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

Project Charter
CSE 4316: Senior Design I
Spring 2022

NurSim
VR Palliative Care

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Revision History

Revision	Date	Author(s)	Description
0.1	02.25.2022	JR	document creation
0.2	02.27.2022	JR, EH, JP, RT	initial draft
1.0	02.28.2022	JR, EH, JP, RT	finalized version 1
1.1	04.23.2022	EH	modified stakeholders
1.2	05.01.2022	EH	changed team logo
2.0	05.01.2022	JR, EH, JP, RT	finalized version 2

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1 Problem Statement

Nursing students at the University of Texas at Arlington require a tool that will give them greater exposure to hospice/palliative care experiences. To create this tool, several computer science and engineering students have worked to design various VR simulations in which you care for a patient at different stages during palliative care. Debugging each scenario and ensuring the fluidity between scenarios before conducting player testing will ensure that nursing students are able to receive proper exposure to hospice/palliative care upon release.

2 Methodology

Based on the previous and current development of the VR Nursing Simulation, the main focus will be to refine each VR scenario and fix any final bugs that the scenarios might have. The look and feel of the levels need to be tested and will be altered to match each other, and any visual and interactive inconsistencies between levels will be fixed. Finally, we need to thoroughly player test the entire simulation so that the product is polished and ready to use by the scheduled demo presentation on August 12, 2022.

3 Value Proposition

Debugging, level consistency, and adjustments needed to make the VR experience more immersive will be the priorities of this team. Player testing, scheduled to start over the Summer at the latest, will provide feedback that will in turn improve the product overall and enhance player experience.

4 Development Milestones

- Project Charter first draft - February 2022
- System Requirements Specification and System Research - March 2022
- Architectural Design Specification - April 2022
- Demonstration of Scenario Refinement Round 1 - April 2022
- Demonstration of Scenario Refinement Round 2 - May 2022
- Detailed Design Specification - June 2022
- Demonstration of Overall Product Refinement - June 2022
- Demonstration of Player Testing 1 Improvements - July 2022
- Demonstration of Player Testing 2 Improvements - July 2022
- Final Project Demonstration - August 2022

5 Background

The sponsor and customer for this project is the Department of Nursing at the University of Texas at Arlington. The points of contact for the department are RaeAnna Jeffers and Jennifer Roye along with Dr. Shawn Gieser who is acting as a foreman for the project.

One area that the Department of Nursing is lacking is hands on experience for nursing students working with hospice patients. This is an area of nursing that is challenging to work in, and by having experience prior to graduating, nursing students will be much more prepared for their careers. Gaining experience will not only help the nurses manage hospice care in a more positive manner, but it will also make them more effective for easing the patient to their end. It can be very difficult to witness an individual on their last legs, and so by training in a realistic environment the nurse will be better prepared for managing the emotions and outcomes involved.

A VR simulation will allow nurses to gain valuable experience working with hospice patients. The simulation will expose students to elderly individuals and how to manage their environment. It will also enable students to witness issues that could potentially come up in a real situation in an immersive training session. Since the simulation will be three dimensional, it will provide a more realistic training for students than any current 2 dimensional implementations.

6 Related Work

The use of virtual simulation for training purposes has already been successfully applied to the medical domain. A popular tool for training undergraduate nurses is vSim for Nursing. This is technology featuring web-based simulations adapted from training scenarios typically performed with a dummy. This gives undergraduates an access to education, training, and practice that otherwise would be limited if offered at all [1]. Virtual reality is implemented in simulation spanning the areas of surgery for practicing procedures such as therapeutic gastroscopy and cardiac catheterisation [2] as well as starting to expand into other areas.

The VR simulations that exist have been tested to show increased knowledge and preparedness of users. A study of a VR Foley catheter insertion simulation showed not only increased performance scores, but also a general sense of confidence and preparedness among the experimental group [3]. Another study revealed that participants of a clinical simulation had significantly more knowledge retention over a period of 2 months in comparison to the control group [4].

Virtual reality has proven to be a good tool for training nurses for knowledge retention as well as self-preparedness of individuals. Due to the lack of scenarios pertaining to hospice and at-home care included in vSim for Nursing [5], another technology is needed. Nurses are shown to be unprepared for hospice care especially the steps required in post-mortem care. This situation is very practical, however preparation for this event can be hard to simulate via mannequins or web-based scenarios. Virtual reality has proven to be more effective in training nurses over a web-based simulation. Therefore the proposed system is a needed addition for training nurses in a variety of scenarios as well as giving students access across many universities and learning programs.

7 System Overview

Our team will be continuing a preexisting project that uses VR technology to train nurses in palliative and post-mortem care. This technology is accomplished using VR equipment and the software architecture includes four different scenarios as shown in Figure 1. All four scenarios have been mainly completed. Our team is going to focus on adding the last bit of functionality to the software as well as run extensive testing to fix any last bugs that need to be addressed.

Users will perform as the nurse assigned to the hospice patient. They will be exposed to four training scenarios which are designed to give them experience working with the patient. They will use virtual

reality headgear and controllers to interact with the environment, identify and manage risks, and communicate with the patient and the family. The planned scenes include a hospital environment, patient's home, and the patient's bedroom. Our team will be assisting the current team with their work as well as working on the remaining scenarios of administering care of the patient when they are in their home and completing the post mortem procedures.

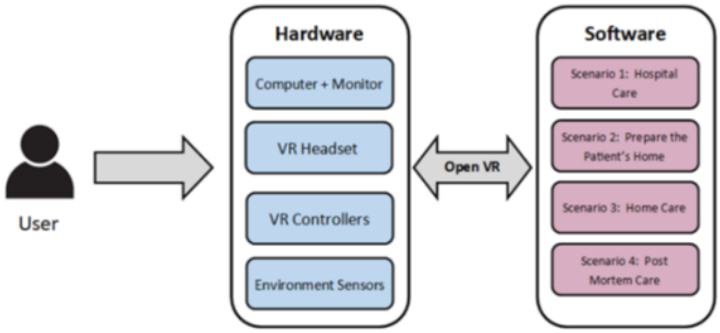

Figure 1: System Architecture

8 Roles and Responsibilities

The stakeholders for this project are Jennifer Roye, the Assistant Dean for Simulation and Technology and a Clinical Assistant Professor at the University of Texas at Arlington College of Nursing and Health Innovation, as well as the Nursing Department as a whole and Shawn Gieser, the professor overseeing our Senior Design course at UTA. Mrs. Roye will be the point of contact for the project requirements and constraints, and Dr. Gieser will be the point of contact for the project's daily needs and for the resolution of any technical issues. Team members will take turns being the point of contact for both of the aforementioned persons to contact our team. Our team members are Emelyne Hoang, Jackson Park, Jorge Rodriguez, Rafel Tsige. As our team's work is contingent upon the current senior design team working on the product, each member's specific duties and roles including product owner and scrum master are subject to change and will be defined more in detail as the project continues.

Team members will meet once a week either in person or via Microsoft Teams in order to evaluate project progress, touch base to divide future work, problem solve, and discuss other matters about the project. Meetings with the sponsors, Jennifer Roye and Shawn Gieser, will be scheduled on a need basis or if requested. These meetings will enable the group to get specific design choices approved as well as get technical and professional advice and feedback. There will also be a meeting with the team from Senior Design 2 team on a need-basis to discuss important aspects of the project, tasks, or if there is confusion with the project. Every sprint, the team will hold meetings to complete the sprint plan and sprint review/retrospective and prepare for in-class presentations including turning in all required deliverables.

9 Cost Proposal

All senior design teams are allotted 800 dollars in budget. Considering the unique nature of this project and the fact that most of the designing and implementation has been completed it is unlikely that most of this budget will be used. However there may be some cost for the necessary VR software to convert the project into VR.

10 Facilities & Equipment

The nature of this project being a virtual reality simulation means that we need to use VR headsets as well as hand held controllers and cameras to track the motion. The equipment will be provided by the senior design laboratory in the form of an HTC vive and openVR software. A desktop computer will also be required with openVR setup on it. This will also be provided by the laboratory as well as a space for in person meetings and experimentation with the VR equipment. In addition to what is required for the VR aspect of this project we will also be using Microsoft Teams to communicate within the group and with the sponsor.

Furthermore in order to work on the project at home we will all need adequately sufficient computers capable of running Unity 3D. The Unity Asset store will be used to acquire assets to be used within the simulation. It may be beneficial for some of the group members to acquire software to create custom assets such as Blender. Along with developing the VR simulation the team will be writing scripts in C which may necessitate the use of an IDE software. The team will also be using Trello to keep track of the project progress. The entirety of the final product will be given to the UTA School of Nursing upon completion. This will include any source code, custom 3D assets, voice lines, and vocal performances created for the project. The remaining funds and grant money will also be returned to the sponsor upon the completion of the project.

11 Assumptions

The following list contains critical assumptions related to the implementation and testing of the project.

- The source code provided by previous teams will require a lot of work to bring up to par.
- Team members and sponsor will be able to attend and participate in all meetings pertaining to them.
- All development team members are capable programmers who will be able to pick up Unity and C# quick enough to create meaningful progress in the project.
- The CSE department will provide us with a computer fully capable of running Unity's VR environment.
- All team members have necessary access to the VR equipment and senior design laboratory.
- The nursing department will provide us with students willing to test the equipment.

12 Constraints

The following list contains key constraints related to the implementation and testing of the project.

- Final prototype demonstration must be completed by May 2022.
- The simulation must not take longer than 30 minutes to complete.
- Testing and simulation will be restricted to the senior design laboratory.
- Senior design laboratory will only be accessible by development team during normal business hours
- Total development costs must not exceed eight-hundred dollars, unless the grant is given to the project of which the cost limit will be determined with the sponsor at a later date.

13 Risks

The following high-level risk census contains identified project risks with the highest exposure. Mitigation strategies will be discussed in future planning sessions.

Risk description	Probability	Loss (days)	Exposure (days)
Scheduling conflicts between team members	1.00	2	2.0
Senior design lab is not available	0.20	5	1.0
Issues with previous team's code and design structure	0.50	7	3.5
Team members are inexperienced in Unity	0.50	8	4.0
Team member did not complete their assigned task on time	0.15	10	1.5

Table 1: Overview of highest exposure project risks

14 Documentation & Reporting

14.1 Major Documentation Deliverables

14.1.1 Project Charter

The Project Charter will be updated at the beginning of each sprint following the creation of the Sprint Plan. Each member will maintain their individual sections and the team will work together to maintain sections that require group decisions and discussion. The initial version will be delivered by February 26th, 2022 and the final version will be delivered by August 12th, 2022.

14.1.2 System Requirements Specification

The System Requirements Specification will be updated each sprint following meetings with sponsors or any instance a requirement needs to be changed during development. Team members can update system requirements with group consensus and/or sponsor agreement. There can be a meeting to discuss the change if needed.

14.1.3 Architecture Design Specification

The Architectural Design Specification will be updated as the scenarios are further developed and planned out. As requirements change and new/other ways to structure the system emerge, the ADS will be adjusted. If there is a SRS change or issues with development that requires an adjustment, the ADS will be adjusted per the consensus of the group. There will be a meeting to discuss the change if needed.

14.1.4 Detailed Design Specification

This document will be completed in Senior Design 2. Further details will be included when the requirements of the document are known.

14.2 Recurring Sprint Items

14.2.1 Product Backlog

Items from the SRS will be added to the product backlog according to a group consensus on the importance of the item. Items will be created and prioritized based on the SRS each sprint with feedback from both the sponsors and the Senior Design 2 team. A project management software like Trello or an excel spreadsheet will be utilized to define product backlog items.

14.2.2 Sprint Planning

Each sprint plan will require a meeting of all group members. Currently, team meetings are held weekly so if it is the beginning of a sprint, the meeting will be primarily dedicated to spring planning. Sprint plans will be based on analyzing what Senior Design 2 is working on, feedback from the sponsors, and what the team would like to get done as a part of the overall requirements.

14.2.3 Sprint Goal

The sprint goal will be discussed at the meetings for the sprint plan and each member will give their feedback on the tasks they feel is most important to satisfying the requirements/project goals. We will bring this idea to the sponsors and if they approve we will set that as our goal.

14.2.4 Sprint Backlog

Although the role will change, the product owner will be responsible for managing the sprint backlog. A project management software such as Trello may be used for maintaining a backlog and is up to the product owner for that sprint.

14.2.5 Task Breakdown

The product owner will propose a division of tasks based on the sprint backlog and each individual member will confirm it is within their bandwidth for that sprint. If an individual has other commitments and cannot take on that many tasks, another member can take the task or the number of tasks can be reduced by pushing low priority tasks to the next sprint.

14.2.6 Sprint Burn Down Charts

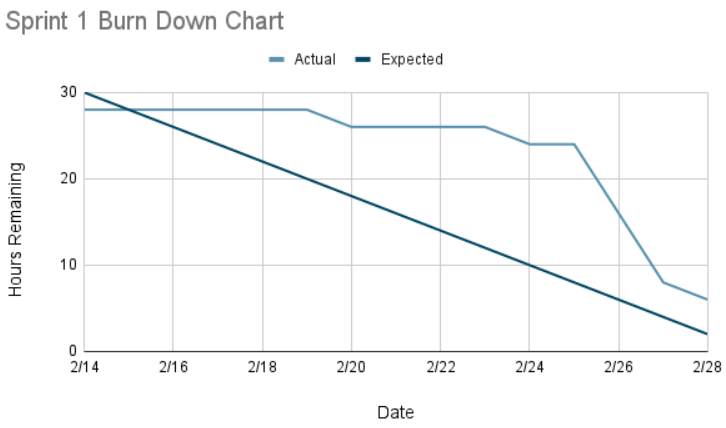

Figure 2: Example sprint burn down chart

14.2.7 Sprint Retrospective

The Sprint Retrospective will be held during the team meeting after the Sprint Review presentation. We will document the changes we make as a group and what each person's responsibilities for the next sprint are.

14.2.8 Individual Status Reports

Status reports will be verbally conducted during each team meeting. It can also be conducted through team chats online.

14.2.9 Engineering Notebook

Each team member is responsible for their own notebook. There is no minimum requirement for update intervals; however, it should be updated to record progress, ideas, meetings, and major changes to the project, along with any other information. Team members are held accountable through ENB assignments, where scanned pages are submitted for review.

14.3 Closeout Material

14.3.1 System Prototype

Our final system prototype will include a packaged Unity project. The project will be demonstrated in a video submitted on August 12, 2022, and will be published on the group's page of the UTA CSE Senior Design blog. We will not perform field acceptance testing.

14.3.2 Project Poster

The poster will have dimensions of 3x4 feet (36"x48") and will include the project vision, mission, architectural design diagram, key requirements, and future work, along with in-game screenshots of the simulation. The poster will be delivered on August 12, 2022.

14.3.3 Web Page

The web page will include the name of our team and all members, our active time as a team, and our sponsors. It will have sections for an abstract, background information, project requirements, system overview, results, and future work, along with links to our project files, a demo video, and any additional references. It will be finalized by August 10, 2022

14.3.4 Demo Video

In our video we will be be presenting a little portion of each scenario and demonstrate that they all run smoothly and without bugs.

14.3.5 Source Code

The source code will be contained on GitHub. The previous team currently has the source code on the PC in the lab in ERB 202 and this team plans to also have that code available on GitHub for access at home. It is currently unknown if the sponsor has access to the source code or if the sponsor plans to keep this as an open source project. Assets (animation files, 3D model files, etc.) will be stored on a OneDrive for easy home access so students are not required to go to the lab to make changes.

14.3.6 Source Code Documentation

Although no code has been written thus far, the team plans on using a tool to organize the code such as doxygen to generate the documentation and a browsable HTML for the final documentation. The reason for this is to provide an organized and easy-to-access documentation for future teams and/or as this project is adopted by others.

14.3.7 Hardware Schematics

There are no hardware components that the team will be developing themselves. There will only be pre-made hardware that must be used such as a VR headset and controllers that the customer is assumed to be equipped with.

14.3.8 CAD Files

There is no aspect of the project that involves mechanical design.

14.3.9 Installation Scripts

This program runs on Unity which has the means for building the code base for different platforms on its own. The sponsor may use Unity's own building tools to port the project over to other platforms.

14.3.10 User Manual

The sponsor will be provided a tutorial for users to learn how to interact with the game world.

15 References

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4. J. M. Padilha, P. Puga Machado, A. Ribeiro, J. Ramos, and P. Costa, "Clinical virtual simulation in nursing education: Randomized controlled trial," Journal of Medical Internet Research, vol. 21, no. 3, 2019.

5. F.-Q. Chen, Y.-F. Leng, J.-F. Ge, D.-W. Wang, C. Li, B. Chen, and Z.-L. Sun, "Effectiveness of virtual reality in nursing education: Meta-analysis," J Med Internet Res, vol. 22, no. 9, p. e18290, Sep 2020.