

# GRAFFITI PAINTING FOR VR

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VERSION 1.0

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## Introduction

From the ancient times, Graffiti has been an art form with global presence. The art of Graffiti had existed during the times of Ancient Egypt, Ancient Greece, and the Roman Empire. Even during the present times, it's appeal is only growing. Although the art's applications are diverse, it has also been used to express underlying social and political message in a society. It's one of the cheapest art form costing almost nothing to get started. In modern times, spray paints and marker pens have become the most common graffiti materials. And the canvas for painting ranges from street walls to buildings to any surface which can be applied with Graphics. Despite its simplicity, Graffiti has served as a powerful tool of expression for the subjects being applied to. In some cases, it had even silently engineered revolutions.



(a) Ancient Graffiti

### Graffiti of Street artists:

Modern Graffiti are drawings or inscriptions on walls or other surfaces that are performed usually without permission and to be seen by the public. There are some countries in the world where painting graffiti outside, on designated areas is prohibited. This art form has emerged to be enthusiastic among the youths and has numerous fans across the globe. In Singapore, performing graffiti outside designated areas may lead to a jail sentence. In contrast, Croatia renamed one of their railway bridge into 'Hendrix Bridge', based on the graffiti that enthusiast drew in the middle of the bridge. Graffiti has established itself across every society as the art of common man and thrives despite continued resistance.

The dawn of a new era is upon us – one of full immersion into digital world through virtual reality. So why not take this great art to virtual world? After all, the goal in Virtual Reality(VR) has been to replicate every form of reality in the virtual world. Graffiti painting is one perfect application for creating a real-world experience using the state of art VR devices like Oculus rift or HTC Vive.



(b) Modern Graffiti

## High Concept

In this project, we chose to use HTC Vive to create an awesome application for Graffiti painting. The idea was inspired from “Kingspray Simulator”, a VR application for HTC Vive. The goal is to create a virtual environment where graffiti enthusiasts can get a chance to test their skills in the virtual space. The two wands in Vive serve as hands of the artist, the left one as a color picker and the right as sprayer. A canvas wall was created with the embedded property to accept spray paints. The artist with the Vive can move around the canvas to create his piece of art.

## Application Design

The two main components of the application are,

- City Exterior environment
- Painting Canvas

### Software Used:

Unity 3d, Steam VR

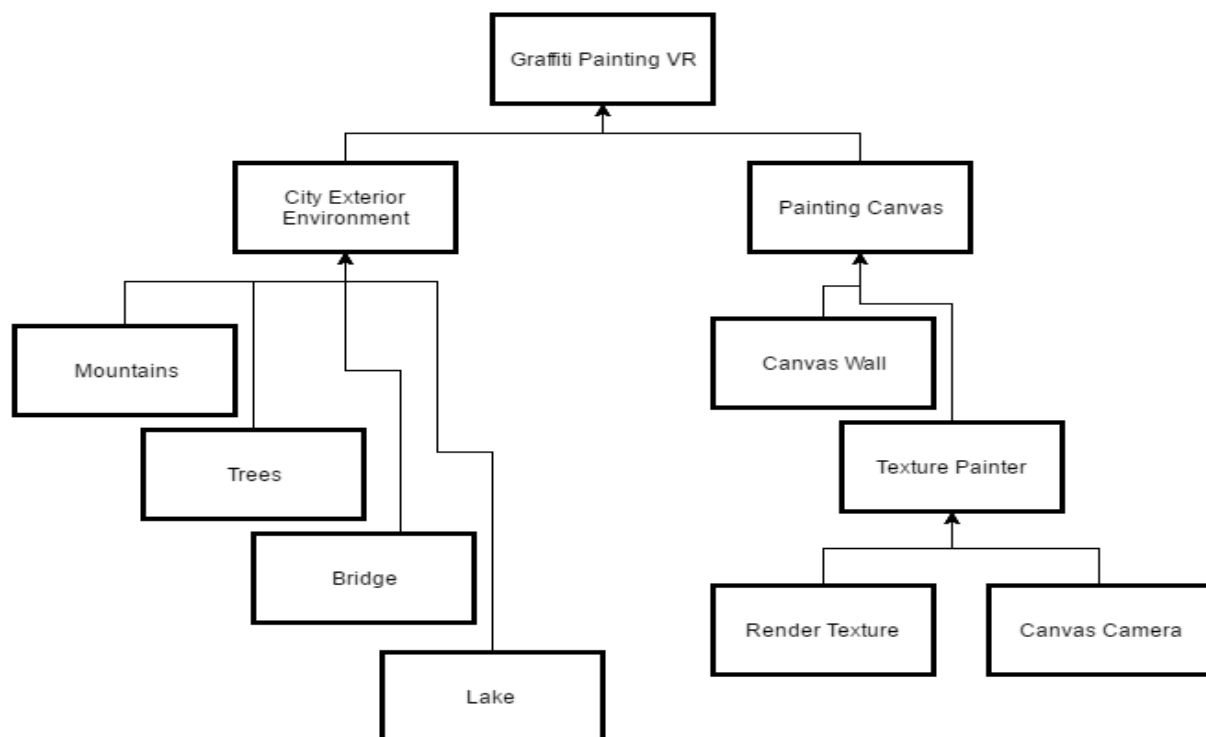
### City Exterior environment:

This serves as a background for the scene. Since the application is targeted for an artist, the environment had to be chosen accordingly. The art of graffiti can happen anywhere and not necessarily confined to an environment. Hence, a typical artist’s preferred place of inspiration is chosen. The environment has elements of Mountains, trees, lake and a bridge representing that of a city exterior. The artist is placed along the road overlooking the elements of the scene.

### Painting Canvas:

The artist paints on a huge wall in front of him. A plane was created as a game object in Unity 3d and embedded with the property of canvas using Render texture. Render textures are textures that can be rendered to and act as pseudo canvas. The paintings first happen on this texture before being transferred to the target wall through the canvas camera. The canvas camera creates an orthographic projection of the rendered texture. Multiple canvas objects can be created this way.

Architecture overview:

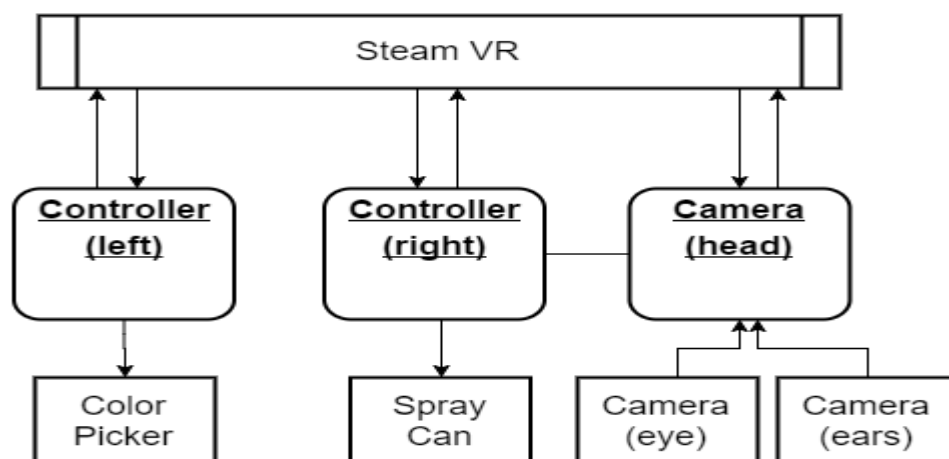


## Integration with VR

The challenge here was to make the painting happen in virtual space. Since the developed application was for HTC Vive, we had to use the libraries provided by Steam VR. HTC Vive has three components to write code for, namely

- Controller(left)
- Controller(right)
- Camera(head)

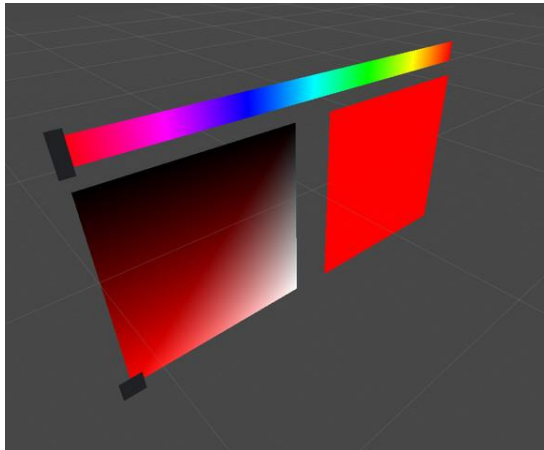
Architecture overview:



In the application, the artist controls the 'Color Picker' and 'spray can' using left and right controller respectively. The Camera(head) is used to render the actual scene along with some background sound.

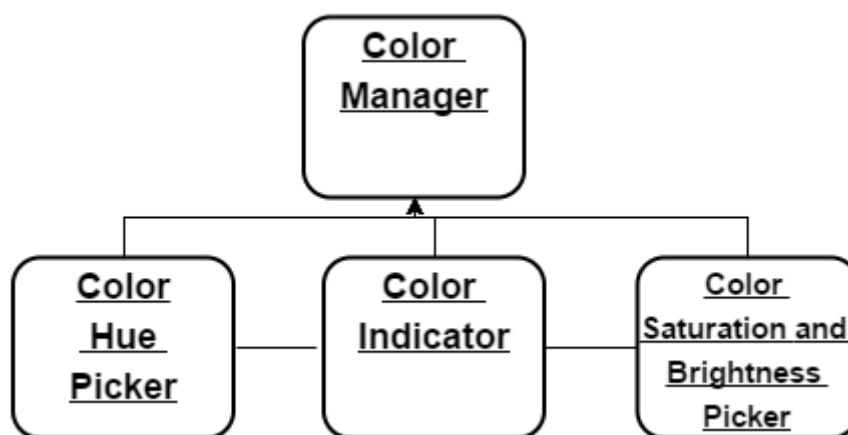
#### Controller(left):

The artist holds the 'Color Picker'(CP) using the left Controller. The goal is to vertically align CP along the axis of the controller. Along with, making CP a child of the controller will ensure that all the movements of the artist's left hand are correlated with the movement of CP. He will get a complete view of the CP by bringing the controller to his front side.



The Color Picker is a combination of three core elements,

- Color Hue Picker
- Color Indicator
- Color Saturation and Brightness Picker



Color Hue Picker displays the spectrum for the user to pick from. For the convenience of the user, the spectrum display is made draggable. The selected hue is then picked by Color Saturation and Brightness Picker to process and set the possible output colors. This component too is made draggable with each drag producing the final color in the Color Indicator. A Color Manager is made the parent of these three components acting as a mediator. It is here that the final color is produced after all the processing.

### Controller(right):

The right controller serves two purposes. First, it lets the user spray on the wall using the spray can. This is achieved by making the object of 'spray can' a child of the controller. Second, using the laser pointer, it enables the selection of colors from color picker. This interaction is made possible by Draggable script.

### Draggable-Property:

The user can drag on two components of the color picker(having Box Collider) using the raycast from right controller. The draggable script waits for the trigger input from the controller and sets the thumb position according to the dragged values. This effectively changes color in color indicator.

### Camera(head):

The actual projection of the scene to the user happens using the head camera. The properties of this camera are tuned for VR display. Also, the camera has an audio listener to project the sounds from the scene to the user.

### Texture painter:

This script is the heart of the application integrating all the components together to achieve the target action of painting. The following are the main objects passed as arguments,

- SteamVR\_TrackedObject(rController)
- Camera (canvasCamera)
- Sprite (cursorPaint)
- RenderTexture (canvasTexture)

The selected color from the Color Manager, passed on as singleton instance is set to variable brushColor. Having set the color, the script waits for input from the trigger of right controller to begin the action of painting. On receiving the trigger, it first computes the position and distance in the world space using raycast. The distance calculated is used to set the size of the painting brush. To simulate the action of spray, the size is small when the user is close to the wall and increases exponentially as he moves away. Every trigger from the right controller creates a brush object. These objects are rendered as Orthographic projections to the target canvas by the canvas camera("target texture" property set to RenderTexture). This will make the camera render into a texture instead of rendering to the screen.

## Conclusion

In the undertaken endeavour, we were able to develop a cool application that showcases the potential of VR to replicate real world. In the past, our approach to VR was more theoretical which didn't do justice to the technology it really was. It's said "You have to experience to believe it". We experienced the true VR by developing one, that which used most of the features from the State of art. For sure, it serves as an inspiration to the future possibilities in virtual space.

## Future work

We plan to improve the project by adding more features such as:

- Multiplayer support
- Ability to take pictures of art.
- Ability to pick location and teleportation to that location
- Adding more realistic simulation
- Undo and Redo spray on the wall.

## References

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<https://www.assetstore.unity3d.com/en/#!/content/7353>
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