This manual provides information of the software and hardware requirements of StereoChem to the developers. It contains instructions on how to set up and run StereoChem on user's mobile.

Introduction

StereoChem is an Augmented Reality based mobile app, that allows learners to spatially visualize and interact with 3D molecular models. Visualization and interaction with molecules happens within the real space of the learners in relation to the objects lying around them. This offers enhanced spatial perception to the learner regarding the spatial orientation of atoms or groups of atoms in a molecule. This is critical in the learning of stereochemistry where just the difference in the spatial orientation of stereo chemicals gives rise different physical, chemical or biological properties. Given below are the screen components of Stereochem application.

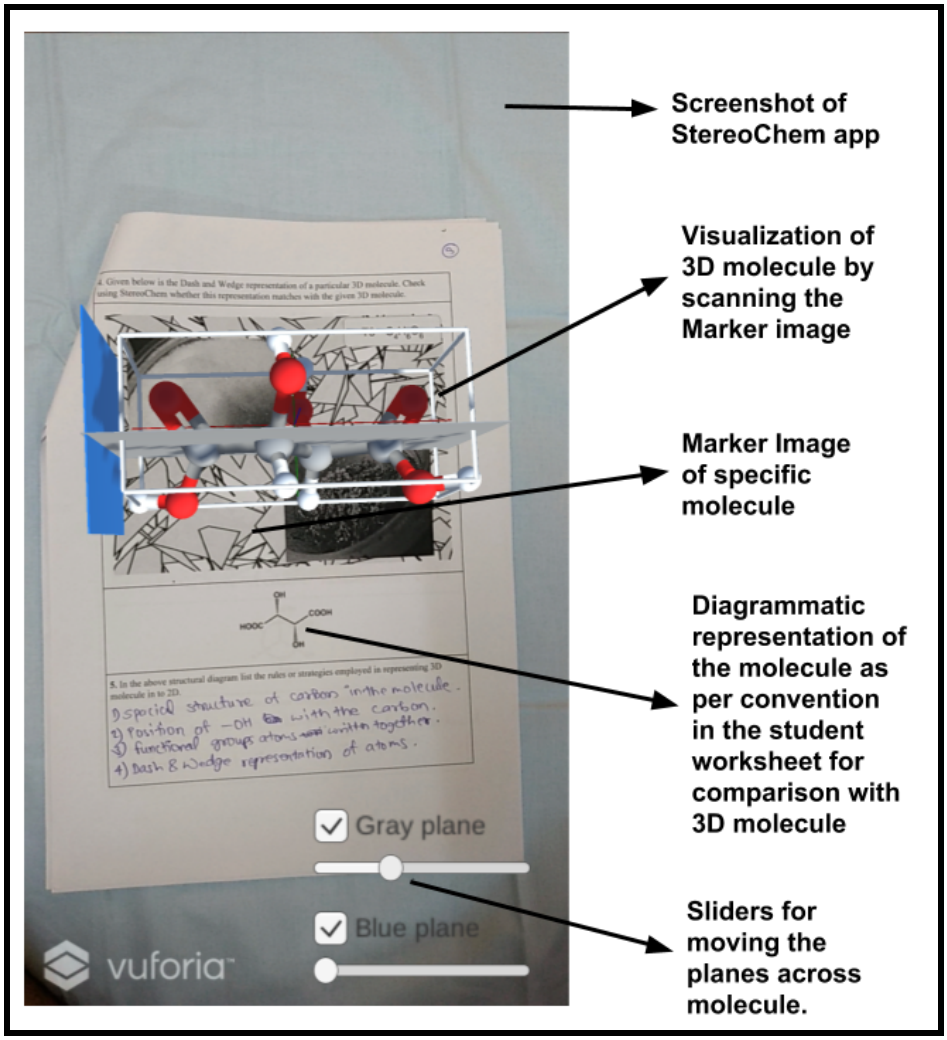

Fig 1: Screen components of StereoChem Application

StereoChem Architecture

The StereoChem app primarily operates in the following manner (fig 2) camera of the mobile scans the marker (or trigger) image of the chemical formula or its 2D representation and sends it to the app in the mobile. The app renders pre-programmed digital object for that image and projects it on to the mobile screen, overlaying it upon the existing image, and this way it is able to give the 3D visualization of the spatial arrangement of molecules in the real space of the observer.

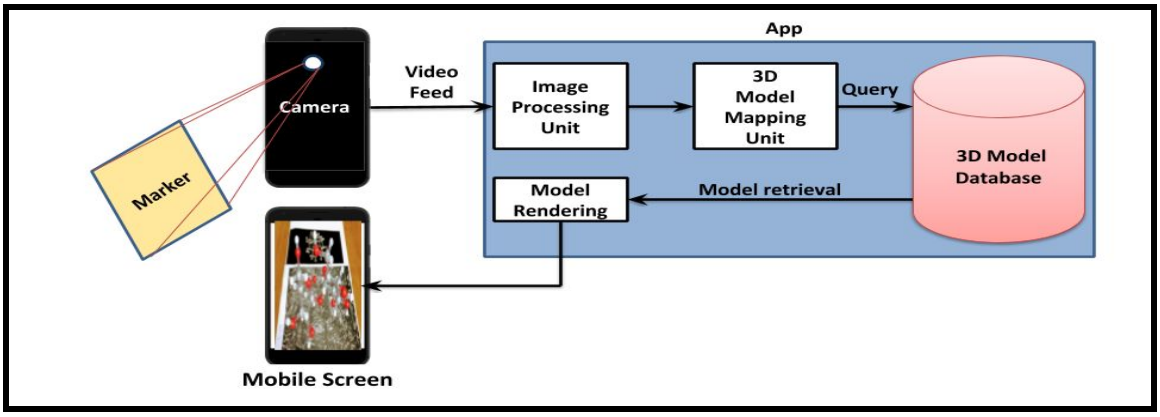

Fig 2: StereoChem Workflow Diagram

Stereochem App Creation Process

Figure 3 shows app creation process. The marker images of the chemical molecules were first uploaded to Vuforia package and then imported to Unity project. Then, 3D chemical structures (or models) were imported from online Jmol library to Unity project. The marker images were then mapped to the respective models imported from online Jmol library. After mapping, the project was exported as apk file to the system and then transferred to an android based mobile device.

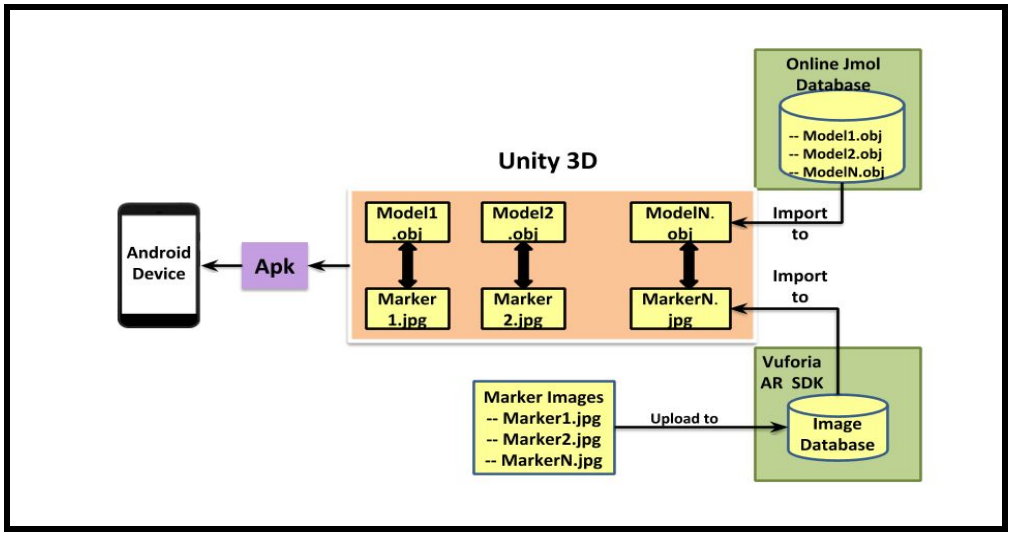

Fig 3: StereoChem App Creation process

Requirements needed to use StereoChem

1. An Android mobile
2. StereoChem app
3. Marker images mapped to molecules

Steps to install StereoChem on your mobile.

1. Download the StereoChem zipped folder.
2. Extract the zipped folder on your computer.
3. Copy APK file to your android mobile.
4. Click on the APK file to open and install the StereoChem app in your mobile.
5. Get printout of all the marker images of molecules.

Steps to run StereoChem on your mobile.

1. After the installing StereoChem, open the app in your mobile.
2. Then using StereoChem app, scan the marker image one at a time to visualize 3D molecule.
3. To rotate the molecule along X-axis, use two fingers to swipe on the mobile screen.
4. To rotate the molecule along Y-axis, rotate the marker image horizontally.
5. To zoom in or zoom out of the visualized 3D molecule move the image marker nearer or farther from the mobile screen.

Operating guidelines:

1. Learners should keep their hands free by placing mobile or tablet devices on table using holders while using the StereoChem app. This lets learners to use their one hand to rotate the marker while the other to simultaneously write 2D symbolic diagrams by examining molecules in the Stereochem.
2. StereoChem may not scan the marker image properly when used near direct sources of light. So try reducing the intensity of light nearby for ease of use.
3. Do not fold the marker images. If there are lots of folded marks on the marker Image then StereoChem may not scan it properly.
4. Photocopies of marker images will work as good as the printed ones.

Reference to the Code -

1. GitHub link to the code of your project.
    a.
2. Link to the Jmol which is a free, open source molecule viewer for students, educators, and researchers in chemistry, biochemistry, physics, and materials science. It is cross-platform, running on Windows, Mac OS X, and Linux/Unix systems.
    a. http://jmol.sourceforge.net/
3. Link to Vuforia where we can create database of AR marker images.
    a. https://www.vuforia.com/
4. Link to Unity3D where we can create an AR app
    a. https://unity3d.com/

Additional Reference -

Swamy, N. Chavan, P. S. & Murthy, S. (2018), StereoChem: Augmented Reality 3D Molecular Model Visualization App for Teaching and Learning Stereochemistry, IEEE International Conference on Advanced Learning Technologies.

People Involved

Conceptualization & Design of StereoChem App	Narasimha Swamy K L, Research Scholar Pankaj S Chavan, Research Scholar Prof. Sahana Murthy
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