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Research Article

The Exploration of New Courtyard Architecture Based on the Guidance of Architectural Culture and Technology

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The paper interprets the "shape" and "meaning" of the new courtyard-style building from the two dimensions of architectural culture and architectural technology, as well as three levels of interpretation, construction, and cooperation. At the same time, it takes the building of "Waterside Cube" in Solar Decathlon China Competition as an example, which puts forward the concept of "Re-Traditional" and analyzes the generation logic and possibility of development of the new courtyard-style building which is combined with architectural culture and architectural aesthetics. Meanwhile, it puts forward the application of building technology and coping methods for rapid construction problems and finally summarizes the new ideas for the development of new courtyard-style buildings.

1. Introduction

With the deepening influence of world architecture style on China, more and more high-rise buildings or Western-style buildings are popular in China's large-sized and medium-sized cities, and buildings with Chinese local culture are not fashionable compared with those which have modern urban atmosphere, and this is the majority of aesthetic concepts. The problem to be solved in the new courtyard-style building is how to regenerate the culture and fit the modern lifestyle, and make the culture livable and feasible, so that it can be adaptive to different groups. In the design, its concept inherits the traditional culture, but the applied techniques and the form and experience of creating a new space are more in line with the characteristics of the times [1].

The embodiment of architectural language in the architectural system has an internal connection with the architectural culture, which is preserved in the development of people's life needs [2]. For example, people's need for "combination" in family life can be represented as defensive outside and warm inside. This is not in contradiction with the creation of modern urban life and public communication space. The type of courtyard building can be constructed in a modular manner, such as misaligning, opposing, interspersing, or superimposing one or more functional unit modules to create different space for internal and external environment. This is also the advantage of a new courtyard-style building which is more satisfied with the characteristics of future lifestyle.

The courtyard-style building is a well-known architectural system and representative of traditional residential buildings. In Solar Decathlon China Competition, the building "Waterside Cube" designed and built by Shanghai Jiao Tong University and the University of Illinois at Urbana-Champaign is an exploration and practice of the construction of contemporary new courtyard buildings in cities and villages. It combines all aspects of humanities, art, and technology in architectural design through modular construction methods, providing innovative ideas for the development of new courtyard-style buildings in the future urban development.

"Waterside Cube" is a new type of courtyard-style building. Its design analyzes and extracts the architectural style and architectural elements of traditional courtyard-style buildings, as well as the "shape" and "meaning" that have been preserved in the process of continuous evolution.

In order to meet the requirements of 20 days to complete the construction of the competition, the design adopts the construction method of prefabricated buildings and uses a combination of passive and active technical methods to fit modern livability. The new courtyard-style building is also different from the construction mode of the traditional courtyard-style building which is easy to be popularized and used in contemporary life.

2. Architectural Culture and New Courtyard Buildings

2.1. Overview. The courtyard-style building is a traditional Chinese architectural form, which is based on the architectural style of the courtyard [3, 4]. In the north, it is represented by the courtyard of Beijing, the courtyard in the south of Jiangsu and Zhejiang Province, and the courtyard of the Huizhou-style building.

The courtyard-style building carries the "shape" and "meaning" of the architectural culture. Starting from the early and most complete courtyard house represented by the ruins of Fengqi Village in Qishan, Shanxi Province, during the Western Zhou Dynasty, to scenes of people living in the inner court in the Han Dynasty portraits, as well as the performance of the courtyard-style buildings in "Riverside Scene at Qingming Festival" ("Riverside Scene at Qingming Festival" is a famous Chinese painting created by Zeduan Zhang in Song Dynasty; this painting describes the prosperous scene of Bianjing, the capital of the Song Dynasty) of the Song Dynasty; they all reflect the status of the courtyard-style architecture in the early Chinese society. Nowadays, there are still courtyard-style buildings in the north and south of China, some of which still have the function of living. However, some of the architectural functions that have been transformed into historic buildings, commercial and cultural centers, and art and creative workshops are more in line with modern needs, and this means that the spirit of the heritage of the courtyard-style buildings should be continued [5].

Architectural culture is the same as culture, which includes entities, norms, ideas, and symbolic culture. It affects the development of architectural systems from different dimensions, such as material form, architectural technology, architectural art, and architectural language.

2.2. Basic Characteristics of Courtyard Buildings. The courtyard-style building has the concept of overall building environment management. Starting from the courtyard house represented by the ruins of Fengqi Village, the prototype of the courtyard-style building was completed, and then people began to gradually improve the structure of the courtyard-style building in the Han Dynasty, including the use of building materials. During the Wei Jin Southern and Northern dynasties, the type of courtyard-style buildings began to diversify, including the "日" shape, the triple courtyard, the quadrangle courtyard, and other flat layouts. These layouts are centered on the inner courtyard and are generally centrally axisymmetric, and they develop longitudinally and laterally along the axis. The architectural function is arranged as "the hall is in front of the bedroom" and "east and west wing layout" [6] (Figure 1).

As the core of the whole building, the courtyard space is not only an important place for daily life and family gatherings, but also the spirit of the family. Geomantic culture plays an important role in the courtyard-style building, and the concept of harmony between man and nature makes people pay more attention to the location and construction of the building, and pay attention to the harmony between man and nature. In southern regions, the conception of "*Si Shui Gui Tang*" (in south of China, sloping rain eaves are built in the inner courtyard surrounded by four rooms, and they allow rainwater to flow into the inner courtyard from all four sides; this phenomenon is called "Si Shui Gui Tang" and means gathering wealth and bringing good luck) in the courtyard reflects the low-key introversion and modesty of Confucianism [7] (Figure 2).

The emergence of the courtyard-type building system in the southern and northern regions is not only the inheritance of culture, but also an optimized architectural form that creates a livable space to adapt to the environment and climate, and isolates the internal and external environment [8]. The courtyard regulates the microclimate inside the building and creates passive ventilation. In the north of China, the courtyard is spacious and easy to receive sunlight, so that the climate is fairly mild in winter and rather cool in summer while resisting wind and sand [9]. The courtyard can collect rainwater and optimizes the built environment [10]. Meanwhile, the courtyard-style building form has the characteristics of clear internal streamlines, clear functional division, and livability environment.

2.3. Development of New Courtyard-Style Buildings. Nowadays, excellent architectural design not only is compatible with urban characteristics in terms of function and form, but also fits regional culture and humanistic environment. Architectural design in the contemporary context can use modern technical methods to inherit and preserve the traditional architectural forms and space creation, especially the courtyard structure design in the courtyard design, so that modern architecture can more closely link the relationship between nature, society, and people. At the same time, the inheritance of two ideas of "harmony between man and nature," and "combination of nihility and reality" makes the spirit of the culture passed down in contemporary life [11].

In traditional construction, the form and function of the courtyard-style building are mostly based on courtyard-style residential buildings. However, in order to adapt to the needs of different geographical environment and urban life, modularized building forms can be used to customize the functions of every single module according to needs and then spatially combine and optimize. In this way, the inheritance of the courtyard-style buildings will not be constrained by the traditional building construction techniques, and the "shape" and "meaning" of the courtyard-style buildings will be better preserved. The new courtyard-style

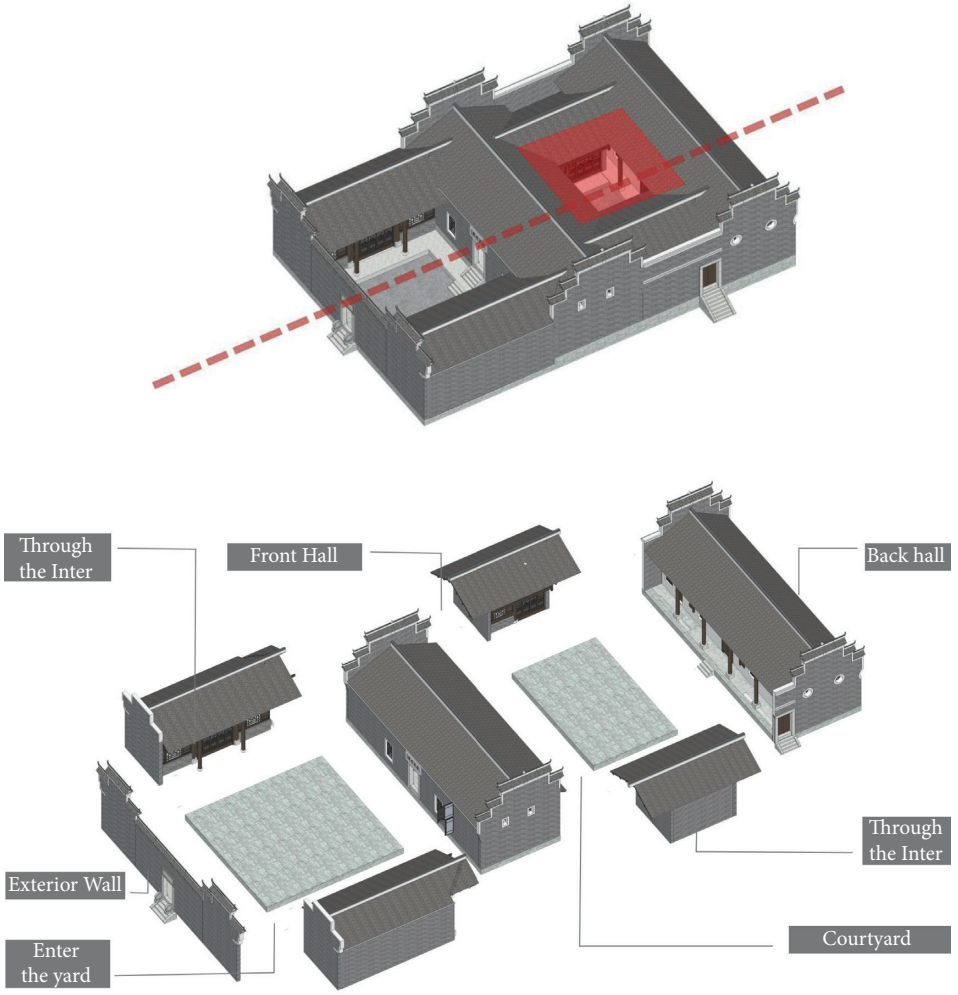

Figure 1: Traditional courtyard-style building layout.

Figure 2: Inner courtyard and community layout.

architecture is the heritage of the culture and an update of the design and construction techniques. Meanwhile, it can be established by using contemporary techniques through the combination of humanity, art, and technology.

In Solar Decathlon China Competition, the architectural design of Shanghai Jiao Tong University was named "Waterside Cube," and the two elements of "water" and "square" were embedded in the design and practice. This not only

inherits the culture but also extracts the elements of traditional courtyard-style architecture and applies it to modern architectural design techniques and space construction. It is a new practice and exploration of courtyard-style architecture in the contemporary context.

3. "Waterside Cube": The Practice and Exploration of the New Courtyard-Style Building

Each architectural design has its unique soul, which is different from the morphological generation of the building or the physical and spatial levels such as regional and functional aspects. It is also different from the technical background under the adaptive demand to make the building achieve better economic, applicable, and beautiful needs. This is a kind of exploration under the background of roots and culture. The meaning of architectural culture is higher than culture. It includes but not limited to multidimensional culture such as material, system, spirit, and symbol. It only transmits culture through the expression of architecture.

The "Waterside Cube" takes architectural culture as its context and takes traditional Chinese courtyard-style buildings as its prototype. It puts forward the design concept of "R-T," which is named as Re-Traditional. And "Re-" means that people can extract the core concepts of traditional architectural culture and integrate them into modern architectural culture for conceptual improvement. This is also a new exploration of combining architectural culture and architectural technology in "Waterside Cube."

"Waterside Cube" interprets the generation logic of the new courtyard-style building under the influence of architectural culture. This paper will analyze the redesign of architectural culture in architecture, the application of architectural technology in practice, and the response of construction mode to competition issues from the three dimensions of interpretation, construction, and consistency. Such a traditional and modern courtyard-style architecture exploration is the new practice to break the traditional courtyard-style construction.

3.1. Design: Design Concept and Layout

3.1.1. Layout. "Waterside Cube" is a courtyard-style house under the influence of architectural culture, which takes the layout of the two-in-one courtyard as the basic type of design. At the same time, the use of traditional architectural elements in design is preserved, which is interpreted and expressed in architectural language, and is realized through modern technological methods. Thus, it enhances the space and experience sense of the building. Considering the coordination between the building and the venue, as well as the experience needs of the customer groups that the competition will face, the design is optimized for the layout of the two-in-one courtyard. In the design, the inner courtyard of the first entrance is opened as an open outer courtyard space, which strengthens the combination of architecture and natural environment, and at the same time has the functions of landscape and recreation. At the same time, the organizational structure of the inner courtyard is retained as a core part of the building, providing space for family activities (Figure 3).

The concept of "Waterside Cube" interprets the innovation and feasibility of architectural culture in contemporary architectural design through the use of the two elements of "water" and "square." In traditional culture, the water element satisfies the needs of people's life and also has the meaning of fortune. And the concept of "square" is not only the intuitive feeling of the whole building, but also an interpretation of the reproduction of the courtyard-style architectural elements and the modular construction technology.

3.1.2. Modular Construction. Taking the 20-day construction completion requirements into account in the competition, the design broke the traditional courtyard-style building construction model and adopted prefabricated containers for modular construction to meet the needs of family life. Customization of the module divides the building into four parts: the public area module, the rest module, the sanitary module, and the kitchen module. The inner courtyard is the core of "Waterside Cube," and four functional modules are arranged around to form a courtyard-style building unit. Such a flexible customization model and rapid construction method also provide the possibility for future popularization (Figures 4–6).

3.1.3. Architectural Elements and Expression of Intention. The inheritance of architectural culture in courtyard-style buildings requires the expression of architectural elements, architectural aesthetics, and architectural systems in the design of new courtyard-style buildings. Buildings in cultural development can neither copy all the construction models of traditional buildings nor create models that do not fit the law of development.

"Waterside Cube" optimizes the space elements of the traditional courtyard-style building's outer corridors, overhangs and inner courtyards, and material elements such as black tiles, white walls, partition windows, and landscapes and retains these architectural elements in the inner courtyard. Rectangular wooden partition windows are retained on the facade of the building, and the surface is covered with perforated aluminum panels to enhance the privacy of family life inside the building (Figure 7).

The courtyard-style architecture has been preserved during so many years of evolution in that its unique cultural qualities conform to the public's aesthetic and value orientation. The design of the inner courtyard in "Waterside Cube" follows the traditional concept of "Harmony between Man and Nature" and the expression of the spirit of the courtyard. We planted green landscapes and expressive images of dry landscapes in the inner courtyard and transplanted a fruit tree in the courtyard as the visual center of the inner courtyard. At the same time, it can create a sense of place with the changes of four seasons. Brick carvings,

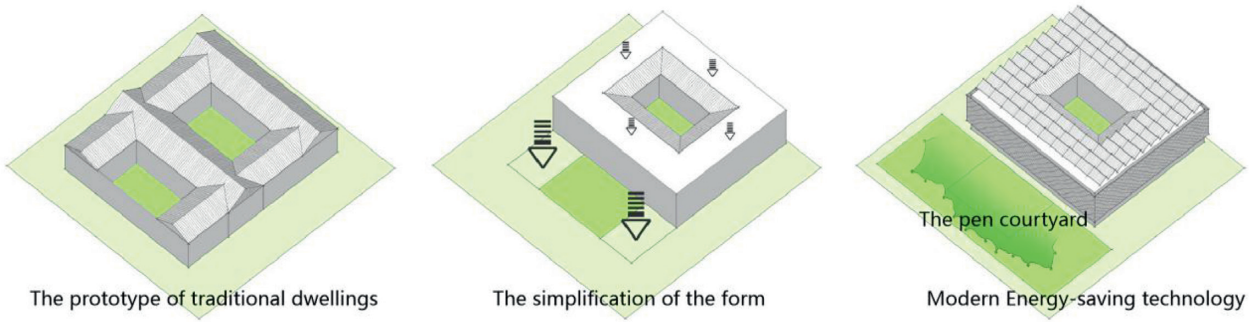

Figure 3: The extraction of elements.

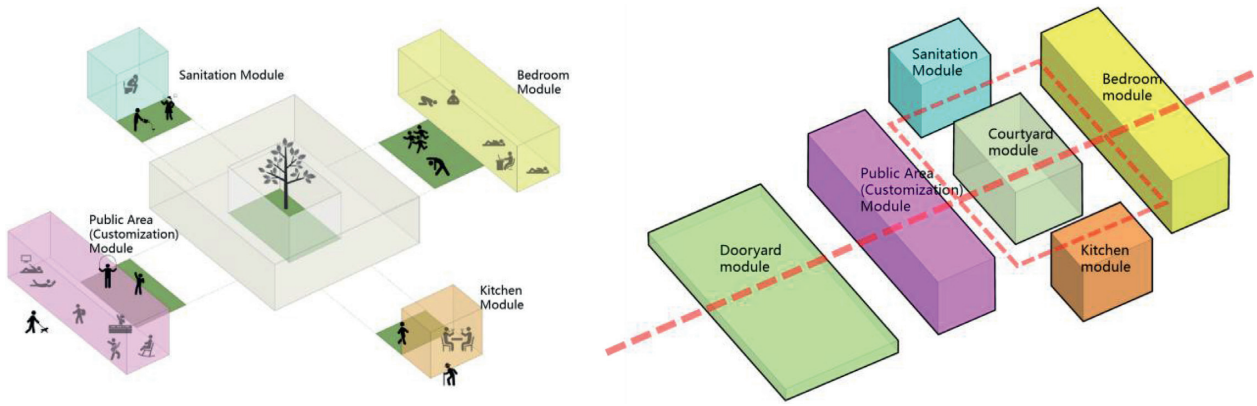

Figure 4: Function modules.

Figure 5: Exterior courtyard and inner courtyard.

stone carvings, and wood carving elements are used in the detailed design of the building to combine nature and design art to interpret the beauty of humanity. The spatial layout and functional layout of the entire building inherited the traditional Chinese architectural system. At the same time, container-style building modules are superior to traditional buildings in space and are suitable for modern lifestyles.

Water plays an indispensable role in traditional culture and family life. The perforated aluminum plate used on the building's facade applies its characteristics of ventilation, shading, and cooling to increase light refraction, so that the effects of heat preservation and heat insulation can be achieved. In addition, the wave shape of perforated aluminum plate can also be applied as an image expression of a traditional water curtain. Therefore, the spray system and the "water curtain" are combined to interpret the water element in an interactive way (Figure 8).

At the same time, the traditional culture is used in the landscape design of the outer courtyard with modern techniques. "*Qu Shui Liu Shang*" (which means that a

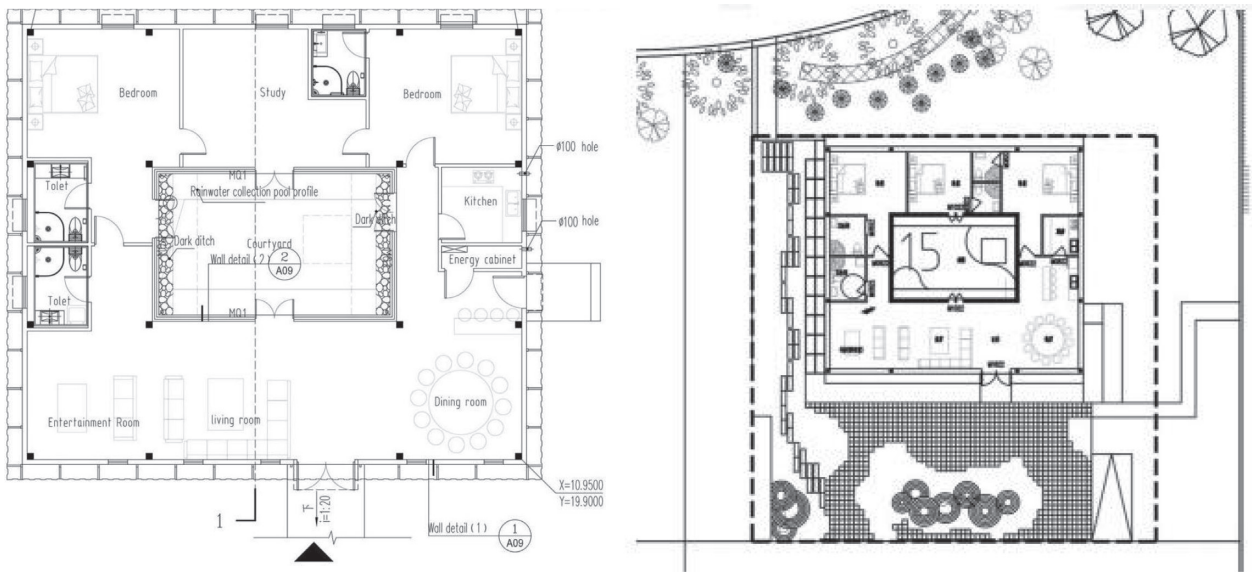

Figure 6: Layout.

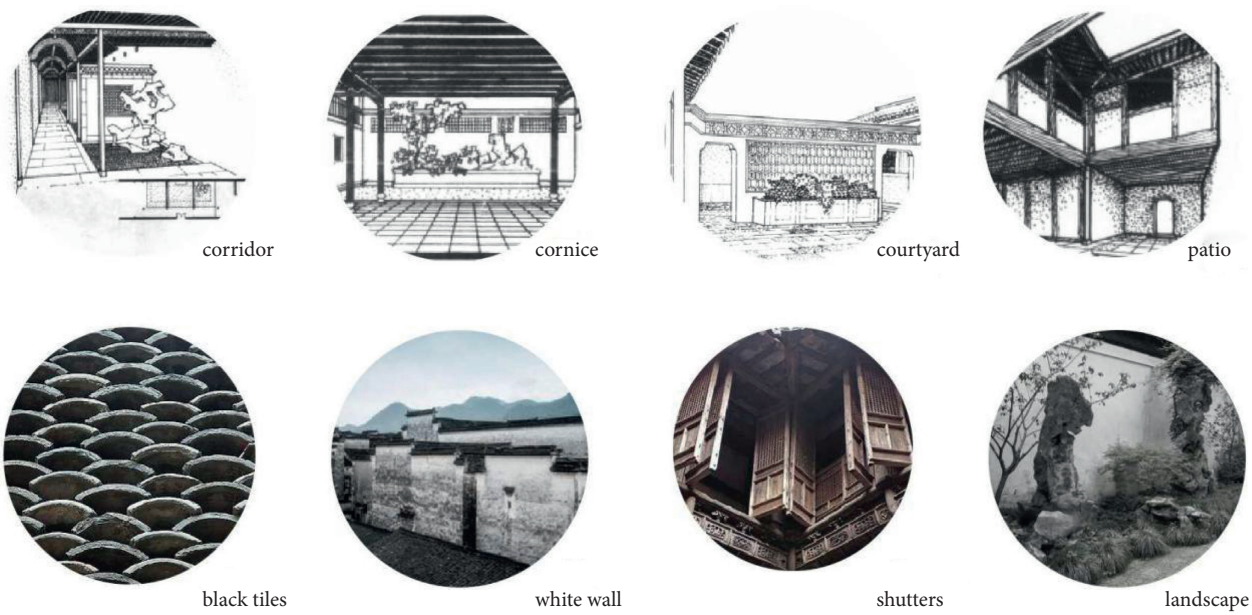

Figure 7: Traditional space elements and material elements.

Figure 8: Modern element placement.

gathered crowd drink water from a winding canal with one wine cup floating on it to wash away ominousness) is an elegant cultural custom in the Chinese folk. It comes from the preface of the calligrapher Wang Xizhi's "The Preface of the Lanting Pavilion" and has two major functions: celebration and praying for disaster prevention. Considering the hot and dry weather in Dezhou, China, PC bricks were laid on the curve instead of water in the traditional sense. In this way, the combination of PC bricks and light strips at night can better create the artistic conception of "*Qu Shui Liu Shang*." The light strip in the outer courtyard, the light and shadow of the building, and the surrounding environment are more suitable for modern gatherings. This landscape has inherited the context of Chinese history and allowed the rebirth of cultural classics here. In addition, we use steel pipes to simulate the shape of mountains and rocks to show the beauty of classical gardens and use modern technology to express traditional landscape shapes.

3.2. Construction: Architectural Technology and Livable Experience. "Waterside Cube" uses a combination of active and passive technologies, including the introduction of passive energy-saving design methods, to create a more comfortable and livable living environment. This is also the advantage of the combination of new courtyard-style architecture and architectural technology. The passive design strategy in "Waterside Cube" is a unique design direction in the new courtyard-style building, which reduces the use of active equipment and achieves the best energy-saving effect.

First of all, in the site, we arranged this square building in a north-south orientation. The building is composed of a central inner courtyard and four container modules around. The functional design follows the layout pattern of a traditional courtyard-style building to ensure the lighting and sunshine of the building.

Secondly, the inner courtyard enclosed by the four modules not only functions as a landscape and family gathering, but also has the functions of ventilation, lighting, and shading. When we open the grilles on both sides of the courtyard, the courtyard space and the living room and study space can be combined inside and outside, and passive ventilation enhances air circulation, acting as a "large living room" and enhancing the flexibility of the space (Figure 9).

Thirdly, in terms of building shading, we adopted a combination of wooden grilles and full floor glass around the inner courtyard to enhance the connection between users and the inner courtyard. At the same time, the wooden grilles are combined with the traditional sloping roof canopy of the inner courtyard to enhance the shading effect. It is worth mentioning that the perforated aluminum plate design on the building envelope has special functions; due to the particularity of the material, its wavy surface not only increases the three-dimensional effect, but also refracts and reflects light to play a role in shading. The use of perforated aluminum panels on the outer protective structure and the placement of the spray system break the heavy feeling of the building block. Meanwhile, the combination of virtual and real facade design and the material properties of perforated aluminum plates make the interface of the building rich in rhythm.

Fourthly, the use of buffer space is a more comprehensive design technique in passive energy-saving design strategies. Through the use of buffer space, the building microenvironment is improved. In the new courtyard-style building, we also added some detailed designs to the inner courtyard.

Water is the core element of the building, so we incorporated natural rainwater into the design of the courtyard. In the inner courtyard, the meaning of "*Si Shui Gui Tang*" carries the cultural context, and considering the arid climate in the north, so we hope that rainwater can be used. Therefore, the rainwater harvesting module is placed below the inner courtyard surface to allow it to absorb water, store water, seep through water, and then purify the water for domestic water and landscape irrigation in the outer courtyard (Figure 10).

In the landscape construction, a spray system is added between the perforated aluminum plate on the outer facade and the box to create a misty rain effect and a different mood. This system also has a cooling function. The principle is that the liquid state is converted into gaseous mist by a physical high-pressure method, and the gaseous mist is formed after atomization, whose particle diameter is less than 4 micrometres with the probability of 70%. Afterwards, the gaseous mist can quickly take away the air heat, and the combination of gaseous mist and radiation-proof thermal energy coating on the external wall has the effect of cooling down 3–7°C. At the same time, it can produce a large number of negative ions which are known as "airborne vitamins" to create a unique "forest oxygen bar" in the city and improve the air quality that is good for health. Its unique moisturizing function can better protect the plant landscape in outer garden.

Fifthly, for the envelope structure, we can conclude that walls, roofss and windows account for 76.6% of the total heat loss through thermal analysis. Therefore, high-density rock wool and extruded board (the density is 120 kg/m^3) are finally used in the design. Their heat transfer coefficient is less than or equal to 0.028 W/(m·K), and the heat transfer coefficient of light weight foamed concrete is 0.052 W/(m·K) in general light steel fabricated houses, and the thermal insulation effect of foamed concrete is the best. In the selection of glass, vacuum glass is used in all buildings to enhance heat preservation, sound insulation, and noise reduction.

Effective use of energy is a key issue for solar homes. At the same time, in order to cope with the possible impact of extreme weather in the future, active technology has been added to the house to ensure the overall operation of the house. Based on geographical location and solar elevation angle of Dezhou, Shandong Province, we calculated the optimal slope, azimuth, and distance between the two solar panels, so that the photovoltaic system can achieve the best results. It has resulted in an installed capacity of 22.770 kW with sixty photovoltaic panels placed on top of the building and nine panels on the garage. According to the actual

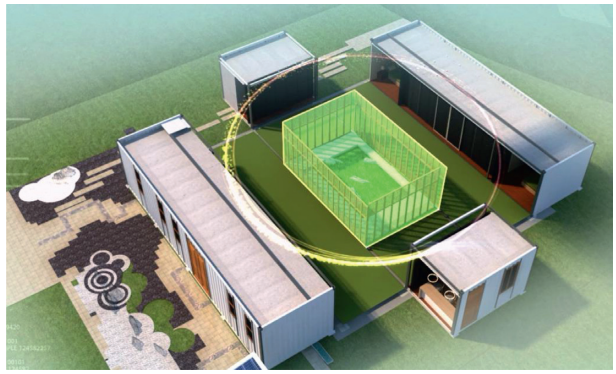

Figure 9: Principle of air flow in the inner courtyard.

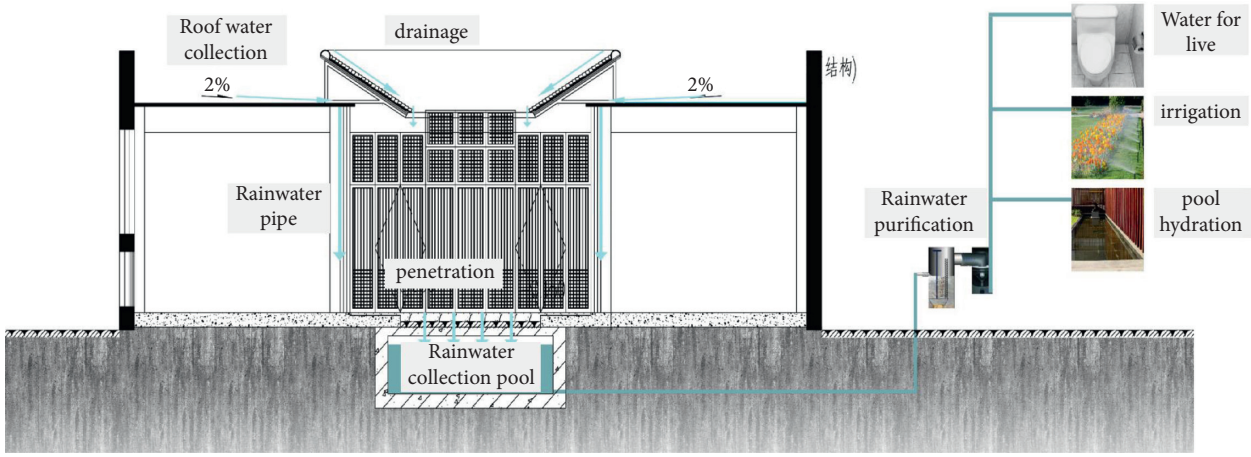

Figure 10: Principle of rainwater harvesting module.

measurement on the site, the power generation per week is 700 kWh, and the power generation per day can reach 125.7 kWh when the radiation is good. The whole system uses high-efficiency photovoltaic panels and microinverters. The photovoltaic panels use N-type single-crystal double-sided double-glass, and the efficiency can reach more than 20% under STC conditions. The advantage of using a microinverter is that each of the four photovoltaic panels is easy to repair and has an efficiency up to 97%, and the power generation inspection fault can be detected in real time from the APP. The house uses a mode of self-use of surplus power to access the Internet. To improve the quality of photovoltaic power generation and reduce the interaction with the power grid, we added a battery to form a photovoltaic battery system, sold the electricity at the highest price, and stored it at a low price to improve economic efficiency.

In order to make users feel more comfortable, the use of water-cooled central air conditioners in buildings can keep the temperature difference at about one degree in winter and summer, and the air supply is more uniform, which is better than traditional air conditioners. It is worth mentioning that the water circulation structure can reduce the use of refrigerants, together with the passive energy-saving technology in the inner courtyard design, as well as the spray system and perforated aluminum panels for the building's climate regulation, and can reduce the load throughout the year.

Whether it is livable or not is an important criterion for judging residential buildings [12, 13]. The application of the smart home system in this building enhances the user's comfort. With the continuous improvement of intelligent systems, such integrated design has improved the past living and operating modes. Its intelligent central control system serves as the wisdom center of the family. The Zigbee Center integrated with the smart host interacts with each front-end device, server platform, and mobile phone client, enabling users to use the mobile APP to view and control indoor conditions (e.g., lighting, scene panels, smart appliances, smart air conditioners, smart air detection, smart door locks, smart security, and family music). It is convenient for different users to make personalized adjustments (Figure 11). During the competition in Dezhou from August 2nd to 15th, the measuring index curve diagram of the competition house under the combined influence of active and passive construction technology is listed as follows. This is to calculate the score according to the scoring curve in the rules and then select the lowest value as the curve of temperature, humidity, PM2.5, and CO2 in the house obtained by recording. It can be seen that these values are stable and in line with the competition requirements (Figures 12–15).

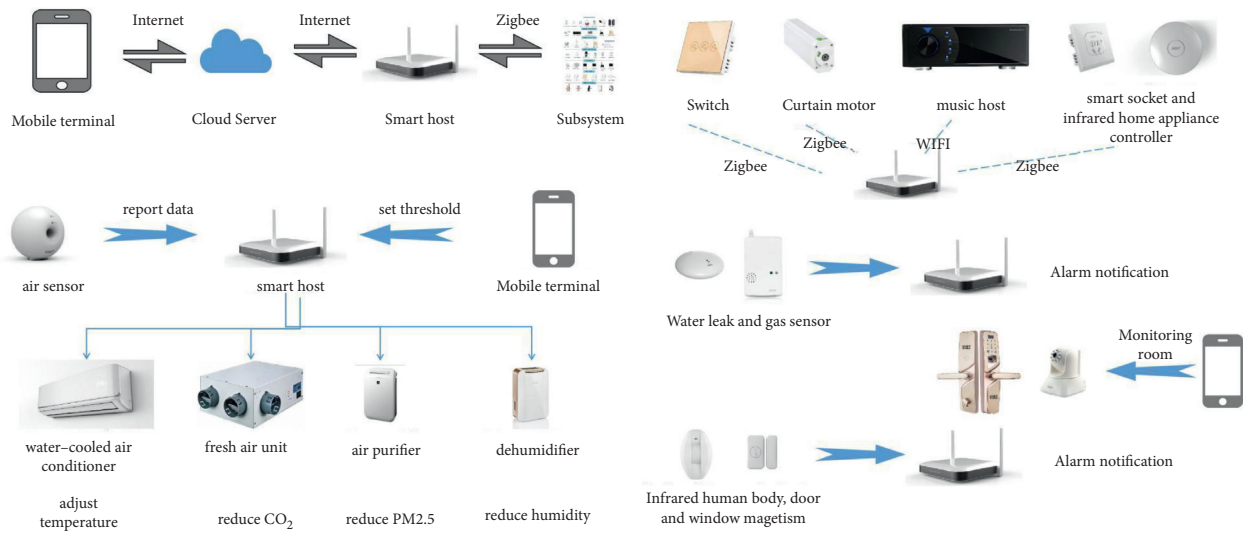

Figure 11: Smart home system application.

3.3. Consistency: Construction Mode and Results Feedback. According to the requirements of the competition, the building must be completed and put into operation within 20 days. Considering the requirements of rapid construction, our design adopts a highly prefabricated container construction model. The "Waterside Cube" consists of four containers. Except for the perforated aluminum panels, wooden grids, steel roof truss, solar panels, and other architectural structures on the facade, the rest are processed and installed in the factory, and then the box splicing and decoration are completed in the site. During the construction, the same assembly was completed in only 2 days, which improved the construction efficiency (Figure 16).

Compared with traditional containers, our architectural design has been improved in terms of structure and size, and at the same time, the public area module and the rest module have been adjusted to a length of 15.7 meters. Meanwhile, the height of the four container modules is 3.6 meters, and the indoor net height is 2.95 meters, which guarantees the comfort of the building space. Compared with light steel fabricated houses, the container has fewer splicing nodes, stronger structural integrity, and less construction waste and environmental noise. This construction mode has the characteristics of convenience, environmental protection, and low cost. If mass production is promoted in the future, it can meet the needs of a wider group of people.

At the same time, the container body can be customized according to the location of the building and can be flexibly transformed in space and form, which has strong adaptability and popularization. In terms of the positioning for target customer groups, the container model also has more potential. Whether it is a young family of three, or a group of elderly customers, this problem can be handled through a combination of module stacking and space. In the future development, people can go to the market to purchase and customize different module functions according to their personal preferences and combine them as needed to create an interesting space. This will promote the future development and popularization of new courtyard-style buildings.

In terms of the height prefabrication of the box, the structural insulation wall panels and embedded pipelines of each standardized module, and even most of the interior decoration, the interior surface of the wall, floor paving and skirting have been prefabricated in the factory, and then the soft decoration and furniture laying are carried out on site. Some flexible wall panels in the box can be removed or installed in a customized manner to allow flexible division of functional areas.

In order to get better feedback from users, many on-site visitors were investigated during the open visit time. These visitors included elderly people, middle-aged people, and children of different ages, covering different social classes. Finally, it is concluded that more than 80% of the customers have more demand for the inner patio than the outer courtyard. At the same time, the architectural form of the inner patio is also a combination of traditional architectural forms and modern lifestyles, which is more conducive to the creation of the family atmosphere. From the perspective of traditional culture, the family lifestyle of four generations living under the same roof is more inclined to the "回" shaped single-family house, rather than the "*C*" shaped or "*L*" shaped layout structure. It has more privacy and fits the needs of users which can be interpreted as warm inside and defensive outside.

4. New Courtyard Architecture and Urban Development

The inheritance of architectural culture emphasizes the protection of its historical features and forms, while the cultural significance of the new courtyard-style building emphasizes not only the characteristics of times, but also the livable space created by the contemporary architecture combined with new technologies. In modern life, the new courtyard-style building is not only the reproduction of

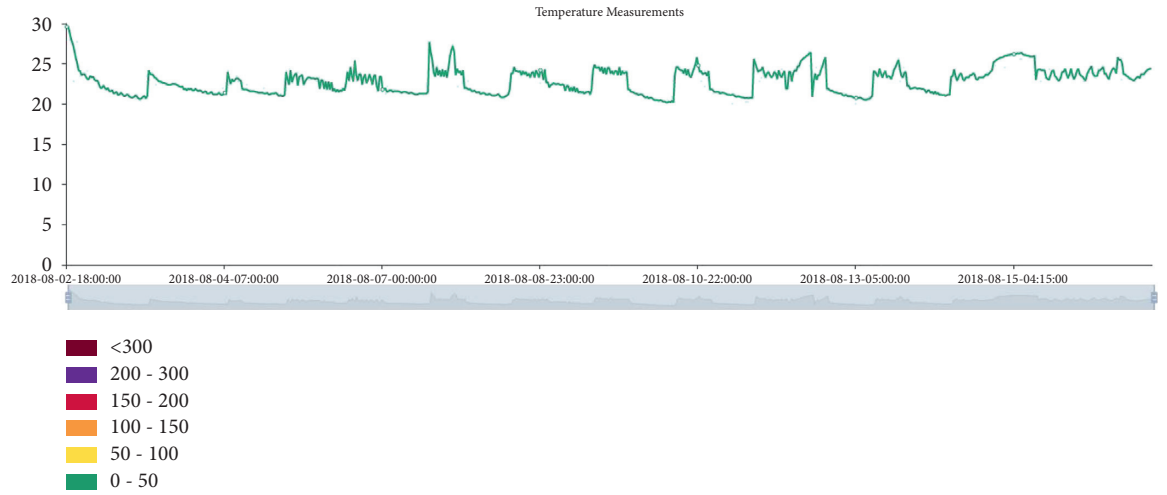

Figure 12: Air temperature during the competition indoors.

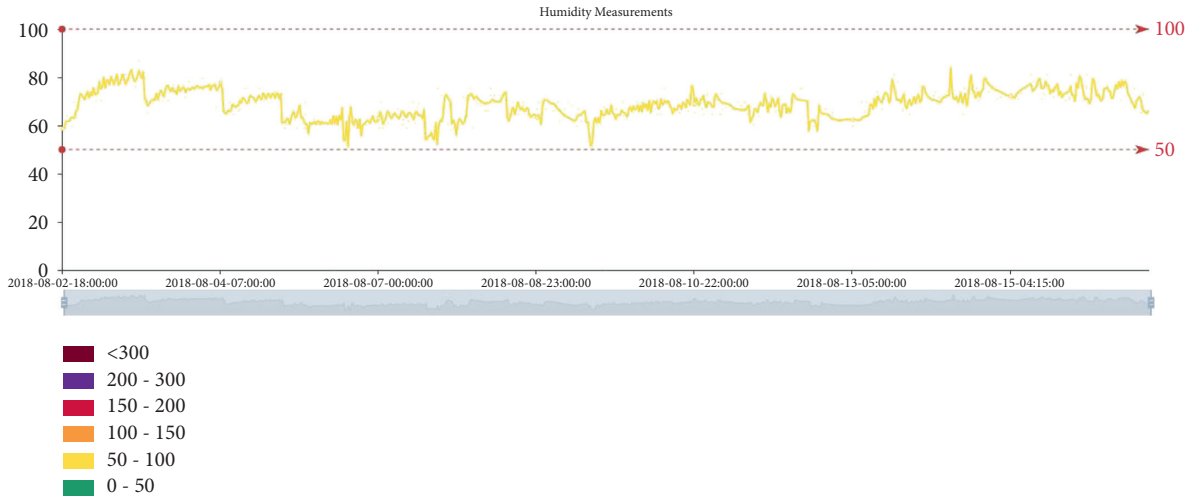

Figure 13: Humidity during the competition.

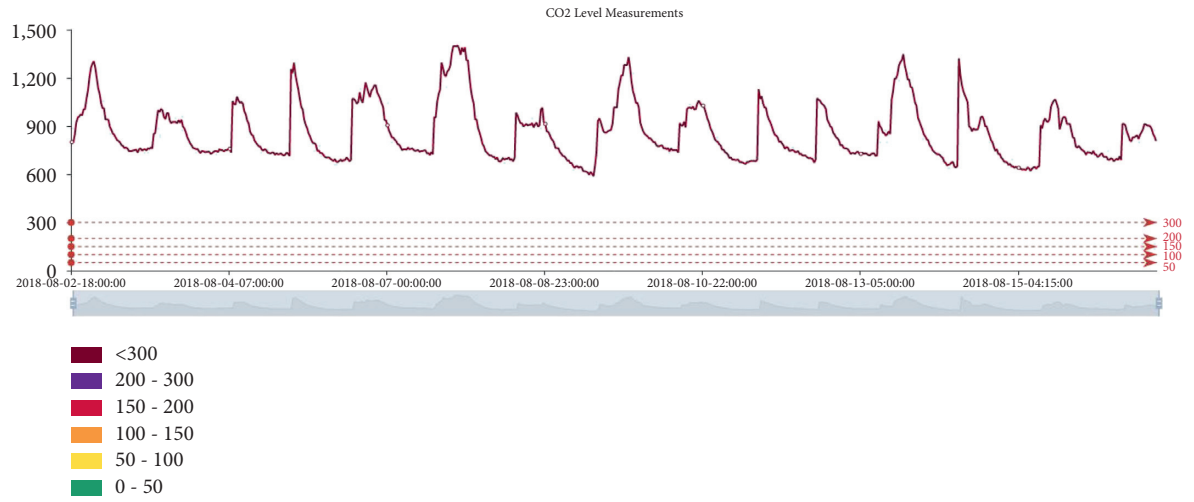

Figure 14: CO_2 level during the competition.

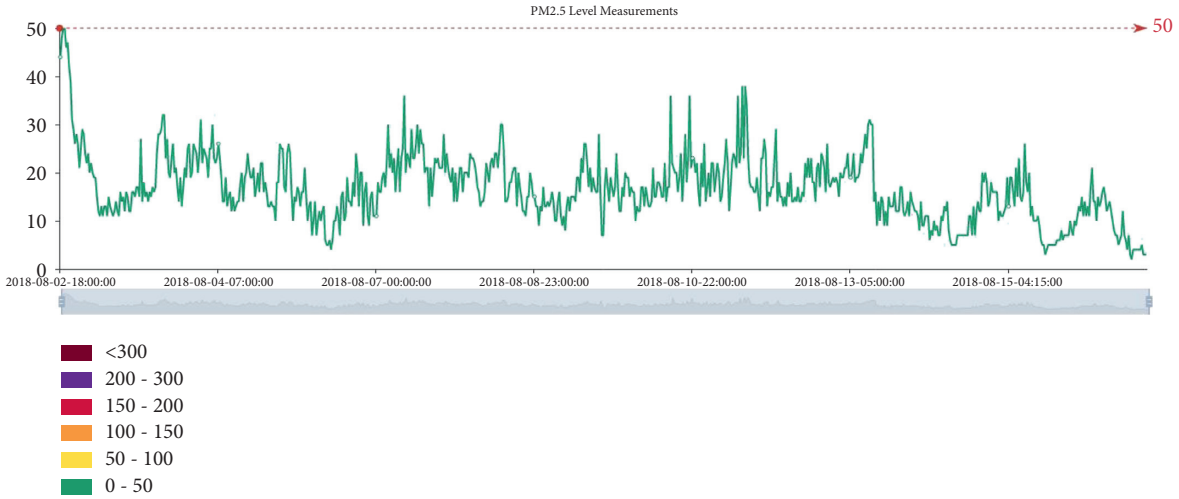

Figure 15: PM2.5 level during the competition.

Figure 16: Building layout and container hoisting and splicing.

architectural culture, but also the continuation of national culture and the concept of harmony between man and nature, as well as the implementation of the sustainable development concept of harmony between man and nature.

With the rapid development of the city, new buildings have gradually replaced old buildings, and the influence of foreign culture on cities has become increasingly apparent. The preservation of traditional cultural architecture should not only protect the building as a heritage, but also apply the architecture and urban texture under the influence of this context to the contemporary society. The main form of contemporary protection for ancient buildings lies in both in situ protection and off-site restoration, and this protection is only aimed at a single building, which lacks the protection for its architectural community and natural environment. Due to the current situation of modern urban development, especially in large- and medium-sized cities, there is a phenomenon of tension in land use. In order to achieve a larger floor area ratio, the building continues to develop at a high altitude, and the traditional courtyard house cannot be realized in such a city background. However, the inheritance of architectural culture is not the copying of the entire architectural system, but the application of language and construction to modern life. For example, the "courtyard" elements of a courtyard house not only allow people in urban life to approach nature and experience the semiprivate environment in a unique house, but also improve the environmental microclimate within the building [14].

At the same time, in "Waterside Cube," the modules of the courtyard-style building can be combined and customized, and the single module can be taken as a unit for horizontal and vertical development to be staggered and opposed. In this way, it not only continues the building layout system of traditional courtyard, but also generates diversified space, and this method has certain development potential [15, 16].

Since the competition includes the inspection for subjective and objective indexes, some local Chinese residents can evaluate different competition buildings after the completion of "Waterside Cube." "Waterside Cube" has obtained the acceptation from most residents in type system and experience of this new courtyard-style building, even

though there is a wide range of visitors and the differences of occupations and ages are obvious. In China, some residents enjoy high-rise residential communities, but they are also fond of the inner courtyard simultaneously. Therefore, in future research and further exploration, the type systems of inner courtyard or such courtyard building can be superposed and constructed in different ways. In this way, the possibility and practice of application in diversified cultural background and architectural type system are also the issues for future in-depth research.

5. Conclusion

The "Waterside Cube" is an exploration of the new courtyard-style buildings under the influence of architectural culture. It utilizes the construction mode of the container to make the building's composition and use functions flexible and also provides many possibilities for the future development of architectural design and development. This building is also an exploration of combining traditional culture with modern technology in the new era which satisfies the requirements of architectural culture, architectural aesthetics, construction technology, and so on and thus has great promotion value. The biggest feature of "Waterside Cube" is to use the expression of modern technology to interpret the "shape" and "meaning" in the courtyard-style architectural culture.

The new type of courtyard-style architecture is a practice in the contemporary context and an exploration of the response to the disappearing traditional architectural culture model. As a practical construction case, the "Waterside Cube" is built not only as a competition in Dezhou, Shandong Province, but also as the inheritance of its courtyard-style architectural form and culture. It will be applied to China through the extraction of different elements and the inheritance of regional culture in the southern and northern regions. The architectural culture will continue to be inherited, and the exploration of this new courtyard-style building is only the beginning.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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