**FUNCTIONAL SPECIFICATIONS – TEAM SIMM**

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Description automatically generated with medium confidence**

**FUNCTIONAL SPECIFICATIONS**

**Reverb VR**

**Joseph M. Evan I. Shayan S. Emma M. Brant A.**

**04/21/2024**

**Version 0.1.0**

| VERSION HISTORY | | | | |
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| VERSION | APPROVED BY | REVISION DATE | DESCRIPTION OF CHANGE | AUTHOR |
| 0.0.1 | Joseph Madigan | 4/15/2024 | Initial Draft | Team |
| 0.1.0 | Joseph Madigan | 4/21/2024 | Baseline functional specification | Team |
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**Functional Specifications Document**

**Authorization Memorandum**

I have carefully assessed the Functional Specifications Document for project Reverb.

MANAGEMENT CERTIFICATION - Please check the appropriate statement.

\_\_\_\_\_\_ The document is accepted.

\_\_\_\_\_\_ The document is accepted pending the changes noted.

\_\_\_\_\_\_ The document is not accepted.

We fully accept the changes as needed improvements and authorize initiation of work to proceed. Based on our authority and judgment, the continued operation of this system is authorized.

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NAME DATE

Project Manager

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NAME DATE

Director

*Add other names and roles as necessary.*

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# INTRODUCTION

Provide an overview of the entire Functional Specifications Document including the purpose, scope, definitions, acronyms, abbreviations, references, etc.

## Purpose

*Describe the purpose of the Functional Specifications Document. What is its intended use and audience? Why is it being created?*

This is meant to clarify and document our specific requirements for design. This will guide development by describing the scope of our work and articulating our vision for the user interface. Additionally, it will serve as a communication tool between our development team and sole “stakeholder”.

## Reference Documents

*List any reference documents or sources of information that were used to develop the functional specifications. This could include project requirements documents, design documents, standards, or external sources.*

IEEE Citations to be completed below:

[*https://www.gamedeveloper.com/design/constraints-and-opportunities-for-ui-design-in-vr#close-modal*](https://www.gamedeveloper.com/design/constraints-and-opportunities-for-ui-design-in-vr#close-modal)

*https://docs.unity3d.com/Manual/VROverview.html#:~:text=The%20VR%20provider%20plug-ins,SteamVR%2C%20HoloLens%2C%20Windows%20Mixed%20Reality*

## Abbreviations and Acronyms

*Define any abbreviations or acronyms used throughout the document to ensure clarity and consistency in communication.*

* **VR**: Virtual Reality
* **UX**: User Experience
* **WebGL**: Web Graphics Library
* **JSON**: JavaScript Object Notation

## Document Conventions

*Specify any conventions or formatting guidelines that should be followed when creating or reviewing the document. This could include naming conventions, formatting styles, or citation formats.*

* Naming conventions for code: CamelCase for methods, snake\_case for variables.
* Use IEEE citation format for all references.

# GENERAL DESCRIPTION

## Product Context

*Describe the broader context in which the product will operate. This could include the industry or market sector, existing systems or technologies, and any relevant background information.*

## Reverb VR operates within the virtual reality experience market sector. Existing products like Cosmic Sugar VR lack rich audio reactivity, while Microdose VR, while direct competition, faces challenges due to high system requirements. Reverb VR aims to fill this gap by offering immersive audio-visual experiences accessible to both web and VR users.

## User Classes and Characteristics

*Identify the different types of users who will interact with the product and describe their characteristics, needs, and expectations. This could include end users, administrators, or other stakeholders.*

Primary User Classes:

* **Browser / Mobile Users**: Average users accessing the application via a hosted webpage.
  + **Characteristics**: Users may have varying levels of familiarity with VR technology and may prefer accessible and easy-to-use interfaces.
  + **Needs and Expectations:** Seamless navigation, immersive audio-visual experiences, and compatibility with mobile devices.
* **VR Users**: Users utilizing VR devices for an immersive experience.
  + **Characteristics:** Enthusiasts, professionals, and consumers familiar with VR technology seeking high-quality immersive experiences.
  + **Needs and Expectations:** Advanced features, interactive environments, and optimized performance for VR devices.

Both user classes should have equal access to application functionalities, ensuring a consistent and enjoyable experience across different platforms.

## Overview of Functional Requirements

*Provide a high-level overview of the functional requirements that the product must fulfill. What are the key features and functionalities that users expect from the product?*

As stated above, our product will be accessed via a hosted webpage. Users will be able to load into a space from which they can access a simple menu to control the environment and audio parameters.

Key Features include:

* **Hosted Webpage Accessibility:** The application must accessible via a hosted webpage
* **Functional and Accessible Menu System:** Users can access a simple menu to control the environment and audio parameters.
  + **Menu Controls**: Start, Preferences, About
  + **Preferences**: Audio Device(input), VR Settings, Delay Synchronization
  + **About**: Automatically displayed first start; end-to-end guide on UX and brief overview of functionality/capabilities.
* **Playback**: once started the application will place the user within a 3D environment.
* **Direct Control over System Media Playback**: Ensures broad compatibility by providing direct control over system media playback.
* **Multiple Variations of Audio Reactive Visuals**: Enhances user experience by offering diverse visualizations.
* **Scalability and Versatility**:
  + Output 3D visuals using WebGL.
  + Allows for VR capabilities as well as browser compatibility.

Framework Utilization:

* **A-Frame for Rapid Development**:
  + We will *potentially* utilize the A-Frame web framework to expedite development and simplify the creation of immersive 3D environments.
  + Entity-component system, built on top of HTML: enhance our ability to quickly prototype and iterate on VR features while ensuring broad compatibility with web standards.
* **Deployment and Hosting with Vercel**:
  + High availability, global reach, and efficient content delivery.
  + **Continuous Deployment:** Vercel integrates directly with our version control system, enabling automatic deployments whenever updates are made to our codebase.
  + **Serverless Architecture:** By leveraging Vercel’s serverless functions, we can dynamically scale our application’s backend services according to user demand and our development timeline.
  + **Preview Environments:** Every git push generates a live preview deployment in Vercel, allowing our team to review changes in a fully functional environment before finalizing updates. This is crucial for maintaining the stability and quality of our application.
  + **Performance Optimization:** The use of Vercel’s global CDN for static and dynamic content drastically reduces latency, which is critical for immersive VR experiences where rapid load times and interaction responsiveness are paramount.

## Overview of Data Requirements

*Summarize the data-related requirements of the product. What types of data will be collected, stored, processed, or transmitted by the system?*

* **Audio Input Data:**
  + Data representing audio from the user’s device or external sources.
  + Continuous audio waveform data for real-time or front-loaded audio analysis
    - Spectrum Analysis
    - Amplitude Detection
    - Beat Detection
* **User Preferences:**
  + Data capturing user preferences and settings.
    - Consistent structured data used to customize a users’ experience session to session.
  + PlayerPrefs in Unity may be utilized (larger file storage is limited).
  + JSON Serialization utilized for a more secure option.
* **Application State:**
  + Managed through enumerated types for state and behavior.
* **WebGL Output:**
  + Data representing the 3D visual content generated by the application using Unity to WebGL
  + Geometry, Textures, Shaders, and Scene configurations.
  + Unity

## Operating Environment

*Describe the environment in which the product will operate. This could include hardware platforms, software dependencies, network configurations, and any other relevant factors.*

* Compatible with major VR hardware and browsers supporting WebGL.
* Dependencies on Unity for WebGL integration and Json.NET for data management.

## General Constraints, Assumptions, Dependencies, Guidelines

*Identify any constraints, assumptions, dependencies, or guidelines that may impact the development or deployment of the product. This could include budget constraints, timeline dependencies, or regulatory requirements.*

* Due to a constrained timeline; product may be limited in some key features
  + **3D / VR:** Implementation may be most effective absent VR support. Reliant on the accessibility of WebXR and WebGL.
  + **3D Graphics:** Depending on availability of open-source content, visualization may be limited to simple geometry/spectrometer.
* This will adhere to copyright law when fully implemented by not directly providing audio content.

## Design and Implementation Constraints

*Specify any constraints or limitations related to the design and implementation of the product. This could include technical limitations, compatibility requirements, or architectural constraints.*

* + **User Comfort:** *High FPS and natural movement tracking to prevent motion sickness.*
  + **Interaction:** *Intuitive interaction models suitable for both casual and experienced users.*
  + **Performance:** *Optimized for low latency and high throughput.*
  + **UI Design:** *Accessible and informative design suitable for new users.*
  + **Audio Processing:** JUCE presents a unique hurdle to developing an API that may be beyond the scope of our product.

## User Documentation

*Describe the documentation that will be provided to users to help them understand and use the product. This could include user manuals, tutorials, help guides, or online documentation.*

User documentation will be provided as a readme file on the GitHub page of our project. Appropriate levels of instruction will also be displayed as the user interacts with the system.

# REQUIREMENTS

## External Interface Requirements

### User Interfaces

*Describe the user interfaces that will be part of the product. This could include graphical user interfaces, command-line interfaces, or other forms of interaction.*

### Browser: (Non VR)

### Window Anchored Menu – In-Session Controls are static.

### Accessibility: High contrast, text-to-speech friendly options.

### VR:

### GUI will be dynamic, moving with the users controllers when possible otherwise defaulting to keyboard inputted controls.

### Hardware Interfaces

*Specify any hardware interfaces that the product must support or interact with. This could include compatibility with specific devices, sensors, or peripherals.*

### Standard Input Devices:

### Compatibility with traditional keyboard/mice, and touchscreen inputs for non VR

### VR Controllers:

### Support for most consumer level VR headsets and controllers.

### The aim is to provide mirrored keyboard controls in the absence of controllers.

### Software Interfaces

*Describe the communication protocols or standards that the product must adhere to for data exchange or interoperability. This could include network protocols, data formats, or messaging systems.*

Unity Data packaging.

JSON

### Communications Interfaces

Reverb VR will use standard internet protocols such as HTTP/S to ensure encrypted data transfer between the client and server.

## Functional Requirements

### Template for functional requirements

* **Purpose / Description:** *Clearly define the objective or goal of the requirement.*
* **Inputs:** *Describe the input data or information required to fulfill the requirement.*
* **Processing:** *Explain the processing or actions that the system must perform to meet the requirement.*
* **Outputs**: *Specify the expected outputs or outcomes of the requirement.*

## Performance Requirements

*Define any performance criteria or benchmarks that the product must meet. This could include response times, throughput, scalability, or resource usage.*

The VR headsets will need to be able to display a 90+ framerate, the machine running the program should also be able to run the experience at a 90+ framerate. The program must also be optimized to be able to run at a 90+ framerate on most modern VR headsets.

Audio latency is likely to be a major hurdle, the application aims to provide a means for the user to ensure that audio and video remains in sync.

## Security

*Specify the security requirements and measures that must be implemented to protect the product and its data from unauthorized access, manipulation, or breaches.*

Minimal security requirement since our application will require little to no data from users.

There will be a disclaimer letting users know that our application will be listening to system audio output and if there don’t agree it disables the application.

Security measures will be taken for saving preferences with JSON serialization through Unity.

## Usability

*Describe the* *usability requirements that the product must meet to ensure an intuitive and user-friendly experience. This could include accessibility, navigation, or interface design considerations.*

A minimal interface that makes it simple for any user to navigate through our application. The user should be able to access all key functionality within our application. All buttons will be self-explanatory with descriptions.

## Other Requirements

*Identify any other requirements that are not covered by the previous sections. This could include legal or regulatory requirements, performance warranties, or industry standards compliance.*

Application should be safe for users with disabilities such as epilepsy.

1. Analysis Models

List any attached / referenced documentation such as data flow diagrams, class diagrams, state-transition diagrams, entity-relationship diagrams, etc.

| ANALYSIS MODELS | | |
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| DOCUMENT NAME | DESCRIPTION | LOCATION |
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1. Issues List

Detail any unresolved issues.

| ISSUES LIST | | |
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| ISSUE ID | ISSUE DESCRIPTION | STATUS |
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