GNG1103 Section #B02 Team #B05

# Project Deliverable C: Design Criteria and Target Specifications

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## Introduction

In this document, we established how our product is going to be designed using the presented needs. As well as listing the functional and nonfunctional requirements to make the experience as enjoyable as possible for the patient. All whilst keeping in mind that there are a few limitations to work around to keep the project successful. We also researched the available VR technology in the medical field that was closest to our own. Comparing the technologies, we were able to find different traits for our application that could benefit us.

**Table 1: Specific Design Criteria**

| Number | Need | Design Criteria |
|---|---|---|
| 1 | Make a platform in which videos can play in VR | Ability to play stereoscopic (180°) video |
| 2 | Using the orientation in the Oculus headset, make it impossible to play without the correct orientation. This will stimulate the actual procedures | Retrieve pan, tilt, and shift from the headset sensors |
| 3 | Be able to put other videos in the program for different operations | Procedure-agnostic software; user interface must not be related to any specific procedure |

| | | |
|---|---|---|
| 4 | Make the software bilingual (French & English) | Display menu options in both French and English |
| 5 | It has to be a tailored experience for each age group/user | Tailor menu options and displays dependant on the user's age and role (patient vs. staff) |

**Table 2: Engineering Design Specifications (EDS)**

| | Design Specifications | Relation (=, < or >) | Value | Units | Verification Method |
|---|---|---|---|---|---|
| | **Functional Requirements** | | | | |
| 1 | The application needs to detect whether the user is lying down | = | 180 | ° | Testing |
| 2 | Efficiency | < | Dependant on video length | minutes | Testing |
| 3 | Being able to use our application in the future in other medical fields | = | yes | N/A | Testing |
| | **Non-Functional Requirements** | | | | |
| 1 | Colours | = | yes | N/A | Analysis, Testing |
| 2 | A different experience for every age group | = | yes | N/A | Testing |
| | **Constraints** | | | | |
| 1 | Setup Time | = | 2 | minutes | Testing |
| 2 | Cost | < | 100.00 | CAD | Budget tracking |
| 3 | Portability | = | yes | N/A | Testing |

**Table 3: Benchmarking**

| *Specifications* | *Importance weight* | *Karuna Labs Chronic Pain Management* | *MedicalHolodeck* | *Orr's Chemotherapy* |
|---|---|---|---|---|
| **Company** | - | Karuna Labs | MedicalHolodeck | Orr's |
| **Portability** | 4 | In-House Headset / HTC VIVE PRO | HTC VIVE | Rift S |
| **Cost** | 3 | 1700 CAD | Free | 528.81 CAD |
| **Memory** | 1 | - | 16 GB RAM | 8 GB |
| **Graphics** | 2 | NVIDIA GTX1080 | NVIDIA GTX1070 | NVIDIA GTX 1050Ti |
| **Storage** | 1 | - | 2 GB | - |
| **Total** | - | 11 | 16 | 24 |

Table 1 and Table 2 outline the specific design criteria and engineering design specifications for designing a fully functional VR platform that can play 180º video provided by the customer. Our clients Dr. Justin Sutherland and Dr. Daniel La Russa have requested our team to design a VR platform through which videos of hospital procedures may play and educate patients ahead of undergoing the aforementioned procedure. Not only will the application show patients what they will be subject to, but it will ease anxiety about the procedure. Our platform will be first used by the radiation units in the hospital, showing the radiation therapy processes in a safe and calm environment. However, our platform will have the option for other units in the hospital to add their own content to then display a multitude of procedures. We are doing this, so our application has the potential to be adapted and used in other medical fields.

The virtual reality application has various functional requirements, which our group will need to attain in order to make a fully operational product. The base product must be able to play back video recorded in a field of view of 180°, as provided by the clients. The application itself will be procedure-agnostic; that is to say, it will not be made specifically for any type of medical procedure (ex. CT scan, surgery, radiation therapy, etc). The application must also be efficient enough to be useful within the medical field; this will require the application to be able to run adequately on most VR hardware.

The virtual reality application has a couple of non-functional requirements which would better the experience of the patient. We have noticed that colours will be playing an important role in shaping this application. For one, our aim is to have an interface for both youth and adults. This will be a meaningful add-on since it will be more multifaceted. It is also well known that the psychology of colours has a definitive impact on human behaviour. It can affect how a person feels and change their mood. Using various colour schemes based on its human impact will help reduce the patients' anxiety levels. We will use colours that ease stress levels and bring peace of mind. For example, the colour white is known to be peacefulness and innocence whereas the colour blue brings calmness and stability. These colours will have a positive influence on the patient's mood and behaviour. We are also looking to provide a different experience for every age group. The interface we will have will ask the user which age group they belong to which will bring them to a different part of the application. The use of colours, as mentioned above, will be a way to have a unique experience for both youths and adults. We will also consider using different jargon. Words that are understood by adults are not necessarily comprehended by youth. It is also a question of generational differences; where we could attempt to use some friendly words for children but remain more professional for the latter age group. Also, the level of complexity and depth going into the description of the various medical machines will depend on the patient's age. These two non-functional requirements can add soundness to our application as it would make it more effective.

There are a few vital constraints that need to be taken into consideration when developing the VR application. One being, Set up time, an efficient process should be followed prior to the use of the device to minimize the overall time required to operate the application. This is vital specifically in a hospital environment as there are many patients that need to be examined daily. Moreover, cost is also an important constraint. Being able to maintain a reasonable budget when developing the VR application will help ensure the task at hand is completed accurately, and effectively. In the case that multiple applications would need to be produced, a cost effective solution would be the most ideal. Finally, the last constraint is portability. The VR application should be easily mobile, and convenient for the user. This ultimately falls under awareness of time and how it must be monitored closely.

Table 3 shows the benchmark comparisons on existing medical VR applications. None of these applications have strong similarities with our own, but we are comparing and collecting all the useful data that we can gather from them in order to use it to improve our own project. We concluded that *Orr's Chemotherapy* was the best available VR software with 24 points, due to its low memory allocation and a less powerful graphics card. In addition, this table shows that the best VR application we can make will have the following traits; low on storage and memory, requires a basic graphics card, uses a basic VR headset and is free for the general public.

## Conclusion

In conclusion, our clients Dr. Justin Sutherland and Dr. Daniel La Russa specified many needs and possible problems associated with our VR app design. They helped our team define the design criteria and specifications. So in order to create a useful VR application, we need to make sure every functional requirement is met while keeping the constraints in mind. Moreover, meeting the non-functional requirements is important, since it will ensure that our design satisfies the client as well as being functional and comfortable for the users.

**Sources**

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