

Team MIMO plans and builds with a cautious and environmentally conscious material concept for the Solar Decathlon Europe 2021

Careful renovation and ecological optimized extension of the Café Ada

Düsseldorf, 17th March 2021

The *Solar Decathlon Europe* is the biggest, international, student architecture competition. After Madrid and Versailles, the finals of *SDE21* come to Wuppertal in summer 2022. 18 international university teams compete in ten disciplines and present their designs for an innovative, sustainable and energy-efficient building project.



Figure 1: Team-Photo MIMO

We, team *MIMO* of Hochschule Düsseldorf - University of Applied Sciences (*HSD*), are very proud that we have come together under the umbrella of the *Institute for Sustainable Urban Development (InLUST)*. As an interdisciplinary team of professors and students of architecture, mechanical engineering and energy technology, design, social and cultural sciences as well as economics, we work together under the guiding principle "MINIMAL IMPACT - MAXIMUM OUTPUT", aka *MIMO*, to develop a solution for resource-efficient buildings. That means just doing things that give you an added value and maximum benefit with minimal intervention.

Our motivation for fulfilling the *SDE21* relates to Professor Eike Musall, *MIMO* team member, as follows: «We do it because the result pays off in the end and a pioneering prototype for urban, energy-efficient and ecologically optimized living is created, everyone involved gains an incredible amount of knowledge and this is exactly my mission.»

In times of worldwide increasing «urbanization» and progressing climate change, the *SDE21* faces the teams with truly existing challenges of energetic urban redevelopment: closing gaps, additions of storey and renovations.

We are currently planning the renovation of a warehouses from 1905 in Wuppertal - the supraregional renowned Café Ada that is used as a restaurant, dance and event location - and its increase with an innovative and energetically optimized residential use that makes the quarter sustainable will appreciate, making good progress. Team *MIMO* focuses on its own urban compression, taking into account a visible value for the relationships.

It means 15 residential modules in wooden construction for all one to four people, which are used under a climate cover, which allows personal ventilation for each individual, and electricity for everyone via solar power systems.

The innovative central energy supply system *energiBUS* links a heat pump for heat and cold supply with household appliances and ensures energy efficiency in the whole system.

We have led the community as a central concept: The coexistence of the relationships will be part of open and community-based living and working relationships as well as a roof terrace. Our shared garden invites you to participate in «urban gardening» by areas and neighbors.

In addition to architectural, procedural and personal challenges, the team has been drawn to include and inspire the people in the neighborhood about energetic and ecological issues and to enable them to become part of the urban energy transition themselves.



Figure 2 and Figure 3: visualization and view of storey-addition to the cultural centre Café Ada

«We are currently feeling very clearly how sensitive our planet is. But also, how grateful for any protection», says Lena Hille, team member in team MIMO, about the motivation to participate in SDE21. «We see sustainable and circular building as an indispensable turning point in architecture.»

For the final in summer of 2022 all teams will plan and build a 70-100 qm representative 1:1 prototype. Also Team MIMO will present a section of our ecologically and economically sustainable residential addition as wood modules in a climate shell. All prototypes will be built, publicly presented and monitored on the «Utopiastadt Campus» in Wuppertal Mirke next to the Nordbahntrasse. Through the development of modular structures and efficient planning and production techniques, we will build components in our own university workshops before the construction period on site and can reduce the emissions associated within the construction phase to a minimum - exemplary for our strategy for inner-city densification.

Key words: Solar Decathlon Europe 21, HSD, Team MIMO, MIMO, Minimal Impact - Maximum Output, Wuppertal, Mirke, Café Ada, House Demonstration Unit, climate envelope, interdisciplinary, storey-addition, modular building, renewable energies, wood construction

Get in touch:

Team MI-MO
Prof. Dr.-Ing. Eike Musall M.Sc.Arch.
+49 211 4351-3027
solardecathlon21@hs-duesseldorf.de
Hochschule Düsseldorf –
University of Applied Sciences
Münsterstraße 156,
40476 Düsseldorf, Germany

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List of Team Members

Title	First Name	Surname	Degree	University course/Research field
Faculty Advisor	Eike	Musall	Prof. Dr.	Faculty of Architecture - Building Performance
Project Manager	Lukas	Horstmann	M.A.	Faculty of Architecture - Architect
Project Manager	Janina	Schleuter	M.A.	Faculty of Architecture - Architect
Project Architect	Dennis	Mueller	Prof.	Faculty of Architecture - Building Construction and Design
Project Engineer	Mario	Adam	Prof. Dr.	Faculty of Mechanical and Process Engineering
Structural Engineer	Christoph	Ackermann	Prof.	Faculty of Architecture
Electrical Engineer	Holger	Wrede	Prof. Dr.	Faculty of Electrical Engineering - Electric Power Engineering and Power Electronics
Student Team Leader	Elias	Hoffmann	B.A.	Faculty of Architecture
Health & Safety Team Coordinator	n/a			
Safety Officers	n/a			
Site Operations Coordinators	n/a			
Contest Captain	n/a			
Instrumentation Contact	n/a			
Communications Coordinator	Hendrik	Siems		Faculty of Design
Sponsorship Manager	Jennifer	Binzen	B.A.	Faculty of Architecture
Team Member	Peter	Andres	Prof.	Lighting
Team Member	Jana	Bauer		Architecture
Team Member	Carina	Bhatti	M.A.	Faculty of Social Sciences and Cultural Studies - methods of social work
Team Member	Max	Bierbach	M.A.	Urban Mobility
Team Member	Maximilian	Brockerhoff		Architecture
Team Member	Lars	Burmann		Engineering & Construction
Team Member	Sonja	Cieslinski		Architecture
Team Member	Marcella	Crespo		Affordability & Viability
Team Member	Chiara	Decher		Architecture
Team Member	Ina	Ehrhardt		Architecture
Team Member	Isabella	Emonds		Architecture
Team Member	Alban	Fangmeier		Architecture
Team Member	Thomas	Fenner	Prof.	Architecture
Team Member	Moritz	Fleischmann	Prof.	Faculty of Architecture - Architectural Computer Science
Team Member	Lena	Frank	M.Sc.	House Functioning
Team Member	Philipp	Freitag		Architecture
Team Member	Eric	Fritsch	M.A.	Communication
Team Member	Sophia	Gerlach		Architecture
Team Member	Liwia	Gnoth		Architecture
Team Member	Alicia	Hachmann		Architecture
Team Member	Janine	Hering	B.A.	Architecture

Team Member	Mira	Hill		
Team Member	Lena	Hille	B.A.	Architecture
Team Member	Marvin	Hillebrand		Communication
Team Member	Georgina	Hogrefe		Architecture
Team Member	Sabrina	Holz		Architecture
Team Member	Fabian	Kasperek		Engineering & Construction
Team Member	Patricia	Keck		Architecture
Team Member	Melis	Kilic		Architecture
Team Member	Alex	Kinzel	B.A.	Architecture
Team Member	Franz	Klein-Wiele		Faculty of Achitecture - Workshop Manager
Team Member	Linus	Knappe		Communication
Team Member	Tim	Kouroudis	B.A.	Engineering & Construction
Team Member	Anna	Kozlov		Architecture
Team Member	Ansgar	Krajewski	M.A.	Architecture
Team Member	Kim	Krall		Architecture
Team Member	Anabel	Kurz		Architecture
Team Member	Jörg	Leeser	Prof.	Faculty of Achitecture - Urban Context Design and Urban Design Theory
Team Member	Maren	Leyendecker		Architecture
Team Member	Sandra	Lohmann	M.Sc.	Institute for Sustainable Urban Development
Team Member	Rebekka	Loschen	Dr.	Research and Transfer
Team Member	Milena	Marsicek		Architecture
Team Member	Moritz	Munkel		Architecture
Team Member	Stephanie	Muscat-Bruhn		Communication
Team Member	Matthias	Neef	Prof. Dr.	Engineering & Construction
Team Member	Christin	Obermauer	M.A.	Communication
Team Member	Malcolm	Osafo		Architecture
Team Member	David	Paul	B.A.	Engineering & Construction
Team Member	Judith	Reitz	Prof.	Architecture
Team Member	Maximilian	Rödder	M.Sc.	House Functioning
Team Member	Katja	Schiebler	Prof.	Lighting
Team Member	Jan	Schmitz	B.A.	Engineering & Construction
Team Member	Nina	Sohnemann		Architecture
Team Member	Matthias	Stemmer	B.A.	Architecture
Team Member	Vanessa	Stratmann		Architecture
Team Member	Isabell	Szonn		Architecture
Team Member	Lisa	van Holt	M.A.	Communication
Team Member	Anne	van Rießen	Prof. Dr.	Affordability & Viability
Team Member	Andrea	Weiner		Architecture
Team Member	Stephanie	Weis	M.A.	Architecture
Team Member	Luise	Westphal		Architecture
Team Member	Cameron Juna	Wiest		Communication

Project Description

Team's Organisation and Objectives

Team MIMO of *Hochschule Düsseldorf - University of Applied Sciences (HSD)* is facing the competition and its new urban profile with the motto «Minimal Impact – Maximum Output». It means that implemented techniques and concepts have to add value to the location and create maximum benefit with minimal intervention. Specific subject of team MIMO is the cautious renovation and addition of storeys of an existing warehouse in Wuppertal Mirke from 1905 which is nowadays used as a catering, dance and event location by the supra-regional known Café Ada. The goal and guiding principle for the redesign of the inventory is therefore above all the aspect of preservation – both preservation of the structural history of the object and preservation of the atmosphere, as this is precisely what visitors appreciate about the Ada.

Six faculties and the *Institute for Sustainable Urban Development (In-LUST)* are involved in the interdisciplinary team. The team currently consists of 40 students and nine professors, supported by other professors, academic and student staff, the *HSD* workshop team and all further partners. Planning and ideas come together in the *Faculty of Architecture* where the concepts for Design Challenge and House Demonstration Unit (HDU) are developed and the subsequent construction is coordinated. Students from the *Faculty of Social Sciences and Cultural Studies* have analysed the clientele of the Mirke district and contribute their thoughts to the planning of the apartments. Members of the *Faculties of Mechanical and Process Engineering* as well as *Electrical Engineering and Information Technology* develop strategies for energy supply and load management. Supported by students of the *Faculty of Design*, the team prepares the concepts and transfers them to public relations via its website as well as Facebook and Instagram.

Project Development and Current State

Due to the corona pandemic, it is still only possible to communicate at a distance, i.e. in purely digital form. This does not prevent our students, employees and professors of the team MIMO as well as representatives of some partner companies from working, discussing and designing together digitally.

We are currently working in small groups on the design of the outdoor space, the further redesign of the existing building and the demonstrator.

Design Challenge

Our main emphasis is on the new building's living areas providing communal space for encounters and social exchange between the inhabitants.

The 15 wooden modules are stacked on top of each other in such a way that living space as well as common room is created. In addition, there are the common modules, which generally serve as washrooms and cold rooms with a shared kitchen. Each of these residential modules is equipped with the basic amenities of a common city apartment. A kitchen area with already connected appliances, a bathroom with prefabricated sanitary facilities and a spacious living area that can be furnished by the residents themselves will be provided. Of course, there is not only one habitation module but they range from small-er student and double apartments to maisonette or family apartments. The individual modules can extend over a length of almost 14 meters.

Special quality of stay offers the seating steps stairs in the south adjacent to the planted fire wall, as well as the roof terrace with Urban Gardening. The entire building can be accessed by a staircase, as well as an elevator on the north side of the building. The entire structure, including the stair core, is surrounded by a climate envelope and closes with the fire wall in the east.

In this way, there are private retreats in the modules and semi-private common areas in the zones between the climatic shell and wooden modules. A semi-public greenhouse will also be built on the roof, which will provide the residents with their own vegetables.

The facade is an elementary part of the design, as it forms a functional shell around the modules. Both the roof and the facade are covered with photovoltaics. The facade consists of movable glass slats that can be adapted to different situations. For example, the slats are tilted in summer to adapt to the steeper light of the season and to be ventilated and act as sun protection to prevent heat accumulation. The same applies to the roof, which can be opened to prevent heat accumulation. Even night aeration on hot days is conceivable. The opposite effect is desired for winter. Solar gains should be trapped in the shell and activate the heat storage mass of the solid wood walls. For this purpose, the slats remain closed. In this way, a buffer layer can be created, which forms a climate zone around the housing modules, which is warmer than the outside air in winter.

Building Challenge

In order to carry the wooden modules on the existing building, we use a grid made of steel beams that is placed on the outer walls of the Café Ada. Each module comprises a small, well-organized single apartment and can be combined with other modules. This creates a flexible floor plan with attractive living space for different groups of people. Due to the variable floor plans, the modules can be prefabricated in series already including openings or milling for power and sanitary connections in the factory.

Construction sites that are cast in reinforced concrete on site are a major time factor and require a larger number of employees, as well as a significantly higher volume of transport routes. In order to counteract this and to plan energetically and economically, prefabricated wooden modules are used in our top-up. A module can be prefabricated from planning to execution in such a way that it can be delivered directly to the construction site by a truck.

The modules are structured in a way that they are four times longer than wide. The dimensions of the prefabricated elements are optimized in their dimensions for transport 14 m x 3.35 m x 3.35 m (l / w / h). The longer sides of the modules are closed so the modules can be lined upside by side and stiffened in themselves. Thanks to the bulkhead construction, in which the load-bearing long sides serve as reinforcement, the modules can be stacked freely. Each module has a central core function including pipelines and sanitary facilities. The residential modules are based on a system of solid wooden elements by our partner "holzius", enclosed by a semi-transparent climate shell.

Dissemination Activities and Current Impact

The dissemination of scientific information to the (professional) public is a central idea of the competition. As a result, an official homepage and pages on social media have been set up as a communication and presentation platform, now with partly new graphics and content.

Thus, all target groups such as experts, the public, sponsors and companies as well as family and friends can participate in the current events of the team and its project status. Team MIMO located in Düsseldorf has a direct connection to the venue in Wuppertal. The team expects feedback from the general public, especially the people from the Mirke district, and is looking forward sharing our project with them.

Collaborating Institutions and Sponsoring Companies

Institution/Company	Type of business/ branch	Type of Sponsor- ship
AIT Dialog	Communication	Partner network / Publications
Albrecht Jung GmbH & Co. KG	Electrical engineering compo- nents	Products
Alware GmbH, Ingenieurbüro für Bauphysik und Gebäudesimula- tion	Building simulation	Know-how
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DIASA e.V.	Association	Financial
ECBM GmbH	Consultant in artificial intelli- gence / smart city	Coaching
EnergieAgentur.NRW	Association	Know-how
Energy Endeavour Foundation	SDE 20/21	Financial
Erco	Manufacturer of Lighting	Material / Items (Outdoor-) lights
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Faculty of Mechanical and Pro- cess Engineering	Hochschule Düsseldorf - Uni- versity of Applied Sciences Düsseldorf	Financial
Faculty of Electrical Engineering & Information Technology	Hochschule Düsseldorf - Uni- versity of Applied Sciences Düsseldorf	Financial
Faculty of Social Sciences and Cultural Studies	Hochschule Düsseldorf - Uni- versity of Applied Sciences Düsseldorf	Financial
Frauenhofer Ifam	Energy / charging infrastructure	Know-how
Gira Giersiepen GmbH & Co. KG	Electrical engineering components	Products / Know- how
Hochschule Düsseldorf - Univer- sity of Applied Sciences Düssel- dorf		Financial
Holzius	Wood building components	Products
Hottgenroth Software GmbH & Co. KG	Software	Software systems
Ingenieurbüro für Bauphysik und Gebäudesimulation alware GmbH	Building simulations	Know-how
Ingenieurbüro Stahl und Weis	Planning	Know-how
Miele & Cie. KG	Home appliances	Products / Financial / Know-how


Passivhaus Institut	Planning	Material / Items
Schneider Electric GmbH	Technical building equipment	Products / Know-how
SMA Solar Technology	Photovoltaic technologies	Products / Know-how
Stadtwerke Kempen	Electricity provider	Financial
Steinbacher Consultatant	Mobility / charging infrastructure	Know-how
SUNOVATION Produktion GmbH	Manufacturer of Photovoltaics	Material / Items
Vaillant Deutschland GmbH	Heating technologies	Products / Know-how / Financial

Get in touch:

Team MI-MO
Prof. Dr.-Ing. Eike Musall M.Sc.Arch.
+49 211 4351-3027
solardecathlon21@hs-duesseldorf.de
Hochschule Düsseldorf –
University of Applied Sciences
Münsterstraße 156,
40476 Düsseldorf, Germany

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MIMO

Logo Team MIMO - © Team MIMO / SDE21



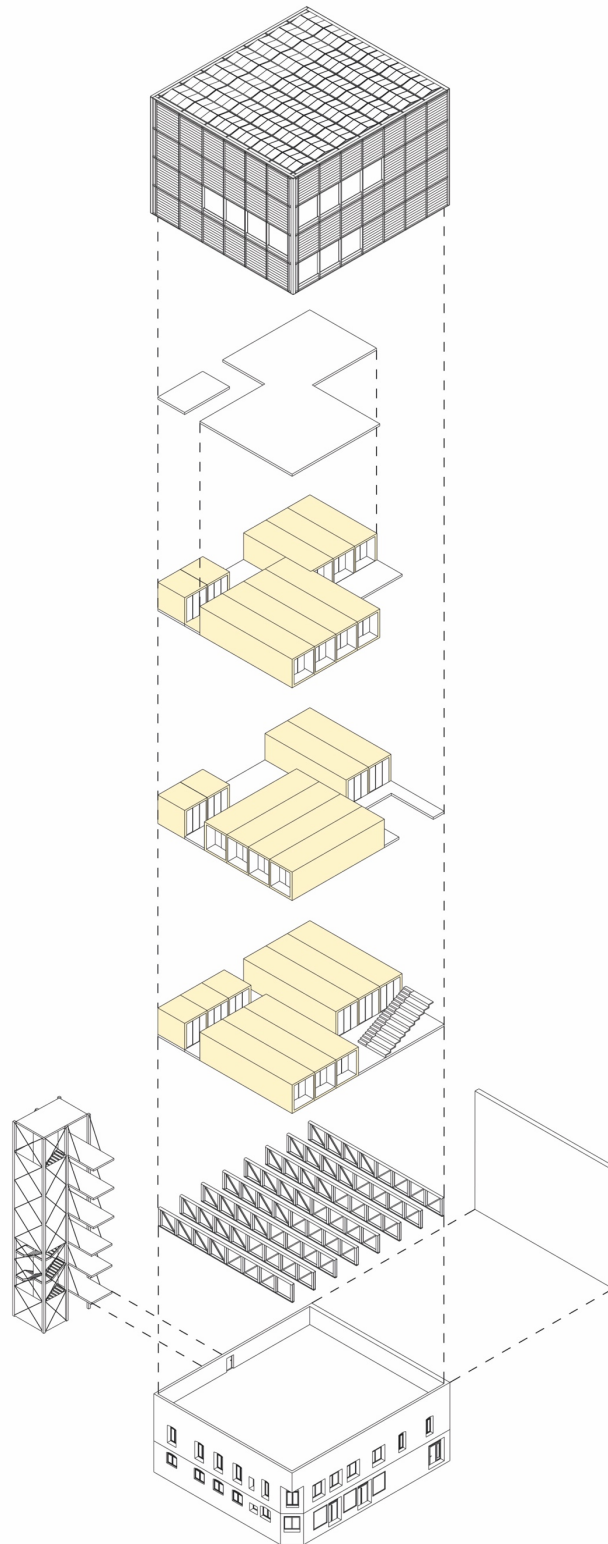
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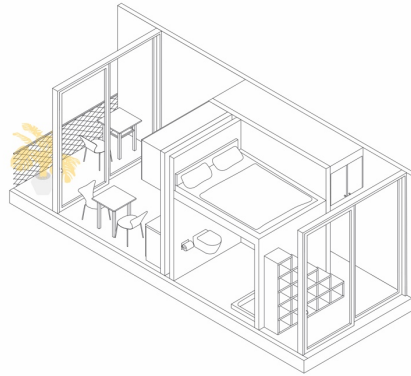
Design Challenge: Exterior Rendering – street view - © Team MIMO / SDE21



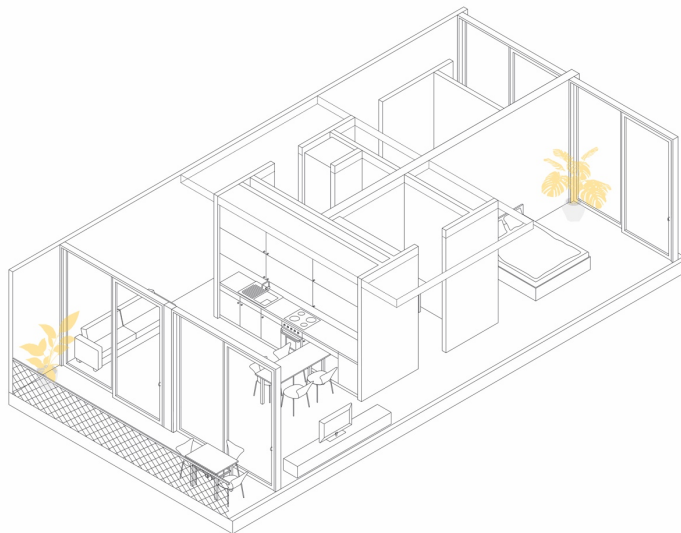
Isometry - Urban context - © Team MIMO / SDE21



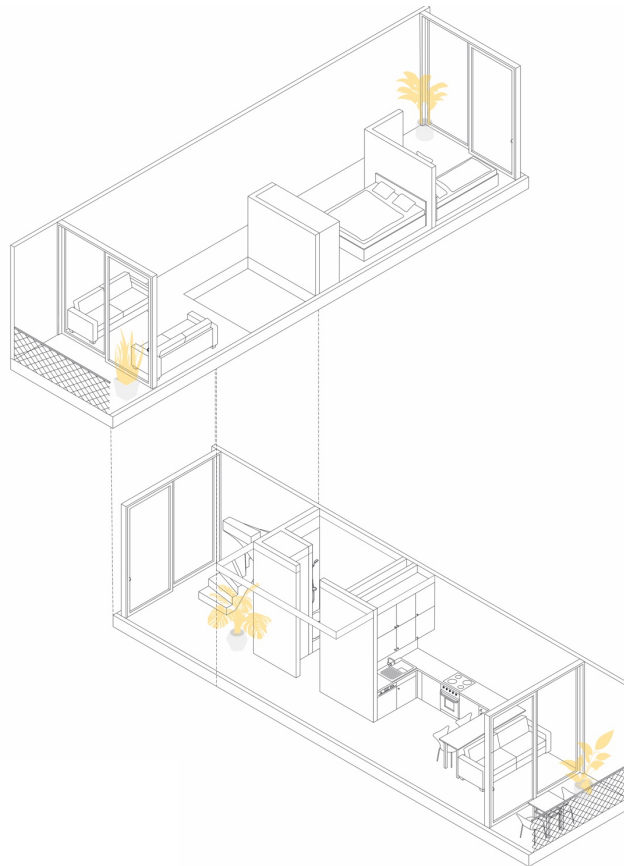
Isometry Building Design - © Team MIMO / SDE21



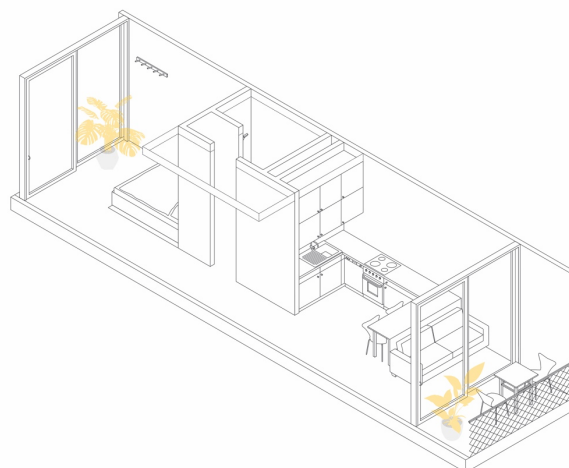
Student apartment isometry - © Team MIMO / SDE21



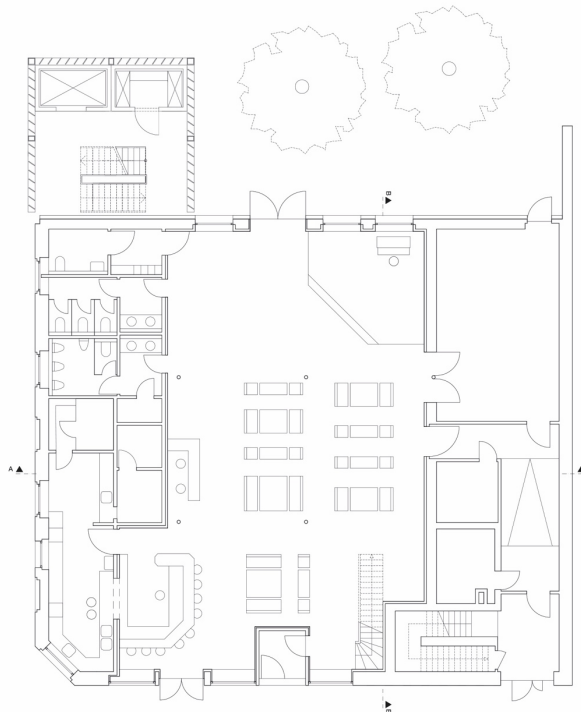
Family apartment isometry - © Team MIMO / SDE21



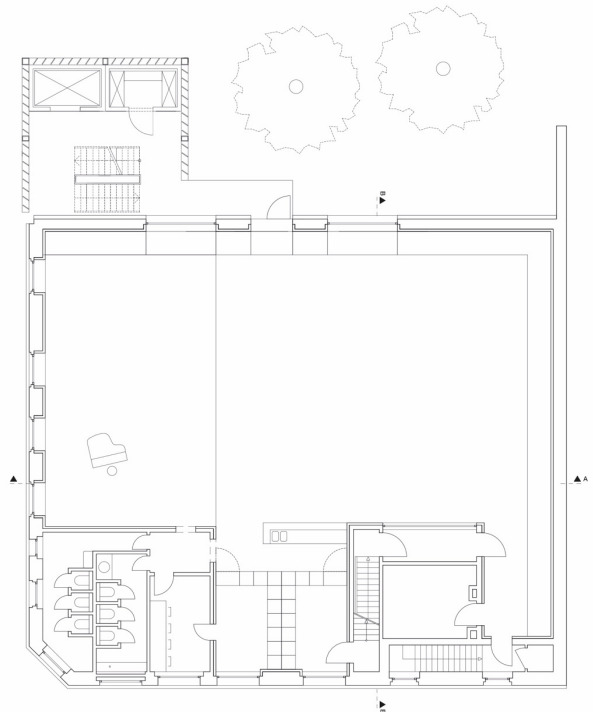
Maisonette apartment isometry - © Team MIMO / SDE21



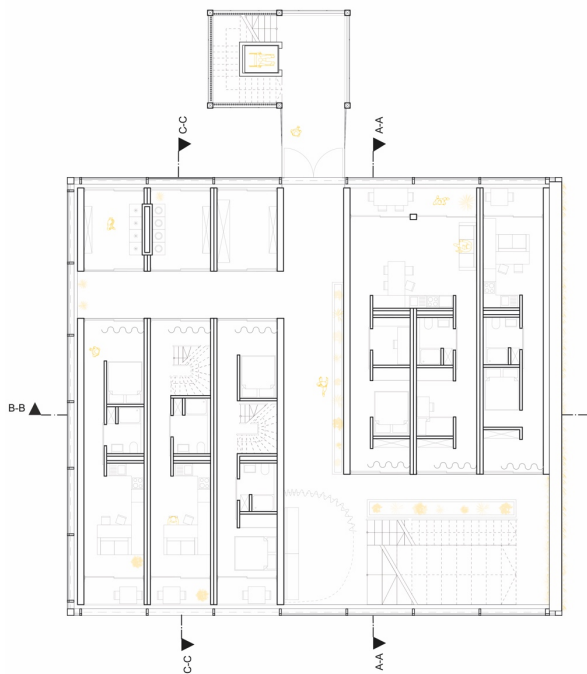
Single apartment isometry - © Team MIMO / SDE21



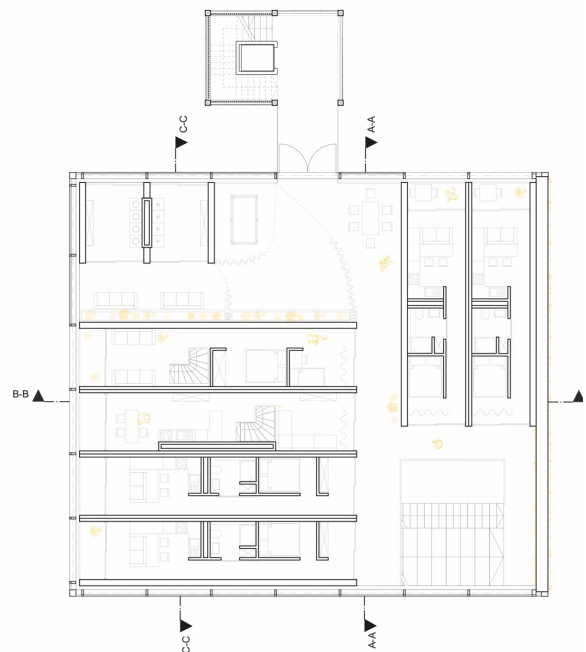
Floor Plan – First Floor
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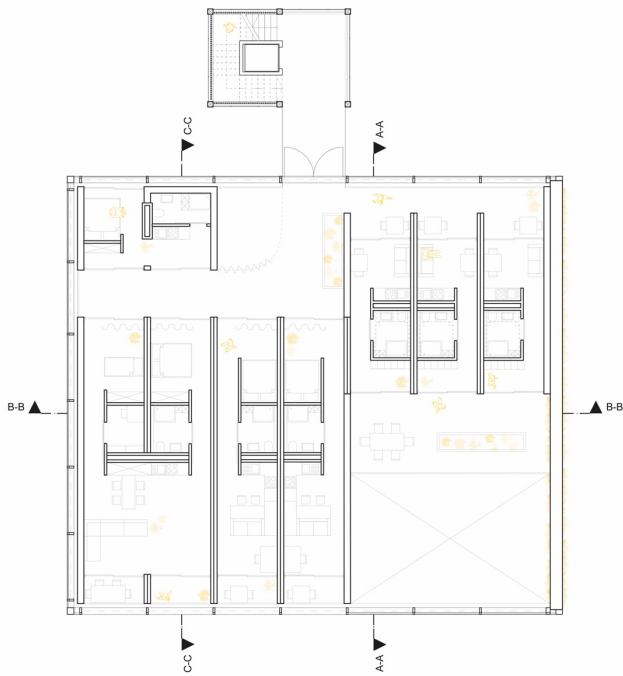
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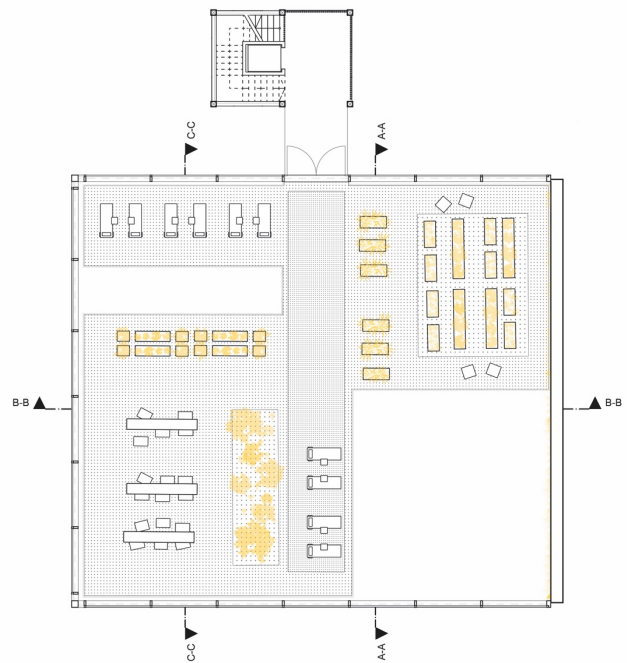
Floor Plan – Third Floor
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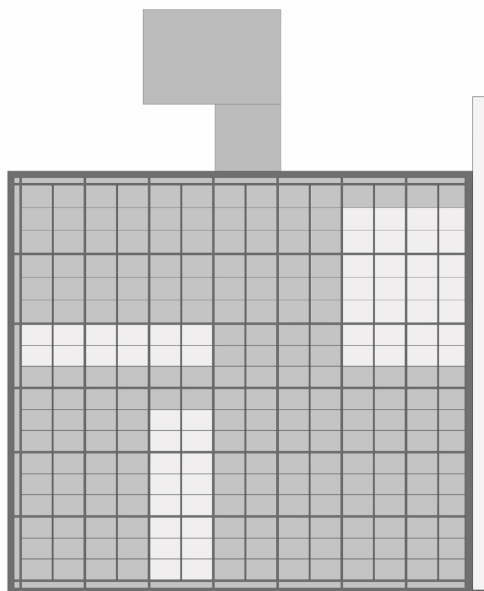
Floor Plan – Fourth Floor
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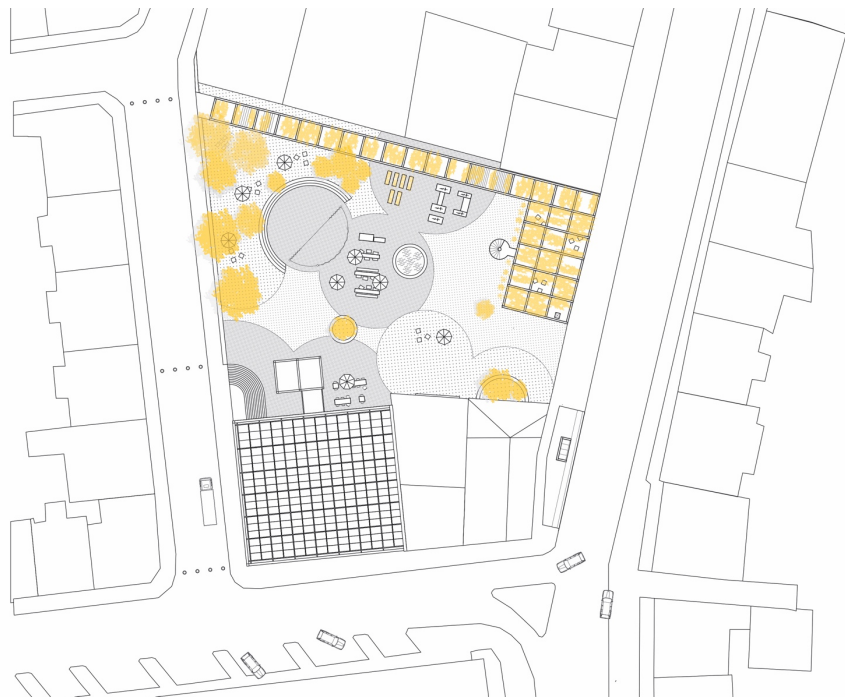
Floor Plan –Fifth Floor
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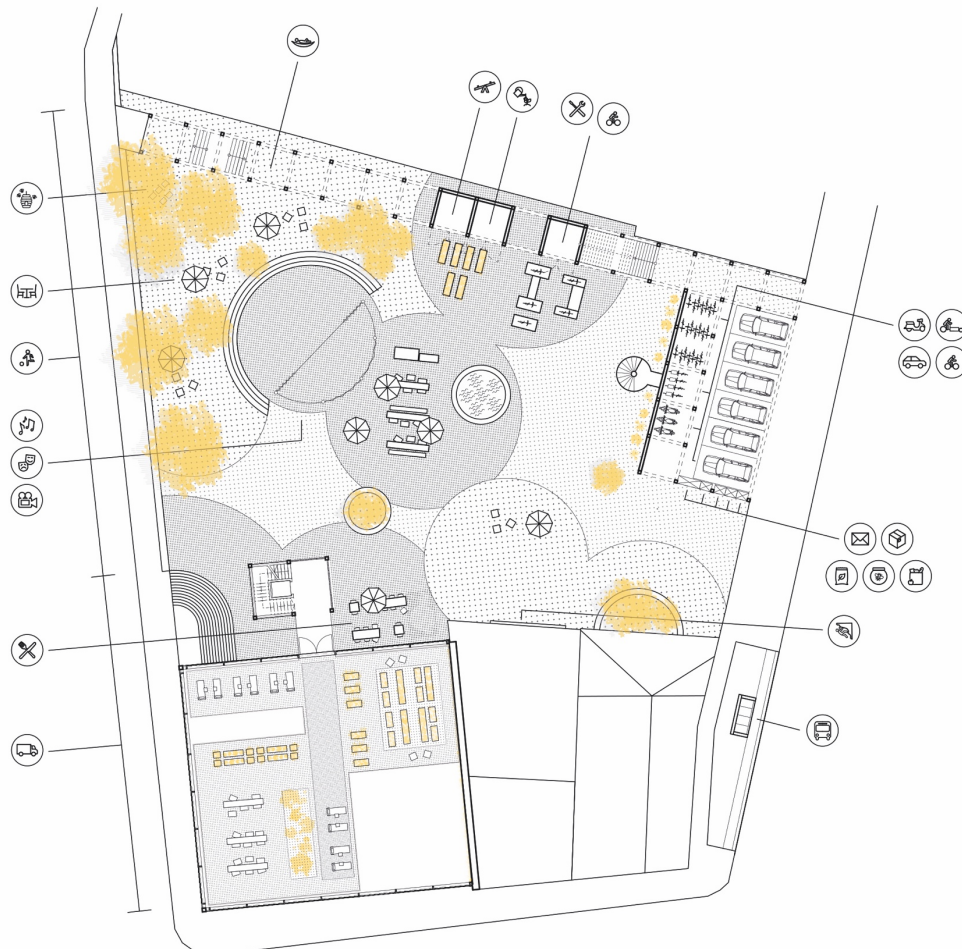
Floor Plan – Sixth Floor
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Floor Plan – Roof Plan
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Location Map – Rooftop View - © Team MIMO / SDE21



Location Map – Activities - © Team MIMO / SDE21



Building Elevation - South - © Team MIMO / SDE21



Building Elevation – West - © Team MIMO / SDE21



Building Elevation - North - © Team MIMO / SDE21



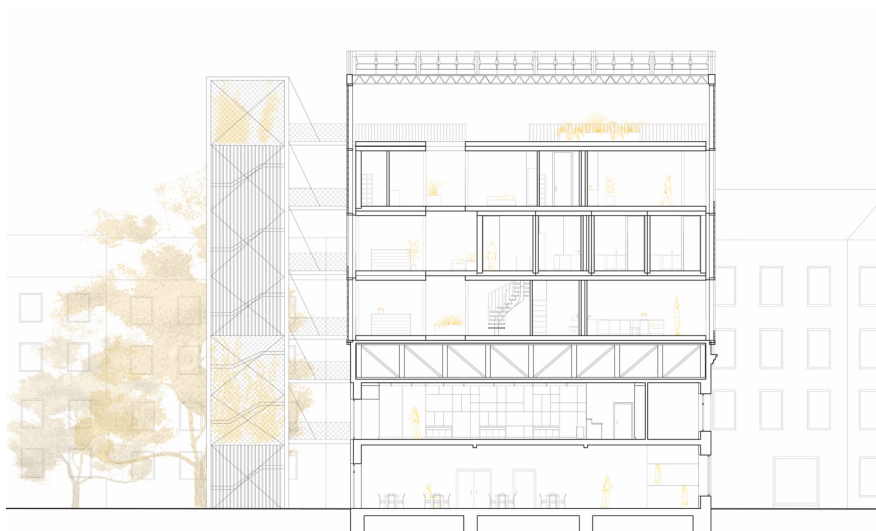
Building Elevation – East - © Team MIMO / SDE21



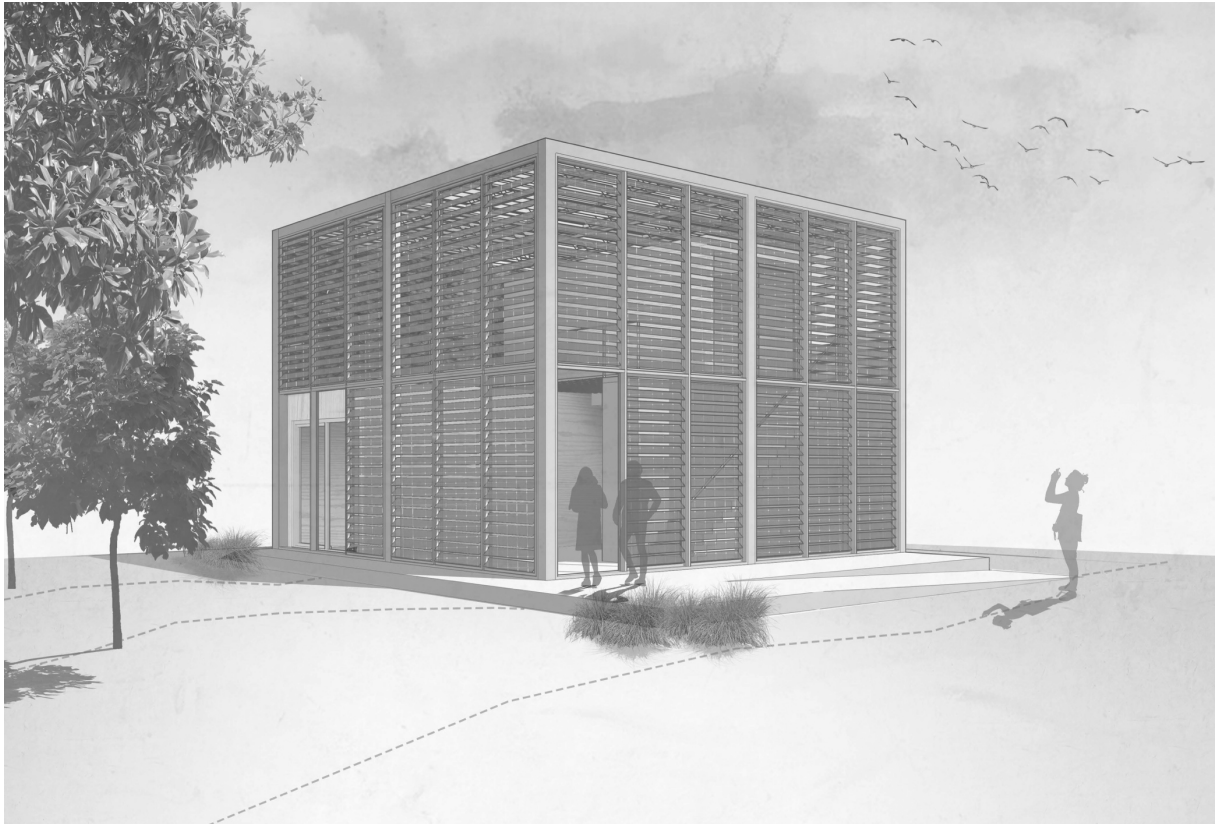
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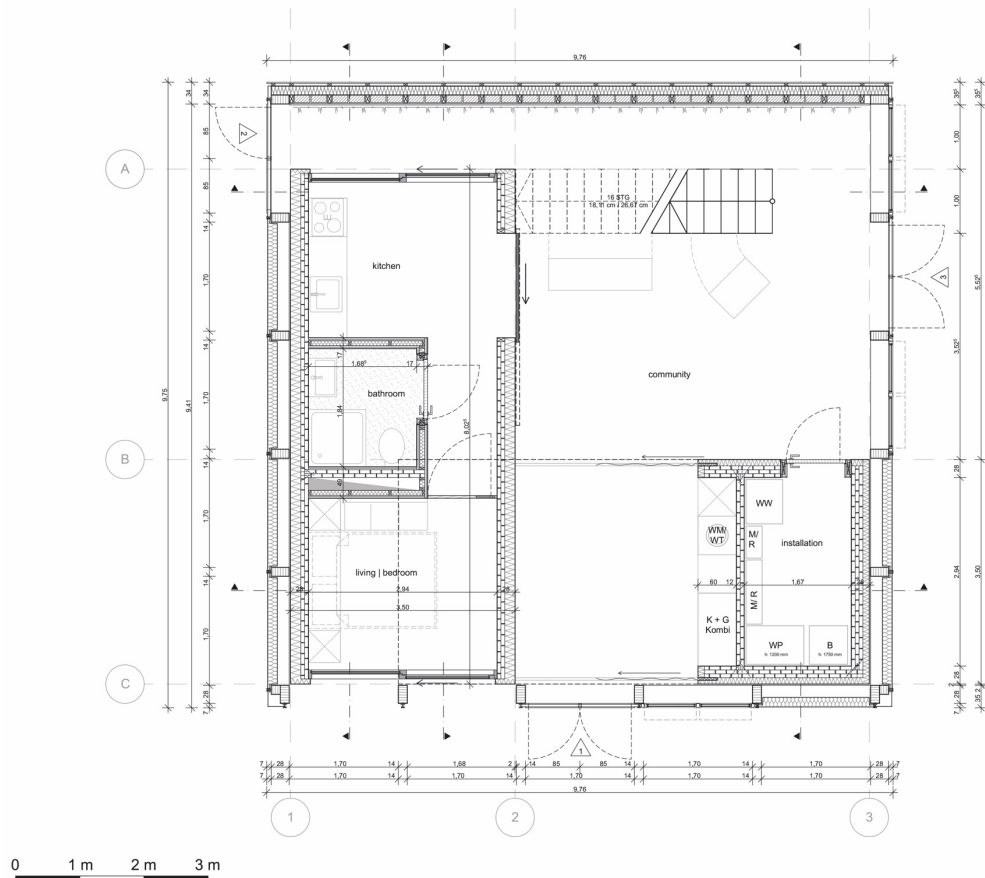
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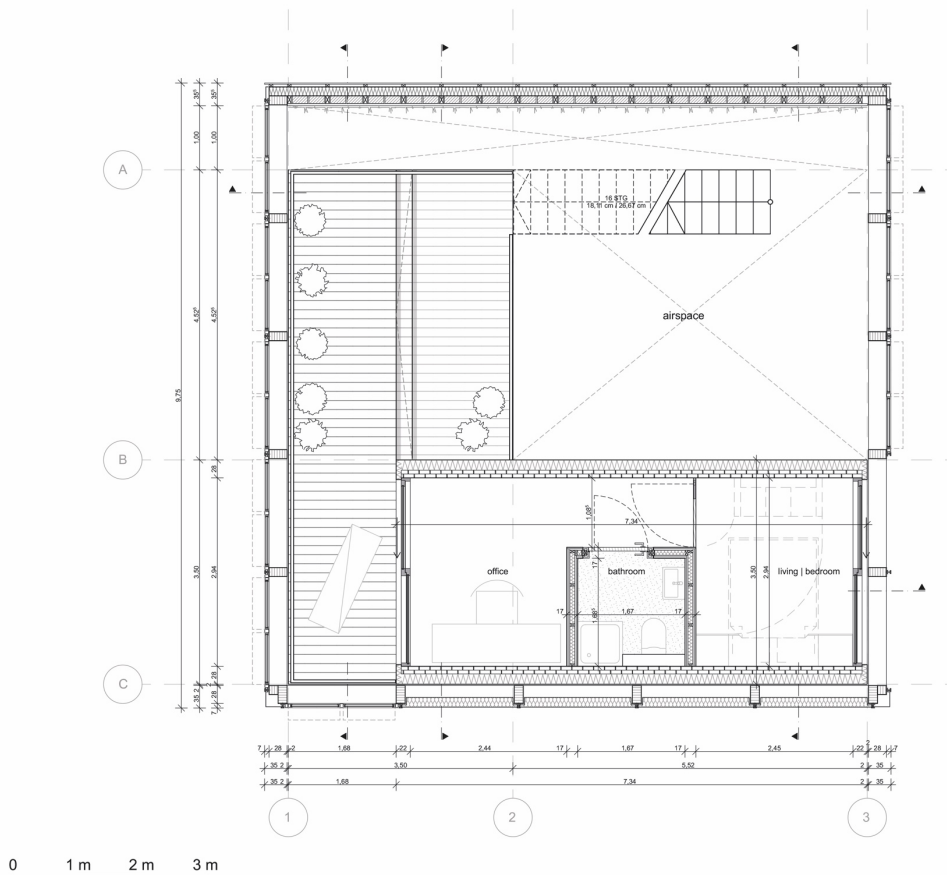
Demonstration Unit – Visualisation - © Team MIMO / SDE21



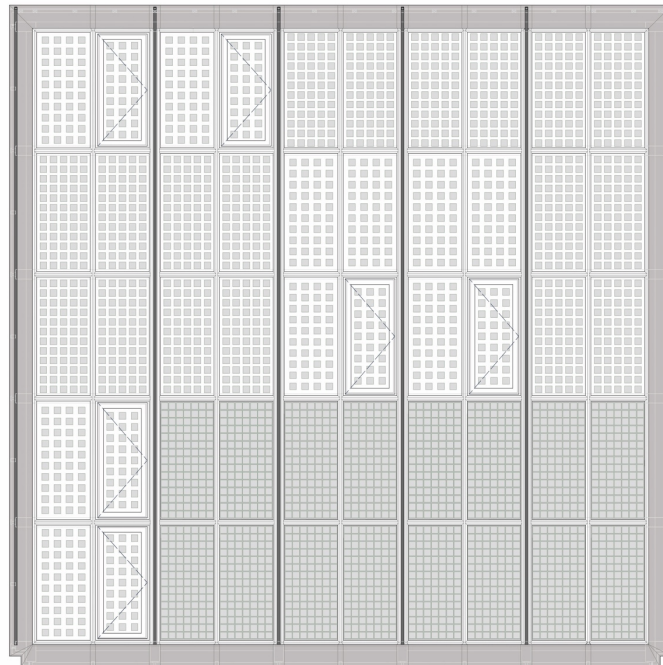
Demonstration Unit – Interior Rendering - © Team MIMO / SDE21



Floor Plan – Ground Floor - © Team MIMO / SDE21



Floor Plan – First Floor - © Team MIMO / SDE21



Roof Plan - © Team MIMO / SDE21



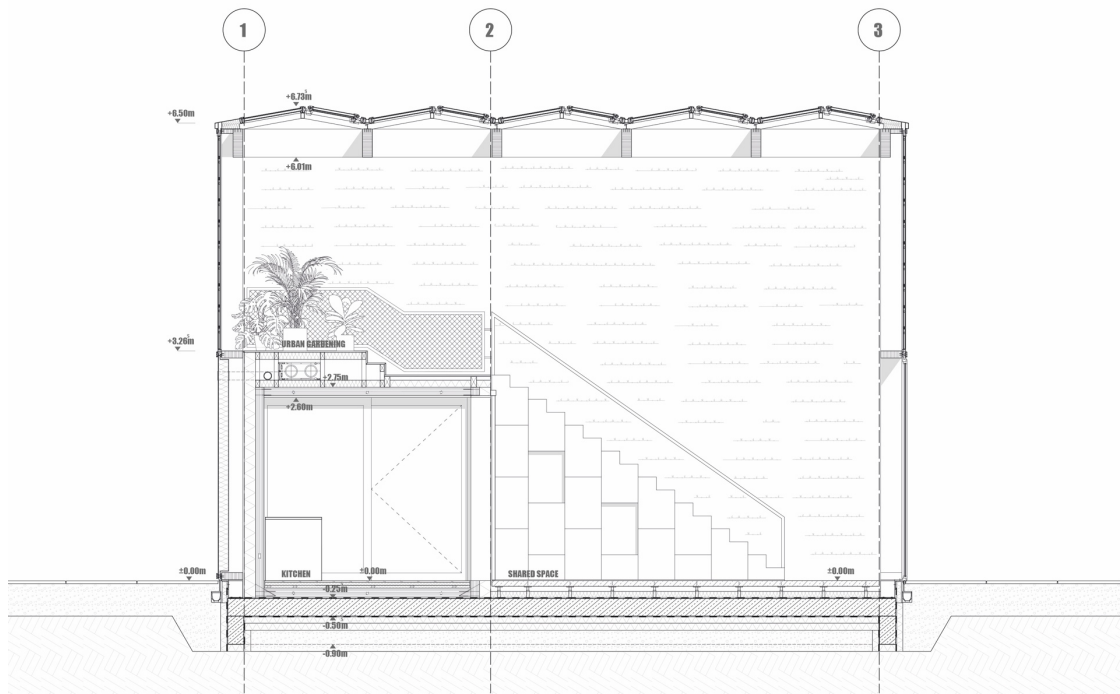
Building Elevation - South - © Team MIMO / SDE21



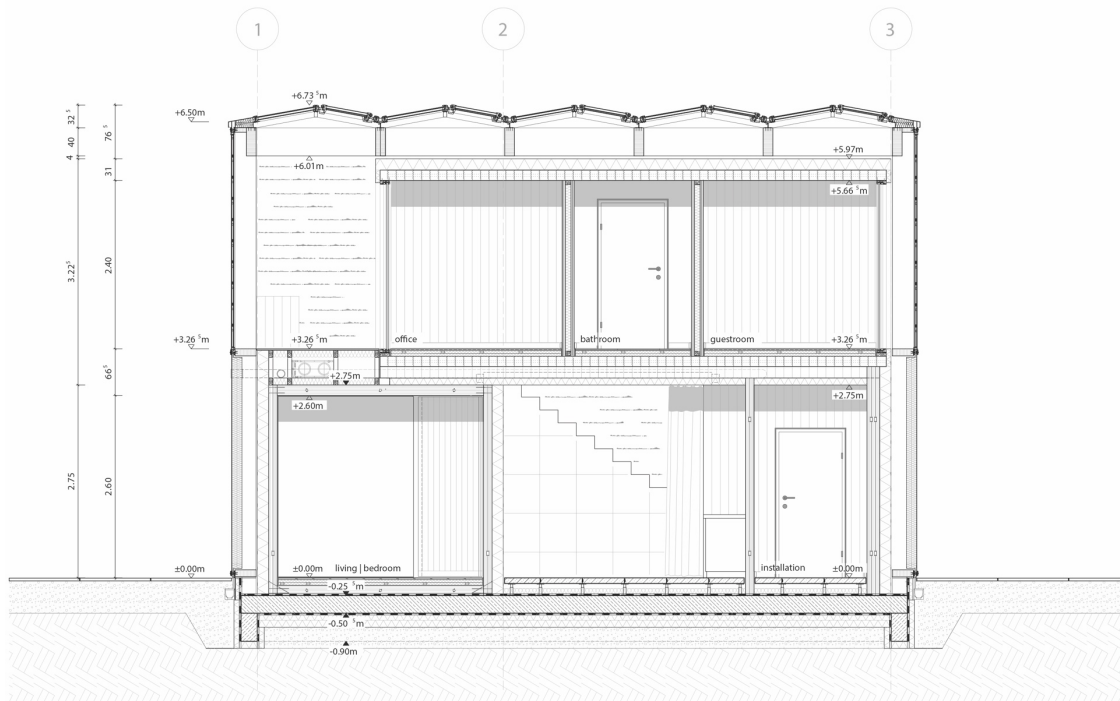
Building Elevation - West - © Team MIMO / SDE21



Building Elevation – East - © Team MIMO / SDE21



Building Section AA- © Team MIMO / SDE21



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