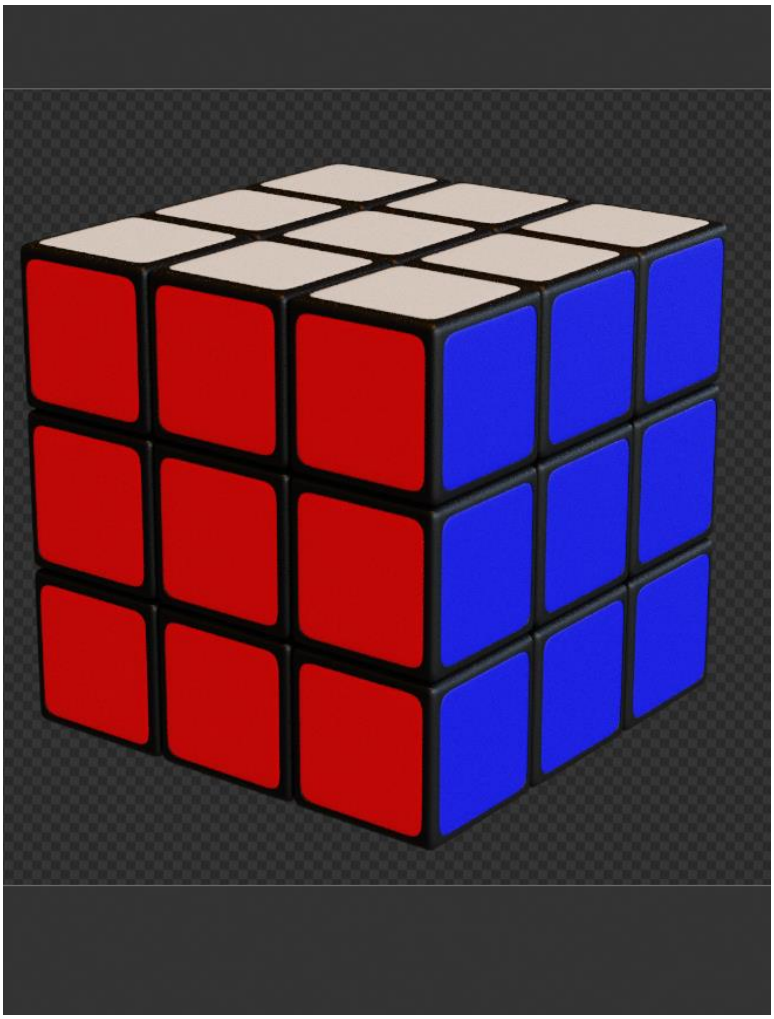

Rubik's Cube 3D Model

MAKING AND ANIMATION

Blender Benders | Computer Graphics | 15-01-2025

Contents

PROJECT

RUBIC CUBE 3D MODEL AND ANIMATION

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INTRODUCTION

The Rubik's Cube is one of the most iconic and widely recognized puzzles in the world, invented in 1974 by Ernő Rubik. This fascinating 3D combination puzzle has captivated millions with its complex yet rewarding challenge of aligning colors on all six faces. Beyond its recreational use, the Rubik's Cube has become a symbol of problem-solving, mathematical theory, and even artistic expression.

In the realm of 3D modeling and animation, creating a Rubik's Cube serves as an excellent project for learning fundamental design principles, material application, and animation techniques. This project aims to replicate the Rubik's Cube with meticulous attention to detail, using Blender as the primary tool. By combining precision modeling with dynamic animation, the goal is to produce a realistic, visually appealing representation of the puzzle that can be used for educational or entertainment purposes.

This report outlines the step-by-step process for creating a Rubik's Cube, starting from building a single cube unit, adding the iconic six colors, assembling the cubes into a 3x3 grid, and finally animating it to simulate realistic twisting movements. The project not only demonstrates the technical aspects of 3D modeling and animation but also explores the creative potential of bringing a static object to life through motion.

OBJECTIVE

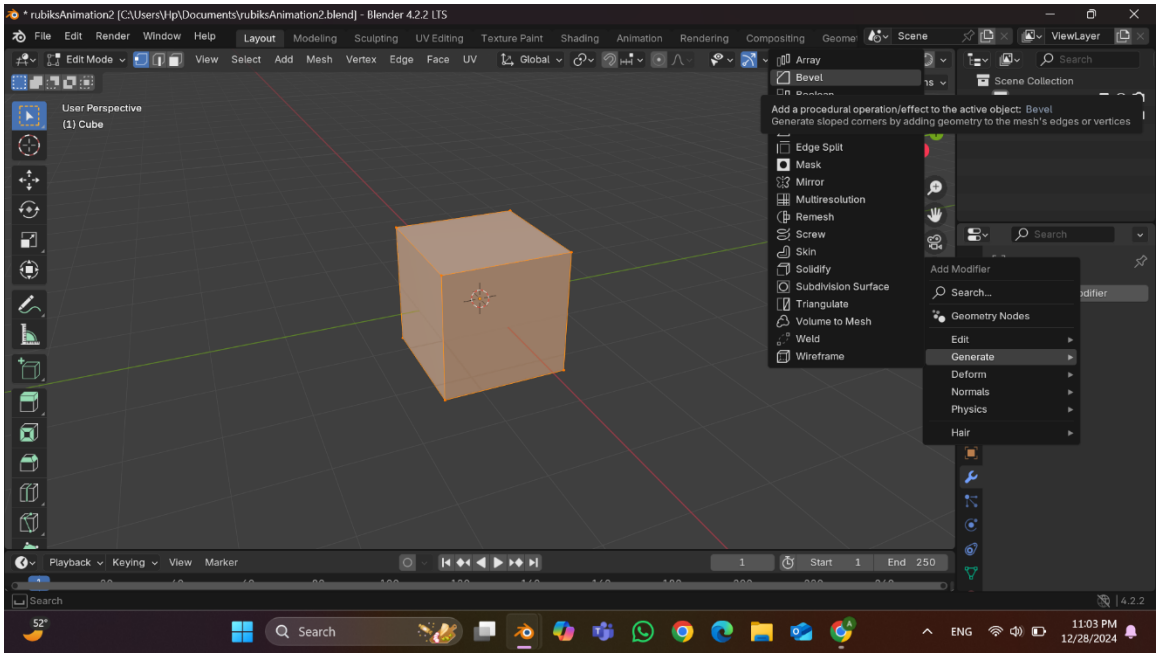
To create a visually accurate and animated 3D Rubik's Cube, the objectives include:

1. Designing a single cube unit.
2. Adding accurate colors to its faces.
3. Assembling the unit into a 3x3 cube.
4. Setting up the pivot for central rotation.
5. Animating the cube to simulate realistic movements.

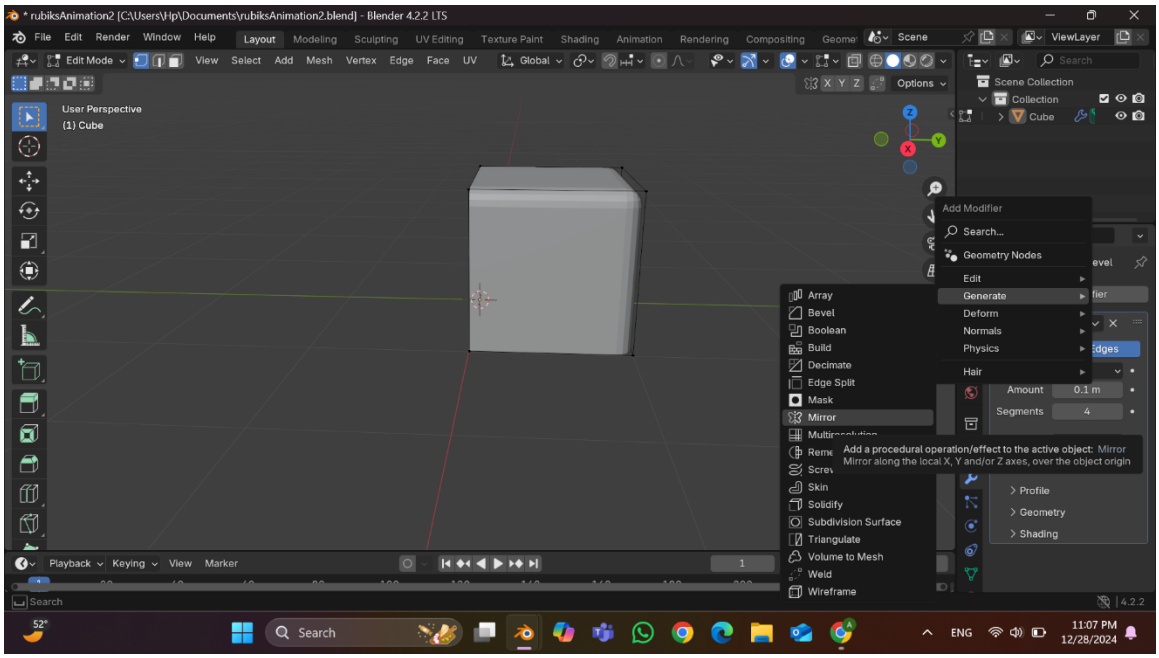
METHODOLOGY

1. Setting Up One Part of the Cube

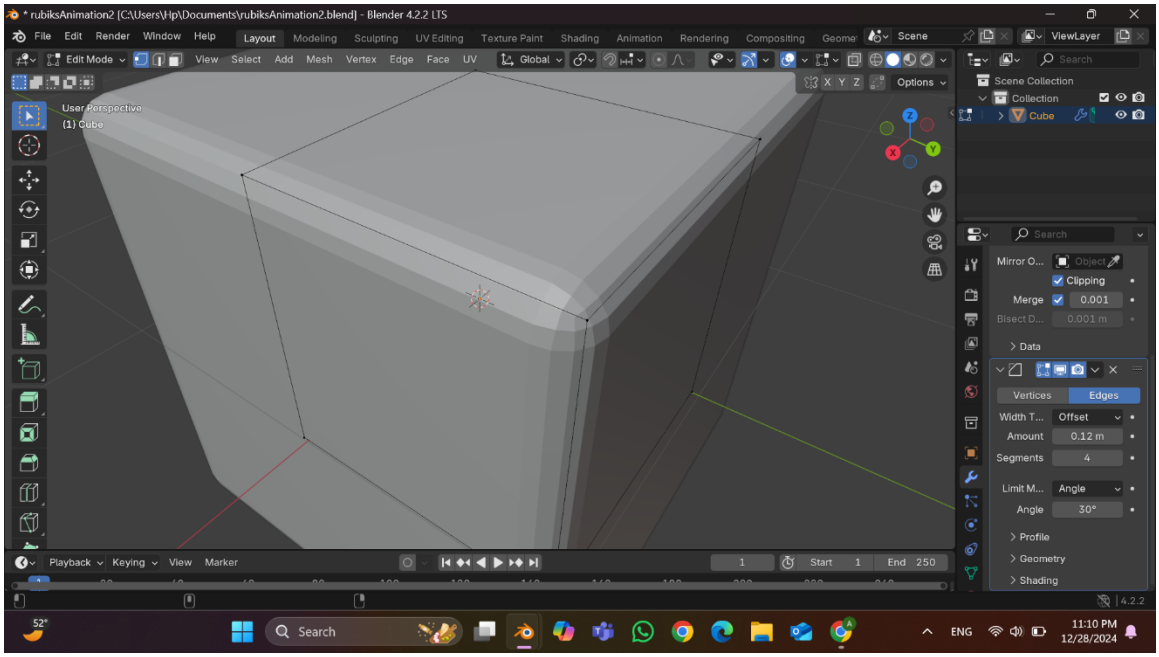
- **Creating the Base Cube**:
  - A cube was added by pressing **Shift** + **A** and selecting **Mesh** > **Cube**.
  - The cube's dimensions were scaled using **S** to adjust its size to the desired proportions.



- **Beveling the Edges**:
  - The edges were rounded slightly to match the real Rubik's Cube by selecting the edges in **Edit Mode (Tab)** and pressing **Ctrl** + **B** for beveling.
  - The mouse was used to adjust the bevel width, and the scroll wheel controlled the number of bevel segments.



- **Creating Grooves for Face Separation**:
  - In **Edit Mode**, the top face was selected by hovering over it and pressing **3** (face selection mode).
  - The face was subdivided into nine equal parts by right-clicking and choosing **Subdivide** or using **Ctrl + E > Subdivide**.



To emphasize the separations, edges between tiles were inset using **I** (Inset Faces).

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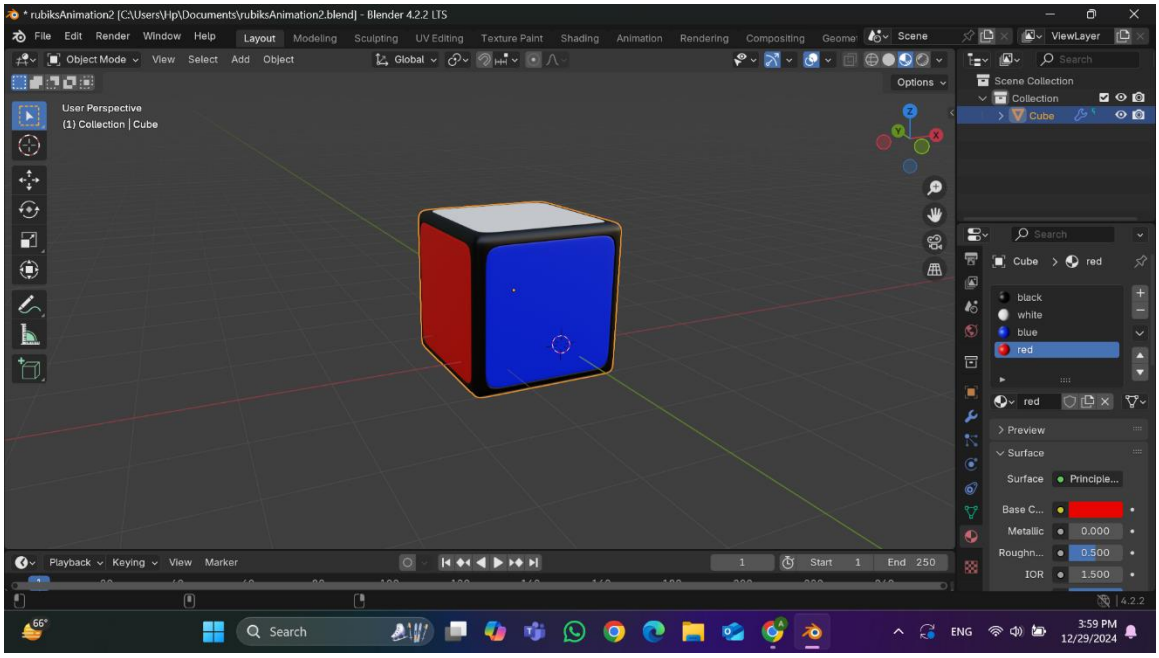
2. Coloring

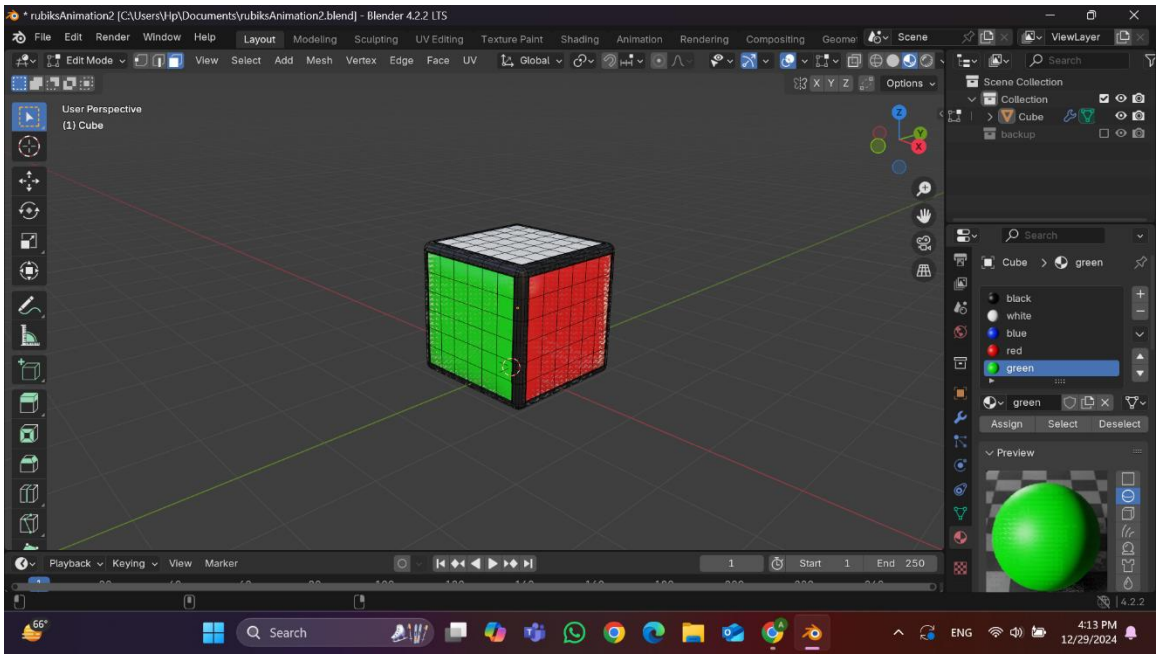
Creating Materials for Each Color:

- Open the **Material Properties** tab in the right-hand menu.
- Click + **New** to create a new material for the first color (e.g., red).
- Set the **Base Color** to red using the color picker or input RGB values.
- Repeat this process to create five more materials for the remaining colors: green, blue, yellow, white, and orange. Each material should be named for easy identification (e.g., "Red," "Green," etc.).



Assigning Materials to Cube Faces:

- In **Edit Mode (Tab)**, press **3** to enable face selection mode.
- Select one face of the cube by clicking on it.
- With the desired face selected, click on the appropriate material in the Materials list and press **Assign** to apply it to the face.
- Repeat this process for all six faces of the cube, ensuring each face has a unique color.



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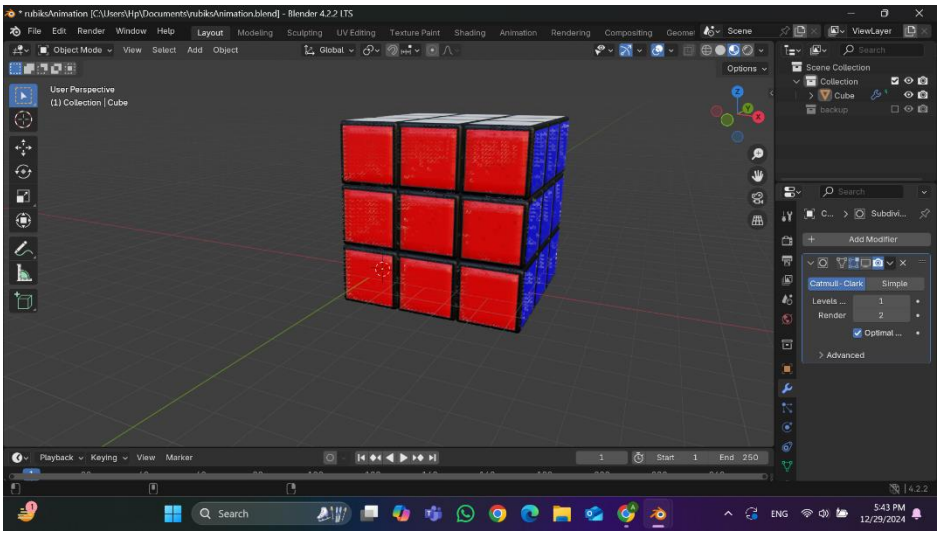
3. Setting Up a 3x3 Grid of the Cube

- **Duplicating the Cube**:
  - The single cube was duplicated using **Shift + D** to create eight additional cubes.
  - These were aligned into a 3x3 grid using the **G** (Grab) key for positioning.
  - **Snap (Shift + Tab)** was enabled to ensure perfect alignment.
- **Stacking the Layers**:
  - Once the first layer was completed, it was duplicated by selecting all the cubes in the layer (**A**) and pressing **Shift + D**, then moving it upward along the Z-axis using **G + Z**.



  - This process was repeated to create three layers, forming a complete 3x3x3 cube.

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4. Pivoting to the Center Part of the Cube

- **Setting the Pivot Point**:
  - The pivot point was adjusted to the cube's center by selecting the entire cube assembly, pressing **Ctrl + A**, and choosing **Set Origin > Origin to Geometry**.
  - The 3D Cursor was centered using **Shift + S > Cursor to World Origin** to align it with the global center.
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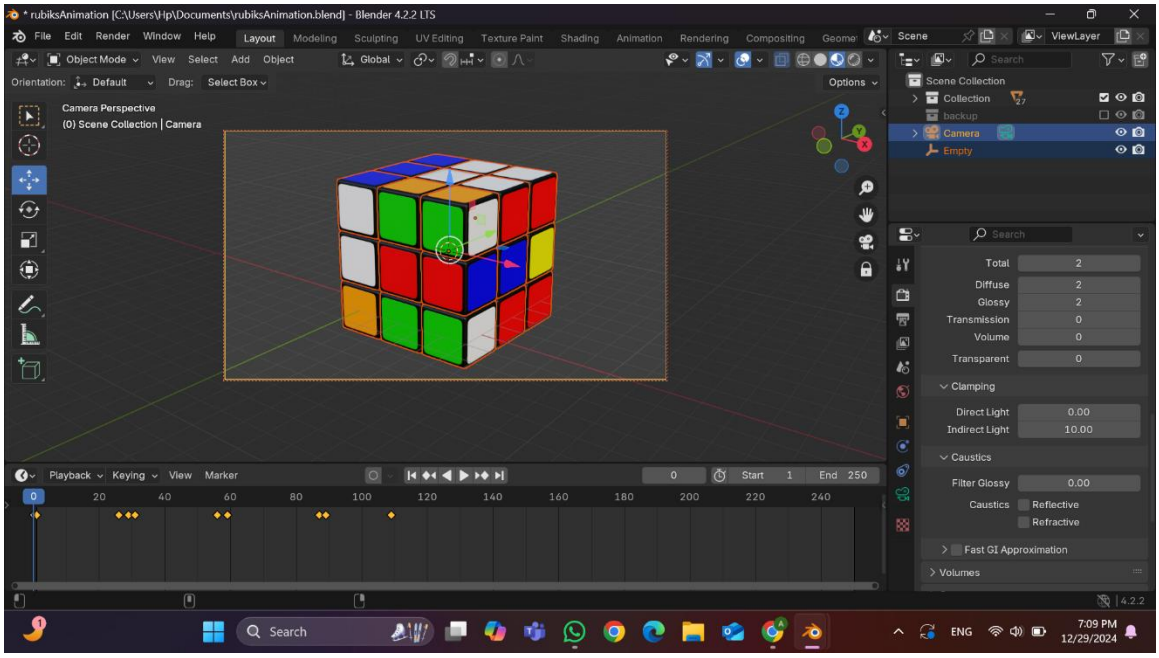
- **Testing Rotations**:
  - Individual layers were rotated using **R** (Rotate), and axis constraints (**X, Y, Z**) ensured movements were smooth and realistic.

5. Animation

- **Creating the Animation Sequence**:
  - Animation was initiated by pressing **Shift + Space** to play the timeline.
  - Keyframes for rotations were added by selecting the layer to animate, pressing **I**, and choosing **Rotation**.
  - At regular intervals (e.g., every 15 frames), new rotations were applied and recorded with additional keyframes.



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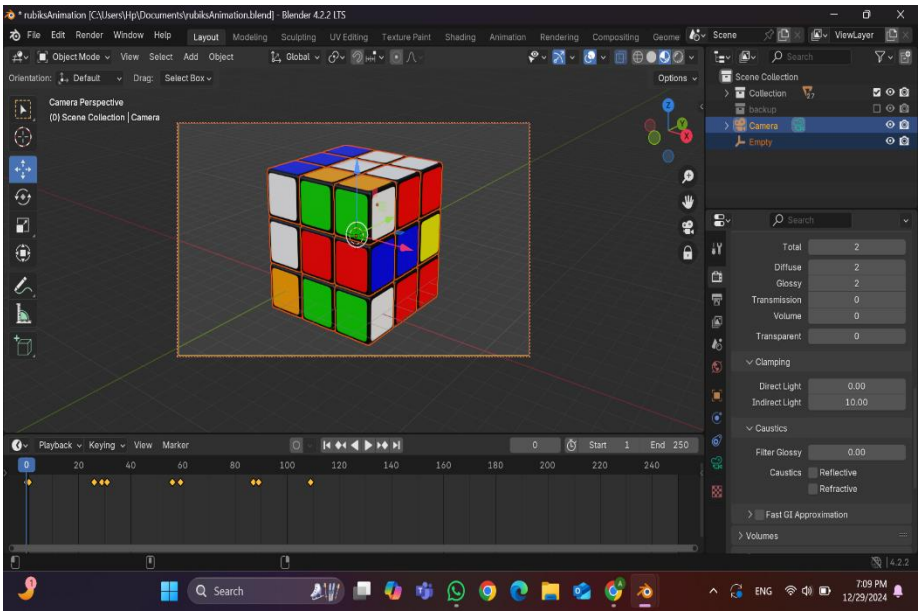
- **Smooth Transitions**:
  - In the **Graph Editor** (accessible via **Shift + F6**), interpolation modes were adjusted to ensure smooth motion.

- Linear or Bezier curves were used to create realistic acceleration and deceleration for rotations.

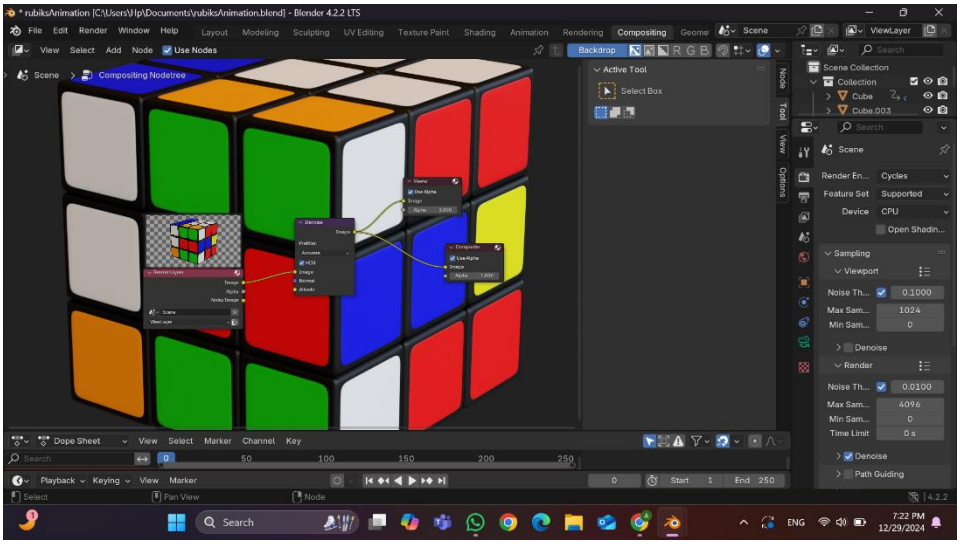
- **Camera and Lighting**:
  - The camera was positioned using **Numpad 0** to align the view.
  - Lights were added using **Shift + A > Light**, and their intensity was adjusted in the



Properties panel.

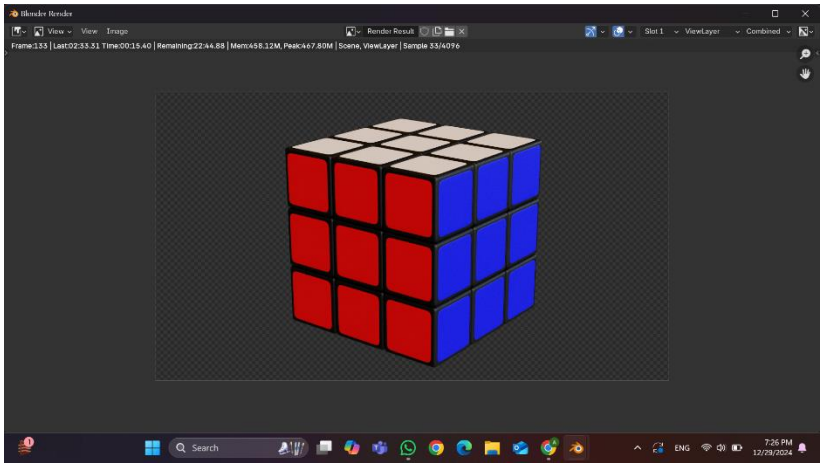
6. Rendering

Rendering is the final process where the 3D model is converted into a 2D image or animation sequence, ready for display. In this project, the Rubik's Cube undergoes rendering to showcase its visual fidelity, with proper lighting, materials, and animation effects applied.



RESULTS

The project successfully created a detailed 3D Rubik's Cube with smooth animations. The final model closely resembled a real Rubik's Cube and displayed fluid, realistic movements during animation.



CONCLUSION

This project effectively demonstrated how to use Blender tools and shortcuts to create and animate a Rubik's Cube. The step-by-step approach provided an efficient way to replicate and enhance the classic puzzle for visual and educational purposes. Future improvements could include interactive features allowing users to manipulate the cube in real time.
