Department of Computer Science & Engineering
The University of Texas at Arlington

System Requirements Specification
CSE 4316: Senior Design I
Spring 2022

NurSim
VR Palliative Care

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Revision History

Revision	Date	Author(s)	Description
0.1	03.08.2022	EH	document creation
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1.0	03.21.2022	EH, JP, JR, RT	finalized version 1
1.1	05.01.2022	EH	changed team logo
2.0	05.01.2022	EH, JP, JR, RT	finalized version 2

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1 Product Concept

This section describes the purpose, use, and intended user audience for the Palliative Care VR. Palliative Care VR is a virtual reality nursing simulator that allows users to participate in one of four scenarios dealing with patient care. Users of Palliative Care VR will be able to interact with their surroundings, the patient and their family, and complete tasks that further them towards the goal of a better patient care.

1.1 Purpose and Use

Palliative Care VR will allow the user to simulate one of four scenarios that are not taught during the regular course load for nursing students. These scenarios are delivering a terminal diagnosis to a patient and their family, accessing a patient's home for hospice release, informing the patient and their caregiver of the proper way to sterilize equipment and maintain good hygiene, and finally how to deal with the patient's body following their death. The Palliative Care VR system will by using Virtual Reality to allow the user to better interact with their surroundings and gain more from the learning process than the traditional computer application. Although the application is intended to be cross-platform with various headsets by using the XR SDK, it will only be tested on the HTC Vive.

1.2 Intended Audience

The intended audience for the Palliative Care VR system is nursing students at the University of Texas at Arlington. The system will not be made publicly available unless the University of Texas at Arlington College of Nursing makes the system available to the public. Palliative Care VR is intended to be used as a supplemental instrument for instruction during the learning process for nursing students.

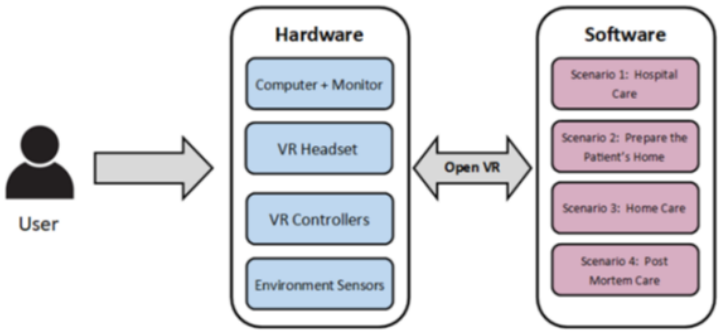

Figure 1: System Architecture

2 PRODUCT DESCRIPTION

This section provides the reader with an overview of the Palliative Care VR system. The primary operational aspects of the product, from the perspective of end users, maintainers and administrators, are defined here. The key features and functions found in the product, as well as critical user interactions and user interfaces are described in detail.

2.1 FEATURES & FUNCTIONS

The Palliative Care VR system utilizes the Unity game engine for the software requirements and an virtual reality headset and controllers. The application is developed with OpenXR to promote cross-platform capabilities so that various VR hardware can be used. The VR headset used during development and testing will be the HTC Vive. The headset is used to project the simulation directly into the user's eyes. The handheld controllers are used to allow the user to move and interact with objects within the simulation. The system will not require internet access to be run.

2.2 EXTERNAL INPUTS & OUTPUTS

Name	Description	Use
Setting	Allows for changing to desired settings	Changes system environment to conform to user preferences
Controls	VR Controller Input	Allows user to interact with in-game environment
Movement	Motion tracking of hand-held controllers and headset	Tracks the user's motions and positions them accordingly in-game
Dialog	Dialogue options with current non-playable character (NPC)	Opens dialogue options that pertain to the current NPC and current scenario

Table 1: Overview of External Inputs & Outputs

2.3 PRODUCT INTERFACES

The simulation will have various interfaces for the user to interact with. The main menu will allow the user to select which scenario to start. The settings page will allow the user to change the field-of-view of the simulation and adjust the volume. The scenarios each have their own interface with common elements between scenarios. A head-up-display (HUD) will be present to assist the user through the scenario. Using the controllers, the user will be able to move around in the scenarios, interact with objects, and pause/exit the scenario. The motion tracking provided by the VR system will allow accurate body and eye movement for the user by tracking the location and orientation of the controllers and headset. Dialog is present in all four scenarios and allows the user to interface with NPCs such as the patient and his wife (Figure 2). Each scenario will display a report upon completion for proctor use. The report will provide scoring for the scenario simulation based on completeness of tasks needed to be performed and correctness of tasks performed.

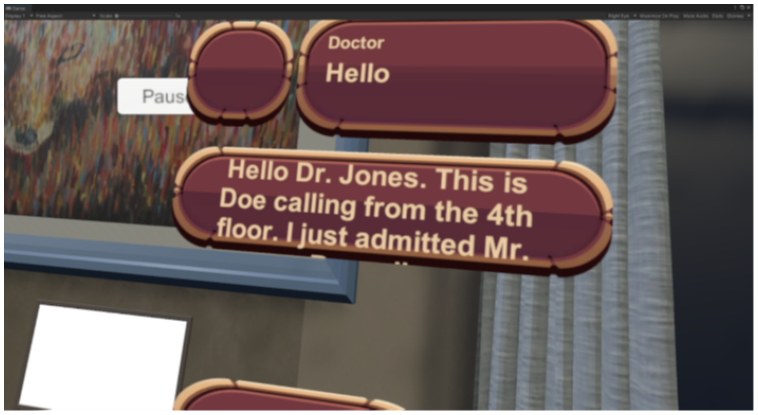

Figure 2: Dialog with doctor in Scenario 1

3 Customer Requirements

The following customer requirements were developed with our Sponsor, the UTA Nursing Department. They describe specific features required to each of the four scenarios, as well as overall functions. Requirements will be ranked in priority from Future to High.

3.1 VR Sickness Warning

3.1.1 Description

The simulation will provide a VR sickness warning upon starting. The warning will pop up on the users googles upon every start and warn them of motion sickness associated with VR use. It will say: "WARNING: Virtual Reality may cause motion sickness. If you have been playing for 30 minutes or are feeling unwell, do not continue use of the VR Headset." The user must press "Okay" on the bottom of the pop-up to dismiss it.

3.1.2 Source

Sponsor

3.1.3 Constraints

None

3.1.4 Standards

The Virtual Reality tool shall remain in compliance with the Texas Administrative Code Title 22, Part 11, Chapter 215. The Virtual Reality tool shall remain in compliance with The Regents' Rules and Regulations of the University of Texas at Arlington.

3.1.5 Priority

Critical

3.2 Main Menu

3.2.1 Description

The simulation shall include a main menu. The user will be able to use the VR controllers to observe the room and will click one of four buttons corresponding to the scenarios or a button to the tutorial. The simulation will then load the user into the appropriate scenario or the tutorial.

3.2.2 Source

Sponsor

3.2.3 Constraints

None

3.2.4 Standards

The Virtual Reality tool shall remain in compliance with the Texas Administrative Code Title 22, Part 11, Chapter 215. The Virtual Reality tool shall remain in compliance with The Regents' Rules and Regulations of the University of Texas at Arlington.

3.2.5 Priority

Critical

3.3 Tutorial

3.3.1 Description

The simulation shall include a playable tutorial. The tutorial will teach the user the controls and functionality of the game. On-screen prompts will teach the user how to jump, move, pick up objects, and interact with objects. The tutorial will also feature a brief dialog example.

3.3.2 Source

Sponsor

3.3.3 Constraints

None

3.3.4 Standards

The Virtual Reality tool shall remain in compliance with the Texas Administrative Code Title 22, Part 11, Chapter 215. The Virtual Reality tool shall remain in compliance with The Regents' Rules and Regulations of the University of Texas at Arlington.

3.3.5 Priority

Critical

3.4 Scenarios

3.4.1 Description

The simulation shall include four hospice nursing scenarios. The scenarios must be completable at a reasonable pace in under thirty minutes. The patient will be Mr. Benny Russell, a 78 year old man. The scenarios shall allow the user to interact with the patient and perform hospice duties. The user shall also be able to interact with Mr. Russell's wife and various environment elements. A high level description of the scenarios are as follows:

- Scenario 1: The nurse encounters the patient in the hospital. The nurse will be required to ensure patient safety, perform an assessment and obtain a nursing diagnosis, and administer medication to the patient.
- Scenario 2: The nurse first enters Mr. Russell's house for hospice care following his terminal cancer diagnosis. The user will assess the safety of the environment and perform an assessment of the patient. The user will communicate Mr. Russell's condition to his wife.

- Scenario 3: Mr. Russell is exhibiting signs and symptoms of impending death. The user will identify the change in status, perform a GCS, assess pain, perform suction, and communicate status with the patient's wife.
- Scenario 4: Mr. Russell will be deceased. The user will perform comfort measures for the patient and his family and will complete post-mortem care.

3.4.2 Source

Sponsor

3.4.3 Constraints

Due to time constraints, it is uncertain if all scenarios will be ready for play-testing.

3.4.4 Standards

The Virtual Reality tool shall remain in compliance with the Texas Administrative Code Title 22, Part 11, Chapter 215. The Virtual Reality tool shall remain in compliance with The Regents' Rules and Regulations of the University of Texas at Arlington.

3.4.5 Priority

Moderate

3.5 Reporting

3.5.1 Description

The simulation shall generate a report upon completion of any of the four scenarios. The simulation shall actively keep score based off the user's actions. The report will be shown on-screen and will also be saved to a text file for later viewing. The report will score the user's simulation based on completeness of tasks needed to be performed and correctness of tasks performed. For example, if a user completes all tasks in a scenario correctly, they will receive full marks. If a user misses a task, points will be deduced and the report will state which task was missed and how many points were deducted. If a task is performed but not correctly, points will be deduced and the report will state which task was performed incorrectly and how many points were deduced. A break down of tasks is listed below. This list is not exhaustive as we continue to work with the sponsor to determine proper tasks for the scenarios.

- User identifies self to patient at least once (all scenarios)
- User performs hygiene by washing hands on entry (all scenarios)
- User performs hygiene by washing hands on exit (all scenarios)
- User checks the patient's vitals (all scenarios)
- User assess patient pain using 0-10 scale (all scenarios)
- User performs focused assessment of patient (lung sounds, heart sounds, etc) (all scenarios)
- User determines nursing diagnosis (all scenarios)
- User communicates condition to patient and/or wife (all scenarios)
- User will access and/or modify the patient's electronic medical records (all scenarios)
- User assess IV site (Scenarios 1, 2, and 3)

- User identifies patient by asking for DOB and name and by checking patient armband (Scenario 1)
- User assess patient for allergies (Scenario 1)
- User checks compatibility of medication with IV using drug book (Scenario 1 and 3)
- User maintains sterile technique during medicine administration (Scenario 1 and 3)
- User administers proper dose of medication (Scenario 1 and 3)
- User performs comfort measures to wife (Scenario 4)
- User performs post-mortem care (Scenario 4)

3.5.2 Source

Sponsor

3.5.3 Constraints

Due to time constraints, it is uncertain if all scenarios will be ready for play-testing; therefore, the reporting requirement may not be implemented for all tasks.

3.5.4 Standards

The Virtual Reality tool shall remain in compliance with the Texas Administrative Code Title 22, Part 11, Chapter 215. The Virtual Reality tool shall remain in compliance with The Regents' Rules and Regulations of the University of Texas at Arlington.

3.5.5 Priority

Low

3.6 Patient Documentation

3.6.1 Description

The simulation shall allow the user to check the patient's electronic medical records (EMR). The EMR shall include medication taken by patient, recorded vital sign data, personal ID info, patient's current symptoms. The simulation shall allow the user to modify the EMR when necessary per the scenario requirements.

3.6.2 Source

Sponsor

3.6.3 Constraints

None

3.6.4 Standards

The Virtual Reality tool shall remain in compliance with the Texas Administrative Code Title 22, Part 11, Chapter 215. The Virtual Reality tool shall remain in compliance with The Regents' Rules and Regulations of the University of Texas at Arlington.

3.6.5 Priority

Moderate

3.7 Glascow Coma Scale

3.7.1 Description

The Glasgow Coma Scale (GSC) is a neurological scale which is used to asses the state of a patient's consciousness. The symptoms of the GCS will be accurately replicated in a way that will allow a nurse to properly observe these symptoms in a patient and record a corresponding score. The GCS is broken into three categories, eye opening, verbal response, and motor response. The simulation will allow the user to assess and record scores for the four categories based on the following criteria. A normal GCS score is 15, meaning the patient is fully conscious.

Eye Opening:

- 4: Eyes open spontaneously
- 3: Eyes open with sound
- 2: Eyes open with paint
- 1: No response

Verbal Response:

- 5: Oriented response
- 4: Confused response
- 3: Inappropriate words
- 2: Incomprehensible sounds
- 1: No response

Motor Response:

- 6: Obeys command
- 5: Localises to pain
- 4: Withdraws to pain
- 3: Abnormal flexion response to pain
- 2: Abnormal extension response to pain
- 1: No response

3.7.2 Source

Sponsor

3.7.3 Constraints

The dexterity of the VR controllers may make accurately implementing the GCS difficult.

3.7.4 Standards

The GCS assessment will follow the standard procedure and scoring as described above. The Virtual Reality tool shall remain in compliance with the Texas Administrative Code Title 22, Part 11, Chapter 215. The Virtual Reality tool shall remain in compliance with The Regents' Rules and Regulations of the University of Texas at Arlington.

3.7.5 Priority

Future

3.8 Patient Identification

3.8.1 Description

The user will be able to verify the identity of the patient by communicating with them and asking for two different identifiers. The identifiers that the patient will give are their name and date of birth which will be listed in the patient's EMR and will be able to be accessed by the user.

3.8.2 Source

Sponsor

3.8.3 Constraints

Because of the infinitude of answers that can be spoken by the user, communication will be text-based and provide a limited amount of options that the user may choose from.

3.8.4 Standards

The Virtual Reality tool shall remain in compliance with the Texas Administrative Code Title 22, Part 11, Chapter 215. The Virtual Reality tool shall remain in compliance with The Regents' Rules and Regulations of the University of Texas at Arlington.

3.8.5 Priority

Moderate

3.9 Administering Medication

3.9.1 Description

The user will be able to identify the patient by communicating with them and asking for two different identifiers. After the correct patient is identified, the user will then assess the patient for allergies. The user will have a choice between several different dosage options. Before administering the drug, the user must verify the compatibility of the IV Push medication to the patient's continuous IV fluid infusion by looking up in the drug book or calling the pharmacy. Then they will be able to administer the correct dose by using the injection port below the IV pump for administration as well as choose between several options of which administration rate should be used.

3.9.2 Source

Sponsor

3.9.3 Constraints

The dexterity of the VR controllers may make accurately implementing the administering medication difficult. Therefore the rate of administration will be determined via text as opposed to via motion controls.

3.9.4 Standards

The Virtual Reality tool shall remain in compliance with the Texas Administrative Code Title 22, Part 11, Chapter 215. The Virtual Reality tool shall remain in compliance with The Regents' Rules and Regulations of the University of Texas at Arlington.

3.9.5 Priority

Moderate

3.10 Hygiene

3.10.1 Description

The system shall provide hygiene mechanics in all scenarios. The scenarios will possess a functional sink paper towel dispenser, and soap dispenser. The user may interact with the sink to run the water and interact with the soap to then wash their hands. The user may then interact with the paper towel dispenser to dry their hands. Alternatively, The user will receive full marks if hand hygiene is performed on each entry and exit.

3.10.2 Source

Sponsor

3.10.3 Constraints

The dexterity of the VR controllers may make accurately depicting hand washing difficult.

3.10.4 Standards

The Virtual Reality tool shall remain in compliance with the Texas Administrative Code Title 22, Part 11, Chapter 215. The Virtual Reality tool shall remain in compliance with The Regents' Rules and Regulations of the University of Texas at Arlington.

3.10.5 Priority

Moderate

3.11 Vitals

3.11.1 Description

The simulation will display the patient's vitals on the monitor. The vitals will include blood pressure, body temperature, pulse rate, and blood oxygenation. The simulation will allow the student to say "I am going to take your vital signs now". The user will need to record the vitals signs on the monitor. In order to obtain full marks, the correct vital signs must be recorded and the user must say the phrase before taking vitals.

3.11.2 Source

Sponsor

3.11.3 Constraints

None

3.11.4 Standards

The Virtual Reality tool shall remain in compliance with the Texas Administrative Code Title 22, Part 11, Chapter 215. The Virtual Reality tool shall remain in compliance with The Regents' Rules and Regulations of the University of Texas at Arlington.

3.11.5 Priority

Moderate

3.12 Focused Assessment of Patient

3.12.1 Description

The simulation will allow the focused assessment and recording of assessment for the patient. The user will observe lung sounds, heart sounds, circulation (capillary refill, skin color, temp of extremities, pulses), abdomen (secondary to pain location prior to your assessment), and perform a neurological assessment (history of CVA (heart attacks/strokes) and administration of prior pain med). The simulation will display the proper symptoms on the patient, and the simulation will provide a Stethoscope that the user may interact with to listen to patient sounds.

3.12.2 Source

Sponsor

3.12.3 Constraints

Graphics quality of VR Headset may make accurately depicting the assessment difficult, particulary capillary refill and skin color.

3.12.4 Standards

The Virtual Reality tool shall remain in compliance with the Texas Administrative Code Title 22, Part 11, Chapter 215. The Virtual Reality tool shall remain in compliance with The Regents' Rules and Regulations of the University of Texas at Arlington.

3.12.5 Priority

Future

3.13 Pain Assessment

3.13.1 Description

The simulation will allow the user to ask the patient to rate their pain on a scale of one to ten. The user should then record the pain level the patient states.

3.13.2 Source

Sponsor

3.13.3 Constraints

None

3.13.4 Standards

The Virtual Reality tool shall remain in compliance with the Texas Administrative Code Title 22, Part 11, Chapter 215. The Virtual Reality tool shall remain in compliance with The Regents' Rules and Regulations of the University of Texas at Arlington.

3.13.5 Priority

Moderate

3.14 IV Site Assessment

3.14.1 Description

The simulation will allow the user to inspect the IV site. The user will be checking for signs of infiltration or extravasation. The user will do a physical inspection, and the simulation will accurately depict the IV site to the user. The user will do light palpation, in which the user will physically interact with the patient to feel for tenderness or other abnormalities. The simulation will display which abnormalities are present upon interacting with patient, as the VR simulation cannot simulation touch. The user will ask the patient if they feel pain or tenderness and the simulation will give the patients response. The user must record all three pieces of information.

3.14.2 Source

Sponsor

3.14.3 Constraints

The graphics quality of the VR Headset may make accurately depicting signs of infiltration or extravasation difficult. The dexterity and lack of feeling will make light palpation impossible, as the user cannot physically feel the IV site. As such, this portion of the requirement must be simplified.

3.14.4 Standards

The Virtual Reality tool shall remain in compliance with the Texas Administrative Code Title 22, Part 11, Chapter 215. The Virtual Reality tool shall remain in compliance with The Regents' Rules and Regulations of the University of Texas at Arlington.

3.14.5 Priority

Future

3.15 Post-mortem Care

3.15.1 Description

The user must perform post-mortem care in scenario 4. The patient will be depicted as deceased, but the death sequence will not be shown. The user will need to initiate dialog with the wife and choose comforting options. More details on post-mortem care will be specified as we work with our sponsor.

3.15.2 Source

Sponsor

3.15.3 Constraints

Not enough information is present on post-mortem care currently.

3.15.4 Standards

The Virtual Reality tool shall remain in compliance with the Texas Administrative Code Title 22, Part 11, Chapter 215. The Virtual Reality tool shall remain in compliance with The Regents' Rules and Regulations of the University of Texas at Arlington.

3.15.5 Priority

Future

4 Packaging Requirements

The following requirements describe needs for packaging the software and system. Because this is an in-university system, there are no packaging requirements detailing distribution.

4.1 Product Size

4.1.1 Description

The finished software product must not take more than 50 gigabytes of disk space.

4.1.2 Source

Team

4.1.3 Constraints

Unity assets are often large in size. The team will need to monitor assets and potentially limit asset use to achieve this product size.

4.1.4 Standards

None

4.1.5 Priority

High

4.2 Transport System

4.2.1 Description

The software will include a portable transport system for the VR headset and controllers. The system will include a brief case with foam cutouts to store the headset, controllers, and necessary cables such that they may be moved around campus safely.

4.2.2 Source

Team

4.2.3 Constraints

Due to the short time span of this project, it is unlikely this requirement will be completed

4.2.4 Standards

None

4.2.5 Priority

Future

5 Performance Requirements

Due to being a simulation there are many different components that need to be perform competently. Low input response time, maintaining 30 Frames Per Second, and clear audio are some of several performance requirements our teams needs to consider.

5.1 Input Response Time

5.1.1 Description

The software shouldn't take too long to respond to user input. When a input is made the software should make the appropriate response within 5 milliseconds.

5.1.2 Source

MediSim

5.1.3 Constraints

5 milliseconds is max possible response time that would be considered acceptable.

5.1.4 Standards

No standards are applicable.

5.1.5 Priority

High

5.2 Minimum 30 Frames Per Second

5.2.1 Description

The simulation should maintain a minimum of 30 Frames Per Second (FPS) to prevent motion sickness.

5.2.2 Source

MediSim

5.2.3 Constraints

30 Frames Per Second is the minimum allowed FPS.

5.2.4 Standards

No standards are applicable.

5.2.5 Priority

High

5.3 Low Frames Per Second Variability

5.3.1 Description

The simulation should maintain a fairly consistent frame rate to prevent motion sickness. Though the minimum FPS is 30 having to high a variability of the FPS can also lead to motion sickness, even if the frame rate stays above 30 FPS.

5.3.2 Source

MediSim

5.3.3 Constraints

No more than ±10 frames per second. Due to the priority of the software on the OS it is possible that resources for our software may suddenly be removed for a process that is considered higher priority. For this reason some situations cause this requirement to be out-of-reach.

5.3.4 Standards

No standards are applicable.

5.3.5 Priority

High

5.4 Clear Audio

5.4.1 Description

The simulation should have clear and clean audio to provide a good teaching experience and prevent agitation of the user.

5.4.2 Source

MediSim

5.4.3 Constraints

Audio should not be distorted, have white noise, or cut out. Sudden resource loss could cause all of the aforementioned issues, this case is out of the teams control.

5.4.4 Standards

No standards are applicable.

5.4.5 Priority

Low

6 Safety Requirements

This simulation will be used by the UTA Nursing Department in their facilities, using their equipment. Therefore, standard UTA policies for lab use will be the used as safety requirements for this product.

6.1 Laboratory equipment lockout/tagout (LOTO) procedures

6.1.1 Description

Any fabrication equipment provided used in the development of the project shall be used in accordance with OSHA standard LOTO procedures. Locks and tags are installed on all equipment items that present use hazards, and ONLY the course instructor or designated teaching assistants may remove a lock. All locks will be immediately replaced once the equipment is no longer in use.

6.1.2 Source

CSE Senior Design laboratory policy

6.1.3 Constraints

Equipment usage, due to lock removal policies, will be limited to availability of the course instructor and designed teaching assistants.

6.1.4 Standards

Occupational Safety and Health Standards 1910.147 - The control of hazardous energy (lockout/tagout).

6.1.5 Priority

Critical

6.2 National Electric Code (NEC) wiring compliance

6.2.1 Description

Any electrical wiring must be completed in compliance with all requirements specified in the National Electric Code. This includes wire runs, insulation, grounding, enclosures, over-current protection, and all other specifications.

6.2.2 Source

CSE Senior Design laboratory policy

6.2.3 Constraints

High voltage power sources, as defined in NFPA 70, will be avoided as much as possible in order to minimize potential hazards.

6.2.4 Standards

NFPA 70

6.2.5 Priority

Critical

6.3 RIA robotic manipulator safety standards

6.3.1 Description

Robotic manipulators, if used, will either housed in a compliant lockout cell with all required safety interlocks, or certified as a "collaborative" unit from the manufacturer.

6.3.2 SOURCE

CSE Senior Design laboratory policy

6.3.3 CONSTRAINTS

Collaborative robotic manipulators will be preferred over non-collaborative units in order to minimize potential hazards. Sourcing and use of any required safety interlock mechanisms will be the responsibility of the engineering team.

6.3.4 STANDARDS

ANSI/RIA R15.06-2012 American National Standard for Industrial Robots and Robot Systems, RIA TR15.606-2016 Collaborative Robots

6.3.5 PRIORITY

Critical

7 Maintenance & Support Requirements

Due to the small volume of people working on this project, it will be difficult to present the full scope of all the issues with the programming. Testing each scenario extensively may not be feasible before delivery. Because of this, we will have to update the program after delivery date if any bugs and crashes occur. The bulk of maintenance will be addressing these issues. Other maintenance issues come from equipment maintenance, maintaining a clean space for students to use the simulation, and performing necessary computer maintenance. These forms of maintenance, however, are the responsibility of the sponsor and are not in our area of concern.

7.1 Bug Fixing

7.1.1 Description

Our team will keep close watch over the usage of the software and ensure that any and all encountered bugs are fixed and the software updated.

7.1.2 Source

MediSim

7.1.3 Constraints

Due to graduation the current teams that are capable of fixing any bugs will not have the full understanding of the software's programming, thus making fixing bugs difficult. Due to low staff on the teams it may be difficult to respond to certain bugs in a reasonable amount of time.

7.1.4 Standards

There are no applicable standards.

7.1.5 Priority

Moderate

7.2 Function Comments

7.2.1 Description

We will maintain comments describing the needed input, expected output, and the usage of each function. The team that worked on the function and the individual(s) who created the function must be credited in the comments.

7.2.2 Source

MediSim

7.2.3 Constraints

Due to not being the first team to work on the Nursing VR project we cannot, with full understanding, give the appropriate commentating for functions that were made by previous individuals.

7.2.4 Standards

There are no applicable standards.

7.2.5 Priority

Low

7.3 Version Control

7.3.1 Description

The project will maintain a Git repository for version control. The repository will include all scripts used in the project. Assets, executables, and other large files will not be stored in the Git repository but with rather be stored on secondary storage. The Git repository will not be publicly available, as this project is for university use. The Git repository will be stored remotely by GitHub.

7.3.2 Source

MediSim

7.3.3 Constraints

GitHub has a 2 gigabyte limit on files for a single repository.

7.3.4 Standards

There are no applicable standards.

7.3.5 Priority

Critical

8 Other Requirements

The following requirements describe other needs to be met by the VR Palliative Care simulation. Currently, this only includes platform requirements for the software.

8.1 Windows OS Functionality

8.1.1 Description

The simulation shall be function on Microsoft Windows 10. Using Unity and developing on Windows 10 will complete this requirement. No further OS integration or portability is necessary.

8.1.2 Source

Team

8.1.3 Constraints

None

8.1.4 Standards

There are no applicable standards.

8.1.5 Priority

Critical

9 Future Items

The following requirements are re-iterated future requirements.

9.1 Glascow Coma Scale

9.1.1 Description

The Glasgow Coma Scale (GSC) is a neurological scale which is used to asses the state of a patient's consciousness. The symptoms of the GCS will be accurately replicated in a way that will allow a nurse to properly observe these symptoms in a patient and record a corresponding score. The GCS is broken into three categories, eye opening, verbal response, and motor response. The simulation will allow the user to assess and record scores for the four categories based on the following criteria. A normal GCS score is 15, meaning the patient is fully conscious.

Eye Opening:

- 4: Eyes open spontaneously
- 3: Eyes open with sound
- 2: Eyes open with paint
- 1: No response

Verbal Response:

- 5: Oriented response
- 4: Confused response
- 3: Inappropriate words
- 2: Incomprehensible sounds
- 1: No response

Motor Response:

- 6: Obeys command
- 5: Localises to pain
- 4: Withdraws to pain
- 3: Abnormal flexion response to pain
- 2: Abnormal extension response to pain
- 1: No response

9.1.2 Source

Sponsor

9.1.3 Constraints

The dexterity of the VR controllers may make accurately implementing the GCS difficult.

9.1.4 Standards

The GCS assessment will follow the standard procedure and scoring as described above. The Virtual Reality tool shall remain in compliance with the Texas Administrative Code Title 22, Part 11, Chapter 215. The Virtual Reality tool shall remain in compliance with The Regents' Rules and Regulations of the University of Texas at Arlington.

9.1.5 Priority

Future

9.2 Focused Assessment of Patient

9.2.1 Description

The simulation will allow the focused assessment and recording of assessment for the patient. The user will observe lung sounds, heart sounds, circulation (capillary refill, skin color, temp of extremities, pulses), abdomen (secondary to pain location prior to your assessment), and perform a neurological assessment (history of CVA (heart attacks/strokes) and administration of prior pain med). The simulation will display the proper symptoms on the patient, and the simulation will provide a Stethoscope that the user may interact with to listen to patient sounds.

9.2.2 Source

Sponsor

9.2.3 Constraints

Graphics quality of VR Headset may make accurately depicting the assessment difficult, particulary capillary refill and skin color.

9.2.4 Standards

The Virtual Reality tool shall remain in compliance with the Texas Administrative Code Title 22, Part 11, Chapter 215. The Virtual Reality tool shall remain in compliance with The Regents' Rules and Regulations of the University of Texas at Arlington.

9.2.5 Priority

Future

9.3 IV Site Assessment

9.3.1 Description

The simulation will allow the user to inspect the IV site. The user will be checking for signs of infiltration or extravasation. The user will do a physical inspection, and the simulation will accurately depict the IV site to the user. The user will do light palpation, in which the user will physically interact with the patient to feel for tenderness or other abnormalities. The simulation will display which abnormalities are present upon interacting with patient, as the VR simulation cannot simulation touch. The user will ask the patient if they feel pain or tenderness and the simulation will give the patients response. The user must record all three pieces of information.

9.3.2 Source

Sponsor

9.3.3 Constraints

The graphics quality of the VR Headset may make accurately depicting signs of infiltration or extravasation difficult. The dexterity and lack of feeling will make light palpation impossible, as the user cannot physically feel the IV site. As such, this portion of the requirement must be simplified.

9.3.4 Standards

The Virtual Reality tool shall remain in compliance with the Texas Administrative Code Title 22, Part 11, Chapter 215. The Virtual Reality tool shall remain in compliance with The Regents' Rules and Regulations of the University of Texas at Arlington.

9.3.5 Priority

Future

9.4 Post-mortem Care

9.4.1 Description

The user must perform post-mortem care in Scenario 4. The patient will be depicted as deceased, but the death sequence will not be shown. The user will need to initiate dialog with the wife and choose comforting options. More details on post-mortem care will be specified as we work with our sponsor.

9.4.2 Source

Sponsor

9.4.3 Constraints

Not enough information is present on post-mortem care currently.

9.4.4 Standards

The Virtual Reality tool shall remain in compliance with the Texas Administrative Code Title 22, Part 11, Chapter 215. The Virtual Reality tool shall remain in compliance with The Regents' Rules and Regulations of the University of Texas at Arlington.

9.4.5 Priority

Future

9.5 Transport System

9.5.1 Description

The software will include a portable transport system for the VR headset and controllers. The system will include a brief case with foam cutouts to store the headset, controllers, and necessary cables such that they may be moved around campus safely.

9.5.2 Source

Team

9.5.3 Constraints

Due to the short time span of this project, it is unlikely this requirement will be completed

9.5.4 Standards

None

9.5.5 Priority

Future

REFERENCES