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INTEGRATING FEATURES OF ISLAMIC TRADITIONAL HOME AND SMART HOME

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ABSTRACT

Architecture is a mirror that reflects the various elements of its environment and surroundings, such as climate, geographical characteristics, standard architectural principles, and social, cultural and scientific developments.Muslims of different regions were able, through architecture, to portray their temperaments and environments, free of external influence and guarantee life goals for users. Every day, building owners and occupants experience the constant challenges of comfort, convenience, cost, productivity, performance and sustainability. Owners, designers, builders, and operators are continuously faced with new processes, technologies and offerings to help them achieve better building performance. Since an intelligent building is run by a "system of systems" that is integrated to deliver a higher level of operational efficiency and an improved set of user-interface tools than are usually found in traditional building automation; at the other hand Arab homes with Islamic Identity guarantee all life goals for use.. Hence, this research focus on the smart environmental treatments of Islamic features for traditional architecture in Arabs homes, features of smart home and life goals for resident users.Trying to achieve a methodology combining them for enriching Arab experience of traditional architecture and its architectural results, with the modern trends of smart architecture. This combination aims at creating a residential model combining the benefits and features of Arab Islamic identity and intelligent design.

KEYWORDS:
Arab islamic identity, smart home, smart architecture, sustainability

INTRODUCTION

Muslims of different regions were able, through architecture, to portray their temperaments and environments, free of external influence and guarantee life goals for users.

An intelligent building is run by a "system of systems" that is integrated to deliver a higher level of operational efficiency and an improved set of user-interface tools than are usually found in traditional building automation. In some ways, an intelligent building can be considered an improved "automated" building, incorporating more building systems and advanced functions [1].

RESEARCH PROBLEM

As the last century especially its end -the 90s- witnessed many successive changes and new beginnings or development phases, and as a reflection and output of this period, a new term appeared called smart architecture. It was created as a result of the high cost of construction generally, and residences' specifically. From the fact that most of the modem residence are not suitable for the surrounding environment and is considered bizarre, and to save energy, modem suitable ones to have to be established.

Every day, building owners and occupants experience the constant challenges of comfort, convenience, cost, productivity, performance and sustainability. Owners, designers, builders, and operators are continuously faced with new processes, technologies and offerings to help them achieve better building performance [1].

RESEARCH OBJECTIVES

Achieving a methodology combining both: the enriching Arab experience of traditional architecture and its architectural results, with the modern trends of smart architecture. This combination aims at creating a residential model combining the benefits and features of them both.

METHODS

Researcher used the analytical approach as the main method, analytical approach to indicate the historical Islamic features in Arab home identity and integrating them with features of smart home to formulate methodology integrating features of Islamic Architecture and smart home and applying study to evaluate the methodology integrating features of smart home and environmental aspects in Islamic Architecture.

DISCUSSION

ENVIRONMENTAL TREATMENT FOR BUILDINGS IN ISLAMIC ARCHITECTURE

Traditional residential architecture of Islamic eras accorded a great deal of importance and respect to the environment, the source of the construction materials that give form to architectural elements. It also contributes to creating architectural spaces that realize mental and physical comfort of users while complementing the surrounding environment [2].

Most Arab regions, for example Cairo is characterized by its dry climate, low rainfall and strong sunshine. Its residential traditional architecture adopted construction methods that made use of these climatic conditions.

Houses were built in close proximity to one another, thus presenting a single architectural bloc to combat climatic elements. Inner courtyards provided air and natural light and ensured the privacy of occupants.

Islamic city plans were designed so that markets were located at a distance from residential areas. To reduce noise levels in residential areas, each trade or craft had its own market. The thick walls and inner courtyards of residential buildings minimized noise and provided shade and shelter from the sun [3].

Numerous solutions were adopted such as minimizing exposed building surfaces and reducing the rate of heat transmission through constructing buildings in groups (complexes), adapting to changing temperatures through the use of brick and mud to build thick walls with a minimal number of openings, to reduce energy exchange with the outside air and to limit the inflow and collection of dust, reducing heat absorption by building deep inner courtyards, surrounded by rooms, and by planting the courtyards, using solar energy to heat rooms reserved for winter use and storing energy in the walls and ceilings; to conserve energy, heating in winter is reserved for living rooms and bedrooms only, using local materials to construct walls of sufficient thickness to combat heat and humidity.

Cairene (of Cairo) traditional residences thus provides an excellent example of architectural innovation and borrowing that is adaptable to environmental and climatic conditions [4].

BUILDING ORIENTATION

In Islamic architecture the selection of direction of the building take in consideration the sun movement more than wind movement so as to ensure maximum shadows and preventing the building from hot dry air that is the main characteristic of Islamic world regions, where air passes on wet or shaded areas before reaching the building. From this point of view, the best orientation of the penning is north, then the south direction where the shading process is as easy as possible. Islamic buildings ignore the openings in front of west direction as much as possible [5].

Due to orienting the building spaces inwards we have two types of façades, external façades which faces the street, is partially solid, with small number of openings. Openings in street façades are covered with mashrabiyyas. The internal façade is the main important façade, and its openings are much wide than those in external ones [6] [7].

BUILDING SHAPE

Building in Islamic city is characterized by not being long, which yields largest amount of interior spaces away from the external climatic conditions to achieve internal thermal stability. Building forms is complicated blocks to provide shadows.

SOUND INSULATION

Design of building in Islam is based on sound acoustics knowledge. Which we found in the horizontal rooms arrangement according to how are they affected by the outside noise, using thick walls made of stone in the internal courtyards which create quiet indoor spaces [6] [8].

FRIENDLY CONSTRUCTION MATERIALS

During Islamic eras, construction materials readily available in hot climate environments were carefully selected; light-colored materials with high thermal insulation properties helped to decrease temperature and increase humidity. 1) The mud-brick, brick and red bricks were the main building materials; also they used the stone, gypsum, lime and wood [9]. Adobe (mud – brick) is the best natural substance that can provide thermal insulation of the building, so it was used widely in the civilizations of Mesopotamia and Egypt and was used by the Romans and the peoples of the Middle East, and was the first Islamic buildings erected Prophet's Mosque in Medina and homes in Mecca and Medina [10]. 2) The brick, red brick or bricks were used in Egypt, Iraq, Iran and the Maghreb, and in the case of construction a large thickness, it helps to provide good thermal insulation in interior spaces. As the stone was used in the construction of Islamic architecture which provides good thermal insulation, the use of limestone helps to keep the interior spaces cold most daily hours. 3) Wood was used in windows, doors and furniture, also was used for building flat, horizontal roofs, mashrabiyyas, takhtabushes,

windows, malqafs, shokhshekhas and as scaffolding during the construction of walls [11] In Bashtak Palace in Cairo double ceiling is used, including pottery provides a porous property and reduce convection and construction on the building and spaces underneath. [10].

BUILDING FEATURES IN ISLAMIC HOME

INNER COURTYARDS

The inner courtyard is one of the inner spaces of the buildings in the social and environmental nature that require his presence inside the building areas; to achieve environmental and utilitarian and social targets. Covering the Roofing yard offers possibility of maintaining the cold acquired at night, it is possible for roofing most of the yard or in part, for protection from sand and severe heat storms. Using courtyards helps collecting cool air layers in courtyard all night, thus cooling indoor spaces, during the day.

At the evening, warm air rises and is gradually replaced by the air from above which was cooled all night. The courtyard works as a reservoir of coolness. Walls looking towards inner courtyard shade large parts of the floors. Stored solar energy in the floors and walls of the courtyard through the day is released back into atmosphere, and the cool air which was stored in courtyards at night serves to keep it cool during the mornings of next day [11].

SHOKHSHEKHAS

They are skylights due to difference in architectural roof level which are higher than the rest of the building that allows having upper windows to allow exit of hot air by rising up [5]. They are used to cover main halls and help providing ventilation and lighting of the hall. Malgaf ventilation system is the most efficient, where it works at tempering temperature of the air and then hot air to withdraw at the top of the room is also helping to provide the upper indirect lighting.

When wind raises, malqaf, which is higher than shokhshekha, captures cool air which pushes the rising hot air out through the shokhshekha windows [6]. Shokhshekha is almost in the form of circular or polygonal wooden dome with circular or hexagonal neck [9].

MASHRABIYYA

Mashrabiyya allow cold air to enter easily due to the roundness of their parts, manufacturing of wood adjust the humidity in air, which absorbs moisture and does not allow the entry of direct sunlight, usually located in the exterior in order to insure privacy [9]. It also has: 1) Sliding or hinged windows in the main fixed panels for to increase ventilation and lighting [12]; 2) Small openings that extend body to earthen drinking bottles by evaporating effect of airflow [13]; 3) Internal glass to protect from coolness and dust [13]; 4) External wooden shutters for protection and privacy; 5) At night, mashrabiyya absorbs moisture air carried by the wind and passing through the interstices. When it is heated by sunlight, it release the moisture into the air passing through, which increase humidity and reduce temperature within the home [6].

MALQAFS (WIND CATCHER)

Malqafs or wind catchers, are used to capture the cool outside air, they are built into the corner of rooms or halls facing the direction which the wind blows from (north or northwest). For capturing the air and propel it into the rooms, their roofs slope upwards towards the direction from which the wind blows [14].

Malqafs have many advantages than other openings and windows. These include: the passing air through them is relatively free from dust due to its composition, movement of air is faster because the higher air from ground the more its speed is, it ventilates indoor spaces that do not have windows facing the outside and it moderates air temperature passing through them [15].

ENTRANCES

In general, entrances opened in secondary streets, having indirect corridors giving access to interior courtyards providing privacy and concealing from outside view [14].

Broken doorways provide privacy for the household during the transition from the road into the house without allowing seeing inside the home [14]. Refractor entrance also provides protection from dust and external noise, and is based on not leading directly into the house through the direction left or right 90 degrees. For the dwelling at least two entrances, one for the people of the house and the other guest men.

ENVIRONMENTAL ASPECTS IN ISLAMIC ARCHITECTURE

Environmental Aspects in Islamic Architecture nearly match all human needs for having a comfortable life which are shown in table [1].

Table 1. Environmental Aspect in Islamic Architecture [4]

Climatic Aspect	
Energy Saving	
1	Using natural and renewable energies (solar and wind).
2	Thermal Insulation building materials with large heat capacity
3	Using material with low energy consumption
4	Using low energy consumption ores.
5	Low energy consumption materials
6	Design helps the flow of natural lighting and ventilation.
7	Using water to adjust humidity, purifying and cooling air.
8	Using thermal Insulation building materials with a large heat capacity.
9	validity of natural lighting and ventilation
Reduce Resource Depletion	
10	Local building materials withstrong durability

Cultural and Social Aspect	
Audio and Visual Privacy	
11	Efficiency of walls to prevent sound transmission
12	Efficiency of materials to prevent sound transmission
13	Design of openings achieves visual privacy
14	Design of openings achieves visual privacy
15	Planting trees in noise side flow
16	Indoor Orientation
Safety and Security	
17	Protection from harmful weather.
Aesthetic and Functional Aspect	
Creativity in Design	
18	Approve the architectural character of the building with the surrounding historical and social environment
Natural Ventilation and Heating	
19	Using natural ventilation and heating systems.
20	Using materials which help natural ventilation and heating.
21	Ignore materials which help concentration of pollutants in the air
22	Moisture control by using porous materials.
Lighting Quality	
23	Distribution of openings for natural light.
24	Creation of open spaces

From the Table 1 can be found that the environmental treatments in Islamic architecture match the major criteria for having a green building where it: 1) Fits sustainability of construction in the desert, by finding architectural solutions capable of achieving protection from harsh weather conditions with the preservation of Arab identity and Islamic content in construction and planning; 2) Fulfill almost all global systems and codes for environmental design criteria [4]; 3) The environmental treatments in Islamic cities and building offers: Energy Saving, Reduce Resource Depletion, Audio and Visual Privacy, Safety and Security, Creativity in Design, Natural Ventilation and Heating, Lighting Quality.

SMART HOMES

A smart home can be defined as a residence equipped with computing and information technology which anticipates and responds to the needs of the occupants, working to promote their comfort, convenience, security and entertainment through the management of technology within the home and connections to the world beyond [16].

TECHNOLOGICAL APPLICATIONS FOR SMART HOMES

SMART TECHNOLOGIES [17]

1) Sensing: Measurement, prediction, and control of health, environmental factors, and user status. Various sensors: measurement of interior environment of building, measurements of users' physical attributes, physiological attributes and forecasting of users' psychological states. 2) Computing: Artificial intelligence applications, distributed computing environment, grid computing, cloud computing. 3) Action: Smart architectural elements, smart household appliances, furniture design Integration of smart appliances and personal equipment in an intelligent house, Adaptive smart architectural elements and corresponding situations: architectural controls and response elements and systems corresponding to internal environmental factors. 4) Communications: Wireless communications and ubiquitous computing technologies, dwelling area domain group and level settings, standard communication protocols. 5) Energy: Types of alternative green energy sources, assessment and application.

SMART MATERIALS

Materials with environmental sensing ability and responsiveness can change their state according to control signals or stimuli. Control signals and stimuli include pressure, temperature, humidity, pH, power, and magnetic fields. Responses include changes in shape, color, density, and phase. Addington (2005) classified smart materials as two types; one type is property changing, and the other is energy exchanging [18].

SMART DESIGN

Traditional static buildings are composed of fixed elements, and cannot respond to transient, dynamic environmental changes. Although a theoretical basis has been established for variation in open architectural systems, open architecture lacking smart mechanisms cannot sense external changes, and cannot actively determine the optimal moments for changes in architectural element, and thereby implement adaptive optimization programs. Because of this, adaptive open architecture applying artificial intelligence to bring about adaptive changes must be developed in order to meet the needs of sustainable development while providing users with a comfortable living environment [17].

Applications for smart design [18]:

1) Intelligent living spaces: Building automation, home automation (HA), home automation control systems, ubiquitous computing and cloud computing. 2) Adaptive open architecture: Adaptation, adjustment, flexibility and open architecture. Support and infill, intelligent agents, group and level. 3) Context aware lifelong home: Context awareness, lifelong home, general-purpose design, the mobility-impaired and the elderly. 4) Smart care: Elderly welfare technology, distance residential care technology and ICT applications. 5) Green buildings : Passive design, active equipment, green energy, green building indicators and comfortable environment. 6) Mobile cities: Computer graphics, virtual reality, photographic surveying technology, satellite images, geographical information system and satellite positioning systems.

HOME AUTOMATION

Building Automation System (BAS) core functionality keeps building climate within a specified

range, provides light to rooms based on an occupancy schedule (in the absence of overt switches to the contrary), monitors performance and device failures in all systems, and provides malfunction alarms to building maintenance staff. A BAS should reduce building energy and maintenance costs compared to a non-controlled building. Most commercial, institutional, and industrial buildings built after 2000 include a BAS. Many older buildings have been retrofitted with a new BAS, typically financed through energy and insurance savings, and other savings associated with pre-emptive maintenance and fault detection [19].

An intelligent building can be defined as: A building that uses technology and processes to reduce its environmental impact, protect occupant health and safety, improve employee productivity, and become more operationally efficient for its owners [19]. Figure 1 shows building automation application in smart home.

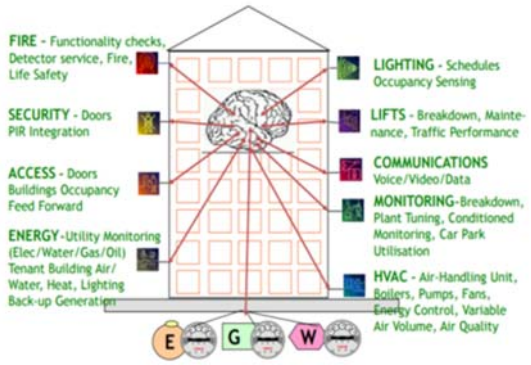


Figure 1. Building automation application in smart home [17]

Safety and Security

1) Safety: Gas & smoke detection, Fire detection, Leak detection, Notification systems. 2) Security: Intrusion detection, Remote audio/video, Surveillance, Access control & locks, Camera systems. 3) Health care: Health/medical/fitness record vaults, Patient monitoring

SUSTAINABILITY AND ENERGY CONSERVATION

1) Energy Management: Lighting Control, Zone & climate controls, Plug-in systems, Fan speed controls, Load shedding systems, Smart metering & grid connected controls. 2) Home Controls & Automation: HVAC and temperature controls, day lighting systems, drapery controls, Multi-room controls/ intercoms Touch-screens, Irrigation controls , Pool & spa controls, Appliance controls

Convenience and comfort

1) Monitoring: Alarm monitoring, Remote home. 2) Entertainment: Audio and volume controls, Multi-media room controls, Home theater/ entertainment System controls.

INTELLIGENT HOUSING THROUGH INTELLIGENCE FEATURES SATISFYING LIFE GOALS FOR USERS

Table 1 shows integration of technological applications of smart homes and life goals for Smart Home users, to reach intelligent housing through intelligencefeatures.

Table 1. Intelligent housing through intelligence featuressatisfying life goals for users.

Technological Applications for Smart Homes	
Smart Technologies	
	Sensing
	Computing
	Action
	Communications
	Energy
Smart Materials	
	Materials with environmental sensing ability and responsiveness can change their state according to control signals or stimuli
Smart Design	
	Intelligent living spaces
	Adaptive open architecture
	Context aware lifelong home
	Smart care
	Green buildings
	Mobile cities
Life Goals for Smart Homes	
Safety and security	
	Safety
	Gas & smoke detection, Fire detection, Leak detection, Notification systems
	Security
	Intrusion detection, Remote audio/video, Surveillance, Access control & locks , Camera systems
Health care	
	Health/medical/fitness record vaults, Patient monitoring
Sustainability and energy conservation	
	Energy Management
	Lighting Control, Zone & climate controls, Plug-in systems, Fan speed controls, Load shedding systems, Smart metering & grid connected controls
	Home Controls & Automation
	HVAC and temperature controls, day lighting systems, Drapery controls, Multi-room controls/ intercoms Touch-screens, Irrigation controls , Pool & spa controls, Appliance controls
Convenience and comfort	
	Monitoring
	Alarm monitoring , Remote home
	Entertainment
	HVAC and temperature controls, Day lighting systems, Drapery controls, Multi-room controls/ intercoms Touch-screens, Irrigation controls , Pool & spa controls, Appliance controls
	Intelligent Housing Through Intelligence Features

FORMULATING METHODOLOGY INTEGRATING FEATURES OFSMART HOME AND ENVIRONMENTAL ASPECTS IN TRADITIONAL ISLAMIC ARABIAN HOME

Table 2 formulating methodology integrating features of smart home and environmental aspect in Islamic traditional Arabian home.

Table 2. Formulating methodology integrating features of smart home and environmental aspect in Islamic traditional Arabian home

Smart Home				
	Automation			
		Building Management System		
			Security and safety systems	
				Fire detection and alarm system
				Security monitoring system
				Access Control System
			Environmental Control Systems	
				Heating, ventilation and air conditioning systems
				Energy Management Systems
				Water management systems
			Electrical network management systems	
				Lighting systems
				Control elements of the outer casing systems
				Cable Management Systems
		Communications and office automation systems		
			Audio and video communication systems	
			Data transfer systems	
			Control system for home distance	
	Response			
		Responding to changes in internal & external environment		
			Limited response	
			The ability to learn (Smart Response)	
		Responding to the occupants needs (Occupants Control)		
			Respond to user needs	
			The ability of the building to change their status and form due to the user pre-order	
			Using the weather temperature sensors and meteorological data	
			Weather forecasting and self decision-making	
	Efficiency of Indoor environment			
			Environmental data collection	
			The use of renewable energy sources	
			Self-power generation	
Environmental Aspects in Islamic Architecture				
	Climatic Aspect			
		Energy Saving		
			Using natural and renewable energies (solar and wind).	
			Thermal Insulation building materials with large heat capacity	
			Using material with low energy consumption	
			Using low energy consumption ores.	
			Design helps the flow of natural lighting and ventilation.	
			Using water to adjust humidity, purifying and cooling air.	
			Using thermal Insulation building materials with a large heat capacity.	
		Reduce Resource Depletion		
			Local building materials with strong durability	
	Cultural and Social Aspect			
		Audio and Visual Privacy		
			Efficiency of walls to prevent sound transmission	
			Efficiency of materials to prevent sound transmission	
			Design of openings achieves visual privacy	
			Planting trees in noise side flow	
			Indoor Orientation	
		Safety and Security		
			Protection from harmful weather	
	Aesthetic and Functional Aspect			
		Creativity in Design		
			Approve the architectural character of the building with the surrounding historical and social environment	
		Natural Ventilation and Heating		
			Using natural ventilation and heating systems.	
			Using materials which help natural ventilation and heating.	
			Ignore materials which help concentration of pollutants in the air	
		Lighting Quality		
			Distribution of openings for natural light.	
			Creation of open spaces	

APPLICATION FOR THE METHODOLOGY INTEGRATING FEATURES OF SMART HOME AND ENVIRONMENTAL ASPECT IN TRADITIONAL ISLAMIC ARABIAN HOME

OXYGEN VILLA [21]

An Egyptian Based firm has been announced as the winner of Hassan Fathi award of 2011 for a sustainable proposal of environmental & economical villa called Oxygen to be built in Saudi Arabia. The design is comprised of modular boxes with both vertical and horizontal screens creating solar-powered gem that provides natural lighting, ventilation and privacy. Combining cutting-edge technology such as photovoltaic (PV) glazing modules and decentralized waste water treatment system with ancient passive design techniques, such as Mashrabia, this young team has conquered the challenge of providing responsible modern housing in today's resource-scarce context.

Oxygen villa e represents the design of a traditional Islamic Arabian home since designers gave respect to climatic, cultural, social, aesthetic and functional aspects, by using features of Islamic identity in inner and outer spaces. The design of the building offers privacy and comfort for users, inner visualization and various environmental treatments for energy conservation and protection from harmful weather.

LAND USE

Achieving the maximum benefit of land use in spaces and referring to the possible increasing of the building in the future by the increasing of the family members' number.

SOCIAL

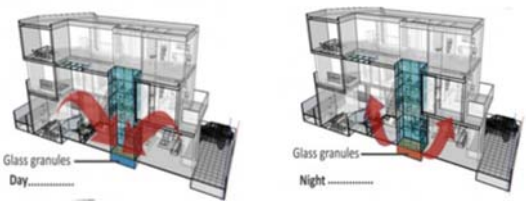
Taking care of the privacy issue in designing the inner spaces which is important for the Arabian family in the men and women spaces and reception spaces also, taking care of the spaces distribution

One of the major features of the Mashrabiya is privacy, an essential aspect of Arabian culture. A good view of the outside can be obtained by the occupants without being seen, figure 2.

Figure 2. Separation between men majlis and women majlis [21]

INNER VISUALIZATION

The design of inner spaces depends on open view idea for all spaces according to the space function. By creating a middle double volume void area makes a visual contact between ground and first floor and also by creating inner court helps in the connecting between spaces in all levels that gives inner open feeling which is visually and Psychologically comfortable (figure 3a), that would also help in cooling process of the inner space (figure 3b) .



a **b**

Figure 3. (a) Inner court at Day (b) Inner court at night

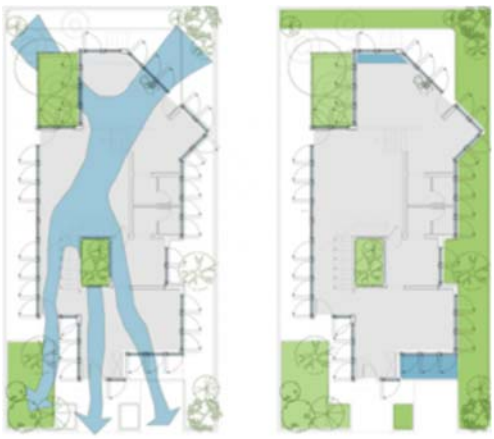
FLEXIBILITY

The building design gives a variety of alternatives by using the module system and the prefabricated units that would help in changing the character of the building at any time when it's needed and it will be in a harmony with each other.

VENTILATION SYSTEM

The inner spaces were designed as a one space to make the air movement more easier inside the spaces, air movement depends on two or more entrances and three exits that gives a continues moving of air all day (figure 4a).

The site was designed to make the air movement always passes through green areas and trees inside and outside the building on the eastern and northern corners for filtering the air then passing through water area for cooling the air (figure 4b).



a **b**

Figure 4. (a) Inner ventilation (b) Outer ventilation

BUILDING MATERIALS

The prefabricated system gives the advantage of reducing the construction time and the simplicity of establishing the building and also for recycling process.

ENVIRONMENT

The wooden screen with open-able windows (figure 5) gives shade and protection from the hot summer sun while allowing the cool air from outside to flow through the building.

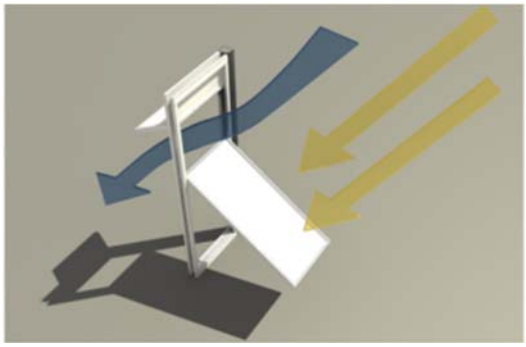


Figure 5. Wooden screen with open-able windows

The projection of the Mashrabiya achieves several purposes, on one hand it allows air from three sides to enter, even if the draught outside was parallel to the house façade; on the other hand it serves the outside and in turn the neighborhood.

A row of projected Mashrabiyas provides shelter for those in the streets from rain or sun. Case 1 (figure 6a): the units would be opened vertical to make a group of sunshades on the building and also having more space for air.

Case 2 (figure 6b): while having a strong storm of wind and sand as example the units will be closed completely on itself to avoid the villa from bad climatic changes. Case 3 (figure 6c): of a good weather with a light sun ray the units would be opened horizontal to make shade from the glass part on the unit and acceleration the air movement inside the building.

a b c

Figure 6. (a) Case 1, (b) Case 2, (c) Case 3

SUN BLOCK SYSTEM

Design of detailed structural unit contains 3 parts (figure 7): two parts solid and one part consists of double layers of glass was nitrogen gas pumped between them and the benefit of nitrogen gas is its ability to absorb thermal energy that comes from the sun's rays and transmits only a low amount of it helps to keep the internal space cool.

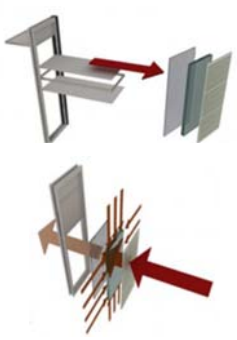


Figure 7. Design of detailed structural unit

ENERGY CONSERVATION

Villa Oxygen apply some energy conservation systems such as: green panels, roof photovoltaic cells, inner court, shading trees and skylight roof (figure 8).

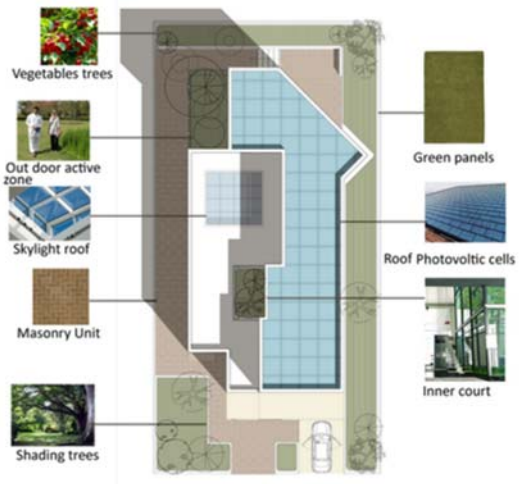


Figure 8. Energy Conservation in Villa Oxygen

EVALUATING THE METHODOLOGY INTEGRATING FEATURES OF SMART HOME AND ENVIRONMENTAL ASPECT IN TRADITIONAL ISLAMIC ARABIAN HOME (TABLE 3)

Table 3. Applying the criteria of evaluating the methodology integrating features of smart home and environmental aspect in traditional Islamic Arabian home on Villa Oxygen.

	Features of smart home and traditional Islamic Arabian home	Oxygen Villa
1	Fire detection and alarm system	1
2	Security monitoring system	1
3	Access Control System	1
4	Heating, ventilation and air conditioning systems	1
5	Energy Management Systems	1
6	Water management systems	0
7	Lighting systems	1
8	Control elements of the outer casing systems	1
9	Cable Management Systems	0
10	Audio and video communication systems	1
11	Data transfer systems	1
12	Control system for home distance	1
13	Limited response	1
14	The ability to learn (Smart Response)	0
15	Respond to user needs	1
16	The ability of the building to change their status and form due to pre-order	1
17	Using the weather temperature sensors and meteorological data	1
18	Weather forecasting and self decision-making	0
19	Environmental data collection	1
20	The use of renewable energy sources	1
21	Self-power generation	1
22	Using natural and renewable energies (solar and wind).	1
23	Thermal Insulation building materials with large heat capacity	1
24	Using material with low energy consumption	1
25	Using low energy consumption ores.	1
26	Design helps the flow of natural lighting and ventilation.	1
27	Using water to adjust humidity, purifying and cooling air.	0
28	Using thermal Insulation building materials with a large heat capacity.	1
29	Local building materials with strong durability	1
30	Efficiency of walls to prevent sound transmission	1
31	Efficiency of materials to prevent sound transmission	1
32	Design of openings achieves visual privacy	1
33	Planting trees in noise side flow	1
34	Indoor Orientation	1
35	Protection from harmful weather	1
36	Approve the architectural character of the building with the surrounding historical and social environment	1
37	Using natural ventilation and heating systems.	1
38	Using materials which help natural ventilation and heating.	1
39	Ignore materials which help concentration of pollutants in the air	1
40	Distribution of openings for natural light.	1
41	Creation of open spaces	1
	Score	**36/41**
	Percentage	**87.8%**

By applying the criteria of evaluating the methodology integrating features of smart home and environmental aspect in traditional Islamic Arabian home on Villa Oxygen as shown in table 3 , Villa Oxygen fulfills 87.8% of smart home features and environmental aspect in traditional Islamic Arabian home.

CONCLUSION

1) Integrating features of smart home and environmental aspect in traditional Islamic Arabian home is possible and is required for houses in Arabian countries. 2) We can evaluate buildings with smart home features with respect to environmental aspects and features of Islamic identity by using the evaluation criteria. 3) The environmental treatments in Islamic cities and building match the major criteria for having a green building where it fulfill all environmental, cultural, social, aesthetic and functional requirements. 4) The environmental treatments in Islamic cities and building offers: Energy Saving, Reduce Resource Depletion, Audio and Visual Privacy, Safety and Security, Creativity in Design, Natural Ventilation and Heating, Lighting Quality. 5) Smart homes have the ability to make life easier and more convenient. 6) We can have a criteria to evaluate smart homes with traditional features providing the user all his life goals. 7) Smart home in Arabian region must fulfill: Harmony between architecture, people and environment, Harmony between the utilization of advance technologies and local characteristics of region, The use of appropriate vernacular features of vernacular built environments as embodiment of smart living environments for creating local smart homes.

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