

CS 3398

Cafe C S#arp

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Introduction

This application is a 3D Modelling Tool. It can be used to create and edit 3D models. These models can be rendered statically or transformed over time with keyframes to animate them or add particle effects. Multiple models can be used to create a 3D environment.

Requirements

User Requirements

1. Functional

- 1.1 The 3D modeling system shall have a visible screen used to interact with the 3D scene. (3D View-port)
 - 1.1.1 View-port shall have navigation tool to change the view around the point of interest.
 - 1.1.2 Select Box tool shall allow users to select and deselect items.
 - 1.1.3 Cursor tool shall allow users to set the cursor location, and drag to transform.
 - 1.1.4 Move tool shall allow users to move objects placement using the orientation of the user's mouse.
 - 1.1.5 Rotate tool shall rotate selected items
 - 1.1.6 Scale tool shall resize selected items
 - 1.1.7 Annotate tool shall make annotations on selected data
 - 1.1.8 Measure tool shall measure distances and angles

- 1.1.9 Add Cube tool shall add a cube to mesh interactively
- 1.2** System shall have a menu of tools for manipulating objects.
 - 1.2.1 Extrude tool shall convert 2D objects to 3D objects.
 - 1.2.2 Merge tool shall merge all selected vertices to one unique vertex.
 - 1.2.3 Edge bevel tool shall smooth corners and edges.
 - 1.2.4 Inset tool shall inset selected faces of an object.
 - 1.2.5 Move tool shall select and change the location of objects.
 - 1.2.6 Copy/paste tool shall create a duplicate of an preexisting item.
 - 1.2.7 Rotation tool shall change the orientation of a selected element.
 - 1.2.8 Scaling tools shall allows users to manipulate the proportions of objects.
 - 1.2.9 User shall be able to move a selected object to a defined point.
 - 1.2.10 System shall have option to quickly Undo/Redo an action.
- 1.3** Lighting tools shall adjust type and color of light.
 - 1.3.1 Ambient Occlusion tool shall simulate indirect lighting.
 - 1.3.2 Global Illumination shall simulate how light reflects/interacts with surfaces.
- 1.4** Customizable user interface where users can customize screen and tool layout.

- 1.4.1 Tool bar shall allow users to customize tool layout.
- 1.4.2 Users shall be able to switch between light and dark mode.
- 1.4.3 Users shall be able to customize keyboard shortcuts for tools.
- 1.5** Camera is used to show current scene from the active cameras perspective.
 - 1.5.1 Orthographic Mode shall allow user to view scene from a distant point.
 - 1.5.2 Lens types shall allow you to manipulate the perspective, focal length, and field of view
 - 1.5.3 Depth shall allow you to adjust what objects are in focus.
- 1.6** Outliner collections(scenes) that allow you to organize and group elements.
 - 1.6.1 Shall allow users to select and deselect objects.
 - 1.6.2 Shall allow users to group objects and elements together in a scene.
 - 1.6.3 Shall allow users to enable and disable visibility of an object or scene.
 - 1.6.4 Shall allow users to enable and disable rendering of an object or scene.
- 1.7** System shall have a menu of help options. (Tutorials/Help menu)
 - 1.7.1 Shall have a support option that has information on who to contact with your issue.
 - 1.7.2 Shall have manual option that has information about what the system and tools can do.

- 1.7.3 Shall have a list of tutorials on tools.
- 1.8** Animation tools and Timeline shall allow users to display and view frames of an animated sequence.
 - 1.8.1 Shall allow users to create, move, and delete point on the timeline.
 - 1.8.2 Shall allow user to stop, start, pause, and fast forward the timeline.
 - 1.8.3 Keyframe shall store the position of an object at a certain time and frame.
 - 1.8.4 Interpolator shall allow user to set the position of an object in two separated frames and it will correct the position in the frames in between.
 - 1.8.5
- 1.9** Render shall turn a 3D scene at a particular point into a 2D image.
 - 1.9.1 Ray Tracing shall allow user to create reflective, mirrored, and transparent surfaces.
- 1.10** System shall have a menu of texturing tools used to change appearance of scene and objects
 - 1.10.1 Draw tool shall allow user to apply color to the scene or object.
 - 1.10.2 Blur tool shall blur or soften the image.
 - 1.10.3 Smudge tool shall blend colors near the cursor in the direction of the cursor.
 - 1.10.4 Fill tool shall allow the user to quickly fill an area with a color.
- 1.11** System shall have properties menu that is used to edit active scene and objects.

- 1.11.1 Shall have transform tab that keeps track of size, location, and rotation.
- 1.11.2 Shall have relations tab that keeps track of related objects.
- 1.11.3 Shall have collections tab to store collection (scene) information.
- 1.11.4 Shall have visibility tab to keep track of where the object is visible.
- 1.12** System shall have a top bar that is comprised of multiple buttons to navigate the program
 - 1.12.1 The System shall have a 'File' tab to perform file operations
 - 1.12.2 The System shall have a 'Render' tab to view the render options
 - 1.12.3 The System shall have a 'Edit' tab to manipulate the operations made on the project
 - 1.12.4 The System shall have a 'Window' tab to manipulate the window

2. Non-Functional

- 2.1** System shall have Linear Algebra Library / Implementation.
 - 2.1.1 System shall support matrix multiplier operations, allowing users to multiply matrices of compatible dimensions.
 - 2.1.2 System shall support computation of cross products between vectors, allowing users to perform vector operations in different applications.
 - 2.1.3 System shall support Delaunay triangulation, allowing users to generate triangulated meshes from a set of input points.

- 2.2** System shall have library to handle input and audio library.
 - 2.2.1 System shall support Simple DirectMedia Layer (SDL2) for handling input and audio functionalities.
- 2.3** System shall support view-port rendering that allows users to create quick preview renders from the users current viewpoint.
 - 2.3.1 System shall support a minimum frame rate 24 frames per second (fps)

System Requirements

1. Functional

- 1.1** Operating System
 - 1.1.1 System shall be compatible with Windows version 7 and up.
 - 1.1.2 System shall use the x86-64 instruction set.

2. Non-Functional

- 2.1** Memory
 - 2.1.1 System shall have a minimum memory capacity of 4 gigabytes (GB).
 - 2.1.2 System shall utilize DDR4 memory technology.
- 2.2** Storage Capacity and Technology
 - 2.2.1 System shall have a minimum of 10 gigabytes (GB) of available storage.
 - 2.2.2 System shall employ a combination of Solid State Drive (SSD) and/or Hard Disk Drive (HDD) technology.

2.3 Video Memory

2.3.1 System shall have dedicated video memory system with a maximum capacity of 512 megabytes (MB).

2.4 Graphics Library Compatibility

2.4.1 System shall be compatible with the OpenGL library, complying to version 3.x and later.

System Architecture

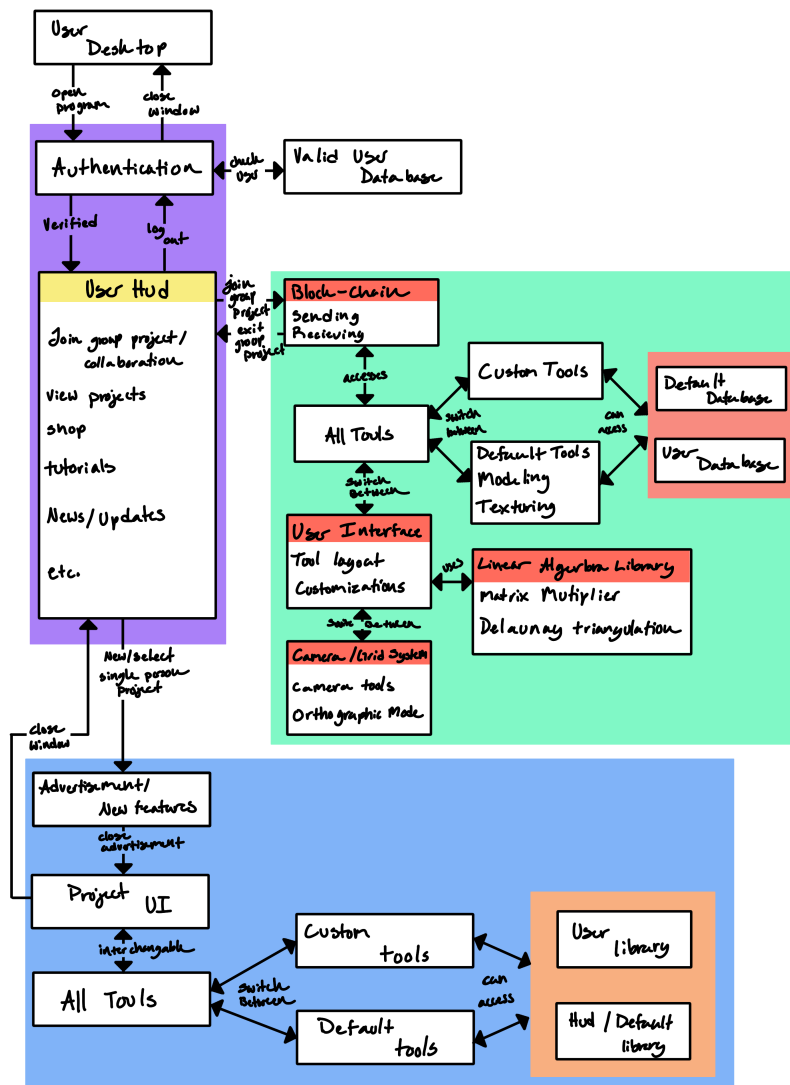


Figure 1: Cafe C S#arp Full Software Architecture

Detailed Design

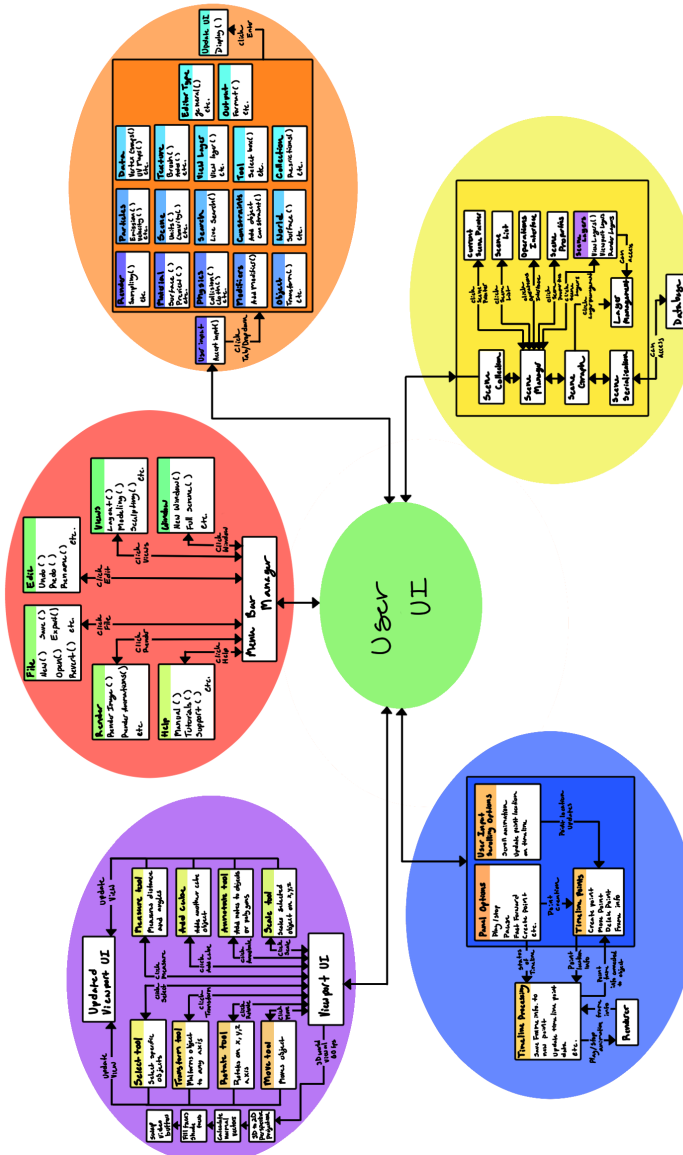


Figure 2: Cafe C S#arp Full Detailed Design

Test Case

Test Case #1: Render Tab Test

Test Number: 1.12.2

Test Case Description: User will locate and click on "Render" tab.

Test Input Data: UI Click

Test Procedure:

1. User opens up Cafe C S#arp.
2. UI will open up to show the view port.
3. User will navigate their mouse to the top left corner of the view port.
4. User will locate the "Render" tab in the top left corner of the view port.
5. Once "Render" tab is located, user will click on the tab.
6. Once "Render" tab is clicked on, a menu of items related to rendering will appear.

Test Results/Status: The results from this test should allow the user to see and access the menu of items related to Render.

Please specify Pass or Fail.

Remarks: What was your experience when testing this procedure?

Please include any/all problems or issues.

Test Case 2: File Tab Test

Test Number: 1.12.1

Test Case Description: User should be able to see a drop-down menu of various options when they click or hover over the 'File' tab button.

Test Input Data: UI click

Test Procedure:

1. User opens up Cafe C S#arp.
2. Click the tab on the top left that says 'File'.

Test Results/Status: You shall be able to see the sub-menu items: 'New', 'Open...', 'Open Recent', 'Revert', 'Recover', 'Save', 'Save Incremental', 'Save As', 'Save Copy', 'Link', 'Append', 'Data Previews', 'Import', 'Export', 'External Data', 'Clean Up', 'Defaults', and 'Quit'.
Please specify Pass or Fail.

Remarks: What was your experience when testing this procedure?
Please include any/all problems or issues.

Test Case #3: Edit Tab Test

Test Number: 1.12.3

Test Case Description: User will locate and click on "Edit" tab.

Test Input Data: UI click

Test Procedure:

1. User opens up Cafe C S#arp.
2. UI will open up to show the view port.
3. User will navigate their mouse to the left side of the screen and select the move tool.
4. User will click on pre-loaded box and drag it to another area on the screen.
5. User will then navigate their mouse to the top left corner of the view port.
6. User will locate the "Edit" tab in the top left corner of the view port.
7. Once "Edit" tab is located, user will click on the tab.
8. Once "Edit" tab is clicked on, a menu of items related to rendering will appear.
9. User will then click on "Undo", the box should move back to its original location.
10. User will again locate the "Edit" tab in the top left corner of the view port.
11. User will then click on "Redo", the box should move back to where the user placed it.

Test Results/Status: The results from this test should allow the user to see and access the menu of items related to Edit. User will also test the functionality of the Undo/Redo options.
Please specify Pass or Fail.

Remarks: What was your experience when testing this procedure?
Please include any/all problems or issues.

Test Case #4: Window Tab Test

Test Number: 1.12.4

Test Case Description: User should be able to see a drop-down menu when they click or hover over the "Window" tab on the menu bar in the UI.

Test Input Data: UI Click

Test Procedure:

1. User opens up Cafe C S#arp.
2. User selects either single or group project button in user hud.
3. The UI will open up and the user will then either click or hover over the "Window" tab on the menu bar on the top left corner.
4. User will then click or hover over the "Window" tab.

Test Results/Status: When hovering the mouse over the "Window tab", the "Window" tab should highlight. When clicking the tab the user should see the sub-menu items: "New Window", "New Main Window", "Toggle Window Fullscreen", "Next Workspace", "Previous Workspace", "Show Status Bar", "Save Screenshot", "Save Screenshot (Editor)", and "Toggle System Console".
Please specify Pass or Fail.

Remarks:What was your experience when testing this procedure?
Please include any/all problems or issues.

Test Case #5: Help Tab Test

Test Number: 1.12.5

Test Case Description: User will locate and click on "Help" tab.

Test Input Data: UI click

Test Procedure:

1. User opens up Cafe C S#arp.
2. UI will open up to show the view port.
3. User will navigate their mouse to the top left corner of the view port.
4. User will locate the "Help" tab in the top left corner of the view port.
5. Once "Help" tab is located, user will click on the tab.
6. Once "Help" tab is clicked on, a menu of items related to rendering will appear.

Test Results/Status: You shall be able to see the sub-menu items: 'Manual', 'Tutorials', 'Support', 'User Communications', 'Report Bug', 'Save Sys. Info'.
Please specify Pass or Fail.

Remarks: What was your experience when testing this procedure?
Please include any/all problems or issues.

Table of Requirements

Requirement #	Test Case Name
1.12.1	File Tab Click
1.12.2	Render Tab Click
1.12.3	Edit Tab Click
1.12.4	Window Tab Click
1.12.5	Help Tab Click

References

Foundation, Blender. “Blender.org - Home of the Blender Project.” Blender.org, blender.org.