Multimedia Interfaces VO (188.640 WS22) – Written Exam

31st January 2023

Time: 2 hours

The current pandemic increased the use of virtual communications, which may require people to be more immersed in virtual environments. Several teachers from a middle school (Hauptschule), wants to try teaching through immersive technologies. They want to design different tasks to increase students' (aged between 10 and 13 years old) involvement. For the first experimental phase of the project, teachers want to focus on three main use cases:

1. **Solar system navigation interface:**

   The proposed interface should allow for the exploration of the solar system (Fig. 1). From an overview perspective, to a close up view of a given planet (e.g., exploring a building or a geological structure). The main challenge is to provide an accurate control for the different degrees of scale.

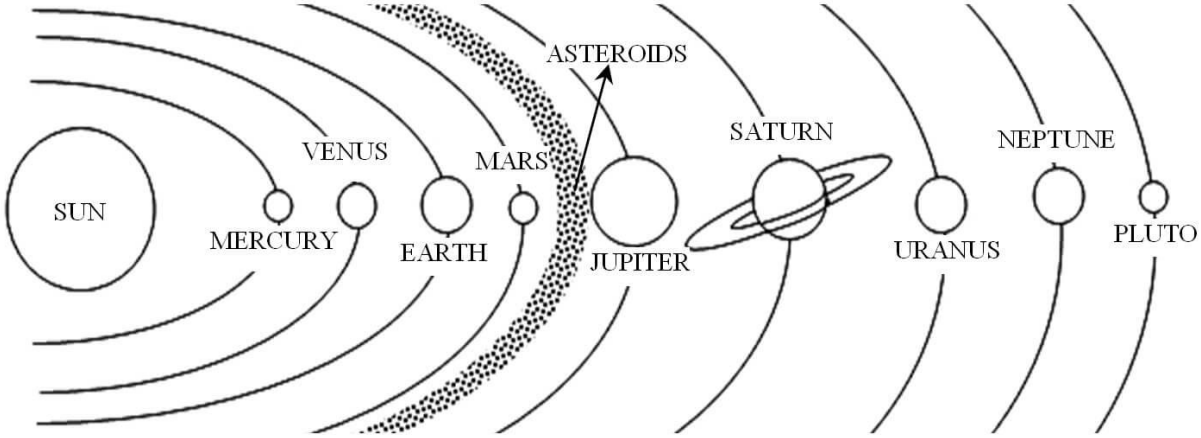

Figure 1: Schematic overview of the Solar System

2. **LEGO construction interface**:

   The proposed interface should allow for the construction of complex LEGO like structures. In particular, it has to enable the precise selection and manipulation of the building blocks, allowing for the construction of complex/huge structures. The main challenge is to increase the precision while selecting and docking blocks.

3. **Molecular docking interface:**

   The proposed interface has to enable the user to select and manipulate complex molecular structures. In particular, it has to enable the creation of new molecules by docking simpler molecules. The main challenge is to provide suggestions and/or guides to drive the docking process. You can assume that given two molecules, only a few valid configurations are enabled, some being more optimal (Fig. 2).

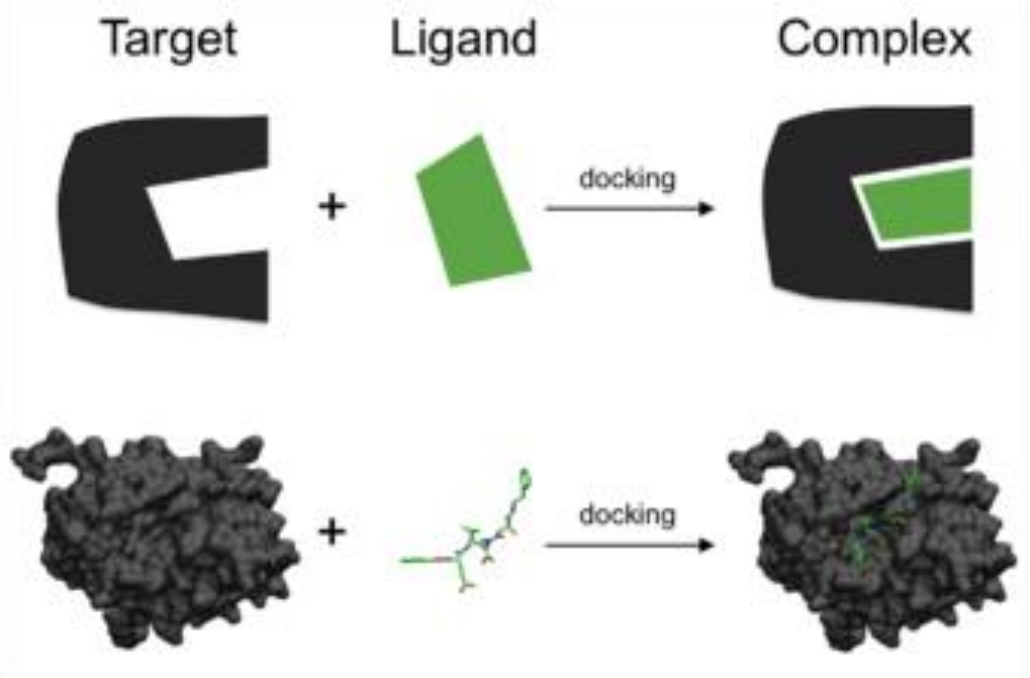

Figure 2: Schematic illustration of docking a small molecule ligand (green) to a protein target (black) producing a stable complex. In the field of molecular modeling, docking is a method which predicts the preferred orientation of one molecule to a second when a ligand and a target are bound to each other to form a stable complex.[

They want you to design ***two*** of the three use cases. For each use case, you will have to propose **two versions**, one with high immersion (with unlimited budget) and another with lower immersion (trying to optimize the tradeoff between the costs and the immersion).

We suggest you to start the design with the more complex version and then downgrade several of their components for the more "basic" version, but justifying their potential impact on the user's experience.

For each use case, you have to provide as many details as possible (e.g. hardware, control algorithms, interactions, feedback modalities) and the impact of your choices in the user's experience (e.g. immersion, presence, simulator sickness, embodiment, usability…).
The designed interfaces have to take advantage of multisensory interaction and feedback (combining at least two senses for interacting).

While describing your platforms, structure the discussion based on the perception-action loop presented during the course:

- What are the actions that the user has to perform?
- How these actions are translated into commands?
- What feedback provided by the system and how the user perceives it?

Describe the different components of the interfaces with text and drawings in order to increase clarity. You can assume that technical aspects rendering of the 3D scenes and the physical simulation are solved, and that you have unlimited access to any multimedia hardware (think big !). In addition, you should also provide few metrics to evaluate their performance and usability.

Finish the discussion for each solution by the viability of the system, and any potential unsolved issues that may remain.