Study of digital architecture and new and smart technologies of building

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ABSTRACT
Shelter construction industry is very wide for technological innovations. The increasing needs in the construction sector, particularly housing development and the need for structural reform is more and more demanding. Therefore, the creation of intelligent systems in the construction industry is in line with the increasing development of science and technology in various fields of human life. Among the important system of digital design in this area, we can point to use of advanced intelligent software and smart materials used in construction. The main purpose of this article, is to investigate the intelligent methods of construction project in two parts. The first part of the architectural design and intelligent view of the stage and the second part of smart materials Their application is assessed. Topics presented in this article can be used on a wide scale Such systems provide the various sectors of the construction industry and The results of the administrative applications used by architects, experts, consulting engineers and other stakeholders in the housing field.

Keywords: design, architecture, digital, technology, intelligent building materials.

INTRODUCTION
In today's competitive world of industry, design is a critical process that depends on the different technologies. The building design is also not an exception The engineering services with the best quality, not only is not an exception, but is considered as one certain and indisputable thing. In this regard, integration and Coordinating the design and construction stages, there is a favorable factor is decisive and Technology that can not only design stage, but also the construction and operation also forgone the promotion, will be of particular importance. Existing buildings are kinds of technology. They adapt to the technology, and they are of interest. Building as a structure as soon as the computer's ability to capture, will be smart. The first intelligent building technology to provide safe, comfortable and Energy benefits. The idea of an intelligent building, the connection between access, lighting, security, Monitoring, management and telecommunication puts ahead. An intelligent building, building efficiency and to increase the efficiency of its inhabitants Effective management based on the specific requirements of a *: provide the lowest cost [1].

In this paper, after the concept of intelligent buildings and multiple definitions, we will review procedures and The formation of intelligent building methods in architectural design of digital and new and smart materials.

2- concept of intelligent building

The word intelligence, was used at the beginning of the 80 th for the first time The building in the United States of America. Intelligent building concept also considered based on IT development some authorities. According to the research, more than 30 defined on Intelligent buildings provided that some of the definitions emphasized on a technology. For example, the intelligent building construction has not been defined fully on automatic control system. Institute of intelligent building in Washington, enhanced intelligent building integrated set of Several systems for effective management of resources, technical capabilities, saving investment costs, operational flexibility and knows Some of the owners of the intelligent building construction, which meet the needs of users (residents or visitors). Another definition is in intelligent dynamic architecture that with the interactions between the four main elements, includes the location, the process (automation, control systems), Person (service users), management (maintenance and operation) creates a convenient productivity [2]. Intelligent building construction and all its components through an integrated system Create logical environmentally interact with each other [3]. The construction of smart buildings means that they combine information technology and communication systems and resulting in the emergence of an integrated system with greater comfort, better security, better economic feasibility and low cost. In general, intelligent building
construction is a building that is benefit from a strong communications infrastructure in order to adapt the conditions can change the environment to continuously react. These factors increase the security and welfare of the people and causes them to residents of them being better and more efficient use of available resources.

**Definition of intelligent building in the United States of America**

Smart building, in act, are the electrical structures reinforced by the pioneers of a new architecture and the promise of an imminent paradigm shift in the world of architecture [7].

Another definition of intelligent building is presented in the figure below [8].

- Sensitive building: the structures convey the sense that it can observe the determined characteristics and conditions.
- Adaptive Building: This building convey activities that can be transferred to risks and warnings have been in a state of active controls to power.
- Controled Building: a combination of sensitive buildings and adaptive building that c well controls the factors.
- Active Building: provides the structure and activity in the sense of average intelligence level and offers control performance as well.
- Intelligent building: the structure, on top of being able to control active and intelligent control hierarchy as an intelligent architecture also.

![Figure 1. Classification of intelligent building [8]](image)

A: sensitive building, B: building adaptive, C: control building, D: building active, E: Intelligent Building

3. Intelligent Architecture

Smart architectural is made in the forms that refers to be able to anticipate and respond to the phenomenon of integration, whether local or foreign, to the performance of the building and its inhabitants will be affected.

- Intelligent Design
- Proper use of intelligent technology
- Application of smart materials

1-3-benefits of intelligent building

The most obvious benefits of an intelligent building include:

- New and appropriate design
- High safety in critical situations
- Ease of Application of automation
- Flexibility in implementation and use of technology and smart materials

- Saving Energy

4. Intelligent Design

Architecture design is a structure has been considered always as critical part of the project. Design software every day have been provided with change and new facilities. Digital design is one of the topics that have been popular in recent years. Continue to investigate the related digital design of models and intelligent architecture.

1.4 models of digital design and its relationship with Intelligent Architecture

The theory of intelligent architecture must conform to the relationship between theoretical and practical implications. Despite the claims of some of these relationships, theory, theory of architecture design, the main factor is the relationship between design theory and theory of architecture. Recent research focuses on the relationship between architecture and technology, and emphasized a set of new
2-4 -- models of design process
One of the ways would describe being preferable and a form of digital design is the taxonomy definition digital design models. In this way, existing models can be amended and when considering the digital design used, the framework recognizes the model of intelligent design
Digital correlation techniques to understand the relationships between different aspects of design And concepts such as models, methods and techniques are. The basic framework and classification of digital models by Oxman, 2007 [11]. Model choice that supports good design original features of intelligent design, including structural models, Production models and models that are functional and will be introduced as follows.

1-2-4 - Introduction
Today, make a difference and distance between CAD (computer aided design) and DAD (Intelligent Design) Necessary. The difference between CAD and DAD term is the definition of above. However, laws, theories and methods of CAD [12] is essentially based on a design on paper, new models of of intelligent design, a different mode of conceptualization, As an alternative to paper introduces design. The new relationship between Digital and digital processes to the emergence of new conceptual structure of words More scientific domain which helps them to be more defined.

2.2.4. Structural model
According to studies Zaero-Polo, processes more intelligent design ideas are very attractive. The production process, which formed a kind of accelerated motion, integrated information construction adds [13] concepts and practices gradually lost its popularity and traditional knowledge and technology aspects of digital design is better.

Digital design theory, the concept of form to the formation offers a different kind of model. Besides the production of simple and complex forms, the concept of digital structural models of the concept of the state. Structure, Graphic transfer is included. This aspect of the process to the dynamic and heterogeneous structure of the topological Beyond the differences will be in the next. Digital techniques associated with this model are: Animation and parametric design. In both, topology plays a major role: Structure by animation, character design, dynamic, and parametric structure of the topological differences. Parametric structures, parameters of a particular scheme is not transparent its shape. Parametric techniques, descriptive geometry relations related to the objects, Interdependencies created and defined the transition of the operation objects.

3-2-4 - manufacturing models
Production models of digital design are identified with computational mechanics manufacturing processes. In this section, as compared to structural models, shapes and forms as a product of the manufacturing processes are considered pre-formulated. Two clear examples of architecture are evolutionary models of, [14] and the rules.
Evolutionary models are based on the laws of nature, such as the duplication of the growth and reproduction of mutant forms and rules are formulated based on the system design, respectively.

3-1-4 - performance models
Performance-based models are derived from the simulations. Today, a wide range of digital tools is available for simulation, analysis and evaluation of performance [15]. None of them truly do offer the ability to modify and production. Current technology and digital design theory, offers a change of simulation analysis for the product. These approaches, manufacturing processes are identified by their performance. Instead of analyzing the performance of the design, and modify it in accordance with the product, is based on performance and easy can directly modify the plans. Such an approach would be in optimal performance As a mechanism to generate and modify designs enable Smart [16].

Here the ability to direct the activities of the physical and functional characteristics of a particular project is defined. The quantitative characteristics of spatial and structural functions can be developed.

Figure 2 shows the difference between the current process and is a functional models [16].

Design of architecture of the poor modelling, can be changeable and improving to the rules and systems of flexible and expandable. The actual form of a process emerges for optimal performance. The process of structural solutions to the current system does not comply with organization members but is achieved by components optimal performance [17].

Forces such as physical forces, wind and in particular, in shaping the form and design based on performance are very important. Foreign forces are considered as environmental factors such as time structure, sound, transportation and site.
According to the algorithm, the development cycle is as follows: in design manufacturing and original design, then an operation, and finally, can be upgraded in digital design and functional models design based on performance.

The figure below shows the topological form of intelligent design, according to the original plan of formation, a structure with multiple functions (such as the Peter B. Lewis building in the United States, Figure 4).
Design provides a project based on parametric systems, structures can be applied to the functional elements. The analysis is based on solar energy is also considered. (Figure 5).

5-design in building information modeling (BIM)
The concept of building information modeling and CAD models beyond the system is modeled on the database. BIM in the design process construct a model, of smart components that represent the windows and doors, roof, beams, stairs, air conditioning, wiring, etc. The components themselves and their relationships are known with the rest of accurately. So the designer and implementer for information about a specific component such as window size, glass, frame and plan maps, sections, front and upside down, and just go directly to the component. These are all features in the data store to apply any changes in its properties, aligns itself with the new plan. Figure 2
shows how designed in a BIM model, it is observed that in this model, BIM as a central core of the building and participate in the production other relevant factors, such as architects, civil engineers, structural, mechanical and electrical systems, manufacturers and operators plan the owners of the fringe elements of its intended use, and are associated in concert with it [18].

A BIM model in addition to intelligent communication between the various components of the design, designed to assess various scenarios for all groups virtually. For example, one of the scenarios can rotate the model building changes in the level of energy consumption, according to various aspects of the sun. As well as other groups, including the design of structures and facilities as well as the ability impose changes in the model, the effects of these scenarios, and finally see the architectural project, contractors are able to design and development of model building, such as a sequence of implementation, performance, production and installation of the virtual experience. In this system, sometimes three dimensional model of the new building construction as a core and the core is intended to act independently and Other objects or components related to buildings (eg, roof, windows, doors, etc.) As the elements and dependent elements in and around the central core of their performance and role (Figure 6) [3].

Maps of the structure and function and design documents and construction and operation of active access and transfer data to another database

(A) the traditional system, (b) a new process and a new system of building information modeling

Figure 6. Comparison between conventional and traditional methods of CAD in comparison to the new system building information modeling [6]

Table 1. Selection of the main differences with the new three-dimensional CAD models BIM in the construction and design

<table>
<thead>
<tr>
<th>New three-dimensional BIM systems</th>
<th>Two-dimensional 2D-CAD system</th>
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<tbody>
<tr>
<td>1. Subject to introduce BIM system with a significant overall volume in a virtual environment offers the possibility of mining plans of the whole volume is</td>
<td>1. The two-dimensional systems, the introduction of the subject using two-dimensional views in the form of a set of lines, dots and determined.</td>
</tr>
<tr>
<td>2- BIM in different parts of the system are interconnected and changes in one of these sections, and sometimes may cause minor changes in other relevant sections of the Constitution.</td>
<td>2- information contained in a two-dimensional graphic only include the data and do not have much meaning. For example, a map, a set of lines and walls in no real sense wall</td>
</tr>
<tr>
<td>3 in terms of intelligent BIM model, the control of the different parts of change, even in a limited part of the operation is done to the integrity of the model.</td>
<td>4 views, different maps in a two-dimensional volume with no other changes in the map-and the necessary changes in other surveys should be carried out manually....</td>
</tr>
<tr>
<td>4. Three-dimensional modeling in BIM, the actual performance of each of the components of information and concepts (such as walls, spaces, columns, etc.) are. Visualization and other features to provide actual images of the building project is a three-dimensional building information modeling.</td>
<td>4 on the basis of the relationship between different parts in a two-dimensional system, map of such installations, structural drawings, architectural ... must be continuously monitored to trend fully considered all of them.</td>
</tr>
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6. Intelligent materials

New buildings present an image that fits the needs of today's man is not only due to different design, but the implementation and the type of materials used in buildings in different buildings of today have a lot of impact.

The materials used in the construction of the value and special place. Without architectural materials will not be realized. Also in the design of $S = Q_{uli}$ together materials exhibit good feelings and a lot of expertise, providing a means to inspire feelings are. Materials as an essential element of a body structure provides the foundation and the basis, ie the continuation of the basic shape and design of the product during its use [4].

Intelligent materials with smart performance in environment like organisms can adapt to the environmental conditions. This material features changed such as shape, degree of difficulty, frequency and color in a controlled mode is significantly.

A so-called smart materials for materials and products that have the ability to perceive and process environmental events and respond appropriately.

1-6-classification of smart materials

Smart materials changing shape

These materials have the ability to change their properties in response to external stimuli internal changes in the shape and size of their own. The most common materials include reaction temperature, piezoelectric, electromagnetic reactive chemical reaction that already have attracted the most attention in the field of architecture.

changing color materials

These materials change color in the light. Two major types are $Ftvkryvmyk$ and electrochromic

light - emitting intelligent materials

Like light-emitting diodes, solar cells (converting sunlight to electricity)

Energy storage materials

These materials can either indicate what the potential energy stored in the Shshkl such as light, heat and hydrogen or electricity. The most widely used in architecture are material changing in the situation following (PCM).

Material has the ability to changing and exchange material in

These materials are compounds that can be returned in the form of molecules and materials In the form of gas, liquid or solid or encapsulated in his release. The materials are used in the interior or exterior materials that notably are self-cleaning coatings and layers, and also that can be inert and being disappeared by measuring the levels of pollutants in air, such as bentonite and titanium dioxide.

Intelligent Glass

The windows without blocking light, heat block. The most important ones are:

Thermo-chromic glass, electrochromic glass, Chromic gas, liquid crystal glass, automobile glass.

Figure 7. thermo chromic glass performance

Conclusion

Architecture profession today than ever before, is facing with a huge range of materials and applications. Although the selection of products is followed by the lowest environmental impact the following are the most important thing to choose
the technology and materials but in every other aspect of beauty, visual quality, the ability to repair and maintenance, to availability, and cheaper, they also considered. In recent years, construction materials and associated technologies have evolved that require special standards Each region as well. In architecture design, digital design and application of more complex applications migrate more and more powerful, more extensive training will be required for this type of design.

Finally, it can be concluded that the use of new technologies and smart building strategy To increase the useful life of buildings, the comfort of residents, reducing the time of construction and design, Saving energy and achieving sustainable development. The use of smart materials An integral part of intelligent building, and interact with the environment is essential. Using a new intelligent control of all parts of the building The beginning of the design to the operation and applications, such as lighting, heating, Security and alarm systems, audio control systems, intelligent ventilation and will be intelligent.

References
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