

Phobia Exposure Therapy using Virtual Reality

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Abstract: *Phobia is a disease caused due to many causes such as rabies, result of having a negative experience or panic attack related to a specific object or situation, or it may be genetic. Water phobia known as aquaphobia is also caused by inheritance or previous false experiences with water. Sometimes, the cause of this disease is eradicated, but the disease itself is a phobia therefore, it remains in the mind. These cases are taken to a psychologist or a psychiatrist, which causes individuals a lot amount of charges. Therefore, a cost-effective solution is needed for this critical issue. Therefore we used Virtual Reality as it creates an environment for any individual which is totally different from the current reality. This might prove to be a solution to the issue of Aquaphobia. Virtual Reality has the ability to render environments where an Aquaphobic individual can experience fearsome situations visually. Our proposed plan focuses on simulating different environments (levels) where fearsome environments of different intensity would be provided to the Aquaphobic people. While experiencing these environments visually, the individual would be in coordination with a pulse-rate sensor. This sensor, integrating with the application would provide a percentage on the removal of Aquaphobia for that respective level. If the amount crosses a certain percentage, then the patient would be able to move on to the next level. This project aims on reducing the effect of Aquaphobia, as the related diseases are removed but the phobias which are caused due to the diseases retain. In the future, the project aims to tackle Claustrophobia and Arachnophobia as well.*

Keywords: Virtual Reality, VR, Aquaphobia, Pulse rate sensor, Temperature sensor, phobia, exposure therapy, simulations

I. INTRODUCTION

Aqua Phobia, or any phobia for instance is a neglected or rather secondary phenomenon once the causing disease is cured. These phobias are caused due to unpleasant experiences or due to diseases that have the phobia as an aftereffect. But, once the disease is cured or reduced to its maximum limit, the phobias are mostly given secondary importance or neglected. But, in period ahead, these phobias can cause harm to a person's mental health. As a concern to this issue, currently only psychiatric treatment is the way to reduce impact of phobias. Especially in the case of Aqua Phobia, the treatments are carried out by traditional methods, using therapist or psychologist views about the scenario. Psychologists tend to put the patient in real life, Aqua phobic situations and record the reactions. This process involves a lot of time as well as a lot of money. The product which is being developed by the team mainly focuses on reducing the impact of Aqua Phobia on the patients using Virtual Reality as a domain.

Virtual Reality is a computer generated simulated experience which provides a user with real-life experiences. The virtual world which is created using Virtual Reality is similar to the real world and provides similar Visual and Auditory feedback, sometimes haptic and sensory too.

Aqua Phobia is basically the fear of water, or sight of water. Therefore, Virtual Reality as a domain would be helpful to reduce the impact of phobia on the patients. The product aims on creating various simulations in which aqua phobic conditions would be depicted to be viewed by the patient. These simulations would be escalating in intensity and would try and reduce the impact of sight of water from the patients. All the simulations are created under the guidance of a psychologist which would make it more helpful for the patients and also would be visually effective at the same time.

As aforementioned, the escalation of levels would play a major role in reducing the impact of Aqua Phobia. The escalation of levels would be happening on the basis of reduction percentage calculated for the previous level. For calculating this percentage, usage of pulse sensors is done. Using pulse sensors while viewing the Simulations the jumping of pulse (in BPM) would be taken as an input and an inverse percentage would be calculated upon that (i.e. lower the number of jumps,

higher the percentage of reduction). Once the count crosses a certain percentage, the further level would be available to the users. Until the percentage count is acquired, the levels would be locked as a security perspective.

The overall work of product development is performed under guidance of a psychologist and all the security aspects regarding the users' health are taken into consideration.

II. RESEARCH

Virtual Reality uses technological innovations such as a simulated environment to give the user real world experience with controlled environment. It is therefore recommended for specific phobias such as closed spaces, large open spaces-agoraphobia, flights, etc. VR may be helpful as it allows for specification of cues, enhances the exposure and all this is done in a controlled manner.

In order to treat phobias, exposure therapy is often used. This therapy involves confronting the patient with his fear by slowly and gradually exposing the patient to phobic/risky situations. If done correctly, the fear tends to decrease.

Traditionally, there are two main ways of exposure therapy:

- a) Vivo exposure.
- b) Imagining the fear.

Most disadvantages of both in vivo exposure and imagining don't apply, while most of the advantages remain. For example, the therapist has more control over the experience and can stop the treatment right away. Also, treating fear of water is a lot less costly, and patient confidentiality will not be violated because the treatment takes place in the therapist's practice. In order to immerse patients in a virtual environment, two main virtual reality setups are used: Head Mounted Display (HMD) and Computer Automatic Virtual Environment (CAVE). HMD uses a headset, which totally shuts the patient off from the real world

III. IMPLEMENTATION

This section discusses techniques under each phobia implemented with two or three different scenarios. Different phobias considered for the study are listed below.

- AcroPhobia (Fear of height).
- NyctoPhobia (Darkness).
- AgoraPhobia (Crowded places).
- KenoPhobia (Fear of voids and empty spaces).
- ClaustroPhobia (Confined places).
- TachoPhobia (Speed).

The platform used for the development of this project are:

- Unity Software
- Blender, BLENDER EEVEE
- VR Headset
- Temperature check
- Heart rate monitor watch
- Android/iOS mobile
- HDRi's
- HTML/CSS
- Arduino Uno R3

IV. RELATED WORK

The traditional method on exposure therapy is flexible to various types of patients, but the necessity of it being flexible is minimal at the cost of the cons the treatment carries. Thus, the product was initially thought of being developed. Aiming on providing a clear visual experience, the Virtual Reality domain was explored before development started, to use the most effective tools for development.

For this we use Blender for making the simulation with the help of EEVEE engine.

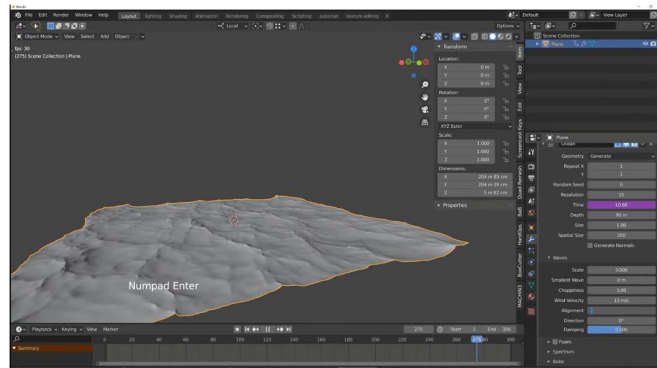


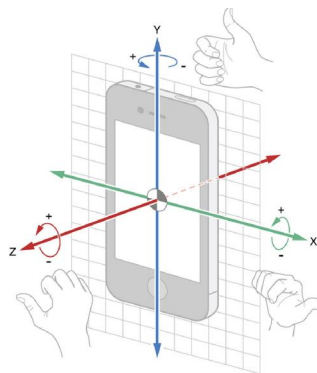
Fig.2: Oceanic Simulation under development

The development of this object when complete is sent to Unity Engine to perform VR adjustments to it. Also, as Unity engine has its own Particle system,, an object can look more enhanced and realistic.



Fig.3: Unity Engine for VR Development

Gyroscope:

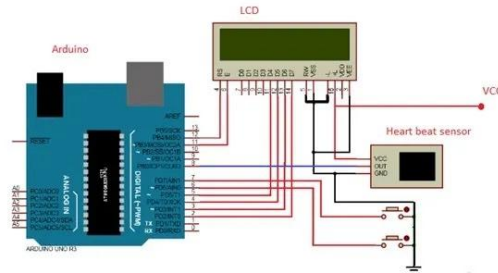


A gyroscope is a device used for measuring or maintaining orientation and angular velocity. It is a spinning wheel or disc in which the axis of rotation (spin axis) is free to assume any orientation by itself. When rotating, the orientation of this axis is unaffected by tilting or rotation of the mounting, according to the conservation of angular momentum.

As the gyroscope allows the calculation of orientation and rotation, designers have incorporated them into modern technology. Integration of the gyroscope has allowed for more accurate recognition of movement within a 3D space than the previous lone accelerometer within a number of smartphones. Gyroscopes in consumer electronics are frequently combined with accelerometers for more robust direction- and motion-sensing.

MEMS (Microelectromechanical Systems) gyroscopes are compact, and carry small-integrated chips. The sensors register change in angular displacement while a current is generated through the vibrating action of the gyro and transmitted in a viable form to alert the user. This would be a simple submission of motion-sensing in our smartphones. A gyroscope in our phone enables it to sense linear orientation of the phone to auto rotate your screen. While the gyroscope takes care of the rotational orientation, it is the accelerometer that senses the linear changes relative to the frame of reference of the device.

Thus, in Order to Run this on the phone and make it rotate with the movement of our phone, as the phone will be inside the VR headset for virtual experience , we have to integrate the gyroscope sensor in our mobile devices with our Unity project. To do this Unity has provided Scripting interface where we can code and give instructions or make any modifications in our project. We can do this by scripting i.e coding in C#



Arduino Uno R3:

Arduino Uno R3 is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.



Applications of Heartbeat Sensor

The applications of heartbeat sensor are the following.

- This sensor is used for Sleep Tracking
- This sensor is used for Anxiety monitoring
- This sensor is used in remote patient monitoring or alarm system
- This sensor is used in Health bands
- This sensor is used in complex gaming consoles

The connection of this sensor on earlobe otherwise fingertip can be done using a Clip, and connect it to Arduino board. So that heart rate can be easily measured.

4.1 System Architecture

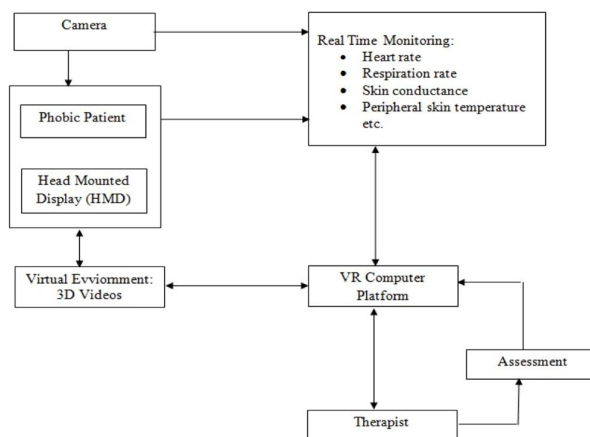
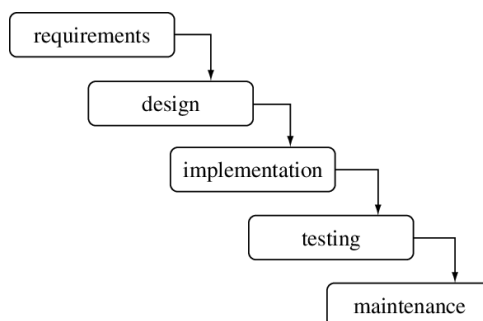


Fig: System Architecture

The inter-connected components are shown with their relationship with each other.

V. METHODOLOGIES USED

1. Development Model: The development model used is the Waterfall Model for our Project as it is easy to manage due to the rigidity of the model. Each phase has specific deliverables and a review process. Phases are processed and completed one at a time.



In Methodologies, all the methods and mechanisms used for development of the product would be discussed. The product basically consists of three main elements, Virtual Reality, web application and the Sensor.

Virtual Reality

Virtual Reality is a domain which immerses an individual in a virtual environment which is visually effective as well as sometimes provide auditory, haptic and sensory feedback. The VR simulation creates a different virtual world. Virtual Reality makes the person believe that he/she is present in the scenario which he/she is viewing. We Use Blender EEVEE to render and create an aquatic body and environment.

Also, for viewing the simulation, usage of Samsung gear VR is preferred as it provides adequate real simulation feel, and is not as expensive as HTC Vive.

A head-mounted display (HMD) is a display device, worn on the head or as part of a helmet like the Helmet-mounted display for aviation application, that has a small display optic in front of one (monocular HMD) or each eye (binocular HMD). An HMD has many uses including gaming, aviation, engineering, and medicine, architecture. Virtual reality headsets are HMDs combined with IMUs.

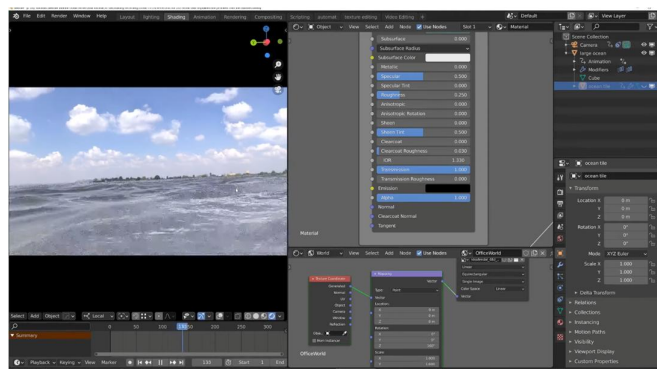


Figure: Blender Workspace

Heartbeat Sensor

In this paper, we have designed a Heart Rate Monitor System using Arduino uno R3 and Heartbeat Sensor. You can find the Principle of Heartbeat Sensor, working of the Heartbeat Sensor and Arduino based Heart Rate monitoring System using a practical heartbeat Sensor. This is a Heartbeat sensor operating in the voltage readings 3.3 v or 5 v

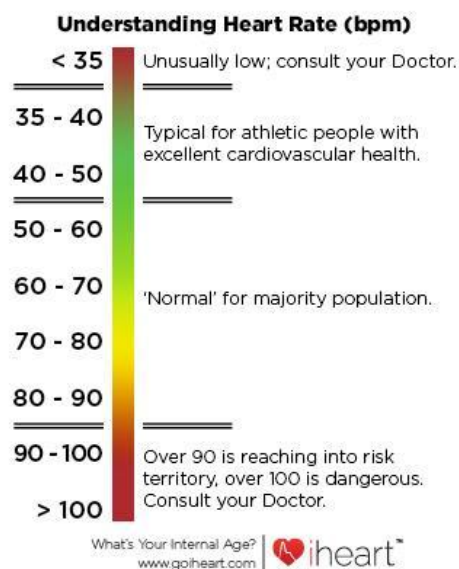


Figure: The pulse rate

VI. CONCLUSION

Hence, we can conclude that Virtual Reality domain can prove to be useful in reducing impact of the phobia over the patients. The domain focuses on putting the individual visually in aqua phobic conditions to reduce the impact. As all the development is done with consultation of a psychologist, the security aspect is looked after.

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