Application of the Mashrabiya philosophy in contemporary architecture

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Abstract:

The mashrabiya is an architectural treatment of climatic, social and religious conditions that covers the exterior surface of the window and window openings of a façade. It is a balcony protruding from the wall of the house or building covered with a frame consisting of an overlap of a group of small cylindrical wooden pieces (circular in section) in the form of chains separated by specific distances and organized in a delicate and highly complex decorative geometry., The idea of mashraiyas was established as models for architectural uses that are consistent with the quality of Arab and Islamic countries, and it is considered a successful architectural solution in controlling temperature and light in Islamic architecture, as it connects the interior to the exterior in a special way that has achieved the required function of reducing the strength of incoming lighting and allowing air to penetrate it to ventilate the internal space while preserving the privacy of the users of the space by controlling the widening of the spaces between its openings.

The mashraiya has effectively responded to the various climatic and light conditions without any negative effects of its use, and has proven to be very effective in reaching a comfortable interior environment, so architects revived it and created designs for some contemporary architectural projects that provide environmental and aesthetic solutions.

So I decided to choose the mashrabiya, which has influenced the thinking of contemporary architects and inspired them with innovative creative solutions to reformulate the mashrabiya. This is evidenced by an analysis of some contemporary buildings influenced by the Mashrabiya philosophy, using contemporary technology and have achieved a great architectural breakthrough in the design of contemporary architectural openings.

Research problem:

The need to find innovative design solutions for architectural openings to control temperature and light in the contemporary Egyptian environment.

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Research Aims:

The research aims at:

- Clarifying the role of the mashrabiya in treating architectural openings.
- To achieve climate treatments to protect the façades and interior spaces from unwanted climatic factors.
- To take into account environmental factors in forming architectural openings.

Research Importance:

The importance of the research lies in the following:

- The need to supply buildings with natural lighting, fresh air and solar energy.
- The possibility of linking technological architecture with environmental architecture and achieving thermal comfort within it.

Research Methodology:

Descriptive analytical method: By presenting and analyzing some contemporary buildings that have been influenced by the philosophy of the Mashrabiya using contemporary technology and have achieved a great architectural breakthrough in the design of contemporary architectural openings.

The mashrabiya formed one of the most important vocabulary of Islamic architecture in the form of narrow mashrabiya lathes, which are made of conical, intertwined and grouped wooden pieces, as it proved to be very effective in reaching a comfortable and effective internal environment despite the very hot external conditions, the nature of its composition enables it to effectively control rays of the sun and air currents, in addition to their importance in achieving visual privacy, especially in residential architecture.

The mashrabiya was spread in the Abbasid period (750-1258) and was used in palaces, public buildings and on a large scale, but the peak of its use was in the Ottoman era (1805-1517) when it reached its glory and spread almost completely in Iraq, the Levant, Egypt and the Arabian Peninsula. This is because they are used in different buildings, and different patterns and shapes of mashrabiyas appeared depending on the type of wood used and the mastery of the craft of forming and assembling wood.

The mashrabiya was called by different names in different regions. The name Mashrabiya is derived from the Arabic word “drink”, which originally means “drinking place,” and in the past it was a prominent space with a “sieve” opening in which small jars of water were placed to cool down due to the evaporation resulting from the movement of air through the hatch, as water vessels are placed in it to cool it down and to cool the air passing over it. While some indicated that the word mashrabiya may be derived from the word (mashrafiya), which means monitoring, vision and supervision, for its original use in seeing and supervising through it on the outside or because it is an external energy that overlooks the street.

Some contemporary buildings that have been influenced by the Mashrabiya philosophy using technology:

Arab World Institute:

The building of the Arab World Institute in Paris, designed by the architect Jean Nouvel, is considered one of the smart buildings, as the building window model was designed with the idea of mashrabiya (one of the heritage vocabulary) so that the heritage simulation is in the context of contemporary, where the design of the mashrabiya unit was taken into account so that its openings that allow light to enter in a mechanical way can be minimized and enlarged, linked to the lighting intensity outside the building, as the window contains photocells that are automatically controlled to stabilize the light.

Jean Nouvel was inspired by his design from the traditional mashrabiya, using modern technologies, to come up with an innovative idea to control the light entering the building, and he won with that design the Architectural Design Competition in 1981.

The sensors are based on effective weather inputs to reduce energy use, only when it is needed, in order to provide visibility as well, and the interface area is divided into several sensor readings and the movement within each square of opening and closing is a result of the state of the external climate, while it is possible to control all windows separately by vacuum users according to their needs.

The southern facade consists of 240 square units consisting of 16,320 motor units, and these membranes consist of lozenges, squares, hexagons, circles and a mixture of them that matche the mosaic patterns in the floors of the institute. Each movement panel consists of one large diaphragm in the middle, surrounded by sixteen medium sized membranes and fifty-five small membranes.

The designer has prepared a striking visual case from the metal barriers of multiple sizes, which were placed with metal frames with holes that act as a camera lens that controls the transmittance of the sun into the interior of the building, so it is possible from the inside to see the color changes in the rainbow dramatically as it can be observed from the outside, but with less intensity and this effect can simulate the influence of the Islamic mashrabiya, which gave this building importance to be studied.

The Arab World Institute building is one of the examples that refer to the use of metal façade systems in a manner that does not conflict with preserving the architectural character. This is what we may miss in metal façade systems in Egypt, and this is due to the import of foreign designs for metal systems produced specifically to suit architectural styles and trends Specific to the country of origin, which makes the attempts to use these systems in architectural facades bearing the Egyptian national character a kind of circumvention of their original uses.

Al Bahar Towers:

The team designed the building to cope with extremely hot weather conditions, so the idea of a movable solar screen came out and it consists of triangular-shaped units and their movement like the applied solar panel. These shading elements are applied at different angles in response to the movement of the sun in order to improve the exposure of the facade to the sun.

It works as a Curtain Wall, 2 meters from the outside of the building, on a separate frame.

This shading screen consists of 1049 units in each tower covering the east, south and west regions, each frame unit of aluminum alloyed with double stainless steel has high rust resistance

as the building faces the sea and the network is made of fiberglass integrated with PTFE, which is from Taflon.

Masdar City:

Masdar City is the first city in the world to be free of carbon and waste, and completely dependent on renewable energy, as the use of solar energy reduces electricity consumption by 51%. Solar panels were used in the roofs to provide solar energy and shading, and the design was a combination of postmodern architecture, hi-tech techniques, and the classical style of Arab-Islamic architecture.

Managing the heat gain and glare of the sun is one of the biggest challenges facing sustainable construction in the extreme heat of the desert, so the façades in Masdar City include a set of techniques and materials to address this issue. The laboratory buildings are provided with ETFE cushions that ensure a reduction in sun heat gain from the buildings and limit the re-release of heat into the street and send a reflective inner layer coated with light sheets to the street, and behind the plate is a super-insulated and tightly sealed panel, and the windows that are not shaded in neighboring buildings have Skylights (vertical to block the morning and afternoon sun, and horizontal to block the rays of the noon sun) and were made to prevent sunlight from entering the building. As for the residential buildings, they are distinguished by red sand-colored facades of concrete reinforced with wavy glass, and these curtains play the same role as the traditional Arabic mashrabiya, as they provide shade consequently, it blocks the heat gain from the walls of the building, and it also allows residents to look out onto the street and preserve their privacy at the same time and for the air to pass through to cool the balconies, and besides the windows, the rest of the façade is also closed and isolated and covered with 90 percent of reused aluminum and the same pinkish-red color as concrete curtains armed with glass.

Muscat Bank:

The Muscat Bank building is designed on the basis of striking a balance between modern building architecture and the traditional Omani style of Islamic architecture.

Architect Rohan Thotapadog explained that the building is a sustainable initiative, as the electric lighting automatically decreases when the sunlight increases.

Doha Tower:

Architect Jean Nouvel was inspired by the idea of the Mashrabiya, but with fixed, non-moving models, and he was awarded the best skyscraper design in Africa and the Middle East in 2012. A space of two meters is left between the glass and the outer mashrabiya curtain to produce a phenomenon known as the chimney effect. Where the air that is concentrated in a well-ventilated room is heated above room temperature, thus creating the chimney effect, and so the warm air inside the building rises and absorbs only part of the heat flow, so the layers of screens that represent the mashrabiya look like old chancel screens that block the effect of intense sunlight, and create vacuums. The interior is luscious while it also absorbs a lot of loads on the cooling system.

Results:

• The mashrabiya effectively responded to the various climatic and light conditions without any negative effects of its use.
• Contemporary mashrabiya applications have succeeded in achieving innovative and creative solutions.
• Contemporary materials technology helped to provide innovative, functional and aesthetic solutions.

Recommendations:

• Take advantage of the mashrabiya to fulfill the material and psychological needs.
• Take advantage of natural sunlight and reduce artificial lighting.
• Take advantage of engineering and technical disciplines and work together to help create innovative designs.

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