SOFTWARE REQUIREMENTS SPECIFICATION

for

Immersive Human Digestive System Tour VR Application

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1 Introduction

This is a Software Requirements Specification (SRS) document describing an "Immersive Human Digestive System Tour VR Application".

1.1 Purpose

The main purpose of this document is to provide a detailed description about the requirements needed to successfully complete the VR application. It also provides a description of all the properties that will be implemented, the system attributes, specialties and the functionalities of the project. The intended audience of this SRS is Professor Samit Bhattacharya, who is in charge of the CS345-6: Software Engineering course.

The main purpose of this project is to develop an immersive Virtual Reality application that would help school students to learn about the functionalities of human digestive system efficiently.

1.2 Scope

This document intends to define the requirements for the Immersive Virtual Tour(IVT) Application. The scope of this project is giving an immersive virtual tour of the human digestive system which will help school students to understand the digestive system in a better way.

The application will provide features to the user to study the interaction of a specific organs with other organs, and how they interact together while helping in the digestion process. It will help the students visualize how the various organs work together instead of studying the organs separately, broadening their idea of the human digestive system.

1.3 References

"IEEE Recommended Practice for Software Requirements Specifications", IEEE Software Engineering Standards Committee, IEEE Std 830-1998, October 20,

1998.

1.4 Overview

The remaining part of the SRS contains:

a. The Overall Description and Functioning of the Software

b. Specific Requirements:

   1. Functional - defining the fundamental actions that the software incorporates in accepting and processing the inputs and corresponding outputs.
   2. Non-Functional - software system attributes that are used to judge the operation of the system.

2 Overall Description

2.1 Product Perspective

This product is a stand-alone Android application that can be launched after installing via a standard freely-distributed APK file. The product requires the device's gyroscope and accelerometer to function - these are accessed through the Android System Interface after requesting permissions from the user. Without these, the application will not function. A VR headset is required to see the 3D representation of the Human Digestive System. No other special hardware or software interfaces are required.

2.1.1 System Interfaces

On launching the application will require the Permissions API on the Android System to access the gyroscope and accelerometer data, the VR display and the audio playback device. If permissions are granted, system APIs are required to read the sensor data.

2.1.2 User Interfaces

a. The product will be accessible to any user on a compatible Android device and VR headset.

b. The user interacts with the virtual world through a visual interface displayed through the VR headset.

c. To change certain accessibility settings and audio/resolution preferences, a menu-based interface is provided which can be accessed through the VR headset buttons.

2.1.3 Memory constraints

The app may requires a minimum of 2 GB of primary memory (RAM) and 1GB of secondary memory for installation and execution.

2.2 Product Functions

a. Virtual World Generation

b. User State Modification

c. Organ Description

2.3 Assumptions and Dependencies

2.3.1 **Assumptions**

a. Device have a working gyroscope and accelerometer.

b. A functioning VR headset is available.

2.3.2 **Dependencies**

a. Graphic drivers installed device.

b. Audio drivers of the device.

2.4 User Characteristics

Product aims to have the following characteristics in intended users:
1. **No visual disability**: There should be no hindrance in perceiving the virtual world
2. **Linguistics**: User should understand English Language
3. Basic motor skills to use the product
4. **Light Senstivity**: User should have no Light-sensitive health conditions. It may lead to unnecessary seizures

3 Specific Requirements

3.1 External Interface Requirements

This section describes all required inputs, outputs and interfaces that the functional requirements will utilize.
Inputs

- Access to Device Internal and External Memory
- Gyroscope Data
- Accelerometer Data
- World Specification File - This is a file that contains all the physical descriptions of everything in the virtual world, including items and characters, present in the application folders in memory.

Outputs

- Display onto the VR Headset
- Vibrational feedback in the VR Headset
- Audio playback through playback device

3.1.1 Hardware Interfaces

No designated hardware posessed by application so there are no direct hardware interfaces. The vibration feedback for the VR headset is handled by the headset drivers installed on the system.

3.1.2 Software Interfaces

Communication takes places between mobile application and gyroscope and accelerometer of phone. It consists of only reading operations.

3.2 Functional Requirements

3.2.1 Virtual World Generation

Description: The 3D world is generated as an object according to the World Specification File.

3.2.1.1 Create Structure and Terrain

* Description: Creates structure and terrain of the 3D human model which will be navigated upon further.
* Input: World Specification File
* Output: 3D display

3.2.1.2 Build features-of-interest

* Description: Creates descriptive text of various regions in the 3D human model.
* Input: Current coordinates
* Output: Text

3.2.2 User State Modification

Description: Modifies position, direction, field-of-view and other view attributes of the virtual world depending on the actions by user.

3.2.2.1 Handle user movement

* Description: Updates user coordinates if the gyroscope and accelerometer readings due to user actions that indicate translational movement.
* Input: Current coordinates, accelerometer data, gyroscope data
* Output: New coordinates

3.2.2.2 Handle user direction

* Description: Updates user direction vector if the gyroscope and accelerometer readings due to user actions indicate pitch, roll or yaw movement.
* Input: Current direction vector, accelerometer data, gyroscope data
* Output: New direction vector

3.2.3 Organ Description

Description: Details like working, connections, interaction, nutrients and diseases associated with the organ are obtained.

3.2.3.1 Show working of organ

* Description: Display animation of organ working in the process of digestion.
* Input: Organ name
* Output: Animation

3.2.3.2 Get Connected Organs

* Description: Obtain list of all organs connected to the specified organ.
* Input: Organ name
* Output: List of connected organs

3.2.3.3 Get Connected Glands

* Description: Obtain list of all glands connected to the specified organ.
* Input: Organ name
* Output: List of connected glands

3.2.3.4 Show nutrients

* Description: Shows list of all nutrients the specified organ acts upon.
* Input: Organ name
* Output: List of nutrients

3.2.3.5 Get diseases

* Description: Obtain list of upto 10 need-to-know diseases related to the specified organ.
* Input: Organ name
* Output: List of diseases

3.3 Contextual Inquiry

In order to record and analyse user requirements for usability, we performed contextual enquiry in **Active mode**. The five stages of Contextual Enquiry were carried out as follows:

- **PLAN**
  - **Goal of observation:** To interact with School Students in a real time environment and record/analyse observations based on their behaviour while studying Digestive System
  - **Arrangements:** A Google Video Meet was set up for interaction with several school students. They were given a Biology Textbook and free access to Internet to study the Digestive System on their own.

- **INITIATE**
  Permission was taken from their parents and consent from respective individuals to carry out this contextual enquiry. We initiated the Video meet by opening communication and removing any anxieties the students had before the conduction.

- **EXECUTE**
  While the students were studying the Digestive system through textbook and internet, we started recording observations and necessary data based on their behaviour in real-time environment.

- **CLOSE**
  When the conduction was over, we thanked the students for their contribution. This was necessary because we may require their support again in future.

- **REFLECT**
  To identify the design goals, the analysis of data and observations collected was done. For this purpose, we used the **Affinity Diagram Method**. Ideas that were generated during the Execute Stage were first displayed and then sorted into groups under different headers. The final Affinity Diagram that was obtained is as follows:

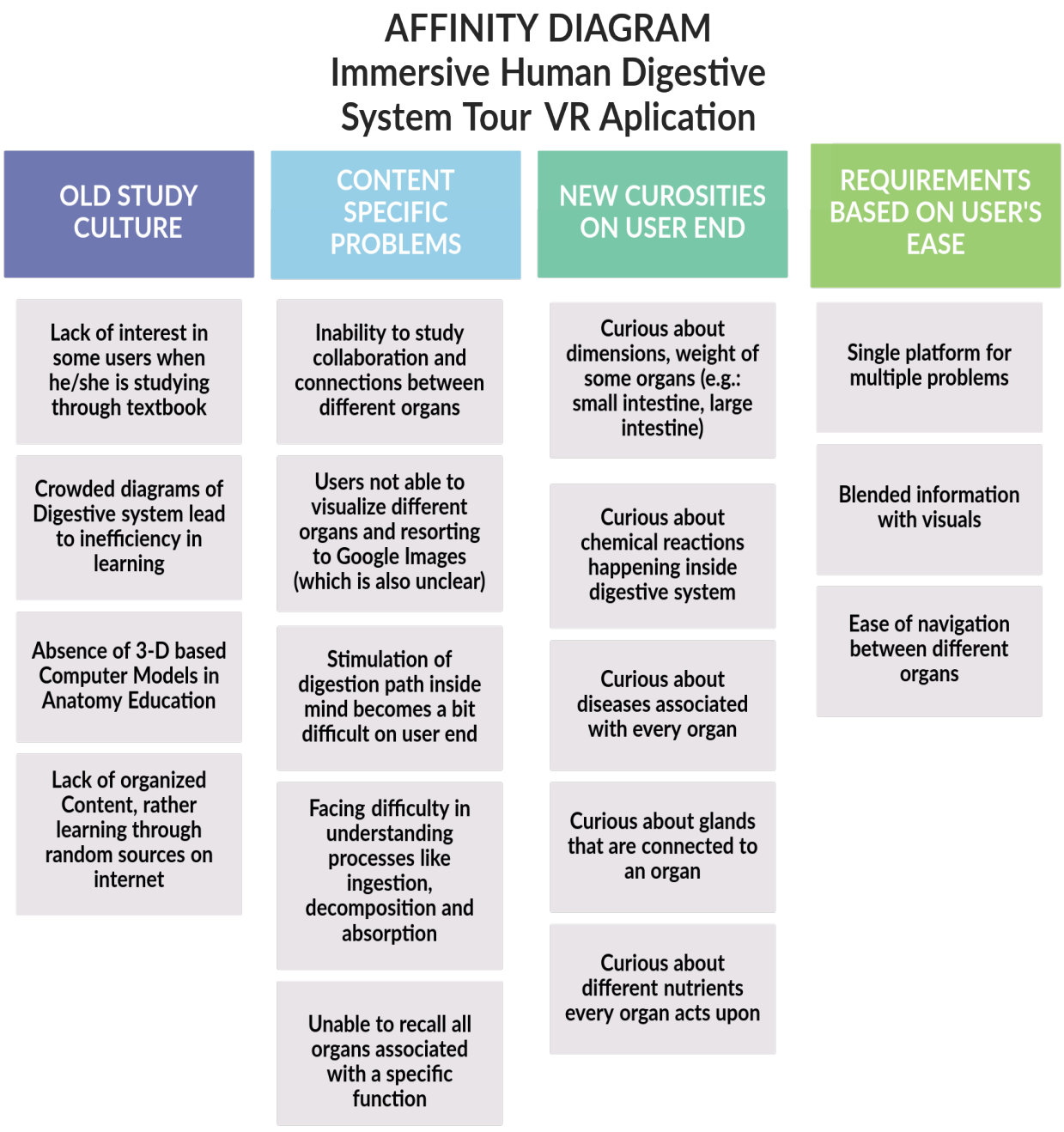

Figure 3.1: Affinity Diagram

3.4 Non-functional Requirements

This section includes all the non-functional requirements for the software.

3.4.1 **Usability**

The software should address all content specific problems, that were implied from Affinity diagram, and provide better usability than old study culture (textbooks, internet etc). Some new curiosities that were recorded on user end should also be incorporated. Further, the software will be designed keeping in mind the requirements based on User's ease.

3.4.2 **Reliability**

Without any chances of failure, the software is expected to run smoothly on the device. If the phone is powered off or a decision is made to run application in background, the application should stop running.

3.4.3 **Security**

No personal data is being collected or shared. No network communication will be made while running the software.

3.4.4 **Availability**

Once decision is made to exit from application, application will restart. Any other application will not be available for use if the current software is being used.

3.4.5 **Portability**

The software can be used on any Android phone satisfying the minimum hardware/software dependencies as specified in this SRS document previously. Installation of this application can be done through the standard Android File Manager, and this application can be shared through an APK file between devices.

3.4.6 **Maintainability**

Software patches will enable updation of the software system through Google Play Store. Necessary updates can be downloaded through standard Android interface.