SciFiHologram Shader Documentation

Overview

The `SciFiHologram` shader is a highly customizable Universal Render Pipeline (URP) shader designed for creating advanced sci-fi holographic effects in Unity. It provides a wide range of visual effects such as flickering, scan lines, rim lighting, glitch effects, and more, making it ideal for holographic interfaces, 3D projections, and futuristic visuals.

This documentation outlines the shader's properties, features, and usage to help artists and developers integrate it into their projects effectively.

Shader Properties

The shader is organized into multiple sections, each controlling a specific aspect of the holographic effect. Below is a detailed breakdown of the properties grouped by their respective headers.

Main

- **Texture (_MainTex)**: The primary texture for the hologram.
- **Color (_Color)**: Tint color applied to the texture (default: cyan with 0.7 alpha).
- **Blend Mode (_BlendMode)**: Choose between `Opaque` (0) or `Transparent` (1) rendering.

Hologram Base

- **Hologram Intensity (_HologramIntensity)**: Controls the overall brightness of the hologram (Range: 0–2, Default: 1).
- **Hologram Opacity (_HologramOpacity)**: Adjusts the transparency of the hologram (Range: 0–1, Default: 0.7).
- **Flicker Speed (_HologramFlickerSpeed)**: Speed of the flickering effect (Range: 0–10, Default: 1).
- **Flicker Intensity (_HologramFlickerIntensity)**: Strength of the flickering effect (Range: 0–1, Default: 0.1).
- **Flicker Pattern (_FlickerPattern)**: Selects the flicker style (Range: 0–3, Default: 0).
    - 0: Sine-based flicker.
    - 1: Sharp, power-based flicker.
    - 2: Noise-based flicker.
    - 3: Segmented noise flicker.
- **Flicker Offset (_FlickerOffset)**: Offsets the flicker position for segmented flicker (Range: 0–1, Default: 0).

Scan Line

- **Enable Scan Line (_EnableScanLine)**: Toggle scan line effect.
- **Scan Line Color (_ScanLineColor)**: Color of the scan lines (Default: bright cyan).
- **Scan Line Width (_ScanLineWidth)**: Width of the scan lines (Range: 0–1, Default: 0.1).
- **Scan Line Speed (_ScanLineSpeed)**: Speed of the scan line movement (Range: 0–5, Default: 1).
- **Scan Line Amount (_ScanLineAmount)**: Number of scan lines (Range: 1–50, Default: 20).
- **Scan Line Shift Speed (_ScanLineShiftSpeed)**: Speed of horizontal shifting (Range: 0–10, Default: 0).
- **Scan Line Deformation (_ScanLineDeform)**: Amount of deformation in scan lines (Range: 0–1, Default: 0).

Rim Effect

- **Enable Rim (_EnableRim)**: Toggle rim lighting effect.
- **Rim Color (_RimColor)**: Color of the rim effect (Default: bright cyan).
- **Rim Power (_RimPower)**: Controls the sharpness of the rim (Range: 0.5–10, Default: 3).
- **Rim Intensity (_RimIntensity)**: Brightness of the rim effect (Range: 0–2, Default: 1).
- **Rim Flutter (_RimFlutter)**: Amount of rim intensity variation (Range: 0–1, Default: 0).
- **Rim Flutter Speed (_RimFlutterSpeed)**: Speed of rim flutter animation (Range: 0–10, Default: 1).

Glitch Effect

- **Enable Glitch (_EnableGlitch)**: Toggle glitch effect.
- **Glitch Intensity (_GlitchIntensity)**: Strength of the glitch effect (Range: 0–1, Default: 0.1).
- **Glitch Speed (_GlitchSpeed)**: Speed of glitch animations (Range: 0–20, Default: 5).
- **Glitch Color Intensity (_GlitchColorIntensity)**: Intensity of color shifts in glitches (Range: 0–1, Default: 0.3).
- **Glitch Frequency (_GlitchFrequency)**: Frequency of glitch occurrences (Range: 0–10, Default: 2).
- **Glitch Jump (_GlitchJump)**: Amount of UV displacement in glitches (Range: 0–1, Default: 0.2).
- **Glitch Distortion (_GlitchDistortion)**: Amount of texture distortion (Range: 0–1, Default: 0.1).
- **Horizontal Intensity (_GlitchHorizontalIntensity)**: Strength of horizontal glitches (Range: 0–1, Default: 1).

Emission

- **Enable Emission (_EnableEmission)**: Toggle emission effect.
- **Emission Map (_EmissionMap)**: Texture for emission areas.

- **Emission Color (_EmissionColor)**: Color of the emission (Default: cyan).
- **Emission Intensity (_EmissionIntensity)**: Brightness of the emission (Range: 0–5, Default: 1).
- **Emission Pulse (_EmissionPulse)**: Strength of pulsing effect (Range: 0–1, Default: 0).
- **Emission Pulse Speed (_EmissionPulseSpeed)**: Speed of the pulsing effect (Range: 0–5, Default: 1).
- **Emission Area Scale (_EmissionAreaScale)**: Scale of the emission texture (Range: 0.1–2, Default: 1).
- **Emission Detail (_EmissionDetail)**: Detail level of emission texture (Range: 0–10, Default: 1).

Fresnel

- **Enable Fresnel (_EnableFresnel)**: Toggle fresnel effect.
- **Fresnel Color (_FresnelColor)**: Color of the fresnel effect (Default: cyan).
- **Fresnel Power (_FresnelPower)**: Sharpness of the fresnel effect (Range: 0.1–10, Default: 2).
- **Fresnel Intensity (_FresnelIntensity)**: Brightness of the fresnel effect (Range: 0–2, Default: 1).
- **Fresnel Exponent (_FresnelExponent)**: Exponent for fresnel calculation (Range: 0.1–5, Default: 1).
- **Fresnel Sharpness (_FresnelSharpness)**: Sharpness of fresnel edges (Range: 0–10, Default: 1).
- **Color Variation (_FresnelColorVariation)**: Amount of color hue variation (Range: 0–1, Default: 0).

Distortion

- **Enable Distortion (_EnableDistortion)**: Toggle distortion effect.
- **Distortion Map (_DistortionMap)**: Normal map for distortion.
- **Distortion Speed (_DistortionSpeed)**: Speed of distortion animation (Range: 0–5, Default: 1).
- **Distortion Intensity (_DistortionIntensity)**: Strength of distortion (Range: 0–1, Default: 0.1).
- **Distortion Tiling (_DistortionTiling)**: Tiling of the distortion map (Range: 0.1–10, Default: 1).
- **Directionality (_DistortionDirectionality)**: Controls distortion direction (Range: 0–1, Default: 0.5).
- **Animation Type (_DistortionAnimation)**: Type of distortion animation (Range: 0–3, Default: 0).
    - 0: Linear scrolling.
    - 1: Rotational movement.
    - 2: Pulsing scale.
    - 3: Wavy distortion.

Hologram Lines

- **Enable Lines (_EnableLines)**: Toggle horizontal line effect.
- **Line Spacing (_LineSpacing)**: Density of lines (Range: 1–50, Default: 30).
- **Line Speed (_LineSpeed)**: Speed of line movement (Range: -10–10, Default: 1).
- **Line Intensity (_LineIntensity)**: Brightness of lines (Range: 0–1, Default: 0.2).
- **Line Color (_LineColor)**: Color of the lines (Default: bright cyan).
- **Line Width (_LineWidth)**: Width of the lines (Range: 0–1, Default: 0.5).
- **Line Distortion (_LineDistortion)**: Amount of line distortion (Range: 0–1, Default: 0).
- **Line Variation (_LineVariation)**: Variation in line intensity (Range: 0–1, Default: 0).
- **Line Fade Distance (_LineFadeDistance)**: Fade distance for lines (Range: 0–1, Default: 0).
- **Highlight Frequency (_LineHighlightFrequency)**: Frequency of line highlights (Range: 0–10, Default: 0).

Noise

- **Enable Noise (_EnableNoise)**: Toggle noise effect.
- **Noise Map (_NoiseMap)**: Texture for noise.
- **Noise Intensity (_NoiseIntensity)**: Strength of noise (Range: 0–1, Default: 0.1).
- **Noise Speed (_NoiseSpeed)**: Speed of noise animation (Range: 0–10, Default: 1).
- **Noise Tiling (_NoiseTiling)**: Tiling of the noise map (Range: 0.1–10, Default: 1).
- **Noise Saturation (_NoiseSaturation)**: Saturation of noise color (Range: 0–1, Default: 0.5).
- **Noise Contrast (_NoiseContrast)**: Contrast of noise (Range: 0–2, Default: 1).
- **Noise Movement (_NoiseMovement)**: Direction of noise movement (Vector, Default: (1,1,0,0)).

Data Stream

- **Enable Data Stream (_EnableDataStream)**: Toggle data stream effect (used for shader types 1 and 2).
- **Data Stream Texture (_DataStreamTex)**: Texture for data stream.
- **Data Stream Speed (_DataStreamSpeed)**: Speed of data stream animation (Range: 0–10, Default: 1).
- **Data Stream Intensity (_DataStreamIntensity)**: Strength of data stream (Range: 0–1, Default: 0.5).
- **Data Stream Tiling (_DataStreamTiling)**: Tiling of the data stream texture (Range: 0.1–10, Default: 1).
- **Data Stream Color (_DataStreamColor)**: Color of the data stream (Default: bright cyan).
- **Data Stream Glow (_DataStreamGlow)**: Glow intensity of the data stream (Range: 0–2, Default: 1).
- **Scroll Direction (_DataStreamScrollDir)**: Direction of scrolling (Vector, Default: (0,1,0,0)).
- **Stream Density (_DataStreamDensity)**: Density of the data stream (Range: 0.1–10, Default: 1).

3D Hologram Projection

- **Enable Projection (_EnableProjection)**: Toggle 3D projection effect (used for shader type 3).
- **Projection Height (_ProjectionHeight)**: Height of the projection (Range: 0–3, Default: 1).
- **Fade Distance (_ProjectionFadeDistance)**: Distance for projection fade (Range: 0–1, Default: 0.3).
- **Projection Color (_ProjectionColor)**: Color of the projection (Default: cyan with low opacity).
- **Projection Intensity (_ProjectionIntensity)**: Brightness of the projection (Range: 0–2, Default: 1).
- **Projection Flicker (_ProjectionFlicker)**: Flicker intensity for projection (Range: 0–1, Default: 0.2).
- **Projection Spread (_ProjectionSpread)**: Spread of the projection (Range: 0–1, Default: 0.5).
- **Angle Multiplier (_ProjectionAngleMultiplier)**: Multiplies projection based on view angle (Range: 0–2, Default: 1).
- **Distortion (_ProjectionDistortion)**: Distortion amount for projection (Range: 0–1, Default: 0).

Interface Elements

- **Enable Interface (_EnableInterface)**: Toggle interface elements (used for shader type 2).
- **Interface Texture (_InterfaceTex)**: Texture for interface elements.
- **Interface Animation Speed (_InterfaceSpeed)**: Speed of interface animation (Range: 0–5, Default: 1).
- **Interface Color (_InterfaceColor)**: Color of interface elements (Default: bright cyan).
- **Interface Intensity (_InterfaceIntensity)**: Strength of interface elements (Range: 0–1, Default: 0.5).
- **Interface Tiling (_InterfaceTiling)**: Tiling of the interface texture (Range: 0.1–10, Default: 1).
- **Interface Glow (_InterfaceGlow)**: Glow intensity of interface elements (Range: 0–2, Default: 1).
- **Scroll X (_InterfaceScrollX)**: Horizontal scroll speed (Range: -2–2, Default: 0).
- **Scroll Y (_InterfaceScrollY)**: Vertical scroll speed (Range: -2–2, Default: 0).
- **Scanline Effect (_InterfaceScanlines)**: Intensity of scanline effect on interface (Range: 0–1, Default: 0).

Edges

- **Enable Edge Highlight (_EnableEdges)**: Toggle edge highlight effect.
- **Edge Color (_EdgeColor)**: Color of the edges (Default: bright cyan).
- **Edge Thickness (_EdgeThickness)**: Thickness of the edges (Range: 0–0.1, Default: 0.01).
- **Edge Sharpness (_EdgeSharpness)**: Sharpness of the edges (Range: 1–20, Default: 5).
- **Edge Power (_EdgePower)**: Intensity of the edge effect (Range: 0.1–5, Default: 1).

- **Edge Emission (_EdgeEmission)**: Emission intensity of edges (Range: 0–5, Default: 1).
- **Edge Distortion (_EdgeDistortion)**: Distortion amount for edges (Range: 0–1, Default: 0).
- **Edge Noise (_EdgeNoise)**: Noise applied to edges (Range: 0–1, Default: 0).

Advanced Hologram Effects

Hexagon Grid

- **Enable Hexagon Grid (_EnableHexGrid)**: Toggle hexagon grid effect.
- **Hexagon Size (_HexSize)**: Size of hexagons (Range: 1–50, Default: 10).
- **Hexagon Intensity (_HexIntensity)**: Strength of hexagon grid (Range: 0–1, Default: 0.5).
- **Hexagon Color (_HexColor)**: Color of the hexagons (Default: bright cyan).
- **Hexagon Emission (_HexEmission)**: Emission intensity of hexagons (Range: 0–2, Default: 1).
- **Hexagon Distortion (_HexDistortion)**: Distortion amount for hexagons (Range: 0–1, Default: 0).
- **Hexagon Rotation (_HexRotation)**: Rotation angle of the grid (Range: 0–6.28, Default: 0).

Square Grid

- **Enable Square Grid (_EnableSquareGrid)**: Toggle square grid effect.
- **Square Size (_SquareSize)**: Size of squares (Range: 1–50, Default: 15).
- **Square Intensity (_SquareIntensity)**: Strength of square grid (Range: 0–1, Default: 0.5).
- **Square Color (_SquareColor)**: Color of the squares (Default: bright cyan).
- **Square Edge Width (_SquareEdgeWidth)**: Width of square edges (Range: 0–0.2, Default: 0.05).
- **Square Distortion (_SquareDistortion)**: Distortion amount for squares (Range: 0–1, Default: 0).

Circuit Pattern

- **Enable Circuit (_EnableCircuit)**: Toggle circuit pattern effect.
- **Circuit Texture (_CircuitTex)**: Texture for circuit pattern.
- **Circuit Intensity (_CircuitIntensity)**: Strength of circuit pattern (Range: 0–1, Default: 0.5).
- **Circuit Color (_CircuitColor)**: Color of the circuit (Default: bright cyan).
- **Circuit Speed (_CircuitSpeed)**: Speed of circuit animation (Range: 0–2, Default: 0.5).
- **Circuit Distortion (_CircuitDistortion)**: Distortion amount for circuit (Range: 0–1, Default: 0).
- **Circuit Detail (_CircuitDetail)**: Detail level of circuit texture (Range: 0–10, Default: 1).

Wireframe

- **Enable Wireframe (_EnableWireframe)**: Toggle wireframe effect.
- **Wireframe Color (_WireframeColor)**: Color of the wireframe (Default: bright cyan).
- **Wireframe Thickness (_WireframeThickness)**: Thickness of wireframe lines (Range: 0–0.1, Default: 0.02).
- **Wireframe Smoothing (_WireframeSmoothing)**: Smoothing of wireframe edges (Range: 0–0.1, Default: 0.01).
- **Wireframe Density (_WireframeDensity)**: Density of wireframe lines (Range: 1–10, Default: 1).
- **Wireframe Glow (_WireframeGlow)**: Glow intensity of wireframe (Range: 0–2, Default: 1).

Time-Based Effects

Pulse Effect

- **Enable Pulse (_EnablePulse)**: Toggle pulse effect.
- **Pulse Speed (_PulseSpeed)**: Speed of the pulse animation (Range: 0–5, Default: 1).
- **Pulse Amplitude (_PulseAmplitude)**: Strength of the pulse (Range: 0–1, Default: 0.2).
- **Pulse Color (_PulseColor)**: Color of the pulse (Default: bright cyan).
- **Pulse Center (_PulseCenter)**: Center point of the pulse (Vector, Default: (0.5,0.5,0,0)).
- **Pulse Distortion (_PulseDistortion)**: Distortion amount for pulse (Range: 0–1, Default: 0).
- **Pulse Exponent (_PulseExp)**: Sharpness of the pulse (Range: 1–5, Default: 2).

Scanning Effect

- **Enable Scanning (_EnableScanning)**: Toggle scanning effect.
- **Scanning Speed (_ScanningSpeed)**: Speed of the scanning animation (Range: 0–5, Default: 1).
- **Scanning Width (_ScanningWidth)**: Width of the scanning band (Range: 0–0.5, Default: 0.1).
- **Scanning Color (_ScanningColor)**: Color of the scanning band (Default: bright cyan).
- **Scanning Direction (_ScanningDirection)**: Direction of scanning (Vector, Default: (0,1,0,0)).
- **Scanning Intensity (_ScanningIntensity)**: Brightness of the scanning effect (Range: 0–2, Default: 1).
- **Scanning Fade (_ScanningFade)**: Fade amount based on distance (Range: 0–1, Default: 0.5).

Beam Effect

- **Enable Beam (_EnableBeam)**: Toggle beam effect.
- **Beam Speed (_BeamSpeed)**: Speed of the beam animation (Range: 0–10, Default: 2).
- **Beam Width (_BeamWidth)**: Width of the beams (Range: 0–0.2, Default: 0.05).

- **Beam Color (_BeamColor)**: Color of the beams (Default: bright cyan).
- **Beam Count (_BeamCount)**: Number of beams (Range: 1–10, Default: 3).
- **Beam Distortion (_BeamDistortion)**: Distortion amount for beams (Range: 0–1, Default: 0).
- **Beam Shift (_BeamShift)**: Horizontal shift of beams (Range: -1–1, Default: 0).

Color Effects

Color Shift

- **Enable Color Shift (_EnableColorShift)**: Toggle color shift effect.
- **Color Shift Speed (_ColorShiftSpeed)**: Speed of hue shifting (Range: 0–5, Default: 1).
- **Color Shift Intensity (_ColorShiftIntensity)**: Strength of color shift (Range: 0–1, Default: 0.5).
- **Hue Range (_ColorShiftHue)**: Range of hue variation (Range: 0–1, Default: 1).
- **Start Hue (_ColorShiftStartHue)**: Starting hue for the shift (Range: 0–1, Default: 0).

Color Banding

- **Enable Color Banding (_EnableColorBanding)**: Toggle color banding effect.
- **Color Bands (_ColorBands)**: Number of color bands (Range: 1–10, Default: 3).
- **Banding Contrast (_BandingContrast)**: Contrast of banding (Range: 0–2, Default: 1).
- **Banding Saturation (_BandingSaturation)**: Saturation of banding (Range: 0–2, Default: 1).
- **Banding Brightness (_BandingBrightness)**: Brightness of banding (Range: 0–2, Default: 1).
- **Banding Direction (_BandingDirection)**: Direction of banding (Vector, Default: (0,1,0,0)).

Chromatic Aberration

- **Enable Chromatic (_EnableChromatic)**: Toggle chromatic aberration effect.
- **Chromatic Intensity (_ChromaticIntensity)**: Strength of chromatic aberration (Range: 0–0.1, Default: 0.05).
- **Chromatic Offset (_ChromaticOffset)**: Offset between color channels (Range: 0–1, Default: 0.5).
- **Chromatic Center (_ChromaticCenter)**: Center point for aberration (Vector, Default: (0.5,0.5,0,0)).
- **Chromatic Mode (_ChromaticMode)**: Type of chromatic aberration (Range: 0–2, Default: 0).
    - 0: Radial offset.
    - 1: Rotational offset.
    - 2: Diagonal offset.

Vignette

- **Enable Vignette (_EnableVignette)**: Toggle vignette effect.

- **Vignette Color (_VignetteColor)**: Color of the vignette (Default: cyan).
- **Vignette Power (_VignettePower)**: Sharpness of the vignette (Range: 1–5, Default: 2).
- **Vignette Intensity (_VignetteIntensity)**: Strength of the vignette (Range: 0–1, Default: 0.5).
- **Vignette Center (_VignetteCenter)**: Center point of the vignette (Vector, Default: (0.5,0.5,0,0)).
- **Vignette Pulse Speed (_VignetteSpeed)**: Speed of vignette pulsing (Range: 0–5, Default: 0).

Volumetric Effects

- **Enable Volumetric (_EnableVolumetric)**: Toggle volumetric light effect.
- **Volumetric Color (_VolumetricColor)**: Color of the volumetric effect (Default: cyan with low opacity).
- **Volumetric Intensity (_VolumetricIntensity)**: Strength of volumetric effect (Range: 0–2, Default: 1).
- **Volumetric Noise (_VolumetricNoise)**: Amount of noise in volumetric effect (Range: 0–1, Default: 0.5).
- **Volumetric Speed (_VolumetricSpeed)**: Speed of noise animation (Range: 0–5, Default: 1).
- **Volumetric Distance (_VolumetricDistance)**: Distance for volumetric falloff (Range: 0–10, Default: 5).
- **Volumetric Falloff (_VolumetricFalloff)**: Sharpness of volumetric falloff (Range: 0.1–10, Default: 1).

Depth Effects

- **Enable Depth (_EnableDepth)**: Toggle depth effect.
- **Depth Color (_DepthColor)**: Color applied based on depth (Default: cyan).
- **Depth Distance (_DepthDistance)**: Distance for depth effect (Range: 0–10, Default: 1).
- **Depth Gradient (_DepthGradient)**: Sharpness of depth gradient (Range: 0–5, Default: 1).
- **Intersection Threshold (_DepthIntersectionThreshold)**: Threshold for depth intersections (Range: 0–1, Default: 0.1).
- **Depth Fade Width (_DepthFadeWidth)**: Width of depth fade (Range: 0–1, Default: 0.5).

Shader Features

The `SciFiHologram` shader supports multiple visual effects, each of which can be toggled on or off using the corresponding `_Enable*` property. Below is a summary of the key features:

1. **Flickering**: Simulates instability in the hologram with customizable flicker patterns and speeds.
2. **Scan Lines**: Adds moving horizontal or vertical lines to mimic a holographic display.
3. **Rim Lighting**: Highlights edges based on view angle for a glowing outline effect.
4. **Glitch Effect**: Introduces random distortions, UV jumps, and color shifts to simulate digital artifacts.
5. **Emission**: Adds glowing areas based on an emission map with optional pulsing.
6. **Fresnel Effect**: Enhances edges with a view-dependent glow, customizable with sharpness and color variation.
7. **Distortion**: Applies normal map-based UV distortion with multiple animation types.
8. **Hologram Lines**: Adds moving horizontal lines with distortion and variation options.
9. **Noise**: Overlays a noise texture for added texture and realism.
10. **Data Stream**: Simulates scrolling data or glyphs, ideal for holographic interfaces.
11. **3D Projection**: Creates a volumetric projection effect with height-based fading (used for shader type 3).
12. **Interface Elements**: Adds animated UI-like elements for futuristic displays.
13. **Edge Highlight**: Highlights model edges with customizable thickness and noise.
14. **Hexagon/Square Grids**: Overlays grid patterns for a high-tech aesthetic.
15. **Circuit Pattern**: Applies a circuit-like texture with animation and detail options.
16. **Wireframe**: Renders a wireframe overlay with customizable thickness and glow.
17. **Pulse Effect**: Creates a radial pulsing effect emanating from a center point.
18. **Scanning Effect**: Simulates a scanning band moving across the surface.
19. **Beam Effect**: Adds moving beam-like highlights across the surface.
20. **Color Effects**: Includes color shifting, banding, chromatic aberration, and vignette for advanced color manipulation.
21. **Volumetric Effect**: Simulates volumetric lighting with noise and distance falloff.
22. **Depth Effect**: Enhances the hologram based on scene depth and intersections.

Shader Types

The shader supports different visual styles through the `_ShaderType` property, which modifies the behavior of certain effects:

- **0 (Default)**: Standard hologram with all effects available.
- **1 (Data Stream)**: Emphasizes the data stream effect for scrolling data visuals.
- **2 (Interface)**: Focuses on interface elements for UI-like holographic displays.
- **3 (Projection)**: Enables 3D projection effects, ideal for volumetric holograms.

To switch between types, set the `_ShaderType` value in the material inspector or via script.

Usage

Setup

1. **Create a Material**:
    - In Unity, create a new material and assign the `SciFiHologram` shader (`SciFiHologram`).
2. **Assign Textures**:
    - Set the `_MainTex` for the base texture.
    - Assign additional textures for emission, distortion, noise, data stream, interface, or circuit effects as needed.
3. **Configure Properties**:
    - Adjust properties in the Unity Inspector to achieve the desired effect.
    - Use the toggle properties (`_Enable*`) to enable or disable specific effects.
4. **Apply to Mesh**:
    - Apply the material to a mesh renderer in your scene.

Performance Considerations

- **Feature Toggles**: Disable unused effects using the `_Enable*` toggles to optimize performance.
- **Texture Usage**: Use compressed textures and lower resolution for non-critical maps to reduce memory usage.
- **Shader Variants**: The shader uses multi-compile directives to reduce the number of active features. Ensure only necessary features are enabled to minimize shader variants.
- **Shader Type**: Choose the appropriate `_ShaderType` to avoid unnecessary calculations for effects not used in your setup.

Best Practices

- **Start Simple**: Begin with a minimal set of enabled features and gradually add effects to avoid overwhelming the material.
- **Test in Scene**: Preview the hologram in your scene with appropriate lighting to ensure the desired look.
- **Combine Effects**: Experiment with combining effects like scan lines, rim lighting, and glitch for a rich holographic appearance.
- **Animation**: Use the time-based properties (e.g., `_HologramFlickerSpeed`, `_ScanLineSpeed`) to create dynamic visuals.
- **Custom Editor**: The shader includes a custom editor (`SciFiForge.HologramShaderGUI`) for a streamlined Inspector experience.

Technical Details

Render Pipeline

- **Render Pipeline**: Universal Render Pipeline (URP).
- **Queue**: Transparent.

- **Render Type**: Transparent.
- **Blending**: SrcAlpha OneMinusSrcAlpha (configurable via `_BlendMode`).
- **ZWrite**: Off.
- **Cull**: Back.

Shader Structure

- **Vertex Shader**: Transforms object-space positions to world and clip space, calculates normals, tangents, and view direction.
- **Fragment Shader**: Combines multiple effects based on UV coordinates, normals, view direction, and time. Uses feature toggles to enable/disable effects.
- **HLSL Includes**:
  - `Core.hlsl`: URP core utilities.
  - `Lighting.hlsl`: Lighting calculations.
  - `DeclareDepthTexture.hlsl`: Depth texture access for depth effects.

Noise Functions

The shader includes several noise functions for procedural effects:

- **rand**: Generates pseudo-random values based on UV coordinates.
- **noise**: 2D Perlin noise for smooth random patterns.
- **fbm**: Fractional Brownian Motion for layered noise.
- **voronoiNoise**: Voronoi noise for cellular patterns.
- **hexDist**: Calculates distance for hexagonal grid patterns.

Custom Editor

The shader uses a custom editor (`SciFiForge.HologramShaderGUI`) to organize properties in the Unity Inspector, making it easier to navigate the extensive list of options.

Troubleshooting

- **Effect Not Visible**: Ensure the corresponding `_Enable*` toggle is checked and the intensity/opacity values are non-zero.
- **Performance Issues**: Disable unused effects and reduce texture resolutions. Check the number of active shader variants in the Unity Profiler.
- **Incorrect Colors**: Verify texture formats (e.g., sRGB for color textures, Linear for normal maps) and color space settings in Unity.
- **Projection Issues**: For `_ShaderType = 3`, ensure the mesh has appropriate geometry for projection height calculations.
- **Depth Effect Not Working**: Ensure the scene has a depth texture enabled in the URP settings.

Examples

Basic Hologram

- Enable `_MainTex`, `_HologramIntensity`, and `_HologramOpacity`.
- Add `_EnableScanLine` for subtle scan lines.
- Use `_EnableRim` for edge highlights.

Futuristic Interface

- Set `_ShaderType = 2`.
- Enable `_EnableInterface` and assign an `_InterfaceTex`.
- Add `_EnableDataStream` for scrolling data visuals.
- Use `_EnableColorShift` for dynamic color changes.

3D Projection

- Set `_ShaderType = 3`.
- Enable `_EnableProjection` and adjust `_ProjectionHeight` and `_ProjectionFadeDistance`.
- Add `_EnableFresnel` for view-dependent glow.
- Use `_EnableVolumetric` for a volumetric light effect.

Conclusion

The `SciFiHologram` shader is a versatile tool for creating stunning sci-fi visuals in Unity. Its modular design allows for fine-tuned control over a wide range of effects, making it suitable for everything from simple holograms to complex futuristic interfaces. By leveraging the provided properties and toggles, you can achieve the perfect holographic look for your project.

For further assistance, consult the Unity URP documentation or reach out to the shader developer for specific customization needs.