Step by Step Guide

Fall Risk Assessment

CS 498 VR Sponsored Project Team:
Jerry Li
Sihang Xu
Mitesh Patel
Aditi Patange
Kexiang Wang
Lohitaksh Gupta

TA: Ben Stoehr
Professor: Manuel Hernandez

Background:

Why is risk assessment important?: The process of Risk Assessment as prescribed by law aims at risk reduction by means of design changes, complementary protective measures or as a last resort, user information[1]

This project examined the following types of visualization while making the 3D model:

- Shape and size of the wall
- Colour of the objects and wall
- Sharpness and orientation of the object
- Texture and material of objects, floor and wall.
- Dimensions and constraints in the room.

Apart from technical aspects, we used psychological aspects such as:

- The sense of “being there”
- User traits:
    - Conscientiousness
    - Risk Perception
    - Age
    - Sex
    - Disability and Accommodation Requirements (if any)
- 3-D model properties

The geometric models and objects used in VR can provide impressions of visually perceivable properties.[2] The focus should be on making the true-to-scale VR-model,

which is suitable for assessments where the size of a machine or object is important such as safety issues or very sharp objects. The model should try its best in giving a true presence of the risky objects around it.

Record Process

1. Before you enter the house, make sure you take the picture of the front door from the outside and after opening it.

2. Take pictures of the corners, intersections and major objects lying around each room so that the Blender designer can get the overall picture of the design.
3. Make a rough sketch of the house with the dimensions of each room. Take care of corners and arcs while making the sketch

4. After looking at the major objects lying around, evaluate for risk objects (which are sharp and unstable). Risk objects are objects which can harm an individual directly or indirectly.
5. Note down the texture and friction of the floor. Give coefficients for slipperiness on a scale of 0-10 (very slippery). At the time coding, these coefficients can be weighed between 0 and 1 to determine a factor of risk in each room (relative to each room's floor). If the room is more slippery (10 or closer to 1), then there are more chances of risk exposure.
6. Now, shift the focus to finer details such as the size and orientation of the risk objects identified previously.
7. After taking all the pictures, go back to the main entrance of the room and film a video slowly capturing every feature of the entire house.

Modelling Process

1. We used bender as our modelling tool and if you are not familiar with blender, you can also use other tools such as Maya and 3ds Max.
2. Since we do not have a floor plan, the best thing we can do is importing a picture of the main structure into various applications available on Android or iOS which can estimate the dimensions of the room.
3. Based on the estimated dimensions, we can recreate the room structure in Blender.
4. Once the room structure (i.e. walls of the room) are modelled, we added Blender objects for various furniture throughout the room.
5. The modelled room with furniture from Blender can be imported into Unity for adding the VR experience and programming user interactions.
6. We need to manually assign fall risk values to each object in the room.
7. In Unity, we need to add colliders for each object so that the user won't be able to walk through objects. It should be verified that the user is unable to walk through walls.
8. The scale for room needs to set to ensure that the room is not too high or too low as compared to real life. Also, the size for each object needs to set appropriately for the user to have a comfortable VR experience.
9. We need to add some collision scripts to all the objects. This script should turn on a red light on the object that is a fall risk when the user is in the vicinity of that object.

References:

[1] Machinery Directive 2006/42/EC of the European Parliament and the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast), Official Journal of the European Union L157, 09/07/2006, 24-86.

[2] Puschmann, P., Horlitz, T., Wittstock, V., & Schütz, A. (2016, August 09). Risk Analysis (Assessment) Using Virtual Reality Technology - Effects of Subjective Experience: An Experimental Study. Retrieved December 11, 2018, from https://www.sciencedirect.com/science/article/pii/S2212827116303031