

Requirements Specification Document

1.1 Introduction

Parametrix is a web-based animation suite designed for functionally programmed animations, utilizing React and Three.js for the frontend and Firebase Cloud Storage for the backend. The application enables users to create, manipulate, and animate 3D objects using programmable functions. Parametrix provides an interface where users can define transformations and color dynamics through mathematical expressions, allowing for precise, customizable animations that can be quickly generated with a seamlessly integrated interface. Animations are small functions created by the user that loop once or forever using a loop control value over a range of input values that animate at a set sample rate.

1.2 CSCI Component Breakdown

The animation suite, Parametrix, is composed of the following CSCs divided into three main subsystems: User Interaction, Animation Programming, and Website Functionality and Backend.

1. User Interaction: Includes 3D object creation, camera control, and object editing.
 2. Animation Programming: Includes functional programming for object and camera animations, loop control, and sample rate management.
 3. Website Functionality and Backend: Includes Firebase integration, object storage, and animation rendering.
-

1.3.1 User Interaction Requirements

The following requirements are levied on the User Interaction subcategory of the Parametrix project.

- 1.3.1.1 The application shall be displayed in a web page.
 - 1.3.1.2 The page shall be hosted with React and Three.js for frontend rendering.
 - 1.3.1.3 The page shall allow users to create 3D objects.
 - 1.3.1.4 The page shall allow users to move the camera around the 3D object using mouse and keyboard controls.
 - 1.3.1.5 The page shall allow users to right-click on an object to open an edit menu.
 - 1.3.1.6 The edit menu shall allow users to modify the object's position, rotation, and scale.
 - 1.3.1.7 The page shall allow users to specify an object's color using RGB values.
 - 1.3.1.8 Selected objects shall glow yellow using a non-user-modifiable layer.
 - 1.3.1.9 The glow color of selected objects shall change when hovering over delete and reset buttons.
 - 1.3.1.10 The page shall allow users to delete selected objects.
 - 1.3.1.11 The page shall allow users to reset the scene to its initial state.
-

1.3.2 Animation Programming Requirements

The following requirements are levied on the Animation Programming subcategory of the Parametrix project.

- 1.3.2.1 The page shall allow users to program a function to control a dimension of an object's position.
 - 1.3.2.2 The page shall allow users to program a function to control a dimension of an object's rotation.
 - 1.3.2.3 The page shall allow users to program a function to control a dimension of an object's scale.
 - 1.3.2.4 The RGB values of an object's color shall be mappable to functions with a floor of 0 and a ceiling of 255.
 - 1.3.2.5 The page shall allow users to animate the camera's angle using a programmed function.
 - 1.3.2.6 The page shall allow users to animate the camera's position using a programmed function.
 - 1.3.2.7 Animations shall be small functions created by the user that loop once or forever.
 - 1.3.2.8 Animations shall use a loop control value over a range of input values.
 - 1.3.2.9 Animations shall animate at a set sample rate defined by the user.
 - 1.3.2.10 The page shall allow users to define the range of input values for animations.
 - 1.3.2.11 The page shall allow users to set the sample rate for animations.
 - 1.3.2.12 The page shall allow users to toggle animations between looping once or looping forever.
 - 1.3.2.13 The page shall provide a visual timeline for animations, showing keyframes and loop points.
-

1.3.3 Website Functionality and Backend Requirements

The following requirements are levied on the Website Functionality and Backend subcategory of the Parametrix project.

- 1.3.3.1 The page shall have a header above the 3D canvas.
 - 1.3.3.2 The header shall host the site logo, sign-in button, sign-out button, and save/load options.
 - 1.3.3.3 The header shall only display the sign-out button and save/load options when a user is signed in.
 - 1.3.3.4 The page shall use Firebase Cloud Storage for saving and loading user projects.
 - 1.3.3.5 The page shall allow users to save their current scene to Firebase Cloud Storage.
 - 1.3.3.6 The page shall allow users to load a previously saved scene from Firebase Cloud Storage.
 - 1.3.3.7 The page shall use Firebase Authentication for user sign-in and sign-out.
 - 1.3.3.8 The page shall allow users to sign in with a Google account.
 - 1.3.3.9 The page shall render animations in real-time using Three.js.
 - 1.3.3.10 The page shall support exporting animations as video files.
 - 1.3.3.11 The page shall support exporting animations as GIF files.
 - 1.3.3.12 The page shall support exporting animations as image sequences.
-

1.4 Performance Requirements

- 1.4.1 Parametrix shall render 3D objects and animations in real-time without significant lag.
 - 1.4.2 Parametrix shall support at least 100 objects in a single scene without performance degradation.
 - 1.4.3 Parametrix shall not require any special computing hardware to operate.
-

1.5 Project Environment Requirements

- 1.5.1 Parametrix shall be able to execute using any standard web browser.
 - 1.5.2 Parametrix shall be able to be viewed with any media account.
 - 1.5.3 Parametrix shall be able to save and load projects through Firebase with a Google account.
 - 1.5.4 Parametrix should be able to work on both desktop and mobile devices.
-

1.6 Development Environment Requirements

- 1.6.1 Parametrix should be able to be worked on in any code editor.
 - 1.6.2 Parametrix shall require Node.js and JavaScript for backend and frontend code.
 - 1.6.3 Parametrix shall require Three.js for 3D rendering and animations.
 - 1.6.4 Parametrix shall require React for frontend design and hosting.
 - 1.6.5 Parametrix shall require Firebase for authentication, cloud storage, and project management.
 - 1.6.6 Firebase shall be used to allow for sign-in, sign-out, and project saving/loading.
 - 1.6.7 Firebase shall be used for cloud storage to allow for archiving and hosting user projects.
-

1.7 Execution Environment Requirements

Due to the nature of the project, Parametrix will not need to be executed from a local device aside from hosting with React and deployment with Firebase.