepared to sense the required change, which are connected to an electronic mind that carries programming and work according to what it reaches from that sensor. Accordingly, this mind makes the decision to perform calculations and implementation through Modern technologies, for example, the automatic lighting operation at sunset, as this system contains sensors dedicated to sensing sunlight, and when it is absent, it gives the signal to the smart electronic mind, which is programmed when the signal is given by the sensor, it works to automatically turn on the lighting, note Figure (4) its lighting It works with a motion sensor, as it senses any movement at an angle of 120 degrees, then lights up for 30 seconds, and can be placed in different places in indoor space. Evacuation or in furniture units, such as the electronic key used in hotels, which when opening the door operates electricity and heating or cooling systems, thus saving energy consumption and maintaining the integrity of the internal space from electrical dangers, as well as fire extinguishing systems as well as alarms for theft.<sup>28</sup>



Figure 4: Shows Smart Lighting <sup>29</sup>

Smart living will be fueled by smart technology that appears in our daily lives, especially our homes. These homes will be controlled in the same way as smart buildings. All household appliances that concern us will be "smart".

The fridge will let us know when food is running low and will automatically order more, the oven will shut off in time for the perfect dinner, homes will be vacuumed and cleaned with robotic cleaners. And the temperature inside the houses will be controlled by thermal control devices, and electronic equipment will be directed by sound after connecting it to the net, which provides richer interactive components.

It is clear from this that the architecture and interior design of smart spaces depends entirely on artificial intelligence, where it is necessary to enter the artificial intelligence in the interior design by employing the interior designer's capabilities of this intelligence in providing the best for the users of the interior spaces, and this is done by providing many advantages, including electronic lighting, Interactive extinguishing system, sensors, energy saving system, cameras, waste treatment system.





## **2.5.2 Features of Smart Interior Spaces**

- 1. Automation: by using a central computer that supports the dwelling's ability to integrate its various equipment and vocabulary, and also supports its ability to adjust performance and self-learning by analyzing and evaluating the dwelling's performance and self-updating its database.
- 2. Virtualization: The last period of the twentieth century witnessed an amazing development in the relationship between the computer industry and the means of communication and information transfer, thus paving the way for the beginning of the digital revolution, and due to the enormous capabilities offered by this revolution, it was possible to convert all forms of information into the digital form such as: texts, graphics and media. multiple, so that they can be circulated through networks, which opened the door to reformulating life activities in the direction of the possibility of their performance.
- 3. The international information network or local networks: which gave the smart home its second feature, which is virtuality and the shift towards virtual reality.
- 4. Sustainability: With the growth of global environmental problems and the declaration of architectural practices as one of the parties responsible for some of these problems, and with the increase in interest in the necessity of preserving natural resources, the concepts of preservation and sustainability emerged to be adopted by many theorists in an attempt to link these concepts with the characteristics of smart housing (automation and virtual), and they were able to achieve some progress in the field of integration between the features of the smart home and the concepts of preservation and sustainability according to the local conditions and data. It is an important feature of its features, so sustainability has been considered a main pillar on which the architectural intelligence of the dwelling depends, and a goal that the smart dwelling should achieve. <sup>30</sup>

## 2.5.3 Design Requirements for Smart Interior Spaces

Smart technical progress and the mechanisms of its application affect all aspects of life. This influence is observed in the field of architecture through materials, building management and operation systems, and the elements of smart space appeared, which are as follows:

1. Smart materials: Construction materials have evolved over the ages, and despite these developments, the traditional construction materials remained with limited characteristics until the emergence and development of smart materials, which were distinguished by the diversity of their shapes and characteristics and became easier to use, and these materials remain under development to obtain To get the maximum benefit from them and to achieve smarter buildings and a more comfortable environment for the occupants of the spaces, and according to the Chemical Encyclopedia, smart materials are defined as smart formations that sense, analyze, store and interact with the surrounding events, and smart materials are considered materials and formations that have the ability to respond to stimuli from the internal and external





environment Materials have the ability to perceive and feel different stimuli and adapt to them by integrating functions in their structures. These stimuli may be electrical, chemical or magnetic.<sup>31</sup> As Figure (5) of the thermal table, which leaves a colored effect according to the temperature change on its surface.



Figure 5: Thermo table is an example of thermally colored materials<sup>32</sup>

Smart systems: The processors that occur in smart spaces require smart systems to form together a system capable of achieving the performance requirements of the building. With her, the building management systems started from simple applications in the 1970s and then developed into complex integrated systems that use complex software to manage the building conditions. These systems can monitor and control most of the building services depending on the level of integration and development in the building. These systems also contribute to energy conservation. Through various effective programs to obtain optimal performance of the systems and help in the process of operation and maintenance. Intelligent systems are energy-saving and help in operating the building easily and with high efficiency, as in the form (6) of a control system using the password or card, and it can be divided into three types: <sup>33</sup>(Control and access control systems), (Direct digital control systems), (Communication systems)



Figure 6: Access control system using password or card <sup>34</sup>

**2. Smart Facade:** The facades in the building account for 15-40% of the total cost of building construction, and their operational costs reach 40% or more through their impact on the cost of building services such as lighting, ventilation and thermal comfort. Smart facades are an integral part of the definition of a smart building, and they refer to that element that encapsulates the internal life of the building. Smart with external changes either through material elements attached to the interface such as sails or through smart materials whose





properties change with the change of external conditions, and is characterized by the provision of sound insulation, remote control of lighting, energy saving and reduction of environmental pollution as well as the ability to change its own thermophysical properties such as permeability and absorption Also, modifying its colors, controlling transparency, and modifying its texture, for example, using a shading system for the facade to reduce sunlight, and also using glass panels to generate electric power. Note the figures (7) (8). <sup>35</sup>



Figure 7: Using a shading system for the façade <sup>36</sup> Figure 8: Using glass panels to generate electric power <sup>37</sup>

It turns out that the smart internal space is the mind that controls the systems, which makes each system change its behavior in proportion to the changes in other systems, and among these systems are the structural system, the smart system, and the systems specific to the function, and it is noted the impact of technical development on the smart space through smart materials and smart systems And interfaces and smart devices, when integration is achieved in all of the above through the employment of all these elements in the space so that this space becomes smart and achieves luxury for its users in most of the work in daily life.

# 2.5.4 Smart furniture and its relationship to interior design

The relationship between man and furniture units is a close relationship that reaches to be an organic relationship in most places through his lineage and average height while walking, sitting, sleeping and eating. With respect to some of them on the one hand, and their relationship with respect to the human being who is in itself a unit of measurement on the other hand. It is worth noting that in the early seventies of the last century, the designer "Joe Colombo" developed his primitive model for the small kitchen by designing a comprehensive furniture unit that was characterized by a dynamic characteristic that is compatible with the lifestyle of the inhabitant, as in the figure of number (9), so that the shape of the space can be transformed by simply pressing a button that emerges from During which the surfaces are suitable for eating, storing, and performing work from different heights and places, and the space also supports the performance of multiple living functions while changing the nature of the shape of the space, and thus the main advantage in this unit is the possibility of obtaining multiple functions in a limited area.<sup>38</sup>







Figure 9: "Joe Colombo" model for the overall furniture unit <sup>39</sup>

Here we are witnessing a remarkable development of smart furniture technology, and this is all a natural product of what we live and live with in the world of digitization and technical development, as it produced smart furniture for us in order to facilitate our lives and help us in carrying out our daily work in a more easy way. Or when it is established so that one piece has more than one use or more than one advantage, as smart furniture represents furniture that responds to the requirements of contemporary life affected by the changing social and economic transformations, as it works to find more innovative solutions to give a group of functions to the user within the space through the use of modern technological methods.<sup>40</sup>

# 2.5.4.1 Types of smart furniture: Computer programmed smart furniture is divided into

A- Digital Furniture: Non-new furniture characterized by the presence of smart electronic equipment, which gave it another dimension in performance that was not expected to be reached, which led to an increase in its cognitive and cognitive ability to meet the user's needs, and computer applications also allowed rediscovering the function it performs, <sup>41</sup> Such as the multi-purpose smart sofa Q4: It is a sofa that contains wires that are compatible with the electronic equipment of the smart home, and it consists of four square-shaped seats, each with an area of 140 x 140 cm, so that it can be arranged as desired to obtain multiple functions, <sup>42</sup> and this means that the sofa It can be assembled so that we get the traditional look of seating, or it can be like a chaise longue or a furniture unit. Note Figures (10) and (11), and one of the sofa seats is without a back and contains a main electrical wire, which allows it to connect to the main power source. The buttons on the base of the sofa are actually magnetic holes that allow different types of devices to be connected and the armrests are hollow inside so that music playing devices can be placed and can be controlled from the side of the armrest. It contains a projector and a lighting unit attached to the attached table.



Figure 10: Some of the equipment included in Figure 11: shows the use of the sofa for more than one activity. <sup>43 44</sup>





B- Interactive furniture: This furniture interacts with humans to become an integral part of the technological community and is able to provide practical solutions that have the ability to respond to environmental variables. Interactive furniture is divided into: "fixed interactive furniture - movable interactive furniture."

- (The fixed interactive bed (Somnos)): It is considered one of the most advanced beds in the world now because it uses high technology and a wonderful design to combine comfort, luxury and interaction with the modernity of the current era. An advanced unit of mobile automatic blinds. The ability to connect to the Internet through Wi-Fi, an HD video projector, a moving screen that can be pulled down, and the ability to play DVDs - an audio system under the mattress connected to 4 speakers and a subwoofer, and a programmed lighting system of the type LED under the bed, in addition to a reading light, with the ability to control the intensity of the lighting, a "RFID" smart card reader, to identify the personality of the holder to download his data, in addition to the ability to play his favorite music, and the possibility of waking individuals for their meetings and informing them of changes first Powell, and the possibility of adjusting the position of the mattress and adjusting its angles to suit different positions for sitting, sleeping, relaxing, and others. <sup>45</sup> Notice the figure (12)



Fig 12: Shows the Fixed Interactive Bed <sup>46</sup>

(The interactive mobile bed): It is a smart bed that is used at night when needed, and it can turn into a ceiling when not in use, as the bed rises to the top, relying on a hydraulic system that makes the bed move up and down in balance until it is fixed in the required position, as in Figure (13) It is also equipped with interactive lighting units that recognize sleep times and different lighting levels according to the nature of the activity required in the interior space, which gives flexibility in using space in more than one function to achieve optimal utilization of spaces.<sup>47</sup>



Figure13: Shows A Moving Reaction Bed. 48





C \_ Futuristic furniture: It is furniture that uses the latest digital technologies to improve the quality of the user's functionality by introducing new standards for the concept of activity, which makes the user feel more comfortable and luxurious than before.

- Future bedrooms: The "Beta Living" company envisioned the future bedroom, which includes interactive mirror glass, smart windows, a wardrobe that displays its contents through its interactive mirror, and a high-tech bed equipped with many sensors to achieve user comfort, Figure (14)



Figure 14: Shows Future Bedrooms<sup>49</sup>

# Rombots

It is an idea that aims to transform pieces of furniture into others as needed, or move them to make way for people as they pass in the room through self-configuring spherical robots, and these robots can disassemble themselves and reassemble them again in another form<sup>50</sup>, and the design consists of two cube-like units Dice stick together, and it contains a battery and three motors for movement and pivoting, in addition to the feature of wireless communication. In addition to containing cameras to track users, and a voice recognition tool so that a person can give directions to it, and thus moving furniture becomes more flexible with less human intervention And the importance of the design lies in the fact that if the type of furniture is not used for a certain period, then it can disassemble itself and gather in a specific place to save space inside the place. <sup>51</sup>Note Figure (15)



Figure 15: Smart robots that transform themselves into Smart Furniture <sup>52</sup>





It is clear from the above that programmed smart furniture is classified using a smart computer into digital furniture. It means non-new furniture that is characterized by the presence of smart electronic equipment. Interactive furniture also interacts with humans to become an integral part of the technological society, as well as future furniture, which uses the latest digital technologies to improve the quality of user functionality.

Indicators of the theoretical framework:

- 1. The interactive design of the internal spaces is based on the physical structure of the space (internal determinants of the space, furniture and accessories) and the electronic structure of the space (physical equipment (visible), electronic programs (invisible)) and among the equipment used in the interactive design are sensors, detectors, transducers, actuators mechanical.
- 2. The internal spaces have characteristics and features that distinguish them, including: flexibility and adaptation, which contribute to making the space capable of disintegration, separation, expansion and transformation.
- 3. The majority of the technologically advanced interior spaces are based on common features that must be present to achieve interaction and efficiency with the user, and for this space to be smart, by achieving economic flexibility so that it is subject to environmental change to achieve for the occupant an environment that is able to raise functionality and creativity and reduce harmful effects on the environment.
- 4. Smart furniture programmed using a smart computer is classified into digital furniture. It is intended as non-new furniture that is characterized by the presence of smart electronic equipment, and interactive furniture. user functionality.
- 5. Smart furniture plays an important role in smart spaces, where smart space is not complete without smart furniture that responds to contemporary life requirements affected by changing social and economic transformations, as it works to find more innovative solutions to give a set of functions to the user within the space through the use of modern technological methods. Also, smart furniture can play more than one role or function within the space, thus providing comfort and luxury to its users.
- 6. The architecture and interior design of smart spaces are based entirely on artificial intelligence, where artificial intelligence must be introduced into the interior design by employing the interior designer's potential to provide the best for the users of the interior spaces, and this is done by providing many advantages and characteristics, including the BAS automation system (Electronic lighting, interactive extinguishing system, sensors, energy saving system, cameras, waste treatment system), information technology (VDI computers, VBN, fast internet, phones, etc.).
- 7. Artificial intelligence is based on a scientific system that includes manufacturing and engineering methods for so-called smart devices and programs, knowing that the goal of artificial intelligence is to produce independent machines capable of performing complex tasks using reflexive processes similar to those of humans. In short, it is





intelligence where we want to add all The capabilities that distinguish humans from machines, but without destroying human work, artificial intelligence was found to facilitate human work in terms of effort, cost, time and safety, but we may not want the existence of a time when machines have eliminated human actions.

- 8. The impact of technical development on smart space is represented through smart materials, smart systems and smart devices. When integration is achieved in all of the above in order to employ all these elements in space, this space becomes a smart space that achieves luxury and safety and reduces the efforts made by the user as you can do most of the work in everyday life.
- 9. The technical development is based on the design output that is linked to its time or contemporary, and it must be part of the existing civilized activity in the daily life of society, and it must be compatible with the present degree that man has reached of knowledge from all directions of the humanities, natural sciences and technological progress that They cannot be separated in design and planning, and this is what we have noticed throughout the ages. Therefore, technology constitutes an important and active aspect of life in general and design in particular, and it also strongly affects the formation of the history of civilization.
- 10. Technologies are the link between the intellectual content and the form of the design output, as well as those that translate ideas into tangible material materials, or in other words, they are the crucible in which principles are converted into designs, and their use will make designers more creative, in order to improve the quality of design and the quality of the environment. The technology also contributes to designers to build their design modernities, and it will guide designers to the best choices and liberate their creativity.

# **3. RESEARCH PROCEDURES**

**3.1 Research methodology:** In this research, the descriptive approach (content analysis) was followed to reveal the standards of efficiency achieved by the interaction of technical development and the extent of their application in the employment of smart furniture, relying primarily on the theoretical framework and the resulting indicators, leading to a comprehensive achievement of the research objective through a study The axes of the analysis adopted.

**3.2 Research community:** The research community included a study of the internal spaces represented by (German international kitchen companies) in the United Arab Emirates), and it included (5) (German international kitchen companies) distributed in the cities of the Emirates. The researcher accepted the best (German international kitchen companies), whose interior designs showed a design diversity within their interior spaces, and thus the research community can be identified as follows:





#	Company Name	The date of establishment or development
1-	Gautling Interiors	2010
2-	Nolte	2011
3-	Ixina	2015
4-	Hacker	2017
5-	Noblessa	2018

Table (1-3): Shows the Research Community

**3.3 Research sample:** Adopting the intentional selective method (non-probabilistic) for the sample of the original research community, to choose the models that serve the goal of the study and are closest to achieving it, which are (2) out of a total of (5) (German international kitchen companies), i.e. (40%) of The research community, which was chosen according to the following conditions and reasons:

- 1. Adopting experience, skill and ability to achieve technical efficiency in kitchen designs and used appliances, in addition to diversity in the use of many techniques in the method of implementation.
- 2. Adopting diversity in choosing the geographical location of the submitted models.
- 3. The researcher was keen on the modernity of the designs of these kitchens in terms of their technical and service progress for the consumer, and that these companies contain smart technologies to display their most prominent designs.

The samples of the selected research study sample are as follows:

- 1. Hacker (2011)
- 2. Nolte (2017)

**3.4 Applied research tool and its validity:** In order to achieve the goal of the research, an analysis tool was designed based on the results of the theoretical framework of indicators, which represented a summary of what emerged from the sources, references, and literature of Arab and foreign specialties in the field of interior design, as well as the intended exploratory study through the global Internet for websites German international kitchen companies in the United Arab Emirates.

**3.5 The validity of the research tool**: For the purpose of confirming the validity and comprehensiveness of the analysis tool<sup>53</sup>, the validity of the tool used was verified after completing all the research tools by presenting it to a group of experts<sup>54</sup> to express their opinions about its validity in the light of their sound scientific observations to give this form its apparent validity for the purposes of applying analysis in this research.





## 3.6 Description and analysis of the research sample models

**3.6.1 The first model:** - The internal space of the German Hacker company in Dubai, as shown in Figure (16):



Figure 16: Hacker's German Kitchen Branch in Dubai<sup>55</sup>

**3.6.1.1 General description:** The hacker Kitchen Studio Dubai is located in the Ibis Al Barsha Hotel \_ Dubai, and it is one of the branches of the German international hacker Kitchen company, which was chosen among the three best kitchen factories in the world, which manufactures modern equipped kitchens and has exhibitions in more than 68 countries, which meet the highest requirements in terms of quality, functionality, durability, design and system for protecting products from water and the surrounding air. With its three product lines, Classic, Concept130 and system at, and its hardware brand Blaupunkt, this company has been certified by the Forest Stewardship Council (FSC). Protecting forests and responsible for forests around the world, and the Hacker exhibition in Dubai is one of the best German kitchens in the country, as it is characterized by modern and modern designs and is characterized by flexibility in shaping the kitchen and its various divisions according to demand, the company enables users to see the company's exhibition by means of virtual reality technology through the phone and walking In the exhibition and showing videos of the kitchens displayed in the company, the company also includes an air protection system so that the kitchen remains safe from emissions It is toxic, and it contains a 20-year guarantee for use through its use of materials that help sustainability<sup>56</sup>, and the movement corridors were carefully designed to walk smoothly and view all designs with a comprehensive vision, and natural lighting was used in the exhibition with dim industrial lighting to highlight kitchen lighting, colors and pieces The furniture used, and the company was distinguished by the use of modern and smart kitchen appliances in order to keep pace with the technological development of the era, as well as the use of finishing materials, natural raw materials and smart technologies, and its designs contained the feature of adaptation, separation and flexibility in the piece of furniture with its containment of sensors, so the doors of cabinets and appliances are closed and opened by remote control. By pressing or touching smoothly. Notice Figure (17) the display method inside the gallery and how lighting is used correctly to highlight the design.







Figure 17: Inside the German Hacker Kitchen exhibition in Dubai

**3.6.1.2 Analysis of the first model:** The interactive design appeared in the physical structure, which represents ceilings, walls, floors, and everything that is tangible on the ground in terms of devices, equipment, and furniture. Sensors and devices used and invisible, which are related to electronic programs, digital information and sensors, look at figures (23) (19), as well as smart internal space systems that were characterized by structural systems, which were achieved through materials and construction techniques such as marble, wood, devices and accessories in line with the design. Figure (18), as well as systems specific to the function were achieved, see Figures (22) (18) through lighting, ventilation and air conditioning, where the lighting was divided into general lighting located in the ceiling and private lighting located inside the cabinets and lighting directed to the design to highlight its details while relying on natural lighting Also, as for the smart system, it appeared realized through the virtual reality application provided by the company to the user, which allows him to roam virtually. Inside the exhibition and seeing the designs and exhibits without having to go to the exhibition, see Figure (20).

While the attributes of smart interior spaces were achieved by giving the space space in general an image of adaptation and flexibility, and also through designs that had the ability to disintegrate, separate and expand, as in doors and cabinets, see Figures (21) (19), and smart digital furniture also appeared to be realized Through the presence of electronics within the designs, figures (23) and (21) are seen. As for the interactive furniture, it was relatively achieved through the use of materials capable of responding to environmental variables with the relative realization of future furniture through advanced digital techniques in the production of designs, as shown in Figure (18). The space has evolved technically by achieving efficiency and interaction, where there was economic flexibility in the technologically advanced designs, and it was achieved relatively through its ability to change the environment through the production of designs with natural materials and raw materials and sustainable materials that resist heat and that contribute to achieving an increase in functional performance (see Figures (18)). 21), while artificial intelligence did not appear in space, which is represented by the techniques and applications of artificial intelligence looking at shapes (20), and the role of smart furniture was achieved through its response to the requirements Life represented by providing luxury for the user as well as carrying out more than one function within the space through the multifunctionality of the devices used and designs, thus providing comfort to the user, looking at figures (19) (21).





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Fig 18:

Fig 19:





Fig 21:





Fig 23:

**3.6.2 The second model:** The internal space of the German company Nolte Küchen in Dubai, as shown in Figure (24):



Figure 24: The German Nolte Kitchens Exhibition in Dubai

**3.6.2.1 General Description:** Nolte is the largest brand of kitchens in Germany, as it was founded in 1923 and has more than 2000 branches around the world. Nolte has won the award for the best German kitchens in the world three times in a row. Same in terms of technology





and amenities, Nolte manufactures its products in harmony with the environment. Nolty was the first German kitchen to obtain the FSC and PEFC certificates in 2010. These are two internationally recognized certification schemes with official status granted to products from the Forest Service. Socially compatible and environmentally friendly, the Nolte Group has completely switched to environmentally friendly energy, which means that all energy use comes from hydropower plants on the Rhine. The Nolte Group highly values the principle of sustainability, and the company's conversion to the use of environmentally friendly energy is unprecedented since it is the first time that a whole group of companies in Germany have taken this step and to this extent, starting with wood brought from forests and through making panels And furniture up to the customer's assembly stage. The Nolte Group offers a package of services that meet the needs of the future and guarantees exceptional products that are flexible and environmentally acceptable.<sup>57</sup>

And as part of Nolte's international business development strategy, Nolte FZE was launched in Dubai in Umm Suqeim, Umm Shaif in 2011, as a central hub for the distribution of Nolte products in the Middle East, Africa and Asia, and the company became famous for its high quality as it is one of the few brands that are produced in Germany entirely. And the issue of quality is controlled and maintained because the entire manufacturing process takes place under one roof. The Nolte Küchen exhibition in Dubai is a symbol of the pinnacle of quality, splendor of design, diversity, and quality of service, reliability, and dedication. The exhibition also provides virtual reality technology to see the designs prepared for the user before their implementation. Through the virtual glasses, the exhibition is characterized by flexibility and regularity in the paths of movement and diversity in the designs displayed, as well as the displayed devices, and the use of lighting in a distinctive way to display the designs beautifully and prominently.

**3.6.2.2** Analysis of the Second Model: The interactive design emerged in the physical structure, which represents the designs of ceilings, walls, floors, and everything tangible on the ground, such as devices, equipment, furniture, and accessories. And the sensors and electronic devices used. Note the figures (28) (30), and it was relatively achieved in the invisible electronic structure that relates to electronic programs, digital information, sensors and sensors that are placed inside the designs or devices. Look at the figures (30) (28), as well as the internal space systems emerged Smart, which was characterized by structural systems, which were achieved through materials and construction techniques through the use of natural and environmentally friendly materials in designs such as oak, granite, marble and others, and devices and accessories in line with the design, looking at Figure (25), as well as systems specific to the function were achieved through lighting ventilation and air conditioning, where lighting elevates the mood and adds a unique home feel, for example, illuminated wall units with The love of the MatrixArt luminous finger, the internal illumination of drawers and drawers, and the illumination of the work surface distinguish an individual style and blend perfectly with time, situation and atmosphere, see figures (29) (30). Virtually inside the exhibition to see the designs prepared for the user before implementing them through the virtual glasses and seeing the designs and exhibits without the need to go to the exhibition, see Figure (30).





While the attributes of smart interior spaces were achieved by giving the space in general an image of adaptation and flexibility, and also through designs that had the ability to disintegrate, separate and expand, as in doors and cabinets, as they provide different planning depths for work surfaces, look at figures (26) (25) ), as well as the appearance of digital smart furniture achieved through the presence of electronics inside the designs seen in figures (28) (30) As for the interactive furniture, it was achieved relatively through the use of materials capable of responding to environmental variables with the relative realization of future furniture through advanced digital technologies in the production of designs See Figures (28) (25), as well as the progress of space technically emerged through its achievement of efficiency and interaction, where there was economic flexibility in the technologically advanced designs, and it was achieved relatively through its ability to change the environment through the production of designs with natural materials and raw materials and sustainable materials that resist heat and that contribute In achieving higher job performance, see Figures (25) (26), while artificial intelligence in space was relatively achieved through the techniques and applications of artificial intelligence used in the production of innovative designs. The diversity and technical progress of the company in introducing technology into its designs or in its production is seen in Figures (27) (30) (28), and the role of smart furniture was achieved through its response to the life requirements of providing luxury to the user as well as carrying out more than one function within the space through multifunctionality For the devices used and the designs and thus provide comfort for the user, see Figures (25) (28).





Fig 26:



Fig 27:

Fig 28:







Fig 29:

Fig 30:

# 4. RESULTS

The analysis within the procedures of the current research resulted in a set of results for the following agencies:

- 1. The interior designer studied the interactive design in the interior spaces, where the interactive design is distinguished by taking into account human behavior and the functions that he performs inside the space, by relying mainly on the physical structure of the space, which was achieved within the two models, as well as the visible and invisible electronic structure of the space, which was relatively achieved. In the first model, with the realization of the fully visible and relatively invisible electronic structure within the second model.
- 2. The study of the interior designer emphasized the systems of smart interior spaces, where the smart space is considered as the mind that controls the systems, which are the structural and function-defining systems, as they were achieved within the two models.
- 3. The results achieved for the characteristics of smart interior spaces within the two models, which were represented by the flexibility of the design scheme and making it more efficient and achieving the feature of adaptation and expansion through the ability of the space to absorb changes, were shown.
- 4. Show the important role of smart furniture in smart spaces, where the smart space is not complete without the presence of smart furniture that responds to life requirements through the use of modern technological methods. Thus, it was classified into digital furniture, which was achieved in the two models, while interactive and future furniture was relatively achieved within the two models.
- 5. The requirements of artificial intelligence were expressed in the smart internal space, as the goal of artificial intelligence is to produce independent machines capable of performing complex tasks using artificial intelligence techniques and applications, which were not achieved within the first model, while the achievement of artificial intelligence techniques was relatively in the second model with no Investigating the applications of artificial intelligence within the second model.





6. The interior designer relied on realizing the role of smart furniture in the interior spaces, as its role is considered important through the smart furniture playing more than one role or function within the space to provide comfort for its users as well as responding to the life requirements to achieve the well-being of its users, which were fully achieved within the two models.

# **5. CONCLUSIONS**

Through the results of the current research, a number of conclusions were reached, as follows:

- 1. The study of the interior designer is related to the study of interactive design in the interior spaces, through its relationship with the components of the interior space, including internal determinants, depending on the physical structure through the diversity of technologies and raw materials from one space to another, as well as the electronic structure of the space, which stipulates the electronic equipment used, which may affect Significantly on the efficiency of the interior space of the kitchen company.
- 2. The study of smart interior space systems is based on the consideration that smart space is the mind that controls the systems, relying on structural and function-defining systems and the smart system by achieving integration in the employment of smart materials, smart systems and smart devices, so that the interior space achieves an integrated smart system that will meet All requirements for kitchen company spaces.
- 3. Achieving the characteristics of smart interior spaces, which were characterized by flexibility, adaptation and expansion through the flexibility of the design scheme and the ability of the space to absorb changes in technical aspects, as well as the ability to disintegrate and separate safely and quickly is important and has become more than just an external appearance of the smart space, which must be in the language of the age of technology Smart that always symbolizes future features.
- 4. Emphasizing the depth of the importance of smart furniture and its role in smart spaces, where smart space is not complete without smart furniture that responds to the requirements of contemporary life, where modern technological methods must be used to produce digital, interactive and future furniture and use it in kitchen designs.
- 5. One of the requirements of artificial intelligence in the smart interior space is to make it capable of performing complex tasks in addition to using smart technologies that simulate human mental capabilities and work patterns through applications of artificial intelligence, where it is necessary to rely on artificial intelligence in interior design by employing the capabilities of the interior designer This intelligence provides the best for the users of the interior spaces.
- 6. Smart furniture in the interior spaces plays an important role, as it works to find more innovative solutions to give a set of functions to the user within the space through smart furniture playing more than one role or function so that it provides comfort to its users as well as responding to the life requirements to achieve the well-being of its users.





7. Technologies are the link between the intellectual content and the form of the design output, as they work to translate ideas into tangible material materials, or in other words, they are the crucible in which principles are converted into designs, and their use will make designers more creative, which contributes to improving the quality of design and improving the quality of the environment. Through that technology, it will provide designers with great capabilities and give them motivation to make their impact in the world, because it will direct designers to the best choices and liberate their creativity.

## 6. RECOMMENDATIONS

In the light of the research results and conclusions, the researcher recommends the following:

- 1. Emphasizing the use of smart furniture in the interior spaces due to its important role in responding to the requirements of contemporary life.
- 2. The need to pay attention to the introduction of artificial intelligence in smart spaces through the latest applications and possible technologies to achieve the best for the users of these spaces.
- 3. The need to pay attention to technology, as it is the link between the intellectual output and the design output form, and its use will make designers more creative, improve the quality of design and the quality of the environment, and that technology will provide designers with great capabilities and give them motivation to make their impact in the world because it will direct designers to the best choices and liberate their creativity
- 4. Attention must be paid to establishing a regulatory and ethical mechanism that governs the work of artificial intelligence and protecting the jobs that will be affected by the intelligent automation process, as well as drafting laws that guarantee the preservation of basic human rights.

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			Luxury Carry func		ng out more than one tion within the space		Smart furniture plays an important role	7

# Appendix No. (1) Analysis form in its final form

#### Appendix No. (2) Names of experts

- 1. Prof. Dr. Shaima Zaki Abdel Hamid / PhD in Interior Design Philosophy / Department of Interior Design Techniques / College of Applied Arts / Central Technical University.
- 2. a. M. Meeting with Ahmed Abdel Rahman / PhD in Interior Design / Department of Interior Design Techniques / College of Applied Arts / Central Technical University.
- 3. 15:00. M. Suhair Yassin Ahmed / Master of Interior Design / Department of Interior Design Techniques / College of Applied Arts / Central Technical University.

