

# VR Project Report: Chemistry VR Lab

10/16/2023

## Introduction

This project report provides an extensive overview of the **Chemistry VR Lab**, a virtual reality application that enables users an engaging and educational experience. The fundamental goal of this application is to provide an immersive platform for learning about a chemistry concept via conducting a simple diffusion experiment, however, ensuring the user an interactive experience.

## Project Objectives

The core objectives of the Chemistry VR Lab are as mentioned:

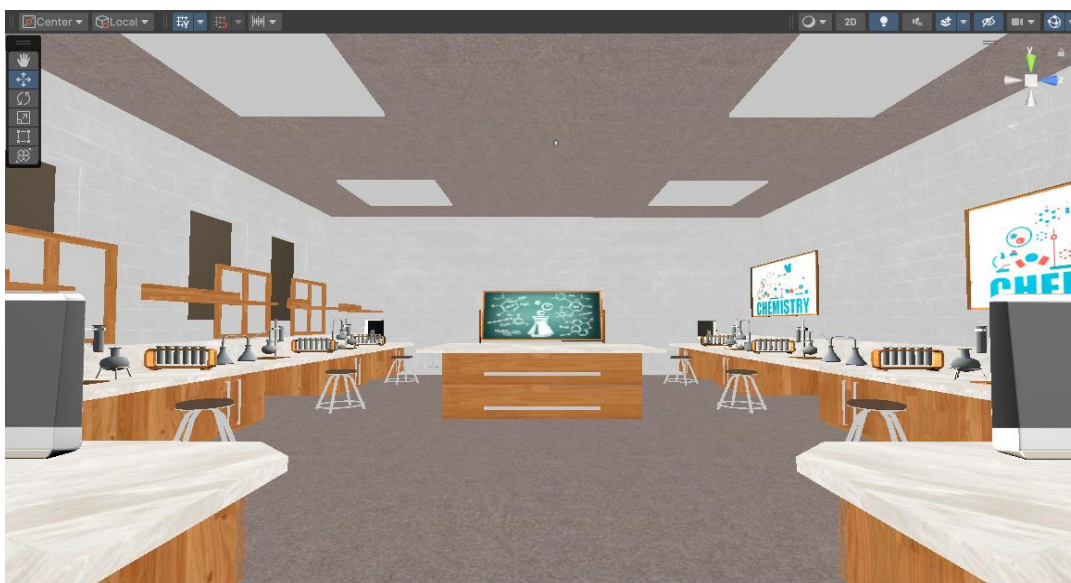
1. **Immersive VR Experience:** Develop a highly immersive VR environment that closely relates to an experience of a chemistry laboratory.
2. **Dynamic Design:** Designed the VR Lab by adding two different scenes to make It more realistic and participating for the user.
3. **Experiment and Explore:** Allow users to understand and experience the fundamentals concepts of chemistry such as color properties on reaction with distinct chemicals and their atomic symbol
4. **User Interaction:** Implement dynamic controls using the VR controllers such that users can interact with various laboratory equipment, chemicals, and perform the experiment.
5. **Educational Value:** Enhance the learning experience by providing precise information about chemical elements, their reactions and its procedure.
6. **Spatial Audio Feedback:** Enable spatial audio to create a realistic auditory environment, enhancing user engagement.
7. **User-Friendly Design:** Ensuring the application is user-friendly, with intuitive and dynamic controls with a user guide to assist navigation in the virtual lab.

8. **Performance Optimization:** Enhance the application's performance to provide seamless VR experience, targeting a frame rate of 60 plus FPS or higher so as to meet the industry standards.

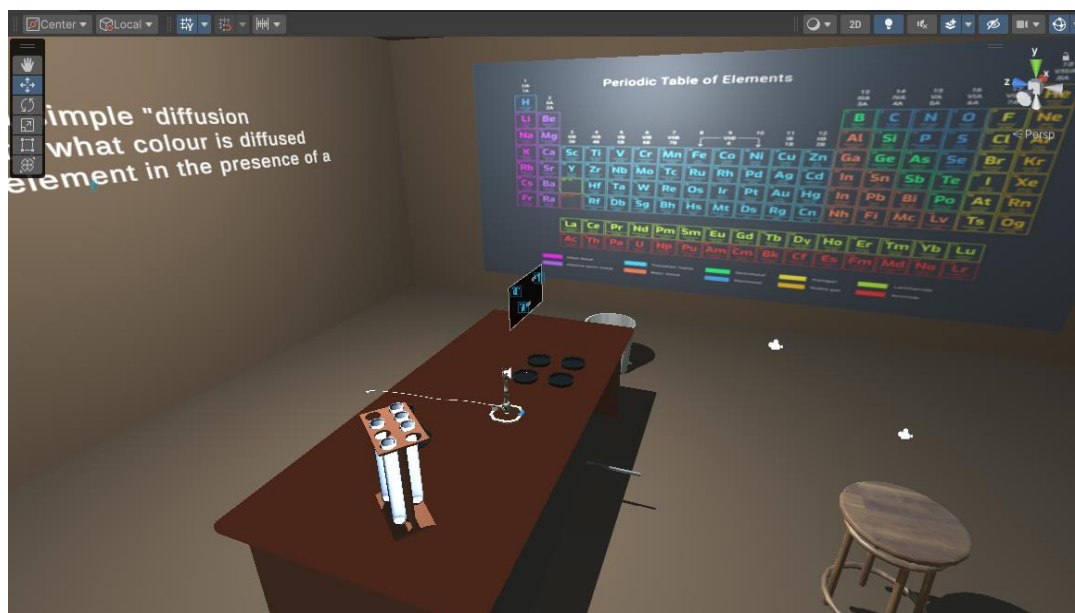
## Development Overview

### 1. Virtual Laboratory Environment

- Asset Integration and modelling: Designed and utilized few pre-existing 3D models and assets to build a sophisticated virtual chemistry laboratory environment.
- Consistency through 3D modelling: Not all the assets were available on unity asset store, in order to fix this issue, many third-party websites like are used to model and construct various textures and its materials to avoid rendering errors.



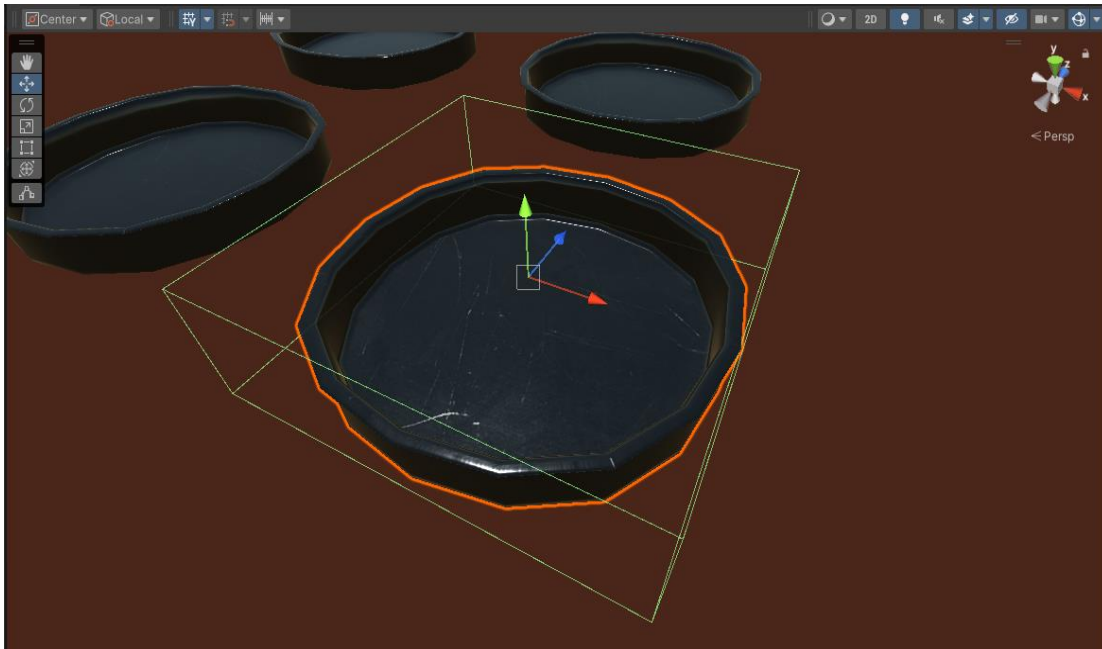
*The above and below images are the representation of the VR Lab which are designed on the Unity engine. This includes various assets such as Monitors, Table and Chairs, Chalkboard, and other Lab equipment. Few assets were downloaded from unity store while some were re modelled to uplift user experience.*



## 2. VR Interaction

- **6DOF Support:** Implemented assistance for devices with six degrees of freedom, allowing users to control their motion in their desired direction whilst providing smooth interactions.
- **Controller Interaction:** Users are enabled to interact with laboratory equipment to perform the experiment facilitating interaction with controllers.

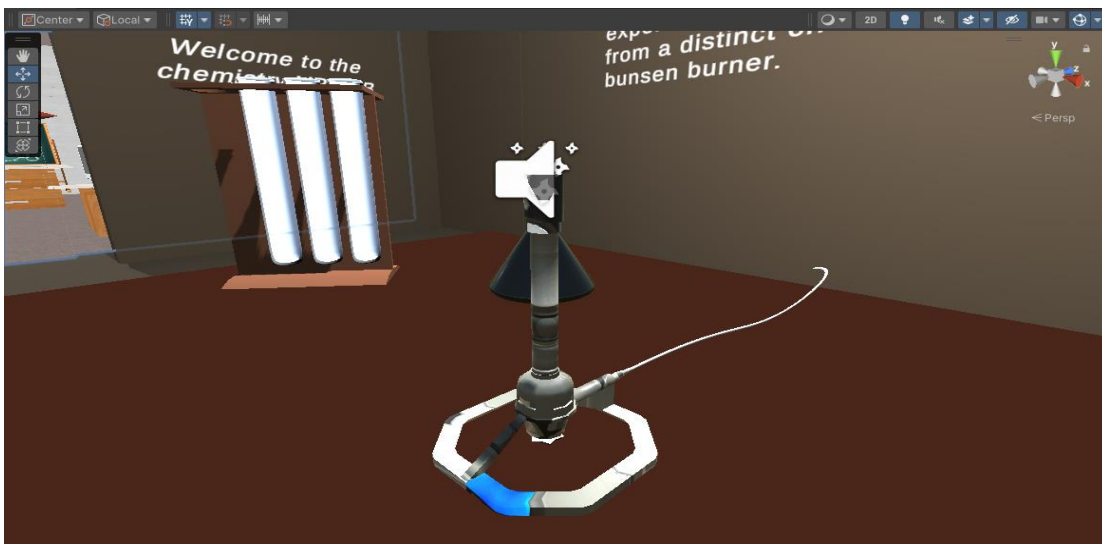




*The above images display two collider boxes which supports interaction between lab equipment, facilitating real time user interactions.*

### 3. Spatial Audio

- Sound Design: Incorporated spatial audio to recreate the sounds of laboratory equipment to create intense engaging experience.

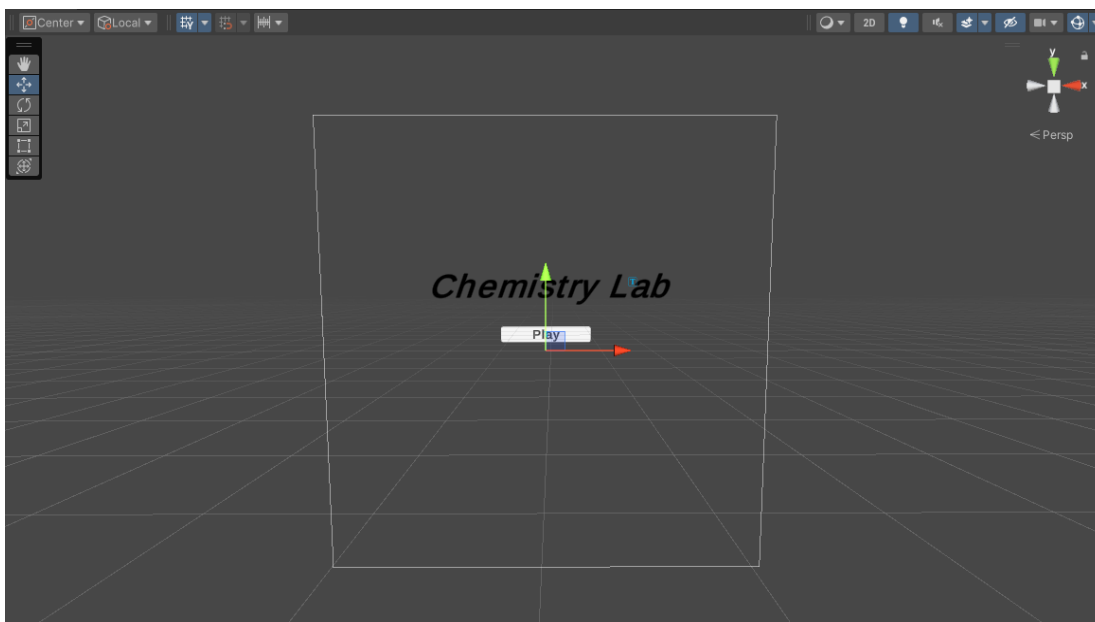


*The above image is representation of an audio property embedded in a Bunsen burner. As the user interacts with its flame, they can hear the 6D audio to provide additional user experience.*

#### 4. User Interface and Design

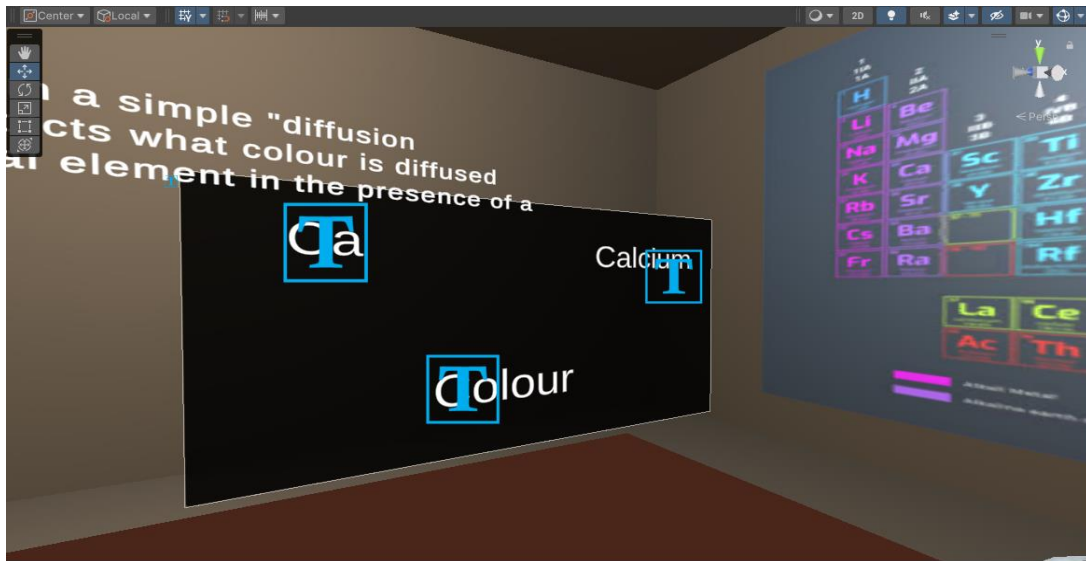
##### Starter Scene:

- As the application is launched the user is taken to a starter scene. The user can progress to the main VR Lab by pushing the right trigger on the right VR controller by aligning the ray Interactor on the “Play” button.
- Once the trigger is pushed, kindly wait for couple of seconds until the transition occurs to progress into main scene.



##### In Game:

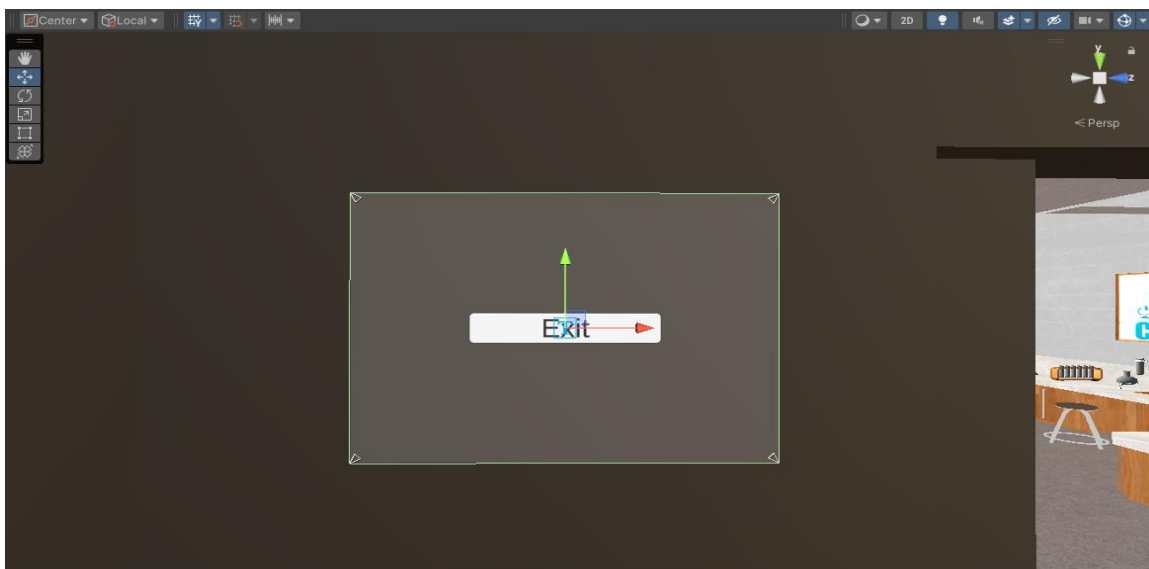
- The In game scene is where the user can perform the main experiment, additionally, it allows user to move around the free space.
- HUD Design: Designed a Heads-Up Display (HUD) for users to acknowledge basic information such as experiment result, element/color details and atomic symbol.



*The above image displays the properties of the chemical element such as atomic symbol, its color which can be a significant representation in the aspect of HUD design.*

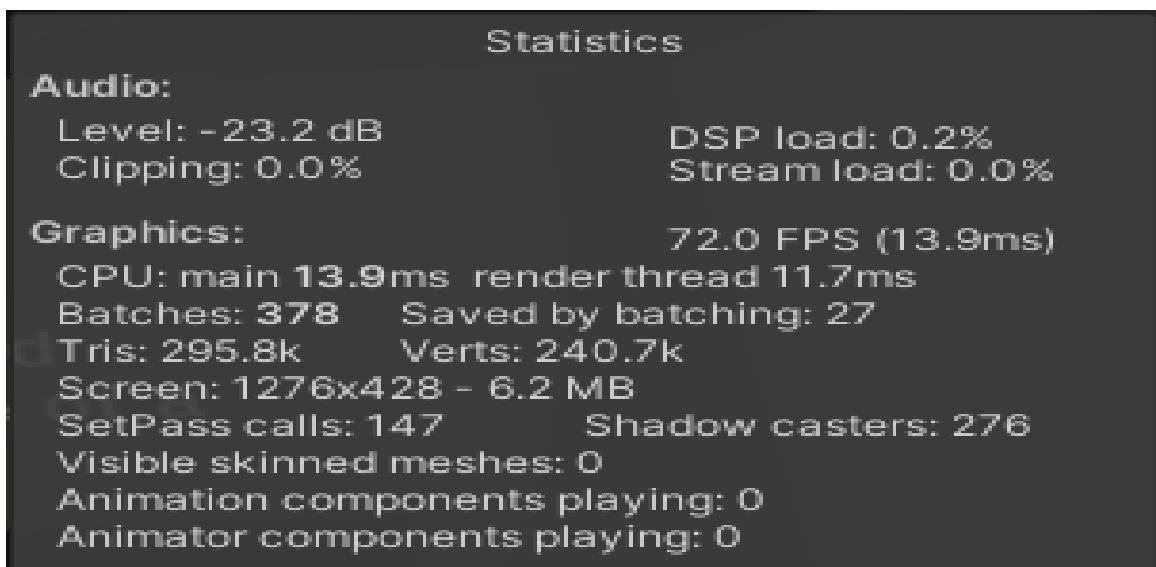
#### **End Scene:**

- After the main experiment is performed the user can now end the application and return to menu by progressing towards the exit panel which is placed towards the left side in the main lab.
- By using the left VR controller, the user can push the left trigger on it by aligning the ray interactor on the “Exit” button.



## 5. Performance Optimization

- **Optimization Techniques:** Various optimization techniques are utilized, such as texture compression, efficient pipeline rendering, and script optimization.
- **Cross Platform Integration:** Successfully achieved cross integration functioning of this application making it platform independent for swift user experience.
- **Frame Rate:** Formulated to develop the VR application supporting at best 60 FPS frame rate to ensure a seamless and shutter free VR experience.



### Impact of Scientific Learning

The Chemistry Virtual Reality Lab is an effective teaching tool that enables users to explore and thoroughly understand intricate chemical concept, as one shown in this application in an interactive and informative manner.

Users may gain knowledge and explore more effectively because to the extensive details it provides regarding chemical elements, their properties and laboratory techniques.

**Conclusion:**

The Chemistry VR Lab thus combines immersive VR technology, educational value as a part of scientific learning allowing interactive engagement for the user. It allows users to virtually engage and experiment with chemical elements in a fascinating manner. As this project continues to develop, it will remain an important resource for providing scientific learning for users interested in the world of chemistry and experimentation.

**Learned Objectives:****1. C# Scripting Proficiency:**

- Understand in depth usage of C# programming.
- Develop the ability to write, test, deploy and debug C# scripts for various applications and purpose.

**2. Understanding Chemical Reactions and Its properties**

- Understand the concept of diffusion reactions in few elements.
- Classify the visual chemical changes, such as color properties.
- Learn about atomic symbols of displayed chemical elements.

**3. Blender 3D Modeling Skills:**

- Master the basics of 3D modeling in Blender to create additional assets as required.
- Create various 3D objects and textures in Blender for use in the main project.

**4. Unity Game Development:**

- Developed an understanding of how to use the unity engine for development and UI.
- Understand the main principles of game development and its various properties.



## **5. Audio Integration**

- Discover various components in the unity engine for incorporating audio into main project and integrating other audio scripts from readily available third-party sources.

## **6. Project Planning and Execution:**

- Analyze and practice various project management skills which include setting objectives and timeline management.
- Enhance distinct problem-solving abilities via analyzing outcomes of experiments and generating inferences.