Virtual and Augmented Reality

AR Project

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Introduction

We propose our application as an educational application which target are middle schools students.

The application consists of two different module; the first one is realted to chemistry and regards atoms and molecules, and the second one is about the Solar System and its planets.

To develop the application we used Unity with the Vuforia plugin. We use QR codes as AR markers. We created our own QR codes using an online generator.

Description

As we launch the application, we are shown the main screen in which we can select the module we want to play with.

Micro World

Micro World is the chemistry module. In this section users have the possibility to create multiple molecules from atoms. At the beginning each QR code, when captured by the camera, presents to the user a single atom. The atom is shown as its core and its electrons. The atom moves up and down while rotates around its local vertical axis. The electrons satellite around the atom core and the orbit configuratio is computed using a simplified version of Schrodinger equation.

Then, in order to create molecules from atoms the user has to put three atoms (application supports only three atom molecules) in the appropriate order. If that happens, the atoms bond: the side atoms move towards the middle one and the middle QR code takes care of displaying the molecule, that will also move up and down and rotates on itself. If any of the side QR code disappears from the camera view and appears again, it is presented as normal atom. If the QR code that is showing the molecule, the QR codes that we used for the bonding will show again the base atom.

In our application it is possible to create more than one molecule at the same time.

Due to Vuforia limitations, it would not be possible to use the same marker twice in the scene; but, since, for example, we needed to show two oxygen atoms, we found a workaround to actually use the same marker twice.

Molecules Available

Here is a list of the molecules that can be created and the atoms needed (the order matters):

- Carbon dioxide: oxygen, carbon, oxygen;
- Silicon dioxide: oxygen, silicon, oxygen;
- Dicarbon monoxide: carbon, oxygen, carbon;
- Hydrogen cyanide: hydrogen, carbon, nitrogen;
- Hydrogen isocynide: hydrogen, nitrogen, carbon;
- Sodium hydroxide: sodium, oxygen, hydrogen;
- Dihydrocarbon: hydrogen, carbon, hydrogen;
- Dihydrogen monxide: hydrogen, oxygen, hydrogen;
- Dihydrogen monosulfide: hydrogen, sulfur, hydrogen;
- Nitrogen dioxide: oxygen, nitrogen, oxygen;
- Sulfure dioxide: oxygen, sulfur, oxygen;
- Hydroperoxyl: oxygen, hydrogen, oxygen.

Macro World

Macro World is the Solar System module. For this part of application, we used smaller QR codes, since we tried to fit in the scene as many planets as we could to try to show the Solar System as it is.

If the camera caputes the QR Code, the cooresponding planet will appear and it will rotate around its rotation axis. In the case of Earth, the Moon will appear too, and it will rotate around its axis and around the Earth.

As soon as the Sun enters the scene, the plantes will start revolving around it. The revolution will last as long as its marker is present on the scene, even though the planet falls off the scene during the animation.

If the Sun is removed from the scene, the planets will go back on their own markers with their default behaviors.

The Sun has an emitting material and a point light inside: this illuminates the part of surface of the planets that is facing the Sun. The intensity of the light decreases with the distance; in fact farther planets are not hit by the light.