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DESIGN OF LABORATORY SPACE FOR NEW DESIGN ACTIVITIES

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Abstract: Flexibility is a concept that can provide constructive and cost-effective interaction between the building, the environment and users, Existence of conditions such as mobility and accountability in our architecture helps to confront people and buildingsIn addition to the functional dimension, the structure also has the beauty and the sense of desirabilityConsidering the theme of the design, which is the design of laboratory space for modern design activitiesThe need for designing flexible, dynamic and dynamic spaces was felt, and the overall routine was based on mobility and spatial diversity.

Kinetic architecture is a concept in which buildings or part of their structures can be moved through kinetic energy without the overall integrity of the problem.

The combination of the Scissors of the Sun with the Origami shells was a good mix of structures for achieving the goal of space dynamics that was considered in the plan.

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INTRODUCTION:

Algorithmic design, a design method with a distinction between the design process and the step-by-step stages, eliminates the problem-solving process from ambiguousAnd it brings a clear path to the designer. Algorithms are step-by-step and finite instructions that lead to solving a problem. (MahdaviNejad, 185: 1393)

Aesthetics is an architecture that is desirable architecture that, in the first place, has the ability to induce sense of space in terms of performance.For example, what is expected from a home is to create a sense of tranquility and vitality away from boredom and monotony.In the functional dimension, the optimal architecture is responsive to the

needs of the user, and there are no disturbances and functional uncertainties.

So in general, the optimal architecture can be said to balance the right balance between beauty, performance and structure. Undesirable architecture, in addition to creating a negative sense of audience, has inadequate functional definitions and unsolved ambiguities.Or not paid. Architects like Richard meier and Ren.

Case Studies:

1. Resonant Chamber, an interior envelope system that deploys the principles of rigid origami, transforms the acoustic environment through dynamic spatial, material and electro-acoustic technologies. The aim is to develop a soundsphere able to adjust its properties in response to changing sonic conditions, altering the sound of a space during performance and creating an instrument at the scale of architecture, flexible enough that it might be capable of being played. The project is funded through the 2011 Research through Making Grant, U-M Office of the Vice President for Research, 2011 Small Projects Grant, U-M Center for Wireless Integrated Microsystems, Social Science and Humanities Research Council of Canada Research Creation Grant. More images and architects' description after the break.

The project is developed through three streams of iterative research and development in both computational testing and full-scale prototype installation: Dynamic Surface Geometries; Performative Material Systems; and Variable Actuation and Response. The faceted acoustic surface is comprised of the composite assembly of reflective, absorbtive and electroacoutsic panels, clustered around an electronics panel that contains circuit controls for linear actuation, electro-acoustic amplification of the distributed mode loudspeaker (DML) embedded speakers and a set of sensing inputs.

Resonant Chamber in interior space (archdaily.com)

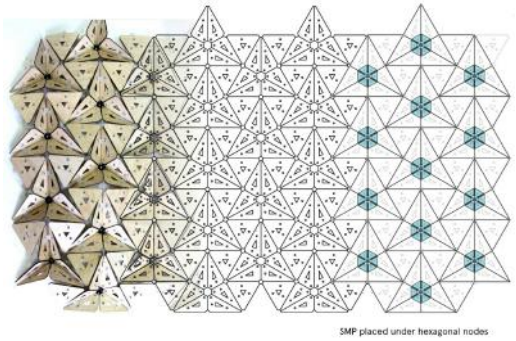
A single electronics panel may contain enough processing to control four DML speakers, local sensing of acoustic pressure and three sets of linear actuators which in turn controls three flat-folding cells.

2. IaaC Students Develop Material System with Responsive Structural Joints

Despite architecture's continued evolution over the course of history, our use of structural materials has remained largely the same since the advent of modern building materials. This reality may be changing thanks to the development of new materials seeking the same kinds of adaptability often found in nature.

These transformable structures have the potential to open further possibilities in the realms of responsive environments. A similar system might be designed to respond to a given environment and improve the experience of occupants, such as providing increased shade if it is sunny, or folding open if it is cloudy. The adaptability of the structure also allow for various spatial configurations to fit different programmatic needs. These foldable structures coupled with the material advantages of Shape Memory Polymers have the potential to create transportable structures and architecture that immediately responds to our changing needs.

The resulting structure can be deformed by heating theses joints and inflating balloons underneath the structure, a technique which is already used in the creation of full-scale buildings such as binishell domes, and has proven to be a viable process for efficient construction. If these structural joints could be developed at the scale of a building, they would be particularly useful for modular structures that need to be transported in a completed state and rapidly constructed on site.



SMP placed under hexagonal nodes (archdaily.com)

Original position and after deformation

3. TU Lisbon - IST, Portugal 2010Master Thesis Project & eCAADe 2011 Publication Supervisors: Jose P. Duarte & Joaquim Jorge

3This research work was developed with the aim of enquiring into the concepts of adaptability, transformation, and interactivity between the built space, its users and the surrounding environment to find appropriate responses to variations in spatial and functional needs, prompted by different uses and activities.

TU Lisbonproject (pinterest.com)

After a look into the roots of kinetic architecture and a brief survey of the state of art, it presents the prototype of a responsive kinetic structure for a multi-purpose pavilion, concluding that by the integration of existing and emergent technologies, we now have the basic means to design and implement such structures.

4. Flexible Stick Structures

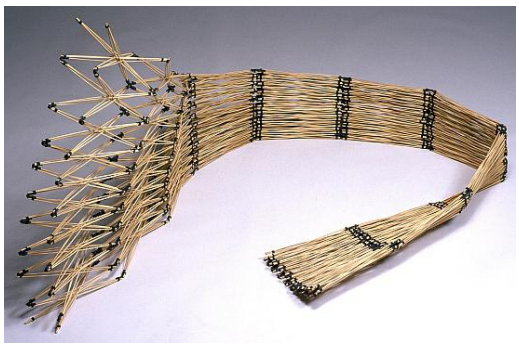
Bradford Hansen-Smith has been experimenting with structures made from a great many 10-inch bamboo skewers held together with short pieces of rubber tubing. He calls the technique stickweaving and presents a gallery of interesting examples. Modular units connect to neighboring units with tubing and the entire structure is flexible enough to be collapsed or morphed into various surfaces.

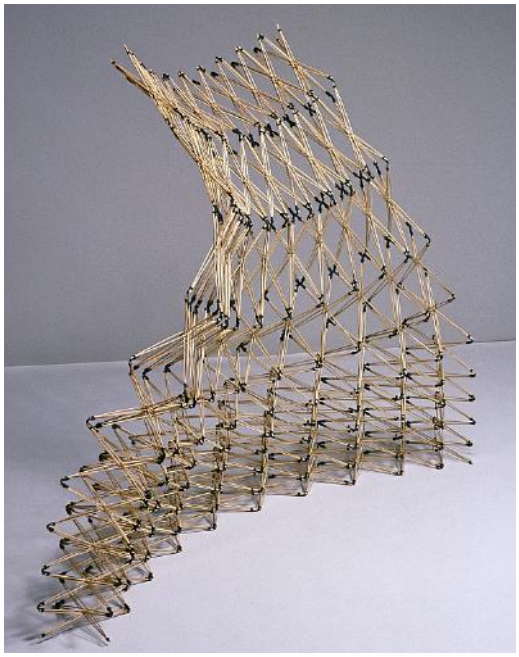
The basic module above is a 3-dimensional cross of twelve sticks arranged with three sticks along each of the long diagonals of a cube. The sticks are joined with tubing at the corners of the cube, so the joint in the center where all the sticks cross is flexible.

Deployable structures refer to any type of structure that has at least two sizes and/or configurations. Any tent qualifies, as does an umbrella. These object transform radically from their stored state, as compact as can be to facilitate their transport, and full expanded to provide (in both of these cases) shelter from the elements. As part of a semester long investigation into types forms of deployable structures, a basic "scissors" hinge was constructed to explore how manipulating points of connection can drastically change how these hinges deploy.

By changing where the center connection is located, these 'extension arms' go from a straight extension to curved to folding in on itself. This transformation, as explored here, required the reassembly of the pieces and thus provided a cumbersome process for adjustment

By incorporating length adjustment into the strut component, larger structures can transform from a uniform deployment, flattening all the way out, to an asymmetrical deployment which results in a partial dome structure.





Example for Flexible Stick Structures (pinterest.com)

METHODOLOGY:

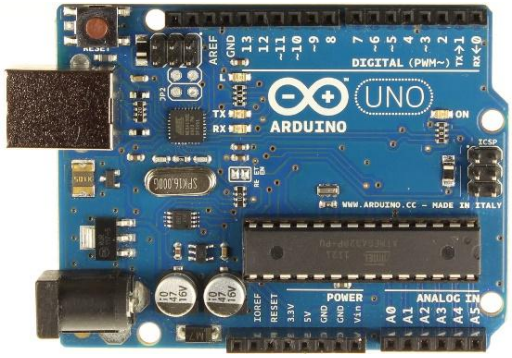
FIREFLY:

FIREFLY is a set of comprehensive software tools dedicated to bridging the gap between Grasshopper - (a free plug-in for Rhino) - the Arduino microcontroller and other input/ output devices like web cams, mobile phones, game controllers and more. It allows near real-time data flow between the digital and physical worlds - enabling the possibility to explore virtual and physical prototypes with unprecedented fluidity.

Ray Activision Plug-in:

Ray Activision is a program that includes identifiable video codes detectable by camera or other sensors. The program introduces video codes as pages in the grass Hopper program, so that with Moving each of the video codes in front of the camera, the page specified in the grass hopper will interchange.

The type of arduino used is the suggestion to rotate the arduinouno array, which has the ability to move the servo motors, the type of servo motor tested for this tower pro micro project that has the ability to rotate at different angles.



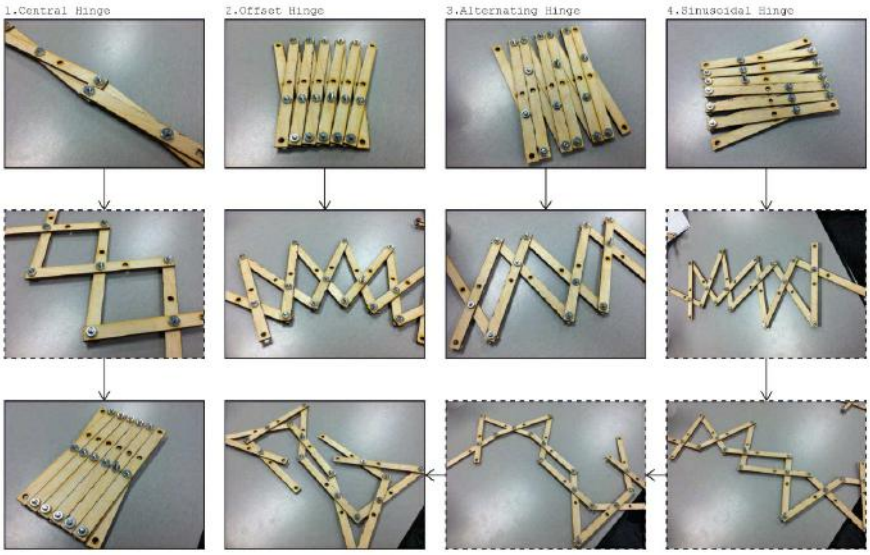
Arduino uno

Tower pro motor

design process:

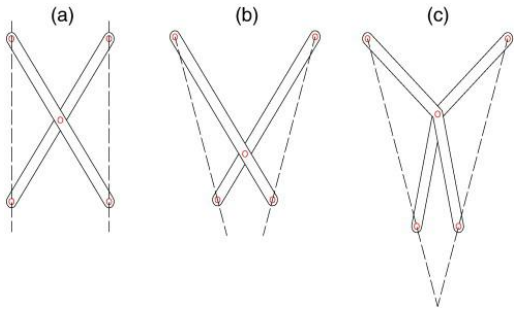
The San Scissors are structured according to the structure of at least two rods of equal or unequal size. Each rod has at least one joint and a junction, and each part acts as an umbrella structure. The movement of one side of the rod is transferred due to the transfer of force by the joints to the other side, and the two to the two affect the rest of the structure.

By transferring the location of the force, as well as the location of the joints and the point of attachment of the rods, we can constrict what kind of force we can have, what kind of movement we can have,Also, the location of the arm joints in the set of sanitary scissors can determine whether the movement of the set is linear or curved. The integration of sanitary scissors with different joints in two different directions can provide a more coherent 3D structure for open and closed ceilings.



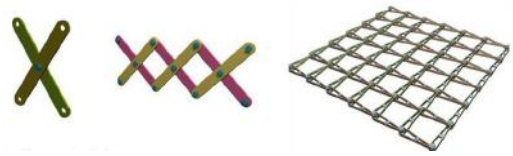
Sample Joints and Arm of San Scissors (Source: pinterest.com)

Scissor structures have a special ability to open and close and reduce volume. Using mid-armed arms accelerates and balances the process and works in two directions: (a) other examples that are joint Examples include cases like (b) and (c)



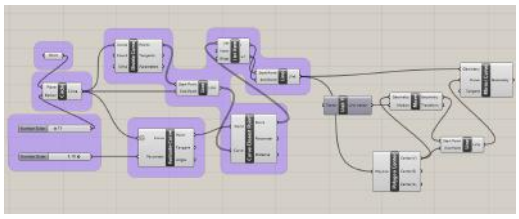
Sample Joints and Arm of San Scissors (Source: pinterest.com)

The evolution of the motor mechanism of the San Scissor structures is a combination of one axis to two main axesTo connect the two vertical axes, each other requires vertical fasteners to create the connection with the bolts between the fasteners and the ends of the arms.

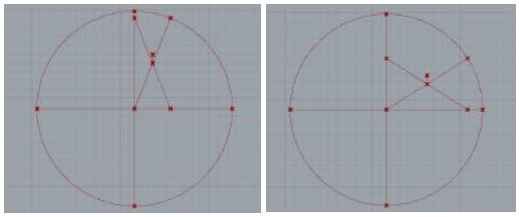


Vertical joints connecting the arms perpendicular to each other

Design and write algorithm in grass hopper and rhino:



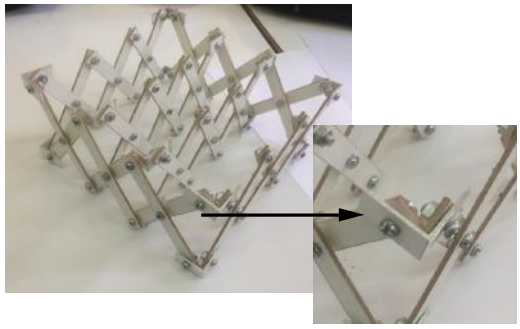
grass hopper for one module of scissors structure



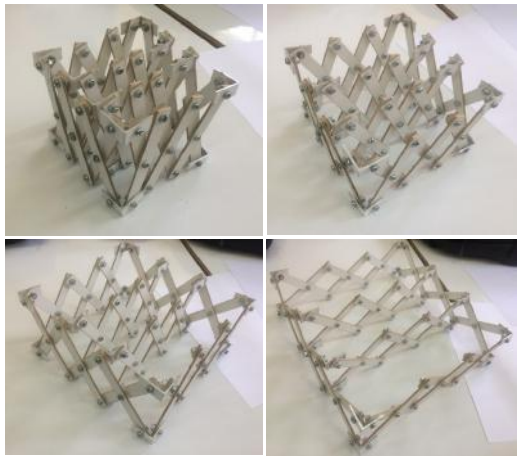
right: scissor model in open form, left: scissor model in close form (rhino)

Structural system of San Scissors due to functional flexibility and the presence of joints and modular bars in the entire open and open assemblyAnd it's a lot to reduce, combining and integrating this structure with the roof structure and the original Origami coating that is plentiful,In sum, the system creates a complete and complete set of components, the different parts of the structure and the various stages of the implementation of the changes, in accordance with the methods described in the following sections, are as follows.

The use of four axles in one direction and two perpendicular axes facilitates the movement of the mechanism on the plate and open and easy closing.



Vertical joints in structure



Steps to open and close the mechanism

To accelerate the process of opening and closing the system, several solutions were proposed and implemented:

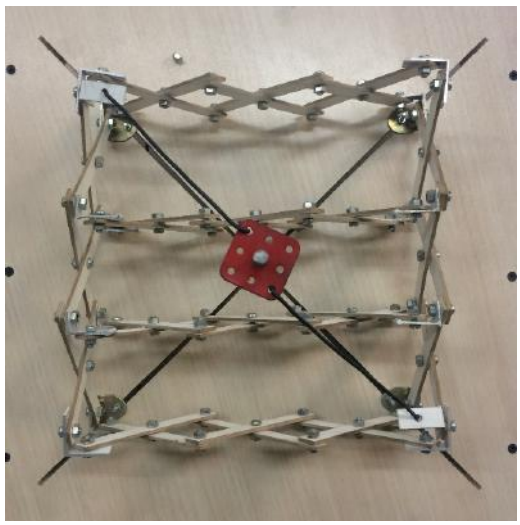
1. The design of a wooden pedestal for the assembly and creation of rails to control the diameter of the vertices to open and close the structure, which is also used as a general structure holder.

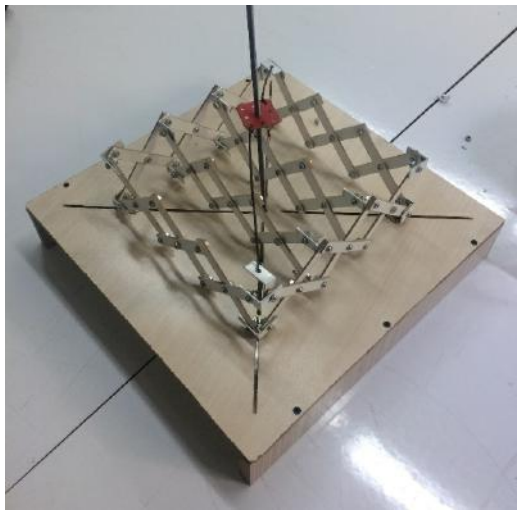
2. The use of the central turning axis and the rods attached to the vertebrae that open and close the structure axis up and down and in effect translate the vertical movement mechanism to the angle of 45 degrees to the diameter movement mechanism

The central axis is screwed

Structural system with central bar mechanism

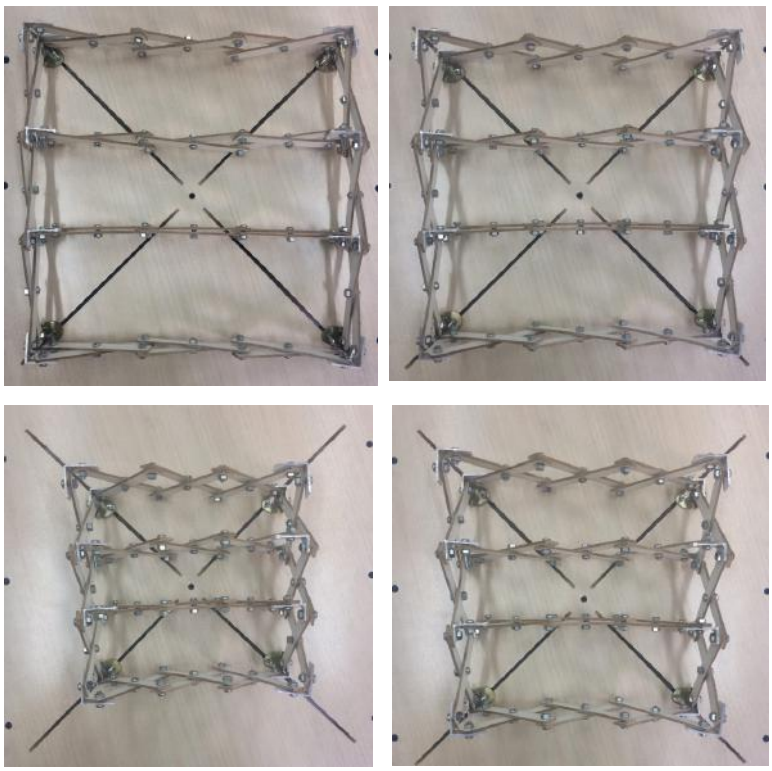
Connecting the plate to the central spindle rod and the central rod rotary bearings



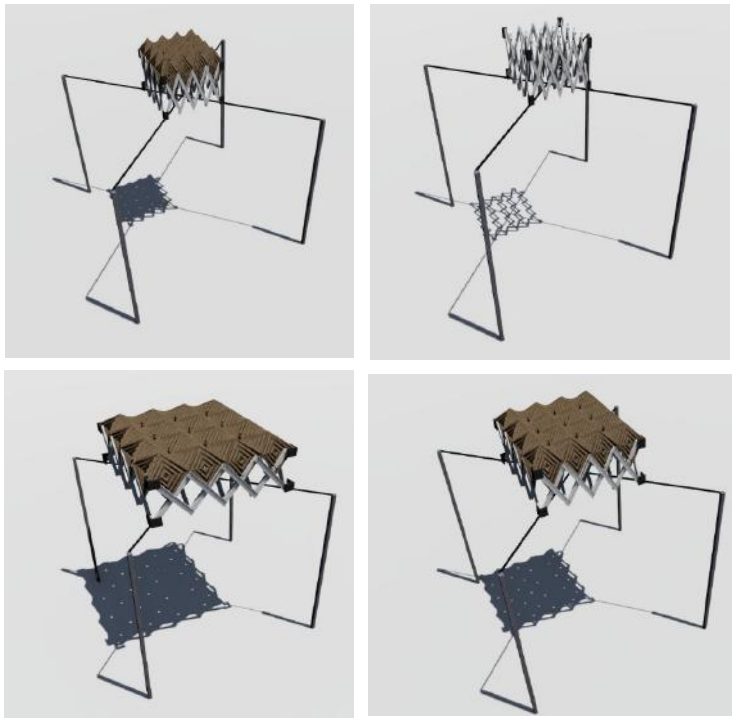


Structure ofsystem withcentral bar mechanism

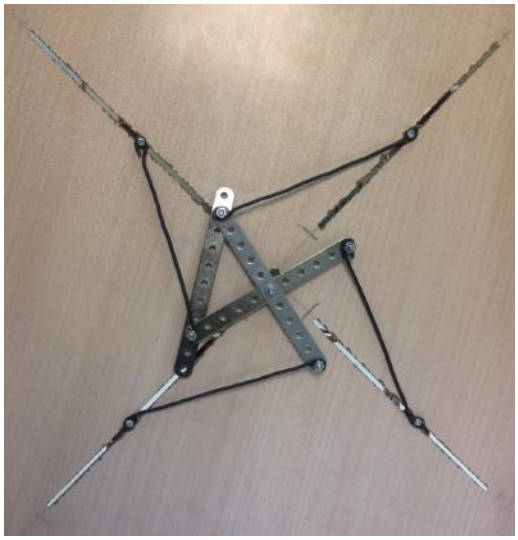
3. Design of screw and rotary structure under the base so that it can be controlled by the rotation of the whole assembly by means of a connection to the four ends and the stabilization of the center of the assembly.



Steps to open and close the structure with the bottom rotation system



Model of Steps to open and close the structure with the bottom rotation system



Swivel structure under the replica for opening and closing

Presentation of the design and description of the structural mechanism

Construction and operation:

The project of building enclosed space as a pavilion pavilion in the area opposite the Faculty of Art of TarbiatModarres University, using an origami canopy in the upper part of the completed system and ready to be exploited.

The design of the canopy of the complex is origami

The canopy mechanism is open and closed to control the amount of light input to the booth, and when closed, it enters the light into the space and the ventilation inside the booth,

The lighting of the pavilion at night under the canopy is used to create an appropriate space at night and on the canopy to create an indicator element in the environment. The dynamic and active form of the set creates a sense of mobility and vivacity in space and according to the theme of the interior design response.

To further interact with the environment, photovoltaic panels and solar energy can be used to control the opening and closing of the structure of the scissor roof.

Implementation of the project at the Faculty of Art and Architecture of Tarbiat Modares University

Conclusion:

The two-dimensional use of the San Scissors makes it possible to maximize the efficiency and maximum utilization of the structural form factors as a canopy in a small volume of space, In a closed state, the structure has only 5% of the space occupancy of the open and open space, which can be a positive factor for optimal use of space. A variety of proposed mechanisms for the movement of structures and the existence of different strategies have made it possible to work in different ways, taking into account the space requirements and conditions of the use of the structure, and choose the most optimal method.

In terms of execution cost, due to the modularity of the components and the lack of specific implementation details, the project can be considered an affordable and cost-effective project.

In general, color coordination, form coordination, minimum occupancy of space, the existence of various solutions for moving the structure system, the use of modular components and easy construction are the most important features of the project.

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