SMACITE

Enhancing skills for smart city tech

SMACITE

Boosting the technical and non-technical skills and competences of smart cities technicians and engineers

WP4: MOOC and Virtual Worlds for the upskilling/reskilling of Smart Cities technicians and Engineers

D4.3 Virtual Worlds for training on soft, entrepreneurship and green skills

Version 1.0

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PROJECT SUMMARY

The project aims to address the skills gap of Smart Cities technicians and engineers, by designing and testing a vocational education and training program that is based on a novel and multi-disciplinary curriculum combining digital skills on Smart Cities enabling technologies, with soft, entrepreneurship and green skills.

The expected project outputs are:

- A Smart Cities competences map and ESCO-compliant Smart Cities job profiles.
- A Smart Cities curriculum combining both technical and non-technical skills and competences and promoting personalized learning pathways.
- Learning resources for Smart Cities enabling technologies and for building the soft, entrepreneurship and green skills of Smart Cities technicians and Engineers.
- A diagnostic tool to identify personalized learning pathways.
- A MOOC for Smart Cities enabling technologies.
- Virtual Worlds for building the soft, green and entrepreneurship skills of Smart Cities technicians and engineers.

The main project beneficiaries are Smart Cities technicians and engineers either from the public sector (i.e. municipalities) or enterprises providing Smart Cities solutions, as well as HEI and VET students interested in Smart Cities.

The curriculum will be tested through 4 national pilots in Greece, Bulgaria, Spain and Italy with at least 160 trainees. The certification of the skills and competences will follow a two-fold approach: (a) using micro-credentials to recognize the knowledge and skills gained through the successful completion of each online training module at the MOOC and Virtual Worlds and (b) designing the "Smart Cities Specialization Certification" that will be awarded to those passing online certifications exams with e-proctoring after the completion of the training modules.

The project will create an ecosystem for the co-design and co-development of an innovative curriculum and technology-enhanced learning tools for the upskilling/reskilling of Smart Cities technicians and engineers.

1 Introduction

The deliverable describes the virtual worlds that were developed for building the horizontal, non-technical skills of Smart Cities technicians and engineers through synchronous online training sessions. 3 Virtual Worlds has been developed, one for soft skills development, another for entrepreneurship skills development and a last for green skills development. The Virtual Worlds complement the MOOC running at https://mooc.smacite.eu/ that hosts self-paced online courses of the SMACITE curriculum.

1.1 Structure of the deliverable

The deliverable is divided into 6 main sections.

- **Section 1** introduces the deliverable. More specifically, Section 1.1 describes the structure of the deliverable, Section 1.2 outlines the target audience and finally, Section 1.3 outlines the dependencies with other WPs and deliverables.
- **Section 2** describes the need analyses performed to identify the proper 3D technology for the design of the Virtual Worlds by examining 3 different platforms.
- **Section 3** presents the technical development of the Virtual Worlds based on the Unity platform.
- **Section 4** presents the Virtual Worlds for soft skills, entrepreneurship skills and green skills development.
- **Section 5** describes how a trainer/learner can access and use the Virtual Worlds.
- Finally, **Section 6** concludes the deliverable.

1.2 Target audience

The target audience of the deliverable includes the following stakeholders:

- The SMACITE granting authority.
- The SMACITE participating organizations (the project coordinator and the project
- partners).
- The SMACITE project stakeholders.
- Educators and trainers in fields of horizontal skills.
- Academic and research institutions that are active on education and training.

1.3 Dependencies with other WPs and deliverables

The deliverable D4.3 has direct connections with the following WPs and deliverables:

- **D4.2 MOOC for Smart Cities** of WP4: this deliverable describes the SMACITE MOOC.
- **D5.3 Report on SMACITE pilots** of WP5: this deliverable describes the piloting activities in the SMACITE project.

2 Need analysis and virtual world technologies

Work Package 4 is focused on the development of technology-enhanced learning tools for delivering the SMACITE curriculum, on technical and non-technical skills required for Smart Cities technicians and engineers. Its primary objectives include the design and implementation of a diagnostic tool to identify the training needs of individuals and support personalized learning pathways based on the Smart Cities competencies framework developed in WP2. Additionally, WP4 involves the creation of a MOOC platform for online training on Smart Cities which covers courses on topics such as Internet of Things, Cloud Computing, Big Data, and Machine Learning.

A key component of WP4 is the development of three Virtual Worlds that serve as immersive environments for soft, entrepreneurship, and green skills development. These Virtual Worlds are designed to offer engaging training experience and allow participants to learn in 3D environments. They incorporate 3D designs, exercises and activities that foster the development of green, soft and entrepreneurship skills. The Virtual Worlds support efficient training approaches by using Virtual Reality to enhance the educational impact and promote learner engagement and active learning.

In the 3D technology domain, there are many approaches and platforms that are available to design and develop virtual world environments for more efficient and intensive learning. One of the latest technologies involves 3D Virtual Worlds that offer the ability for students to virtually interact and see items and constructions in a similar way they would do in the real world.

In the following subsections, the main 3D technological approaches are discussed as part of the needs analysis performed in the context of the project.

2.1 OpenSimulator

One popular platform that offers the ability to create Virtual Worlds is the Open Simulator (OpenSim) platform (http://opensimulator.org/wiki/Main_Page). OpenSim is an open-source multi-platform, multi-user 3D application server. It can be used to create a virtual environment (or world) which can be accessed through a variety of clients, on multiple protocols. OpenSim can empower learners - through their avatars - to move around the areas of the virtual world, to communicate with one another using text, voice and gesture animations, and to interact with items.

OpenSim allows developers to customize virtual worlds to meet specific needs by providing access to its source code. It supports a wide range of operating systems and devices, including desktops, laptops, and VR systems, enabling broad accessibility. OpenSim features interoperability through the Open Grid Protocol, which facilitates seamless connections between different virtual environments. Its modular design supports custom scripts, assets, and functionalities, enabling dynamic interactivity. The platform also allows for cost-effective hosting on local servers or cloud platforms, making it an economical alternative to commercial solutions. It supports rich media integration, allowing images, videos, and interactive objects to enhance user experiences.

Inside the virtual world, trainers and trainees can communicate with instant messages. It is possible for teachers to create groups and invite their students to create working groups. OpenSim can also embed suitable communication software such as the FreeSWITCH server to allow voice communication. This communication can be in the form of the trainer speaking and being heard by any avatars that are near to him, or in the form of private calls with selected avatars or groups in the world.

2.2 Unity

Unity (https://unity.com/) is a powerful and versatile platform for real-time 3D development, widely used for creating interactive experiences, including games, simulations, and virtual environments. Unity provides a robust suite of tools for designing and deploying applications across multiple platforms, including desktops, mobile devices, consoles, and virtual or augmented reality systems.

It has an advanced graphics engine that supports high-quality rendering, physics simulations, and animation, allowing developers to create visually stunning and realistic environments. Unity's scripting capabilities enable the development of dynamic interactions and complex behaviors within projects. With its extensive library of assets, plugins, and integration with third-party tools, Unity accelerates the development process and fosters creativity.

Additionally, its real-time collaboration features, and scalability make it suitable for projects of any size, from small prototypes to large-scale, immersive applications. Unity's accessibility can be combined with technologies like VR and AR and can make it a good choice for industries such as gaming and education.

2.3 Second Life

Second Life (https://secondlife.com/) is a widely recognized virtual world platform launched by Linden Lab in 2003. It offers an immersive, user-generated 3D environment where individuals can create, explore, and interact. Unlike traditional games, Second Life focuses on fostering creativity, social interaction, and collaborative experiences rather than predefined goals or gameplay mechanics. Users, referred to as "residents," can customize their avatars, construct virtual objects and environments, and engage in various activities, including social gatherings, business meetings, educational sessions, and cultural events.

The platform provides a robust suite of tools for content creation, enabling users to build and script interactive objects, design landscapes, and even develop virtual businesses. Second Life also supports multimedia integration, enabling users to incorporate videos, music, and presentations, making it a versatile tool for a wide range of applications.

In educational contexts, Second Life has been utilized for virtual classrooms, simulations, and collaborative learning. Institutions and organizations have leveraged its capabilities to create realistic training scenarios, host conferences, and provide experiential learning opportunities. Its ability to simulate real-world environments and situations, makes it

particularly effective for skill development in areas such as communication, leadership, problem-solving, and technical training.

Second Life's social and collaborative features are integral to its appeal. Residents can join communities, participate in events, and interact with users from around the globe. Its persistent world ensures that content remains available across sessions, enabling ongoing projects and long-term engagement.

2.4 Comparative analysis

Table 1 compares the key characteristics of OpenSim, Unity, and Second Life.

Table 1: Comparative study of Virtual World technologies

Characteristic	OpenSim	Unity	Second Life
Type of Platform	Open-source virtual world platform	Game engine and development platform	Persistent virtual world platform
Ease of Use	Moderate	Moderate	Moderate
Content Creation	Supports custom scripts, assets, and modular components	Advanced content creation, third-party plugins (asset store) and easy integration with external APIs through .NET (C#).	Supports custom scripts, assets, and modular components
Graphic quality	Good graphics quality, low rendering capabilities	Excellent graphics quality with advanced options	Good quality of graphics
Immersive Capabilities	Moderate	High	Moderate
User Collaboration	Excellent	Excellent	Excellent
Multimedia Integration	High	High	High

OpenSim is open-source and is suitable for customizable virtual worlds but requires extensive technical expertise. Second Life provides a pre-built, socially focused environment with limited customization but is easy to use for content creators. Unity stands out as the most advanced platform, offering cutting-edge graphics, VR and AR integration, and unparalleled flexibility for creating immersive and high-quality virtual environments. While Unity demands a steeper learning curve due to its robust

development tools and programming requirements, it is unmatched in its ability to create sophisticated, interactive, and visually stunning simulations. Unity is the preferred choice for projects that prioritize advanced graphics and immersive experiences, making it ideal for high-end applications such as training on horizontal skills.

We decided to utilize the Unity platform for the creation of the Virtual Worlds for soft, entrepreneurial, and green skills development, as it provides a versatile and scalable framework that supports the development of interactive, immersive, and engaging virtual environments. Its flexibility enables developers to design realistic simulations and role-playing scenarios that replicate real-world challenges faced in Smart Cities, fostering experiential learning. The main features that make Unity the best option for the SMACITE project are the following:

1. **Cross-Platform compatibility:** Unity supports deployment across multiple platforms, including desktop, mobile, and Virtual Reality devices, ensuring accessibility for learners with varying technological capabilities.
2. **Immersive environment creation**: The platform offers advanced 3D rendering, physics engines, and environmental controls that allow the development of lifelike scenarios. These features enable learners to practice problem-solving, decision-making, and collaboration in virtual settings that closely mimic real-life challenges.
3. **Interactive training tools**: Unity's robust scripting capabilities using C# allow developers to integrate dynamic interactions, real-time feedback, and adaptive learning pathways within the Virtual Worlds. This adaptability enhances the training experience by personalizing it to the needs of each learner.
4. **Scalability**: Unity is designed to handle projects of varying scales, making it suitable for both small-scale pilot implementations and broader rollouts. It enables the addition of new training modules and scenarios without compromising system performance.
5. **Integration of learning resources**: Unity supports the seamless integration of multimedia content, including videos, animations, and assessment tools. This enables the incorporation of learning materials developed in WP3 directly into the virtual training environments, ensuring a cohesive and comprehensive educational experience.
6. **Collaborative capabilities**: Through features like networked multiplayer options, Unity allows participants to engage in collaborative exercises, promoting teamwork and communication skills critical for Smart Cities professionals.

The utilization of Unity ensures the development of cutting-edge Virtual Worlds that combine technical sophistication with pedagogical effectiveness. This use of Virtual Reality technology supports the project's goal of creating engaging and impactful training tools, empowering participants with the skills needed to thrive in the Smart Cities sector.

3 Development of Virtual Worlds

The SMACITE training platform revolves around the development of three immersive Virtual Worlds aimed at fostering the soft, entrepreneurial, and green skills of Smart Cities technicians and engineers. These Virtual Worlds offer an engaging training environment, integrating 3D infrastructures, avatars, real time voice interaction between participants and on demand training materials loading.

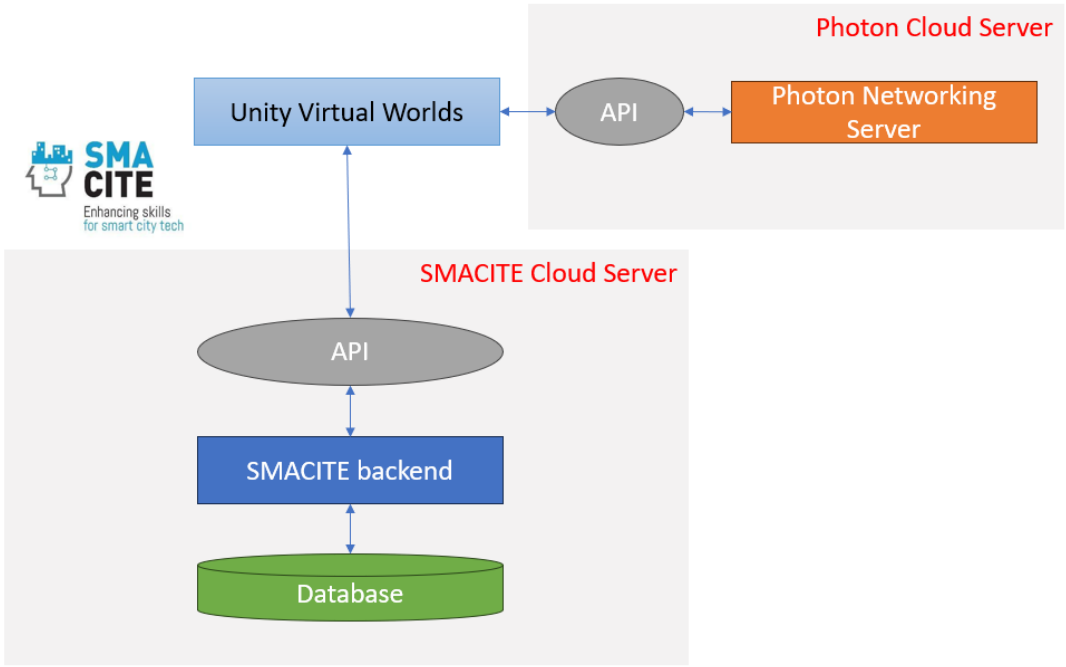

Figure 1: Virtual World platform architecture

The system is designed to be user-friendly for both trainers and learners. Trainers in a **backend** system, similar to those used for managing online courses (e.g. Zoom), can organize sessions, add participants in each session, upload training materials, and select the specific virtual world in which each session will take place. The training sessions take place in the Unity 3D platform, where participants enter the selected **3D virtual world** where they can interact with other trainees and the trainers in the same instance. The trainer has the ability to move through the virtual environment, talk to the participants and load training materials directly into any area of the virtual world via a panel that can be placed dynamically.

For the real-time synchronization of trainers and trainees in the same virtual world, **Photon** is utilized, offering a powerful networking solution tailored for multiplayer games and applications. This ensures a seamless, shared experience where both trainers and trainees can interact with the virtual environment and each other in real time. Photon

enables the synchronization of various elements within the virtual world, such as player movements, object interactions, and event triggers, so that all participants view and experience the world in unison.

The system architecture ensures seamless communication between the Unity 3D virtual worlds and the backend through an API. This communication ensures that the right materials are dynamically loaded into the virtual world at the appropriate times during a session. By leveraging Unity 3D, Photon networking, and a well-organized backend system, the Virtual World allow for efficient session management and an immersive, interactive learning environment.

The 3D Virtual Worlds app contains 6 different scenes. Initial scene for loading, Login-Screen for participants authentication and roles attribution, main menu scene for avatar customization and meeting selection as well as the three Virtual Worlds scenes.

Figure 2: Virtual World Scenes

The user interface system that is visible in some scenes, is used to design elements like login screens, main menus, and character editors. The Unity's Canvas component is used for creating these interactive overlays.

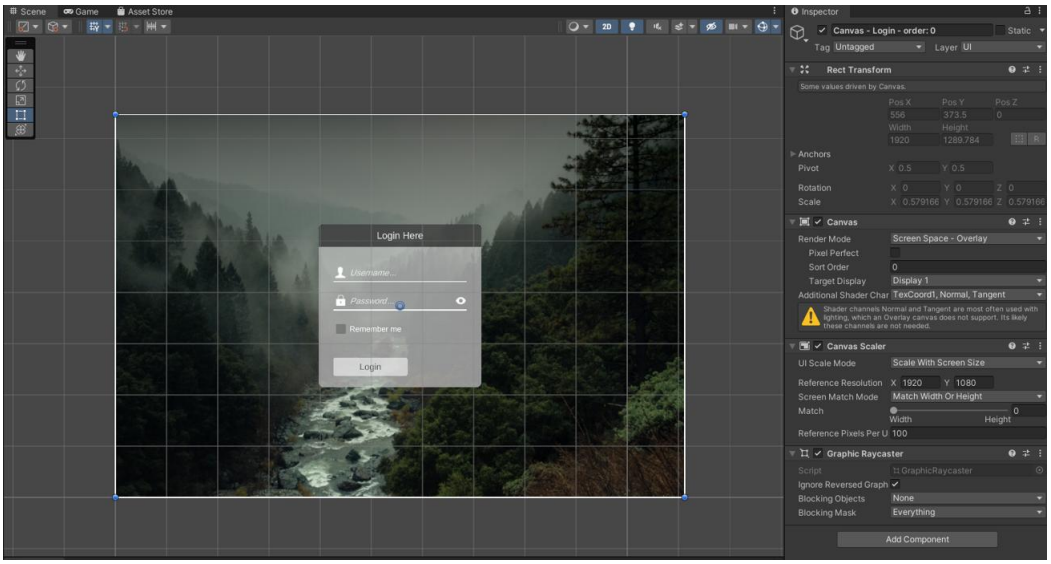

Figure 3: Login Screen

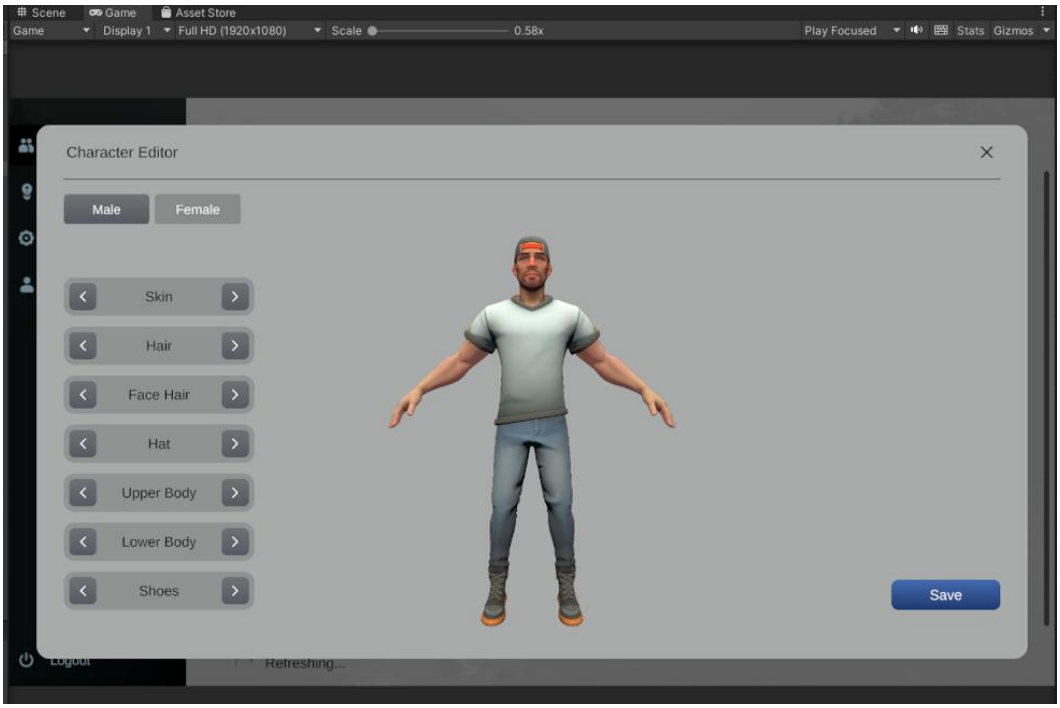

Figure 4: Avatar Customization

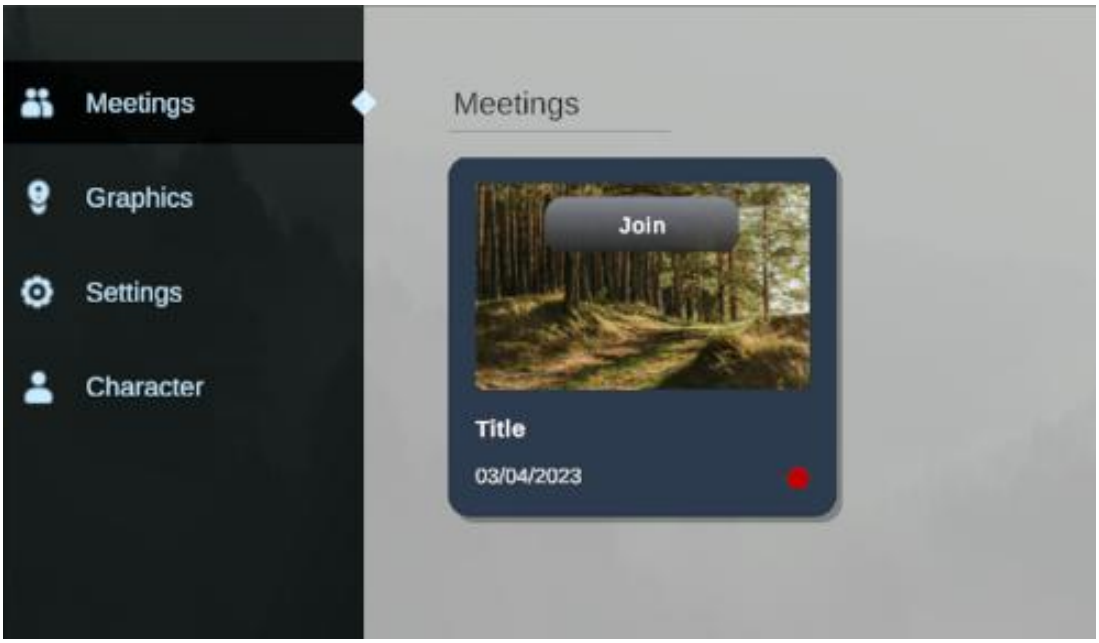

Figure 5: Meeting Selection

The scenes show detailed models (avatars, terrain, etc.) and animations for character movement (such as walking, jumping, etc.), which are controlled via Unity's Animator.

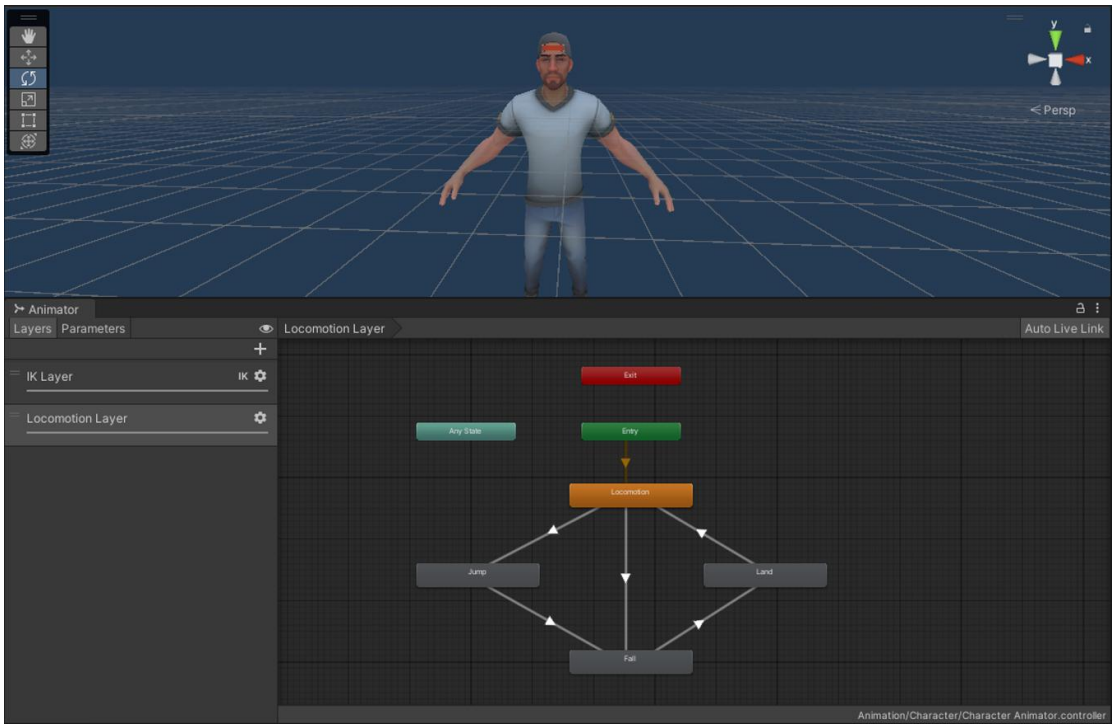

Figure 6: Avatar Animation States

In each of the three virtual worlds, a Navigation Mesh (NavMesh) in Unity helps define areas where the avatars can move. It's essentially a representation of the walkable areas of the scene, and it is used to guide the movement of characters in multiplayer scenarios.

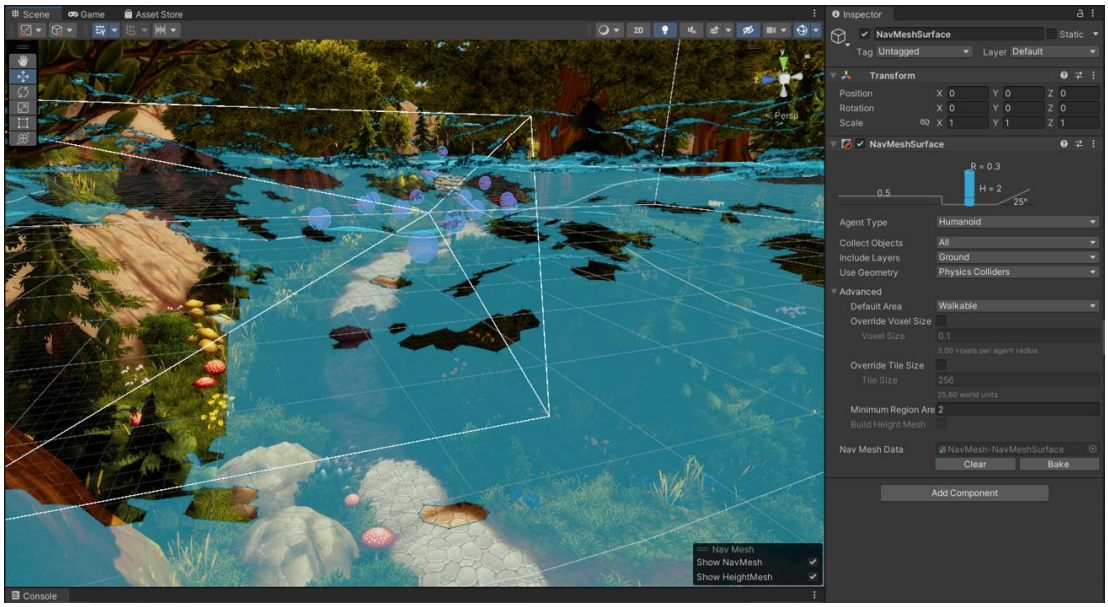

Figure 7: Navigation Mesh

Unity's camera system is used to control the viewpoint for each participant in the virtual world, while lighting ensures that the environments are visually appealing and realistic. Special attention was given to the projector that presents the training materials to the participants in order for everyone to be able to see clearly even if other avatars are in front of them.

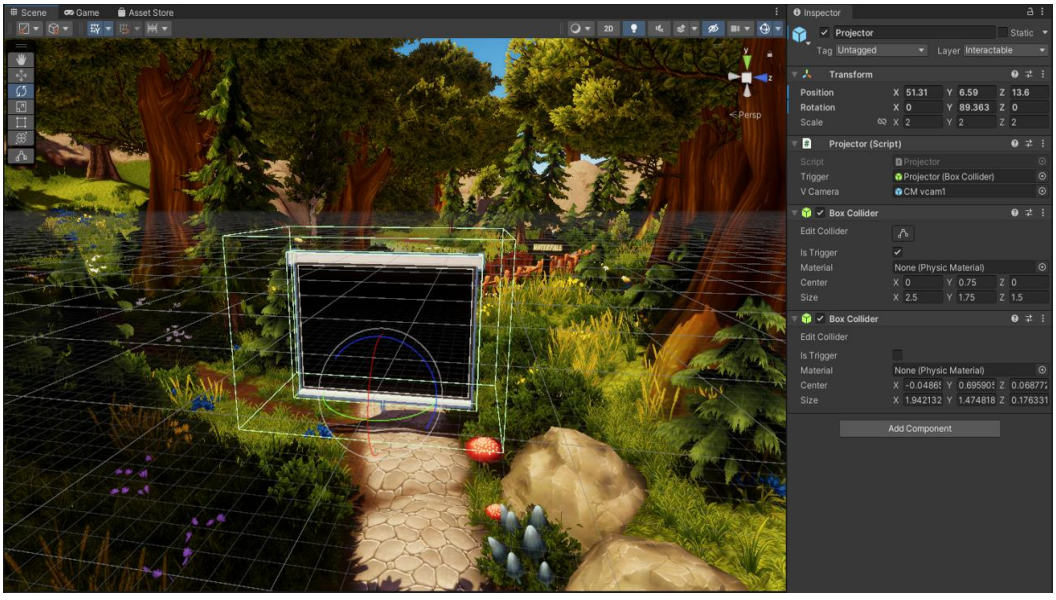

Figure 8: Materials projections on a virtual screen place by the trainers in the 3D World

Spawn points play a crucial role in ensuring that avatars appear in areas of the virtual world that are both accessible and strategically placed to support navigation and interaction between trainers and participants.

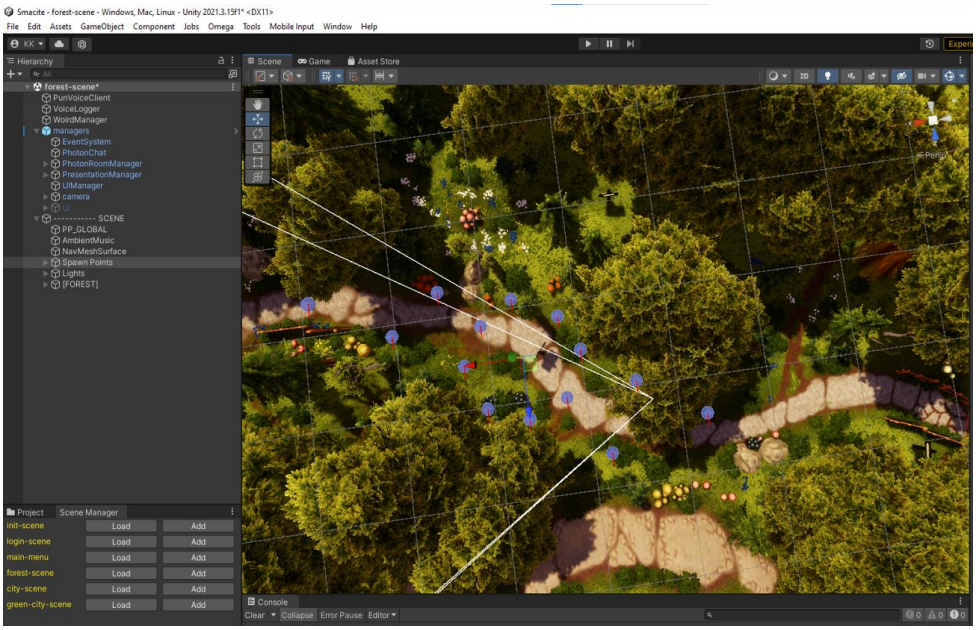

Figure 9: Spawn points for participant avatars initial locations

The backend behind the Virtual Worlds is a Web application that is used by the trainers to organize training sessions, to grant access to the trainees to these sessions and to upload the materials they will need in each session.

4 Description of Virtual Worlds

The primary design environment used for the development of the Virtual Worlds was Unity version 2021.3.15. Blender, a free and open-source 3D computer graphics software tool was also used for the design of assets. Bitbucket and SourceTree were used to keep and manage a common repository for the 3 Virtual Worlds, including a common library of assets. The development team of the Virtual Worlds decided on a couple of guidelines about the assets used in all the different Virtual Worlds to make sure a common artistic style is followed and also set limitations regarding Quality, Level of Detail, Modularity, Supported Versions and others.

4.1 Virtual World for soft skills development

After careful analysis and consultation with the SMACITE trainers, this innovative course takes place within a forest environment, integrating diverse learning spaces including open areas, natural settings, and symbolic landscape elements. The forest serves as a dynamic, metaphorical learning landscape where soft skills development unfolds through immersive, experiential learning modules. Seven distinct learning units are strategically

mapped across the forest's terrain, with each location symbolizing a specific skill development area.

Figure 10: Welcome Sign

The journey takes place through carefully designed scenes: a grassy field exploring communication, a path with directional signs examining teamwork, a blocked path challenging problem-solving, a riverside illustrating adaptability, and a pond scene investigating leadership.

Figure 11: Grassy Field

Figure 12: Path with directional signs

Figure 13: Blocked path

Figure 14: River with Fall

Figure 15: Pond

Each natural setting acts as a living metaphor, transforming abstract skill development into a tangible, memorable learning experience. By using the forest as an interactive learning environment, the course creates a dynamic, immersive approach to soft skills development, encouraging deep reflection and practical understanding.

4.2 Virtual world for entrepreneurship skills development

After consultation with the SMACITE trainers, the course on entrepreneurship skills development has been decided to take place inside a modern city, including a combination of open areas (streets, squares, parks) and offices where the activities are undergone. Large cities provide physical and technological infrastructures, partnerships, and expertise to test and scale the proposed actions. Thus, a city becomes an open laboratory, attracting companies and skills to develop it.

For each module of the entrepreneurship skills course, there are corresponding spaces in the Virtual World. There is a suggested path that users can take inside the city to traverse the areas in the intended order, following the learning units. The landing area where users (trainers and students) arrive is a large square at one of the corners of the city. There is a large sign that indicates that the first module takes place there.

Figure 16: Initial scene

From the initial square, users can choose to follow a street that leads to a junction. There is a big sign above, that indicates the second module. The trainer can describe all the theoretical topics about entrepreneurship in an urban and open environment.

Following another road, on the next block, the users can find a big building with a large sign above, indicating the third learning module. The trainer and the students can enter the building where a large table and chairs are available. The teacher can use examples to discuss project management, such as how students would assist a local enterprise in increasing environmental sustainability (e.g., by reducing waste).

Figure 17: Area of the virtual world

In a central park nearby, there is a large sign indicating the fourth module. The street behind the central square leads to another building with a sign indicating the fifth module. Again, the users can enter the building. The trainer can instruct students to assume working as a project team to develop a new product, from scratch to the production till the sales to the client.

Figure 18: Entrepreneurship area

The final street leads to a building with a sign about the last module. The trainer can instruct students to imagine that they are attempting to persuade a group of investors to invest in a company, either an existing company or one that they have created.

4.3 Virtual World for green skills development

The Virtual World for green skills development is a 3D environment which serves as a platform for training in areas such as energy, waste management and renewable energy sources via the corresponding areas it consists of. It is designed to provide an immersive and interactive learning environment that replicates real-world urban settings to teach sustainability concepts and practices. The following main areas form the backbone of the training experience, each tailored to specific educational objectives and practical applications:

Tech Park - Power House

At the Tech Park, the power generation house serves as a central location for energy sustainability training. This area features a control room displaying live data from renewable energy sources such as wind turbines and solar panels, visible in the background. Participants engage with tools and simulations that allow them to experiment with energy production choices, analyze costs, and assess pollution impacts. The experience encourages critical thinking about renewable energy strategies and performance improvements in energy planning.

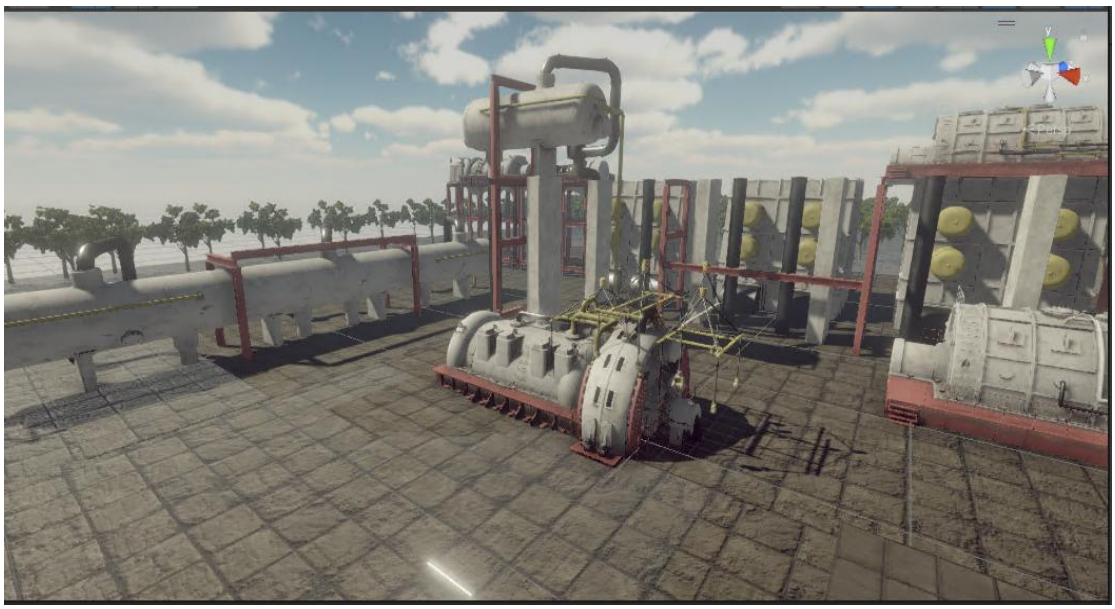

Figure 19: A scene of the Tech Park illustrating the energy power house

Solar energy production is simulated using photovoltaic panels that convert sunlight into electricity. Participants learn about the efficiency factors affecting solar power generation, including panel orientation. The Virtual World provides interactive tools to adjust these variables. Additionally, in the Virtual Worlds users can analyze the aspects related to solar energy installation and maintenance which are essential for energy production from green energy sources.

Figure 20: Energy production from solar and wind

Wind energy production is demonstrated using wind turbines situated within the Virtual World. Participants can visit the turbines and see illustrations of energy generation from the wind to gain a comprehensive understanding of how solar and wind energy technologies work, their benefits and limitations, and their role in producing energy.

Tech Park – Waste Plant

Another key area within the Tech Park is the Waste Plant, which includes a water treatment plant, a waste treatment facility, and a storage warehouse. This setting provides an in-depth look at industrial-scale waste and water management processes. Participants are tasked with analyzing and improving these processes through learning activities. This area emphasizes the importance of effective resource management and the impact of innovative solutions on urban sustainability.

Figure 21: The entrance to the waste plant area of the virtual world

The Virtual World also includes environmental changes, such as cleaner streets infrastructure. Overall, the Virtual World combines practical applications, tools, and realistic settings to provide a comprehensive training experience for green skills development.

Figure 22: City powered by renewable and green energy sources

The Virtual World for green skills development has structured a sequence of training activities designed to assist participants in their study. The activities are built around key themes, starting with the application of the circular economy concept. This takes place in a scene featuring a large display, such as a skyscraper screen akin to Times Square,

showcasing rotating Sustainable Development Goal (SDG) graphics. Participants engage in discussions and presentations that emphasize the importance of resource efficiency and waste minimization. The focus then can go to energy conservation at the tech park and examination of the wind turbines and after that, the waste management can be explored through an engaging experience centered around a waste management plant. Participants are introduced to the travel of the waste from dumpsters or garbage trucks to the processing facility.

5 Access to and use of the Virtual Worlds

To get an account to access the Virtual Worlds as a trainer/student please contact gkamas@ceid.upatras.gr and rigou@ceid.upatras.gr.

5.1 Access to and use of the back-end system

The back-end system is running at the following URL: http://vr-admin.smacite.eu/. It is a Web application that is used by the trainers to organize training sessions, to grant access to the trainees to these sessions and to upload the materials they will need in each session.

The back-end system supports 3 different roles:

- Administrators: They create accounts and assign roles to trainers and trainees.
- Trainers: They create training programs (i.e. for soft skills, green skills and entrepreneurship skills) and schedule meetings to these trainings.
- Trainees: They can (optional) access the back-end system, if they want to add their materials to a meeting (e.g. assignments given by the trainer).

When trainers login, they can see the list of the existing training programs by selecting the "Trainings" option on the left menu.

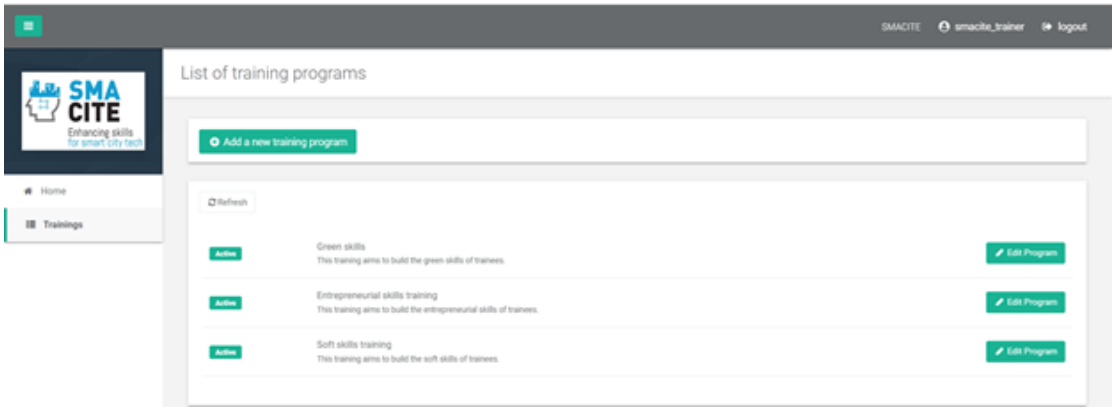

Figure 23: List of available training programs

Trainers can also add new training programs. To add a new training program as a trainer, select the button "Add a new training program", identify its title and description and press "Save".

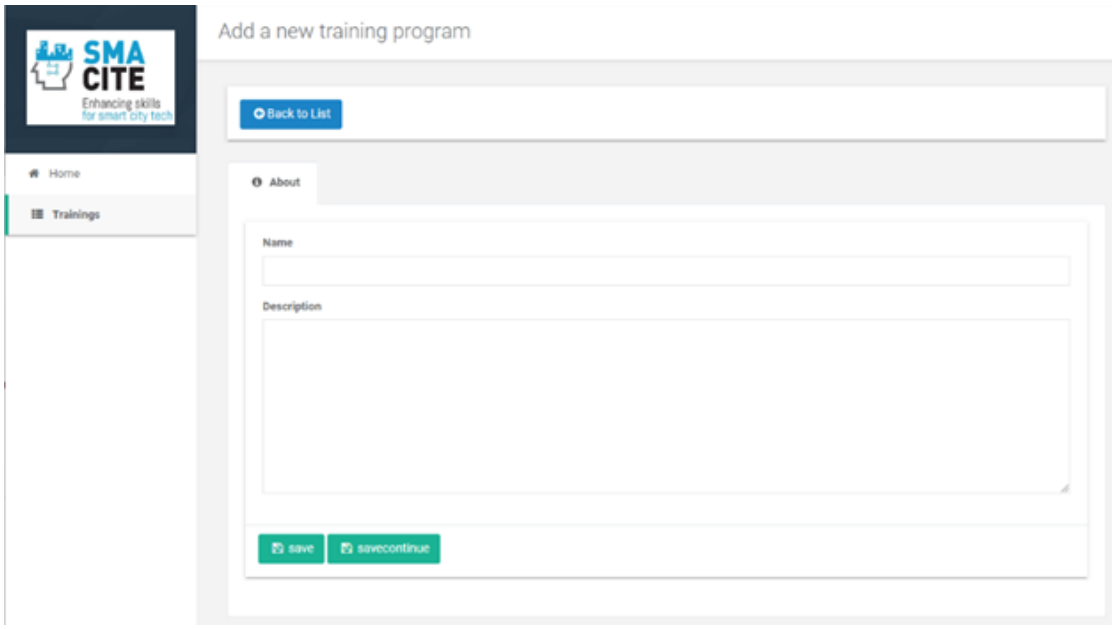

Figure 24: Adding a new training program

To edit a training program, press the “Edit Program” button. Then, you will see 3 tabs:

1. About

You can edit the name and description of the meeting.

2. Meetings

You can schedule a meeting that is associated with the selected training program. You have to provide the following information in order to schedule the meeting:

- Name: The name of the meeting.
- Description. A short description of the meeting.
- Place. Select the Virtual World in which the meeting will take place.
- Duration. The duration of the meeting in minutes.
- Date. The date of the meeting.
- Hours and minutes. The start hour of the meeting.

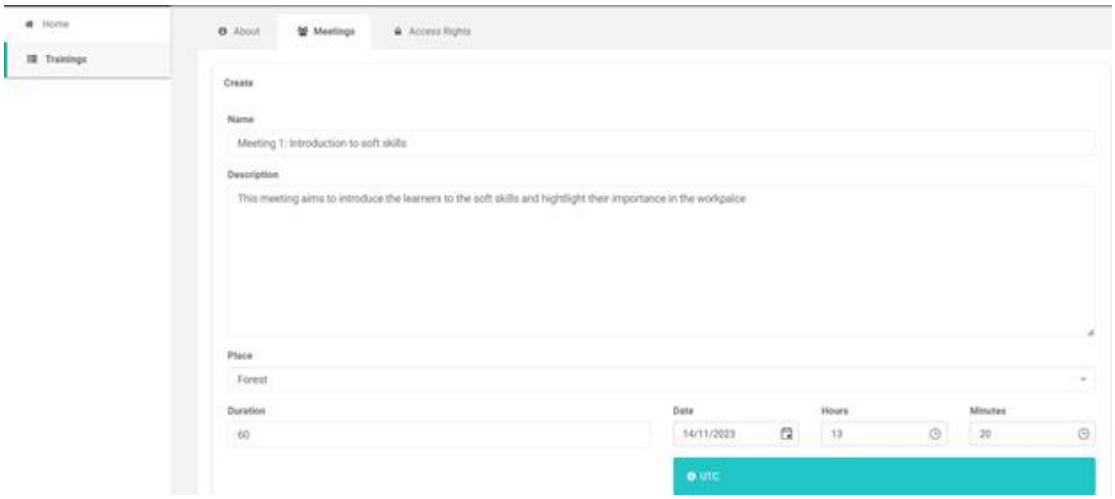

Figure 25: Configuring a new meeting associated with a training program.

Once the trainer identifies that information the schedule meeting is depicted under the training program.

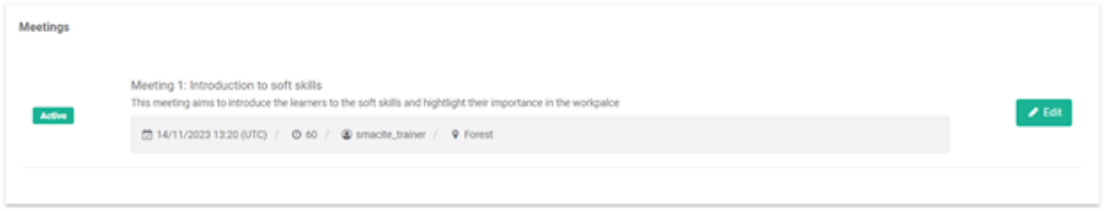

Figure 26: New meeting associated with a training program.

3. Access Rights

At the Access Rights tab, the trainer can see the trainees enrolled in the training program and select those that will participate in the specific meeting.

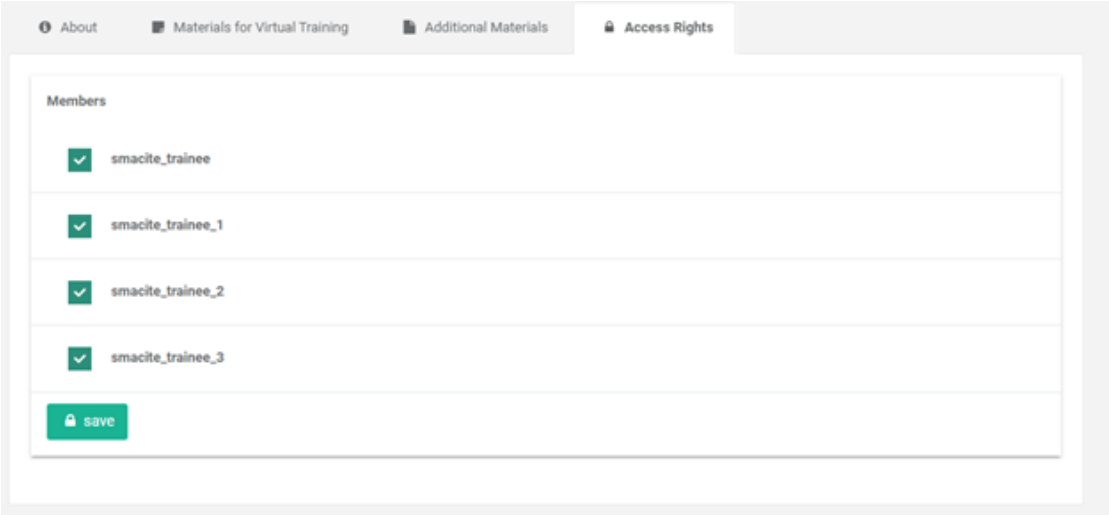

Figure 27: Selecting the participants of a meeting.

To edit a scheduled meeting as a trainer follow the next steps.

- From the available training programs select the one with which the meeting is associated and press the “Edit Program” button.
- Select the “Meetings” tab. At the end of the page, you will see the schedule meetings.
- Press the “Edit” button.

Then you will see 4 tabs.

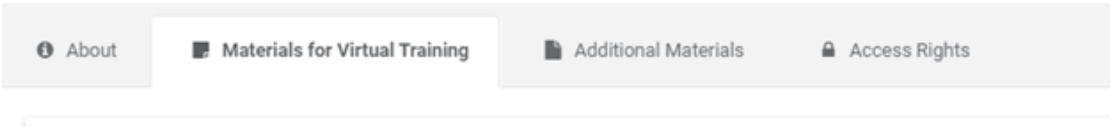

Figure 28: Available tabs while editing a schedule meeting

1. About

This is the information you have already provided when you scheduled the meeting.

2. Materials for Virtual Training

A trainer can add materials for a meeting in the format of images or videos. Those training materials are organized in groups that the trainers create. This will help the trainer to open the training materials during the online training session (meeting). To add training materials, follow the next steps:

- Create a group by identifying its name and press “Save”.
- Press the “Edit” button of the previously created group.
- At the Multimedia (Image or Video) tab press “Select” to select the material and then “Upload” to upload the material.

The trainer can upload different materials to each group (images and video).

Figure 29: Multimedia materials for a meeting

The trainer can see these materials as a slide show.

Figure 30: Uploaded materials

3. Additional Materials

At this tab the trainer can add additional materials, such as an assignment for trainees.

4. Access Rights

Like while scheduling the meeting, at this tab the trainer can see the trainees enrolled in the training program and select those that will participate in the specific meeting.

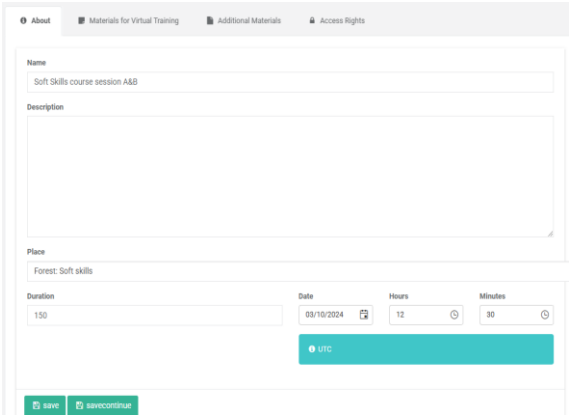

Figure 31: Back-end system for organizing training sessions

5.2 Access to and use of the Virtual Worlds application

To access the Virtual Worlds, one have to download the Windows executable from this URL, unzip the file and run the executable “Smacite.exe”.

The recommended technical requirements of the PC to access the Virtual Worlds are the following:

- Windows operating system
- 16GB RAM
- Intel Core i7 Processor, or higher
- 64-bit operating system
- Graphic card Nvidia 1660, or higher

Moreover, at least 50 Mbps Internet connection is suggested.

To join an online meeting, users just need to select the training icon and hit the join button. Each meeting panel provides essential information, such as its name, date, and scheduled time.

The meeting place isn't just a static environment; it's a dynamic Virtual World tailored to the course content. Users can navigate this world using their avatars, allowing them to explore, interact, and engage with other participants.

Figure 32: Inside the Virtual World

Figure 33: Different landscapes can be visited

Figure 34: Multiplayer capacity

A user-friendly menu positioned at the bottom right of the screen offers quick access to various functions of Virtual Worlds. Additionally, trainers can load presentations, enhancing the platform's versatility.

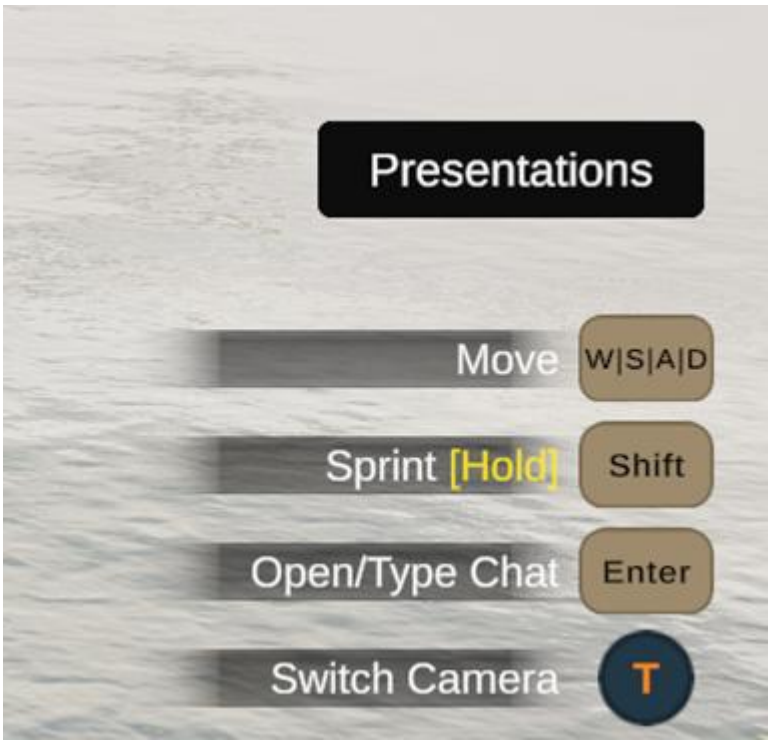

Figure 35: Users' menu

When users click on the "Presentations" option, a list of materials uploaded by the trainer pops up (trainees should first upload the materials in the back-end system). This allows

the trainer to seamlessly bring these materials into the Virtual World, integrating them into their teaching plan.

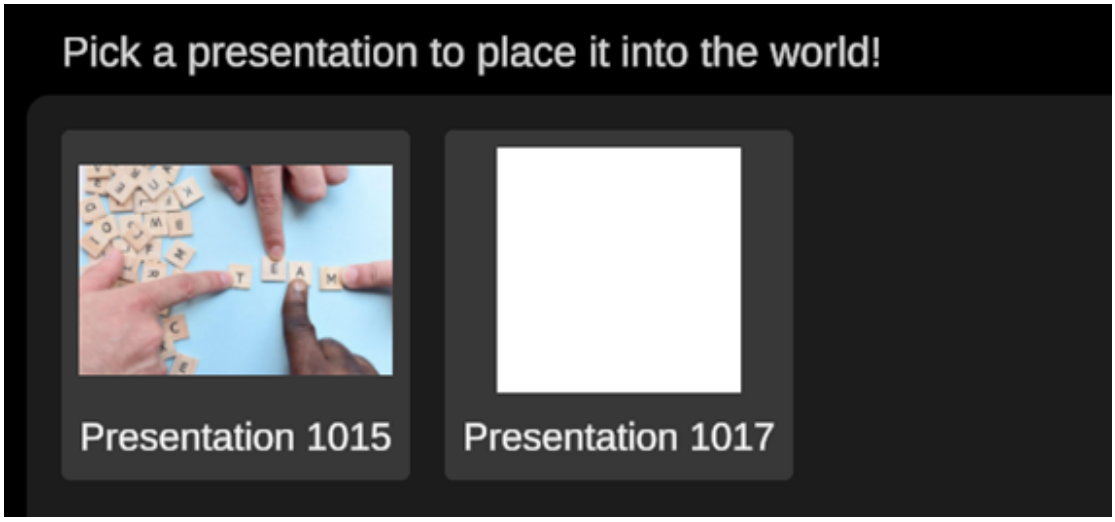

Figure 15: Available presentations uploaded by the trainer for the specific meeting.

The trainer can place the presentations wherever he/she prefers in the Virtual World. Then with the navigation buttons that are located in the bottom of the screen, he/she can select the different materials to load in the Virtual World.

Figure 36: Presenting in the Virtual World

Figure 37: Changing materials on the screen

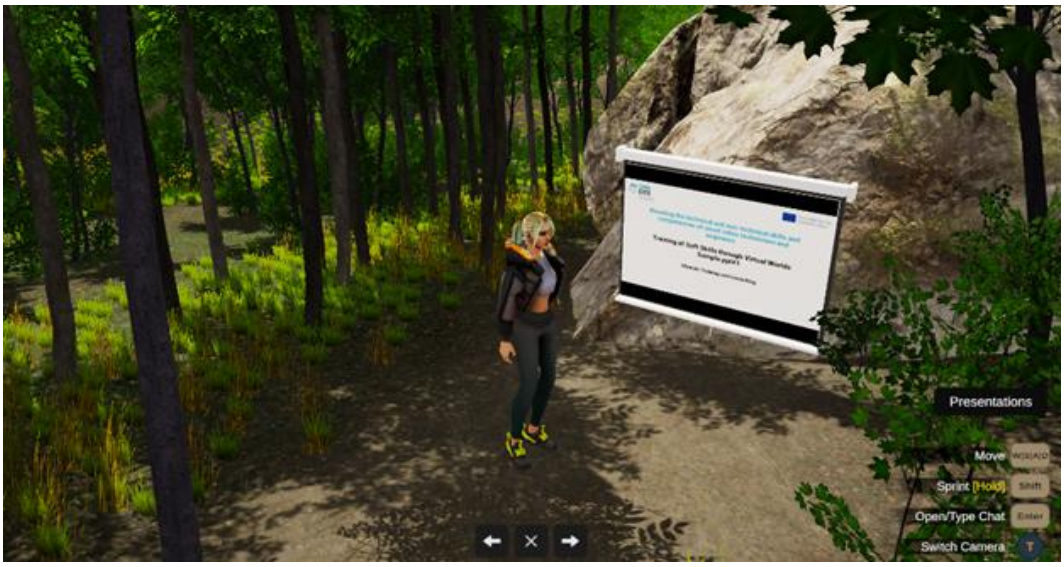

Figure 38: Placing presentations to different places, anywhere in the Virtual World

Users can open the chat panel located in the right bottom part of the Virtual World, by hitting the enter button, enabling seamless message exchanges with all participants in the Virtual World. Users can also enjoy constant voice communication for a more immersive experience.

6 Conclusions

Overall, the Virtual Worlds complemented by the MOOC facilitate the objectives of the project to equip participants with horizontal (i.e. soft, entrepreneurship and green) skills needed to contribute to the transition toward sustainable and resilient Smart cities. The deliverable "D5.3 Report on SMACITE pilots – Section 2.2.3 Virtual World pilot" provides details about the piloting activities of the Virtual Worlds.

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