Team MIMO is adding living space to Café Ada
It goes to the execution planning

Düsseldorf, 1st December 2021

The *Solar Decathlon Europe* is the largest international university competition for sustainable building and living in cities. In June 2022 the Solar Decathlon Europe 21/22 will come to Germany for the first time and also for the first time it will be dedicated to specific construction tasks in the existing building. The 18 university teams from eleven nations are to develop concepts for sustainable building gaps, additions and extensions.

Figure 1: Visualization of the Café Ada

Figure 2: Visualization of the HDU

We, *team MIMO of Hochschule Düsseldorf - University of Applied Sciences (HSD)*, and 17 other teams from 11 countries have a vision: to make our building and living sustainable. We 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 *SDE 21/22* relates to Professor Mario Adam, MIMO team member, as follows: «The protection of the climate is one of the very important tasks of mankind and climate-neutral buildings and neighbourhoods are particularly important in Germany for this. I would like to and can contribute to this with my knowledge of renewable energies and energy-efficient technologies.»

In times of worldwide increasing ‹urbanization› and progressing climate change, the SDE 21/22 faces the teams with truly existing challenges of energetic urban redevelopment: closing gaps, additions of storey and renovations.
Our design focuses on the supraregional renowned *Café Ada* in the Mirker Quartier, which is used today as a restaurant, dance and event location. We are currently planning the renovation of a warehouses from 1905 in Wuppertal 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.

Figure 3: Team MIMO

The individual living space is severely restricted in the sense of sufficiency, but the space between the modules should be usable for the community: 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 neighbours. In addition to architectural, procedural and personal challenges, the team has been drawn to include and inspire the people in the neighbourhood about energetic and ecological issues and to enable them to become part of the urban energy transition themselves.

> «The SDE makes sustainable an conscious building more real and varied to students than theory courses can. Therefore a generation of future architects can develop this important consciousness and pass it on», says Jana Bauer, team member in team MIMO, about the motivation to participate in SDE 21/22.

From the middle of May 2022, all 18 teams will set up their representative 1: 1 sections on the ‹Solar Campus›, opposite the Mirke train station on the renowned Nordbahntrasse - as fully functional living modules of around 100 square meters.
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.

Keywords: Solar Decathlon Europe 21/22, Hochschule Düsseldorf, University of Applied Sciences, HSD, Team MIMO, MIMO, Minimal Impact - Maximum Output, Wuppertal, Mirke, Café Ada, storey-addition, modular building, renewable energies, climate envelope, wood construction, House Demonstration Unit, HDU interdisciplinary

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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

Almost all teams of Solar Decathlon Europe 21/22 gathered in Wuppertal for a two-day workshop in September, subject to hygiene and protective measures. Finally, we got to know the other contestants! It was a pleasure to meet all of these talents from all over the world. On Thursday, the day started on the campus of the University of Wuppertal. The organizers held

several talks about the contest, its rules and the final. Each team presented its concept. On Friday we met at Cotton Factory. There we had the chance to talk directly to the organizers and to ask them all of our questions about the competition.

To have a meeting place for Team MIMO, we already organized a group room to have the possibility to work concentrated and undisturbed together. Unfortunately, due to the current situation, this room cannot be used by everyone at the same time as desired. Therefore, most of our means of communication are still digital. We have created a Share Point to compare our actual results and organize video calls within different task forces several times a week, so that everyone is up to date and can continue with their work.
We are currently still working on our implementation planning. In particular, the statics is a big issue and the statics of the shipping of the wooden boxes. Further details, for example for the sanitary facilities, are also being planned in cooperation with Grohe. In addition we also had workshops with partners such as MIELE, Schüco and Eurolam. In these workshops students met and talked with representatives of those companies about our project and their involvement. Together they planned which parts of our HDU get sponsored and how to organize the process. The end results were precise plans of the HDU, which where then used by the teams that develop specific parts like the doors or the facade. This was and is a great opportunity for our students to learn how to talk to companies and organize a building process.

Design Challenge

Our main emphasis is on the new building's living areas providing communal space for encounters and social exchange between the inhabitants. In order to achieve optimally used living space for everyone, a new living room and lounge is being built for all age groups.
This is guaranteed by adding another storey to the existing building. Individual wooden modules are stacked on top of each other so that living room, common room, 'urban gardening' and a roof terrace can be created. By stacking the modules, a variety of living options are possible. A range of smaller student and two-person apartments through to maisonette or family apartments is being created. The individual modules can extend over a length of almost 14 meters. The entire building can be accessed by a staircase, as well as an elevator on the north side of the building. There are a total of 15 residential modules designed for a total of 33 residents. In addition, there are the common modules, which generally serve as wash-rooms and cold rooms with a shared kitchen. All module types have a balcony and face north-south and west-east. A wire mesh, which can be found in all the parapets of the design, forms the end of the balconies of the individual modules. 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.

The entire structure, including the stair core, is surrounded by a climate envelope and closes with the fire wall in the east. The grid of the climate envelope adapts to the position of the modules in the interior and thus forms a unit. 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.

In the public garden, the residents of the house meet the visitors of the café and can thus also use the offers of the Café Ada. In addition, a selection of different activity and interaction options was created, which should cover the bandwidth of the target groups. This should be ensured by addressing different age and interest groups. The terrace at Café Ada will be retained as a lingering area for customers to eat. In the garden, on the one hand, the areas can be used for events such as theatre, music or film combined with catering or food truck offers on weekends, and on the other hand, during the week, for example, it can be converted into a usable area for children playing, urban gardening and bicycle mechanics workshops.
Urban gardening buckets, bicycle workbenches and toy utensils can be stowed in sheds.
On the existing slope you will find seating to enjoy nature paired with a bee hotel. At the eastern end of the scaffolding, a roof-top car park is forming, which has several mobility options, such as electric cars or bicycles, for both the residents of the upper floor and those of the neighbourhood. In this frame there are several self-service machines for a fruit and vegetable sharing box, a seed and honey machine, a letter box and a packing station. There is also a climbing wall for children and teenagers on the south-eastern edge of the courtyard.
With the help of retractable bollards, the street can be converted into two traffic-calmed zones. The lower one serves as a temporary delivery zone for Café Ada, the upper one as a temporary play street and / or venue for street festivals and similar events.

Building Challenge

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. We want to counterpoint and offer an economical alternative by stacking prefabricated wooden modules on top of each other. 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.

Just like the extension of the Design Challenge, the Building Challenge consists of layered, compact living modules made of wood and is surrounded by a climate cover with openable glass slats. On each of the two different floors there is a living box with minimal housing, which divides the space between the module and shell as a communal space. In addition, there is a technology module inside the climate envelope, among other things for accommodating the energiBUS4home system. The roof of the ground floor module can be expanded as a roof terrace area thanks to the offset layering. In this way, all the important elements (roof terrace, communal area, wooden module construction, climate envelope and energy concept) of the Design Challenge are transferred to the Building Challenge. This will be conveyed to the visitor during the competition on the basis of these architectural and technical aspects.

Both modules together form an apartment with a kitchen unit in the lower module. A special feature of the relationship between the living module and the climate cover is that the cover is pierced in two places, once per module. This gives the resident access to more fresh air and more light without impairing the function of the climate envelope. In the large, communal

space in between, a staircase piercing the room opens up the roof garden and contains various usable furniture modules that can be pulled out in their cavity. The main entrance of the building leads the visitor across under the living module on the first floor, when exiting under the module into the climate envelope, a spacious and open feeling of space is suggested. In the winter months it is possible to set up a heat island in the area under the living module on the first floor with the help of a curtain and underfloor heating. All of the grid modules of the climate envelope facing the inner space are fitted with openable glass lamellas, which are covered with PV-modules to varying degrees depending on their exact position. The PV-lamellas are glass-glass modules used in the intermediate layer opaque photovoltaic cells. So not only energy, but also shading can be generated to prevent a to be adopted overheat the envelope in the summer months.
Between the mullion and transom facade on the roof there are two stainless steel tubs, each of which contains green roofs, as otherwise too much light would flow into the entire building.

‹Fienchen› is a cargo bike service in Wuppertal, with whom we have been planning a collaboration for a long time now. We plan to place a box next to our house demonstration unit, in which one of the bikes from Fienchen will be available, so that the visitors have the opportunity to benefit directly from this sustainable idea. The box will of course be designed strictly according to our principles and will naturally fit into the overall concept of our HDU.

Dissemination Activities and Current Impact

The dissemination of scientific information to the (professional) public is a central idea of the competition. We want to address a broad mass, because we want to educate people about sustainability and the goal of an improved future together - topics that ultimately concern us all. For our online communication we use different channels and media. Besides our website, the focus is currently on Instagram, but in the future, we would also like to explore other channels to increase our reach.

Our website ‹mimo-hsd.de› is the central contact point for our project on the internet. All our media including all social media channels link to the website, which in turn links to all channels. In the section ‹Updates› we are posting regular updates on our website about the progress of our team and the SDE21/22.
We have completely relaunched our Instagram channel. We changed the primary language of our channel from German to English to reach more international people. But our channel remains relevant to the German audience: Not only because we include a German translation of each post in the post description, but also because many Germans and especially German students are able to understand English. As before, the activities on our Instagram channel follow different strategies, each adapted to the formats: Posts, Story and ig-tv.
For Facebook we apply the same strategies as with Instagram.
Since we also generate video content like on-site footage or architectural animations, a video platform like YouTube fits our means too. Since it is used by practically everyone in the world, YouTube is great for approaching a wider audience.
Another online channel we use is our university‘s website. There we post the most important updates that are published on our own website. Our university‘s website is another good contact point for our university‘s students, but it fails to connect us with new people.

The focus of our press work is in NRW. The aim of our press work is to reach as many people as possible who have not previously come into contact with us or the SDE21/22. We have already achieved publicity on local television and in national and international newspaper:
Eike Musall was invited as an expert to the TV format ‹Lokalzeit Düsseldorf› in the german public service broadcaster WDR. Also the oldest German newspaper on renewable energies called ‹Sonnenenergie› has now written two articles about SDE21/22 and the German teams

including us and our project. Team MIMO was featured in the professional journal ‹energy›. Dr. Stephan Keller, the mayor of Düsseldorf gave a great video greeting to Team MIMO. A great source for sharing, and a strong connection point for people outside of our natural reach. Aside from that the trade journal ‹Haus und Grund›, online in the ‹Detail› and in the ‹AITDialog› provided information about the SDE21/22 and about German teams, including about Team MIMO. The semester newspaper ‹Bergzeit› of the Bergische Universität Wuppertal also reports on the Solar Decathlon and Team MIMO, as well as a picture of our increase idea.
In October Eike Musall was at «die 2. lange Nacht der Politik» in Düsseldorf where he talked about energetic city renovation and our team MIMO.
Further publications in the journals ‹tab› and ‹Bauphysik› have already been agreed with the publishers. In addition, there will most likely be a self-published book by the seven German teams after the end of 2022.
Finally, the models of all participating teams are currently being exhibited in public buildings in Wuppertal. The MIMO team models are very prominent in the CityArkaden, the largest shopping center in Wuppertal Elberfeld.
Also we managed to get in touch with the public relations department of our university, in order to increase our range in reaching the press. We are currently talking the local press in NRW like: RP Digital, Düsseldorf Anzeiger, Antenne Düsseldorf, Hochschulradio Düsseldorf or Coolibri. We will talk to newspapers in Wuppertal, the city of the finals: like Wuppertaler Rundschau, Die Stadtzeitung Wuppertal, Radio Wuppertal as well as even more local media of the Mirke district like Utopiastadt.

Currently we have designed one set of posters that informs about our project and the SDE. The multiple posters cover topics like: The HSD at the SDE, our situation, Café Ada, our vision, our model, the final, our HDU and our team. We distribute these in Wuppertal, Düsseldorf, Essen, Duisburg, Dortmund, Cologne and other cities in the densely populated Rhine-Ruhr area.

Collaborating Institutions and Sponsoring Companies

Institution / Company	**Type of business/branch**	**Type of Sponsor-ship**
AIT Dialog	Communication	Know-How
Albrecht JUNG GmbH & Co. KG	Electrical installation	Material / Items
alware GmbH Ingenieurbüro für Bauphysik und Gebäudesimulation	Building physics and building simulation	Know-How
ArgillaTherm GmbH	Wall heating	Material / Items
Barmenia Versicherungen	Insurance	Financial
Binder	Flat roof	Material / Items
BMWi	Ministry as a funding agency	Financial
BPK Fire Safety Consultants GmbH & Co. KG	Fire protection	
Cellco	Cork insulation	Material / Items
Claytec	Earth building materials	Material / Items
DAW SE - Caparol	Building materials	Material / Items
Düsseldorf Institute of Applied Sciences and Arts e.V. (DIASA)	Association	Financial
ECBM GmbH - Enterprise CONNECTED BUSINESS MODELS	Consultant in artificial intelligence	Know-How

eds - Elektro- und Datentechnik Ser-vivce GmbH	Electrical installation	Implementation
EnergieAgentur.NRW	Association	Know-How
Energy Endevour Foundation	Organizer	Financial
Erco	Lighting	Material / Items
EuroLam GmbH	Louvre window system manufacturer	Material / Items
Fachbereich Architektur	University of Applied Sciences Düsseldorf	Financial
Fachbereich Maschinenbau & Verfahrenstechnik	University of Applied Sciences Düsseldorf	Financial
Fachbereich Sozial- & Kulturwissen-schaften	University of Applied Sciences Düsseldorf	Financial
Fienchen Wuppertal - E Lastenrad	Mobility	Material / Items
Frauenhofer Ifam	Energy / charging infras-tructure	Know-How
Gardinia (Alugard)	Curtain rails	Material / Items
Geberit	Sanitary, Ceramics	Material / Items
GFM Junker Massivholz	GFM - solid wood panels	Material / Items
Gira Giersiepen GmbH & Co. KG	Electrical installation	Material / Items
Green4Cities GmbH	Greening	Know-How
Grohe	Sanitary, Fitting	Material / Items
Hochschule Düsseldorf	University of Applied Sciences Düsseldorf	Financial
holzius GmbH - S.r.l.	Wood building components	Material / Items
Hottgenroth Software GmbH & Co. KG	Software	Material / Items
Ingenieurbüro Stahl u. Weis, Freiburg	Planning	Know-How
Institut für Baubiologie + Nachhaltigkeit IBN	Specialist planner	Know-How
KNIPEX-Werk C. Gustav Putsch KG	Tool	Material / Items
Landeshauptstadt Düsseldorf - Dezernat für Umweltschutz und öffent-liche Erinrichtungen	Administration	
Landeshauptstadt Düsseldorf - Amt für Umwelt- und Verbraucherschutz 19/3.3 Kommunales Klimamanagment	Administration	
Landeshauptstadt Düsseldorf - Amt für Umwelt- und Verbraucherschutz Öffentlichkeitsarbeit, Umweltbildung	Administration	
Leonhards	Garden landscaping	Implementation
Living Lab NRW	Research project	Financial
Miele & Cie. KG	Home appliances	Material / Items
Passivhaus Institut	Planning	Material / Items
Petershaus - Holzbau	Timber construction	Implementation

Reinshagen und Schroeder	Sanitary, heating, ventilation, air conditioning	Material / Items
Schneider Electric GmbH	Technical building equipment	Material / Items
Schüco International KG	Window, facade	Material / Items
SMA Solar Technology AG	Inverter	Material / Items
Sonos	Entertainment	Material / Items
Stadt Düsseldorf - Landeshauptstadt Düsseldorf - Der Oberbürgermeister Wirtschaftsförderung	Administration	Financial
Stadtwerke Kempen GmbH	Electricity provider	Financial
Steinbacher Consult	Mobility / charing infrastructure	Know-How
STEINEL Vertrieb GmbH	Sensors	Material / Items
Stiftung Mercator GmbH	non-profit private foundation	Financial
SUNOVATION Produktion GmbH	Manufacturer of Photovoltaics	Material / Items
Vaillant Deutschland GmbH & Co. KG	Heat supply	Material / Items
Ziebell Willner & Partner Ingenieurgesellschaft für Technische Gebäudeausrüstung mbH	mechanical and electrical installations and plumbing systems	Know-How
Zinco	Flat roof	Material / Items
Ziro Kork	Cork insulation	Material / Items

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Project Images

MIMO

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discussion - © MIMO / SDE 21/22

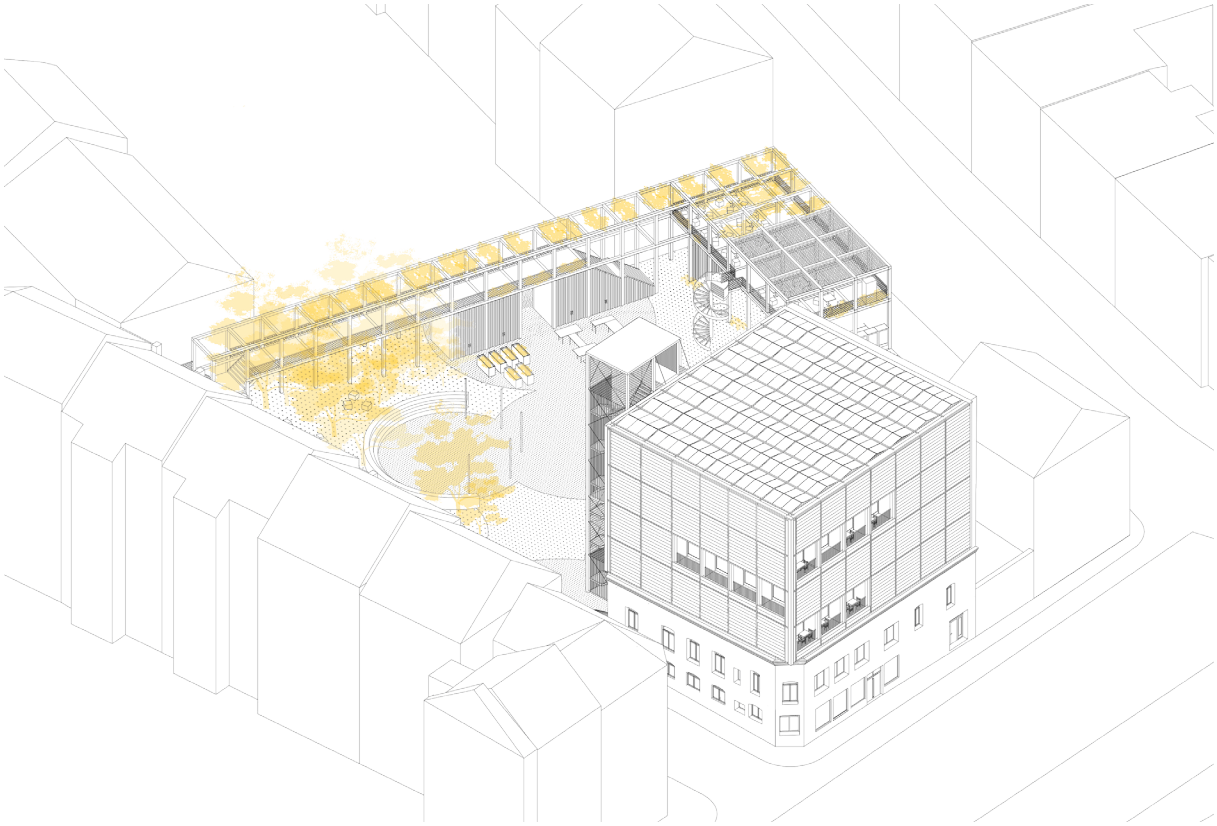
team MIMO - © MIMO / SDE 21/22

Interview with Mobility Fienchen - © MIMO / SDE 21/22

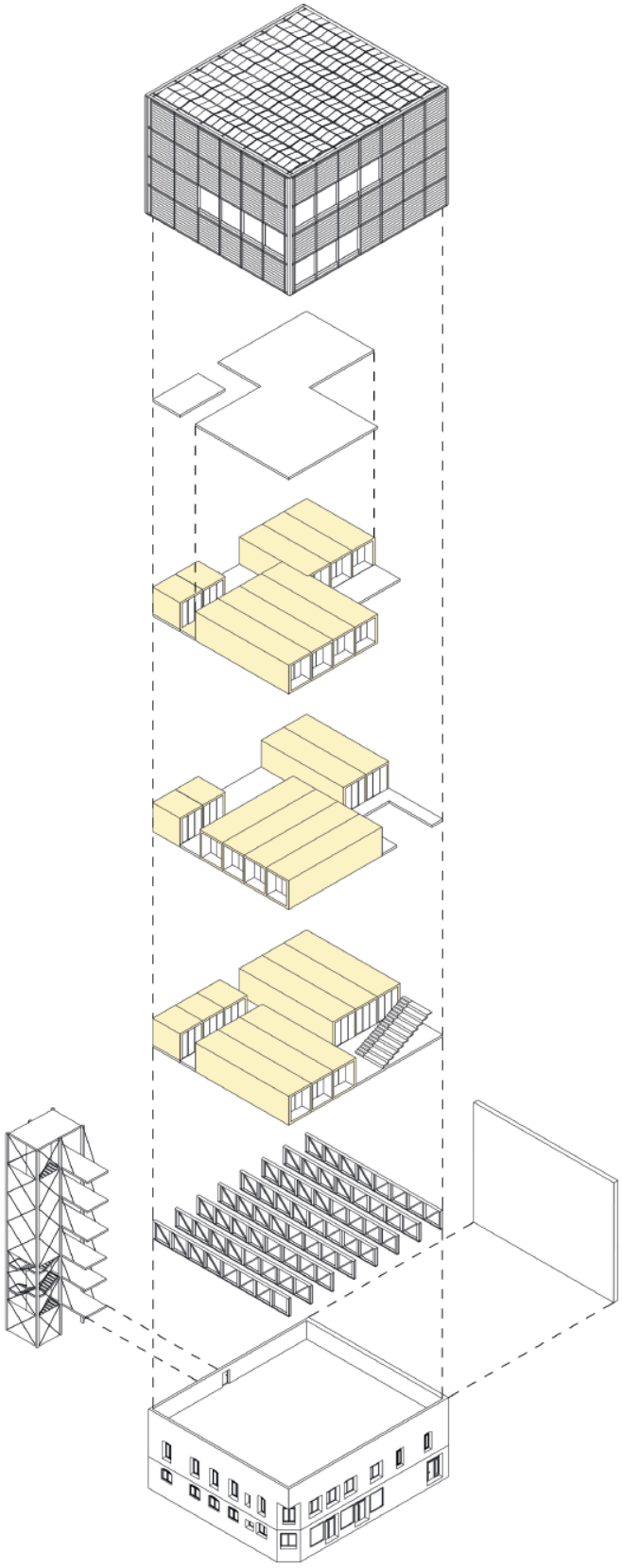
Test drive with Mobilty Fienchen - © MIMO / SDE 21/22

Model for the cargo bike box - © MIMO / SDE 21/22

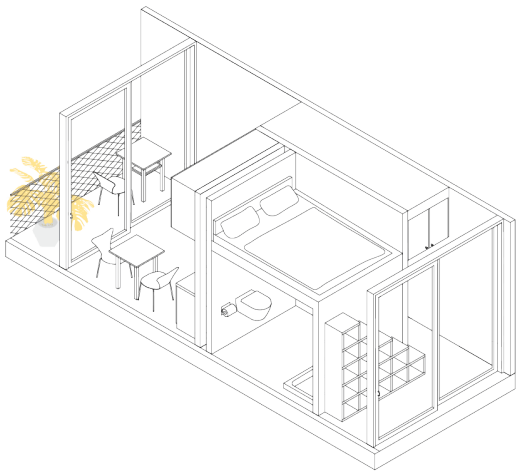
Design Challenge: Exterior Rendering – street view - © MIMO / SDE 21/22



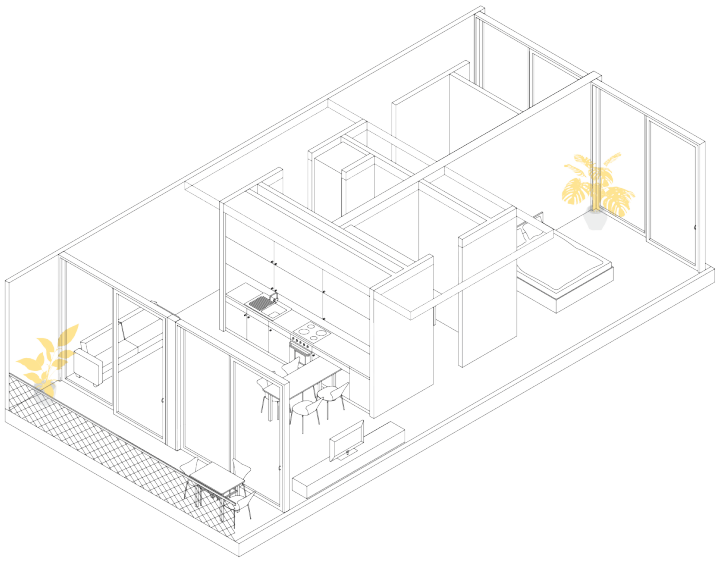
Isometry - Urban context - © MIMO / SDE 21/22



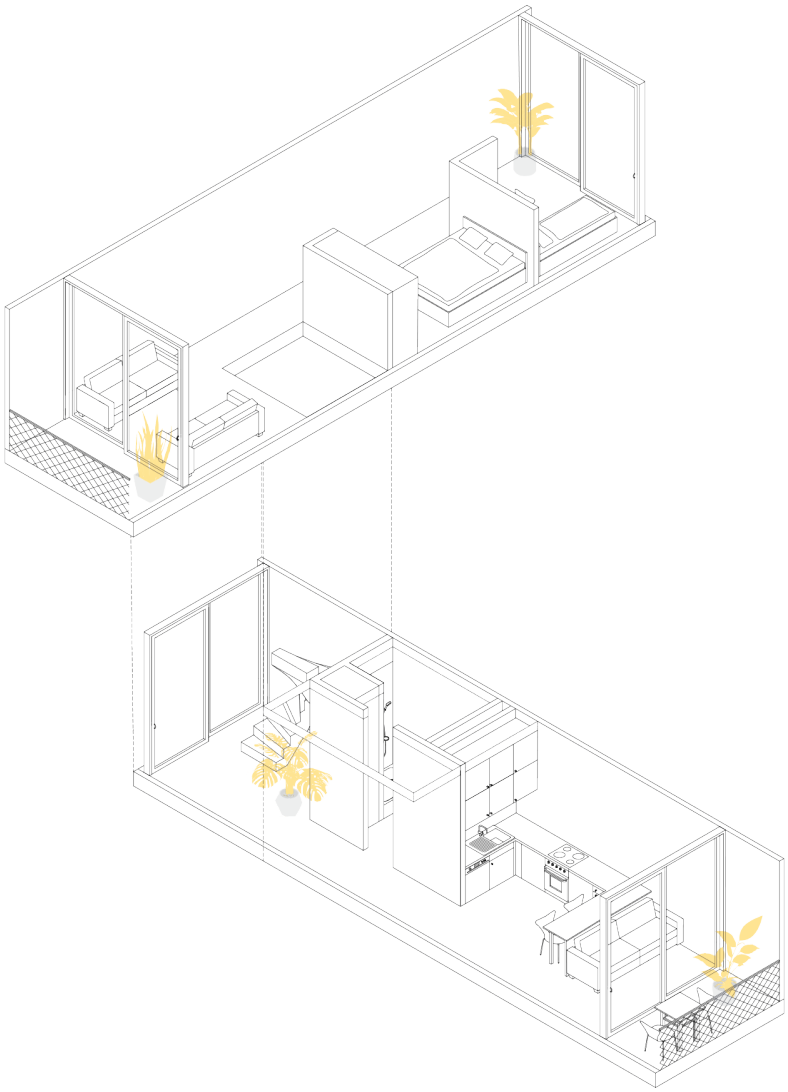
Isometry Building Design - © MIMO / SDE 21/22



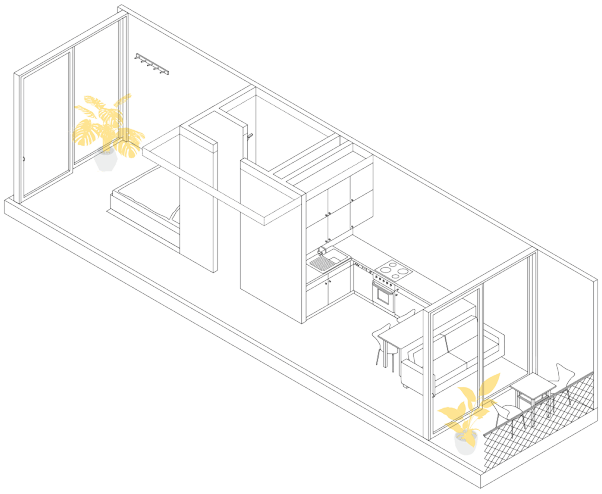
Student apartment isometry - © MIMO / SDE 21/22



Family apartment isometry - © MIMO / SDE 21/22



Maisonette apartment isometry - © MIMO / SDE 21/22



Single apartment isometry - © MIMO / SDE 21/22

apartment - © MIMO / SDE 21/22

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Floor Plan – First Floor
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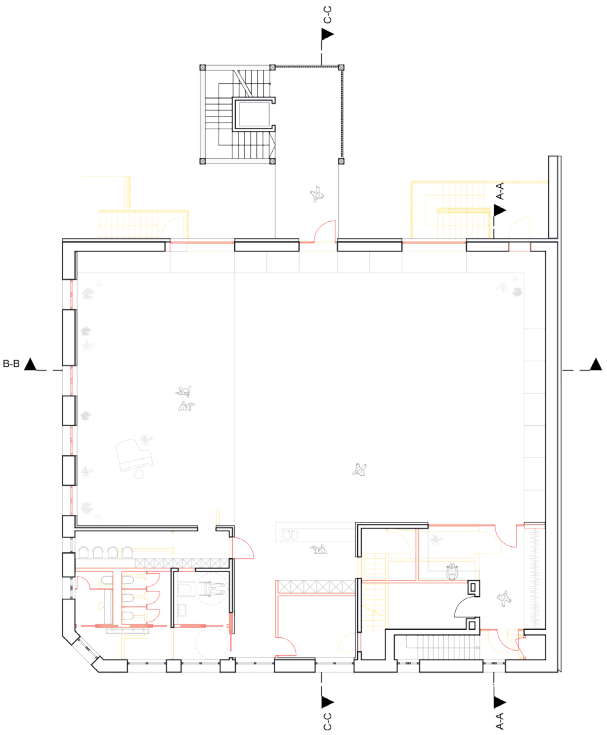

Floor Plan – Second Floor
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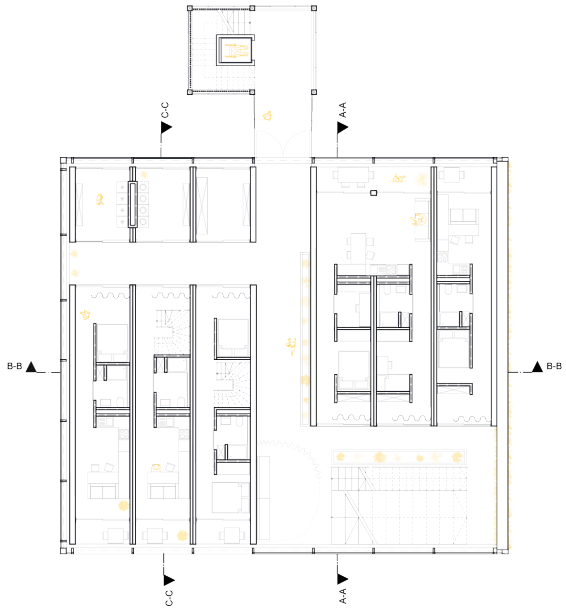

Floor Plan – Third Floor
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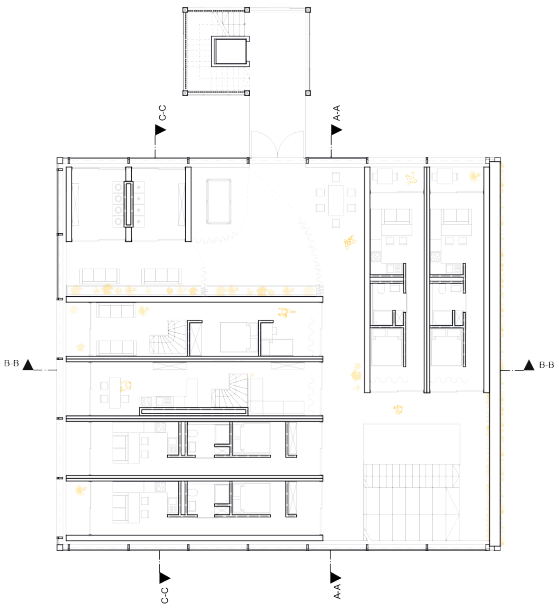

Floor Plan – Fourth Floor
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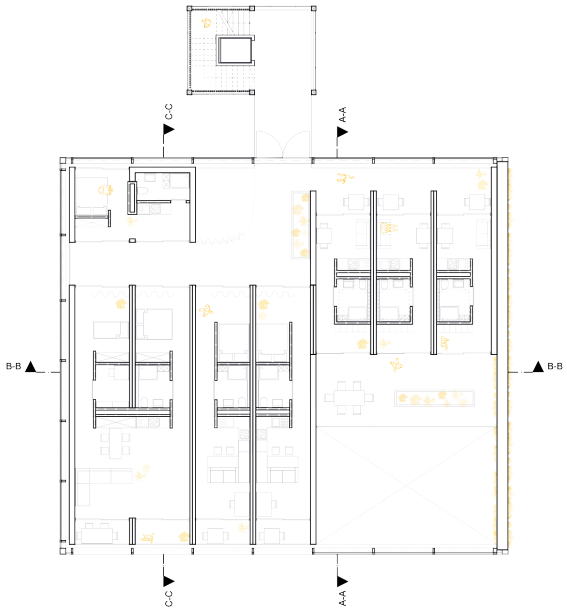

Floor Plan –Fifth Floor
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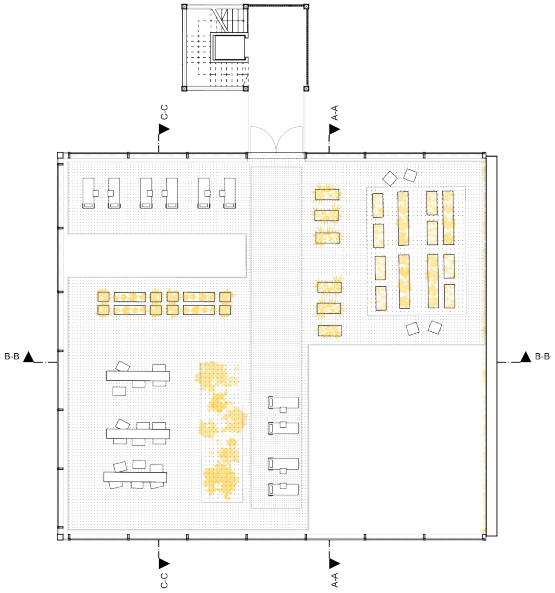

Floor Plan – Sixth Floor
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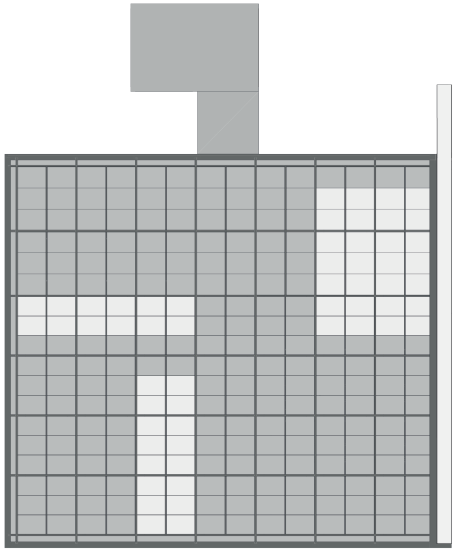

Floor Plan – Roof Plan
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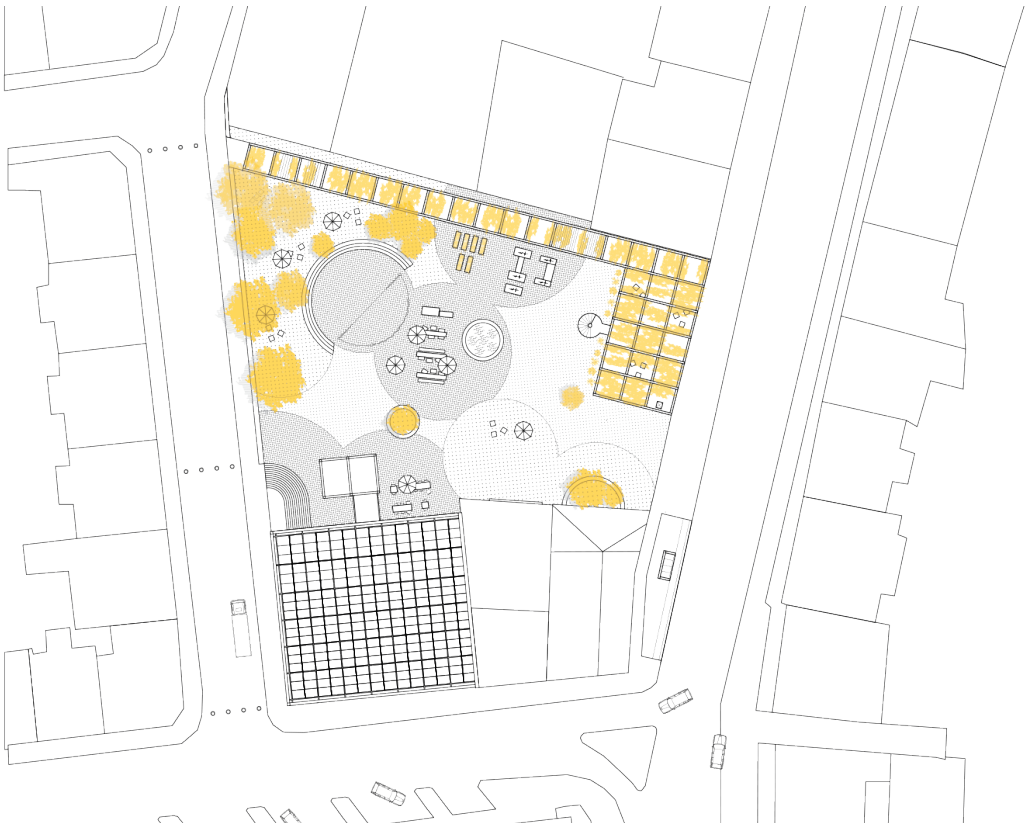
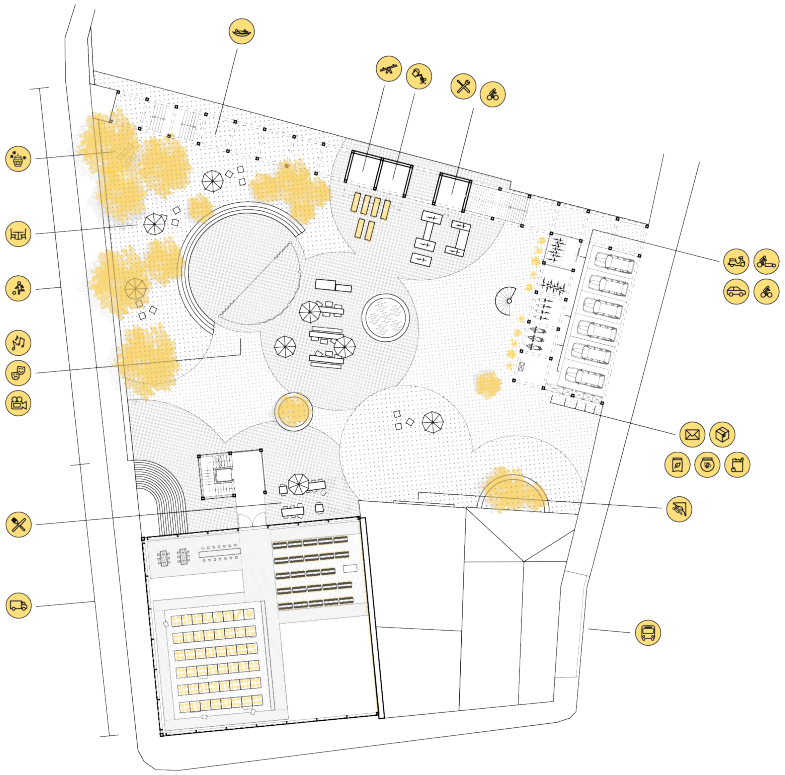


Location Map – Rooftop View - © MIMO / SDE 21/22



Location Map – Activities - © MIMO / SDE 21/22

Building Elevation - South - © MIMO / SDE 21/22

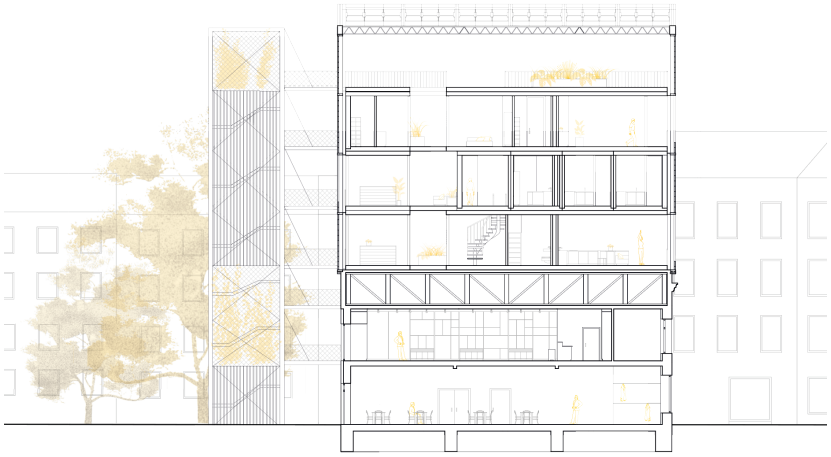
Building Elevation - West - © MIMO / SDE 21/22

Building Elevation - North - © MIMO / SDE 21/22

Building Elevation - East - © MIMO / SDE 21/22

Section AA - © MIMO / SDE 21/22

Section BB - © MIMO / SDE 21/22



Section CC - © MIMO / SDE 21/22

Building Challenge: Exterior Rendering - © MIMO / SDE 21/22

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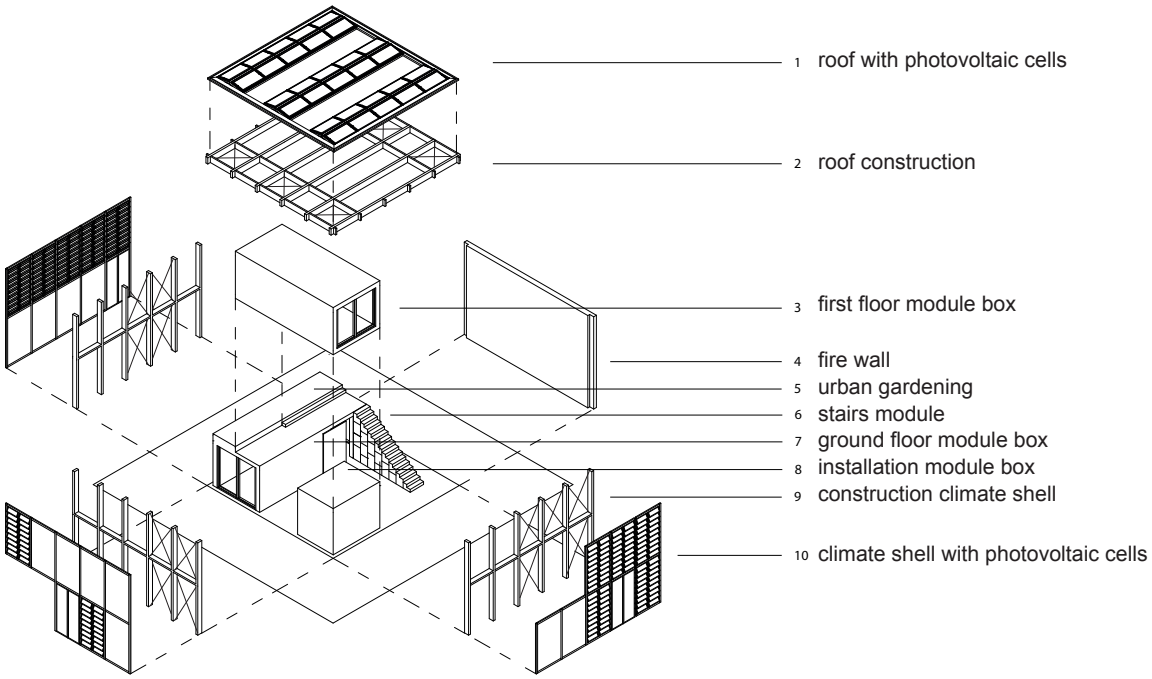
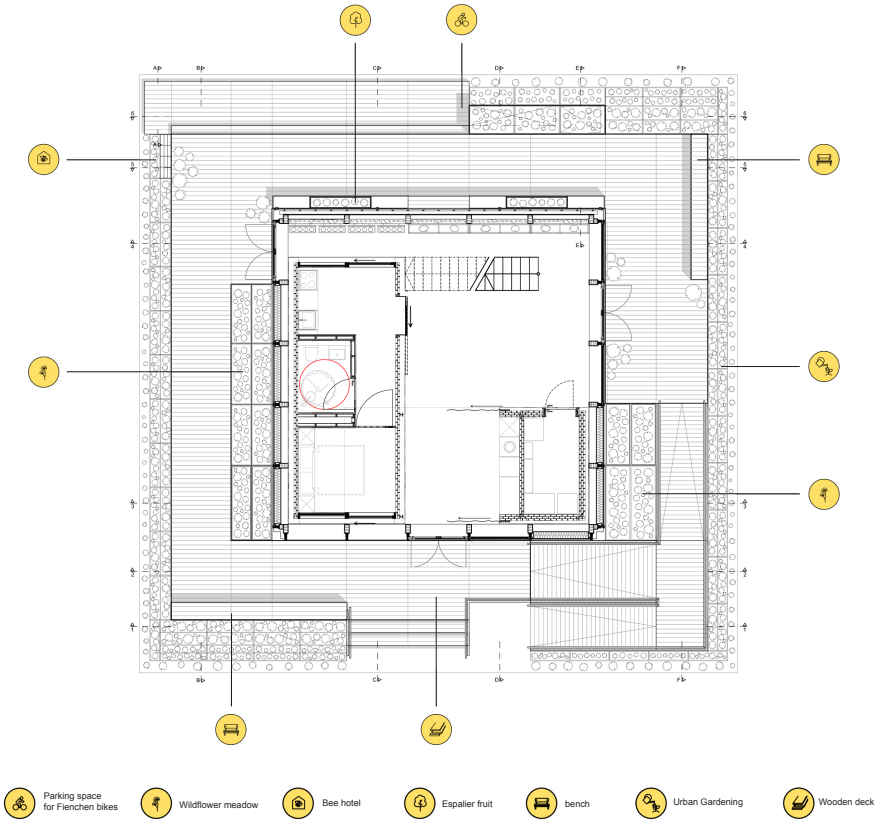
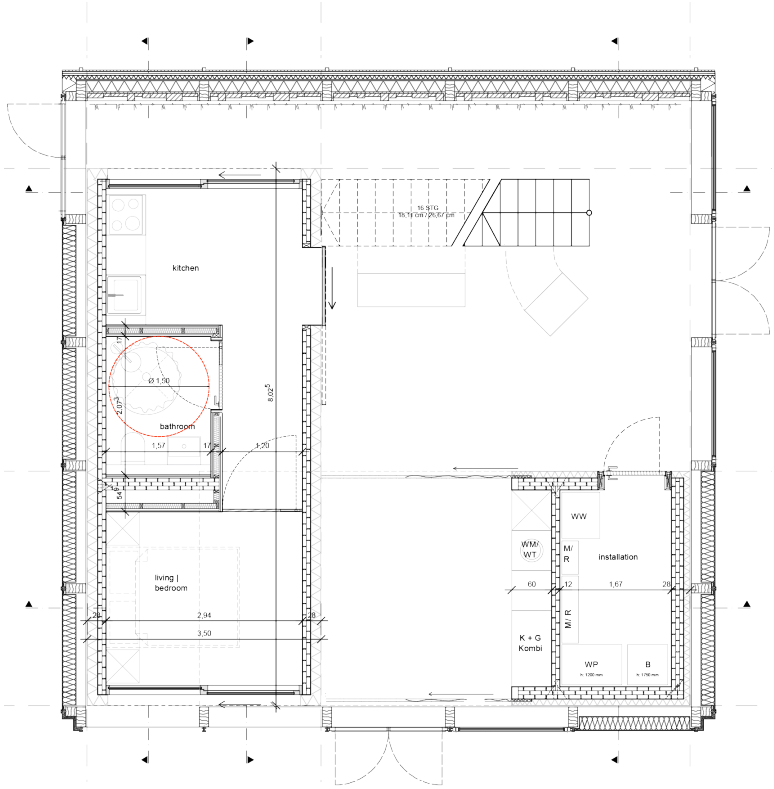


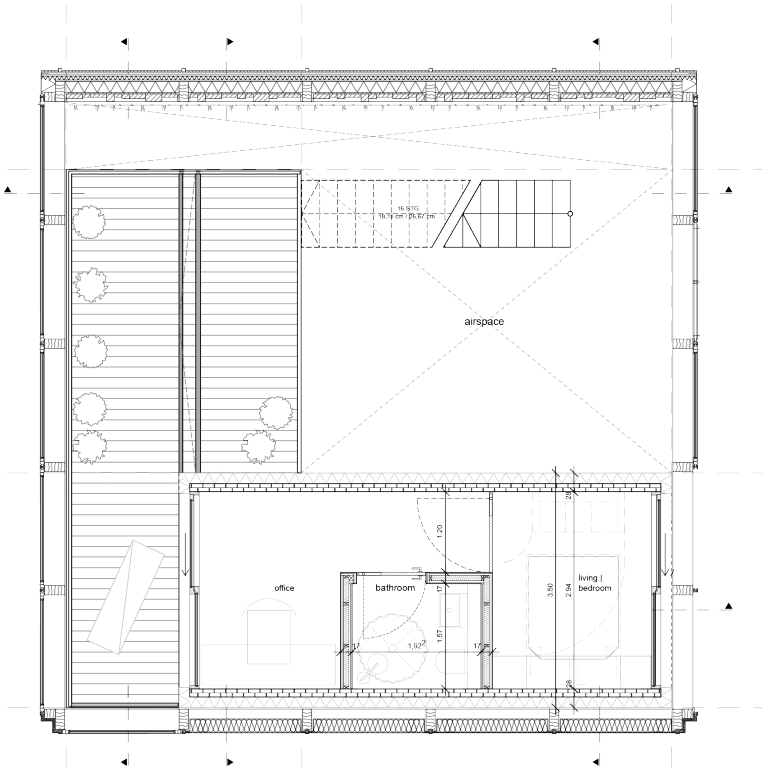
Demonstration Unit – Isometry - © MIMO / SDE 21/22



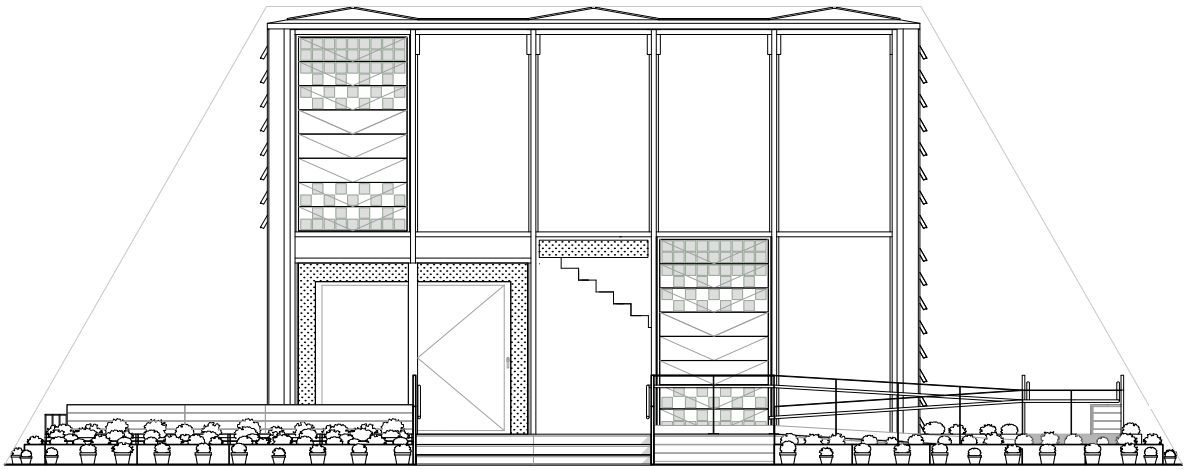
Demonstration Unit – Location Map – Activities - © MIMO / SDE 21/22



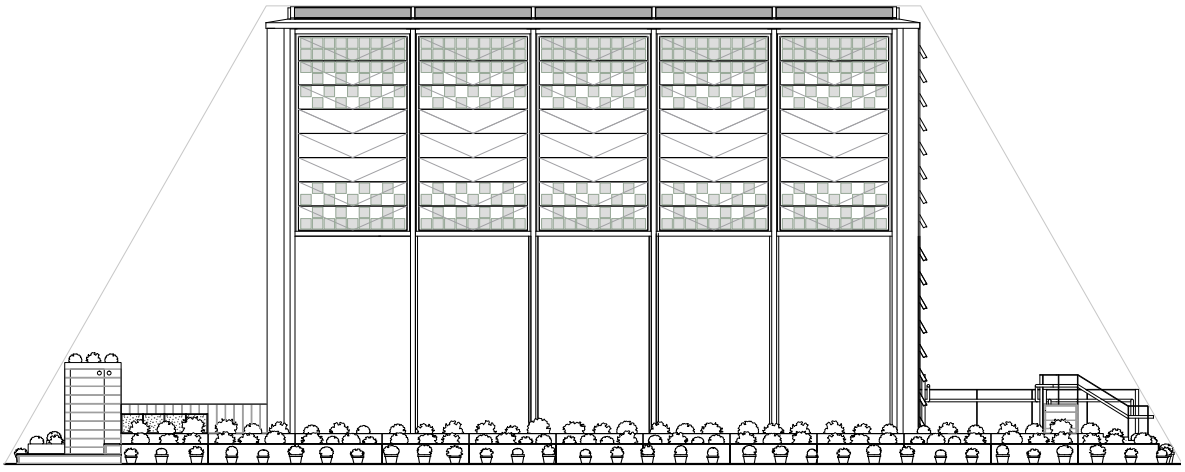
Floor Plan – Ground Floor - © MIMO / SDE 21/22



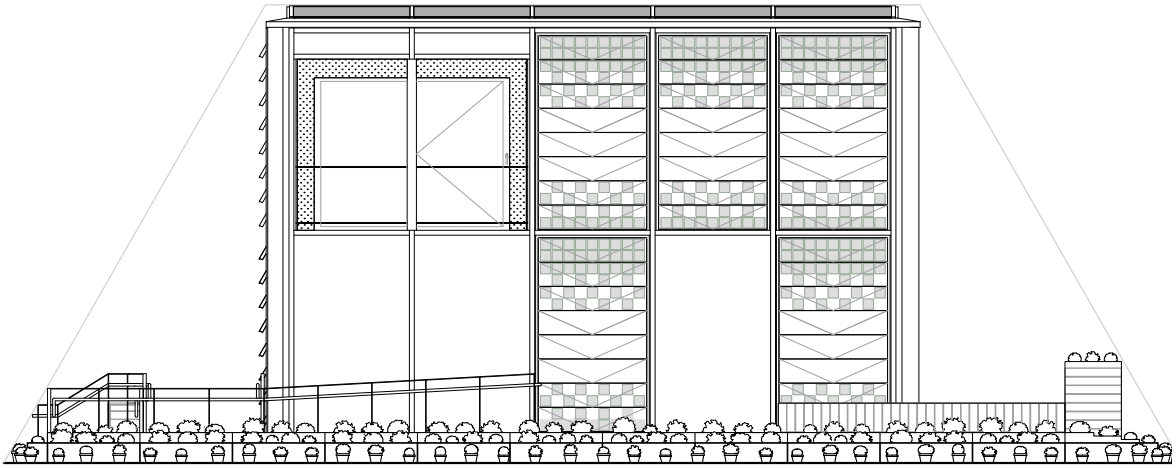
Floor Plan – First Floor - © MIMO / SDE 21/22



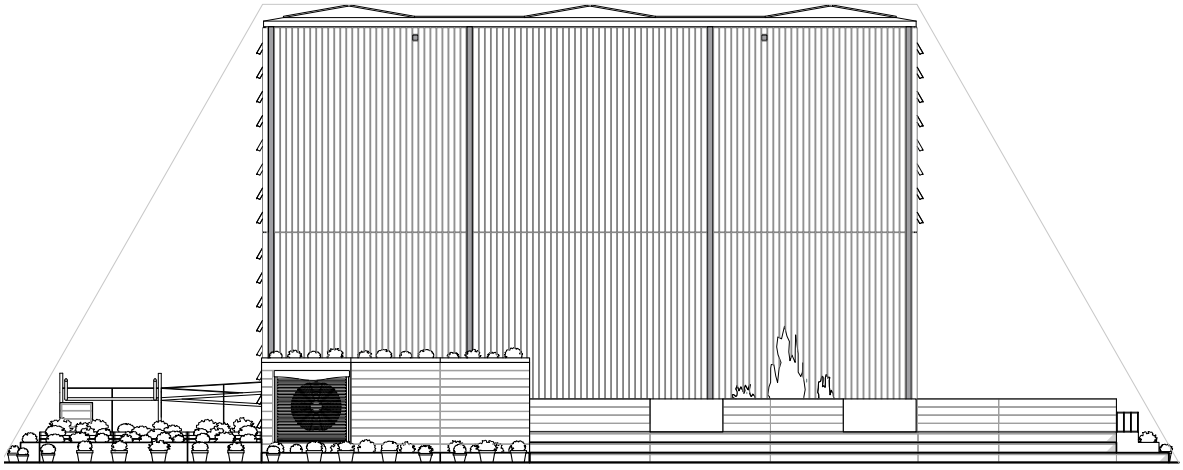
Building Elevation - South - © MIMO / SDE 21/22



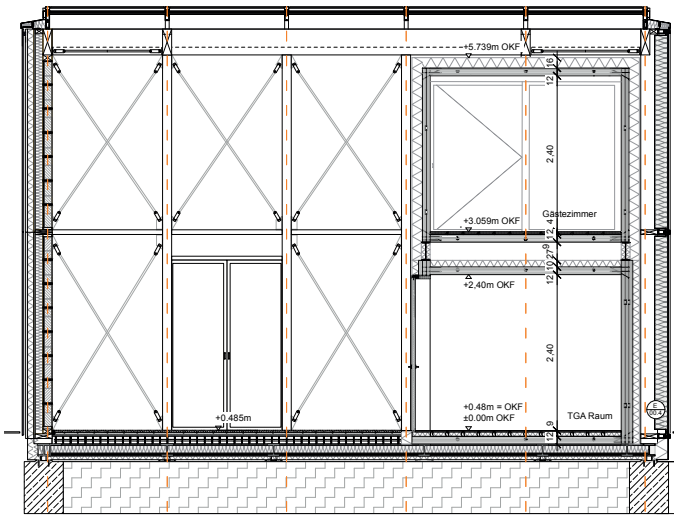
Building Elevation - West - © MIMO /SDE 21/22



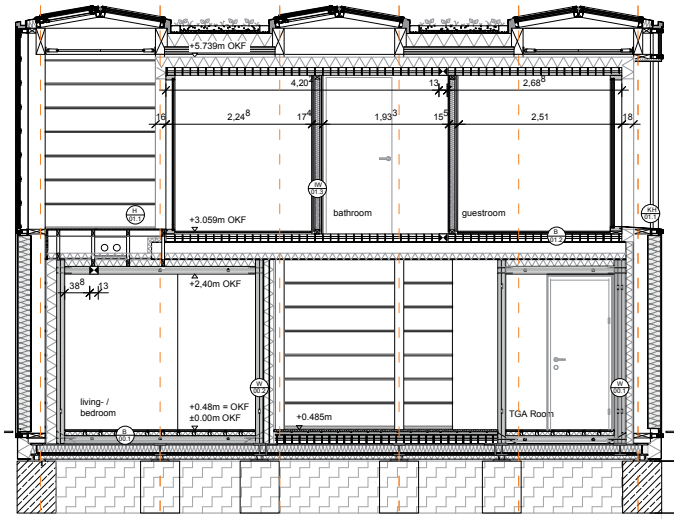
Building Elevation - East - © MIMO / SDE 21/22



Building Elevation - North - © MIMO /SDE 21/22



Building Elevation - Section AA - © MIMO / SDE 21/22



Building Elevation - Section CC - © MIMO / SDE 21/22

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