



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 12, December 2021

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.569

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com



The Role of Environmental Simulation Programs in Design of Urban Space Coverage (A Case Study of Magdy Yaqoub Square Yard in Aswan Governorate)

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ABSTRACT:Urban space that a person perceives with all his senses influences his behavior and regulates his actions. This research aims to deal with the use of simulation through a computer program to design urban coverings in the urban space to achieve thermal comfort for the user and will be applied to the city of Aswan in southern Egypt to reach the proposed final design for urban coverage applied in Magdy Yaqoub square yard in Aswan.

KEYWORDS:Urban space coverage–Computer Applications In urban design– Ladybug &Honeybee –shadow benefits analysis– radiation analysis.

I. INTRODUCTION

The effect of the temperature of cities is most evident in the urban open spaces in Egypt (UHI), where the effect of warming can be more pronounced in urban climate areas than in rural areas as a result of human activities, building materials, reduced vegetation cover, and urban coverage, and this presents a special challenge for urban planners in the face of a very hot climate. Climate change, High temperatures, and direct exposure to solar radiation for long periods will lead to uncomfortable urban space (1). Therefore, there was a need to use a tool to measure the thermal performance in the urban space using the urban coverage of the urban space; to try to find practical solutions based on science; to beat rising temperatures, help local governments and development makers. Not only will the tool provide scenario analysis; to better handle the heat, it will relieve urban fatigue, improve outdoor, thermal, and physiological comfort, protect users from high temperatures and direct radiation and provide greater shades. There was a need to use a tool to measure thermal performance in the urban space to find solutions based on a scientific basis; to overcome high temperatures and unpleasant winds; to help local governments and development makers. The use of computer simulations will provide better heat treatment, and modify future urban policies, development assessment, and planning practices related to mitigating urban exhaustion, improving outdoor air, thermal comfort, and protecting the health of the vulnerable so Simulations can be designed; To match the local climate in different regions in different cities, providing a tool to support decision-making; To bridge the gap between urban climate research and the practical application of heat reduction strategies in public spaces.

II. RELATED WORK

-The importance of using computer programs in environmental design: The last decades have witnessed a growing interest in environmental standards as one of the basic standards contributing to improving the quality of life. The environmental design process aims to find an integrated system for design that includes the integration of a set of standards in product design. These standards include “functional, structural, economic, and aesthetic standards.”

Environmental design using computers is a direct application of the principles of design technology in general. It also helped in adopting many climatic design decisions with minimal effort in mathematical calculations. Which led to



facilitating the climate design process, which is used in the early stages of architectural and urban design. . Table (1) shows a comparison between climatic design using the usual methods, and what computer-aided work can become(2).

Computer-aided climate design study	The study of climatic design in the traditional way
A-Climate data: Climatic data can be obtained on CD-ROM, in standard form (TMY), or through an information network. The programs include updated climate data for most major cities.	A-Climate data: Obtaining climate data from the nearest meteorological station (meteorological authority headquarters) in an official way, The required data rarely appears in the form of climatic or architectural design.
b- Determining solar radiation according to quantity and quality: Solar path determination programs calculate the angle of elevation and direction of the sun at any moment in any part of the world as soon as it is determined.The path of the solar movement and the shape of the shadows can also be drawn, and the solar energy falling on any surface is calculated in the form of pictures, tables, printed drawings, or digital files that design programs can read.	b- Determining solar radiation according to quantity and quality: This is done using the sun’s movement maps found in climate design books, where the nearest solar map latitude is chosen in those books, and some graphs and tables are used to determine the falling solar radiation from all directions.
C- Analyze climatic data: Computer programs analyze climatic conditions and their suitability for humans as they deal with 6 variables (temperature - humidity - solar and thermal radiation - wind movement - human activity and type of clothing), which is difficult to deal with on paper, but easy to analyze and deal with through the computer.	C- Analyze climatic data: Climatic data in its current form is not useful for climatic design in Egypt; Therefore, it must be analyzed to reach its thermal performance and provide thermal comfort to humans. Biological maps are now used in a simplified way, and some maps deal with two variables, namely temperature, and humidity, and there are complex maps that deal comprehensively with the rest of the maps, where 60 panels are placed on top of each other to reach the climatic assessment, which reduces the accuracy of the process.
D- Deduce the modified climatic conditions as a result of the location parameters: The programs calculate the impact of the surrounding buildings on the climate on the site with higher accuracy, and deduce the amount of solar radiation falling on the site so that its impact on the design of the building or urban assembly can be calculated.	D- Deduce the modified climatic conditions as a result of the location parameters: Modifying the climatic conditions based on the local determinants of the site is very important before starting the climatic design, which is done through maps of the sun and wind paths, where all buildings are signed with a stylographic projection to determine the characteristics of sun exposure on the site and wind speed in the presence of buildings and trees on the site
Y-stage to propose solutions: There is a huge and well-categorized database of climate treatments that provides a set of solutions that are theoretically suitable for the proposed location and based on their selection by digital representation, we determine the best of them.	Y-stage to propose solutions: The designer proposes solutions based on his experience, and this can be done by using Mahoney's table to suggest solutions, and there is no practical way to test the validity of the proposal.
Q - Representing solutions: All data, aspects and visual variables are calculated to reach an optimal solution.	Q - Representing solutions: The representation is done using drawings or geometry that does not reflect the thermal properties.
N-stages of solution evaluation: The evaluation is carried out using the digital program representation, which gives accurate quantitative values, and enables us to compare between the different alternatives and choose the optimal one.	N-stages of solution evaluation: It is difficult to evaluate any proposed tool, and evaluation is sometimes done using a model placed in an air tunnel, which is a difficult and expensive process.

From the foregoing, we conclude that digital design programs represent part of the programs that are used in climate design, but not all of them, and the idea of climate design using computers is not applied to the fullest now, despite the presence of dozens of programs to represent the thermal behavior of architectural or urban space.



III. METHODOLOGY

Research methodology sequence: The importance of using a computer in environmental design is recognized, The most important goal of choosing the honeybee and ladybug digital simulation program is to reach the thermal performance assessment system for the urban covers in the covered urban space in southern Egypt to provide comfort in the covered urban space for users.

-Computer programs used in environmental design: Many programs have been used for environmental design and take into account the climatic factors on the site, some of them have been continuously developed, and some have been discontinued and more advanced programs have been used than them, and some of them have introduced many PLUGINS; to improve and develop its performance, Table (2) shows computer programs that used to make a comparison between climatic design used in environmental design: -

Program name	input	output	Processes and Environmental use in urban space
Climate Consult (3)	Climatic information for the site to be designed	Main site analytics -2D and 3D design guidelines -Thermal comfort map of the site	Processes: Integrating the three-dimensional shape of the site with the informational map to make a heat map of the site to be studied, Environmental use in urban space: Making thermal comfort maps for the site
Autodesk ECOTECH Analysis (4)	Making a primitive simulation of the building in the current situation	Direct analytical results of the building model-It targets the initial stages of design	Processes:Making 3D blocks is similar to the current situation with the introduction of the initial climatic information on the blocks to make the study, Environmental use in urban space: it needs complementary programs to carry out the required studies.
Grasshopper -Rhino (5)	It uses a set of components (components) as the base form; To execute the commands, and through these components, we use (Rhino Script-Basic Rhino) commands; To execute commands, they are linked as modular commands through cables	- To create a specific geometric shape called Generative algorithms and combine those components as it contains many Plugins that support linking (GH) with other programs that represent Excel	Processes: Create a specific geometric shape and any output shape that can be modified through Definition. It is also the key that controls the parameters in the simulation model, such as the size of the holes and changes them through the simulation process automatically, Environmental use in urban space: Create a specific geometric shape and any output shape that can be modified through Definition. It is also the key that controls the parameters in the simulation model, such as the size of the holes and changes them through the simulation process automatically
Diva (6)	DIVA-for-Rhino allows users to perform a series of environmental performance assessments for individual buildings, urban landscapes including radiation maps, realism displays, and based	Create solar exposure displays, calculate voltage, and explore pseudo-dynamic color maps in the CAD viewport. Create photo-realistic, pseudo-illumination color maps, and lighting contour overlays	Processes: DIVA's radiation map tools allow simulations on an annual, seasonal or one-time basis to have complete control over simulation speed and quality, Environmental use in urban space: One of the best applications on Rhino, but the most complex to use.



	daylight meters		
ANSYS FLUED (7)	Location information, temperature, humidity and heat content, wind data and solar radiation data, building heights at the site	CAD drawings that express road widths and building heights, in addition to colors that express wind paths and atmospheric pressure on buildings	Processes: Providing a wide range of turbulence models to accurately and efficiently capture the effects of turbulence, Environmental use in urban space: Reduces the time used in making dynamic analyzes that are used in environmental design
Honeybee & ladybug (7)	Location information, temperature, humidity and enthalpy, wind data, and solar radiation data	To help designers create an environmentally-conscious architectural design that also has urban uses.- It provides a variety of interactive 3D graphics/metrics, including sun path, wind movement, radiation incidence, radiation analysis, shadow studies, and display analysis	Processes: Performs dynamic modeling of climate inputs; To make it more relevant to the design phase of the space to be studied, Environmental use in urban space: It is one of the most comprehensive applications of environmental design requirements currently in place.

From the previous, we conclude:

- ✘ Some programs are incomplete due to the lack of periodic program updates. Their role is limited to making the first steps in the climatic analysis of the vacuum, then other programs are used.
- ✘ Programs that are periodically updated, such as the additions of the Rhino program, can more accurately measure all the most sensitive climatic variables in affecting thermal performance, so urbanists and architects prefer to use them.
- ✘ Updates of some additions to Rhino - as the best program capable of modeling models that are directly related to the environment – enable us to measure the thermal performance of the urban space, as well as the thermal loads on the roofs of the buildings inside, which enables the designer to make energy-saving systems and reduce harmful emissions For some gases, such as carbon dioxide to reduce the inflation of global warming.
- ✘ There are some complications in the steps of some programs such as Diva, but it is one of the most powerful additions that were introduced to the programs, which were used to measure thermal performance inside the Space.
- ✘ In this paper honeybee and ladybug will be used because of the ease of handling their inputs and their ability to further measure the thermal performance of the urban space.

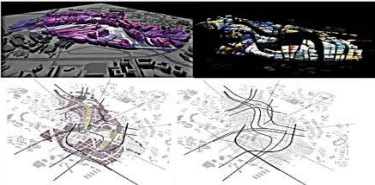


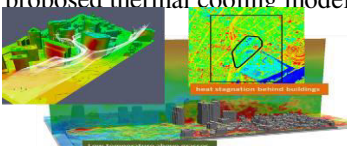
-Reasons for choosing honeybee and ladybug for environmental measurements in the research: There are many reasons why honeybee and ladybug plugins were chosen to perform environmental measurements on Grasshopper.

- A form of additions that support the modeling of the local climate and its integration with the elements of the space from surrounding buildings or rock blocks.
- The ability of the program to read the approved climatic data (one of the important meteorological criteria that balance human energy and human thermal comfort) for the vacuum of temperatures and solar radiation, which leads to accurate measurement results, not based on assumptions, but on the approved readings of the urban space.
- It can measure MRT Mean Radiant Temperature, which is the balance of human energy and thermal comfort. It is defined as “a uniform temperature of an imaginary container at which the transfer of radiant heat from the human body is equal to the transfer of radiant heat in the actual envelope, which is a better measure than air temperature or apparent temperature; for analyzing the effect of climate on people’s health. It is the basis of many indicators of External comfort.



- In the past three years, several practice-oriented tools have been developed (10) and refined to include MRT modeling - Ladybug 0.0.69 and Honeybee 0.0.66-
- The long-wave solar radiation (11) can be simulated based on the surface temperatures received from energy plus, which leads to the most accurate approximate predictions of the measurements used in the simulation.
- Offers a variety of designer-friendly 2D and 3D interactive graphics; To support decision-making during the early stages of design (12), it also allows users to work with certified power and daylight engines such as EnergyPlus, Radiance, and Days. Integration with the Grasshopper's parametric tools allows for nearly instant feedback on design modifications, and since it runs in the design environment, the information and analysis are interactive.

-Computer applications and parametric design at the urban level: There are many applications for the use of simulation programs in urban environmental design. **As Avans and Sutherland definition of digital simulation:** (13) It is a real operating model or proposed system for an environmental process, in which modern communication networks are used; To reach this virtual world, given the features and characteristics offered by these media, it enables us to cross many boundaries of age groups, academic disciplines, professions, geographical locations, as well as cultural, religious, social and economic. The following is a table (3) shows some of the projects that used computer simulation for the environmental urban space

Project name	The outline layout of One North	Eleftheria Square Project	Project to benefit from wind movement
input	<p>One North is in Singapore designed by Zaha Haded 2001:2019 Use the fluid dynamics calculations; To determine the paths of the streets away from the torrents - the angles of the sun's rays and the temperature in the urban space</p> 	<p>Eleftheria Square Project is in Nicosia, Cyprus, designed by Zaha Haded 2005:2021. Thermal loads on the covering surface- The percentage of shade on the floor -Temperature in urban space</p> 	<p>Project to benefit from wind movement in Singapore central business ,2018, Use of fluid dynamics calculations- Use of wind path maps</p> 
output	<p>Determining a network of smooth roads far from the floods' exits- Determine street performances</p>	<p>Determine the appropriate coverage form for the void Determine the type of processing; To reduce the heat load on the surface</p>	<p>Determine the paths of the favorable winds -Determining the thermal loads on the buildings to be tested in a proposed thermal cooling model</p> 

-The front Yard of Magdy Yaqoub Square in Aswan Governorate, southern Egypt (case study):

The public yard of Magdy Yacoub Square was chosen, as the field is one of the most important fields of the capital of African youth (Aswan), the field was previously called Tayaran Square, the field is located first Sheikha, Aswan Department, Aswan Governorate, the field was used in major celebrations such as the October victory celebrations on 10- 10 2020 After the development work that took place in the field, the field is lively and has heavy traffic; Due to its location near the Aswan Court of First Instance in the northeast, and the Nile from the west, it is located at the intersections of Nile Corniche Street.

Magdi Yaqoub Square yard in Aswan was chosen for the simulation process, according to several criteria, the most important of which are:

- The yard is located in a hot climate zone, which experiences high temperatures during the day and needs to provide shade; To address the effects of direct radiation on floors and users
- The chosen site expresses a distinctive public square - the third chapter classification of the covered urban spaces - having social or economic importance and crowded during the day.
- The maximum height surrounding it does not exceed 20 m. Therefore, two cases can be tried: the first is a coverage that does not cover the buildings, and the second is 20 m or more in height to cover the buildings or parts of them. The following fig. (1) shows Magdi Yacoub Square yard in Aswan (Case study).



Fig (1) The location of the front yard of Magdi Yacoub Square in Aswan for Egypt and the surrounding buildings

IV. EXPERIMENTAL RESULTS

- The applied methodology of using honeybee & ladybug in the design of urban space coverage in Aswan city:

The methodology used in this part of research presents the variables and settings of the simulation process, with a mention of the main inputs and outputs, in addition to documenting the stages of the simulation process, identifying the variables and measures for each stage, including analyzing and evaluating the results for each stage separately; To reach the goal, which is to formulate a list for making urban coverages after measuring their thermal performance, and then to put forward the final list after the primitive one as an approach for a thermal assessment method for the urban space in southern Egypt.

- Analytical study of the plaza surrounding Magdi Yacoub Square yard in Aswan: The simulation of comfort, heat, shadows, and radiation was tested on The front yard of Magdi Yacoub Square, located in Aswan Governorate, after adding urban coverage to it to find out the optimal alternative.

- The constants of the simulation process: The simulation process is carried out in three stages (The first stage is to choose the optimal alternative - the second stage is to cover parts of the surrounding buildings - the third stage is the additions to improve the thermal performance of the coverage), the shape - the color - the construction method - the inclinations of the surfaces of each coverage form will be fixed, the height change - the ratio of the openings - the area of the space covered under the coverage will be controlled In the second stage, in the third stage of the simulation, it will be added electromechanical additive element; To improve the thermal performance of the covering.

- The maximum height of the yard does not exceed 20 m
- The yard used in public celebrations in the city
- The usage of space during the day and the need to provide shades in it; to address the effects of direct radiation on floors and users

This part documents the simulation model “software definitions” through basic stages, and is divided into four sections, during which it includes the most important processes through which the spaces selected for research can be simulated and the thermal effect measured from temperatures and solar radiation in the spaces.

The first stage: The Model Geometry- The second stage: conducting the thermal simulation process for the chosen space and integrating the model with it - The third stage: the documentation form - Fourth stage: Evaluation Model

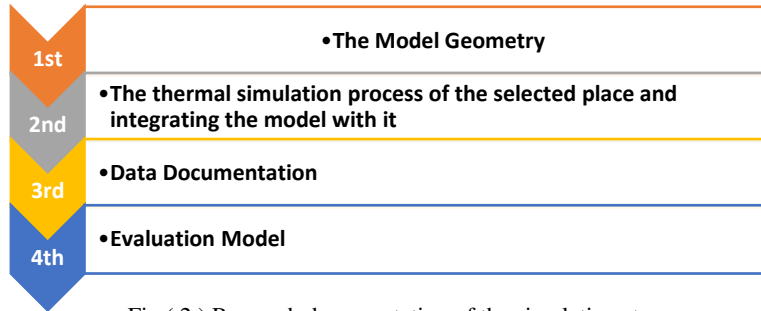


Fig (2) Research documentation of the simulation stage

-Standards for designing an urban space coverage: Three alternatives were made to design the coverages according to formal bases (domes as a part of the environmental treatments recognized in the heritage of southern Egypt as shown in fig 3) and the foundations of construction methods where the tree structure system. The design was inspired by the shape of the domes inspired by the ancient coverings of heritage spaces.

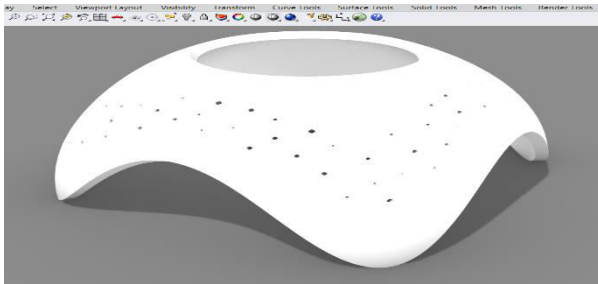


Fig (3) The design of the first alternative

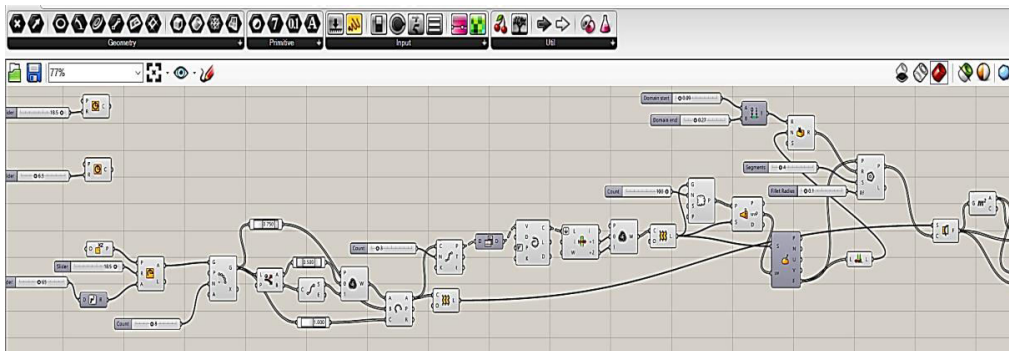


Fig (4) Script steps for the first alternative on grasshopper

A design was made for one of the models according to the construction method, where the tree structure system was used - as shown in fig 5 - to identify fulcrums that do not conflict with the traffic of cars and pedestrians under the coverage

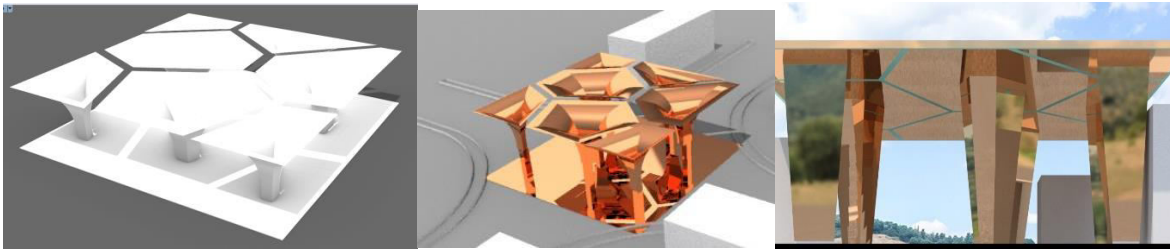


Fig (5) second alternative design

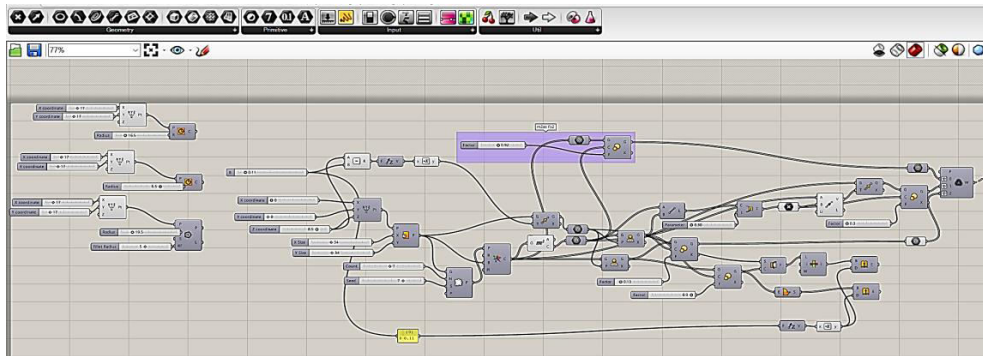


Fig (6) Script steps for the second alternative on grasshopper

One of the covers was also made with a tree structure system as one unit, with a large height in the middle, with the correction of the diameter of the support bearing the cover according to its height and several branches with different interstitial openings, the thickness and number of each of which is controlled.

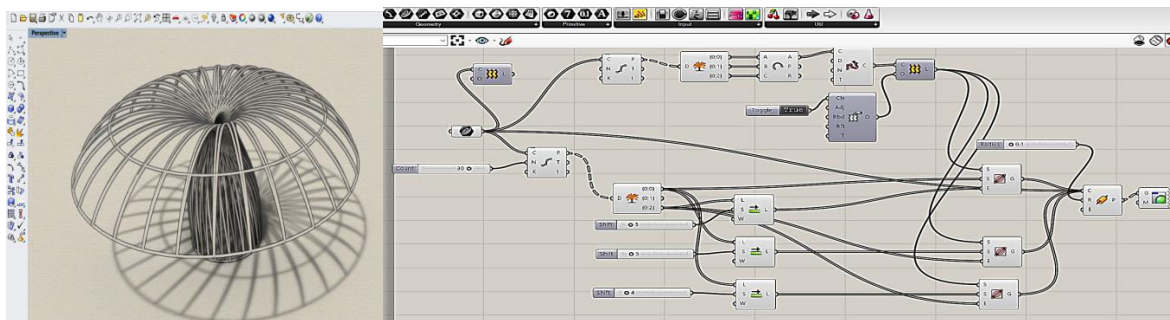


Fig (7)The third alternative design

Fig (8) Script steps for the 3rd alternative on grasshopper

- Thermal simulation measures of the urban space coverage: It includes a set of different metrics used to measure comfort indicators in the urban covered space as a result of changing the form of coverage and assessment elements as it includes setting the simulation engine; To perform a natural simulation of thermal comfort in the urban space, where the following are measured:

- Shade places according to the hours of radiation and the form of coverage.
- Measurement of thermal comfort in the urban space (temperature - humidity - the rate of thermal comfort in the urban space) according to the coverage status in each case.
- Measurements of solar radiation and its impact on the form of coverage in the urban space.

The data that needs to be entered to complete the simulation process is also prepared - the location and the weather file in EPW format for the urban space to be covered), to measure the impact of the thermal performance of the urban space



by the presence of treatment for its roof – urban coverage – and work is being done to add variables to the designed coverage; To provide types of comfort in the covered urban space according to the elements of coverage assessment - (coverage height –the percentage of openings - form of coverage - structural system - angles of inclination of roofs).

This previous data is transmitted through communication channels to the simulation engine and the basic components; To activate this simulation are ladybug sun path & ladybug sunlight analysis hours - ladybug radiation analysis - ladybug select sky MTX -& ladybug outdoor comfort calculator ladybug outdoor solar temperature adjustor - ladybug comfort shade benefit evaluator.

The ladybug and honeybee component used is ladybug version 0.0.69 & honeybee 0.0.66, and it requires an input set up in the previous stage; To run the simulation (engineering construction - simulation variables from within the design).

-Thermal simulation measures for a covered spaces: It includes a set of different scales used in measuring comfort indicators in the covered urban space as results of changing the form of coverage and its evaluation elements

- ladybug sunlight analysis hours scale:

It is an indicator for measuring and analyzing the hours of illumination caused by the sun, which results in determining the places of light and shade on the chosen space, taking into account the elements of the site’s shade as in the following figure (9), where the climate file is entered in the form of an examination EPW, then ladybug sun path, then activating the ladybug sunlight analysis hours The readings OUTBUT also depend on the region's climate file EPW file.

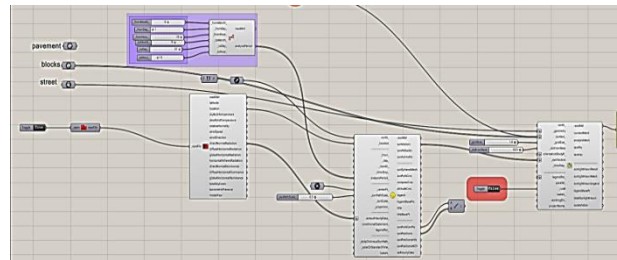


Fig. (9) simulation steps of sunlight analysis hours

- ladybug radiation analysis scale:

This scale is used to measure the analysis of radiation falling on a specific point on the surface on which measurements are to be made for the sky at the time to be studied by ladybug analysis period, which determines the month, hour, and day for the target period of the study. It also requires entering the EPW file, the climate file for the region. To show the result on the screen, a ladybug recolor mesh is made as shown in the following figure

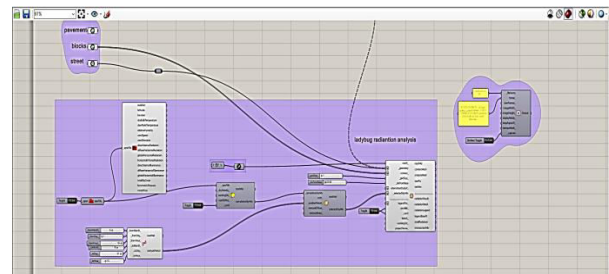


Fig. (10) steps of the simulation work of radiation analysis

- ladybug outdoor comfort calculator: This scale is used for making thermal comfort calculations for outdoor spaces. Its activation depends on the presence of the ladybug outdoor solar temperature adjustor,

whose activation is also dependent on determining the location and dry measurement of temperature, humidity, and radiation from the ladybug import EPW, which depends on the climate profile of the site, and depends on the indication of the time in which the study is to be carried out on ladybug analysis period, which specifies the month, hour and day for the target period of the study and to show the result on the screen, a ladybug recolor mesh is made as shown in the following figure

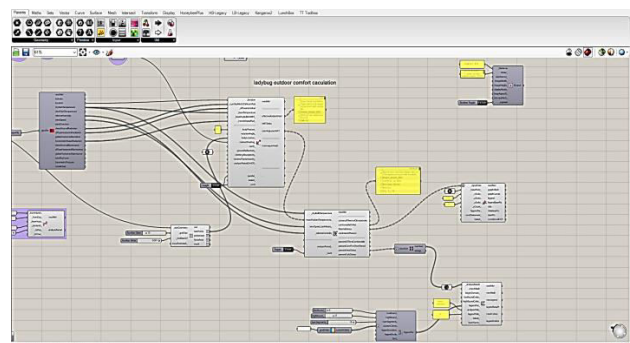


Fig. (11) steps of the simulation outdoor comfort calculator



- the ladybug comfort shade benefit evaluator scale: It is a measure for calculating the evaluation of the advantages of comfortable shade in a vacuum by making a color grading to distribute the shade on the surface on which measurements are to be made, depending on the location and temperatures resulting from the EPW file for the space, resulting in:

- Gradual saturation in blue means that there are unshaded places that need shading, especially in the summer.
- Gradual saturation in red means that there are unshaded places that we do not need to shade in the winter to reach the appropriate heating.
- Light and white intertones mean no effect on thermal comfort

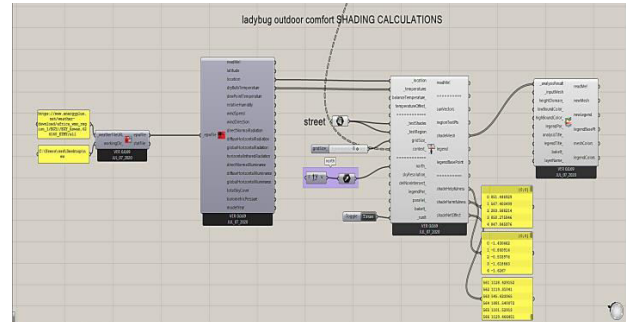


Fig. (12) steps to make the simulation comfort shade benefit

The following table (4) the analyses tool and its result in simulation

Pointer	Analysis tool	The result
the shadow	Ladybug comfort shade benefit evaluator	Measuring the greatest benefit from the largest percentage of shadows achieved on Earth
Radiation	Radiation analysis	Measuring the effect of changing the percentage of radiation by changing the characteristics of coverage
Number of hours of direct exposure to sunlight	Ladybug sunlight analysis hours	Measurement of places of direct exposure to the sun while changing the proportions of the holes in the coverage
Thermal comfort calculations (humidity - temperature)	Ladybug outdoor comfort calculation	Reaching the best indicators, which in turn leads to reaching thermal comfort in a space

-Stages of the analytical study of the simulation process: The area on which the simulation will be conducted is determined, by developing the coverage elements in the first model and selecting the optimal alternative according to the measurements generated by the simulation process for each of them.

-Measuring the environmental impact by reducing heat and direct radiation.

-Reducing the percentage of loads on some roofs of buildings and facades; Covering the roofs of some neighboring buildings and ways to reduce the temperature between them. It must be taken into account that the height of the coverage does not exceed twice the height of the covered building, which is equivalent to 30 m (the maximum height of the building) to maintain thermal comfort in the required proportions at that stage.

-Some additives are added that improve thermal performance to cover and some of them can be controlled electromechanically remotely

- The first alternative to urban coverage in Magdi Yaqoub Square yard: The height of the coverage designed for the treatment is 16.5 meters, the width is 31.5 meters, the coverage form is spherical as a dome shape hollow from the middle with a radius of 15.5 meters (It is changed three times for outdoor comfort).

(ladybug sunlight analysis hour’s scale):The following analysis is the results of the number of hours of sunshine on the surface directly exposed to the sun and the resulting direct radiation, and this appears in yellow, and other shaded places as a result of coverage or urban convergence appear in red as a result of the presence of a barrier between direct



sunlight that makes it not exposed to the sun for a longer time In the buildings as a result of the lack of hours of direct exposure to the sun, and this appears in blue.

The first model was tested three times to get the best results: The color is white - light -, structural construction of heat-reflecting light metal, the heights were determined by the coverage according to the height ratios of the buildings surrounding the covered space

- 1- Coverage height 16.5 m, spherical surface in the form of a dome hollow in the middle with a radius of 15.5 meters (the radius of the ball is 65% complete)
- 2- Coverage height 17.6 m, spherical surface in the form of a dome hollow in the middle with a radius of 9.6 meters (the radius of the sphere is 75% complete)
- 3- Coverage height is 18.2 m, spherical surface in the form of a dome hollowed out in the middle with a radius of 3.3 meters. (the radius of the sphere is 85% complete).

The best results of the analysis in the first alternative tested model in Magdi Yaqoub Square yard after comparing 3 previous cases to study is when Coverage height is 18.2 m, spherical surface in the form of a dome hollowed out in the middle with a radius of 3.3 meters. (radius of the sphere is 85% complete) , it seems to us that by reducing the radius of the upper part of the aperture, the shade increases and the natural lighting decreases in the covered space . The following fig (13) is the best results of ladybug sunlight analysis hours result : The red color shows exposure to sunlight for a longer number of hours, and the blue shows the shade areas resulting from the coverage used for treatment in the previous sizes, where the blue color in this case represents 88%, the shade places are concentrated due to the lack of hours of direct exposure to the sun on the northern part with a greater percentage than the middle and southern - (The hours of direct exposure to the sun are reduced to 61: 224 hours)

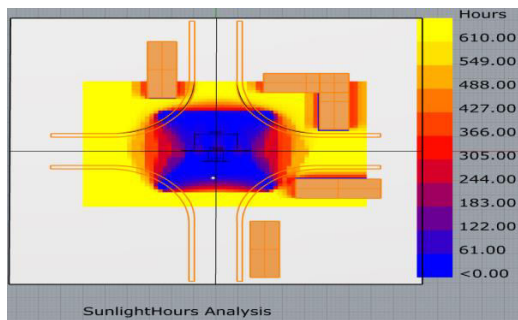


Figure (13) The number of hours of exposure to the sun on the surface of the earth - for the first alternative - at a radius of an upper opening 3.3 m

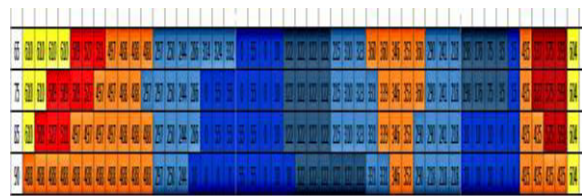


Figure (14) Increasing the percentage of shade due to the lack of hours of direct exposure to the sun - for the first alternative-

- **(ladybug radiation analysis scale):** The blue color represents the places that are not subject to direct solar radiation and gradually to reach the yellow color, which expresses the places where there is solar radiation at an average rate that helps to reach comfort in the void, and the color gradation to reach the red means an increase in the percentage of solar radiation falling directly on the coverage. The following fig (15) is the best results of ladybug radiation analysis scale (The top of the coverage intercepts a radiation ratio of up to 579.6 KWH/M² and it decreases in the middle, the height of the coverage reaches 322 KWH/M² and then reaches 128 KWH/M² by reaching the ground).

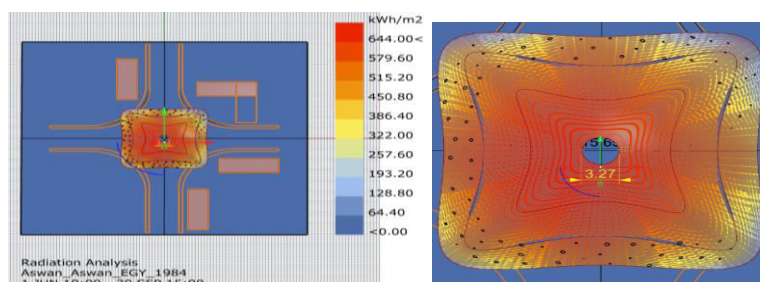


Figure (15) Study of the radiation falling on the coverage surface - for the first alternative - at the diameter of the upper aperture 3.27 m



When there is a ceiling opening of 3.3 m, a decrease in the percentage of solar radiation reaching the floor is observed as a result of the interception of a larger part of the coverage

- ladybug outdoor comfort calculator: The covered floor is divided into several parts with 9 points in separate places to measure the extent of thermal comfort in each of them; to show the extent of the impact of coverage as an environmental treatment on the urban space. Average dry bulb temperature is 35°, average relative humidity 16% / m 3, average wind speed is 5.2 It is also possible to calculate the percentage of rest hours, which in this case is equal to 50.3%, and the percentage of heat pressure reaches 39.8%, as this can be shown on a drawing as in the following figures

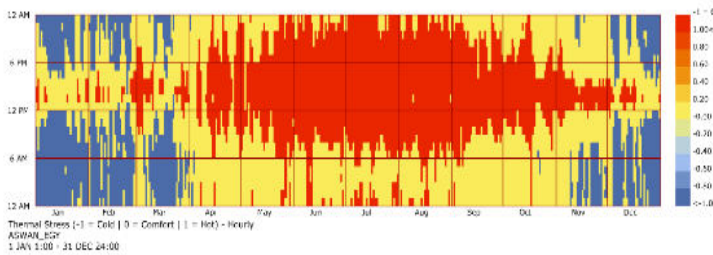


Figure (16) Thermal stress on each measurement point - for the first alternative—

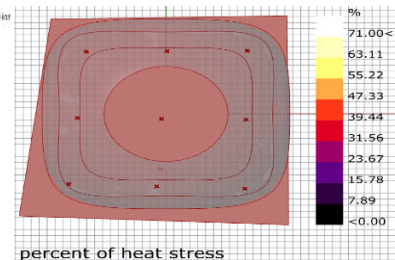


Figure (17) Percentage of rest time and thermal pressure - for the first alternative - at a roof hatch diameter of 15.5

- ladybug comfort shade benefit evaluator scale: Where the red color represents the unshaded parts that we need to have without shades in the winter; To make heating, while the dark blue color suggests the need to make shades for those spaces in the summer, while the colors are in the middle, To reach the white, it suggests that there is a sufficient percentage of shade as a result of the presence of a treatment in the void or a neighboring building that reflects its shadow on the urban space to be studied. The following fig (18) is the best results of ladybug comfort shade benefit evaluator scale : (The percentage of benefit from places of shade as a result of using coverage reaches 90% under coverage and is surrounded by 15% shadow).

The percentage of white color is up to 90% below the covered void and is concentrated in the middle

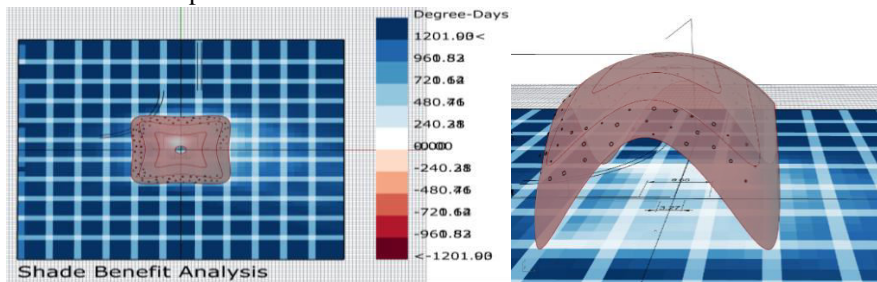


Fig. (18) the percentage of benefit from the presence of shadows - for the first alternative - when there is an upper opening with a diameter of 3.4 m

- The second alternative to urban coverage in Magdi Yaqoub Square yard: The surface is semi-flat, containing spaces in the middle of the design of each one, structural system: TREE STRUCTURE SYSTEM, consisting of several units, between which spaces are changed to reach the best possible alternative.

The second model was tested three times to get the best results:The color is white - light -, structural construction of heat-reflecting light metal, the heights were determined by the coverage according to the height ratios of the buildings surrounding the covered space

- Height 8 m, dimensions 33.25 * 33.28 m, the ceiling of each unit is extended by 75% of the unit allocated to it.
- Height 9.1 m, dimensions 33.25 * 33.28 meters, the ceiling of each unit is extended by 92% for the unit allocated to it.



- Height 10 m, dimensions 33.25 * 33.28 meters, the ceiling in each unit is extended by 98% of the unit allocated to it.

The best results of the analysis in the second alternative tested model in Magdi Yaqoub Square yard after comparing 3 previous cases to study is when Coverage Height 10 m, dimensions 33.25 * 33.28 meters, the ceiling in each unit is extended by 98% of the unit allocated to it, and the spaces between each unit are 98 cm. in the second alternative the best results of ladybug sun hours analysis result : The number of hours of direct exposure to the sun decreases in the case of the spread of the coverage surface by 98% in the second alternative above the ground, but the percentage of the first alternative remains higher in reducing the percentage of hours of direct exposure to the sun. (The hours of exposure to direct sunlight are reduced to 199:398 hours).

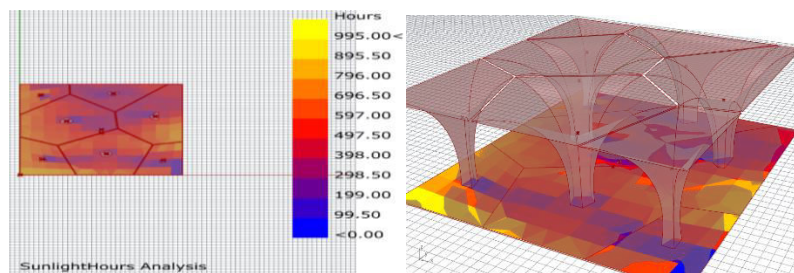


Fig. (19) The number of hours of exposure to the sun on the surface of the earth - the second alternative - at the distances between each unit of up to 98 cm

- (ladybug radiation analysis scale: After performing the simulation on the three cases in the second alternative, it is shown in the following fig (20) the best results of the ladybug radiation analysis hours scale for the second alternative in Aswan. The following fig (20) is the best results of ladybug radiation analysis result: The radiation decreases under the coverage to reach from 68.11: 136.21 KWH/M² and around the coverage at a distance of 3 m it reaches 340.5 KWH/M². The maximum amount of radiation falling on the floors is blocked as a result of the interception of coverage at a spread rate of 98% over the urban space

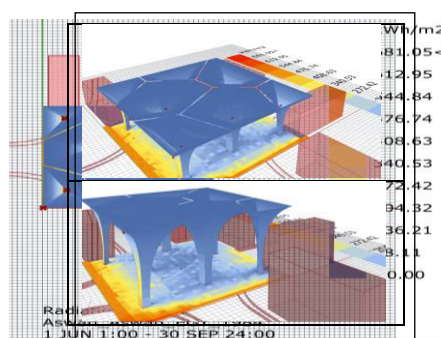


Fig. (20) Study of radiation falling on the ground and coverage - the second alternative in Aswan - at a coverage rate of 98% for the unit

- ladybug outdoor comfort calculator: After performing the simulation on the three cases in the second alternative, it is shown that the results show achieving thermal comfort by up to 50% as a maximum as a result of using the coverage and a thermal load of up to 30% less

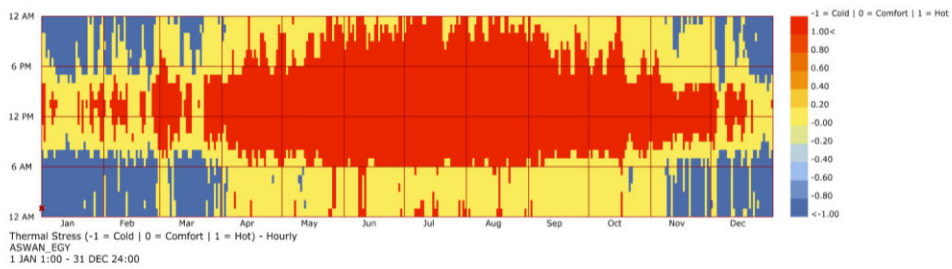


Fig. (21) Study of thermal comfort for several points on the ground and coverage - for the second alternative

- (ladybug comfort shade benefit evaluator scale: After performing the simulation on the three cases in the second alternative, it is shown in the following fig (22) the best results of the ladybug comfort shade benefit evaluator analysis scale for the second alternative in Magdi Yaqoub Square yard. The following figure is the best results of ladybug comfort shade benefit evaluator analysis result: The percentage of benefit from places of shade as a result of using coverage reaches 90% under cover and is surrounded by 20% shade.

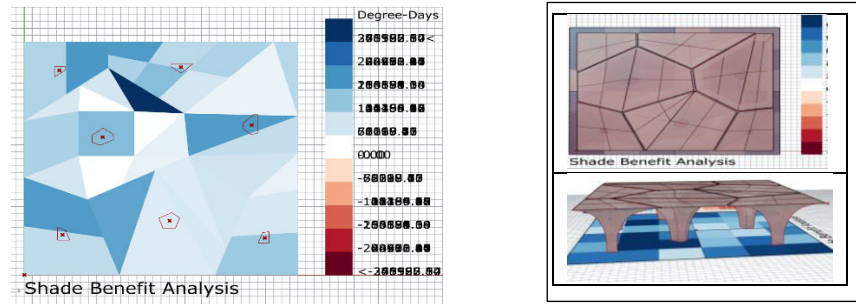


Fig. (22) Study of the utilization of shadows places - for the second alternative - at a coverage rate of 98% for the unit

The second alternative appears less effective in taking advantage of the shaded places resulting from it as a result of the coverage form than the first alternative, as evidenced by the increase in the places of the blue color that appear in the previous studies, which indicate a greater need for shaded spaces.

- The third alternative to urban space coverage in Magdi Yaqoub Square yard: It is a single unit with a large height in the middle, with the thickness and radius of the units forming the coverage to be controlled to test achieving comfort in the urban space.

- The third model was tested three times to get the best results: Height 8 m, the radius of one repeating unit covering 0.1 m - Height 8 m, the radius of one repeating unit covering 0.7 m - Height 8 m, the radius of one repeating unit covering 1.2 m - The third alternative did not give successful results by reducing the percentage of solar radiation falling on the void under the coverage and gave the largest percentage of non-utilization of the form of shadows as a result of the presence of coverage and it also shows a greater percentage in the number of hours of direct exposure to sunlight during the day.

In the case study in Aswan, the results indicated that in the case of using the first alternative at a roof opening with a diameter of 3.3 m at the top (the shape of the open dome from the top), the maximum rate of thermal comfort was reached The urban space to be treated 60% of the day.

- Simulation results: Work lists have been reached; Thermal Comfort Performance Assessment SYSTEM FOR URBAN COVERINGS IN URBAN SPACES. This proposed system goes through four stages, in each stage, and element of treatment and development is increased, which increases the efficiency of the urban space coverage in the space, thus increasing the value of its evaluation. The following figure (30) illustrates these stages:

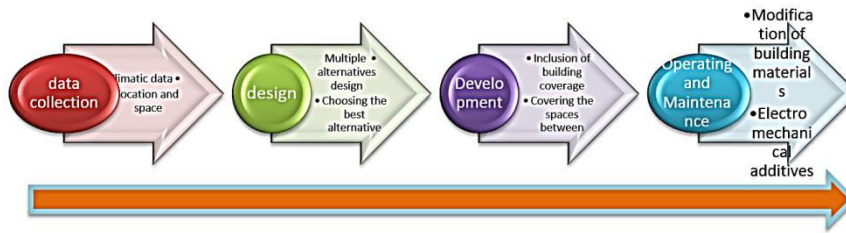


Fig. (23) Stages of the thermal comfort performance System Assessment for Urban Coverage (Researcher)

Each stage, from the design stage to its operation, was evaluated in a color that follows the percentage given to it, where:

- a) The design stage is the acceptable stage for evaluation.
- b) The development stage is the Good stage of the evaluation.
- c) The operation and maintenance phase is the very good phase of evaluation.

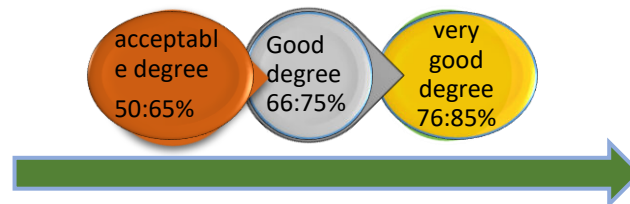


Fig. (24) Scores of the evaluation system according to the percentages of thermal comfort in the space after coverage (the researcher)

- Acceptable degree in the thermal comfort performance Assessment System for Coverings in Urban Space: The acceptable degree is based on providing thermal comfort performance in the urban space by up to 60%:65% , The following table (5) shows the factors for achieving types of comfort in the urban space covered in Aswan

Elements of evaluating coverage in Magdy Yaqoub yard in Aswan	Indicators of comfort First alternative sunroof 3.3 m
-Covering shape and color of coverage: Dome with an open roof, central opening, in light color (white) - Covering height: 18.2 m -Structural system: a metal structure with four pillars on four sides of the covered plaza -Angles of inclination: a quasi-plane inclined surface of the four letters of the pillars at angles of 45 degrees having a circular formation of letters -Construction Material: Radiation Reflective Metal -Slots ratio: a central upper sunroof with a diameter of 3.3 m with small side openings	-Temperature and hours of exposure to the sun: The hours of direct exposure to the sun are reduced to 61:224 hours - Radiation and rain: Coverage peak intercepts radiation up to 579.6 KWH/M^2 and decreases in the middle the height of coverage reaches 322, then reaches 128 by reaching the ground -Shading and lighting ratio: The percentage of benefit from places of shadows as a result of using coverage reaches 90% undercover and is surrounded by 15% shadow. -Thermal comfort ratio and heat pressure: The percentage of rest hours in this case is 50.3% -And the proportion of heat pressure up to 39.8%.
-Temperature and hours of exposure to the sun:% 13 -Radiation and rain:% 20 -Shading and lighting ratio , Thermal comfort ratio and heat pressure:17.3% Total comfort achieved = 50.3%	
Elements of evaluating coverage in the urban space in Aswan	Indicators to achieve comfort The second alternative in the case of one element covers 98%
-Shape and color: simulates a group of light-colored shrubs with a hollow inward end and semi-flat as we head out -Covering height: 10m -Structural system: tree structure system -Angles of inclination: the letters	-Temperature and hours of exposure to the sun: The hours of exposure to direct sunlight are reduced to 199:398 hours. - Radiation and rain: Radiation decreases under coverage to 68.11 : 136.21 KWH/M^2 and around 3m coverage reaches 340.5



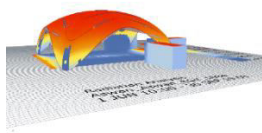
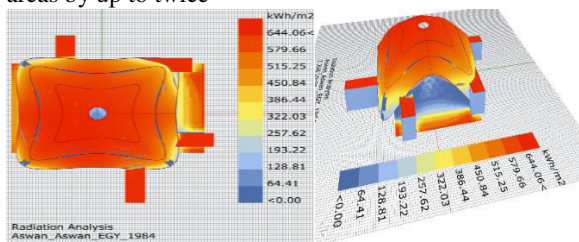
are inclined inward at 45-degree angles, and have a circular formation - Construction Material: Radiation Reflective Metal - Slot ratio: Module extension up to 98%	KWH/M ² . - Shading and lighting ratio: The percentage of utilization of shade areas as a result of using coverage reaches 90% under coverage and is surrounded by 20% shade. - Thermal comfort ratio and heat pressure: The results show that thermal comfort is achieved by up to 50% as a result of the use of coverage- Heat load up to 30% less		
-Temperature and hours of exposure to the sun: 11.7% -Radiation and rain:21% -Shading and lighting ratio , Thermal comfort ratio and heat pressure:18.3% Total comfort achieved = 50.3%			
-Temperature and hours of exposure to the sun: Hours of direct exposure to the sun range from 61 hours to 393 hours	-Radiation and rain: The radiation ratio ranges from 68.11 KWH/M ² to 128 KWH/M ²	-Shading and lighting ratio: Shades reach 90% of the area under coverage, and a shadow forms around 15-20% of the area around it	Thermal comfort ratio and heat pressure:The percentage of rest hours in this case is 50.3% , And the proportion of heat pressure up to 39.8%.

The good degree in the thermal comfort performance Assessment System for Coverings in the Urban Space: The good degree depends on providing thermal comfort in the urban space at a rate of 66% to 75% per day, according to the findings of studies

Elements Of Evaluating Coverage In The Urban Space In Aswan -Covering Shape And Color Of Coverage: Open-Roof Dome, Central Opening, Light Color (White) - Covering Height: 20m -Structural System: Metal Frame With Four Pillars With Four Sides Of The Covered Arena-Angles Of Inclination: Inclined Quasi-Flat Surface Of The Four Letters Of The Pillars At 45-Degree Angles, Has A Circular Edges-Construction Material: Radiation Reflective Metal-Slots Ratio: 4m High Center Sunroof With Side Hatches

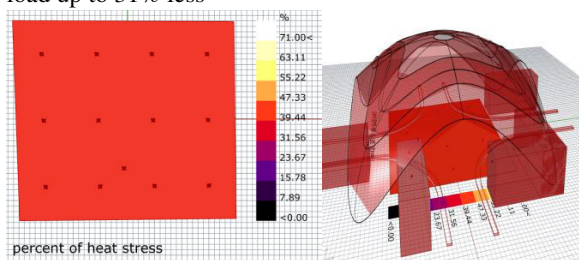
Indicators of comfort First alternative coverage 3.3 m

-Radiation and rain: The radiation decreases below the coverage to reach from 50: 193 KWH/M² on the ground, the parts of the coverage in contact with the ground are 193: 257 KWH/M², and around the coverage at a distance of 3 m it reaches 322KWH/M². Changing the dimensions of the coverage led to the presence of shadow areas by up to twice

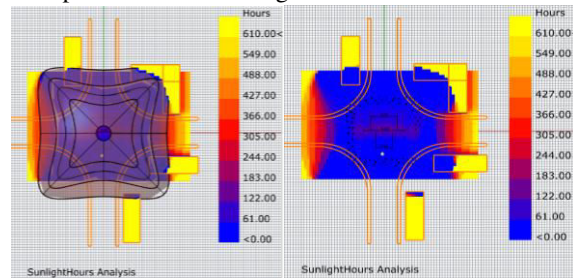


Reducing the percentage of direct solar radiation on the covered parts of the buildings by up to 128.81: 193.22 KWH/M²

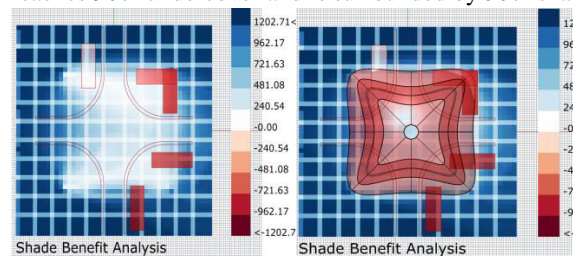
-Thermal comfort ratio and heat pressure: Provides up to 70% thermal comfort as a result of using coverage -Heat load up to 31% less



-Temperature and hours of exposure to the sun: The hours of exposure to direct sunlight are reduced to 61:200 hours.



-Shading and lighting ratio: The percentage of benefit from places of shadows as a result of using coverage reaches 90% undercover and is surrounded by 30% shade.



-Temperature and hours of exposure to the sun:20% - Radiation and rain:30%-Shading and lighting ratio , Thermal comfort ratio and heat pressure:20% -Total comfort achieved = 70%

The very good degree of the environmental thermal performance assessment system for the coverage in the urban space: The very good degree depends on providing thermal comfort in urban space at a rate of 76% to 85% per day, which is



the maximum that has been reached-**Additions with coverage that improve the rates of providing thermal comfort in the covered urban space:** Covering the joints between the covering parts and the upper openings with treated glass. The closure of these openings can be controlled; to control the provision of the largest proportion of thermal comfort within the vacuum during the day. In this paper, two methods of heat treatment of the glass covering the openings were adopted after reviewing the previous research findings in the field of smart architecture and sustainability.

-Elements of evaluating urban space coverage in Magdi Yaqoub Square yard: It depends on providing thermal comfort in the urban space at a rate of 76% to 85% per day, which is the maximum that has been reached by the practical study; To raise the efficiency of thermal performance by adding electromechanical and treatment additives to the vents to treat the urban space in this research; To reach the thermal comfort within it,

Covering form: dome with open roof in the middle and the color of the cover is white - Covering height: 17m-
Structural system: a metal structure with four pillars on four sides of the covered plaza - Angles of inclination: a quasi-flat surface inclined from the four letters of the pillars at angles of 45 degrees, having a circular formation of letters -
Construction Material: Radiation Reflective Metal - Openings ratio: a central upper sunroof with a diameter of 4 m with small side openings -
Electromechanical additives: double glazed glass: Reducing the percentage of absorbed radiation and thus reducing the temperature by 7%

The following table (6) shows the form of the list used in the very good stage (the researcher).

Elements of evaluating coverage in the urban space in southern Egypt	Temperature and hours of exposure to the sun	Radiation and rain	Shading and lighting ratio	Thermal comfort ratio and heat pressure
Total achieving comfort in the covered space = 77%	% 20	% 37	% 20	
Covering form: dome with open roof in the middle and the color of the cover is white Covering height: 10-20 m Structural system: a metal structure with four pillars on four sides of the covered plaza Angles of inclination: a quasi-flat surface inclined from the four letters of the pillars at angles of 45 degrees, having a circular formation of letters Construction Material: Radiation Reflective Metal Openings ratio: a central upper sunroof with a diameter of 4 m with small side openings	-Hours of direct exposure to the sun range from 61:200 hours. -The radiation ratio ranges from 50KWH/M ² to 100 KWH/M ²		-Shades reach 90% of the area under coverage, and a shadow forms around 20-30% of the area around it -In this case, the percentage of rest hours is 77%. -The proportion of heat pressure up to 31%.	
Electromechanical additives: double glazed glass	Reducing the percentage of absorbed radiation and thus reducing the temperature by 7%			

-The final design of the proposed urban space coverage in Magdi Yaqoub Square yard: From the above, it is possible to clarify the final form of the coverage for each climatic zone in southern Egypt, according to what was reached from the previous tables, a white dome, a structural construction covered with reflective metal with a thickness of 0.5 cm, the angles of inclination to cover a semi-flat surface inclined from the four corners of the pillars at angles of 45 degrees, it has a circular shape, the letters are 17: 20 m high, and the central roof opening is 3.3: 4 m covered with glass Double glazed, it has small side openings for lightning.

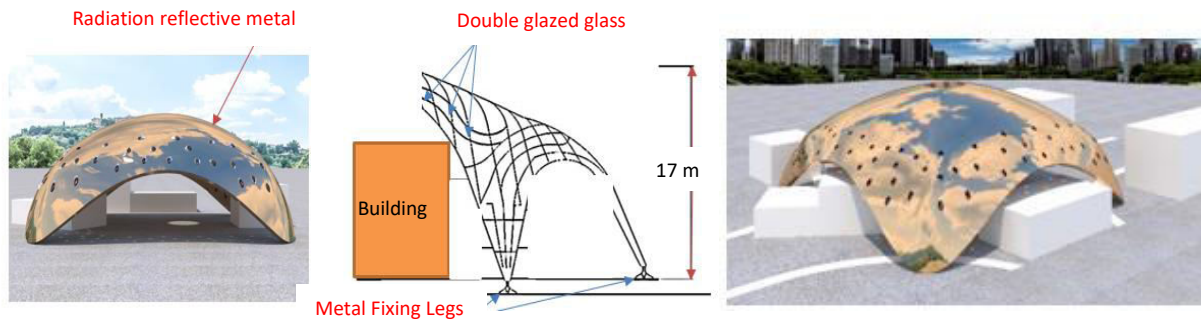


Fig. (25) Shades in the summer due to the presence of coverage

The shape of the shadows on the inner surface as a result of the covering tendencies from the sides



Fig. (26) Shades in the winter due to the presence of coverage– coverage layout

V. CONCLUSIONS AND RECOMMENDATIONS

From the above, The use of the computer in the design of urban spaces and the use of the simulation process leads to increased accuracy of results and acceleration of the design process and access to the best alternatives as a result of relying on climatic data in the design process. Therefore, the researcher chose the honeybee & ladybug program for its ability to read the approved climate data (one of the most important meteorological data). Standards that balance human energy and human thermal comfort) for vacuum temperatures and solar radiation leading to accurate measurement results that are not based on assumptions but rather .on the approved readings of urban space of Magdy Yaquob square yard in Aswan, it can be concluded that the efficiency of urban coverage in achieving comfort in the urban space can be evaluated in three stages:- **The coverage is classified thermally acceptable** stage when obtaining a percentage of 50.5 % in achieving thermal comfort, and this appears in the simulation results. The measure of hours of exposure to the sun gives an effect of 11.7% -Radiation gives an effect of 21%.- The comfort and shade utilization scale gives an effect of 18.3%.- **Coverage is classified as a Good thermal performance** phase when obtaining a percentage of 70 % in achieving thermal comfort, and this appears in the simulation results.-Radiation gives an effect of 30 %.-The comfort and shade utilization scale gives an effect of 20:30 %.- **Coverage is classified as a very Good thermal performance** stage when obtaining a percentage of 77% in achieving thermal comfort and this is shown in the simulation results. The measure of hours of exposure to the sun gives an effect of 20 % - radiation gives an effect of 37 % - a measure of comfort and utilization of shade gives an effect of 20%

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