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Screening & Mashrabiah

New Applications as Smart, Green , and Unique Identity Factors

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Abstract

Due to living in a society plagued by acceleration and significant development in building technology, information, and computer applications, a transformation in Arts and Architecture has resulted in a neglect, whether deliberate or non-deliberate, in the dimensions of moral and non–physical values such as heritage and civilization. It is safe to say that such neglect has led to the creation of Architectural products with no idenities. As a result, an appearance of new architectural trends that includes Green and Smart Architecture, for instance, was identified. This new type of Architecture generally relies on merge between the use of the natural and surrounding environment in serving the design process as well as the use of modern computer applications, fixtures, technology, and new building materials combined to provide a comfortable and safe environment for users.

When traditional Arab Architecture is the product of a rich experience of its manufacturers', it presents an integrated mixture between each of the non–physical features represented in religious beliefs, traditions and customs prevailing in the community, and the physical elements that include the effects of the natural environment, climate changes, building materials, and natural resources available.

Screening and Mashrabiah represent a very important element in traditional and Arab Architecture. It is also still being used nowadays in Modern Architecture after enduring a study of its functions, benefits, new materials and applications such as smart Mashrabiah. The conslusion of this research provides recommendations of new applications and Architectural treatments for Screening and Mashrabiah and their possible use as unique identity factors that represent our modern Architecture both in the Arab world and worldwide.

Introduction

The Arab Architectural identity is a dream sought by all architects only to be turned into a reality when we, as Arabs, establish a unique Architectural style that represents our traditional, social, and cultural values. Nonetheless, it should satisfy the needs of today's users as it should correspond to new building technologies and satisfy the demans of Green Architecture.

For instance, traditional Islamic Architecture in the past had some unique elements such as courtyards, domes, vaults, arches, malqaffs, and mashrabiahs. Such elements generated a unique Architectural identity for traditional Arab Architecture and recognition all over the world. Unfotunately these elements became old fashioned and had been neglected by architects over time. Consequently, a new era of building technology and rapid growth in the built environment encouraged by mass production in building materials led directly to a new and worldwide architecture

without an identity. One building could be built in a certain setting and moved to another and yet make no significant difference or impact even while considering the building materials, orientation and façade treatments.

1. Mashrabiah and Screening Systems

Mashrabiah and Screening facades are two methods of treatments used in building exterior walls to achieve certain design goals such as privacy, climate control, and shading. Mashrabiah is a traditional element while a screening façade is a much newer one.

1.1 Mashrabiahs

Mashrabiah is the Arabic term given to a type of projecting window enclosed with carved wood latticework located on the second storey of a building or higher. Such windows could also sometimes be set wihtout a projection (Mohamed, 2006). The Mashrabiah is an element of the traditional Arab Architecture that has been used since the 12th century in the Mamloki period and up until the mid-20th century. Most of the time, a Mashrabiah was being used on the street side of a building. However, it may also be used internally on a courtyard side (Rafat, 2009).Generally Mashrabiahs were used in houses and palaces although and, sometimes, in public buildings such as hospitals, inns, schools and government buildings. They were very prevalent in Iraq, Hejaz and Egypt.

The Mashrabiah, as shown in Fig1(a) and 1(b), generally has five functions as well as different patterns and shapes that have been designed to accommodate a variety of conditions and circumstances which require an emphasis on one or more of these functions. These functions include controlling the passage of light, controlling the air flow, reducing the temperature of the air current, increasing the humidity of the air current, and ensuring privacy (Ajaj and Pugnaloni,

2014). Each Mashrabiya design is selected to fulfill several or all of these functions. In the design, it is the size and shape of the units and the spacing between units that are adjusted (Fathy,1986).

Fig. 1(a) Projected Mashrabiah

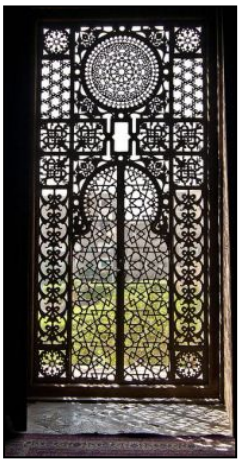

Fig.1(b) Non-Projected Flat Mashrabiah

The Mashrabiah inspired the architects and designers of the modern building's shading devices. Like the Mashrabiah, the design of the shades was both to control the amount of sun rays entering the building, as shown in Fig.2, as well as to create beautiful light and shade patterns.

Fig.2 Control over the amount of light depending on pattern size

1.2 Screening and Dynamic Facades

Designers and building owners have always admired the use of glass in building exterior walls. The façade is an interpretation of the building image representing prestige and power. Glass is a great material that gives the designers a wide range of opportunities in creating a design characterized by elegance, transparency and lightness. Transparency increases interaction and communication between exterior and interior environments. Moreover, and from an architectural point of view, the benefits of the exterior glass wall solution vary from daylight to view. However, the design chosen for the facade has a high effect on both indoor climate and energy consumption as there are several energy-flows between exterior and interior surroundings. The main role of the façade is to act as a barrier that protects

the indoor areas from the outdoor environment. To achieve mentioned functions of the façade design, a control of the following should be ensured:

- Heat transmission from inside to outside
- Solar load from outside to inside
- High utilization of passive solar gains
- High utilization of daylight
- Protection against glare from outside
- Air flows between inside and outside (both ways)
- Allow for a view to the outside
- Allow for privacy (Johnsen and Winther, 2015)

Screening and dynamic facades are the perfect tools to achieveing the above points. There are many types of Screening such as folding shading systems, kinetic titanium screens, or simple double skin screens of wood, steel, aluminium, titanium or GRC that are designed according to a certain criteria to meet the designed facility needs and functions (see Fig 3and Fig 4).

Fig 3 Folding Screen System(city-emotion.com)

Fig 4 Simple Double Skin Metal Façade(abiya-mashrabiya,com)

Identity Through Architecture

In the Moein Dictionary, identity can be expressed as follows: a supreme being, essence, and existence (Ettehad, Azeri, and Kari, 2014).

2.1 Architectural Identity

What constitutes the identification of something are the special characteristics making it unique. When considering Architectural identity, included are all the elements of the built environment such as buildings, spaces, urban fabric, landscape, and special architectural elements that identify a certain regional architecture, or that of a certain era (Nooraddin, 2012), as a social construct shaped by the need for meaning and a frame of reference for the respective present. The past is considered to a product of culture rather than a product of nature (Czumalo, 2012).

The current built environment and architecture, specially in Arab world, fails to express the arab's magnificent legacy, morals and social heritage. It does respect its sunny and warm climate. On the contrary, the architecture in Arab world now reflects a flawed image of western Architecture.

2.2 How to Achieve A Unique Arab Architectural Identity

To achieve a unique Arab Architectural identity, arabs simply need to pause, take a closer look to their architectural legacy; one that continuously inspires the whole. Necessary then would be an analysis of and emphasis on the strengths and elements of architecture built then. It was an architecture that respected environmental circumstances, social heritage and availability of building materials.

The answer is simple, we need to merge our traditional Arab Architectural elements with new smart building technologies to design new Architectural models that represent and portray the arab identity. Arabs dream of an identity that respects moral and social heritage, cultural legacy, climate of the Arab Region while using the unique elements and features of the arab traditional architecture. It should meanwhile fulfill the customers needs and adopt new smart technology systems and green and smart architecture principles (Abdelmoez, 2012).

New Applications and Interpritations for Mashrabiah and Screening Facades

In this section, presented will be an analysis and study cases, both, from the Arab world and worldwide for buildings that have adopted the above solutions of merging design using modified traditional elements and adapting smart technological systems but still reflect a unique architectural identity.

1.1. Arab World Case Studies

Three case studies are to be presented from the Arab world that shoud reflect the concept of merging traditional architecture with smart technology and present new applications and interpretations for Mashrabiah and screening facades.

1.1.1. Al Bahr Twin Towers

Building name : Al Bahr Towers (Fig 5a)

Location : Abu Dhabi, A.R.E

Designer : Aedas Architects

Year of opening : June 2012

Study element : Folding Shading Screen Façade

The geometrical pattern of the shading screen folds and unfolds in response to the movement of the sun, see Fig 5(b), and reduces solar gain by up to 50%. It improves visibility inside the towers. Each triangle is coated with fiberglass and is programmed to respond to the movement of the sun as a way to reduce solar gain and glare as shown in Fig 5(c) (Fernandez, 2016).

Fig 5(a) Al Bahr Towers, Abu Dhab

Fig 5(b) Folding Screen

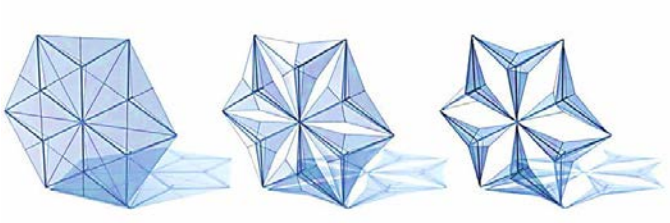

Fig 5(c) The geometric pattern coated with fiberglass

1.1.2. Doha Tower

Building name : Doha Tower (Fig 7(a))

Location : Doha, Qatar

Designer : Jean Nouvel

Year of opening : 2012

Study element : Geometrical Fixed Screen Façade

The facade's screen pattern of GRC material, as shown in Fig 7(b) and 7(c), is fixed on comprised aluminium grids that take the shape of butterflies representing traditional old Shansheal -the Mashrabiah name in Qatar- at four different scales as shown in Fig 7(d). The geometrical pattern of several scales is overlaid at different densities along the facade in response to the solar conditions to reduce sunlight and plur. It also gives an excellent experience from the interior of the building as shown in Fig 7(e) and 7(f) (Karakuş, 2016).

Fig 7(a) Doha Tower,Qatar

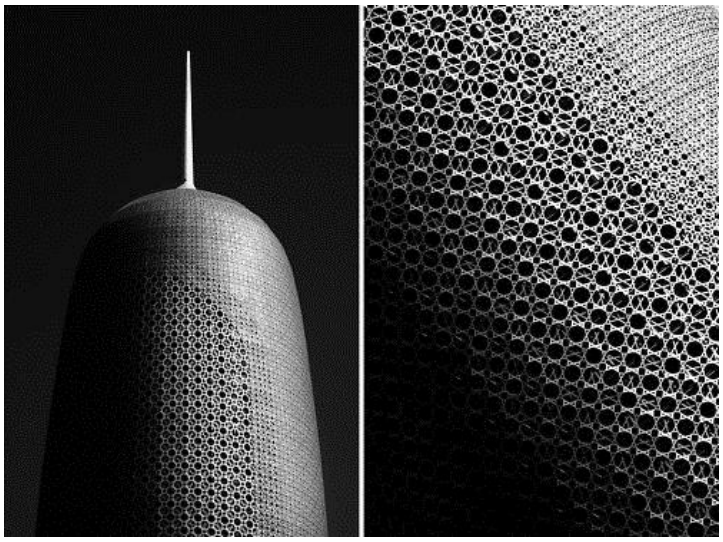

Fig 7(b) GRC Mashrabiah like pattern Fig 7(c) GRC Screen

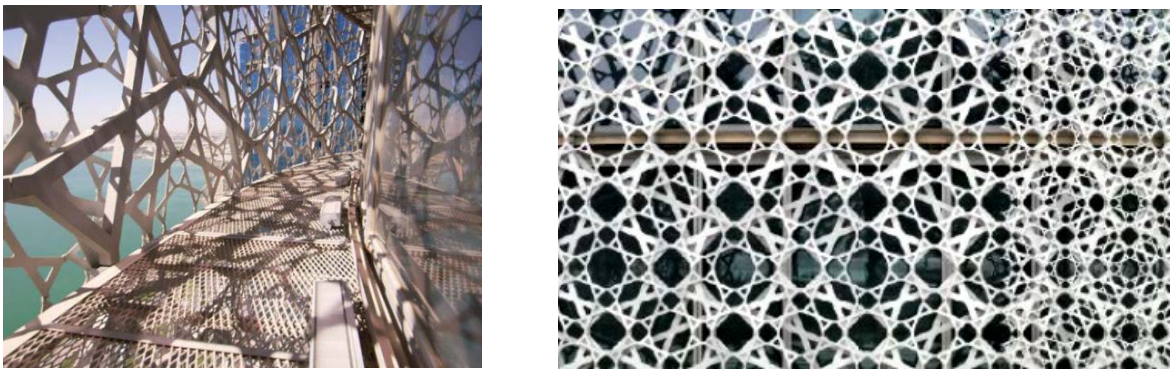

Fig 7(d) The traditional shap of Mashrabiah in four different scales

Fig 7(d) The Screen Façade Effect from the last floor

Fig 7(e) The Screen Façade Effect on the interior

1.1.3. KAFD Men & Women Portal Spas Proposal

Building name : Portal Spas Proposal (Fig 8(a))

Location : King Abdullah Financial District, Riyadh, KSA

Designer : WORKSBUREAU

Year of opening : Under construction

Study element: Kinetic Titanium Screen Façade

The facade's screen pattern consists of kinetic titanium sheets, as shown in Fig 8(b), which operates like a camera lens, opening and closing to regulate light as shown in Fig 8(c). The Screen is powered by small motors. The middle layers move back and forth creating both shades. The design is protected by glass on both sides of the metal parts. This design is created to ensure privacy of the users, to control sunlight and create a relaxing environment from within as shown in Fig 8(d) and Fig 8(e) (Furuto, 2013).

Fig 8(a) KAFD Portal Spas Proposal

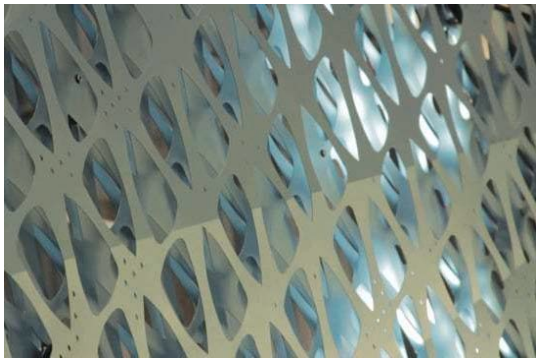

Fig 8(c) Kinetic Titanium Screening Sheets

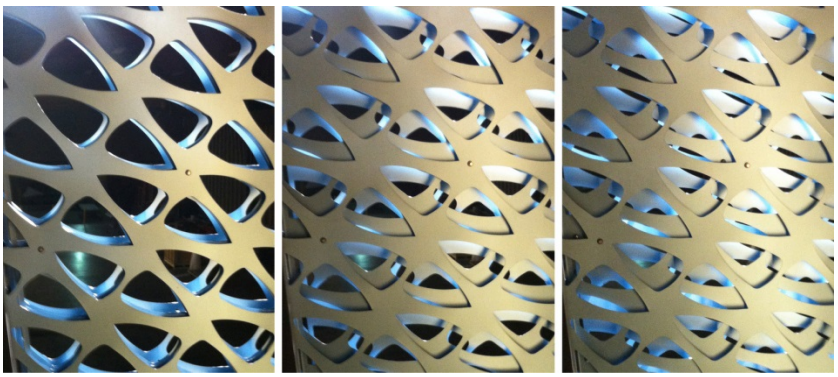

Fig 8(d) The mock-up titanium screening façade opening and closing like a camera lens due to light

Fig 8(d) Kinetic Screening System regulating sun light

Fig 8(e) Kinetic Screening System providing privacy

1.2. Worldwide Case Studies

Two worldwide case studies will be presented to reflect the influence of our Arab and traditional Architecture on foreign architects' designs and on presenting new applications and interpretations for Mashrabiah and screening facades.

1.2.1. Lotus Haus

Building name : Lotus Haus. (Fig 9(a))

Location : Daegu, South Korea

Designer : local studio Smart Architecture

Year of opening : 2015

Study Element : Simple Fixed Metal Screen Façade

The Screening Façade simply is made of one layer of punched steel covering the upper stories of the house as shown in Fig 9(b). The pattern chosen for the screening system looks like a simple Mashrabiah pattern used, particulary, in Egypt based on the lotus flower as in Fig 9(c). The screening system was used to control sunlight and to give some kind of privacy for residential floors. It also gives a unique pattern of light and shadow in the rooms and staircases as shown in Fig 9(d) and Fig 9(e) (Griffiths, 2015).

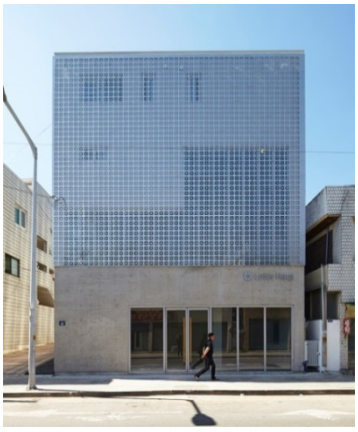

Fig 9(a) Screening Façade of Lotus Haus

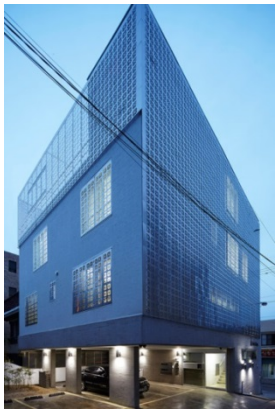

Fig 9(b) Screening covering residential floors

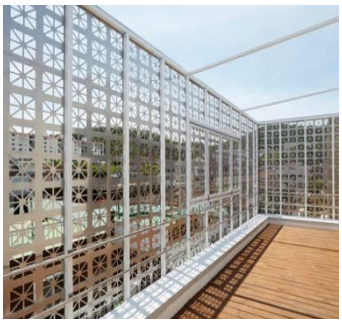

Fig 9(c) The punched metal Screen as a shape of Lotus Flower [Egyptian Mashrabiah]

Fig 9(d) Screening on bedroom gives privacy & controls sunlight

Fig 9(e) Screening on the staircase

1.2.2. Lund Office Building Extension

Building name: Office Building Extension (Fig 10(a))

Location: Lund, Sweetherland

Designer: Swedish firms Johan Sundberg Arkitektur and Blasberg Andréasson Arkitekter

Year of opening: 2015

Study Element: Simple Fixed Perforated Metal sheets (Fig 10(b))

The Screening Façade is simply made of one layer of punched metal sheets with circular shapes as shown in Fig 10(c). This design was mainly used to give a remarkable image to the office building located in the industrial zone of the city but in a very moderate context. The design achieved its goals of creating a distinguished look for the office building through the way it provided light control and a cozy atmosphere for the employees inside as in Fig 10(d) and Fig 10(e) (Mairs, 2015).

Fig 10(a) Lund Office Building Extension

Fig 10(b) Screening of simple punched metal sheet

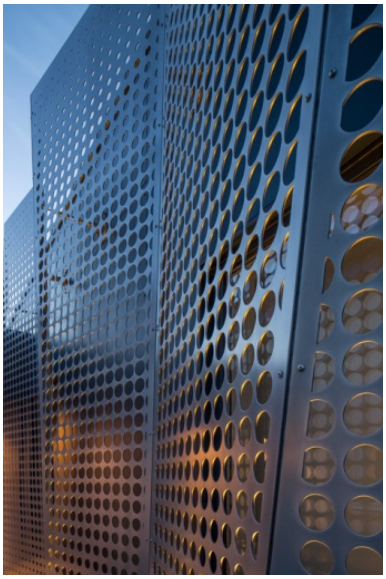

Fig 10(c) Screening of perforated metal sheet with circular shapes (dezeen.com) Fig 10(d) Offices Interior(dezeen.com)

Fig 10(e) The cozy interior generated from the screening design

Conclusion

Mashrabiahs represent a unique element of our architectural legacy and heritage. It could be modified, adjusted and reused in architecture nowadays. The new Mashrabiah model could be a very important feature of the Arab architectural identity consistently sought.Moreover, screening systems come in many kinds. Simple fixed screens that are punched or perforated, folding or movable shades, or kinetic facades that respond to light like a camera lens. Screening systems represent a new green and smart architectural solution inspired by traditional Mashrabiah. In most cases, screening is a new interpretation of Mashrabiah.

The architectural identity contains all the elements of the built environment such as buildings, spaces, urban fabric, landscape, and special architectural elements that identify a certain regional architecture or the architecture of a certain era.The Arab architectural identity could, once more, be achieved by merging traditional Arab architectural elements with smart green architecture applications and technologies in order to produce new architectural models that should then become the elements of this new architectural movement. This research has established that there exist several new applications and interpretations for Mashrabiah and screening systems, both in Arab world and internationally.

Screening systems' and Mashrabiah's rebirth are a prevailing trend in the Arab world especially within the Gulf areas. There are several successful architectural models for this trend such as Al Bahr Towers-Abu Dhabi, Doha Tower-Doha, and KADF Portal Spas Proposal-Riyadh. New Mashrabiah and screening systems' applications in the Arab world vary from folding shades, fixed geometrical layered screens to kinetic facades. Foreign architects are inspired by traditional Mashrabiah in the design of some kinds of screening systems. Their trails are still shallow, on the other hand, as in most cases, they are inspired only by the form and not the function as well. However, far eastern architects are more interested in designing screening systems with inspiration from traditional Mashrabiahs due to its historical background, shared morals and social beliefs such as an individual's need for privacy. Their trails are more varied and are more aware with the Mashrabiah functions. Therefore, it is strongly advised to continue studying, evolving and analyzing the Mashrabiah and screening systems in order to generate new and distinct models that are still appropriate and suitable for today's circumstances and demands.

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