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

Project Charter
CSE 4316: Senior Design I
Summer 2021

VR Nursing Team
CareVR

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Revision History

Revision	Date	Author(s)	Description
0.1	07.07.2021	MC, KD, NM, AA	Initial draft

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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. Currently, these simulations are disjointed in how they feel and operate. Combining these simulations into one cohesive program will increase their effectiveness for both students and instructors.

2 Methodology

The first step to solving this problem is to design a VR program with a menu that will allow the user to select a simulation. The second step is to take each of the previously created VR simulations in their current states and integrate them with this newly created menu. This step is likely to introduce many issues in each of the simulations, so the next step is to any fix issues introduced during this process making sure each simulation works properly. Once all of the simulations are functionally working the final step will be to create consistency between them, which means making sure they all look, feel, and operate the same way.

3 Value Proposition

Combining all of the work done by previous teams on this project will be a major step towards its completion. Going forward, those who work on this project will have access to all of the parts that comprise it, making further developments much more efficient and consistent. Not only will this streamline the developmental process, but it will also make for a more complete end user experience.

4 Development Milestones

This list of core project milestones should include all major documents, demonstration of major project features, and associated deadlines. Any date that has not yet been officially scheduled at the time of preparing this document may be listed by month.

- Project Charter first draft - July 2021
- System Requirements Specification - July 2021
- Architectural Design Specification - August 2021
- Demonstration of VR Simulation Menu - August 2021
- Detailed Design Specification - September 2021
- Demonstration of VR Simulation Integration (not working) - September 2021
- Demonstration of VR Simulation Integration (working) - October 2021
- CoE Innovation Day poster presentation - November 2021
- Demonstration of Consistency Improvements - November 2021
- Demonstration of Consistency Finalization - November 2021
- Final Project Demonstration - December 2021

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

As of now, virtual reality is a very active area of research for the nursing field. One article details how simulating a patient setting results in greater student confidence and overall better work performance [1]. Another area that tackles the hospice field is the use of manikins which nursing students will maintain and take care of. Manikins provide excellent hands on exposure for nursing students as they progress in their training. The largest issue is the cost of the manikins, with each boasting a large 10,000 dollars [2].

A virtual reality solution would be much more cost effective while still maintaining a high degree of immersion. One virtual reality solution for the nursing field is the Oxford Medical Virtual Reality Simulation [3]. This technology allows nursing students to fully immerse themselves in a wide range of patient care situations. However, where this technology falls short is that it does not address the hospice care area. Because of this, it does not completely prepare nursing students for the unique types of scenarios that they will encounter during hospice.

7 System Overview

Currently the Nursing Department utilizes a two dimensional simulator which will be improved upon with the use of Virtual Reality technologies. The training program is in a partial state of completion and our team will be meshing the previous projects into one uniform program. We will be utilizing OpenVR in order to create a cross-platform project that support multiple VR headsets such as the Oculus Quest II and the HTC Vive headsets. Since previous teams developed their respective projects in different versions of Unity, our team will match versions and perform quality control to ensure that users have a more unified experience when changing from level to level.

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, identity and manage risks, and communicate with the patient and the family. The planned scenes include a hospital environment, the patient's home, and the patient's bedroom. Our team will be joining these scenarios together as well as creating general menu options to form a complete product.

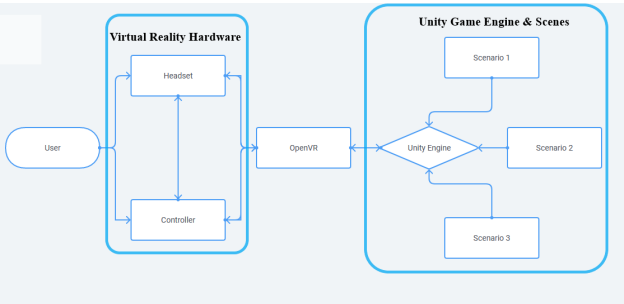

Figure 1: System Flowchart

8 Roles & Responsibilities

The stakeholders for this project are Raenna Jeffers, the Health Sciences Librarian at UTA as well as the Nursing Department as a whole and Shawn Gieser the professor teaching Senior Design 1 at UTA. Ms.Jeffers will be the point of contact for the project requirements and constraints, and Mr.Gieser will be the point of contact for the project's daily needs and for the resolution of any technical issues. The team members working on this project will also be stakeholders in the sense that their professional reputation relies on the success of the project. Those team members are Adam Albawab, Kyle Deweese, Max Chan, and Nikolas Murguia. Din will serve as the team leader. Nikolas will serve as the liaison between the team and the sponsors. Kyle will serve as the scrum master to facilitate the scrum by ensuring the scrum framework is followed. Adam will be the lead programmer although everyone on the team will serve as programmers as well.

Team members will meet at least once a week to evaluate the progress made until that point and determine the goals for the next sprint. During this meeting help can be provided and information can be shared between group members. After the meeting Nikolas can relay this information to Raenna and gather her input in regards to potential solutions or new requirements. The team will also meet with Shawn every other week to gather his input and discuss the best way to proceed with the project in regard to solving new problems and innovating new solutions. The last regular meeting required will be to convene before the end of the sprint in order to complete the sprint review and create the new sprint plan. During this meeting members will also make changes to the project charter and supporting documentation as well as fill out their engineering notebooks.

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.

9.1 Preliminary Budget

Unity assets would be the only expense and it costs around 400

9.2 Current & Pending Support

The budget is currently provided by the Department of Computer Science with 800 dollars. There is no pending support that is necessary to be secured.

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 is in its preliminary stages and will require lots of work to bring up to par.
- All team members will be able to attend and engage in the meetings as well as work on the project.
- All members of the development team are capable programmers who can pick up Unity and C quick enough to create meaningful progress in the project.
- The budget will not be an issue given the low cost of the project.
- All members have access to the senior design laboratory and VR 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 December 3rd, 2021
- Total development costs must not exceed $800
- Prototype will be developed off of all previous nursing projects
- Simulation testing is restricted to the senior design lab

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)
Previous projects didn't match versions with each other	1.00	20	20
Senior design lab is not available on certain days	0.20	5	1
VR headset doesn't operate properly	0.05	20	1
Team member dropped out from class	0.05	20	1
Team member didn't complete assigned tasks on time	0.10	10	1

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 revised in the beginning of every new sprint to account for prior sprint's progress. The document could also be maintained after each weekly meetings with the sponsors and team lead, if there are any new requirements or alterations requested. The initial version will be delivered by July 7th, 2021. The final version will be delivered by December 3rd, 2021.

14.1.2 System Requirements Specification

The System Requirements Specification will be maintained and updated after weekly meetings with the sponsors to account for any changes along the way. If there are any changes in system requirements during development, the document can also be edited by any team member with approval from the team. The initial version will be delivered by July 26th, 2021. The final version will be delivered by December 3rd, 2021.

14.1.3 Architectural Design Specification

The Architectural Design Specification will be maintained and updated after weekly meetings with the sponsors to account for any changes along the way. If there are any changes in system requirements during development, the document can also be edited by any team member with approval from the team. The initial version will be delivered by August 16th, 2021. The final version will be delivered by December 3rd, 2021.

14.1.4 Detailed Design Specification

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14.2 Recurring Sprint Items

14.2.1 Product Backlog

Prior to the beginning of each sprint, we will hold a team meeting in which we will list out all the requirements and sort them by importance. Each member of the group will select which requirement to complete. We will give our time estimates, and all the progress will be tracked by using project management tool, Trello. GitHub will be used as version control, where each member can complete their requirements on a separate branch.

14.2.2 Sprint Planning

There will be 7 sprints through the course of this project. Prior to the beginning of each sprint, we will hold a team meeting to address remaining requirements and split the tasks. We will also revise the progress from the previous sprint and reevaluate progress and time estimates for each task if necessary.

14.2.3 Sprint Goal

Sprint goals will be determined by the team during the sprint planning meeting. If sponsor emphasized certain requirements, those requirements will become the top priority.

14.2.4 Sprint Backlog

Our team will manage product backlog through meetings and discussions. The backlog will be maintained through Trello.

14.2.5 Task Breakdown

Each team member will voluntarily claim tasks they wish to complete. Once tasks have been selected, team members make an estimation of the required time of completion. Time spent on tasks will be recorded in Excel sheet. Team member will also create a to-do list and establish deadline on Trello for each task. At the end of the sprint, all team member's time spent on the tasks will be collected and accumulated from Excel sheet.

14.2.6 Sprint Burn Down Charts

Sprint Burndown Charts will be generated by Max Chan. The responsible member will gather timesheets, accumulate time spent for each team member, then create and distribute the burndown charts to the other members of the team.

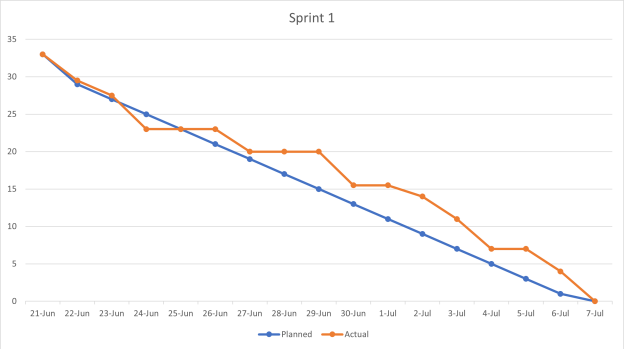

Figure 2: Sprint Burndown Chart

14.2.7 Sprint Retrospective

After receiving a burndown chart, each team member will be responsible for creating and submitting their own retrospectives

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 Notebooks

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 Materials

14.3.1 System Prototype

Our final system prototype will include a packaged Unity project. The project will be demonstrated in class on December 3rd, 2021, and will be published on the CareVR page of the UTA CSE Senior Design blog.

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 December 3rd, 2021.

14.3.3 Web Page

The webpage 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 on December 3rd, 2021.

14.3.4 Demo Video

The demo video will be between 2 - 5 minutes in length, and will include a brief overview of our project, a short explanation of the ECS design pattern used, and a demo of the application. Implemented requirements will be covered as the demo progresses.

14.3.5 Source Code

The source code will be maintained on GitHub. A final package using Google Drive will be used to send our completed project to our sponsors, instructor, and future teams. The licensing of the project will be determined by the sponsors.

14.3.6 Source Code Documentation

Source code will be documented in-line through Unity as it is produced by the team members.

14.3.7 Hardware Schematics

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14.3.8 CAD files

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14.3.9 Installation Scripts

Readme file will be provided with the software explaining how to load the program using Unity for the first time.

14.3.10 User Manual

Digital user manual will be left for future team who is assigned to this project to create.

REFERENCES

[1] Cynthia A Blum. *High-Fidelity Nursing Simulation: Impact on Student Self-Confidence and Clinical Competence*. International Journal of Nursing Education Scholarship, 7th edition, 2010.

[2] Education. *g*. Basic Geriatric care trainer, 2002.

[3] HealthySimulation Team. Oxford Medical Simulation Transforms Healthcare Education with Virtual Reality, 2019.