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Emerging the concept of Sustainable Architecture in forming a Smart City

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Abstract

The creation of smart cities requires setting a specific definition of smart cities and identifying the technology, modern technologies and systems that are linked to the mechanism of work of smart cities, where computing and virtual reality have helped in the development of city designs through data analysis and evaluation of alternatives, in order to save energy and achieve sustainability, which requires linking smart cities with green architecture; which tends to preserve a valid and safe environment outside and inside the building, rationalize the use of energy, water and other natural resources and reduce maintenance and operating costs.

Keywords

Climates, Energy, Green Buildings, Grey Water, Solar Cells

1. Introduction

Energy saving is an important topic, as traditional energy sources have become limited and pose a severe threat. The environmental concept of design contributes to reducing the negative effects resulting from the use of traditional energy resources; such as, high rates of carbon dioxide emissions, climatic changes, negative weather fluctuations, and breaches in the ozone layer.

The information revolution, digital communications and artificial intelligence have been linked to the field of architecture, and the process of transmitting information through local and international networks and computers have become a routine matter that facilitates the requirements of life. One of the results of this impact is the emergence of the term “Smart Architecture”. It led to the development of some concepts starting from the city level and ending with the level of building elements components. And then, the term Smart City appeared, as the use of these smart technologies in one way or another in the streets and buildings in general and housing in particular aims to control the energy consumed and improve its thermal performance.

2. Smart Cities

A Smart City merges information and communication technology in order to improve operational efficiency. The concepts of smart architecture for these cities are related to other architectural concepts and terms such as sustainability, green architecture, climate architecture and digital cities.

3. Smart Cities’ Terms

This research is concerned with how to create smart cities that achieve the concepts of sustainable development with the trend towards green architecture. Therefore, some terms that are related to smart cities must be identified.

3.1. Technology

Represents the development and application of tools and automatic processes, which is the way of thinking and the means used by man to provide his well-being and adapt nature at his service, by applying modern sciences and innovations to human, natural and industrial resources to the maximum extent to achieve speed, accuracy and ease in the implementation of buildings, the emergence of better civilized gatherings, the design of buildings with potential multiple buildings such as wide seas, high rises and giant installations.(14)

3.2. The concept of artificial intelligence

It represents the science that enables machines to implement things that require intelligence in the event that they are implemented by the designer, based on the computer to design and create virtual reality through the speed and accuracy of the machine's response. And feeding it with ideas, information, data and design determinants, and thus the personality of the designer is reflected on the design. Programming machines through digital information media.

3.3. Internet of Things (IOT)

The Internet of Things is a diverse set of cloud-connected equipment, products, and devices designed to securely collect and transmit data. IOT enables organizations to quickly collect and use data to make quick decisions Smarter cities around the world use IOT sensors to capture data, monitor operations remotely, and perform real-time tracking to improve citywide operations and predictive maintenance that helps identify leading issues to failures or slowdowns and fix them before they become a major problem.

3.4. Cloud Computing

Is the provision of computing services; This includes servers, storage, networking, databases, software, analytics, and data intelligence; Online cloud solutions are becoming increasingly popular with consumers, businesses, and governments; Because they offer lower price and easier access, this helps companies and city governments to control their workforce systems, accelerate innovation, increase efficiency, and reduce costs while helping to protect sensitive personal data. Cloud solutions also allow city employees and residents to securely access information remotely; this is essential in order for government services to continue to ensure optimum performance through a global network of fast, efficient, and secure data centers. (15)

3.5. Automation system

Automation has been adopted as one of the most important features of smart homes. Therefore, this generation was called Automated Buildings. To achieve automation, we must rely on technical equipment such as self-sensing, decision-making, sensors, connections necessary to transmit information and orders in their digital form, and motion control devices. Automation is the development and promotion of physical architectural environments in the direction, support and capabilities of intelligent response to internal and external variables, meeting user desires, reducing energy consumption and improving performance.(7) It is linked to automation, the so-called "virtuality", which is the optimal use of advanced communication technologies, high-speed information network and virtual reality data with the aim of creating cities capable of accommodating services support for remote activities, and integration with society for the information age to replace the virtual environment with its traditional physical counterpart.(1)

4. Smart city systems

Include lighting, heating, ventilation, energy management, fire protection, security and safety systems, where communication technology is flexible. (4)

4.1. Smart lighting inside cities

Solar panels are used on the facades to conserve energy by relying on natural lighting and ventilation, as well as, night cooling to reduce cooling loads during the day and achieve a good insulation system. Photovoltaic cells are conductive silicon and the cells have a standard size of 15.6 x 15.6 cm. (12)

They also use smart glass, which controls the light according to its response to external stimuli. It slowly changes between transparent and opaque glass when flipping the control knob and is controlled by touch, pressing the keyboard, using the phone or the control; which does not require additional power sources and control connections. (2) It provides optimal lighting and thermal comfort in the room as it acts as a barrier to solar radiation, protecting 99% from UV rays. (3)

Photocells do not need electrical installations and are characterized by being soundless and containing no mechanical elements. They are free from pollution, have a long life, don't get damaged and work well even in the presence of clouds or when the weather is cold. In the interior space of the smart building, individuals can control them through the computer or mobile, where the rooms are lit remotely and the appropriate lighting is adjusted while monitoring consumption. (15)

Optical fibers can transmit optical signals over large distances. It also has other uses, such as: safety lighting for emergency exits, corridors, roads, lighting of stairs and lighting of places that pose a danger when exposed to electricity; such as: swimming pools and lighting of shopping centers. It is also possible to use natural lighting in optical fibers, through what is known as the photovoltaic cells system, to the heart of the optical fibers and from them to the inside of the building.

Energy-saving LED bulbs are considered smart technologies, as the control systems adjust the lighting process according to conditions such as occupancy of the place or the availability of daylight, and the lighting can be easily controlled wirelessly via the remote control or An application on your mobile phone whether to turn on the power, dim it or change its color, lighting is installed in all public places and workplaces that people need to go to.

LED technology has been able to improve the condition of many residential cities such as: Palencia, Spain, where the city network was very old and characterized by high operating costs and inefficiencies, in addition to emitting an excessive amount of carbon dioxide. 3139 Luma LED lighting units were installed on the extension of the main roads with a distinctive and clear design, while Selenium LED units were installed in the residential areas, and Villa LED units were added in the old quarters of the city. The luminaires are connected via City Touch control software, allowing the lighting to be controlled remotely by zone, and allowing operators to monitor and manage the overall outdoor lighting system. In Szczecin: 2000 luminaires were controlled through the communication application in the City Touch system and by connecting and controlling individual lighting spaces in this network; the former fixed lighting system was converted into an intelligent system controlled by the operator's computer, reducing Electricity consumption to 50%. (17)

Also, smart designs save a lot of energy, such as the Arab World Institute in Paris; smart systems are represented in the design of windows related to the idea of the Mashrabiya on the southern and northern facades of the same size, which takes into account the possibility of reducing and enlarging its openings to allow the entry of light through mechanical control and related to the intensity of brightness outside the building (17) . Each Mashrabiya contains a series of photovoltaic cells like the lenses of a camera, which open when they receive less light outside and vice versa. In each window there is a photovoltaic central cell arranged geometrically in glass volumes. In some parts of the facade there are only hexagonal and orthogonal drawings like cells moved by wind energy. The building automatically controls the light and reflections inside.

Figure 1 Optical fibers

https://kayf.co/fiber-optic-lighting/

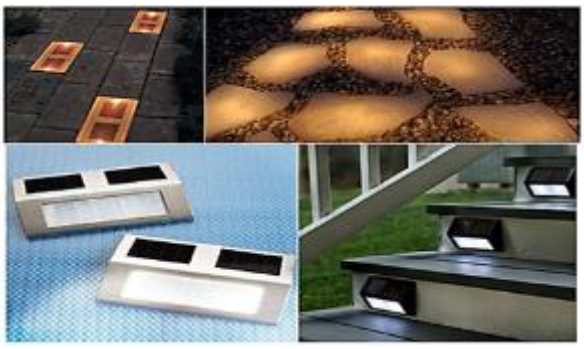

Figure2 LED Lights

https://www.w-dd.net/design_ask/archives/975

Figure 3 City of Palencia

https://www.lighting.philips.com/main/cases/cases/road-and-street/palencia

Figure 4 City of Szczecin

https://www.lighting.philips.com/main/cases/cases/road-and-street/szczecin-city

4.2. Heating, ventilation or cooling systems

Allow the user of the interior space in smart cities to adjust the temperatures according to the degree of user desire and body temperature due to the presence of sensors and the smart design plays a major role in providing ventilation and cooling according to the air temperature. (5) One of the best smart ways to cool buildings from an economic point of view is: The use of “solar ponds” depends on the presence of vast, shallow surfaces, to absorb and store solar energy better than flat solar collectors with a direct absorption system, and at the same time need large tanks to save warm water, and does not work at night, while the solar ponds can absorb energy from them during the night, and they work efficiently during the winter season as well. Sun diffusers that open and close automatically without the need for electrical systems can also be used to protect against sunlight to provide maximum shade during the day. Heat-insulating materials and smart materials are also used to make the place environmentally friendly, and if there is a need to use air conditioning, the heat emitted by air conditioners can be used to heat the water. (13)

4.3. Security and safety systems

These systems provide identification of the city’s residents and visitors through a database by investigating voice, finger, hand, retina and signature. Only the owners of digital codes can enter and the movement of people can be identified through the smart floor reaction - preparing buildings to confront the forces of nature Such as dealing with wind and earthquakes through smart joints that enable the building to move independently and with a separate movement when earthquakes occur, or by smart spider handles that fix the glass to the facade when winds blow - securing city buildings in the event of something happening by connecting to the mobile using the international information network or by connecting to a wired network. (9)

4.4. Transport and Communications

Traffic lights in many smart cities are connected to sensors to reduce traffic and pressure. Open databases allow business owners to adapt based on traffic or pedestrian flow. Self-driving cars can be used. Cars are also charged with electricity as a fuel-saving alternative and as a solution to confronting energy crises, the tendency to produce green hydrogen through electrolysis using machines that analyze water into hydrogen and oxygen, without any other by-products, and hydrogen can be mixed in existing natural gas networks, especially in cities with high population density, by up to 20% without changing the existing infrastructure, to deal with climate change by replacing sustainable green energies instead of fossil fuels, which are a major source of emissions leading to global warming.

4.5. Disposal of waste and garbage

Smart cities lean towards not using plastic bags or recycling through the processes of waste management facilities, having digital tracking of waste receptacles, telling the garbage carrier when the can is full, and waste can be converted into energy through a process called "gasification" that is known as one of the most environmentally friendly means of converting waste into energy. An example of this is the smart systems in the "Bee'ah" building in Sharjah: the

launch of the "cleaning" fleet equipped with an environmentally friendly smart system by adding some new electric vehicles, as well as smart waste containers equipped with wireless internet. (12)

4.6. Water saving

Smart cities rely on rainwater recycling, sewage treatment, gray water recycling, and purification; for use in irrigating gardens and green areas. High technologies can also be used in bathrooms, public places and inside homes. Automated, self-cleaning toilets with antimicrobial seats and automatic hydraulically actuated ejection boxes with beam light when leaving the seat, motion sensors when the toilet lid is raised and lowered, and eco-friendly digital faucets; and advantages are: reducing water consumption, digital temperature control settings, and infrared pressure technology that turns off when the hand is not under the tap.

4.7. Fire protection systems

They work with smoke detectors and sensors that open windows automatically. Alarms are also set off and recycled and stored water sprinklers are automatically fired for this purpose, which limits the losses that the city may be exposed to. (12)

4.8. Smart materials used in the construction of cities

To mention some of them: Smart bricks: are a smart building system that supports itself, in the form of concrete molds that can be overlapped between them and do not need cement. Self-Healing Concrete is technology that's based on bacteria or microorganisms that produce limestone when mixed during concrete production. Concrete structures become more durable with the ability to independently repair crack formations. Graphitene of Nano-materials: is used in construction by mixing it with concrete or coating steel structures, thus extending the life of the building. Air gel: insulates buildings thermally to protect against severe shocks, fires or acoustics. Smart dust particles: are operated by microcontrollers, which consist of small sensors to record different types of data, which is stored in memory to be sent to the main control stations. It is used in heating and cooling to measure light, acceleration, position, stress, pressure, humidity, sound and vibration, and it is disadvantaged by the possibility of spying companies and also very expensive. Smart Cement: repairs cracks inside cement without the need for human intervention by adding a plastic concrete material that acts as a cover for cement, and leads to a decrease in the quantities of carbon dioxide. Plastics: considered one of the smart, environmentally friendly materials used in construction due to their diversity and different shapes, colors and functions to suit different environments. Shape Memory Alloys (SMAs): are used to make highways and bridges more resistant, especially in earthquake-prone areas and heritage structures. Polycarbonate: is used in buildings externally as roofs for swimming pools (sky light) and in covering trusses .And to make geometric formations, such as forming a pyramid in an outdoor courtyard, in covering doors and fences, or as coverings for lanterns and lighting equipment, and used as an insulator in electrical panels. Polyurethane (Polyurethane and Styrene): is used in the insulation of ceilings and internal and external walls. It is a multi-layered and easy-to-implement cladding. It is characterized by low cost, light weight, strength, sustainability, dimensional stability and resistance to various influences.

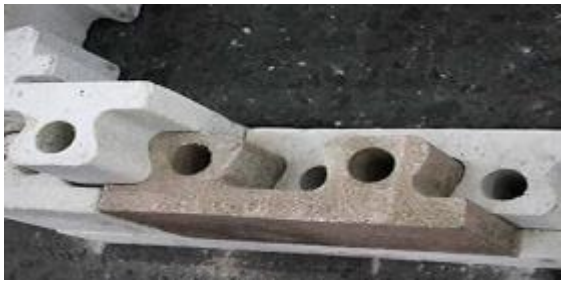

Figure5 Smart bricks

https://www.emmarsyria.com/post/1927

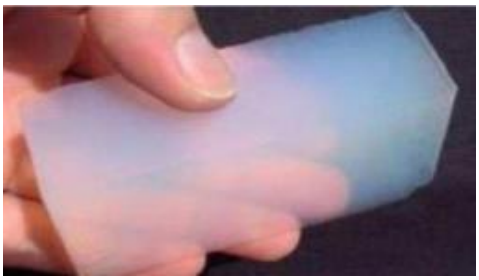

Figure 6 Aerogel

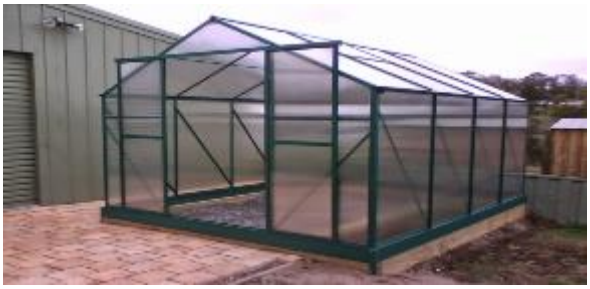

Figure7 Polycarbonate

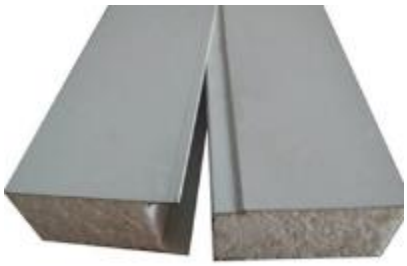

Figure 8 Polyurethane

5. How to connect to a smart home within a smart city

Everything in the smart home works by communicating with other systems such as the motion sensitivity system, breaking glass and bird sensors that work with each other by communicating with systems. Comprehensive control starts with: protection systems (movement: sound, breaking glass, printing, gas leakage, surveillance cameras, and IR networks to penetrate the fences represented by storage). Lighting system and lighting degrees, house control schemes, and audio-visual system. Air conditioning and temperature control system (thermostats) to energy conservation. Building automation systems and local networks to communicate business management information and as decision support aids through connection to the central computer. Telecommunication: Rapid communication with the outside world by computers, optical fibers, microwaves, and satellite links.

Any internal space can be controlled by: :Internet of Things: To connect things with each other in order to exchange or retrieve data, and these devices must operate in a way that saves electrical energy; Because it is efficient around the clock. Bluetooth: Bluetooth version 5.0 allows greater coverage, higher speed, and greater data transfer volume in an energy-saving mode known as Bluetooth Low Energy. Bluetooth technology starting from version 5.1 provides better positioning capabilities. Gateway: act as the control center of the smart home; where the network devices in the home are connected via a router and an internet connection, the gate is usually referred to by different names such as Bridge, Hub, or simply the control center. The EEBUS initiative includes an open standard for devices and systems through which the efficient use of energy and communication between devices and systems is independent of the companies that produce them - multi-room to play music wirelessly and synchronously in different rooms in the smart home, and all network speakers or audio devices are controlled by WLAN wireless.

Sensors with actuators Equipment elements for retrieving data such as temperatures or motions for command execution KNX standard Data bus system with programmable switches ZigBee and Z-Wave standards These wireless standards are energy efficient and operate within a limited range similar to Bluetooth technology, smart bulbs are considered or wireless electrical sockets are among the examples of the uses of this technology - if it is required to transmit larger amounts of data, such as images of surveillance cameras or large household appliances such as smart refrigerators, in this case the wireless WLAN or LAN network is relied on through cables.

Bill Gates' house is considered a successful application of informational smart homes, which he described in his book "The Road Ahead" based on changes in decisions, as he explained when he formed an engineering drawing in the age of digital. And he allowed the publication of an interior picture in his home, specifically in the outdoor nature. There is a plant tree by the timeline created by the timeline created in those large spaces. And to keep the salmon and trout special, I also have their own underwater sonic. The storage space in the home appears to be used by Xanadu 2.0, thanks to the 3,900-square-foot home-purchased space, and inside the bottom. It is under water and listens to music, and room temperature and temperature, inside rooms, temperature degree and the appropriate degree a good picture to control the security of those large places in time to know the weight.

Figure 9 devices to connect home

6. Smart Cities and Sustainability

Sustainability is finding urban cities that are able to assume their environmental responsibility and achieve the principles and concepts of preserving the environment by relying on renewable energy sources that do not pollute the environment.

Smart architecture is one of the disciplines of sustainable architecture, but it is characterized by its exploitation of external and internal variables and the reformulation of spatial conditions and can be controlled by self-means or remote control devices by employing computer technologies, means of communication and knowledge in integrating building systems to rationalize use and energy. For (self-operating) design, for example, conserving water inside the building is of great importance, as it is used for drinking, bathing, cooking food, watering gardens, beautifying the building and hydrating it through fountains, water basins and waterfalls. A quantity of water is lost during the water journey in the pipes from the purification plant until it reaches the inside of the building, especially in the event of pipe damage and water leakage from them. Here comes the role of smart architecture in using technology, environmentally friendly digital taps and infrared radiation as a great way to maintain and reduce water consumption and digital temperature control settings. (6)

The existence of smart cities and the use of smart buildings and homes is not only for the sake of luxury and comfort, but it is also a distinctive and effective way to reduce your expenses and the costs of your monthly spending on several issues, including the expenses of electricity, water and fuel, as by smart sensors, all machines connected to energy sources stop as soon as the user leaves the house or as soon as it senses that there is no need It has a good weather, so you turn off the heater, the radiator, or the sun rises, so you turn off the light or reduce its intensity, and other similar matters. Of course, this has another benefit, which is to make the lifestyle more environmentally friendly. However, there are challenges facing smart cities Challenge:

First challenge: Major urban areas face challenges in replacing aging infrastructure, such as underground wires, steam pipes, and transportation tunnels, as well as installing high-speed internet. Wireless broadband service is increasing, but there are still areas in major cities where access to it is limited.

Second challenge: As the use of IOT technologies and sensors expands, the threat level for security also expands. This begs the question... Is technology really considered "smart" if hackers can break into it and lock down an entire city?

Third challenge: Privacy Concerns. In any large city, there is a balance between quality of life and privacy violations. Cameras installed on every street corner may help deter crime, but they can also instill fear in law-abiding citizens.

Fourth challenge: Intelligent transportation software that provides passengers with real-time updates is a great idea for a bustling city. But what about the growing elderly population that doesn't use mobile devices or apps? How will smart technology reach and benefit from these groups of people? It is critical that smart city planning includes consideration of all groups of people, technology should always bring people together, rather than dividing them further on the basis of income or education levels.

7. Architectural trends shared with smart cities

Smart cities are closely related to other architectural concepts in order to achieve the highest degree of sustainability standards, including green architecture and climate architecture.

7.1. The relation between smart cities and green architecture

Green architecture is a holistic concept closely related to smart, environmentally friendly cities, to achieve sustainability, less energy and water must be consumed by relying on renewable and natural sources of energy that do not pollute the environment; such as the use of solar cells and panels, which produce electricity directly from sunlight; using wind, waves and waterfalls, and adapt to the climate using designs that take into account the environment with the use of available technology to improve the health and productivity of residents, as this type of construction provides thermal comfort and has a positive impact on production. The health of users and residents due to the use of components of green architecture building products and less toxic materials such as: bricks, hemp, straw, wood fibers, sheep's wool, cellulose filler. Resource and building leftovers can also be recycled. For example, straw bales plastered buildings in Nebraska gained the interest of construction workers in the early 1990s, so using straw was a clever job because it was easy to use and heat-insulated. Empty bottles were also used in Masonry as an alternative to bricks in wall construction; silicon was used as an adhesive for stacking bottles. (10)

The World Trade Center in Bahrain is a successful model in extracting energy through wind turbines to provide clean energy, and the building is designed as two connected buildings with a height of 240 meters, and includes three giant windmills to generate electricity using wind energy, regardless of wind direction and climatic conditions. The wind

turbines provide 11 %: 15% of the total energy consumption in the two towers or approximately 1.1: 1.3 GW per year and this is equivalent to providing lighting for about 300 homes. (19)

The Edge building in the Netherlands is the smartest green office space on the planet where an employee automatically connects to the application to check their own schedule, find a parking space, and help find an available office to work on, because in The Edge there is no private office at any people. One of the standout features of this building are the ultra-efficient LED panels that require very little electricity and operate using the same cables that carry data to the Internet. As the central panels monitor everything in the building, it is also equipped with an extensive network of two different types of pipes, one carrying data (internet cables) and the other carrying water, and behind each ceiling panel there are huge coils of thin blue pipes that provide water for heating and cooling purposes. During the summer months, the warm water is pumped to a tank located 400 feet under the building, and remains there insulated until winter comes to be re-absorbed for use for heating purposes, and the system in "The Edge" is the most efficient thermal energy storage in the world. The southern wall of the building is a wafer of solar panels and windows that help regulate heat and reduce the need for shade despite direct exposure to the sun, and use about 70% less energy than any similar building. There are sensors in each solar panel that provide detailed reports on temperature and humidity. Robots go out at night on patrols to guard the building, and if the alarm is triggered, the automatic device equipped with a camera quickly identifies the culprit, which allows the security staff to check whether it is a false alarm or not. For a more efficient cleaning process, the sensors on the ceilings are sent Photovoltaic at the end of each day provide data on the areas that have seen the most movement, so that cleaners with the help of the cleaning robots focus on those areas. (20)

Figure 10 The Edge building

https://igsmag.com/features/case-studies/the-edge-amsterdam-breeam-supreme/

Figure 11 Robots

https://www.bloomberg.com/features/2015-the-edge-the-worlds-greenest-building/

7.2. The relationship between smart cities and climate architecture:

Bioclimatic architecture: It studies the relationship of architectural design and construction to climatic factors. It has introduced new construction methods that helped in the development of architectural formation and design, which led to the possibility of using glass surfaces in openings or cladding the facades of the entire building with glass while controlling the temperature of the interior space using air conditioners.(5)

The smart design is the one that achieves continuous efficiency in the relationships between the spaces used, such as movement paths, building formation, wind direction, solar radiation, mechanical systems and building technology and environment to conserve resources and building performance to provide thermal performance within the space. Therefore, it has become necessary to find appropriate smart solutions for any building in any climatic region, especially for hot regions. These solutions include: full control of all air conditioning and heating devices in the house at any time or from anywhere, inside or outside the house. Before arriving at the house to create the appropriate climate on demand, so that it will be cold when receiving the individual on hot summer days, or the floor heating systems can be operated in advance to raise the temperature of the house in proportion to the user's desire on cold winter nights by pressing the appropriate button, it will appear on the device screen (Map Thermal) any graph that accurately shows the temperature of each section of the house. Of course, the appropriate temperature can be modified or set so that the system will automatically maintain it later. (13)

The use of mechanical systems such as cooling and heating systems and the use of technology in building load-bearing walls in the hot dry desert region.

- Improving the use of insulation materials for walls by using modern and advanced insulation materials such as: polyurethane, polystyrene or glass wool, cork, felt, and ventilation insulation methods such as shading systems and methods over openings.

The use of reflective glass for solar radiation to protect against the hot climate, as well as to purify the air passing through the window opening from dust before it enters the building space. (10)

- For roofs: Designing curved or broken roofs for the building to increase the amount of shade falling on the building itself and covering the upper surface of the roof with a material that reflects the sun's rays.

Building the roof from two tiles completely separated from each other to leave a space for the free movement of air, where the upper slab acts as a canopy that protects the main roof or the lower slab from sunlight, with the air layer confined between them acting as thermal insulation.

The use of a heat-insulating material placed directly over the concrete slab. It is also possible to plant roofs and use automatic sprinklers to reduce the temperature of the ceilings. (8)

As for the walls: The building is painted with a material that reflects the sun if the building is self-contained, i.e. away from adjacent buildings. It is preferable to use coarse white "splashes", making protrusions in the facade to increase the shade on the surface of the facade and make the wall thick or double.

The use of sun breakers: They are wide panels of different shapes, including "horizontal, vertical and compound", as well as fixed and mobile. It is preferable to use mobile breakers made of light materials that do not retain heat. It is also preferable to leave a small space between the breakers and the interface to reduce heat transfer. (11)

7.3. Example for smart cities and green architecture

Among the most important cities that represent a successful application of smart cities based on sustainability: "Masdar City" in Abu Dhabi, which is characterized by the fact that it derives the necessary energy completely from a solar power plant, which is the largest of its kind in the Middle East, with a production capacity of 10 megawatts and extending over an area of 22 hectares. In this city, the power plant using photovoltaic panels produces about 17,500 megawatt-hours of clean energy annually, in addition to its contribution to avoiding the release of 15,000 tons of carbon emissions annually. In its solar power projects, Masdar uses three types of solar panels that are the most commercially viable: monocrystalline silicon panels, polycrystalline silicon panels, and polycrystalline silicon panels. The plant consists of 87,780 thin-film solar panels and crystalline silicon cells.

Concentrating solar power systems use lenses or mirrors to focus a large spot of sunlight or solar thermal energy over a small area. The focused light is then converted into heat that drives a heat engine connected to a power generator to generate electricity. These systems are considered promising technologies that can be employed to generate electricity in large quantities. Equipping CSP plants with technologies to store thermal energy will allow stable electricity generation (base load) over 24 hours, making it eligible to be connected to the main electricity grid. Masdar uses several types of CSP systems. For example, the 100MW Shams 1 plant includes a system of parabolic reflectors, which are solar thermal collectors that incorporate parabolic mirrors with a central tube to focus the heat of the sun's rays directly. The heat, in turn, produces steam to drive conventional turbines and ultimately generate electricity. On the other hand, the 20MW Gema Solar plant, developed by Masdar, uses a central tower consisting of a heliostat to focus sunlight on a central receiver within the tower that stores heat in molten salt. This heating process generates the steam needed to operate the turbine. At the time of its inauguration, the Gema Solar plant was the first solar energy project at the utility level in the world in which the solar energy receiving system in the central tower is combined with heat storage technology using molten salt, which enables the plant to generate electricity continuously.

Biological waste is used to obtain organic fertilizers, while some of this waste is converted, by incineration, into an additional source of energy. As for industrial waste, such as plastic, it is recycled or reused for other purposes.

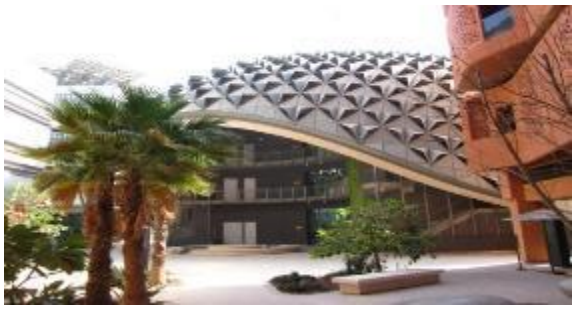

Figure 12 Masdar City

Figure 13 Solar Panels

8. Results

The concept of smart cities is important, especially for developed countries and countries wishing to develop in providing the use of electricity by relying on renewable energy sources, achieving concepts of sustainable development, and moving towards green architecture that is environmentally friendly.

Smart cities help rationalize energy consumption, recycle solid waste, reduce carbon emissions, contribute to user comfort and well-being, and maintain human health and safety.

Architectural intelligence is not limited to technology only, but smart design includes the employment of all other architectural concepts and environmental resources so that the human, architectural and technical element is integrated and the smart city becomes sustainable, healthy, safe and environmentally friendly.

9. Recommendations

The capabilities of artificial intelligence must be understood to develop the design process for smart cities. Successful experiences that employed digital and information technology must be circulated in many cities for the convenience and well-being of the user, and in order to increase production, save energy and rationalize electricity consumption. The designer must be informed of the latest technologies in order to improve opportunities for creativity and development. Connecting the design to the computer, simulating the building and the veiled buildings with materials and colors, which ensures your design in an imaginary and virtual form on the ground.

The need to focus scientific research on making comprehensive studies of smart homes and knowing the extent of their impact on different aspects of family life. The need to employ computer technologies and means of communication. Different types of building systems to coordinate between building systems in smart cities to solve many of the problems that were facing the traditional housing.

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