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Launch of T.T. #5 Activities on Citizen engagement and motivating feedback (Gothenburg)

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Disclaimer

Executive Summary

This Deliverable describes the development and launch of the demonstrators performed in IRIS Task 7.7, Demonstrating Transition Track #5: Citizen engagement. Within this task four demonstrators have been developed; 1) **Minecraft as a tool for citizen engagement** and 2) **Min Stad as a tool for citizen engagement**, 3) **3D BIM** and 4) **Personal Energy Threshold** with several activities that address the potential for using digital platforms and open data to achieve citizen engagement and motivating feedback in city-and real estate planning and city development. To achieve these objectives, five measures will be developed and implemented in the demonstration area Campus Johanneberg, Bergsjön and Frihamnen in Gothenburg. These Measures are:

Table 1. Measures

Measures
Measure 1: Model a Better City"
Measure 2: Resident digital assistance
Measure 3: Citizen sourcing
Measure 4: 3D VR/AR visualisation of BIM and sensor data
Measure 5: Personal Energy Threshold (PET)

Table 2. TT5 Demonstrations Overview

Demonstrator	In a nutshell
1) Minecraft as a dialogue tool for citizen engagement Activity Minecraft: 1a) Minecraft in the planning process	Brief summary: The activity investigates whether and how the digital platform Minecraft can be used as a tool for collecting information and knowledge from children within the work of a detail plan for city development. Expected impact: To be able to summarize experiences and success factors for using Minecraft as a tool for child dialogue in the planning process. By extension, the activity itself can arouse children's interest in planning and urban development in general, which is a positive side effect. Another side effect: The City Planning Office has a need to study, test and evaluate methods for citizen dialogues with children, something that is not fully accommodated in the ordinary planning process. Implementing this within the IRIS project provides an opportunity to get a much-needed work done.
Minecraft as a dialogue tool for citizen engagement Activity Minecraft: 1b) Minecraft summer camp in Gothenburg City Triennal, 2021	Brief summary: In the summer of 2021 Gothenburg turns 400 years. This will be manifested in an urban exhibition by the Jubilee park in the city development area Frihamnen and the new bridge over the river. The IRIS project will collaborate with the Gothenburg City Triennial 2021 to create a summer camp where 3-4th graders can participate for a week to rebuild Gothenburg in Minecraft and physically build parts of the suggestions as part of the urban exhibition.

	Expected impact: The test will provide information on how Minecraft can be used as a tool for citizen engagement in combination with traditional physical construction work for citizen engagement in site building activity for children and young people.
2) Min Stad as a dialogue tool for citizen engagement Activity Min Stad 2a) The citizenship engagement model **(**ME-model)	Brief summary: ME-model will provide a starting point for the planned activities within this WP and all the activities will, in turn, contribute to the knowledge about what rights and obligations citizens have in the different types of commitment in each phase. Within the IRIS project the Engagement Ladder is used as a reference tool to determine the possibilities for citizens to influence decision-making, articulating their needs, challenges and problems. Expected impact: The ME model constitutes the basis for learning and knowledge generation about citizens' involvement and commitment to further development of the Min Stad Platform. The ME model will also provide the basis for discussing what kind of organization and facilitation the different types of citizenship require.
Min Stad as a dialogue tool for citizen engagement Activity Min Stad 2b) Smart City Hub	Brief summary: The Smart City Hub is an idea of tool that compiles, and filters information based on specified rules and a geographic context. The information that such a tool consumes should be open data provided by the City. For example, data describing ongoing plans, ongoing street work, planned events or documents, and information stating political decisions, all geocoded to a geographic location or area. Expected impact: To investigate the need and possibilities for a platform / tool that compiles, and filters information / selects specific geographical contexts. Identification of opportunities and challenges in continued work on the development of Min Stad 2.0.
Min Stad as a dialogue tool for citizen engagement Activity Min Stad: 2c) Continous Dialogue	Brief summary: 'Continuous Dialogue' aims to study and analyse how the established forms of citizen dialogue works and how they can be developed. A fundamental question is what the urban building processes would look like if we opened up to citizen influence during the entire planning process and how it could be done with the help of the digital platform Min Stad (My City). The activity aims to broaden the concept of dialogue to emphasize how the city can receive comments from citizens and the channels to respond to them. The activity is carried out through a number of workshops with representatives from the city building office and the city's various administrations and Chalmers. Expected impact: An analysis of how the established forms of citizen dialogue works and how they can be developed.
Min Stad as a dialogue tool for citizen engagement Activity Min Stad: 2d) Inclusive Life Challenge	Brief summary: Students at Chalmers university of Technology enrolled in the master's course "Leading in a digital world", will be engaged in Gothenburg Smart City Challenge based on the city's open data. The incentive for The City's contribution is to fulfil the vision of becoming a Smart City which is circular and sustainable. Expected impact: The course will lead to innovations on the area of smart and sustainable cities as well as citizen dialogue / citizen engagement and will be an opportunity for The City Building Office's Geodata department to get new open data innovatively tested and evaluated.

Min Stad as a dialogue tool for citizen engagement Activity Min Stad 2e) Interview Survey	Brief summary: This is an interview study on digital platforms for citizen engagement and innovation. The study is to be carried out in Gothenburg and is about how to encourage greater citizen participation through further developing *Min Stad* as a dialogue tool, particularly in line with the goals of *Jämlikt Göteborg* (Equal Gothenburg).[1] The main task is to create an interview guide, conduct about 30 interviews with citizens around the digital platform *Min Stad* and suggest some ideas for development of the platform. The project is to be carried out during the autumn 2020. Expected impact: The project will contribute to the overall research aims of: • disseminating information more efficiently in a new digital channel, reaching new user groups and • improving the dialogue between the municipality and citizens as much as possible within the constraints of the current legislative framework.
3) 3D - VR/AR visualisation of BIM and sensor data	Brief Summary: JSP will demonstrate a BIM (Building Information Modelling) based 3D Augmented Reality/Virtual Reality Environment. This demonstrator will be housed in the office building "A Working Lab", where the innovative environment and extensive sensor network will provide relevant information to the demonstrator. The AR/VR BIM demonstrator will virtually immerse users in the inner workings and properties of a building, providing deeper understanding and involvement in the building's processes. Expected Impact Thanks to the intuitive and simple user interface, a number of new stakeholders that have previously not been involved or asked will be able to engage themselves in these matters. All this, in turn, will enable a greater understanding of and a momentum towards how buildings should be designed and operated for increased sustainability, accessibility and comfort.
4) Personal Threshold Application (PET)	Brief Summary: Within the PET project an app was developed that to monitor energy usage and giving feedback to users regarding their energy consumption. The ERO application was designed for a smart home system in mind that could balance the energy demand and supply. The app has a function called Personal Energy Threshold (PET), a momentary power level showing when there is plenty and short of energy in relation to the household's energy consumption. Expected Impact: The expected impact was to develop a deeper understanding of the tenants' energy consumption at individual level, and let each individual choose what type of energy source to be used and when. Through the developed application ERO the aim was to nudge individuals to choose "green" energy such as energy from the installed PVs (façade and roof).

[1] https://goteborg.se/jamlikt

Table of Contents

List of Figures

List of Tables

List of Abbreviations and Acronyms

Table 3. List of abbreviations and acronyms

Abbreviation	Definition
API	Application Programming Interface
AR	Augmented Reality
BIM	Building Information Modelling
CH	Chalmers
CIP	City Innovation Platform
DoA	Description of Action
ERO	An application for a smart home system that could balance the energy demand and supply
EU	European Union
FC	Follower City
GOT-SBK (CPO)	Gothenburg City-City Planning Office
HKU	University of The Arts, Utrecht
IS	IRIS Solution
JSP	Johanneberg Science Park
KPI	Key Performance Indicator
LH	Lighthouse
LHCSM	Lighthouse City Site Manager
MaaS	Mobility as a Service
PoR	Programme of Specification
PV	Photovoltaic
RES	Renewable Energy Sources
TT	Transition Track(s)
UX	User Experience
VR	Virtual Reality
WP	Work Package

1 Introduction

Gothenburg is in the middle of a major transformation in the City's central areas. Such big changes within urban areas will affect many people's lives and force a higher degree of coordination between many actors and organizations. It also requires better information and communication. This could easily be perceived to be a problem but can also be an opportunity to take the next evolutionary step in adopting and using new technology and thus achieve an improved citizen engagement and a more effective planning process.

This deliverable provides a detailed overview of the activities for Transition Track #5 Citizen engagement within the Gothenburg demonstrations. This deliverable is relevant for other organizations, since the subject of citizen engagement is generally known and everywhere a topic of attention. The Deliverable reports on the launch of activities for the following demonstrators from the Grant Agreement:

- Minecraft Planning Competition
- Min Stad - Dialogue tool in the city's planning process
- 3D VR/AR visualisation of BIM (Building Information Model) and sensor data
- Personal Energy Threshold (PET)

The deliverable is intended to provide sufficient level of detail to enable the reader to learn about the main features of each demonstrator and to serve as an inroad to the replication process.

1.1 Scope, objectives and expected impact

1.1.1 Minecraft as a dialogue tool for citizen engagement

The objective of the demonstrator Minecraft as a dialogue tool for citizen engagement is to study the possibility to increase the ability for children to have influence of the development of their local environment through Minecraft. The hypothesis is that the digital platform and computer game Minecraft can facilitate the dialogue with children since it's both engaging and easily accessible to many children.

The demonstrator includes the two activities 1a) Minecraft in the planning process in Bergsjön and 1b) Minecraft summer camp in Gothenburg City Triennal, 2021.

The expected impact of the demonstrator is to increase the knowledge about how to use Minecraft as a dialogue tool in relation to the citizens in planning processes and urban development. The ambition is to identify opportunities and success factors.

A valuable synergy of the demonstrator Minecraft as a dialogue tool for citizen engagement is that the demonstrator is linked to the important government work with the Children's Convention being applied in practice and in urban planning in Sweden, ratified since January 2020. According to the law all children must have their rights respected and fulfilled - at all levels of society. Gothenburg City Building Office has a strong need to test tools and methods for child dialogue in the planning process to which the project will respond.

1.1.2 Min Stad (My City) as a dialogue tool for citizen engagement

The objective of the demonstrator Min Stad (My City) as a dialogue tool for citizen engagement is to explore the possibilities for developing the digital platform Min Stad (My City) into an active dialogue tool. Develop and evaluate how to increase citizen interaction and engagement based on models of co-creation and collaborative innovation - The process dimension.

The demonstrator scope the five activities 2a) Citizenship engagement model **(**ME-model), 2b) Smart City Hub, 2c) Continuous Dialogue, 2d) Inclusive Life Challenge, and 2e) Interview Survey.

The expected impact of the demonstrator Min Stad (My City) as a dialogue tool for citizen engagement is to find ways for citizen engagement through a new channel, to reach new user groups and to explore how far the dialogue between the municipality and citizens can be developed within the current legislative framework.

1.1.3 VR/AR visualization of BIM and sensor data

The demonstrator objective: This demonstration entails demonstration of a BIM (Building Information Modelling) based 3D Augmented Reality/Virtual Reality (AR/VR) Environment that will virtually immerse users into the inner workings and properties of a building, providing deeper understanding and involvement in the building's processes. This demonstrator is implemented in the AWL (A Working Lab) building, where the innovative environment and extensive sensor network will provide relevant inputs to the demonstrator.

The demonstrator scope: The solution will be implemented as a client-server solution consisting of a cloud server responsible for hosting and serving data, including both BIM and sensor data, and serving the data to both AR and VR clients. The cloud server communicates with the sensor network(s) of the building(s) and processes the sensor data for further streaming to the AR and VR clients.

The cloud server will be accessible via an online web-based user portal, which will allow users to both browse existing data (BIM models) and upload new BIM models.

The expected impact: Thanks to the intuitive and simple user interface, a number of new stakeholders that have previously not been involved or asked will be able to engage themselves in these matters. All this, in turn, will enable a greater understanding of and a momentum towards how buildings should be designed and operated for increased sustainability, accessibility and comfort

1.1.4 Personal Energy Threshold (PET)

The objective of the demonstrator: The objective was to demonstrate a PET, together with tenants in the HSB Living Lab for possible replication in the HSB building stock. The tenants have not earlier been able to choose what kind of energy source they want and when to use it, and there is also poor feedback on their own energy consumption. The property owners' knowledge of the individuals' energy consumption is not visual enough, and the PET have been demonstrated and monitored within a research study for possible replication and upscaling.

The demonstrator scope: Within the PET project an app was developed to monitor energy usage and give feedback to users regarding their energy consumption. The ERO application was designed with a smart home system in mind that could balance the energy demand and supply. The app has a function called

Personal Energy Threshold (PET), a momentary power level showing when there is a plenitude or a shortage of energy in relation to the household's energy consumption.

The expected impact: Designing a smart energy system (smart home system) that enables balancing energy demand and supply, together with an evaluation of the results.

1.2 Contributions of partners

1.2.1 Minecraft as a dialogue tool for citizen engagement

In the five measures the following partners have contributed:

The demonstrator Minecraft as a dialogue tool for citizen engagement primarily includes contributions from The City of Gothenburg; the City Planning Office and Consumer- and Citizen, Chalmers University and JSP as primary partners. City of Gothenburg direct the work and are responsible for the requirements and demands. City of Gothenburg provides Gothenburg as an environment in Minecraft with its licenses. Chalmers is responsible for developing the methodology, the ME-model. External parties in the planning process of the activity Minecraft are Gothenburg City Culture Administration, Bergsjö School and Bergsjön 2021, and a platform for collaboration between real estate companies.

The activity_Minecraft in Gothenburg City Triennal 2021 is a collaboration with the Gothenburg City Triennial 2021 and its partners.

1.2.2 Min Stad (Min Stad) as a dialogue tool for citizen engagement

The demonstrator Min Stad primarily includes contributions from the GOT - City Planning Office and the GOT - Consumer- and Citizen service at City of Gothenburg, Chalmers University of Technology (CH) and Johanneberg Science Park AB as primary partners. City of Gothenburg is leading the work, are responsible for the requirements and demands and provides the digital platform Min Stad. Chalmers are responsible for developing the methodology, the ME-model, and to arrange the Inclusive Life Challenge as part of a master's course. Chalmers will also conduct an interview survey. Also see chapter **Fout! Verwijzingsbron niet gevonden.** for description of each party's responsibility.

1.2.3 VR/AR visualisation of BIM and sensor data

The development work is carried out by an external firm, ReSpace AB and procured by IRIS Partner JSP. Partner Akademiska Hus is delivering BIM data and providing access to sensor data for the AWL (A Working Lab) building.

1.2.4 Personal Energy Threshold (PET)

The project owner is HSB Göteborg who procured the subcontractors for IT-consultants. The demonstration was procured by the project leader Chalmers as a part of a research study and the demonstration took part in HSB Living Lab providing access to sensor data.

1.3 Relation to other activities

The deliverable builds further on work reported in D7.1 and D7.2. The plan for monitoring of activities is presented in D9.5, and the results of the monitoring of the demonstration in T7.7 will be reported in D9.6 (intermediate monitoring report) and D9.7. Activities in T7.7 are also related to work in WP3 on business model and exploitation activities, as well as WP8 on replication.

1.4 Structure of the deliverable

This Deliverable is structured according to the following:

Chapter 1 provides an introduction and overview of the purpose, content and scope of the Deliverable

Chapter 2 describes the framework of the demonstrators in the Deliverable, including a description of the demonstration area, integration of demonstrators to solutions and ambitions for the Transition Track as a whole

Chapter 3 describes the baseline of the demonstrators along with the drivers and barriers affecting each demonstrator

Chapter 4 treats the organization of work within the Transition Track, including roles and responsibilities of the partners

Chapter 5 describes the demonstrator “Minecraft as a dialogue tool for citizen engagement”

Chapter 6 describes the demonstrator “Min Stad (My City) as a dialogue tool for citizen engagement demonstrator”

Chapter 7 describes the demonstrator “AR/VR visualisation of BIM and sensor data”

Chapter 8 describes the demonstrator “Personal Energy Threshold app”

Chapter 9 deals with monitoring KPI’s on an aggregated level, i. e. Transition Track or City level

Chapter 10 gives an account of how ethics requirements have been handled by the project.

Chapter 11 provides information concerning how resources and information from other Work Packages are being incorporated in the current work.

Chapter 12 compares the results so far with the objectives set in the Description of Work and outlines future activities to mitigate and deviations

Chapter 13 lists any references that have been included to support the main text

2 Demonstration in a nutshell

Within the four demonstrators described in this deliverable, a total of seven activities have been planned for the City of Gothenburg, Johanneberg Science Park and HSB within TT # 5, Work package 7, Task 7.7. The objectives of the four demonstrators described in this deliverable are to study and test dialogue tools and tools for citizen engagement through the existing digital platforms Minecraft and Min Stad (My City), as well as the office building "A Working Lab" and HSB Living Lab. As a further impact target for the project, the knowledge accumulation obtained should also be useful for the development of methods of citizen engagement within the city of Gothenburg's planning process.

In general, the two demonstrations of Minecraft and Min Stad (My City) aim to improve and strengthen the possibilities for citizen engagement in the planning process in Gothenburg. Within the City of Gothenburg there are several needs of citizens dialogue and wanting to explore the possibilities in engage at more levels and ways. One of several internal questions are; how do we open channels for more people to be involved, as it is in the early processes that there are possibilities to exercise democracy, dialogue and participation? Today it is not clearly in the city how the feedback takes place. The project explores various tools that can be used in citizen dialogues, especially as the focus is on dialogue in urban development processes, but in a broader perspective that touches on other forms of dialogues and making information available is also included as issues.

The residents in the HSB Living Lab and HSB building stock have not earlier been able to choose what kind of energy source they want and when to use it. There has also been poor feedback on their own energy consumption. The property owners' knowledge of the individuals' energy consumption is not visual enough. Therefore, the Personal Energy Threshold (PET) has been demonstrated for evaluation and replication possibilities. PET is a tool for visualising and optimising residential energy usage for the individual, and has until recently, been available for smartphones and tablets.

JSP will demonstrate a BIM (Building Information Modelling) based Augmented Reality/Virtual Reality Environment in "A Working Lab", that will virtually immerse users in the inner workings and properties of a building, providing deeper understanding and involvement in the building's processes (Fig 23). This demonstrator will be housed in the HSB Living Lab, where the innovative environment and extensive sensor network will provide relevant inputs to the demonstrator.

Within the PET project HSB together with Chalmers developed an application developed to monitor energy usage and giving feedback to users regarding their energy consumption. The ERO application was designed for a smart home system in mind that could balance the energy demand and supply.

2.1 Ambitions for TT#5

Gothenburg's planning process includes measures for citizens dialogue. In proposals that directly and significantly affect the city and/or district's residents, civil dialogue should always be considered, and the position taken at major changes of municipal activities should endeavour to engage in dialogue with citizens. The use of Minecraft targeting young people, will engage schoolchildren and youths using a model of Gothenburg in the popular game Minecraft. The objective is to reach and animate new and hard-

to-reach population groups to involve them in shaping the city of the future. Towards this goal the following measures will be applied,

(1) the use of Minecraft city model aimed at young people
    a. Minecraft in planning process
    b. Minecraft in Gothenburg city triennial 2021
(2) the Min Stad Citizen-sourcing platform, with the following components
    a. The citizenship engagement model (ME model) will provide a starting point for the planned activities within WP7
    b. The Smart City Hub (SHC), a tool that compiles and filters information based on specified rules and a geographic context.
    c. Continuous Dialogue (CD), to spread information more efficiently in a new channel, to reach new user groups and to explore how far the dialogue between the municipality and citizens can be driven within the current legislative framework
    d. The Inclusive Life Challenge
    e. Interview survey

4) The BIM (Building Information Modelling) based 3D Virtual Reality Environment in "A Working Lab", will virtually immerse users in the inner workings and properties of a building, providing deeper understanding and involvement in the building's processes. Demonstration area have been moved from HSB Living Lab as there have been a lack of resources for this demonstrator within the company. JSP's ambition is to reach a wider target group and a wider amount of need within this change of demonstration area.

3) Personal Energy Threshold (PET) was developed with the ambition of awareness of energy use and lower the energy costs, through an application (ERO) for tenants in HSB Living Lab. By following and evaluate the demonstration through a research study, included an aim for possible replication in other residents.

2.2 Demonstration area

2.2.1 Minecraft as a dialogue tool for citizen engagement

The activities within the demonstrator Minecraft as a dialogue tool for citizen engagement has two different demonstration areas. Minecraft in the planning process is being conducted in Bergsjön and Minecraft in Gothenburg City Triennal 2021 will be conducted in the Jubilee Park in Frihamnen. See map in Figure 1 below.

2.2.2 Min Stad (My City) as a dialogue tool for citizen engagement

The activities within the demonstrator Min Stad as a dialogue tool for citizen engagement has the whole city of Gothenburg as its demonstration area.

Figure 1 Demonstration areas for Minecraft as a tool for citizen engagement

2.2.3 AR/VR visualisation of BIM and sensor data

Figure 2 AWL (A Working Lab) building on Chalmers Campus

The AR/VR visualisation of BIM and sensor data will take place in the AWL (A Working Lab) building (Figure 2) on the Chalmers Campus. The AWL building is an office building with approximately 400 workplaces, also home to other IRIS demonstrators (PV/DC microgrid and PCM storage facility) as well as several other novel features, including a Maker Space and a Digital Studio.

2.2.4 Personal Energy Threshold (PET)

The demonstration of PET was demonstrated in HSB Living Lab in the LH City district Campus Johanneberg. The HSBL Living Lab is a third generation Living Lab and a building, with 30 households living in an continuously changing environment.

2.3 Integrated Solutions in TT#5

Citizen engagement in IRIS Gothenburg comprises of three integrated solutions (IS). Minecraft and Min Stad are demonstrators in the integrated solution IS-5.2 Participatory city modelling.

- **IS-5.2 Participatory city modelling**:
  The organization of a spatial planning design contest (GOT) will be an activity using the Minecraft® city model aimed at young people in one school in the area of Bergsjön, but also including others in the area. Another activity will be the organization of a summer camp using the Minecraft® city model aimed at young people in collaboration with the Gothenburg City Triennial 2021. 3-4th graders will have the opportunity to participate for a week to rebuild Gothenburg in Minecraft and physically build aspects of the suggestions as part of the urban exhibition.
- **IS-5.4: Apps and interfaces for energy efficient behaviour**

  The AR/VR BIM and sensor data visualisation contains a smartphone app that will provide information and insights to the users that will enable them to shift towards a more energy-efficient behaviour, for instance by monitoring room temperature, ventilation and air quality.

2.4 Integration of Demonstrators

The demonstrators within TT#5 are about citizen engagement within the planning process and are connecting with each other by providing important input on citizen dialogue and citizen engagement. The City want to reach a variety of target groups and a big question is how to engage new groups of citizens and to find out new ways of doing that. The activities aim to test and study the usefulness of various digital tools and platforms for citizen engagement. The MedborgarEngagemang (ME) model serves as an integrating mechanism bringing together experiences, reflections and learning from the demonstrators. The ME model capturing the contingencies on when to use what citizen engagement mode is developed in parallel with the implementation of the activities. The Smart City Hub is a digital solution designed to bring together the digital solutions within an overall platform.

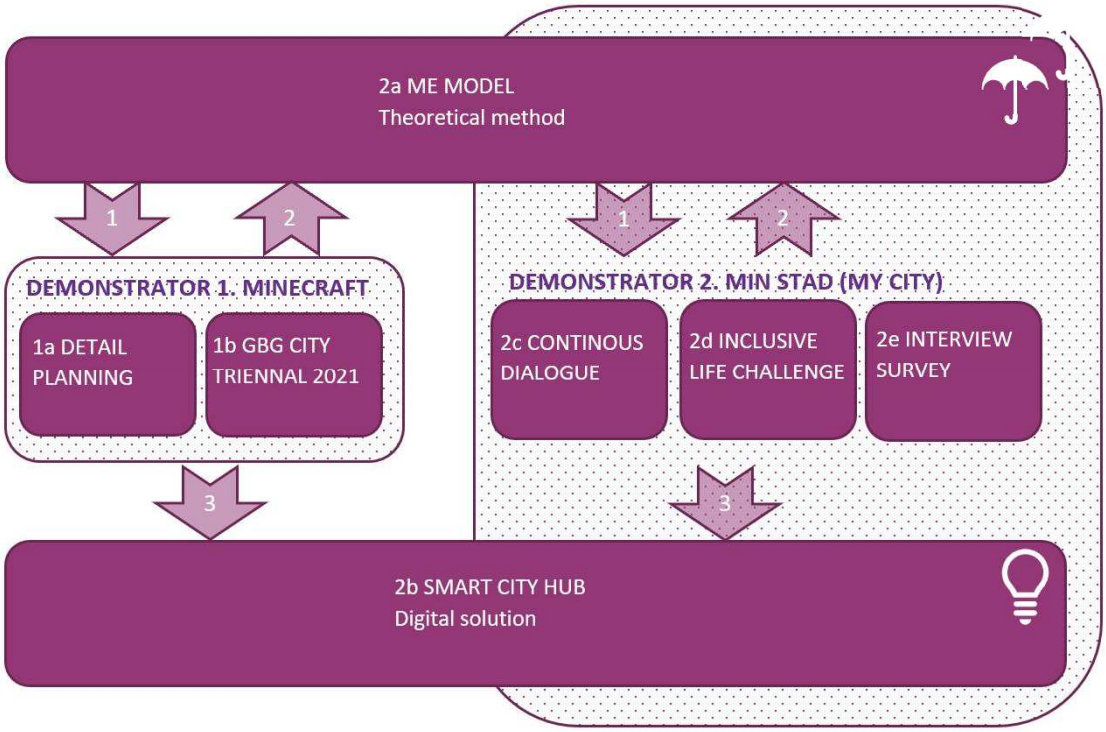

Figure 3. Integration of the demonstrators and the activities in TT#5, WP7. Illustration by Anna Reuter Metelius

2.4.1 Minecraft as a dialogue tool for citizen engagement

The activity Minecraft in the planning process has deviated from the original wording of Minecraft Demonstrator in the Grant Agreement regarding that it's no longer conducted as a competition. The demonstration area has also changed from the previous report. There was a previous plan to carry out the entire activity in the detailed planning work for Önneredsskolan. This is no longer relevant as the school is no longer interested as of the time lag that occurred during the resource loss on SBK. New proposal for current planning work to link activity 'Citizens' Dialogue through Minecraft ' is a detailed plan in Bergsjön. The activity Minecraft in Gothenburg City Triennale 2021 has been added to create a wider width of the test of Minecraft as a tool for Citizen engagement.

At first planning stage, the City Planning Office was committed of planning for Minecraft® Planning Competition where the intervention was to involve and organise a spatial planning design contest for children and youths based on a Minecraft® model, targeted at the new electricity bus line no: 55, and the bus route between demonstration district Campus Johanneberg and Lindholmen.

The project group decided finally not to target the Minecraft® activity at the Electricity bus line no 55, and the decision was based on the ambition to test and evaluate the digital tool in an existing spatial planning project which is in an early stage, with the possibility for the participants to influence the direction of the spatial planning project. Further it was prioritized to choose a project encompassing an existing school, this allows to involve youth from the area targeted in the competition and the possibility incorporate the activity as an element of learning in the curricular activities. The chosen project where the Minecraft

activity was to be tested was after that a detailed development plan for Önneredsvägen in west Gothenburg, a plan that involved new housing, renewal of an existing school and elderly home as well as a new outdoor activity area. The planning process started in Q4 2018 and Minecraft were used as part of the consultation process.

2.4.2 AR/VR Visualisation of BIM and sensor data

The AR/VR visualisation demonstrator was originally foreseen to be procured by Partner HSB and to be implemented in the HSB Living Lab building. Due to resource shortage and contractual issues, the task was transferred to Partner JSP in M26. This also entailed moving the demonstrator from HSB Living Lab to the AWL (A Working Lab) building.

3 Baseline / Drivers and Barriers

3.1 Baseline

Within the City of Gothenburg there are several needs of citizens dialogue and wanting to explore the possibilities in engage at more levels and ways. One of several internal questions are; how do we open channels for more people to be involved, as it is in the early processes that there are possibilities to exercise democracy, dialogue and participation? Today it is not clearly in the city how the feedback takes place. The project explores various tools that can be used in citizen dialogues, especially as the focus is on dialogue in urban development processes, but in a broader perspective that touches on other forms of dialogues and making information available is also included as issues.

The aim of the City Planning Office (SBK) - Municipality of Gothenburg´s participation in IRIS is to develop opportunities for the methods of dialogue tools and citizen engagement using the digital tools Minecraft and Min Stad (My City).

The City of Gothenburg works with different types of civil society dialogues in various operations and processes in the city. Within urban development, a public tool called Min Stad (“My City”) (Min Stad.goteborg.se) has been developed. In Min Stad, citizens have the opportunity to read others’ or create their own contributions and suggestions regarding urban development. Furthermore, the city presents information in the tool, such as planned urban development projects and anniversary efforts (the city's 400th anniversary). The tool is available in both Swedish and English. Residents also have the opportunity to upload self-contained stories about events or places. The tool has been around since 2012 and is a cloud service constituted by a web portal built around a 3D map as well as an app for mobile platforms. Posts from Min Stad are loaded into the Urban Business Office's internal operating system and are managed as general conditions and inputs regarding the detailed planning process. On the other hand, there is no requirement or any possibility that posts are treated as a legal opinion within the planning process. In order to get there, a study needs to be conducted that highlights the possibility of including this type of input in the process.

The City of Gothenburg City Council's overall goal is to increase the opportunities for participation and influence of Gothenburg. This will be done by allowing participation and influence for groups in the city that are usually not active in decision making. The Board of the Consumer and Citizens' Service owns the process of achieving this goal. An assignment that is linked to the goal is that democracy and election-enhancing efforts will take place in the areas with the lowest number of voters; Angered (N Gårdsten), Västra Hisingen (Biskopsgården N) and Östra Göteborg (Gärdsmosse), which in the election to the City Council 2014 had a voting participation of 37.4, 52.6 and 46.1 percent respectively. Västra Hisingen’s election participation was lowest in the country.

During the year, discussions are held on the city's functions that involve participation and influence (City Council Office, Youth Council, Electoral Committee, Jämlikt Göteborg (“Equal Gothenburg”), Sports- and Association Administration, Cultural Administration, Social Resource Management and the neighbourhoods, etc.). The purpose of these meetings is to understand the needs and coordinate the work.

In order to work for increased influence, recurring contacts have been taken with the districts with the lowest proportion of voters; Angered, Västra Hisingen and Östra Göteborg. The Bureau for Consumer and Citizens' Service invites consultations with politicians and district directors for the neighbourhoods based on ideas on how the City can support democracy work and how the means available to stimulate increased involvement and influence can be used.

Göteborgs SOM (a yearly opinion poll concerning public attitudes to current issues) is implemented to understand the citizens experiences of local democracy, the ability to influence political decisions and confidence in the municipality's activities, etc. The ambition is to analyse and learn more about the citizens' perspective over a span of years until 2021 in order to take action in places where it is needed.

Jämlikt Göteborg is about Gothenburg being the equal city that contributes to a good life for all. Here the commitment is to support and contribute and to take responsibility for the focus area called participation, influence and trust.

Another group receiving special attendance at the City of Gothenburg are the young voters who now have the opportunity to vote for the first time. Voting when young increases the chance that you will continue it even further in life. The city therefore invests extra on the young first-time voters.

The city is carrying out an annual inventory to see how the city's administrations and companies work with civil dialogue. In this inventory we are considering what kind of dialogues are being conducted. Civil dialogue refers to a politically driven dialogue, that is, the dialogue created by the politicians and citizens or the dialogue conducted by municipal authorities/ companies, but on the clear assignment of politicians (based on decisions, governing documents or similar).

The above work is a starting point for the development of the Min Stad dialogue tool and the associated areas of action intended to develop within the framework of the IRIS project.

3.1.1 Minecraft as a dialogue tool for citizen engagement

In city planning, that has such an obvious impact on children's environment and everyday life, it is of great importance to take into consideration the children's own perspective. Gothenburg’s city building office developed the entire Gothenburg in Minecraft. Everything is based on the city's own real geographical data; houses, roads, trees and lighting. Although the game is built on that one should construct with one square meter blocks, you still quickly recognize yourself as you walk or fly through the city. Using Minecraft to arouse interest and engagement for urban development issues is relatively new in the City of Gothenburg. It is also a new way of making geographical data available to the public. The idea is that in the future Minecraft-Gothenburg will be used as a way to get ideas from children and young people, and it can also be a tool to show what the city of the future will look like. "We use Minecraft to get children and young people more involved in urban planning. We want to make them want to be involved and influence the development of the city".

Figure 4. A part of Gothenburg in Minecraft

The question is how well Minecraft functions as a dialogue tool in the planning process. Issues based on the objectives of the Minecraft demonstrator are:

- Can Minecraft be used as a tool for gathering knowledge work with floor plans and detailed plans?
- What information can be collected using this the tool?
- Is this application of the tool suitable for increasing school pupils' interest and knowledge of urban development issues?

The activity aims to develop dialogue tools for children's perspectives in the planning process. Starting from a children's perspective aims to meet the needs of the children and ensure that the rights of the children are exercised. Legislation, policy, strategy and policy documents at international and national level (the Children's Convention, Agenda 2030, Politik för gestaltad livsmiljö) clearly states that we must decide on the basis of children's best interests. To understand the best interests of children, we need to have children's own perspectives (in addition to our professional knowledge and our personal experience of having been children).

In planning, which has such a clear impact on the children's local environment and everyday life, it is of extra importance to strive to start from the children's own perspective. The hypothesis is that the application of digital tools, such as Minecraft, can facilitate the dialogue with the children, in that the form of a computer game is both engaging and easily accessible to many children, and in the long term increase the children's ability to influence the development of their local environment. Furthermore, it is considered equally important that the activities have a knowledge-enhancing effect for school students, that they learn about how urban planning works and to increase their interest and commitment to the issues.

To assist in physical planning, there is the tool and process support **Child Impact Assessment (BKA)** developed in the City of Gothenburg (https://goteborg.se/wps/wcm/connect/171d705a-cfa7-48fe-b788-c0b18eac593e/OPA_R_BKAenglish.pdf?MOD=AJPERES). BKA highlights the issues that are relevant to children and young people in a systematic way and is done to develop the children's perspective and

children's own perspectives in urban development and thereby improve the decision-making basis at different planning stages.

The Gothenburg model for Child-Impact analysis is an analytical tool that can be used as an aid for illustrating the needs, assets and deficiencies which need to be highlighted from a child's perspective. It can also be used to describe the impact of any proposed measure. Working with the matrix models requires an open, instructive process in which many must be given the opportunity to participate and contribute with their opinions and experience. Participation from young people is key to the success of using these tools.

There are several ways to give children and adolescents a chance to influence the public space. All of these are aimed at getting young people to speak and meet people who are responsible for the built and planned environment. It also aims to give planners, architects, decision makers and other adults access to the children's insights about their local environment. The City Building Office has a need to study and test methods for citizen dialogues with children, which is not fully accommodated in ordinary operations. Implementing this within the IRIS project provides an opportunity to get much-needed work done.

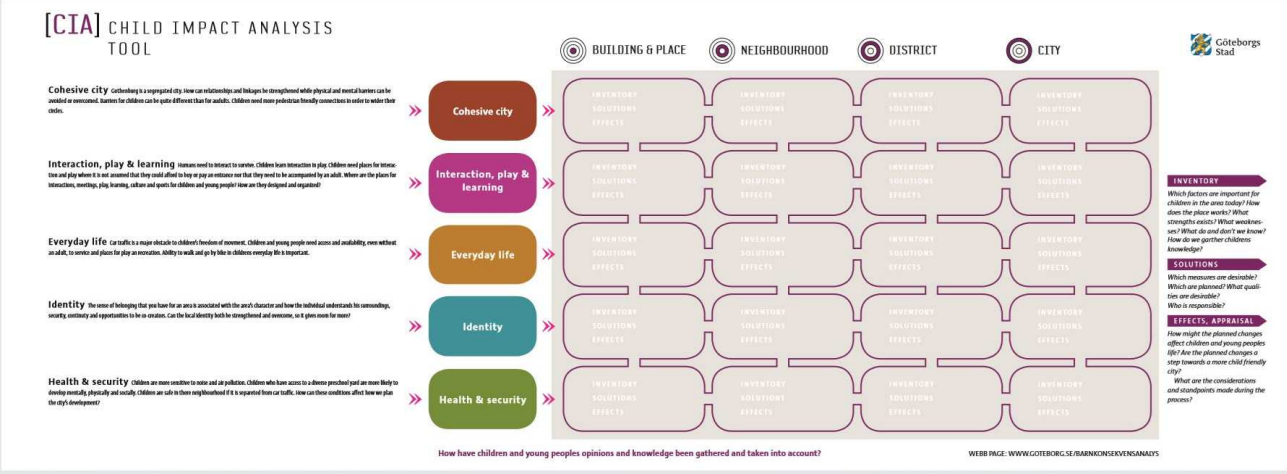

Figure 5. Child impact analysis tool (CIA)

3.1.2 Min Stad as a dialogue tool for citizen engagement

The City of Gothenburg created *Min Stad* (My City)[2] in 2012 as a platform where planned urban development projects can be presented and where citizens can comment and make suggestions. The tool is a cloud service with a web portal built around a 3D map as well as a mobile app. The City is now thinking of the next step of the digital platform *Min Stad* and this project with all its activities is related to that work.

A possible development trail for Min Stad, and perhaps the strongest development opportunity for the tool if the ambition is to develop it into a dialogue tool between the municipality and the citizens, is to open the possibility that parts of the planning process's civil dialogue can take place through Min Stad.

[2] www.minstad.goteborg.se

Such a development opens the possibility of reaching a new user group that is unrepresented today, but it also involves several different deliberations and issues that need to be addressed.

In the Swedish planning process, the prerequisites for, and the possibilities of, civil dialogue are relatively controlled. Dialogue can take place in many different ways and involve many different people and professions. However, in order for the individual's opinion to be given a legal status, it is in principle required that it be provided as a written opinion in which the proposer's identity is ensured. Such an opinion delivered in one of the planning process phases is a prerequisite for the individual to, at a later stage, be entitled to appeal a decision. The individual also must be considered directly affected by proposed changes.

Today, consultation with the public is taking place in the planning process through the presentation of traditional drawings, maps and text documents published on the municipality's website and exhibited at different locations in the city. This happens at some specific stages, where citizens are invited to dialogue and can also comment. During the planning process, the municipality may also choose to hold public meetings in various forms inviting the public to receive information and convey views directly to the city's officials. However, the views expressed in this way are not official in the opinion of the law but must be supplemented by a letter that is diarised by the municipality. Today's civil dialogue is characterized by a high degree of one-way communication, where the municipality collects a large amount of facts and information presented as a static material for citizens to absorb. There are obvious problems that the material is both difficult to access and that it is aimed at certain groups in society. The scope for dialogue is also greatly restricted by the fact that the viewpoint pickup takes place only on specific occasions, usually over a period of six plus three weeks during planning projects that often take two to three years to develop.

Today's Min Stad is largely based on the city as a whole. A large amount of information is presented, and residents have the opportunity to engage with the whole city. In today's information society, however, the large amount of information becomes a problem of its own. It is difficult for citizens to find the information they seek in the overflow of information and it is usually from the own geographic context that you are interested in seeking information, what happens near where I live and work. Examples of information that is interesting from such a perspective include: Are there any political decisions that concern my neighbourhood? Is there any planning in my vicinity that I may have any comments on? Will road work affect my way to and from work, etc. In a first step, a preliminary study on a Smart City Hub will be conducted.

3.1.3 AR/VR Visualisation of BIM and sensor data

Properties are now being connected to cloud-based systems i.e. sensors that measure energy consumption that are useful for energy monitoring and allows it to be controlled by a mobile phone. The virtual copy of the office Building “A Working Lab” has the potential of being a platform for all IoT products. Furthermore, it could also be a digital version of the building that sends notifications for property managers when, how and why to do different kind of services. When starting up a renovation process/new research project the BIM model can be used to simulate different scenarios prior to decision making.

3.1.4 AR/VR BIM Visualisation

Properties are now being connected to cloud-based systems i.e. sensors that measure energy consumption that are useful for energy monitoring and allows it to be controlled by a mobile phone. The virtual copy of the office Building "A Working Lab" has the potential of being a platform for all IoT products. Furthermore, it could also be a digital version of the building that sends notifications for property managers when, how and why to do different kind of services. When starting up a renovation process/new research project the BIM (Building Information Modelling) data can be used to simulate different scenarios prior to decision making.

BIM data are becoming ubiquitous in new construction projects, but all too often, the data is not readily available to the property owners or facility managers due to overly complex data management and visualisation tools, instead requiring consultants and specialists as go-betweens to access information. The AR/VR BIM visualisation tool developed in IRIS puts the information at the fingertips of the users in a simple and easily understood interface.

3.1.5 Personal Energy Threshold

With the PET project's application the awareness of energy consumption and its environmental impact will be visual for both the tenant and the property owner within HSB Living Lab in the Lighthouse district and for potential replication in HSBs building stocks. The application will deliver several ways to choose what kind of energy to use, when to use it and what to use it for. i.e the tenant can primarily choose energy produced by the PVs for a certain purpose and when to use it or use a mix of energy with the lowest environmental impact. PV installations are as well increasing in Sweden, and property owners are searching for solutions to deliver PV energy directly to the tenants with the purpose of nudging and awareness of saving energy and climate impact. The PET app can therefore be a very useful and engaging tool for energy distribution.

Energy saving compared to average Swedish buildings: 67 kWh/m2/a, or totally 1,5 GWh/a

3.2 Barriers and Drivers

3.2.1 Political

Barriers: No political barriers were identified.

Drivers: There is great emphasis on citizens' engagement and participation in civic matters from politicians and city management in Gothenburg.

3.2.2 Economic

Barriers: No economic barriers were identified.

Drivers: No economic drivers were identified.

3.2.3 Sociological

Barriers: No sociological barriers were identified.

Drivers: Gamification might boost the participation in planning process dialogue for youth.

3.2.4 Technological

Barriers: Min Stad: Today, there is no technical solution and / or legal support to cope with citizens' views within the framework of the planning process and other governmental activities that come in other ways than by digital and analogue letters that can be diarised. This needs to be developed. An acceptable technical solution for identifying the citizen must be introduced if the tool is supposed to be fully used in dialogue. It must be possible to verify the person behind an opinion in order to give them the status of concerned parties at a later stage (if they are directly concerned) and thus have the right to appeal an authority decision. A login with, for example, a Facebook or Google account is probably not enough.

Drivers: AR/VR BIM Visualisation: BIM data is becoming a more and more important aspect of planning, construction, operation and management of buildings, requiring new tools to make it truly useful

3.2.5 Legal

Barriers:

- Min Stad: Handling of personal data is always a key issue in creating new services and managing citizens' views. Storing personal data is managed according to GDPR.
- Min Stad: Today's planning process governs the views of citizens and other actors in society. It is therefore difficult to process comments and views that come from outside of a so-called consultation process. Within the framework of the IRIS project, we will highlight and see the possibilities for continuous dialogue.
- Min Stad: If citizens change the city's proposal or build own models of alternative development proposals in Min Stad, a function and a procedure must be developed that ensures that the proposal is handled and translated into an opinion given legal status.
- AR/VR BIM Visualisation: BIM data is often viewed as sensitive and/or proprietary, hence can be difficult to access

Drivers: A driver for all activities within TT5 ambition and political decision are essential. Digital Agenda for Europe, the Programme for e-society (GOT) are important drivers.

3.2.6 Environmental

Barriers: No environmental barriers were identified.

Drivers: No environmental drivers were identified.

3.2.7 Inclusive citizens

Drivers: Min Stad: Included citizens and an equal city is one of the most important issues for the modern city. In Gothenburg segregation is a major problem. Including citizens in the city development process is a way to create bridges between residents as well as include these in development. We must always act proactively to find new ways to include new groups in this process, from children and young people who will live in the future city as well as to newcomers.

3.2.8 Smart City

Drivers: Min Stad: Gothenburg's city view of the Smart City is based on the citizen and that she can live a good life. It is therefore important to have citizens' needs foremost as we create services for them.

4 Organisation of work

The work is carried out by the City: City Planning Office and Consumer-and Citizens service department, in collaboration with researchers at Chalmers Technical University - MiB (Management in Between) and Johanneberg Science Park (JSP).

4.1 Steering Committee

The work is directed by a Steering Committee consisting of project owner and resource owner (department manager) at the City of Gothenburg: City Planning Office and Consumer-and Citizens service department. Their main responsibility is to direct the project to be in line with the City´s requirements and to secure budget and resources within the project. The Steering Committee is chaired by Arvid Thörnqvist, department manager at the Planning department at the City Planning office. Other participants are the managers for the departments of Geodata, Strategic department and Consumer-and Citizens service department. The steering committee meets before every important gate in the project. Rapporteur in the meetings is the project owner Arvid Thörnqvist together with the subtask leader IRIS task 7.7 Anna Reuter Metelius.

4.2 Project management

The work in TT#5 is managed by the Project management team. Their main responsibility is to manage the project according to IRIS Grant Agreement and directives from the Steering Committee. Project management consists of the project manager and the assistant. Project management meets on a regular basis to handle the work ahead and current tasks.

4.3 Technical team Gothenburg

The technical team from the City of Gothenburg is managed by the project manager. This team is responsible for the technical set up and project implementation.

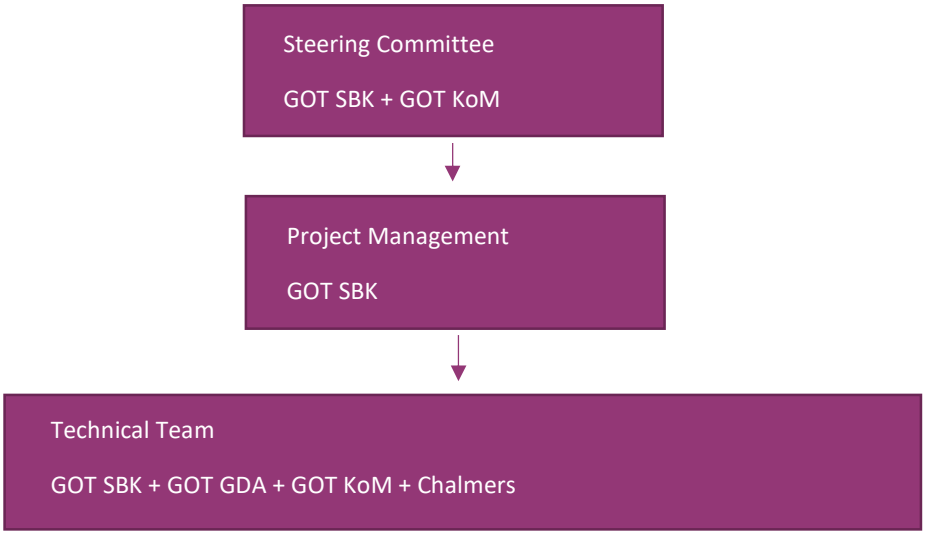

Figure 6. Organisation of work, The city of Gothenburg TT #5. Illustration by Anna Reuter Metelius

4.4 Minecraft as a dialogue tool for citizen engagement

Project lead: JSP

Technical support: GOT-SBK (City Planning Office)

The following tasks will be subcontracted (according to the plan laid out in the GA?)

- Architecture pedagog for the Minecraft workshops, interacting with personnel in the target area, carrying out workshops with students.
- Software licenses for Minecraft® Education.

4.5 Min Stad (My city) as a dialogue tool for citizen engagement

Organization for the five activities within the demonstrator:

- ME-model (Citizenship Modelling) Overall theoretical umbrella. The work is led by Professor Susanne Ollila, Chalmers with the participation of GOT-SBK Geodata, Strategic and Planning Department, as well as Consumer and Citizenship Service Administration.
- Smart City Hub (SCH) The work is led by GOT-SBK Geodata and / or Consumer and Citizenship Service Administration, supported by GOT-SBK Plans and Strategies.
- KD (Continuous Dialogue) The work is led by the GOT-SBK Planning Department, supported by GOT-SBK Strategies and Geodata.
- ILC (Inclusive Life Challenge) The work is led by GOT-Sbk Geodata, supported by GOT-Sbk Planning and Strategic. Chalmers is responsible for the organization of the master's course in which ILC is integrated.

- Interview Survey. The work is led by Professor Susanne Ollila, Chalmers with the participation of GOT-SBK Geodata, Strategic and Planning Department, as well as Consumer and Citizenship Service Administration.

Part of the practical work can be outsourced to consultants, but as we are limited by public procurement regulations, we are unable at this time to say anything about the consultant, scope or cost of their efforts at this time.

4.6 Project organization within Gothenburg City

Project owner: Arvid Thörnqvist, SBK

Project manager: Anna Reuter Metelius, SBK

Project group: Anna Reuter Metelius, SBK, Martin Trpkovski, SBK, Robin Nilsson, SBK, Kim Lantto, KoM, Mie Svennberg, SBK, Kristoffer Nilsson, SBK, Cecilia Hellsing, SBK, Sam Carvalho, SBK

Steering Committee: Arvid Thörnqvist (president), SBK, Andreas Jonsson, SBK, Mia Edström, SBK, Maria Holmgren, KoM, Åsa Lindborg, SBK

Change of staff

Contact person from SBK has from the start been Eric Jeansson, Geodata strategist, who coordinated SBK`s work initially. Arvid Thörnqvist, Architect, from the Planning Department (SBK) came later to be involved and new first contact person, as Eric Jeansson was assigned for other missions and no longer had the possibilities of working in the IRIS project. Arvid Thörnqvist has been the person who primarily participated in various types of project meetings and the work for the first reporting.

In early 2018, Arvid announced that he no longer has the opportunity to be active involved in the project, and a new person replaced him partly to coordinate SBK's work, Frida Bard from the Planning Department. Unfortunately, Frida Bard became sick in April 2019 and later changed workplace. New project manager and contact person since October 2019 is Anna Reuter Metelius.

4.7 Organisation of partners

4.7.1 Minecraft in the planning process

Table 4. Organisation of partners, Activity Minecraft #1a: Minecraft in the planning process

Name	Role and main responsibility in project	Organisation
Arvid Thörnqvist	Project owner	GOT-SBK
Anna Reuter Metelius	Project manager	GOT-SBK
Eva Pavic	IRIS Site manager Gothenburg	JSP
Martin Trpkovski	Assistant	GOT-SBK

Martin Steen	Planner. Project manager for detailed plan Bergsjön	GOT-SBK
Robin Nilsson	GIS Engineer Technical developer	GOT-SBK
Lars Johnsson	Architecture pedagog	GOT- Culture administration
Ida Liffner	Architecture pedagog	Consultant
Mie Svennberg	Children and young people	GOT-SBK
Susanne Ollila	ME-model- Prof. Technology Management and Economics, Entrepreneurship and Strategy	Chalmers University of Technology
Kim Lantto	Leader Digitalization	GOT – Consumer and Citizen service Administration

4.7.2 Minecraft in the City Triennal 2021

Table 5. Organisation of partners, Activity Minecraft #1b: Minecraft in the City Triennal 2021

Name	Role and main responsibility in project	Organisation
Arvid Thörnqvist	Project owner	GOT-SBK
Anna Reuter Metelius	Project manager	GOT-SBK
Eva Pavic	IRIS Site manager	JSP
Martin Trpkovski	Assistant	GOT-SBK
Kristoffer Nilsson	Process leader, City Triennale 2021	GOT-SBK
Robin Nilsson	GIS Engineer Technical developer	GOT-SBK
Sam Carvalho	Architecture pedagog	GOT-SBK
Cecilia Hellsing	Architecture pedagog	GOT-SBK
Susanne Ollila	ME-model- Prof. Technology Management and Economics, Entrepreneurship and Strategy	Chalmers University of Technology
Kim Lantto	Leader Digitalization	GOT – Consumer and Citizen service Administration

4.7.3 ME-modell, Smart City Hub and Continous Dialogue

Table 6. Organisation of partners, Activities Min Stad: ME-model, SCH and Continous Dialogue

Name	Role and main responsibility in project	Organisation
Arvid Thörnqvist	Project owner	GOT-SBK

Anna Reuter Metelius	Project manager	GOT-SBK
Eva Pavic	IRIS Site manager	JSP
Martin Trpkovski	Assistant	GOT-SBK
Susanne Ollila	ME-model- Prof. Technology Management and Economics, Entrepreneurship and Strategy	Chalmers University of Technology
Kim Lantto	Leader Digitalization	GOT – Consumer and Citizen service Administration
Stefan Lydén	Leader Digitalization	GOT – Consumer and Citizen service Administration

4.7.4 Inclusive Life Challenge and Interview Study

Activity Inclusive Life Challenge, Hackaton - Leading in a digital world is a collaboration project with Chalmers through Phd Susanne Ollila, Department of Technology Management and Economics and Phd Robin Teigland, Department of Entrepreneurship and Strategy.

Table 7. Organisation of partners, Activities Min Stad: ILC and Interview Study

Name	Role and main responsibility in project	Organisation
Arvid Thörnqvist	Project owner	GOT-SBK
Anna Reuter Metelius	Project manager	GOT-SBK
Martin Trpkovski	Assistant	GOT-SBK
Eva Pavic	IRIS Project Manager	JSP
Karin Weijdegård	Communications Officer	JSP
Ann Bergermark Rintala	Communications Strategist	GOT-SBK
Robin Teigland	Phd, Department of Entrepreneurship and Strategy	Chalmers University of Technology
Malin Finlöf	Exhibition, Curator	GOT-SBK
Susanne Ollila	ME-model- Prof. Technology Management and Economics, Entrepreneurship and Strategy	Chalmers University of Technology
Robert Heurlin	Researcher	Chalmers University of Technology
Kim Lantto	Leader Digitalization	GOT – Consumer and Citizen service Administration
Stefan Lydén	Leader Digitalization	GOT – Consumer and Citizen service Administration

4.8 AR/VR Visualisation of BIM and sensor data

The development work is carried out by ReSpace AB and managed and overseen by Johanneberg Science Park (Table 1). Akademiska Hus is supplying BIM data and access to building sensor data.

Table 1 AR/VR development team

Name	Role and main responsibility in project	Organisation
Christopher Zangelidis	Development lead	ReSpace AB
Sara West	UX and interface lead	ReSpace AB
Anders Logg	Scientific lead	ReSpace AB
Björn Westling	Coordinator	Johanneberg Science Park

5 Demonstration: Minecraft as a dialogue tool for citizen engagement

5.1 Specifications

The demonstrator is a test of the digital platform Minecraft, for dialogue with children and young people.

The demonstrator aims to study how Minecraft can be included as a tool to contribute to children's and young people's engagement in urban planning.

To take part of and involve children's and young people's perspectives, the children's perspective and young people's local knowledge is an important part of city planning. At the same time, it gives them new knowledge about the city's planning work.

The demonstrator Minecraft as a dialogue tool for citizen engagement includes two activities that will be carried out through dialogue and work with children and young people within a detail plan and during the Gothenburg City Triennal 2021:

- Activity 1a: Minecraft in the planning process
- Activity 1b: Minecraft in the Gothenburg City Triennal 2021

The demonstrator will address and involve different age groups of children and young people. Activity 1a: Minecraft in the planning process is being performed through the Child Impact Assessment (BKA) within an ongoing sharp detailed plan. Activity 1b will be performed both trough a Platsbyggnadsprocess (“placemaking process”) and within the work with an architecture exhibition at Röhsska Design Museum in Gothenburg (Sweden’s national Design museum) and with a book – the city’s new architecture guide of Gothenburg.

5.1.1 Minecraft in the planning process

Figure 7. A part of the area Bergsjön in Minecraft

The first project to be performed within this activity is that Minecraft is investigated more closely and tested sharply in an ongoing detailed planning project. Minecraft can be used both isolated and integrated as a complement to the following existing dialogue methods:

- REBUS. A way of working for smaller projects based on co-creation. The model has been applied for several years, mainly with small children. More methods could be developed within the REBUS approach.
- Safety walks from a children's perspective is a model based on knowledge sharing between the architect's knowledge, the children's experiences and the teachers' knowledge and that they know the children they work with.
- City planning board game

The issues within this activity are:

- Can Minecraft be used as a tool for gathering knowledge for work with planning programs and detailed plans?
- What information can be collected using this tool?
- Is this application of the tool suitable for increasing the interest and knowledge of school students in urban development issues?

The detailed plan for housing between the Rymndtorget and Komettorget in the district of Bergsjön has been selected as a test object where students at Bergsjöskolan will be involved in Minecraft activities linked to the ongoing detailed plan.

The detailed plan was chosen because it was seen as an advantage that there was a clear target group with children who can be involved (school students). The detailed plan is at a very early stage, which also increases the possibilities of using the outcome from the Minecraft activities to something concrete in the detailed plan, which also contributed to this particular detailed planning project being selected.

The activity will be carried out through 6 workshops at the Bergsjö School in the spring and autumn and in collaboration with the organization for the planning work and Bergsjön 2021. The city building office specialist in dialogue with children and young people participates. An architecture educator / pedagog leads the work. The first two workshops (yellow in figure below) will be a test to get to know the school and the children and to calibrate tools and methods. Workshop 1-4 (green in figure below) will be the sharp activity implementation.

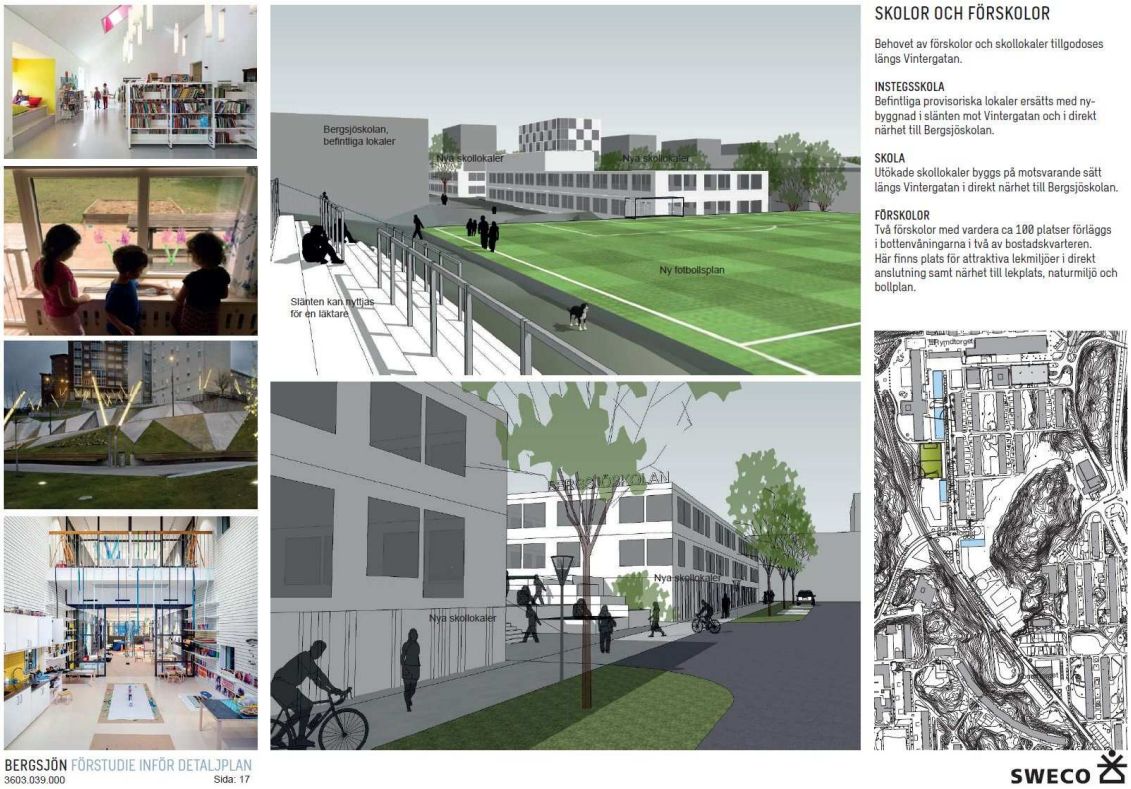

Figure 8-9. Extract from the document "Bergsjön, Vintergatan – Prestudy for detailed plan, August 2012", Sweco.

5.1.2 Minecraft in the Gothenburg City Triennal 2021

Minecraft in City Triennale 2021 is a summer camp for children, arranged in collaboration with the Gothenburg City Triennial 2021 and its contributing partners.

In the summer of 2021 Gothenburg turns 400 years. This will be manifested in an urban exhibition by the Jubilee park and the new bridge over the river. The IRIS project will collaborate with the Triennial to create a summer camp where 3-4th graders can participate for a week to rebuild Gothenburg in Minecraft and physically build parts of the suggestions as part of the urban exhibition.

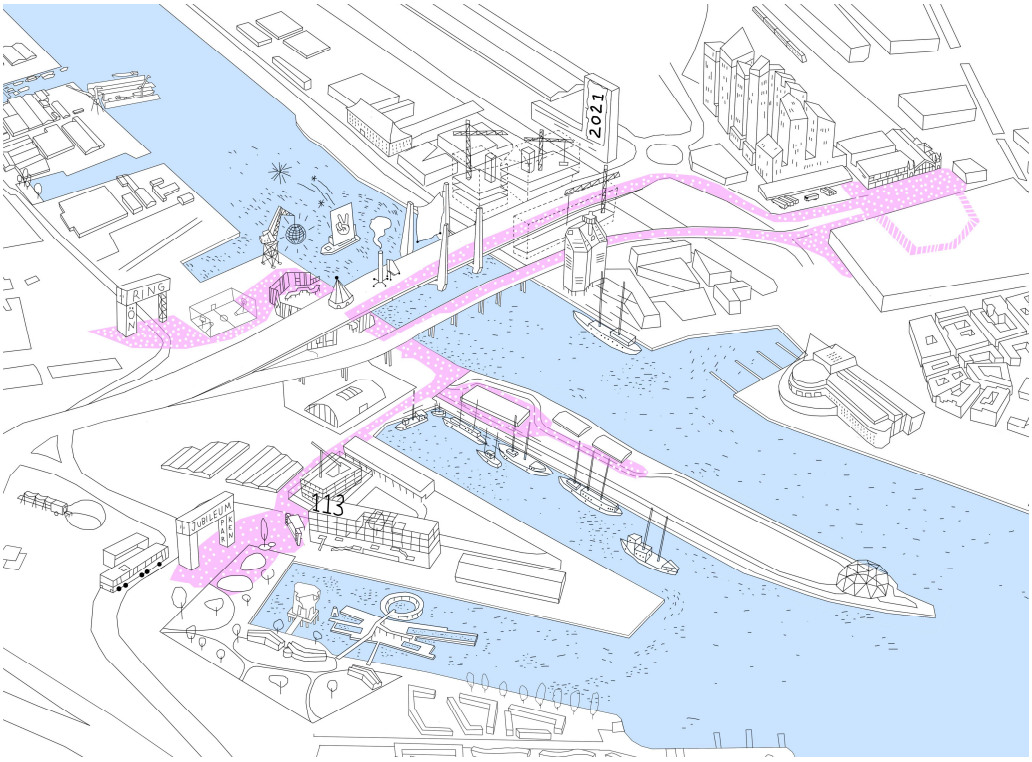

Figure 10. Demonstration areas for Minecraft summer camp: The urban exhibition within the Gothenburg City Triennial 2021, by the Jubilee park and the new bridge over the river. Illustration: Samuel Carvalho

In the former port area of Frihamnen in Gothenburg, since 2013, an investigative design process has been the driving force in the work on the Jubilee Park. Today, there are dozens of prototypes that not only show how we can work for a sustainable and inclusive city, but also challenge notions about what architecture is and can be. Within this activity Minecraft will be tested as a tool for citizen engagement within the investigative design process.

The activity will be carried out in four occasions, suggested week 24, 25, 31 and 32 during 2021. Target group is children in grades 3-6 and the number of participants per group has been proposed to be 10 (so 40 participants in total). In the event of great interest, the places will be drawn out. Times are 10-15 pm, lunch and coffee included. Location: Jubileumsparken. Within the activity the work with Minecraft is combined with more practical workshops where it is also built with nails and hammers.

There is also a plan of perform an activity of citizen engagement with children and young people within an exhibition at the Design museum of Röhsska, also a part of the Gothenburg City Triennal 2021. A plan for this is being developed.

Figure 11. The playground and art piece / sculpture Berget, one of the prototypes in the Jubilee Park, built by the City of Gothenburg in co-creation with children.

5.2 Hardware

Standard computer; does not require any extreme performance.

5.3 Software

Minecraft license required.

5.4 Target group

The target group for this activity is the city's citizens and visitors, above all young people and children. From different parts of the city.

5.5 Mode of engagement

Workshops at school and at a summer camp for children and young people within the Gothenburg city Triennale 2021.

5.6 Societal, user and business aspects

5.6.1 Societal benefits

The demonstrators aim to enable and encourage citizen engagement. Gothenburg in Minecraft provide software and data to help getting citizens engaged.

5.6.2 Business model

Not applicable.

5.6.3 Governance

The city of Gothenburg.

5.7 Impact Assessment

5.7.1 Expected impact

The expected impact is to get a deeper understanding and knowledge of how to use Minecraft as a dialogue toll for citizen engagement with children and young people.

5.7.2 KPIs

Table 9 Minecraft in the planning process

KPI	Parameter(s)	Baseline	Target (as described in DoW or declared)
Local community involvement in the planning phase	Number of participants	N/A	Number of participants in the spatial planning contest, more than hundred.

Table 10 Minecraft in the Gothenburg City Triennal 2021

KPI	Parameter(s)	Baseline	Target (as described in DoW or declared)
Local community involvement in the planning phase	Number of participants	N/A	N/A

5.7.3 Monitoring plan

Survey and / or interviews with participants after workshops in activity Minecraft in the planning process. Survey and / or interviews with participants after summer camp in activity Minecraft summer camp in Gothenburg City Triennal 2021.

5.8 Implementation plan

The plan for the implementation of the demonstrator is to test different digital tools in the citizen engagement of children and young people and that this will be implemented within the work with a detail plan and at the Gothenburg City Triennale 2021. The study will involve different age groups of children and young people.

5.8.1 Planning of activities

Gantt (2020-04-05)
IRIS - Transition track #5: Citizen engagement and co-creation [SMA-IRIS]

Göteborgs Stad

Aktivitet	Startdatum	Slutdatum	Var	Progress
Projektglobal - IRIS - Transition trac				1%
Start	2018-02-26			
Genomförande	2017-10-01	2022-09-30	1275	15%
WP1 Transition Strategy	2017-10-01	2020-10-08	762	0%
WP3 Development BBM	2018-02-26	2022-09-30	1170	1%
WP7 Task 7.7 Citizen Engagem	2017-11-28	2022-07-02	1169	63%
T7.7 1 Minecraft	2017-11-28	2021-07-30	929	50%
T7.7 2a Citizenship Engage	2017-11-28	2022-07-01	1169	75%
T7.7 2b Smart City Hub	2017-11-28	2022-07-02	1169	50%
T7.7 2c Continous Dialogue	2017-11-28	2022-07-01	1169	75%
T7.7 2d Inclusive Life Challa	2017-11-28	2020-06-30	649	80%
T7.7 2e Digital Platforms for	2019-10-29	2022-06-28	682	50%
WP8 Replication	2020-02-17	2022-09-30	677	0%
WP9 Monitoring and Evaluation	2020-02-17	2022-09-30	677	0%
WP10 Communication and	2020-02-17	2022-09-30	677	0%
WP11 Project Management	2019-10-01	2022-09-30	770	1%
EU Rapportering 2019	2019-09-01	2020-02-29	124	70%
Launch of activities	2020-02-29			0%
Slut	2022-10-03			

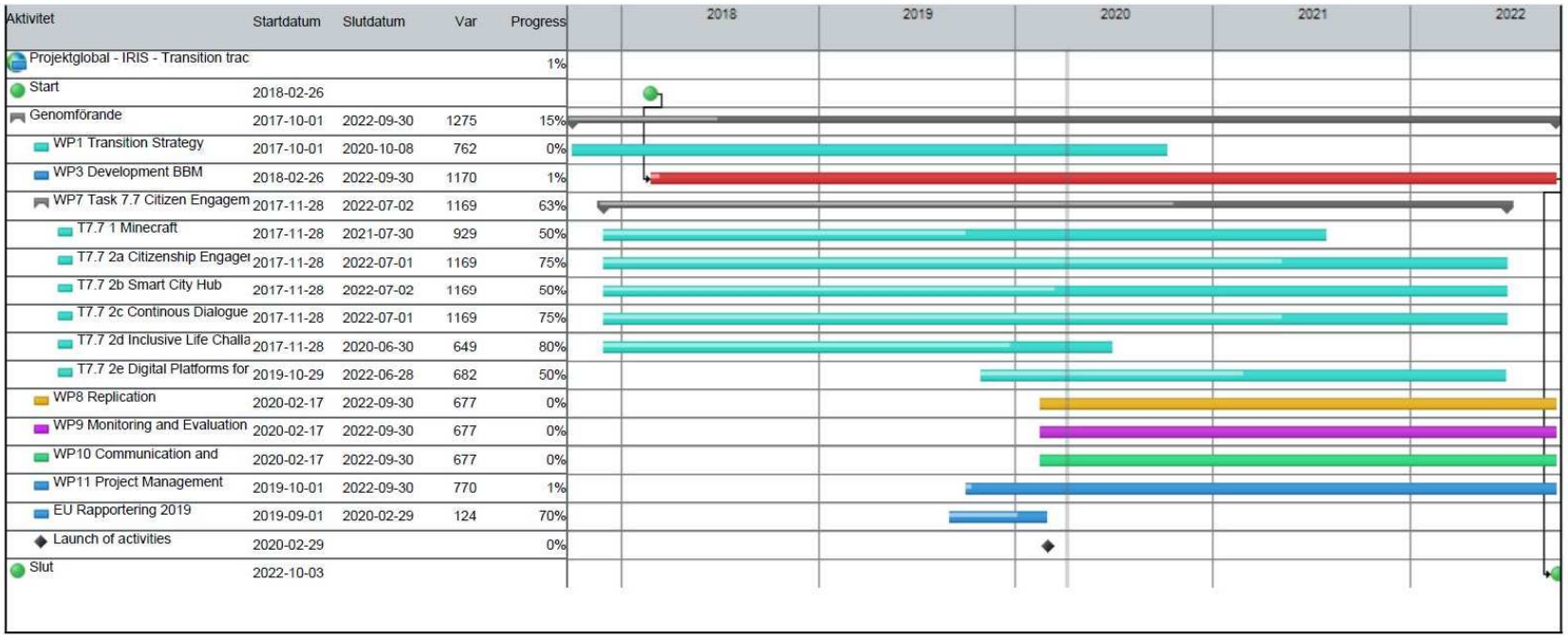

Figure 12. Gantt Schedule for the City of Gothenburg plan of activities within TT#5

5.8.1.1 Minecraft in the planning process

The activity is conducted at the Bergsjö School within the work with a detailed plan in the district Bergsjön with the following arrangement:

- A first dialogue with open house is planned in the area, where the public (= the parents of the children) can come and get information about the planning project. At this time, there is advantageously a presentation of Minecraft and the opportunity to test the tool for the visitors. This will also be a way to involve parents in the students' work, possibly a virtual security walk can be carried out with visitors at the open house. In the consultation in the detailed plan, it is also possible to in some way report what the students worked with in Minecraft and show how it may have affected the planning work, this also becomes a form of feedback to the participating students.
- Four different Minecraft workshop occasions, with two workshops each, will be conducted with the children at the Bergsjö School during spring 2020, with the following arrangement:

1. Creative info on architecture and urban planning, Bergsjön history and a walk in the area, good, bad or potential places - analysis / discussion afterwards. An architecture pedagog, Ida Liffler, will do the presentation.
2. Hiking in Minecraft - further discussion of these sites and discussion of the new plan proposals.
3. Work on different creative approaches.
4. Complete the work, analysis - presentation and summation, in a report focusing on being a good basis for BKA and describing how the children used Minecraft.
5. Feedback and dialogue. Architectural pedagog Ida Liffler compiles the material and describes thoughts on how the children used and how Minecraft worked based on their profession. Architecture pedagog compiles the children's views into a clear basis for the BKA. (reconciliation with plan group).

The activity is carried out in collaboration with the local initiative Bergsjön 2021 and will also be able to use the project website for Bergsjön 2021 for dissemination of information and publish the students' proposals. Bergsjön 2021 is a collaboration between ten property owners who, through new construction, want to develop the quality of life for all people in the future Bergsjön.

Figure 13. Picture from the website of the local initiative Bergsjön 2021

5.8.1.2 Minecraft in the Gothenburg City Triennal 2021

Minecraft in City Triennale 2021 is a kid's summer camp in collaboration with the Gothenburg City Triennial 2021. In the summer of 2021 Gothenburg turns 400 years. This will be manifested in an urban exhibition by the Jubilee park and the new bridge over the river.

The IRIS project will collaborate with the Triennial to create one or two summer camps where 3-4th graders can participate for a week to rebuild Gothenburg in Minecraft and physically build parts of the suggestions as part of the urban exhibition

5.8.2 Planning of costs and (equipment) investments

Costs for the activity are possible expenses for Minecraft licenses as well as licenses for other digital tools used as well as compensation for the work of an architectural pedagog (cost 22 000 sek).

5.8.3 Risk management

Table 11. Risks and Risk Management - Transition Track #5

Demonstrator	Identified Risk	Proposed mitigation measures
Minecraft	Not enough contestants	Establish a wide network for marketing the competition and recruiting contestants

5.8.4 Progress achieved up to M24

Work so far has largely consisted of planning work. A number of workshops that have been conducted which have been aimed at knowledge acquisition, implementation and anchoring.

During the late autumn 2019, it has been an intense and important phase for project implementation. SBK's activities have been planned for implementation in the first half of 2020.

April 6-8, 2020, the first Minecraft workshops were held at the Bergsjö School. Workshops will be conducted on three additional occasions in the spring and autumn of 2020.

*Article about the Minecraft workshop in Bergsjön, "*Young people give input on their neighbourhood through Minecraft", *at Johanneberg Science Park website:*

*"*What do children and youngsters in Bergsjön, a suburb of Gothenburg, think about their neighborhood? How do they move? What routes do they take to school? What do they do in their spare time? What places do they like or not like? What does the future Bergsjön look like? These were some of the questions raised during two workshops in Bergsjön during the Easter holidays. The workshops are part of an EU-funded collaboration project on smart cities and citizen engagement that the City of Gothenburg conducts together with Johanneberg Science Park and Chalmers, among others.

During the Easter holidays, children and youngsters gathered at the Bergsjö School to work together with planners from the City Building Office and an Architectural Educator to explore their local environment virtually. Inside Minecraft, the students got to walk around and experience the new neighborhoods that is planned to be built. "For us working with urban development, this input is important and we also get to

reach out to young people with issues concerning urban development, says Martin Steen," plan architect at the City Building Office who is responsible for the planning work at Solgatan in Bergsjön.

A way to get the views of children and youngsters

A lot is going on in Bergsjön. In addition to the construction of a new cultural center, work on the local plan *Housing between Rymdtorget and Komettorget* is underway. The idea is to link Rymdtorget and Komettorget by creating new streets as well as about 700 new homes and facilities. The plan will also include an extension of the Bergsjö School, the relocation of a football field, improvement at Komettorget, new preschools and accommodation with special services and more.

The workshops at the Bergsjö School during the Easter holidays were the first in a series to be carried out during the year, and it is a way to get the views of children and youngsters on their local environment and on the planned development. The computer game Minecraft is one of several different dialogue tools used and through the EU project IRIS Smart Cities, the workshops also aim to test and evaluate how Minecraft works to engage children and youngsters and involve them in urban development. The city of Gothenburg has been built up in Minecraft for a couple of years and the City Building Office has now also put in the new local plan in order to get a sense of what it will be like in the future.

How are different places experienced?

"Today, there is a great and urgent need to develop methods and tools for dialogue with children and young people in order to incorporate their experiences and make them participate in the development of society. The collaboration between the ongoing planning work in Bergsjön and IRIS Smart Cities is valuable in several ways. On the one hand, thanks to the work done in Minecraft, we have received many good ideas and new knowledge from the young people that we can use in the local plans for Bergsjön and on the other hand we can use the experience of the dialogue tool in other planning projects in the City Building Office as well as in all the cities that are part of the EU project," says Anna Reuter Metelius, at the City Building Office and project manager for the city of Gothenburg in the focus area Citizen Engagement of IRIS Smart Cities.

During the workshops, maps and walks outdoors were also used to identify places and routes to understand how the young people experience them. What places and environments in the area are experienced as nice and inviting? What places are perceived as unsafe or unused? The work resulted in many ideas and wishes. For example they wanted a bigger space or playground for all generations - a central meeting place where everyone has something to do – play or just hang out.

Increase the influence and participation of young people

"We now have a large material to continue working with. We have tested several tools, that have reinforced one another. Minecraft is a good dialogue tool and we see great potential in using the game to increase the influence of young people in urban planning. Unlike just seeing plans or visualized images, it becomes more understandable when you can wander around the environment as well as tear down, build up and shape completely freely," says Martin Steen.

The workshops in Bergsjön are part of the detailed planning of the child impact assessment, to collect and take advantage of the perspectives of children and young people, their local knowledge and needs.

The Easter holiday activity in Bergsjö School has also taken place in cooperation with Bergsjön2021, which is a collaboration between property owners in Bergsjön".

Figure 14. The frontpage of the presentation at the first Minecraft workshop

Figure 15-16. Minecraft workshop at the Bergsjö School, April 2020

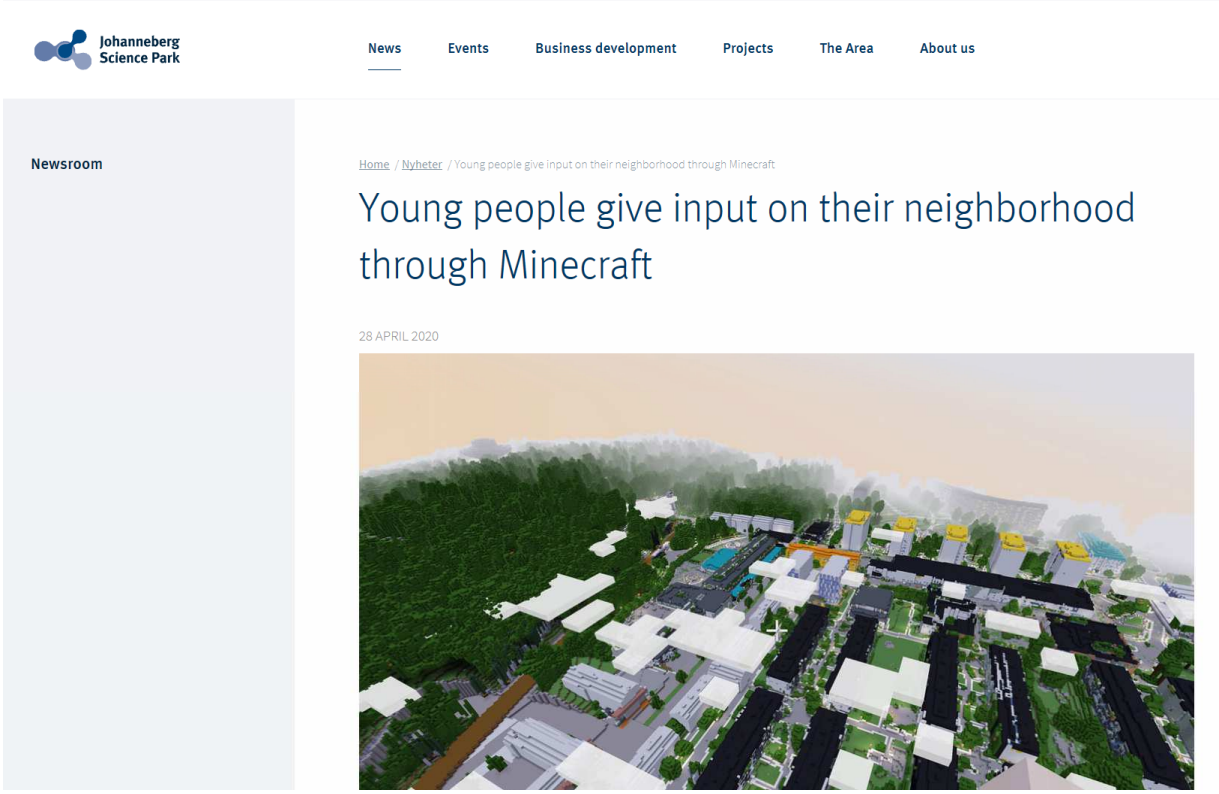

Figure 17. Article about the Minecraft workshop in Bergsjön at Johanneberg Science Park website.

5.9 Conclusion

The Minecraft demonstrator has been through a re-boot process due to a lack of resources at City Planning Office in 2019. There was a previous plan to carry out the entire activity in the detailed planning work for Önneredsskolan. This is no longer relevant as the school is no longer interested as of the time lag that occurred during the resource loss on SBK.

The project is however now back on track with a project directive, steering and project group, and planned activities with objectives in line with the overall IRIS objectives.

New proposal for current planning work to link activity 'Citizens' Dialogue through Minecraft ' is a detailed plan in Bergsjön, for housing between Space and Komettorget about 700 housing units. April 6-8, the first Minecraft workshops were held at the Bergsjö School. Workshops will be conducted on three additional occasions in the spring of 2020. The Architecture Pedagog Ida Liffner wrote this brief summary about the result of this first Minecraft workshop occasion: “We have tested several tools, which have given effect to each other. In particular, Minecraft has been valuable for understanding the scope and volume of the proposed changes, and which may otherwise be too abstract to be able to have thoughts and opinions about. We have used several of the questions from SBK to have something to apply “Can we use Minecraft to extract information from children and young people in urban planning projects” on. Since we had so few participants, we cannot draw much conclusions, but the children who participated have all expressed that it was fun to play Minecraft and that it has helped them understand what the proposal for the area means”.

To investigate other possibilities with Minecraft in a more open and creative phase of the planning process a new activity has been developed within the Minecraft demonstrator: Minecraft in the Gothenburg City Triennal 2021. The planning of this activity is being done during this spring 2020.

6 Demonstrator: Min Stad (My City) as a dialogue tool for citizen engagement

6.1 Specifications

Within IRIS, the possibilities for developing Min Stad (My City) into an active dialogue tool will be explored. The goal is to spread information more efficiently in a new channel, to reach new user groups and to explore how far the dialogue between the municipality and citizens can be developed within the current legislative framework. A first step may be to, with the help of citizens, find a good form for how data is presented and to link new forms of information into the current dialogue process. In a further development, the tool Min Stad can be developed to present more complex information while allowing the citizen to not only write comments but also modify the proposal presented by the city and / or create their own suggestions in the form of models, sketches or the like.

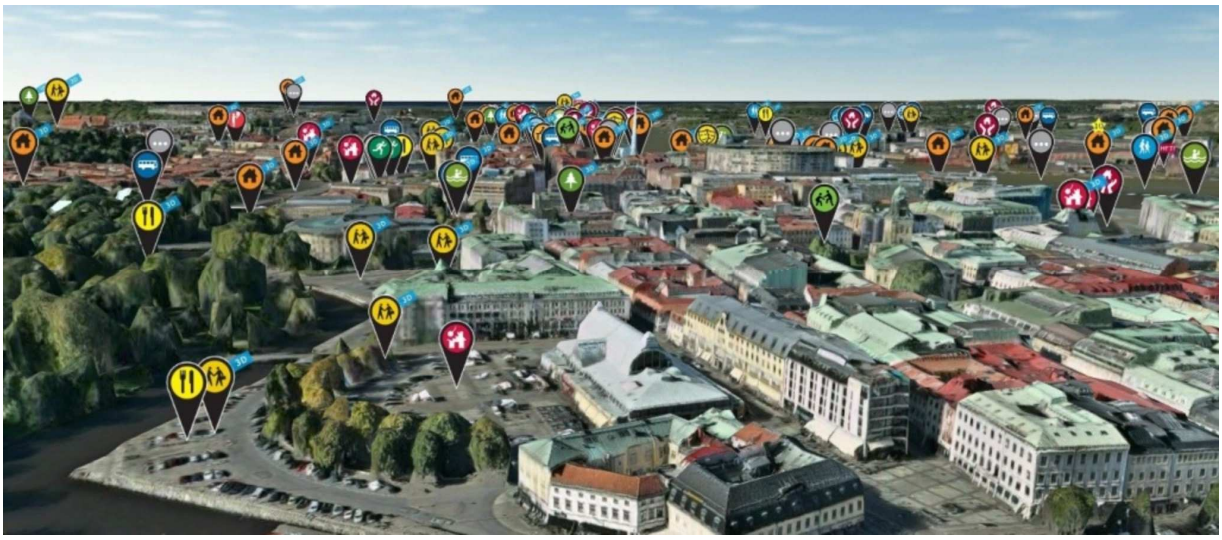

Figure 18. Min Stad (My City) introduction page http://minstad.goteborg.se/minstad/index.do?lang=en

Develop and evaluate how to increase citizen interaction and engagement based on models of co-creation and collaborative innovation - The process dimension.

A combination of passive (informed and involved according to HKU categorization) and active (contributing and co-creating) citizens involvement in the development of Min Stad in different phases of development work: idea generation, idea conceptualization, idea assessment. The two different varieties of commitment mean that the role of civil servants in the city and the role of citizens have changed somewhat. When giving citizens the space to actively contribute to development work, the control of the contents is shifted towards the citizen. In the position as passively engaged, you have different rights and

obligations than those you have as actively engaged. The two different types of engagement also require specific organization and facilitation to be perceived by both parties as worthwhile and meaningful.

The activity, through four sub-activities, studies the possibilities of developing My City into an active dialogue tool in the planning process. The four sub-activities are as follows:

6.1.1 The citizenship engagement model (ME-model):

The citizenship engagement model will provide a starting point for the planned activities within WP7, Task 7.7 Citizen engagement, and the activities will, in turn, contribute to the knowledge about what rights and obligations citizens have in the different types of commitment in each phase. The ME model constitutes the basis for learning and knowledge generation about citizens' involvement and commitment to further development of the Min Stad Platform. The ME model will also provide the basis for discussing what kind of organization and facilitation the different types of citizenship require.

Within the IRIS project the Engagement Ladder is used as a reference tool to determine the *possibilities* for citizens to influence decision-making, articulating their needs, challenges and problems. This ladder distinguishes 4 levels of engagement.

- Level 1 of the Engagement ladder consists of IS that have no touch point. These integrated solutions will be implemented with the support of concise communication strategies, informing citizens on the impending changes in their environment.
- Level 2 of the Citizen Engagement Ladder implies the involvement of citizens in actively contributing to the storytelling about the IRIS changes in their own neighbourhood, as part of the communication strategies. These citizens will have a higher level of engagement in being able to effectively communicate the IRIS integrated solutions and objectives from their own citizen perspective.
- Level 3 of the Engagement ladder contains the integrated solutions that allow citizens some kind of agency, control or steering of the integrated solutions. For this we introduce the notion of active touch points. Through these active touch points, citizens should be able to influence the outcomes of the KPI's of the IRIS project through their own behaviour.
- Level 4 of the Engagement ladder contains those integrated solutions where there is an existing touch point that can be adapted, modified, simplified or enhanced within the possibilities of the IRIS project or integrated solutions where new touch points will and shall be developed.

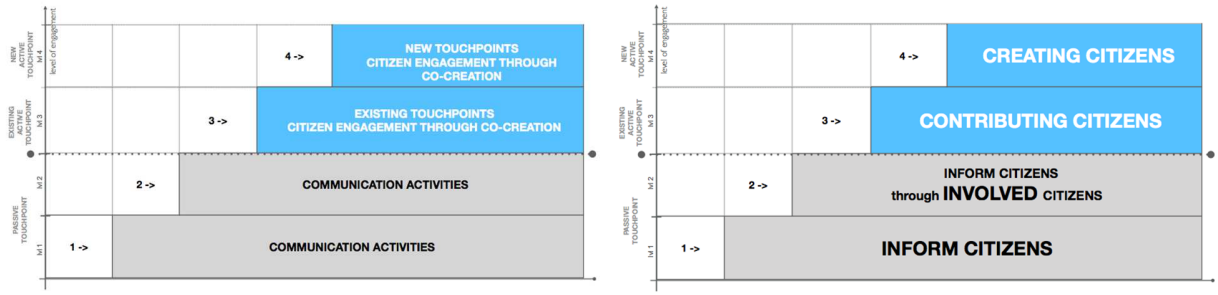

Figure 19. The Engagement Ladder

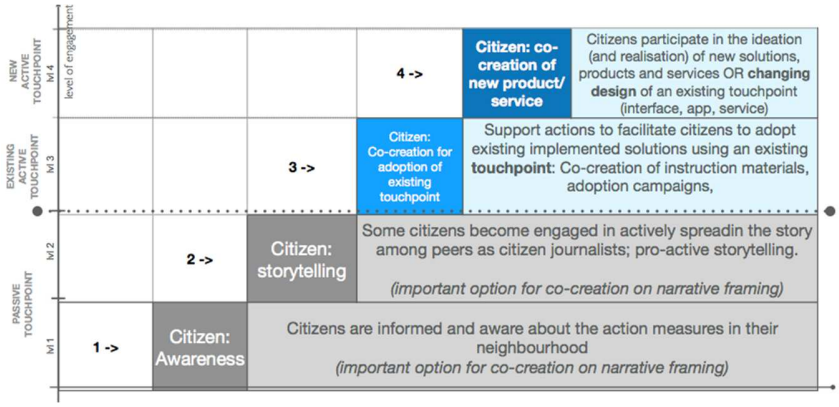

Figure 20. Outline of the citizen engagement ladder with possibilities for involvement of citizen in the implementation of the IRIS measures.

Detailing of the approach for each step on the ladder:

- Informing citizen (level 1): Citizen awareness needs to be for the whole IRIS project. Therefore, a key communication message needs to be developed. Guiding principle in de communication are:
  - Focus on the impact of measures on the day-to-day life of citizens and how the measures can help in the challenges of everyday life in an underprivileged district.
  - Due to the sub-average language and education level of a substantial part of the population, information will spread through word of mouth
  - Add content and information to existing channels for citizens rather than the creation of new and unknown channels
  - To increase knowledge of the principles behind the integrated solutions, existing educational materials will be used in combination with physical examples in the district to increase awareness and understanding of the technologies involved.
  - Multichannel approach: website, (existing) educational materials, information through local partners, schools and where necessary door to door information in writing will be used to complement one another.
- Informing citizens through citizen journalism (level1/2): Citizen storytelling will be applied for tor amongst other integrated solutions placed on level 2. Existing volunteer district news networks will be key for the citizen journalism approach, in addition, cooperation with the local primary and community college is in the early stages.
- Contributing and creating citizens (level 3 and 4). The HKU developed a quick scan tool that can be used to map planned measures to be implemented against required citizen engagement activities. This results of this mapping for Utrecht is presented in the IRIS deliverable D1.6. For the measure placed on level 3 and 4 the HKU developed a co-creating process based on a design thinking approach. This approach will be applied in Utrecht for the integrated solutions on level 3 and 4. A provisional overview of anticipated citizen engagement activities is elaborated in Annex I of D1.7.

6.1.2 Smart City Hub

The activity is about how the city can make open data more user-friendly. ”A tool that compiles and filters information based on specific rules and geographic context. The information is open data provided by the city. Data describing ongoing plans, ongoing street work, planned events or documents, etc.”

Today's Min Stad is largely based on the city as a whole. A large amount of information is presented, and residents have the opportunity to engage with the whole city. In today's information society, however, the large amount of information becomes a problem of its own. It is difficult for citizens to find the information they seek in the overflow of information and it is usually from the own geographic context that you are interested in seeking information, what happens near where I live and work. Examples of information that is interesting from such a perspective include: Are there any political decisions that concern my neighbourhood? Is there any planning in my vicinity that I may have any comments on? Will road work affect my way to and from work, etc.

A solution to this problem can be a so-called smart city hub. A tool that compiles and filters information based on specified rules and a geographic context. The information that such a tool consumes should be open data provided by the City. Data describing ongoing plans, ongoing street work, planned events or documents, and information stating political decisions, all geocoded to a geographic location or area.

6.1.3 Continuous Dialogue

The activity explores the possibility of dialogue within the framework of the municipality's planning process. "How can Gothenburg city administrations become more aware of and develop their work with continuous citizen dialogue?"

Within the framework of IRIS, the possibilities of developing Min Stad into an active and ongoing dialogue tool should be explored. The goal is to spread information more efficiently in a new channel, to reach new user groups and to explore how far the dialogue between the municipality and citizens can be driven within the current legislative framework. A first step may be to, with the help of citizens, find a good form for how data is presented and to link new forms of information into the current dialogue process. In a further development, the Min Stad tool can be developed to present more complex information while allowing the citizen to not only comment but may also modify the proposal presented by the city and / or create own suggestions in the form of models, sketches or the like.

6.1.4 Inclusive Life Challenge

Activity Hackaton - Leading in a digital world is a collaboration project with Chalmers through Phd Susanne Ollila, Department of Technology Management and Economics and Phd Robin Teigland, Department of Entrepreneurship and Strategy. Students in CTH the master's course ”Leading in a digital world”, will implement a so-called Hackaton for innovation based on the city's open data. The incentive for The City's contribution is to fulfill the vision of becoming a Smart City which is circular and sustainable. The course will lead to innovations on the area of citizen dialogue / citizen engagement and will be an opportunity for The City Building Office's Geodata department to get new open data innovatively tested and evaluated, which is valuable.

6.1.5 Interview Study

An interview study is to be carried out in Gothenburg that connects to research into how to encourage greater citizen participation through further developing *Min Stad* as a dialogue tool, particularly in line with the goals of *Jämlikt Göteborg* (Equal Gothenburg).[3]

The project will contribute to the overall research aims of:

1) disseminating information more efficiently in a new digital channel,
2) reaching new user groups and
3) improving the dialogue between the municipality and citizens as much as possible within the constraints of the current legislative framework.

The main task is to create an interview guide by talking to Susanne Ollila and Anna Reuter Metelius, conduct about 30 interviews with citizens around the digital platform *Min Stad* and suggest some ideas for development of the platform.

6.2 Hardware

Standard computer; does not require extreme performance, but the 3D model becomes smoother with good graphics card. The MinStad app is available on iPhone and Android.

6.3 Software

The digital platform My City Builds on OpenCities Planner from Bentley, which you can access via a regular browser. There is also an app, but the 3D view is not available.

6.4 Target group

The target group of the activity is the city's citizens and visitors of all ages.

6.5 Mode of engagement

The citizens can access Min Stad trough the cities webpage Stadsbyggnadswebben.

[3] https://goteborg.se/jamlikt

6.6 Societal, user and business aspects

6.6.1 Societal benefits

The demonstrators aim to enable and encourage citizen engagement. Min Stad provide software and data to help getting citizens engaged.

6.6.2 Business model

Not applicable.

6.6.3 Governance

The city of Gothenburg.

6.7 Impact Assessment

6.7.1 Expected impact

The activity, through four sub-activities, studies the possibilities of developing My City into an active dialogue tool in the planning process. The expected impact is to improve the possibilities for citizen engagement in the planning process.

Table 12. KPI's Min Stad continuos dialogue

KPI	Parameter(s)	Baseline	Target (as described in DoW or declared)
Local community involvement in the planning phase	Number of participants	N/A	N/A

Table 13 KPI's Inclusive Life Challenge

KPI	Parameter(s)	Baseline	Target (as described in DoW or declared)
User engagement	Number of participants	N/A	N/A

6.7.2 Monitoring plan

To check the number of users through yearly statistics for users of Min Stad.

6.8 Implementation plan

6.8.1 Planning of activities

Gantt (2020-04-05)
IRIS - Transition track #5: Citizen engagement and co-creation [SMA-IRIS]

Göteborgs Stad

Aktivitet	Startdatum	Slutdatum	Var	Progress
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EU Rapportering 2019	2019-09-01	2020-02-29	124	70%
Launch of activities	2020-02-29			0%
Slut	2022-10-03			

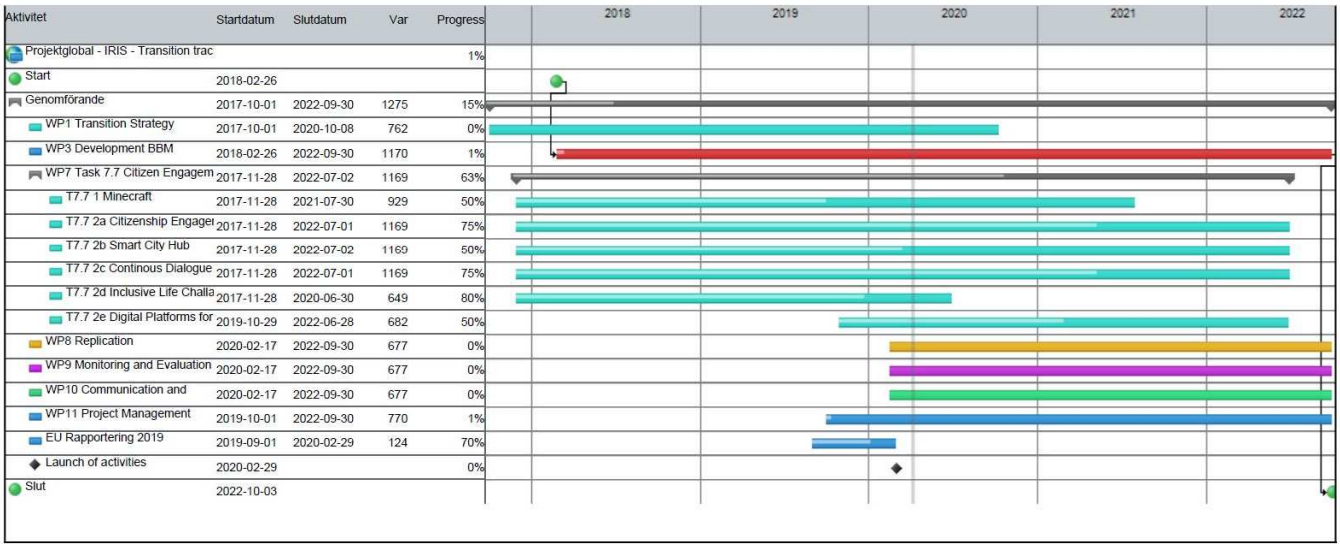


Figure 21. Gantt Schedule for the City of Gothenburg plan of activities within TT#5

6.8.1.1 The citizenship engagement model (ME-model)

Work on the ME model includes the following activities:

- 3 Workshops (Workshops 1-3) in WP 7 Task 7 to talk about 1) What kind of commitment should be used in the different phases of the development of the "Continuous Dialogue", "Inclusive Life" contest and "Smart City Hub" 2) what rights and obligations citizens should have linked to the different types of engagement and phases; 3) how is this commitment to be organized and facilitated
- During a selection of activities, participatory observations will be conducted to see how citizens act.
- Following the activity of citizens involvement linked to the "Inclusive Life contest" and "Smart City Hub", the citizens' perceived rights and obligations will be captured via surveys and / or interviews.
- 3 Workshops (Workshops 4-6) in WP 7 Task 7 where data from surveys and / or interviews are discussed to further develop the ME model and evaluate whether the desired degree of citizens' engagement has been achieved and how this relates to the results obtained through this commitment and how organization and facilitation worked.

Idea Generation Conceptualisation Assessment	Citizens' engagement			
	Passive (informed and involved)		Active (contributes and co-creates)	
	Rights	Obligations	Rights	Obligations
	xxx	xxx	xxx	xxx
	xxx	xxx	xxx	xxx
	xxx	xxx	xxx	xxx

Figure 22. Citizen's engagement model

6.8.1.2 Smart City Hub

In a first step, a preliminary study will be conducted. The preliminary study will highlight citizens' needs, what kind of data that can meet these needs, which data is available for a prototype as open data and how a technical solution can be designed.

6.8.1.3 Continuous Dialogue

Work in this intervention is conducted as investigative work, where conditions such as laws and frameworks are highlighted from different perspectives, leading to demonstrations of possible approaches.

6.8.1.4 Inclusive Life Challenge

Since the beginning of the semester in January, 100 Chalmers students have worked in teams to develop and present ideas to help the City of Gothenburg achieve its goal of becoming a smart and sustainable city. The requirement is that the ides should be based on open data and digital technology and offer something that is not already in Gothenburg.

The voting is conducted through *Cityplanning Office external webpage:* https://stadsutveckling.goteborg.se/smart-city-challenge/ and the information about the project is communicated thorough social media such as Facobook, Twitter and Instagram.

Until a week ago, the plan was to also showcase the proposals through an exhibition in the information kiosk in the Shopping center Nordstan in the middle of Gothenburg city center. Unfortunately, we had to cancel because the exhibition because of the Covid-19.

6.8.1.5 Interview Study

The project is to be carried out during the autumn 2020. *Susanne Ollila,* Professor at Entrepreneurship & Strategy Division, Department of Technology Management and Economics at Chalmers University of Technology is the project manager at Chalmers.

6.8.2 Planning of costs and (equipment) investments

Costs for advertisement in social media, 60 EUR

6.8.3 Risk management

Table 14. Risks and Risk Management Min Stad

Demonstrator	Identified Risk	Proposed mitigation measures

Min stad	Difficulties to obtain data to release in the application	Liaise with the relevant City offices and authorities to secure access to data

6.8.4 Progress achieved up to M24

Work so far has largely consisted of planning work. In addition, there are a number of workshops that have been conducted which have been aimed at knowledge acquisition, implementation and anchoring. During the late autumn 2019, it has been a very intense and important phase for project implementation. SBK's activities have been planned for implementation in the first half of 2020.

6.8.5 Progress in activity Inclusive Life Challenge

As part of the IKA097 course, 'The Gothenburg Smart City Challenge Innovation', Chalmers is collaborating with the City of Gothenburg on **The Gothenburg Smart City Challenge**. In self-assigned teams of maximum six people, students are to conceive of and pitch a digital innovation to help the City of Gothenburg pursue its vision of becoming a Smart City as well as a circular and sustainable one.

The City of Gothenburg has created a jury to evaluate the innovations and will select the winners of The Gothenburg Smart City Challenge in April 2020, together with the Citizens of Gothenburg (in a "Eurovision" style). The City of Gothenburg will write an article on The Gothenburg Smart City Challenge, highlighting the Challenge winners and their innovations. Furthermore, during March the students Innovation Pitch Videos will be displayed online and the Innovation Pitch Posters will be displayed at an exhibition area in The City of Gothenburg, the shopping center Nordstan in the middle of the city center. Nordstan is the hub of Gothenburg city center with 35 million visitors a year.

More information on The City of Gothenburg will be provided in both the Lecture in early January as well as in documents on the course portal provided by The City of Gothenburg.

Similar to many other cities around the world, the City of Gothenburg strives to create an attractive city that not only retains its inhabitants but that also attracts others to live there. One means to do this is to build a Smart City in which the UN's sustainability development goals are pursued through a circular economy focus. To help the City of Gothenburg fulfil its vision towards a Smart City, the teams of students will develop a digital innovation and accompanying business model to convince the City of Gothenburg's jury, the citizens of Gothenburg, the faculty, and the rest of the class that their innovation is a great innovation for the City. Below are some guidelines that the students had for the innovation.

Innovation Guidelines:

- *Novelty*. Your innovation can be a product, a service, a new way of working, or a technical solution, and it must be something either entirely new to the City of Gothenburg or build upon existing ideas and adapted in a new way or in a new context. Your innovation can be something that your team develops specifically for Gothenburg or it may be something inspired by an innovation in another city anywhere across the globe that you then adapt to the City of Gothenburg's needs. However, it cannot be something that already exists in the City of Gothenburg. If there is a similar product already, then you will need to convince us that your innovation differentiates itself substantially to what is already in the market.

- *Digital:* Your innovation must incorporate digital concepts and digital technologies discussed in the course. It may also include technologies found elsewhere. Technologies might include one or more of the following: artificial intelligence, big data analytics, IoT, 3D printing, autonomous vehicles/drones on land or in the water, smart robots, the blockchain, cryptocurrencies, new materials such as graphene, and gene editing.
- *Smart and Circular Measurable Impact:* Your innovation must enable the City of Gothenburg to fulfil its vision of becoming a Smart City as well as a circular and sustainable one. The implementation of your innovation must be measurable not only in terms of usage but also in terms of measures showing that the city is moving towards fulfilling one or more of the UN's SDGs: https://www.un.org/sustainabledevelopment/sustainable-development-goals/
- *User-focused.* Your innovation must be marketable. You need to convince us that someone out there would want your innovation. To do so, you need to show us that you have done your market research using *at least one of the digital tools and one of the datasets provided by the City of Gothenburg*. Feel free to use other digital tools or datasets in addition.
- *Self-financing and self-sustaining.* **The City of Gothenburg has no financial resources to invest in your innovation**. You must develop a financing plan and business model to not only pay for the development of your innovation but also to sustain its usage over time. Here you can be creative and think about the various new fintech solutions, eg crowdfunding, crowd equity, real estate crowdfunding, blockchain, cryptocurrencies, etc.
- *Idea.* **You need *not* demonstrate that your team could produce or create this innovation now.** The relevant question is this, "Given reasonable assumptions, would it be possible for your innovation to be developed and implemented in the City of Gothenburg?"

Several members of the City of Gothenburg presented their views on the development of the City of Gothenburg and the City's digital tools and open datasets.

Göteborgs Stad

Intranät

Stadsbyggnadskontoret | Strategiska

Start | Internt SBK | Nyheter | Styrande dokument | Hela staden

Studenter hjälper Göteborg att bli smartare

2020-03-31 | Stadsbyggnadskontoret

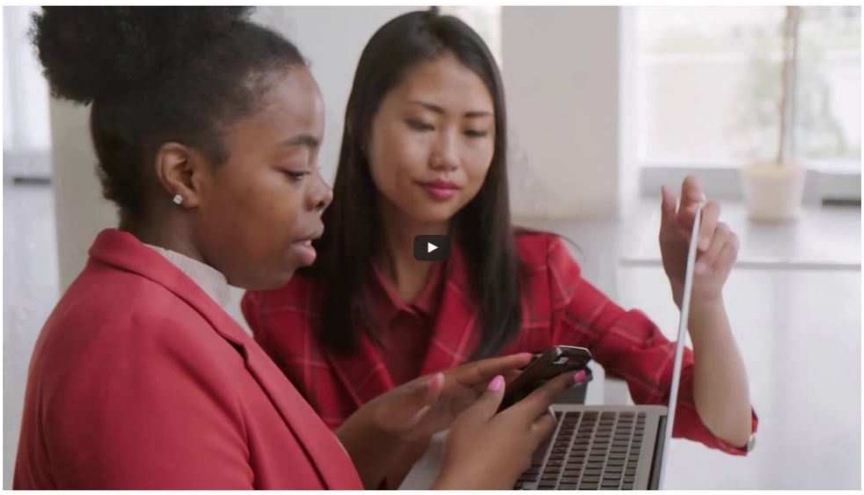
Nu kan göteborgarna rösta på vilket innovativt förslag som ska vinna Gothenburg Smart City Challenge. Tävlingen är ett samarbete mellan Göteborgs stad och Chalmers.

Det kan handla om sådant som att minska matsvinn, mäta vattenkonsumtion, hitta en ledig parkering, framtidens kontorslösningar eller en personlig och interaktiv turistkarta.

100 studenter deltar

Sedan januari har 100 chalmersstudenter jobbat i team med att utveckla idéer för en smart och hållbar stad. De har tagit fram 18 förslag som bygger på öppna data, digital teknik och som ska erbjuda något som inte redan finns i

Figure 23. Inclusive Life Challenge on Gothenburg Cityplanning Office internal webbpage: "Students helping Gothenburg to become smarter".



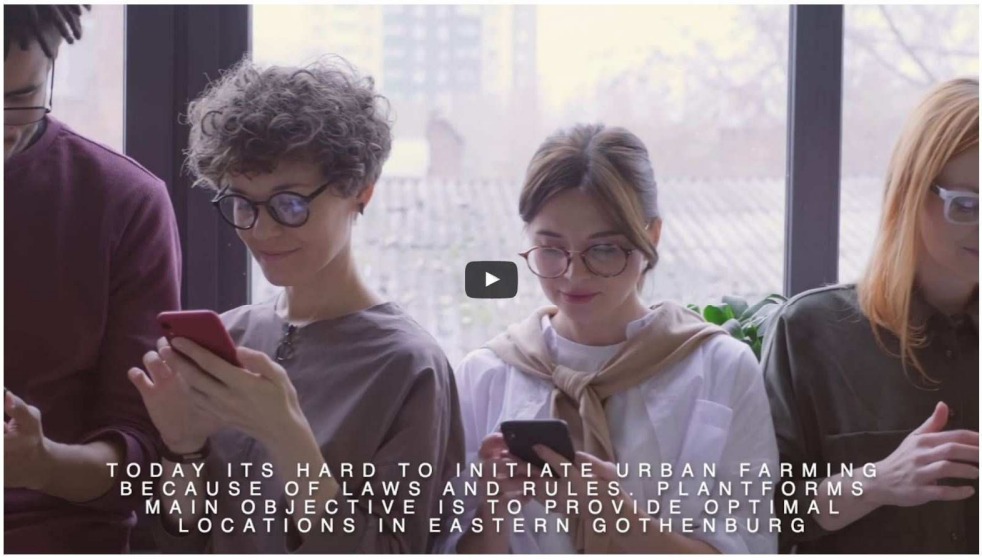
Bidrag 2 - GoGo

Bidrag 2 GoGo

Gör gott med Go:Go - Den nya transportappen för alla behov.

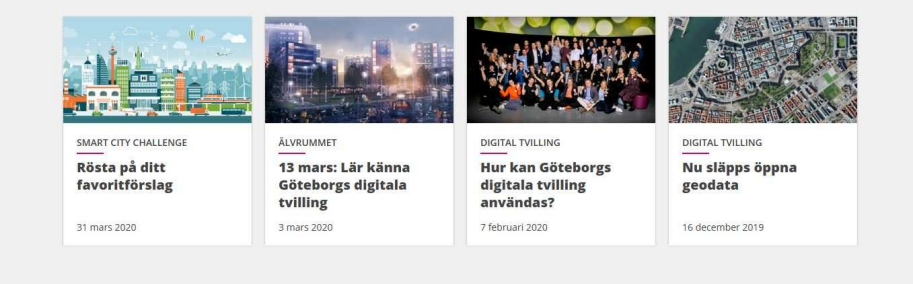
→ Affisch - Bidrag 2 GoGo (138 kb)

Figure 24. One of the student proposals, "2 GoGo", on Cityplanning Office external webpage: https://stadsutveckling.goteborg.se/smart-city-challenge/



Bidrag 14 Plantform

Figure 25. One of the student proposals, "Plantform", on Cityplanning Office external webpage: https://stadsutveckling.goteborg.se/smart-city-challenge/



Smart City Challenge

The Gothenburg Smart City Challenge genomförs inom ramen för EU-projektet IRIS Smart Cities där olika aktörer i Göteborg samverkar för att utveckla smarta lösningar som kommer medborgarna till godo och som kan exporteras till andra europeiska städer.

Sedan början av terminen i januari har 100 Chalmersstudenter jobbat i team med att utveckla och presentera idéer i syfte att hjälpa Göteborgs Stad att nå sitt mål om att bli en smart och hållbar stad.

Kravet är att idéerna ska bygga på öppna data och digital teknik och erbjuda något som inte redan finns i Göteborg.

Kravet är att idéerna ska bygga på öppna data och digital teknik och erbjuda något som inte redan finns i Göteborg.

Värdefull input

– För Göteborgs Stad är det av stort värde att få input av dessa unga, kreativa studenter.

Figure 26. The vocation on Cityplanning Office external webpage: https://stadsutveckling.goteborg.se/smart-city-challenge/

Figure 27. About Inclusive Life Challenge at the webpage of the meeting place Dome of Visions at Lindholmen Science Park

Figure 28. About Inclusive Life Challenge at the meeting place Dome of Visions at Lindholmen Science Park. Gothenburg City website. www.stadsutvecklinggoteborg.se

6.9 Conclusion

The demonstrator has been through a re-boot process due to a lack of resources at City Planning Office in 2019. The project is however now back on track with planned activities with objectives in line with the overall IRIS objectives as well as the original objectives for the demonstrator. The project also has an updated project plan including an updated timeline that indicates a 6-month delay of this report. It´s however expected that the project demonstrator still will be implemented and evaluated within the time boundaries of the IRIS-project overall time plan.

The purpose of Min Stad is to involve the Gothenburg citizens in order to increase involvement in urban development issues, increase knowledge of urban planning and to create and open debate. The service is aimed at anyone who has an interest in urban building issues; residents, politicians, officials and architectural firms and others. Conclusions drawn from the work so far within the demonstrator Min Stad is the need for a development of the tool. A first step with the development of Min Stad may be to, with the help of citizens, find a good form for how data is presented and to link new forms of information into the current dialogue process. In a further development, the tool Min Stad can be developed to present more complex information while allowing the citizen to not only write comments but also modify the proposal presented by the city and / or create their own suggestions in the form of models, sketches or the like.

A combination of passive (informed and involved according to HKU categorization) and active (contributing and co-creating) citizens involvement in the development of Min Stad in different phases of development work: idea generation, idea conceptualization, idea assessment. The two different varieties of commitment mean that the role of civil servants in the city and the role of citizens have changed somewhat. When giving citizens the space to actively contribute to development work, the control of the contents is shifted towards the citizen. In the position as passively engaged, you have different rights and obligations than those you have as actively engaged. The two different types of engagement also require specific organization and facilitation to be perceived by both parties as worthwhile and meaningful.

The current work consists of the description of a “roadmap” for adding functionalities and the design of an interaction model articulating how the creation of a dialogue with citizens on relevant subjects might be achieved.

The conclusions of the activity Inclusive Life Challenge is that is has been of great value for the city to get input from young, creative students at Chalmers. The city building office has just released geodata as open data, and in this way examples and ideas about what the data can be used for were developed together with ideas of how it can contribute to smart and sustainable solutions for the city. At the same time, the city has been contributing to the education by sharing its employees' knowledge and attracting interest in the work the city is doing in urban development. The Inclusive Life Challenge has been a great opportunity for all parties to learn. The students got to work with data and digital solutions for the public sector and test their ideas in reality and the city gets an in-depth knowledge of how the younger generation thinks. Hopefully we also get new ideas that can be developed in the long term.

7 Demonstration of a VR/AR visualisation of BIM and sensor data

7.1 Specifications

This demonstration entails Demonstrate a BIM (Building Information Modeling) based 3D Virtual Reality Environment that will virtually immerse users in the inner workings and properties of a building, providing deeper understanding and involvement in the building's processes. This demonstrator is implemented in the AWL (A Working Lab) building, where the innovative environment and extensive sensor network will provide relevant inputs to the demonstrator.

7.1.1 Hardware

The solution will be implemented as a client-server solution consisting of a cloud server responsible for hosting and serving data, including both BIM and sensor data, and serving the data to both AR and VR clients. The cloud server communicates with the sensor network(s) of the building(s) and processes the sensor data for further streaming to the AR and VR clients. The cloud server will be accessible via an online web-based user portal, which will allow users to both browse existing data (BIM models) and upload new BIM models (Figure 1).

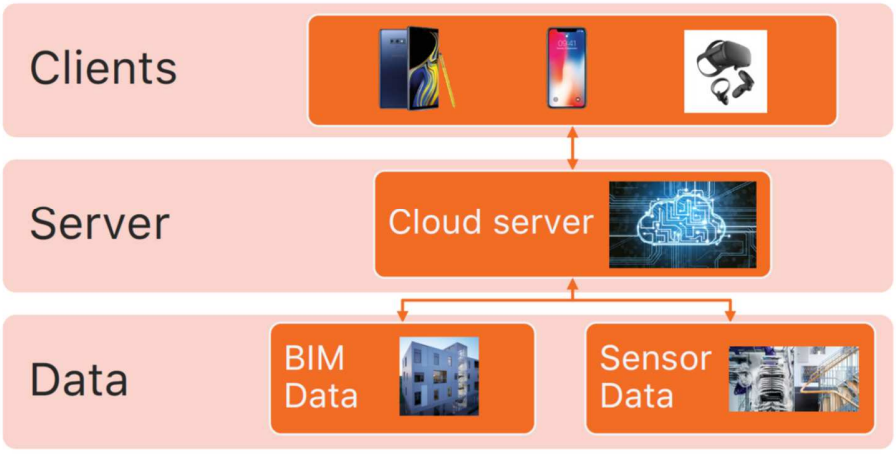


Figure 29 VR/AR demonstrator lay-out

The visualisation hardware will consist of a headset (Figure) for the VR visualisation and, for the AR visualisation, smartphones running IOS or Android operating systems.

Figure 30 Oculus Quest VR headset

7.1.2 Figure Sensors

The system will have access to 500 devices and some 1 000 sensors. The sensor data that is currently available in the AWL building includes

- Channel pressure in duct system [Pa]
- Relative humidity [%]
- Luminance [lumen]
- CO_2-content [ppm]
- Room temperature [°C]
- Presence [binary]
- Inlet air flow [l/s]
- Person traffic
- Noise level [dB]

All of this data can be accessed and visualised via the AR and VR applications through an API provided by the property owner.

7.1.3 Software

The cloud server will be hosted at a professional data centre, most likely at one of Sweden's most highly reputed data centres with servers located physically in Gothenburg. The main focus of the server implementation is on the design of a robust and extensible API, to enable future modification and addition of BIM and sensor data.

A web portal will make it possible to upload new BIM models in the industry standard IFC format. The cloud server will process the IFC data and convert the data to a format that is more suitable for dynamic streaming to the AR and VR clients.

The web portal will be hosted throughout the duration of the project and testing period, as well as for an extended time after the project's end.

7.1.4 Target group

Main target groups of the demonstrators include

1 Property owners
2 Maintenance staff
3 Residents/tenants of the building
4 Visitors to the building
5 Researchers

7.1.5 Mode of engagement

7.1.5.1 Property owners

For property owners, the visualisation will provide easy access to BIM data. Currently, property owners rely on third parties such as consultants or design firms to handle and provide access to BIM data. With this system, BIM data will be readily available without having to employ expert resources, providing greater understanding of the building's working and performance. The system can also be used as a means of communication with the tenants.

7.1.5.2 Maintenance staff

Maintenance and technical staff may use the system as a tool to simplify identification, specification and execution of repair and maintenance tasks, for instance by using the annotation feature (Figure), where the user may interactively add new data to BIM objects in the form of *annotations*. An annotation consists of a title, a description, and, optionally, a snapshot (using the phone's camera) of the current view, and a voice memo. Annotations are persistent in the AR space and may be viewed at a later time, either by the same user or another user. Comments may also be added to annotations to enable a dialogue between multiple users. Annotations may thus be used to create *issues* and, if desirable, integrated into an issue tracking system.

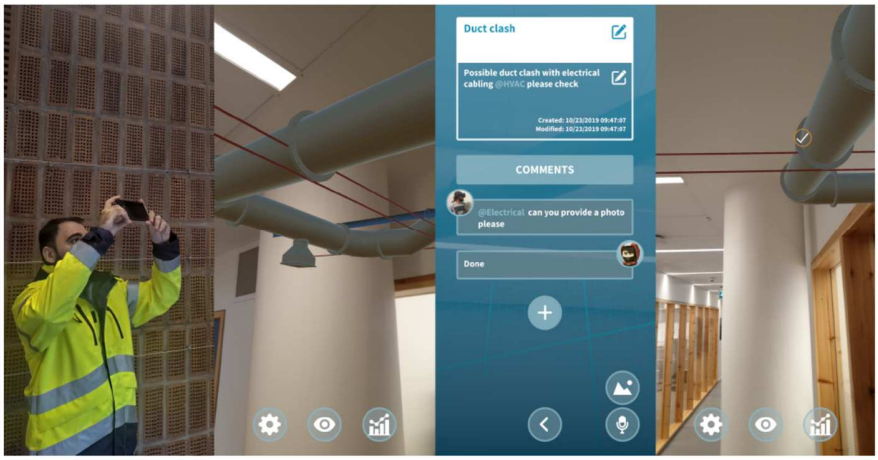


Figure 31 Example use of the annotation feature

7.1.5.3 Residents/tenants of the building

People using the AWL building as their place of work may use the system to better understand the workings of the building, and how their work habits affect for instance air quality, noise and ventilation. The system could also be used for navigating in building, or accessing common features of the building, such as conference rooms or training facilities. The system may be used to report faults in the building and to suggest improvements or new features, fostering a higher level of engagement from the tenants. The system also provides excellent insight into the concept of BIM data.

7.1.5.4 Visitors to the building

Visitors may use the system to get acquainted, through presentations and explanations, with the innovative features of the building, using it for navigation and orientation. The system also provides excellent insight into the concept of BIM data.

7.1.5.5 Researchers

For researchers, the system provides an opportunity to get an overview of what sensor data is available, and also the opportunity to easily sample data and make simple experiments.

7.1.6 Procurement of equipment and/or services

The development work was procured through a bid-at-three process. Three reputed firms in the architectural visualisation field were invited to submit bids. The bid from ReSpace AB, a start-up with origins in Chalmers University of Technology was selected.

7.2 Societal, user and business aspects:

7.2.1 Societal benefits

The benefit intended with this demonstrator is to provide easy access to the inner workings of a building, including geometrical and structural data, components, wiring and ventilation. Additionally, the state of the building is visualised, making it possible to see how the residents of the building interact with the building.

Thanks to the intuitive and simple user interface, a number of new stakeholders that have previously not been involved or asked will be able to engage themselves in these matters. All this, in turn, will enable a greater understanding of and a momentum towards how buildings should be designed and operated for increased sustainability, accessibility and comfort.

7.2.2 Business model

There is no a priori business model developed for this demonstrator. However, there are some possible business cases to be considered:

1 The visualisation is provided to a property owner as a service. The value proposition includes improved access to information, improved maintenance efficiency, etc.

2 The visualisation is provided to the tenants as a part of the lease, in which case the value proposition is less clear, but is likely to increase the attractiveness of the property.

7.2.3 Governance

The AR/VR BIM demonstrator will be governed by Akademiska Hus, the owner of the AWL property, since Akademiska Hus is also the owner of BIM data and sensor data. Data protection and integrity issues that may arise from monitoring of sensor data will be governed by the General Data Protection Regulation (GDPR), and if applicable, by national legislation.

7.3 Impact Assessment (previously KPIs and monitoring)

There are no specific KPI's associated with this demonstrator.

7.3.1 Expected impact

The demonstrator aims to contribute to the following IRIS impact areas.

- IMPACT 1 Put in practice a bankable solution for a challenge identified by the city
  - IS-5.4: Apps and interfaces for energy efficient behaviour
- IMPACT 2 Increase the energy efficiency on district scale

7.3.2 KPIs

For this demonstrator, the KPIs listed in Table will be used.

Table 15 KPI's for AR/VR BIM visualisation

KPI	Parameter(s)	Baseline	Target (as described in DoW or declared)
Increased environmental awareness	The extent to which the project has used opportunities for increasing environmental awareness and educating about sustainability and the environment. (Likert scale)	N/A	Not defined
Ease of use for end users of the solution	The extent to which the solution is perceived as difficult to understand and use for potential end-users. End-users are conceptualised as those individuals who will be using/working with the solution. Some solutions or innovations are perceived as relatively difficult to understand and use while others are clear and easy to the adopters. It is presumed that a smart city solution that is easy to use and understand	N/A	Not defined

	will be more likely adopted than a difficult solution. (Likert scale)		

7.3.3 Monitoring plan

The monitoring will be conducted by measuring:

- By automatic means
  - The number of registered users
  - The number of sessions initiated
  - The number of API calls made to sensor data

- By user surveys
  - The ease of use
  - The increased environmental awareness
  - The perceived usefulness of the demonstrator

7.4 Implementation plan

The development team (Respace AB) will consist of the following roles:

- Backend engineer, responsible for developing and integrating APIs, network protocols and endpoints for network communication;
- User-interface designer, responsible for developing an intuitive user interface for visualization and interaction with BIM and sensor data;
- AR developer, responsible for developing the AR application for visualization and interaction on smartphones;
- VR developer, responsible for developing the VR application for visualization and interaction on Occulus Quest (or another recent VR device);
- BIM engineer, responsible for validating and extending the BIM model(s);
- Software engineer, responsible for evaluating and testing the application(s);
- Project manager, responsible for project management and integration.

7.4.1 Planning of activities

WP1: VALIDATION OF BIM MODEL DATA
This work package will gather and validate existing BIM data for the two buildings. If necessary, the data will be cleaned and amended with missing data.

WP 2: INTEGRATION OF SENSOR NETWORK DATA WITH BIM MODEL
This work package will gather and validate existing sensor network data streams and integrate the sensor data streams with the BIM data such that the sensor data may be located in and integrated with the BIM model(s).

WP3: IMPLEMENTATION OF BIM AND SENSOR DATA PROCESSING

This work package will implement the necessary server-side functionality for processing (conversion, extraction, packaging) and storing both BIM data and sensor data on the cloud server.

WP4: IMPLEMENTATION OF NETWORK COMMUNICATION AND API

This work package will develop and implement the necessary network API for communication of both BIM data and sensor data.

WP5: IMPLEMENTATION OF AR APPLICATION

This work package will implement the AR application. The work will be based on the existing prototype application for interactive BIM exploration in AR developed by ReSpace. The process will consist of numerous iterative design and implementation phases in order to make sure the prototype and the whole UX remains aligned with the Project's objectives.

WP6: IMPLEMENTATION OF VR APPLICATION

This work package will implement the VR application according to the Project's goals and target user-groups. The process will consist of numerous iterative design and implementation phases in order to make sure the prototype and the whole UX remains aligned with the Project's objectives.

WP7: TESTING AND EVALUATION

This work package will evaluate the solution, including BIM and sensor data processing, data streaming, and user interaction. The main part of the work will be carried out during the final two-week test period, but iterative usability testing and feedback will be important throughout the whole project.

WP8: SYSTEM DESIGN AND PROJECT MANAGEMENT

This work package will coordinate the work performed in work packages 1-7 and be responsible for the overall progress of the project, as well as making technical decisions regarding formats, protocols and system design.

TIME PLAN

The project will be carried out within the stipulated 4-month project period with work package distribution according to the Gantt chart below.

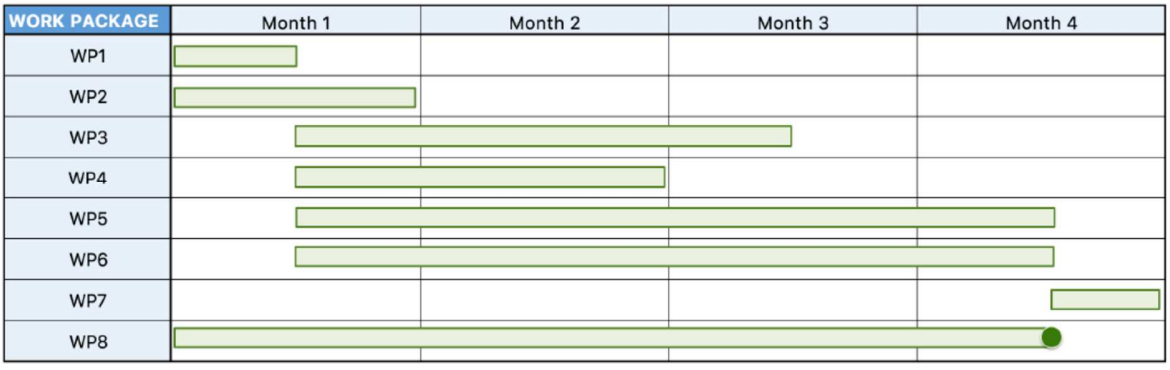


Figure 32 AR/VR BIM visualisation Gantt chart

7.4.2 Planning of costs and (equipment) investments

The demonstrator is commissioned at a fixed cost of SEK 500 000. This is payable monthly in arrears, except for the final 20% of the total sum, which will be paid at final acceptance of the delivery.

7.4.3 Risk management

The risks and mitigation actions that have been identified are listed in Table 16. Risk management.

Table 16. Risk management

Risk	Probability	Impact	Risk value	Mitigation action
Delay due to late hardware deliveries	2	3	6	Create redundancy by having alternative hardware solution
Unavailability of some sensor data	1	2	3	Stay in close touch with Akademiska Hus to ensure that data will be accessible
Low usage of the demonstrator	2	3	6	Communicate the system and its benefits to potential user groups

7.4.4 Progress achieved up to M24

Due to the transition of the management of this demonstrator from HSB to JSP, there was a delay compared to original plan. The development of the demonstrator was commissioned in M30 and launch of implementation is planned for M34.

7.5 Conclusion

An AR/VR application will be developed according to the requirements of the project. The focus remains on UX (including immersion, responsiveness, user-friendliness) taking into consideration the distinct characteristics of smartphones/tablets and VR headsets. The aim is to create a cross-platform application that can be ported to any of the state-of-the-art headsets (Oculus, Valve etc.) and is available for iOS and Android devices.

Moreover, any IoT and sensors available can be connected to the AR/VR application and be visualized or even controlled, according to the API limitations of the connected devices.

8 Demonstrating citizen engagement and motivating feedback; Personal Energy Threshold (PET)

8.1 Specifications

Within the PET project an app was developed that to monitor energy usage and giving feedback to users regarding their energy consumption. The ERO application was designed for a smart home system in mind that could balance the energy demand and supply. The app has a function called Personal Energy Threshold (PET), a momentary power level showing when there is plenty and short of energy in relation to the household's energy consumption.

- Each power outlet had a sensor measuring energy use which was reported to a data base and presented in the app.
- During the evaluation of ERO most power outlets were also equipped with smart plugs that could be opened, closed and scheduled
- Users was in the app able to set the energy characteristics by
  - Choosing preferred electricity sources (wind, solar, nuclear, fossil, hydro) and
  - District heating (renewable, recycled, fossil) or
  - Set the maximum carbon dioxide intensity
- Momentary power levels showed when there was plenty or short of energy from preferred sources
- If users staid below their energy threshold it means they were using energy at a time when there was plenty of their preferred energy
- Ero shows the energy status screen, showing the availability of different sources of energy for both electricity and district heating
- On the home screen and on the more detailed electricity consumption screen; Ero allowed the user to open and close smart plugs during the following 24 hours

Overview of the ERO infrastructure:

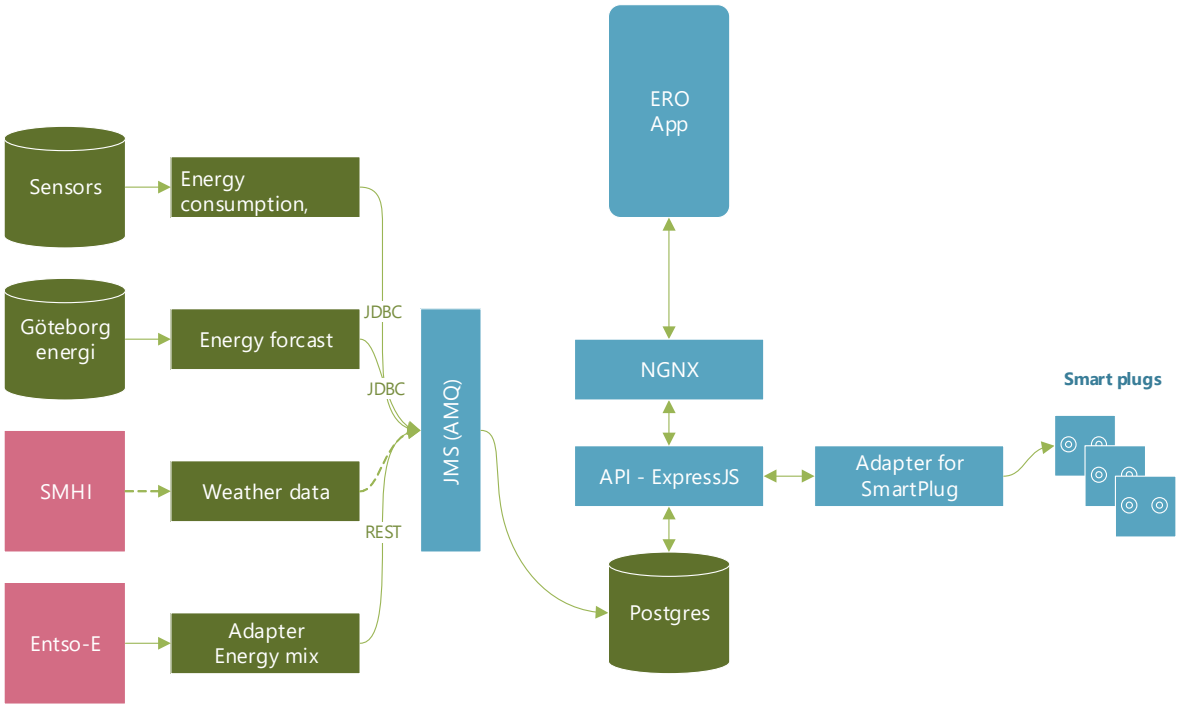


Figure 33 ERO infrastructure

The general idea has been to re-use much of the existing infrastructure at Living Lab (green) and External sources (red) as possible and focus our efforts on the app and its infrastructure (blue).

8.2 Hardware

Table 17. Hardware

Smart plugs	Each participant received 3 to 5 smart plugs to control electrical devices in their room, as well as a handful of smart plugs.
iPads	The project purchased 10 iPads that the participants could borrow during the study. This let enabled our developers to focus the app development on only one target platform and reduced the total cost.
Smart plug controllers	To enable monitoring and control of the smart plugs. The controllers were reused from another project.
Faster electrical sensors	Sensors with an improved energy resolution compared to the existing ones at the Living Lab. These sensors and installation were the largest hardware cost of the project.

Server, storage and network infrastructure have been provided as a service from Chalmers University of Technology. One virtual machine was used to for the backend of the app, all other components were reused from either the Living Lab infrastructure or the Chalmers IT-infrastructure free of charge.

8.3 Software

The software used in the project was open source and free of charge. Notable software components are Ubuntu Linux, PostgreSQL, Node JS, NGINX, React Native, open-jdk.

Proprietary software such as the developer's IDE or VMware licenses are financed by Chalmers and charged through the price of the services.

Figure 34: The ERO app and different interfaces. (Connecting the solar production system was not possible within the frame works of this project.)

8.4 Target group

Users of the app was people living in HSB Living Lab. Target group/groups could be any citizen with total or some possibility to control their energy usage.

Within the PET project it was not possible to connect the district heating and the solar energy storage system. The focus became electricity usage.
In total 11 individuals were asked to participate. 7 of them gave their permission to take part in the study from beginning to the end. During the time of the study there was more men than women that lived in the Living Lab which is reflected in the study.

Participants

"In total, seven participants took part in the study from the beginning to the end. At the time of the study, more men than women lived in the living lab and a majority of the participants were also men. The age of the participants covered a wide range and both university students and people in employment

participated. (details of the participants are left out to ensure privacy.) The cost of the participants energy use was included in the rent."[41]

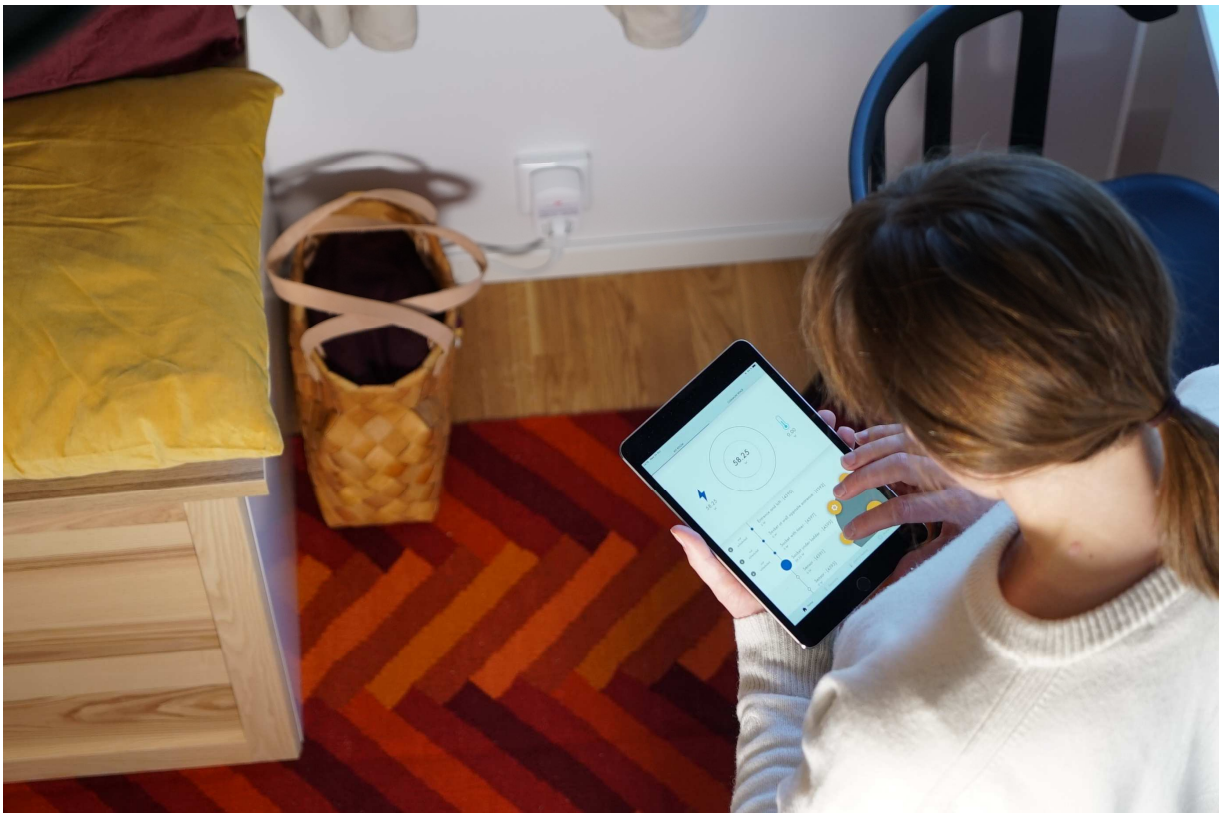


Figure 35. User in HSB Living Lab

8.5 Mode of engagement

Within the PET project it was not possible to connect the district heating and the solar energy storage system. The focus became electricity usage.
In total 11 individuals were asked to participate. 7 of them gave their permission to take part in the study from beginning to the end.

- For two participants, A and D, ERO became a part of everyday activities as the scheduled when to charge their mobile phones, D to explicitly match energy supply. Both users indicated that it would have been useful also for charging larger batteries i electric vehicles.
- For the rest of the participants, ERO did not succeed in becoming an integrated part of their existing activities.
- During the evaluation, the participants use of ERO followed different patterns. Participant B did not use ERO during the test period and F tried it out once or a few times[1].

[1] Renström, S. (2019) *Limit My Energy! An IN-Situ Exploration of a Smart Home System Featuring an Adaptive Energy Threshold.*

The most common explanation that was given to why ERO did not become part of the everyday activities was:

- "All participant, except two, talked about their energy consumption being small and they felt limited in their possibilities to actually make an impact." [1]

8.6 Impact Assessment

8.6.1 Expected impact

The expected impact was to develop a deeper understanding of the tenants' energy consumption at individual level, and let each individual choose what type of energy source to be used and when. Through the developed application ERO the aim was to nudge individuals to choose "green" energy such as energy from the installed PVs (façade and roof).

8.6.2 KPIs

Table 18. KPI's

KPI	Parameter(s)	Baseline	Target (as describe DoW or declared)
Increased environmental awareness	The extent to which the project has used opportunities for increasing environmental awareness and educating about sustainability and the environment. (Likert scale)	N/A	Not defined

8.6.3 Monitoring plan

"The evaluation of ERO was done during fall and winter to also test indoor heating." [1]

- "In September, the participants completed an online questionnaire covering organisation of everyday life and orientations to energy systems and sustainability.
- In October, ERO, was installed in the participants home. The participants were additionally interviewed in a semi-structured manner. The interview guide covered demographics, life in a living lab, organisation of everyday life, and questions about the participants orientation to energy systems and sustainability. As a part of the latter, all participants marked on scales of different orientations to energy and sustainability. After installation there was occasional contact with some of the participants to fix reported technical issues. In January, the participants completed a similar online questionnaire as in the beginning f the study but extended with questions about the acceptance and use of ERO. The interview guide covered attitudes towards and use of ERO,

[1] Renström, S. (2019) *Limit My Energy! An IN-Situ Exploration of a Smart Home System Featuring an Adaptive Energy Threshold.*

organisation of everyday life, orientations to energy systems and sustainability, and potential changes as a resultat of testing ERO. Finally, all participants again marked on scales of different orientations to energy systems and sustainability.

- The questionnairs were analysed to find differences between responses in the first and second questionnaire. The statistical significance of these differences was analysed with non-parametric statitistics in the software SPSS." [1]

Results

"The seven participants, from A to G, had similarities and differences in their intentions towards energy and sustainability, see figure 36.

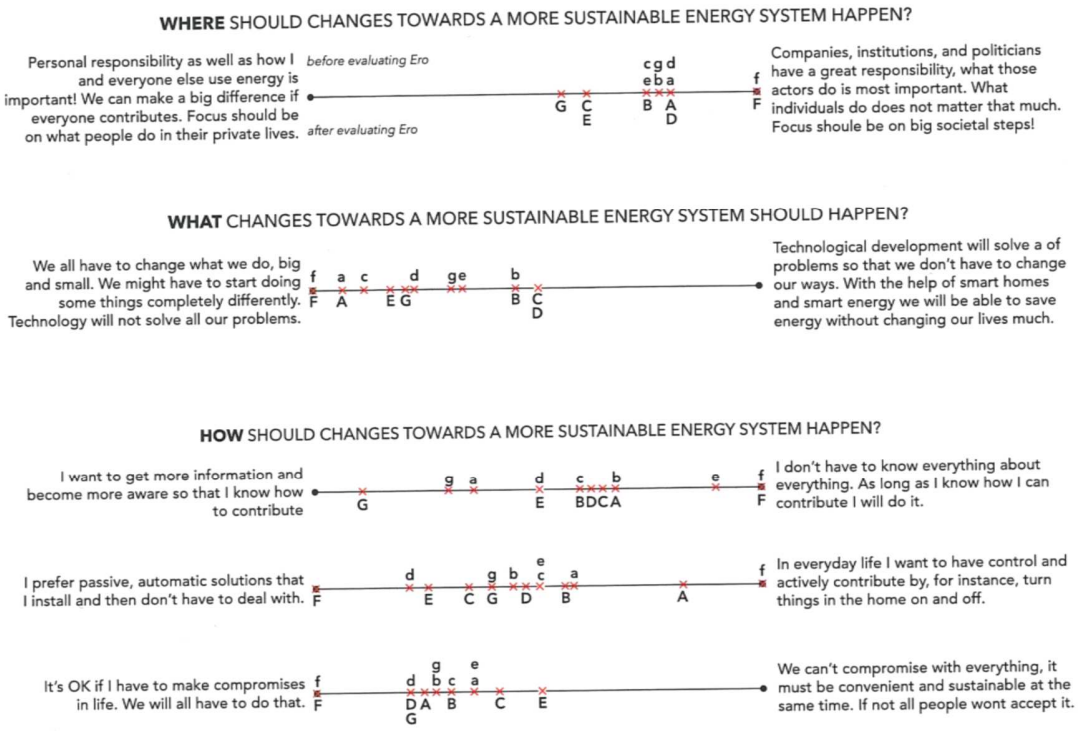


Figure 36: The participants perception of energy and sustainability before (lower case) and after using the ERO app (upper case). Renström, S. (2019) *Limit My Energy! An IN-Situ Exploration of a Smart HomeSystem Featuring an Adaptive Energy Threshold.*

8.7 Societal, user and business aspects

Not applicable

8.8 Implementation plan

8.8.1 Planning of activities

Commissioning of the technical components were optimized on speed and keeping cost under control. Therefore, we used processes with few controls and a small organization with few layers of management and low barriers between different roles. The reliance on each individuals' good judgement and ability to deliver was high in this project.

Before the app was built the researchers had built a mockup of the app, this made the transfer of ideas from researchers to developers easier and also provided the project with graphic components.

The development was done using agile methods where the mockup served as an epic. Development was done in close collaboration between researchers and developers in weeklong sprints. Testing was done by researchers after each sprint and bugs and feature changes channeled back to the development team. Development was done between 2017-11-06 and 2018-03-11.

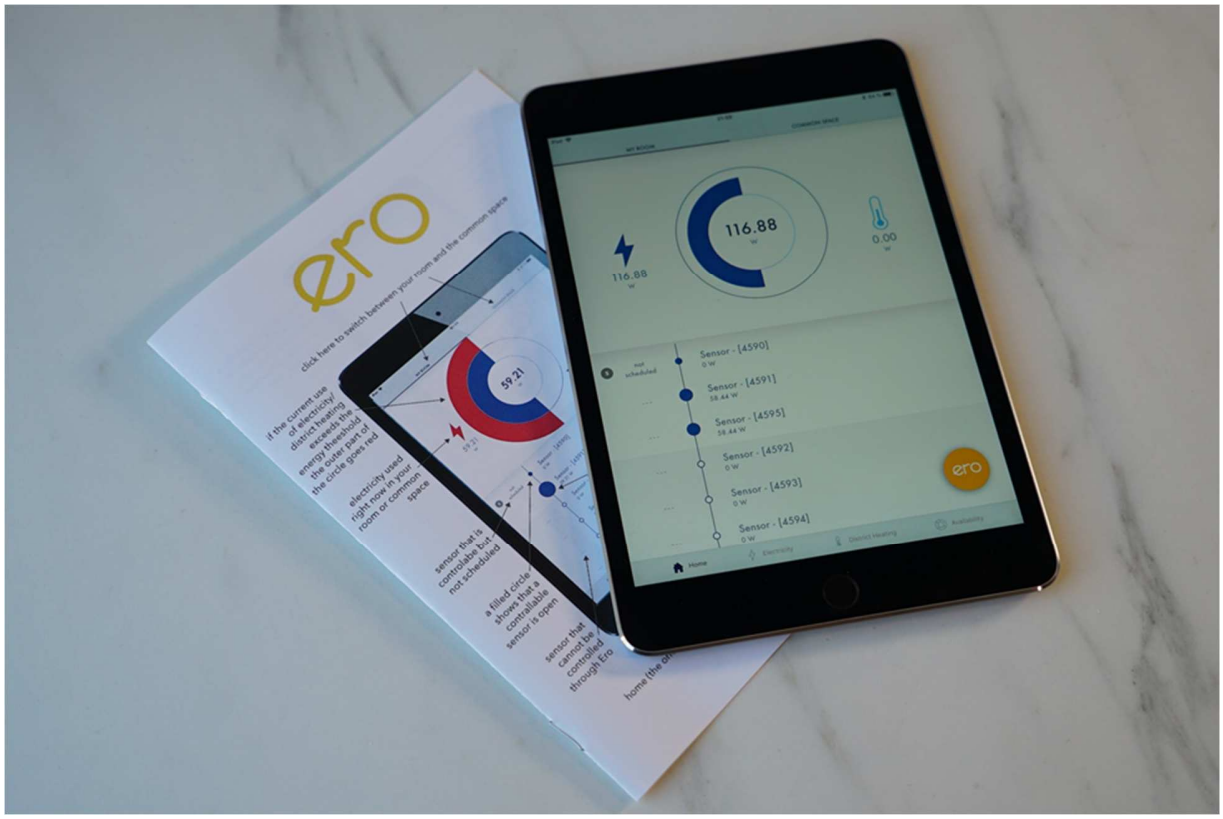


Figure 37. Instructions for the user involvement

The research question and the general idea of the app was formulated before the implementation began. Senior IT professionals were consulted and laid out a rough architecture of the components of the solution. All developers were consulted before starting development to catch weaknesses in the proposed solution. Backend and front-end components were built in parallel in two-week sprints using the mockup

from the researchers as an epic. While development was done researchers tested the existing app and prepared the rollout of the solution.

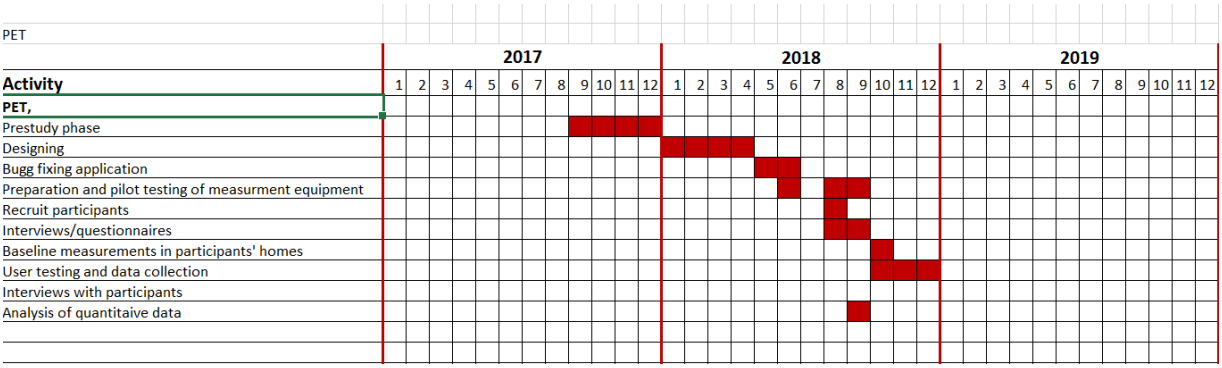


Figure 38. Planning and demonstration of PET

8.8.2 Components

- The App, written for Apple devices in React Native.
- App backend running on NodeJS, providing a REST-like interface for the App.
- PostgreSQL database for storing all persistent data.
- Sensor data and data from external services were collected and transferred as messages to the database using Apache AMQ.

The smart plugs were controlled via Vera controller that had a simple web service that could be used.

8.8.3 Technical personnel

- Two junior frontend/backend developers fresh from IT-program at Chalmers, both with less than one year of working experience. Both had been active students developing apps during their studies, however.
- One senior integration developer with more than three years' experience writing integrations.
- Technical project lead from the IT-office at Chalmers. Senior IT-manager with more than 10 years of experience.
- Network technician, database administrator and UNIX system administrator from the IT-office at Chalmers. All technicians with more than five years' experience within their respective fields.

8.8.4 Processes

The team was organized as a tight DevOps team containing the technical personnel described above as well as researchers. Direct communication within the team was encouraged without passing through any management layers. All roles enjoyed a high degree of freedom to solve their respective tasks they deemed best.

Development was done in two-week sprints. At team meetings the group collectively decided what to include in the next sprint. If the team were uncertain the technical lead took decisions based on the input from the researchers.

8.8.5 The operation of the App and service was done according to Chalmers standard processes for IT-services. These processes are heavily influenced by ITIL and Scrum But. Validation

After each sprint researchers and developers tested the end result. All code ran through a battery of unit-tests developed in parallel with the code.

8.8.6 Documentation

Code is stored in a GIT repository. Operational documentation is stored in a wiki.

8.8.7 Replicability

The code is available in GIT and will in part be re-used in coming projects, but since iOS and the frameworks in general change very fast the code base needs to be refreshed to be re-used. Ideas, integrations and graphical elements will most likely be re-used, while the app-code mostly will be used as pseudo-code.

8.8.8 Planning of costs and (equipment) investments

Most of the development was done under fixed budget constraints forcing a very strict focus on the core functionality. Each sprint planning ended with a prioritizing of the upcoming tasks to ensure the project kept its focus.

The cost for hardware and services where quite low compared to the hours of work. The project tried to re-use as much hardware and services as possible.

8.8.9 Risk management

The risk that was identified for the PET demonstration in the early stage of the planning process included the risk of low user engagement:

Table 19. Risk management

PET	Low user acceptance	Make an effort to educate users and help them realise how the app can help them save energy and money

Complemented risk management were developed during the planning and was considered:

- To mitigate the risk collaboration between researchers and developers were very close. Using agile methods to develop the solution resolved issues before they became serious and costly. The project managers were all senior with experience of similar projects.
- Electrical installations where required for this project such as the installation of faster electrical sensors in the Living Lab were done by certified electricians in accordance to Swedish regulations.
- Physical installation of Vera-controllers was done in accordance with Swedish safety regulations, since it required work on ladders.
- All electrical and radio devices followed EU-regulations.

8.8.10 Progress achieved up to M24

The demonstration has been planned for, demonstrated and evaluated with included conclusions.

8.9 Conclusion

It was unfortunately not possible to control district heating. In total, seven participants took part in the study from the beginning to the end. None of the participants used ERO extensively. The reason according to themselves was that they did not use much energy and had therefore not much energy to optimise.

Findings showed, according to Sara Renström PHD who studied the behaviour of users throughout the project, "that it was possible to create a smart home system that functions as an energy status lens through which appliances and functions in a smart home can be monitored, accessed, and controlled."[5]

Renström continues: "Many of the participants appreciated the idea of having momentary energy power limits, called energy thresholds, and some of them wanted even stricter energy limitations. Yet, as the participants in this evaluation had a limited number of energy-using appliances, many of them questioned the extent to which their demand shifting could contribute. Instead, they considered other paths towards a more sustainable energy system to be equally or more important, such as influencing decisions made by companies."[1] Unfortunately ERO did not provide the possibility to influence e.g. companies, politicians, and non-governmental organisations.

Possibilities with ERO beyond the PET/IRIS -project

"Based on the participants comments, five possibilities emerged.

- First, as indicated above, ERO was seen as more relevant in other contexts, especially in detached houses with several (such as a family) in which the residents pay directly for energy use and with functions and appliances with significant energy use.
- Second, if more functions and appliances would have been controllable through ERO the participants might have found ERO more relevant, given that the overall usability would be improved.
- Third, as the participant used ERO most frequently in the beginning of the study, an alternative would be to not see ERO as a permanent home system but as a system used for a limited period of time to support awareness.
- Fourth, the energy threshold in ERO could be made more explicit and stricter. Two participants mentioned wanting to be made aware of energy threshold as they are engaged in activities through either reminders or suggestions[6]."

[5] Renström, S. (2019) *Limit My Energy! An IN-Situ Exploration of a Smart Home System Featuring an Adaptive Energy Threshold.*

[6] Renström, S. (2019) Limit My Energy! An IN-Situ Exploration of a Smart Home System Featuring an Adaptive Energy Threshold.

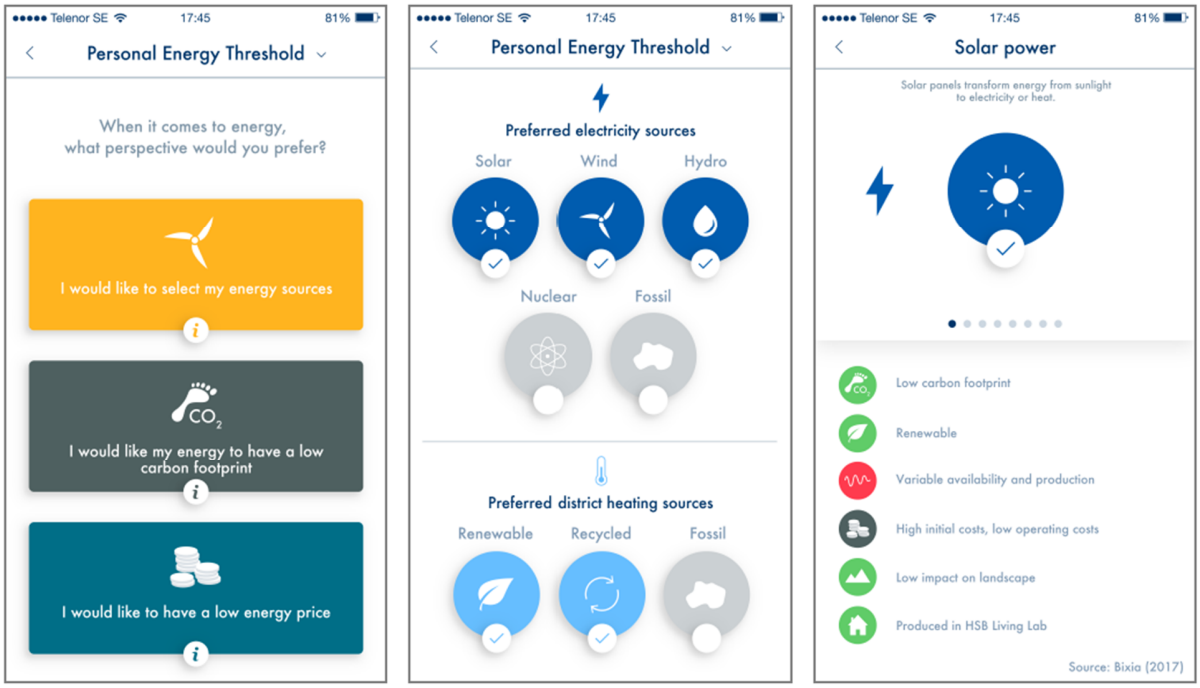


Figure 39. Shows the possibilities to choose different energy sources/mixes.

Figure 40. Shows an example of how the feedback could look like when using the app. Within the projects budget it was not possible to realize/test this feature.

Figure 41. Shows the possibility for users to monitor their energy consumption and what kind of energy that was available.

8.9.1 Conclusions of the method

This method of develop the solution worked well for a project of this scale. Key success factors were:

- Close collaboration between researchers and IT-professionals. A mutual respect and understanding between the roles. Work was done as one team with a free flow of ideas.
- The scope was limited which meant that all key competences could be kept within the team. This reduced to solve issues.
- The agile method of development kept a strict focus on the goal and reduced the amount of unnecessary work. It also encouraged collaboration between researchers and developers.
- Important roles such as project leader and solutions architect had senior personnel with several years of experience. The value of choosing a good path at the beginning of a project is hard to estimate but likely substantial. With experience calculated risks can be taken and there is a keen understanding of what corners that can be cut and which tasks that require extra attention to detail.
- Re-use of infrastructure components. The project had the benefit of building the solution on top of a solid IT-infrastructure provided by Chalmers focusing work on the specific tasks of the project rather than building infrastructure components.

9 Summary on monitoring of KPIs

In Gothenburg City the demonstrators Minecraft and Min Stad (My city) are expected to contribute to Citizen engagement in urban development and growth. The ERO app and the AR/VR visualisation of BIM sensor data are expected to contribute to citizen engagement in reduced energy usage and shift towards sustainable behaviour.

9.1 Aggregation of KPI's for Gothenburg

Each LH city has its own set of KPIs that can be related to the IRIS KPI house; the top level of the house containing the IRIS level KPIs (IL) is however the same for all cities. On solution level (STT1-5), the KPIs may vary between the cities since different solutions are implemented in each city and the cities have different objectives, but in many cases the same KPIs can be found in all cities, thus allowing comparison between the Transition Tracks of the cities. For some Transition Tracks the evaluation of integrated solutions cannot be separated and the KPIs are hence calculated at Transition Track level (TT1-5). The KPIs for each transition track and possibilities to aggregate them are presented in Table 20.

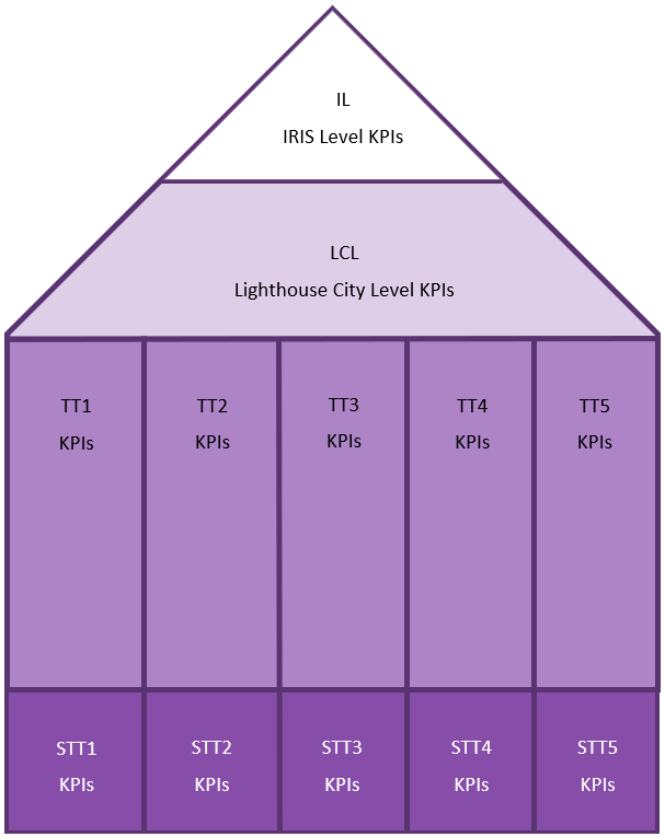


Figure 42. IRIS KPI-house. The KPIs are, if possible, aggregated to transition track level (TT1-5) or higher.

Table 20. The KPI's position in the IRIS-KPI-House

KPIs	Solution	Proposed position in IRIS KPI-house
Local community involvement in the planning phase	Minecraft in the planning phase	S TT5 KPIs
Local community involvement in the planning phase	Minecraft in the Gothenburg city Triennal 2021	S TT5 KPIs
Local community involvement in the planning phase	Continuous Dialogue	S TT5 KPIs
User engagement	Inclusive Life Challenge	
Increased environmental awareness	AR/VR BIM Visualisation; PET (ERO) app	GOT LHC KPI
Ease of use for end users of the solution	AR/VR BIM Visualisation	GOT LHC KPI

10 Ethics requirements

The IRIS Ethics Deliverables are consortium confidential documents that provide information on the IRIS ethics approach and are the basis for the ethics requirements described in this chapter.

D12.1 H – Requirements No.1: The scope of this deliverable is to explain how the IRIS consortium will address the identification and recruitment of participation of humans in the demonstration pilot projects and how the consortium will implement informed consent procedures for these human research participants.

D12.2 POPD - Requirement No. 2: The scope of this deliverable is to show how the IRIS consortium will address the ethical, data protection, confidentiality and privacy aspects related to the processing of personal data collected by IRIS consortium partners for the purpose of executing the project tasks.

10.1GDPR compliance

10.1.1 Overall Lighthouse Approach

A general description of how the City of Gothenburg work in terms of GDPR can be found on [7] Homepage of GOT "How the City of Gothenburg handles personal information". In the City of Gothenburg, it is each administrative unit's responsibility to make sure that any personal data that is collected is processed lawfully, safely and properly according to the Data Protection Regulation (EU) 2016/679 and other applicable laws. Each administrative unit in the City have their own Data Protection Officer. These Data Protection Officers work together at a unit for data protection at the City.

The administrative unit responsible for Min Stad and Minecraft is the Geodata department which is governed by Gothenburg City Planning Office. A description of how The City Planning Office work in terms of GDPR is described on [8] Homepage of GOT "How The City Planning Office handles personal information". The Data Protection Officer for The City Planning Office is Martin Brunhage. Martin has participated in the GDPR compliance analysis for the Demos Minecraft and Min Stad below.

6.5.1 GDPR compliance per IRIS demonstration measure

Table 21: GDPR compliance per IRIS demonstration measure

Demonstrator	In a nutshell	
#1 Min Stad	Data controller:	Data controller is the Geodata department. They are aware of their responsibilities to ensure that EU and national data legislation regarding GDPR is followed. Correct handling is ensured through routines at City Planning Office, and the Data Protection Officer is not specifically informed of each project such as the IRIS project.

Demonstrator	In a nutshell	
	Personal Data:	Non-personal data collected
	High risk involved:	The City of Gothenburg does not find any high risks for Min Stad in the IRIS project. The risks have been evaluated according to the criteria for risk assessment of the Swedish Data Protection Agency. See [9] Homepage of Swedish Data Protection Agency "Criteria for risk assessment"
	DPIA:	No
	Informed Consent Procedure	Through Facebook consent
#2 Minecraft	Data controller:	Data controller is the Geodata department. They are aware of their responsibilities to ensure that EU and national data legislation regarding GDPR is followed. Correct handling is ensured through routines at City Planning Office, and the Data Protection Officer is not specifically informed of each project such as the IRIS project.
	Personal Data:	Non-personal data collected
	High risk involved:	The City of Gothenburg does not find any high risks for Min Stad in the IRIS project. The risks have been evaluated according to the criteria for risk assessment of the Swedish Data Protection Agency. See [9] Homepage of Swedish Data Protection Agency "Criteria for risk assessment"
	DPIA:	No
	Informed Consent Procedure	Not needed
	Data controller:	Data controller is the Geodata department. They are aware of their responsibilities to ensure that EU and national data legislation regarding GDPR is followed. Correct handling is ensured through routines at City Planning Office, and the Data Protection Officer is not specifically informed of each project such as the IRIS project.
	Personal Data:	Non-personal data collected

Demonstrator	In a nutshell	
	High risk involved:	The City of Gothenburg does not find any high risks for Min Stad in the IRIS project. The risks have been evaluated according to the criteria for risk assessment of the Swedish Data Protection Agency. See [9] Homepage of Swedish Data Protection Agency "Criteria for risk assessment"
#4 AR/VR visualisation of BIM and sensor data	Data controller:	Akademiska Hus
	Personal Data:	No personal data collected
	High risk involved:	None
	DPIA:	N/A
	Informed Consent Procedure	N/A
	High risk involved:	N/A
	DPIA:	N/A
	Informed Consent Procedure	N/A

10.2 Ethical aspects

6.5.2 Min Stad

All research done will be in full compliance with the ethical principles and guidelines of the Horizon2020 and European and National legislation.
The purpose with Min Stad is to provide a public space for exchange of views on urban building issues. The submitter can enter an alias (User IDs) and does not necessarily have to reveal his or her identity but can choose to use an existing Facebook ID. If the submitter decides to use an alias, the platform Min Stad doesn't require you to give any form of consent. By using the Facebook ID users give their consent to Min Stad to use their Facebook ID in the platform and accept Facebooks terms of use.
The tool uses an aerial imagery material which can itself contain personal data of a general image character. The information available through the aerial imagery material has been deemed harmless by the Gothenburg city council.

Data collection done for Min Stad demonstration are:

- Non-personal City Data collected through input from users using the platform

- User ID's saved through Agency 9's Min StadApplication Programming Interface

6.5.3 Minecraft

All research done will be in full compliance with the ethical principles and guidelines of the Horizon2020 and European and National legislation.
The purpose of using Minecraft has been to focus on giving the younger local residents a chance to give their view and opinions about their neighbourhood and their way of life.
Minecraft uses non-personal data, all data is collected through aerial photos with only landscape, nature and buildings as subject. Non-personal data has been collected from the participants. Participants have been able to give their input without any form av personal data collected from them.

- Non-personal data has been collected through Minecraft

6.5.4 AR/VR visualisation of BIM and sensor data

All research done will be in full compliance with the ethical principles and guidelines of the Horizon2020 and European and National legislation. No personal data will be collected.

11 Links to other Work Packages

WP 7 is a link to all workpackages through T7.2 which has a coordinating function. Each task in the work package contributes in particular to the following:

WP2 Information in D7.7 provides good input for other LH cities and FC for possible replication, inspiration and opportunities in their own regional context.

WP3 will support for reducing the technical and financial risks, lower the risks for investors and strengthen the possibilities of replication.

WP4 is linked to the deliverable as demonstrators will be connected to future CIP platform.

WP8 The deliverable D7.7 provide input to the replication roadmap. The demonstrators can be studied and visual available for mentoring and give possibilities for replication.

WP9 is related to the TT#5 demonstrators as it provides related KPI:s for impact analysis with qualitative and quantitative key performance indicators of each Measure.

WP10 The demonstrators and deliverables, are communicated through activities and material within this WP.

WP11 This deliverable is valuable input to the WP 11 on the progress and status of the work and risks.

WP12 The WP is giving guidance for ethics requirements.

12 Conclusions and Next Steps

The demonstrator has been through a re-boot process due to a lack of resources at City Planning Office in 2019. The project is however now back on track with planned activities with objectives in line with the overall IRIS objectives as well as the original objectives for the demonstrator. The project also has an updated project plan including an updated timeline that indicates a 6-month delay of this report. It´s however expected that the project demonstrator still will be implemented and evaluated within the time boundaries of the IRIS-project overall time plan.

The purpose of Min Stad is to involve the Gothenburg citizens in order to increase involvement in urban development issues, increase knowledge of urban planning and to create and open debate. The service is aimed at anyone who has an interest in urban building issues; residents, politicians, officials and architectural firms and others. Conclusions drawn from the work so far within the demonstrator Min Stad is the need for a development of the tool. A first step with the development of Min Stad may be to, with the help of citizens, find a good form for how data is presented and to link new forms of information into the current dialogue process. In a further development, the tool Min Stad can be developed to present more complex information while allowing the citizen to not only write comments but also modify the proposal presented by the city and / or create their own suggestions in the form of models, sketches or the like.

A combination of passive (informed and involved according to HKU categorization) and active (contributing and co-creating) citizens involvement in the development of Min Stad in different phases of development work: idea generation, idea conceptualization, idea assessment. The two different varieties of commitment mean that the role of civil servants in the city and the role of citizens have changed somewhat. When giving citizens the space to actively contribute to development work, the control of the contents is shifted towards the citizen. In the position as passively engaged, you have different rights and obligations than those you have as actively engaged. The two different types of engagement also require specific organization and facilitation to be perceived by both parties as worthwhile and meaningful.

The conclusions of the activity Inclusive Life Challenge is that is has been of great value for the city to get input from young, creative students at Chalmers. The city building office has just released geodata as open data, and in this way examples and ideas about what the data can be used for were developed together with ideas of how it can contribute to smart and sustainable solutions for the city. At the same time, the city has been contributing to the education by sharing its employees' knowledge and attracting interest in the work the city is doing in urban development. The Inclusive Life Challenge has been a great opportunity for all parties to learn. The students got to work with data and digital solutions for the public sector and test their ideas in reality and the city gets an in-depth knowledge of how the younger generation thinks. Hopefully we also get new ideas that can be developed in the long term.

The current work within the demonstrator consists of the description of a “roadmap” for adding functionalities to Min Stad and the design of an interaction model articulating how the creation of a dialogue with citizens on relevant subjects might be achieved through the digital platform.

The demonstrator Minecraft is now integrated in a planning work for a new detailed plan in Bergsjön, for housing between Rymd- and Komettorget, about 700 housing units. April 6-8, the first Minecraft

workshops were held at the Bergsjö School. Workshops will be conducted on three additional occasions in the spring and autumn of 2020.

The Architecture Pedagog Ida Liffner wrote this brief summary about the result of this first workshop occasion: “We have tested several tools, which have given effect to each other. In particular, Minecraft has been valuable for understanding the scope and volume of the proposed changes, and which may otherwise be too abstract to be able to have thoughts and opinions about. We have used several of the questions from SBK to have something to apply “Can we use Minecraft to extract information from children and young people in urban planning projects” on. Since we had so few participants, we cannot draw much conclusions from this first workshop, but the children who participated have all expressed that it was fun to play Minecraft and that it has helped them understand what the proposal for the area means”.

To investigate other possibilities with Minecraft in a more open and creative phase of the planning process a new activity has been developed within the Minecraft demonstrator: Minecraft in the Gothenburg City Triennal 2021. The planning of this activity is being done during this spring 2020.

The VR/AR BIM visualisation app shows great promise in engaging multiple user groups such as facility managers, maintenance technicians and not least tenants and visitors. Thanks to its interactive features and the unique insight it provides into the “inner workings” of the building it will support facilitating and streamlining property management as well as offering innovative ways of making the building more accessible and attractive to tenants and visitors. As a next step, user workshops will be conducted to investigate additional potential user groups and applications. An important aspect of this work is to identify if/how the app could be used to “nudge” towards more sustainable behaviour.

Personal Energy Threshold (PET) was developed with the ambition of raising the awareness of energy use and lower the energy costs, through an application (ERO) for tenants in HSB Living Lab. By following and evaluating the demonstration through a research study, an aim was included for possible replication among other residents. The conclusions from the demonstration and study showed that there are opportunities to develop the application as it for example was seen as also being relevant in other contexts, especially in detached houses in which the residents pay directly for energy use, and with functions and appliances with significant energy use. The possibility of further developing the application is being reviewed.

The next steps include as well monitoring and evaluation for the demonstrations except Personal Energy Threshold (PET) as this demonstration is completed.

13 References

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