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# Experiential learning in immersive nature

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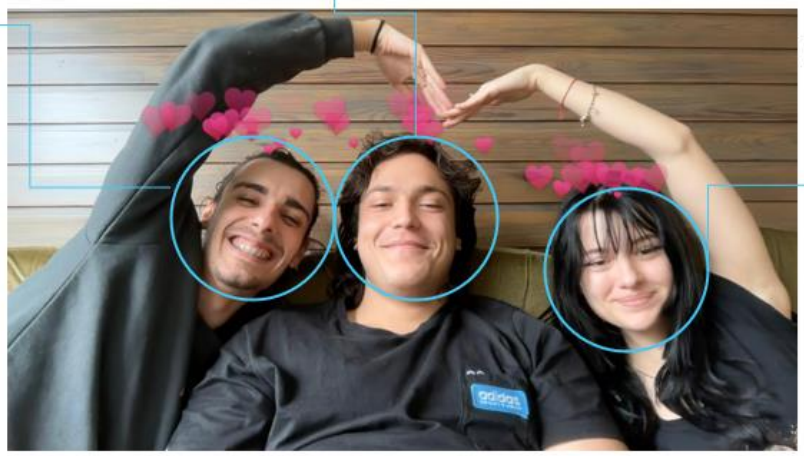
# Team Role Distribution

**Alexandru**
Product Owner
Connectivity
Unity
API
Documentation

**Matteo**
Scrum Master
Trello
Unity
API



**Roxana**
Developer
Unity
UI/Digital design
AI
Research

# Project Description

## Key question

How can we enable teenagers that might have mental vulnerability, lack of resilience or difficulties with emotional regulation to undergo immersive nature therapy while also guiding them through an experiential approach to explore a natural environment?

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## Solution

The "Experiential Learning in Nature" project will be designed to guide teenagers aged between 12 and 25 through an immersive natural environment created in our 360 degree immersive room. This environment will be a blend of AI generated images, sounds and digital elements which will all contribute towards creating a simple way of experimenting and learning with nature, in an immersive environment.

The core element of this project is the 360 degree immersive room in The Core building of our campus. Making use of the HTC Vive controller, the user will be able to interact with the digital environment, leading to a more immersive experience. Additions like fans and mist diffusers would further enhance the experience, but we still need further research in order to manage the funding part of the implementation.

The whole application will have a simple menu that can be interacted with through the Vive controller, and the user will also be able to interact with the environment through speech, using a general-purpose mic for voice input. This will further increase the immersive aspect of the environment, allowing the teenagers to be fully engaged in the activity.

We plan to mostly focus on pre-generating a few highly detailed scenes that are responsive to the user's inputs and that will allow for a simple learning experience, focusing on seemingly daunting subjects such as Nature Biology or Animal behavior. The users will be able to step into the Stretch zone while enjoying the calming experience of an immersive nature environment.

Another addition to the experience could be to allow the user to use speech to prompt a model to generate a custom environment. This will allow the user to experience creating a digital world with seemingly low effort, enabling them towards a rewarding and confidence improving experience.

# Draft of technical solution

## Technical implementation

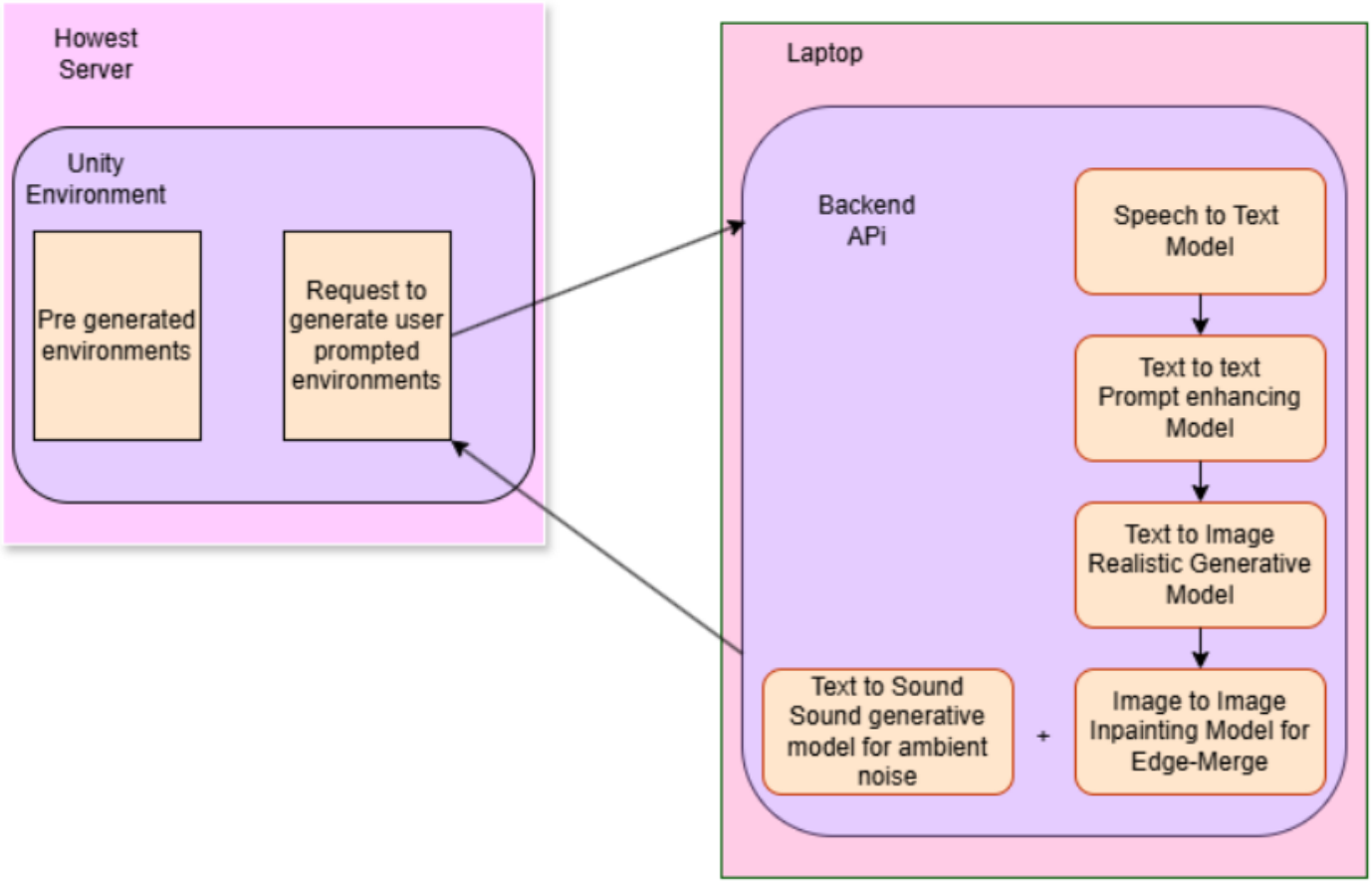
The whole application starts with a simple Unity Environment. This will be a room with 4 walls on which we will project the AI generated images. We will further enhance the immersive experience by adding characters and objects designed by us, that the user can interact with and which will also be able to guide them through the environment.

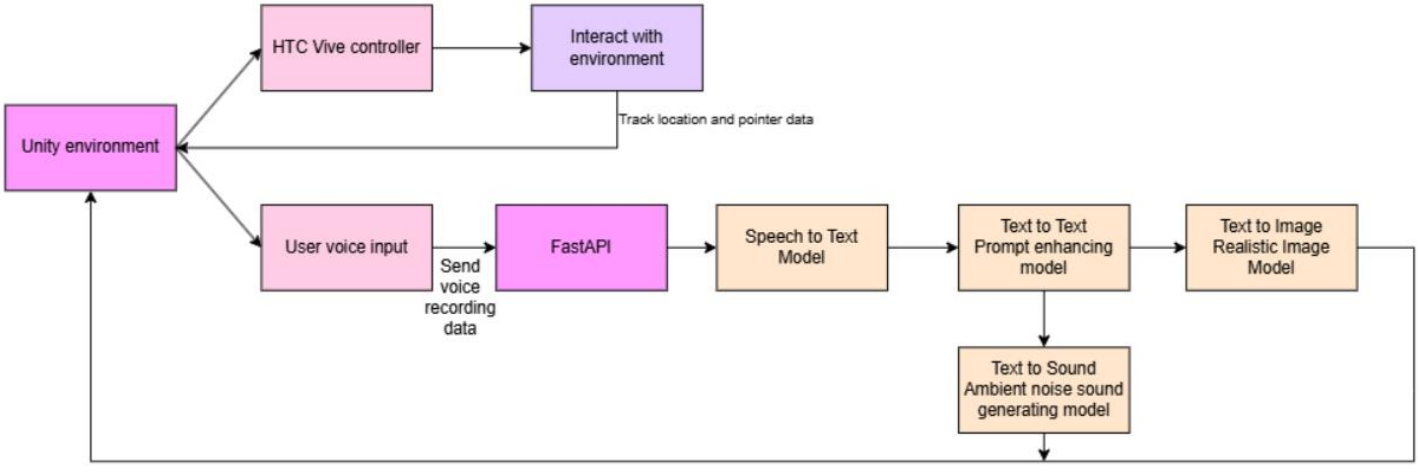
We will also make use of a containerized FastAPI application to which the Unity instance can make simple calls. This will enhance the modularity of the whole application, enabling us to develop faster and to familiarize ourselves more with production-like best practices.

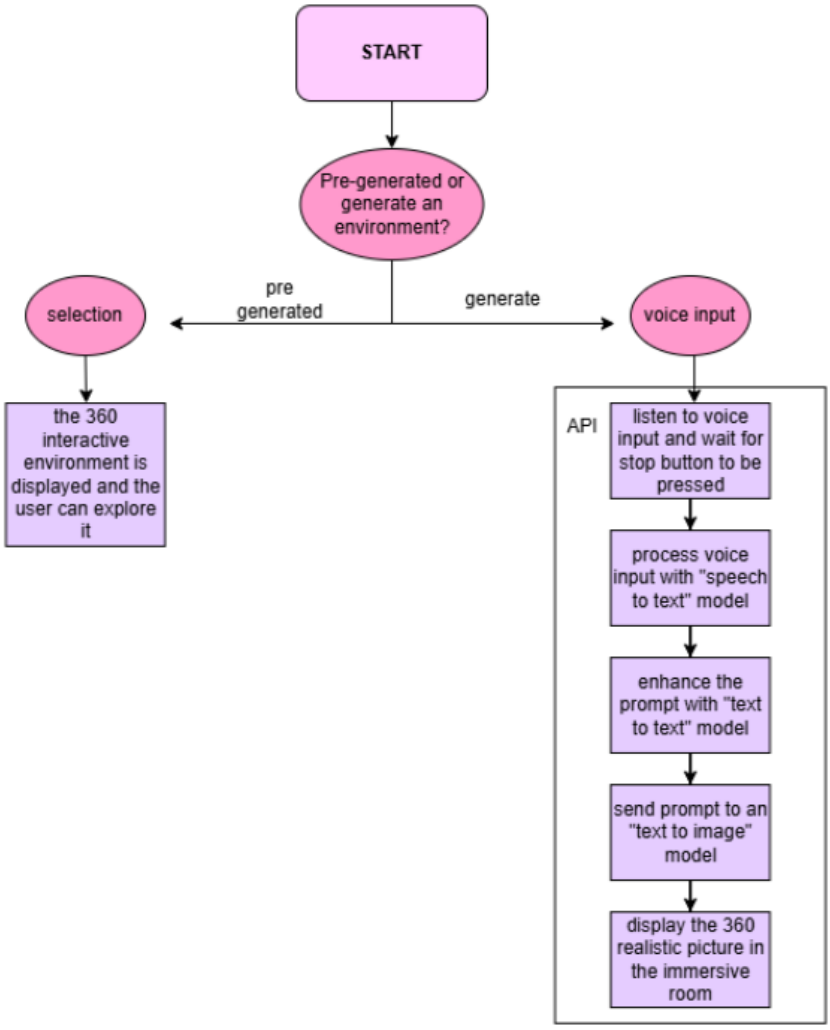
The unity environment will also be used to slightly animate the panoramic images in order to make the environment more dynamic. Therefore, we will overlap simple grass, water or leaves objects on the panoramic image and match them with the environment. This will make interacting with the digital world easier for the user, since the interactive elements will be easy to spot and it will also provide us with better tools to guide the user throughout the whole learning experience.

## Unity

We will be provided with an already created environment in unity, which resembles the physical room in our campus. We will try to add certain digital characters and elements to help the teaching process. We will also implement specific games and special interactions for each pre-generated environment in order to achieve the learning objective of this project.


Howest
Server
Unity
Environment
Pre generated environments
Request to generate user prompted environments
Laptop
Backend
APi
Speech to Text Model
Text to text Prompt enhancing Model
Text to Image Realistic Generative Model
Text to Sound Sound generative model for ambient noise
+
Image to Image Inpainting Model for Edge-Merge


Unity environment
HTC Vive controller
Interact with environment
Track location and pointer data
User voice input
Send voice recording data
FastAPI
Speech to Text Model
Text to Text Prompt enhancing model
Text to Image Realistic Image Model
Text to Sound Ambient noise sound generating model


START
Pre-generated or generate an environment?
pre generated
generate
selection
voice input
the 360 interactive environment is displayed and the user can explore it
API
listen to voice input and wait for stop button to be pressed
process voice input with "speech to text" model
enhance the prompt with "text to text" model
send prompt to an "text to image" model
display the 360 realistic picture in the immersive room

## Similar implementations

One implementation in a similar fashion as ours that stands out most is the Rewild our Planet immersive experience. Being based on the Netflix documentary “Our planet”, it provides a learning medium in which everyone can explore the secrets of nature and biology. The implementation seems different, since they will make use of VR glasses instead of an immersive room, but the approach and the goal is similar.

## Main benefits

To achieve our goal to apply experiential learning in an immersive environment, we must build a responsive world to the users’ inputs. Therefore, using the Vive controllers and implementing dynamic elements that can be interacted with is crucial in facilitating a relaxing learning process. In our project architecture, we chose to separate the Unity environment and the AI API to parallelize the development process, to make the whole program modular and to enable us to fix bugs easier.

## Challenges

One important challenge that we are faced with is assuring a stable connection between the Unity application that is running on a different server and our API backend. We are currently exploring options with containerized local applications, cloud containers and cloud functions, but further research is needed in order to reach the optimal solution. Since we have a modular application, our team should be able to distribute the workload easily between the members, without too many organizational issues.

Furthermore, we also need to pay attention to what AI models we implement, since the cost of running the application for a long time might become a concern.

## AI

Throughout our whole project, we use AI for speech recognition, prompt enhancement, image generation and image upscaling. One important constraint in our project is cost management; therefore, careful research is needed in choosing the AI models. Hugging face hub provides a wide variety of models for all types of use cases and therefore will be one of our main resources. The AI pipeline will look like the following:

- Speech to Text

We plan to use a simple Speech to Text model to transform the user's input into a Text Prompt. This is the first step in the pipeline, and it will allow us to enrich the prompt, resulting in better results and more accurate images.

- Text to Text

After we get the user's input, we will enrich it with a text-to-text model. This will be able to refine the user's core ideas, enabling the next model to provide a more accurate and suitable representation.

- Text to Image

We will use an up-to-date AI model that can generate realistic images of nature. The prompt will have to describe generic scenery in nature and after the prompt enrichment process, the model should be able to yield a good image that is suitable for that context. If the image does respect the user's criteria, the user will have the option to refine and change the prompt.

- Image to Image

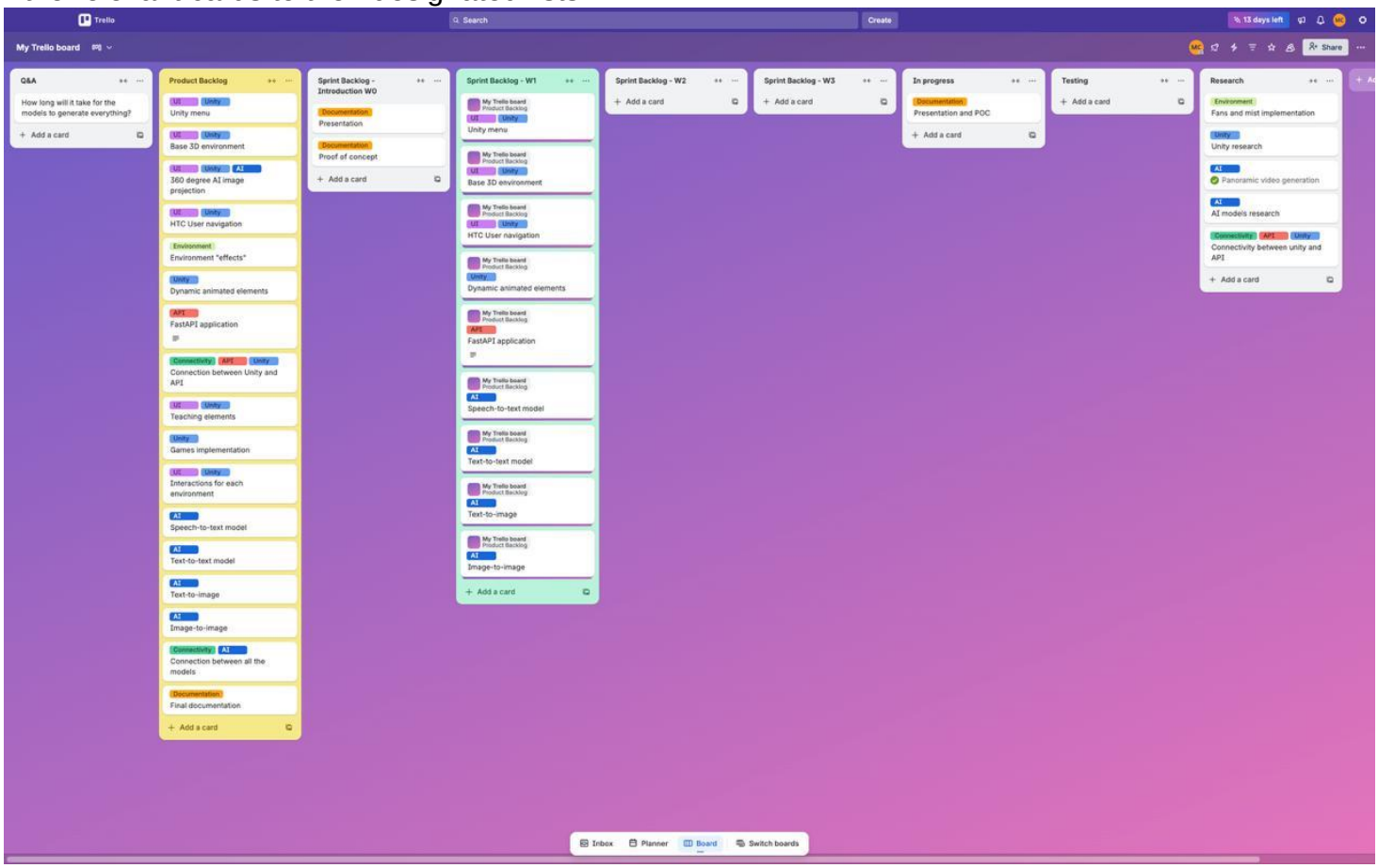
We will use a realistic inpainting model which will handle the "wrapping" of the image. This will make certain that the 360 view of the room will be an accurate realistic representation and that it won't have any merging problems (where the walls meet) at either point.

## Client input

In terms of input from our coaches, we just have to make sure that our ideas align with the client's vision, assuring proper communication and therefore reaching a mutually beneficial result, so perhaps a clarification of whether it's more important to have highly interactive environments with unique games, curated information that provides a tailored learning experience or to be able to create nature images on the spot, would prove to be of great help.

# Trello

We reviewed all the essential functionalities needed for our project and created detailed tasks in Trello. Following the Agile methodology, we organized the lists accordingly and systematically added the relevant cards to their designated lists.




## Sprints

The sprint duration for our project is set to one week, followed by a retrospective at the end of each sprint to review our progress and accuracy. Initially, we had outlined tasks for the first week, and after completing it, we'll assess our time and resource estimations to plan the next sprint more. Each team member has defined responsibilities, and we plan to do research before the project weeks begin for better preparation and management.

Our workflow is organized so that we start by developing the application’s foundation using simple building blocks. In week one, we focus on these components. As soon as every service and module has a solid base, we will integrate them, after which we’ll add advanced features and optional enhancements if time allows. Tasks planned for weeks 2 and 3 are labeled as W2 and W3 on our board.

We use story points to estimate work, with each story point equaling 6 hours. For this project, 55 story points were assigned, resulting in a total available time of 330 hours (55 × 6). Divided among

three people, each member is allocated 110 hours for the project. With 15 days of work scheduled, this comes out to 7.3 hours of work per person each day. This calculation helped us balance workloads, set realistic expectations, and align our Agile planning and productivity goals.

## Links:

### Github:

**https://github.com/mihaialexmatei/experiential-learning**

### Trello:

https://trello.com/invite/b/690b41433c2b05b3578ba51f/ATTI2b6fc2d35d929fb752b615910a579575B2F05839/my-trello-board