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Virtual Tour of FIT for Oculus Quest

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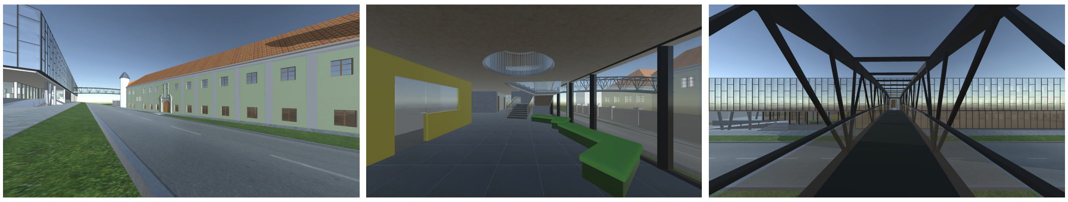

Abstract
The main goal of this project is to make an application for the Oculus Quest VR headset called FIT_VR. This application has several features that allow the user to do more than just walk freely around the FIT BUT areal, such as Navigation and Instant travel. The Navigation feature is used to find the shortest route to the desired office or lecture room and instant travel allows to choose a starting location.

Keywords: VR tour of FIT — VR FIT — FIT tour on Oculus Quest — VR Oculus quest — Unity based VR application

Supplementary Material: Demonstration Video

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1. Introduction

The focus of this application is to help students and any other users get oriented on the school grounds and help them find a route to the room they need to go to. Another goal is just to let users explore the areal from the comfort of home and familiarize virtual reality to anyone by showing that VR [1] is not just used for gaming but that it can be used for something useful.

There already is an existing method to look around the school and that is with use of 360° photos [2] that are accessible from any device but 360° photos do not allow the user to go everywhere, unlike FIT_VR[1].

The whole VR application is based on the Unity3D engine[2] that provides the basic building elements. Oculus provides an SDK for Unity3D that enables easier work with their VR headset and controllers. All models (More in Section 6) appearing in FIT_VR[1] are done in Blender[3].

Everything in the application is made from scratch, e.g. movement, navigation (Section 3), all interactive objects (Section 4) such as menus and doors. This allows to make everything exactly as needed, for example, the default movement in VR is really uncomfortable for some people so the application allows the user to set up (Section 5) the movement as they prefer it to be. In order to make FIT_VR even more user-friendly, the application provides controller hints (Section 5) that help the user with the use of controllers.

2. Oculus Quest

The headset (Figure 1) is completely wireless thanks to the mobile CPU that is integrated inside the headset and to four cameras that use positional tracking that means no sensor stations so the VR can be set up practically anywhere. With the headset also come two wireless controllers [3].

3. Navigation

For navigation, is used Unity3D's NavMesh [4] which is used for spatial queries, like pathfinding [5] and walkability tests. The NavMesh creates Mesh that

[1] Application for a virtual tour of BUT FIT
[2] https://unity.com
[3] https://blender.org

Figure 1. Oculus Quest headset and controllers

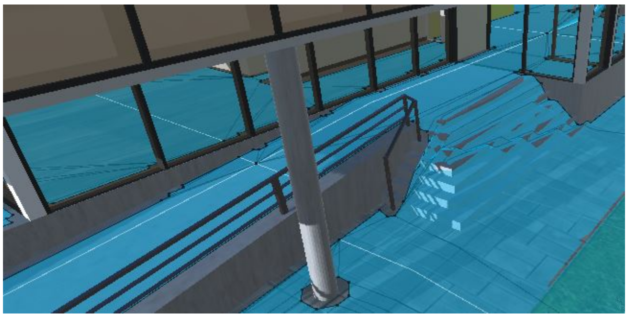

Figure 2. Blue texture on the ground is the generated mesh.

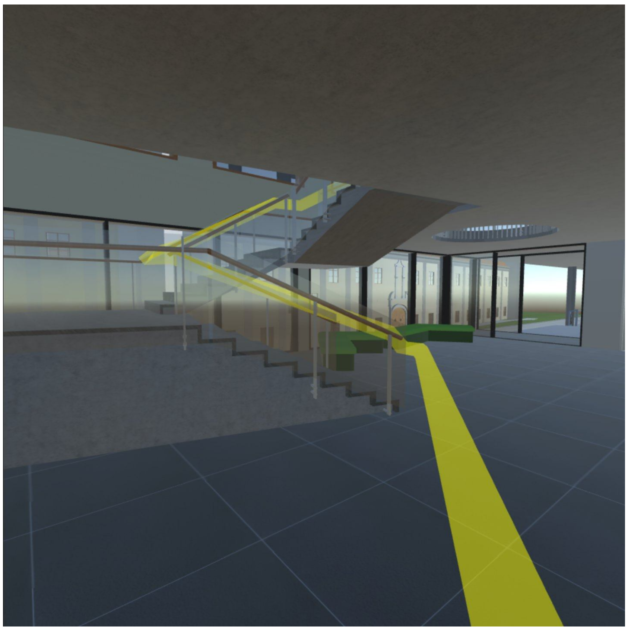

Figure 3. Visual representation of the navigation. The yellow path shows the shortest path calculated by NavMesh.

represents the walkable area – see Figure 2. It uses colliders to determine if the path is walkable or not. NavMesh is used by NavMeshAgent to verify the existence of a path between the Agent (user) and the destination (object).

With an object present on the mesh selected as the destination, the NavMesh finds the shortest route through the mesh which is then returned as array of coordinates. To visualise the path all coordinate points are connected by a line-renderer, which highlights the route – Figure 3. The Navigation is extended for re-routing if there is a shorter route existing.

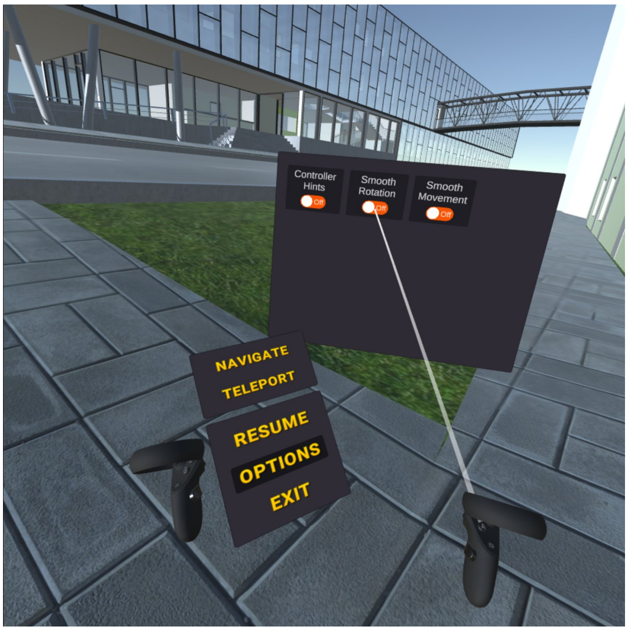

Figure 4. In the picture, you can see the user interface of the menu. With opened options tab where the user can set up the movement and hints. The white line is representing where the cursor is being directed.

4. Interactive Environment

All interactive objects in the application can be divided into two categories. One category of interactive objects are physically interactive objects such as floors, walls and other objects that have a rigid body (More in Section 4.1) or colliders (Section 4.1). The other category of user interactive objects are widgets shown only for user interaction, for example menus and door handles.

4.1 Physical Interactive Objects

Physical interactive objects are all objects that have a visible model (except menus etc.) in terms of FIT_VR. For example, walls and floors have colliders that restrict the user from falling through the floor or walk through walls and doors. The user has control over the object with a camera that can move on any surface and has a rigid-body attribute that is restricted by colliders.

- **Rigid-body** It's component used on the user object, that applies Unity3D's physics engine.
- **Colliders** Defines the physical collision of selected object.

4.2 User-Centered Interactive Objects

User-centered interactive objects are objects such as menus and door handles, where the user uses controllers to interact with them. For menus, a prefab provided by Oculus is used, whitch uses ray-casting from the controller in the direction of its normal and

Figure 5. Upper image shows visualisation of ray-cast hitting door handle and the image below when the ray-cast is not hitting the handle.

then checking if the ray hits any UI element in its path and visualizes the ray with line-renderer (More in Section 3). For door handles, is used a similar script that uses ray-casting from controllers that evaluates if the door handle is hit and then a button is pressed for the door to be open.

- **Prefab** Prefab is an object created as a reusable asset. Such object (prefab) stores all scripts and components applied to it.

5. Options

Using VR can cause motion sickness to some people. That's why the application allows configuring movement so that the user feels most comfortable. Users can configure whether walking and turning are smooth or not. There is an option to turn on/off controller hints as well.

6. Models

All models are made in Blender[3] and referenced by building plans provided by Lukáš Duránik and references for details of models thanks to 360° photos made by Anna Popková. User has access to all rooms

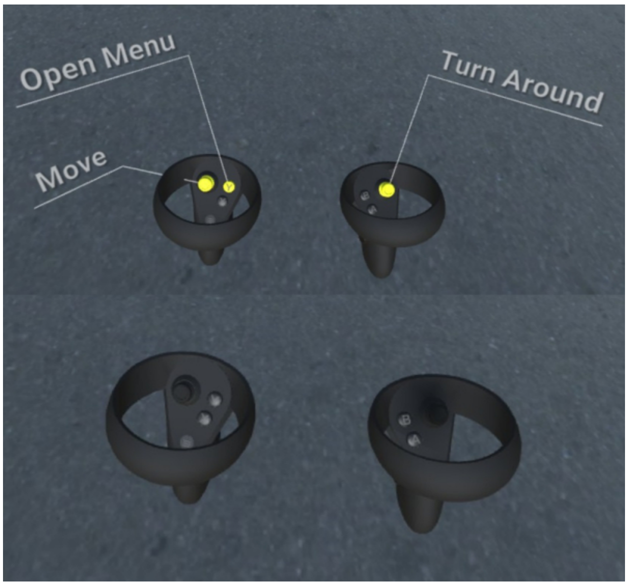

Figure 6. Visualisation of when the controller hints are enabled and disabled.

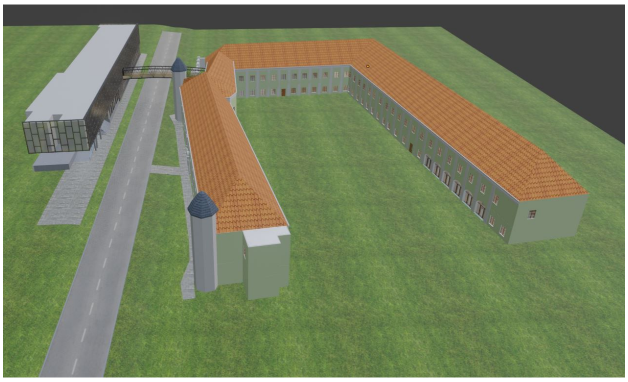

Figure 7. All currently user accessible buildings such as buildings A,B,C,L and bridge connecting building A and L.

and corridors that normal student has usually access to. Models for controllers are provided by Oculus but they had to be modified in the way where all buttons and joysticks could be highlighted for controller hints.

7. Conclusions

Through this application, anyone can explore FIT BUT without having to leave the room. If one is trying to find the right office or lecture room, he or she can use this application to find out the right way.

This application can become much more than it already is. In the future, the user could walk towards any room, for example, the library and opens the UI window that contains the information about the room, such as the current schedule. The model itself could be combined with 360° photos to show a more realistic view. Thanks to the Oculus Quest's mobile CPU that runs android it could be modified to run on any device, not just the VR ones.

Acknowledgements

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