P2 Concept Selection and Website Outline Reports

TS3-5 **EF158** **4/6/20**

Concept Selection:

When deciding upon our final solution for virtual reality therapy, we needed to think of all the constraints of our problem statement. Our problem statement states “Current virtual reality technology is too ill-equipped to properly administer to the needs of patients dealing with phobias or PTSD in regards to present-day VR hardware and software. Thus, new virtual reality is needed to be designed to properly address the unique symptoms and situations of each patient willing to use VR as a means to alleviate their phobia or PTSD in the Knoxville area.” After much deliberation, we decided to use a combination of all three of our ideas as one solution to virtual reality therapy. This combined solution would include two different approaches: an accelerated program where patients would be exposed right away to their phobias or a gradual “fear hierarchy” approach that would slowly expose patients to their fears in increments so that patients could remain calm and desensitized throughout the entire experience. Ultimately, the choice of which program to use would be made a patient-to-patient basis based on the recommendation of a medical professional. For example, if a patient was diagnosed with a mental disorder that was known to cause severe trauma and stress (such as post-traumatic stress disorder), this patient should be recommended for the gradual “fear hierarchy” approach. However, due to the potential stresses and anxieties caused by this therapy, we felt that more safety was necessary. When patients undergo either approach, they should be placed in a padded room, and they should be equipped with protective bodywear. Finally, they should equip a heartbeat monitor as a failsafe, so that if their heartbeat reaches too high, the program will be automatically shut down. While the development of the software for

these two different approaches may take lots of time and money, we feel that this solution is realistic for the Knoxville area. Already, research is being conducted to find out the effectiveness of virtual reality in rehabilitation and therapy for those with mental health disorders and disabilities. For example, research is being conducted to help smokers quit their habits through personalized virtual reality group-therapy sessions [1]. Thus, we feel that the development of these virtual reality therapy approaches is a realistic solution and could happen in the near future to help aid mental health patients at the University of Tennessee-Knoxville and the large numbers of veterans with PTSD in Knoxville.

We feel that our combined solution provides benefits to all of our potential stakeholders. The four main stakeholders for our product are medical professionals, people with mental health disorders/phobias, companies intertwined with common phobias, and the government. In the case of medical professionals, because mental health is such a case-by-case diagnosis, they would need a product that is able to aid a wide-variety of patients [2]. To address this need, we feel that our two different approaches will provide the flexibility to aid a wide-range of patients. Whether patients choose the expedited approach or the “fear hierarchy” approach, we feel that our product will be able to benefit everyone who uses it. In the case of people with mental health disorders/phobias, because they are actually dealing with their disorders, they would want a product that is safe and helps them [3]. Furthermore, not everyone is able to afford going to doctors or health professionals, so they would want a product that is affordable. To address these needs, we feel that the added safety features of our virtual reality software makes sure that the product is safe. Because the patient should be placed in a padded room and because they should be equipped with protective body gear and a heartbeat monitor, we feel that our product provides a safe and effective treatment for all users. To address the economic aspect of our product, as of now, we recommend that only medical professionals utilize this technology so

that we can assure that patients are correctly led on the program and that patients remain safe throughout the therapy. However, perhaps in the future when virtual reality becomes more advanced and immersive, virtual reality therapy could be downloaded on individual headsets so that patients would only need to purchase a headset to receive treatment. In the case of companies intertwined with common phobias, because their customers must be able to cope with their anxieties to use their products (e.g. fear of height in airline companies), they would need a product that would reduce the phobias of their customers so that their customer base would grow. To address these needs, we feel that our product would work perfectly to meet these needs. Because of the flexibility of our proposed virtual reality software, we feel that most people who utilize our software will be able to alleviate or even end their phobias. This will allow these companies whose product or service is involved with common phobias to grow their potential customer base and make more revenue. Finally, in the case of the government, because the government would like for all of its citizens to be safe and healthy, they would be interested in holding a stake in virtual reality therapy that could help solve the mental health crisis, along with aiding the military through the effects of post-traumatic stress disorder [4]. To address these needs, we feel that this product will provide an effective way to keep citizens safe and help the military through post-traumatic stress disorder because of the two different approaches of our program. Overall, because of the immersive aspect of virtual reality therapy, we feel that this product will be more effective in treating mental health disorders than typical therapy, and this will help keep the people of Knoxville healthy. Along with this, the “fear hierarchy” approach will provide a safe and effective treatment for veterans with post-traumatic stress disorder in Knoxville.

When evaluating our solution, we had select criteria that we graded it on. The criteria that we based our solution on was: effectiveness, accessibility, cost, feasibility, and safety.

When evaluating our solution on effectiveness, we felt that our product would exceedingly meet this criteria. With effectiveness being one of the stronger suits of this product, this virtual reality software should be able to help patients with a wide range of mental health disorders. Because of virtual reality' immersive qualities, patients can be exposed to all kinds of different scenarios and therapies that will allow far greater results than typical therapy. Not to mention, users typically receive some enjoyment from using virtual reality, so not only will this product improve upon the treatment of mental health disorders, it will also be entertaining and enjoyable for the patient. When evaluating our solution on accessibility, we had to look into the future of virtual reality to gauge this aspect. While our product could be utilized at therapists' offices at UTK and around the Knoxville area, due to the safety concerns with our preliminary product, we would not want to make this software for individuals to use at their home. However, because virtual reality technology is vastly growing every year, perhaps in the near future, our product will be available for everyone with a VR headset, making it accessible for nearly the whole population of Knoxville. When evaluating our solution on cost, once again, we had to look at the future of virtual reality to gauge this aspect. Right now, the cost of virtual reality headsets is quite high, and it would cost even more money and time to develop the software for our product. However, as stated in the evaluation of the accessibility criteria, virtual reality technology is improving and reducing in price every year. Because of this, we feel that our virtual reality therapy product will be cost-effective for nearly all medical professionals in the Knoxville area in the near future. When evaluating our solution on feasibility, we felt that our product would exceedingly meet this criteria. Much research is already being done on the implementation of virtual reality in the therapy and rehabilitation of those with mental health disorders and disabilities. Thus, because of the research already being done on this kind of technology, we feel that our solution would be feasible. Finally, when evaluating our solution on safety, we felt that our product met this criteria.

Because patients will be placed in a padded room and will be equipped with safety equipment and a heartbeat monitor, we feel that patients will have adequate safety when using our product. Along with this, patients will be under the supervision of medical professionals, so medical professionals will be able to double check that everything is safe. When deciding upon our final product, we had to decide between this solution and a different solution that would allow patients to escape from their phobias when using virtual reality. For example, when traveling on a plane, people could be offered a virtual reality headset so that they could be placed in a more comfortable environment where they could escape their fear of heights. While the second solution had numerous advantages, we ultimately decided upon our solution for a number of reasons. To begin with, our selected solution solved our problem statement better. Our problem statement involved alleviating the symptoms of mental health disorders and phobias. Our second proposed solution, while it did alleviate the effects of phobias for a while, it did not serve as a long term solution for alleviating symptoms of mental health disorders and phobias. Along with this, our second proposed solution focused purely on phobias and not mental health disorders. People suffering from mental health problems were a main stakeholder for our product, so not being able to benefit these people were one of the main factors why we did not choose this solution. Furthermore, we felt that the accessibility in both the present and future were lacking in the second solution. For our chosen solution, the virtual reality therapy would be given to medical professionals in the Knoxville area so that those with mental health disorders at UTK and veterans with PTSD could access this treatment. This solution also allowed for future accessibility for anyone with a virtual reality headset. Conversely, the second solution only allowed for those who used airports in the Knoxville area, such as McGhee Tyson Airport. This audience was not as large and did not open up opportunities for expansion in the future, so this is another reason why we chose our solution.

Works Cited

[1] Kim, Byeol, et al. “Virtual Reality Behavioral Therapy.” *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, vol. 60, no. 1, pp. 356-360, 2016. [Online]. Available: *Sage Journals Online*, https://journals-sagepub-com.proxy.lib.utk.edu/doi/pdf/10.1177/1541931213601081. [Accessed April 2, 2020].

[2] “The Primary Care Medicine Clerkship.” *Vanderbilt University Medical Center*, 2020. [Online]. Available: https://medicine.vumc.org/goals-and-objectives. [Accessed April 2, 2020].

[3] Polikandrioti M. “Needs of hospitalized patients.” Health Science Journal [Online]. Available: https://www.hsj.gr/medicine/needs-of-hospitalized-patients.php?aid=3492. [Accessed April 2, 2020].

[4] “Our American Government.” Congressman James E. Clyburn. [Online]. Available: https://clyburn.house.gov/fun-youth/us-government [Accessed April 2, 2020].

Website Outline Criteria

Design process

Our team selected the grand challenge of Enhancing Virtual Reality with the idea that we want to improve VR’s application to education, specifically to UTK’s College of Engineering. We sent out a survey to our college peer’s inquiring if they thought Virtual Reality could be useful for learning or solidifying students’ understanding of concepts. Additionally, we conducted some online investigation into the topic of VR’s educational application and stumbled upon another interesting application: VR therapy. We learned that VR was used to help treat/manage PTSD and phobias and that this application of the technology was quite new so the possibilities for enhancement were plentiful. We decided to conduct some more online research to obtain a deeper understanding of VR therapy. Our team discovered that VR therapy had shown

significant improvement in people's chronic phobias and PTSD and that some possible areas of enhancement were present such as increasing affordability, user friendliness, and safety.

In light of uncovering VR's application to phobia and PTSD therapy, we redefined our tentative problem statement to say that current VR therapy is under equipped to maximize the benefits received by therapy patients. VR therapy is so new and the technology is so little developed that treatment cannot yet be personalized to specific severities of phobias and PTSD. Our goal is to enhance the current hardware and software of VR therapy to allow for more personalized care and increased patient benefits.

During brainstorming, many possible improvements to VR technology were discussed. Possible improvement ideas included developing different speeds of immersion for phobia and PTSD treatment, developing hardware suited for use in a doctor's office by a trained mental health professional, and safety mechanisms like padded hardware and fail safe device that would monitor the patient's heart rate and cut off the VR program if it exceeded a certain point.

Further research was conducted to determine which of these many possible enhancements would be the most feasible and worthwhile improvement. Our team discovered that nearly all of the ideas generated during the brainstorming phase of development were viable solutions and would have generous returns for the amount of resources (time, money from shareholders, effort) put into them. As a result, our final concept for VR enhancement will be a combination of multiple ideas. The enhancement will include VR software that is capable of immediate full-immersion as well as a gradual approach to treatment that follows a "fear hierarchy". Also, safety precautions will be made including adding padding to the VR room and hardware and adding the heart rate monitor and safety shut off.

Solution Background

Our version of how we're going to push the boundaries of virtual reality has some costs when associated with solution implementation and overall maintenance. The main point of our VR system that we're aiming to develop is to help individuals overcome their phobias or anxiety related issues. Primarily, in order to enhance the safety of VR equipment and a person's overall experience with the technology, we need to know what responses people may have when their phobia or PTSD is triggered and the extent to these responses. These responses we suspect will fall under the category of fight or flight which can vary in severity from person to person. Depending on what action the individual takes, the fear induced response may end up harming the person using the equipment, the virtual reality equipment itself, and any other person in the room. Therefore, we believe safety is a top priority and have come up with measures to reduce any possibility of harm coming to the people or machinery. Padded walls and flooring in the virtual reality space can reduce the impact of a person running into a wall or falling to the floor. The VR headset and accompanied electronics won't break so easily as well if carelessly dropped or thrown with this padding in place. VR headsets could also be designed as more like protective bodywear to both reduce the chance of injury in the event of negative patient responses and act as extra motion sensors to improve the fluidity of avatar movement within the virtual reality environment. As a fail-safe, a heart monitor connected to the patient can automatically shut off the VR system if the user shows signs of extreme distress. These improvements to safety are specific to the therapy application of VR because there are risks associated with treatment that are not associated with the videogame or educational application of the technology.

Additionally, in our approach to develop a human-centered solution, we realized early on that virtual reality is notoriously expensive. Since it's a fairly recent form of advanced

technology, the price to buy a simple standard headset already costs several hundred dollars. If no harm or degradation to the equipment were to occur, then a complete system of VR equipment for our desired solution could be paid back in a few short years after being implemented in certain facilities. Currently, there might be possible alternatives to all the possible equipment that we need but we're still researching those specific alternatives and their drawbacks. As of now, a full set of VR equipment includes: a VR headset or oculus rift, VR controllers, a computer, headphones, cover for the headset, charging and docking stations, cleaning equipment (must clean after a person finishes for sanitation purposes), additional peripherals, and cable management tools. With oncoming years, the technology might update so purchases for updated equipment could be deemed necessary.

Moreover, because VR technology is a fairly recent technology, not many people have experience with this technology, so researching different techniques to make VR easier to access for users would make the best human-centered solution. This could be done in person, over the computer, or with a personal headset provided by a healthcare professional or purchased for self-use. In regard to who, where, and when our solution implementation will take place, we believe that our solution will work best in healthcare facilities specializing in behavioral and psychological disorders and treatments. Our target group is those individuals suffering from phobias and PTSD so it makes sense that these individuals will go to these areas to help find a solution to their problem. We hope to implement this solution as soon as possible, preferable within the next year or so as to help make this idea mainstream across the country, if not the world. Furthermore, we suspect that our solution will prove beneficial to airlines and the military. If VR headsets could be made available to passengers on a plane that fear flying, then VR can transport said scared individuals into a scenario of peace and tranquility to help shield them from their fear. Similarly, if upcoming soldiers who hadn't experienced war yet could get a taste

of what war really is without having to be in the actual scenario, then VR could help create that situation for them.

Finally, we also believe that VR technology can be used more than just a form of therapy treatment but also as a way for individuals to undergo rehab. For long term treatment, VR would be combined with other therapeutic treatments such as true exposure therapy and counseling. The idea behind this stems from the fact that the VR exposure therapy wouldn't be as useful by itself as compared to combining it with other extremely effective forms of physical therapy.

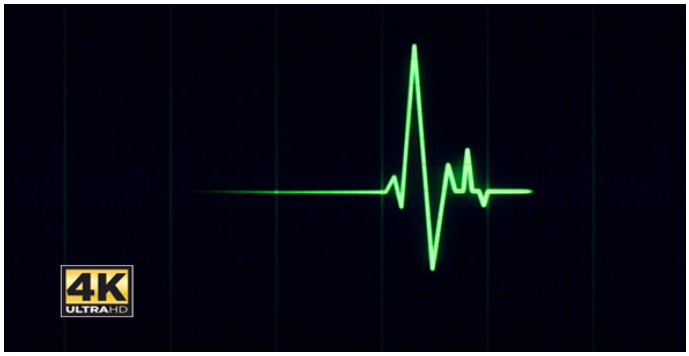
Solution Details

Expected cost for our chosen solution should be quite affordable, if not very low because reworking/adding software is an upfront expense that is mostly based on hourly wages for a team of programmers and/or software engineers. The added safety mechanisms like padding and the heart rate monitor will be per unit expenses but the cost for these features will be miniscule considering potential clients will be able to afford the VR hardware in the first place. These potential buyers include doctor's offices, government facilities, specialized practices, and individuals who decide they want in-home care.

Our enhancement to VR therapy could reasonably be introduced within a year or so. The most time-consuming portion of the suggested improvements is the development of new software, but software development is a team sport in that our team of developers can pull from existing programs and create a combination with the desired capabilities. Implementation of the safety additions would be as quick as making minor adjustments to VR hardware production or contracting third party companies to make additions to pre-existing hardware. The final product would be marketed to the potential buyers mentioned in the above paragraph in virtual any part of the globe. In the early stages of production, we would probably produce for the Knoxville area

to test that the project is monetarily feasible for large production, but our goal is to make VR therapy available to everyone in need.

The U.T. Student Health Center is a possible location for our virtual reality therapy product so that students have reliable access to treatment for their mental health disorders (https://studentlife.utk.edu/2019/02/14/book-an-appointment-with-the-student-health-center/).



A heart rate monitor would be an additional safety precaution included in our solution. The picture above showcases an example heart rate monitor (https://videohive.net/item/heart-rate-monitor/20643816).

Kickstarter pitch

Hello valued customer, We are the Equilibrium Enforcers. We're a group of aspiring engineers undertaking the task of how we can push virtual reality to it's undefined limits. Nowadays, people commonly make the mistake that virtual reality is too foreign of a concept to be utilized properly by regular individuals and companies or is simply another game console for their children to play. We come to you today with a way that will shatter the traditional view of what virtual reality truly is and can be.

Hiding on this planet are countless people suffering from unique mental issues. These people are citizens like you and I who often find it hard to overcome their special anxiety, phobias, or PTSD related problems and thus makes it hard for them to live a normal life. While there are existing treatment options that can help these people live a regular life free from fear, these options don't cater to the specific needs and designs to every individual. While some may be afraid of things that remind them of the horrors, they experienced in the past like living through a war, there are those who freak out over the simplest of things such as a tiny spider which some people find unreasonable or peculiar. Our solution is virtual reality therapy.

We stoutly believe that it's best for the individual to overcome their own fears rather than having to be dependent on medication or other individuals. Through the customization of VR programs,

we find that it’s possible to develop and create a scenario that perfectly replicates the fears of a certain individual while giving them the sense of control that they might not necessarily feel in real life. This can be administered in either a fear hierarchy situation where the patient takes baby steps in triumphing their fear or a situation designed to mimic the patient's worst fear so as to, they can battle it full on while staying in a comfortable, safe environment.

Our take on virtual reality therapy will have the following aspects described:

- The certain facilities and organization that would benefit most from this solution/product and possible stakeholders and how they’d benefit from this.
- Costs and maintenance necessary in acquiring a complete set of VR therapy equipment and the potential risks associated with the product/solution.
- Basic and essential knowledge of how our solution process works and the results and data we suspect to receive from patients using this.
- Future considerations as VR technology grows and expands and other possible ways to utilize our solution in different fields.
- Any miscellaneous questions and answers potential consumers might have.

Thank you for your support in helping us, the Equilibrium Enforcers, take our solution on virtual reality to the next level.

https://mondaynote.com/apple-ar-vr-reality-bites-virtual-reality-4e50930ea460

https://www.docwirenews.com/docwire-pick/top-4-virtual-reality-vr-breakthroughs-in-medicine/

Future Development

Virtual Reality has amazing potential for treating things such as phobias and mental health issues that have yet to be fully recognized. This potential only grows as both consumers and industries continue to adopt new VR technologies that are more cost-efficient and effective.

However, current Virtual Reality Exposure Therapy solutions continue to remain extraordinarily high in price which puts them out of their target audience's reach while not achieving exactly what people receive out of normal therapy. Virtual Reality Exposure Therapy should be a more all-inclusive, cost-effective therapy option that grants the user many of the benefits of traditional exposure therapy while being much cheaper and having many other benefits such as safety and convenience.

For our solution, in the future, we hope that it functions exactly as intended: to aid as many people as possible with issues such as common phobias to mental health. Ideally, it would have two main functions: provide a comfortable, safe environment for the user while still being able to expose them to stimuli & be able to expose as many people with differing issues to the aforementioned stimuli. In order to improve our solution, we would first need to figure out a way to effectively lower the cost of virtual reality. This could come with future technological developments; as scientists and engineers develop different ways and methods of creating virtual reality, the cost of the technology would lower. As a result of the cost lowering, we would be able to get better technology as a better foundation & platform for our product. Secondly, along with lowering the cost, we would need higher-power software and hardware in order to run the programs we wish to implement into our program. Our initial idea is composed of a system that would aid people with common fears, such as the fear of heights or fear of spiders, along with aiding people with PTSD by a fear hierarchy. However, in the future, we would wish to add other "fears" such as social anxiety and the fear of public speaking. Adding these components into our product would assist in making it entirely comprehensive and inclusive, only bettering the final product.

FAQ

- *Doesn't this already exist?*
  - Yes, Virtual Reality Exposure Therapy (VRET) exists today, however, VR has been proven to be a useful tool in conquering mental illnesses. However, it remains inaccessible to the average patient despite the exponential increases in the accessibility of VR in the last few years.
- *How is it different than other solution attempts in the past?*
  - As mentioned above, there haven't been many recent attempts to improve VRET, and as a result, there aren't that many products on the market that are widely used.
- *How does the solution actually work?*
  - Our product works like common exposure therapy: exposing the patient to a "fear hierarchy", so that the patient can become more accustomed to the target fear while maintaining a comfortable and safe environment.
- *Who would be able to use this?*
  - Current VRET is only accessible exclusively by companies or therapists. The goal of this product would to be able to make this program widely accessible to the students of the University of Tennessee who deal with high stresses along with the greater Knoxville area.
- *I have really bad social anxiety, could something like this help?*
  - As mentioned in the ***Future Development*** Section, the current solution doesn't include problems such as social anxiety, as the target fears as of now are common, everyday fears while maintaining the current use of VRET for mental illnesses such as PTSD.
- *Where could I use this?*

- Currently, we would implement this in a location such as the Virtual Reality rooms on campus, so the technology already maintained by the University could be accessed.