Software Requirements Specification (SRS)

INTERACTIVE HUMAN DIGESTIVE SYSTEM VR TOUR

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INDEX

1. INTRODUCTION

1.1. Purpose

The purpose of this document is to describe the software requirements of an Interactive Human Digestive System Tour Application which aims to provide a visual insight into the working and functions of the digestive system to the students through Virtual Reality Simulations. This document includes detailed information about the requirements of the above VR application. This document is intended for both the users and developers of the application as it reflects the identified constraints and proposed software functionalities. Moreover, the SRS document explains how the students interact with the simulation.

1.2. Intended Audience and Intended Use

This SRS Document is meant for all the project team members and our project professor Dr. Samit Bhattacharya as a means to instruct and inspect the team members according to the project goals and with the purpose of allowing the team members to meet all the requirements and functionalities mentioned in this document.

1.3. Product Scope

Understanding human biology as a part of primary school education is very important for the students as it gives them us a proper idea of the functioning and working of the organs and how to take care of their own body but the students always suffer in this particular learning phase as they cannot see inside their own body and watch with their own eyes, the processes and functioning of the various organs and systems and the learning remains in-effective. With the new advancements in technology, we can easily tackle this problem and this application aims to provide the students with a better idea of the functioning and working of the Human Digestive System through the medium of VR.

This application, with the help of realistic HDS model and human interaction, aims to provide a better visual insight into the HDS and the various organs involved in the process of digestion as the users will be able to see the close-up view of the whole process and from multiple perspectives according to their will. This will not only help in better understanding but also in better retaining of the knowledge which is based on the fact that visuals are processed 60,000x faster in the brain than normal text information.

1.4. Overview of the Document

The second part of the document describes the functionalities of the Immersive Human Digestive Tour application. Informal requirements are described and it is a context for technical requirement specification in the Requirement Specifications Chapter.

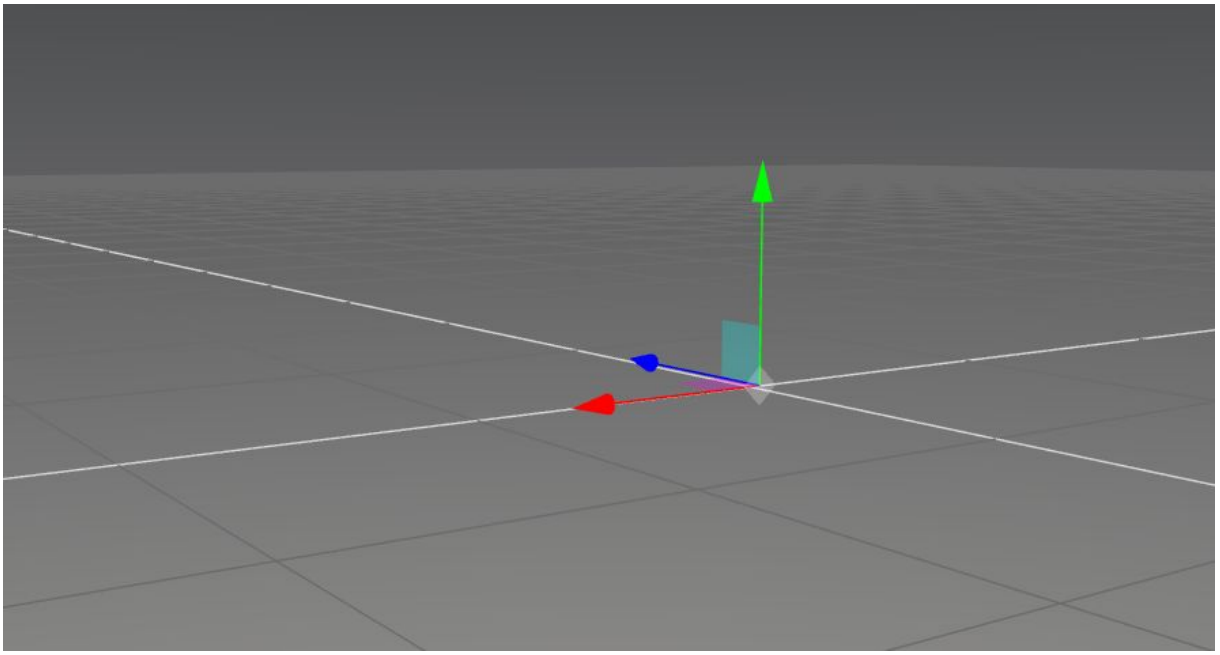
Requirement Specifications chapter is written for the software developers and details of the functionality of the application are described in technical terms.

2. OVERALL DESCRIPTION

2.1. Product Perspective

Immersive Human Digestive System VR Tour is an application that has the purpose of enabling the users to view a 3D simulation of the human digestive system from various perspectives and from various positions. The Simulation will have 2 parts: Static and Dynamic. In Static Mode, the users will be able to view the various organs of the digestive system and interact with them which will enable them to view information about that particular organ and in Dynamic mode, the simulation will show how the food is processed and undergoes various cycles while passing through the digestive system which will allow the users to get a visually better idea and context about the whole working of the human digestive system.
The VR Environment is a 3D space with X-Y-Z (Blue-Red-Green Arrows respectively) Axis and a FPV which is basically the point of view of the virtual

character in the environment. Users can transform the FPV in the 3D space both in linear and rotational terms.



The human digestive system model will be at the original and the user will be able to immerse him/herself around the model and change the POV according to their will.

2.2. User Characteristics

Target user group of this product is mainly older primary school students who will interact with this VR application. The preferred language of the users is English and have minimal to moderate technical knowledge and hence, would be assisted by a simple user interface and application design.

2.3. Assumptions and Dependencies

> The users have access to a computer system which has a web browser installed with VR libraries support and enough graphics computational power.

> The users have access to any external input device which is supported by the VR application for the gesture/haptic input from the device.

> Performance of the VR application can vary from machine to machine with different hardware specifications and architecture.

3. REQUIREMENTS SPECIFICATIONS

3.1. External Interface Requirements

3.1.1. User Interfaces

3.1.2. > Main Page - This Page will contain the on-screen buttons and 3D model of the human digestive system in the VR environment. The on-screen buttons will assist the user in navigation and changing the mode of the simulation and the VR environment will be responsible for taking input from the user and change camera position accordingly and to interact with any organ of the digestive system which will open an info-page.

> Info Page - This page will contain the information about the particular organ being interacted with and will pop up when the user interacts with a certain organ with a mouse click or from the input divide supported by the VR application and also a close button to close the info-page and return back to the main page.

3.2.2. Hardware Interfaces

A Computer System with GPU support is necessary to run the simulation. It also requires an input device which can be a camera to track hand gestures and movements or any other VR supported input device (for eg. Oculus) which in turn requires USB and HDMI Ports on the computer system and appropriate drivers installed.

3.2.3 Software Interfaces

The simulation will be able to run on any modern browser with javascript support and A-frame support and will also be able to run without an active internet connection.

3.2. Functional Requirements

3.2.1. FPV Movement

A) Move FPV Forward

Input: Pressing Forward Button on VR input device

Alternate Input: Pressing Forward Arrow on Keyboard

Output: Increments the X coordinate value of FPV

Short Description: Using the forward key will move the FPV in +ve X direction

B) Move FPV Backwards

Input: Pressing Backward Button on VR input device

Alternate Input: Pressing Backward Arrow on Keyboard

Output: Decrements the X coordinate value of FPV

Short Description: Using the backward key will move the FPV in -ve X direction

C) Move FPV Left

Input: Pressing Left Button on VR input device

Alternate Input: Pressing Left Arrow on Keyboard

Output: Increments the Y coordinate value of FPV

Short Description: Using the left key will move the FPV in +ve Y direction

D) Move FPV Right

Input: Pressing Right Button on VR input device

Alternate Input: Pressing Right Arrow on Keyboard

Output: Decrements the Y coordinate value of FPV

Short Description: Using the right key will move the FPV in -ve Y direction

E) Move FPV Upwards

Input: Pressing Up Button on VR input device

Alternate Input: Pressing + (Plus) Key on Keyboard

Output: Increments the Z coordinate value of FPV

Short Description: Using the up key will move the FPV in +ve Z direction

F) Move FPV Downwards

Input: Pressing Down Button on VR input device

Alternate Input: Pressing - (Minus) Key on Keyboard

Output: Decrements the Z coordinate value of FPV

Short Description: Using the down key will move the FPV in -ve Z direction

3.2.2. FPV Rotation

Input: Head Gesture using VR headset

Alternate Input: Mouse Cursor Movement

Output: Change in Rotation Value of FPV

Short Description: Using the head gesture will rotate the FPV wrt to the user's POV

3.2.3. Interaction

Input: Interaction Button Press on VR input device

Alternate Input: Mouse Click

Output: Displays a pop-up screen with organ information

Short Description: Pressing the assigned interaction button will display the selected organ's information on a pop-up screen.

3.3. Non-Functional Requirements

3.3.1. Performance Requirements

Simulation's visuals must run smoothly without any latency to keep the level of immersion high. This requirement is dependent on system specification of the user's computer system. Minimum requirements for running Oculus Rift are:

Processor	Intel i3-6100/AMD Ryzen 3 1200, FX4350 or greater
Graphics Card	NVIDIA GTX 1050 Ti/AMD Radeon RX 470 or greater

Alternative Graphics Card	NVIDIA GTX 960 4 GB/AMD Radeon R9 290 or greater
Memory	8 GB+ RAM
Operating System	Windows 10
USB Ports (Rift)	1 x USB 3.0 port, plus 2 x USB 2.0 ports
Video Output (Rift)	Compatible HDMI 1.3 video output

3.3.2. Software Attributes

> Portability - Immersive Human Digestive System Tour is designed as a VR web based application and can be used with any supported VR headset with the inclusion of mouse and keyboard if no external input device is available that is required for VR.

> Performance - All the assets and models should be pre-loaded so that the immersive VR experience is not affected by any sort of loading interruptions. Animations should start only when clicked and not otherwise. The 3D Model of the human digestive system should be graphically optimized so that the graphical computation can be effective and faster even on old architecture. The VR environment bounds should be optimized for the best overall performance of the web application.

> Usability - Keyboard keys and on screen keys available for navigation. If a VR input device is not available for the gesture input then the mouse can be used instead for interaction with different organs and changing camera perspective. For each functionally, an on screen button will be present including changing of static and dynamic mode of the simulation.

> Scalability - The application is to be used by 1 user at a single time so no scalability required.

3.3.3. Other Requirements

> To use the product effectively, a general idea of operation computer systems and VR input/output devices is must.

3.4. Safety Requirements

> If Hand-Held VR Input devices are used then they should be used at a minimum of 2 metres away from any object which might pose as an obstacle and cause injury to the user or the computer system or the input device itself.

> Prolonged time spent in a VR environment can produce brain-body conflict and might cause nausea, dizziness or other similar symptoms in rare cases. Brain-body conflict can be caused in simulation by changing position or rotation of the user in the simulation while the user stands still in real life. Therefore, VR applications should be used in supervision of an adult.

4. APPENDIX: GLOSSARY

> HDS : Human Digestive System

> POV : Point of View

> GPU : A graphics processing unit is a specialized electronic circuit designed to rapidly manipulate and alter memory to accelerate the creation of images in a frame buffer intended for output to a display device.

> Oculus Rift : It is a virtual reality (VR) technology that is manufactured by Oculus VR. The Oculus is a head mounted device that allows users to naturally interact with 3D virtual environments.

> USB Port : It is a standard cable connection interface for PC and consumer electronics devices. It stands for Universal Serial Bus, an industry standard for short-distance digital data communications.

> HDMI Port : High Definition Multimedia Interface is a Display connectivity port between Video & Audio provider Source over to a Display Device capable of Video & Audio Outputs.

> A-Frame : It is an open-source web framework for building virtual reality experiences. It is an entity component system framework for Three.js where developers can create 3D and WebVR scenes using HTML.

> FPV : First-Person View