THE MAKING OF CERVICAL PATHOLOGY DETECTION THROUGH VR PHONE APPLICATION

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ABSTRACT

As a graduation project the Institute Osteopathic of Toulouse, asked ENSEEIHT students to help them with developing a phone application able to capture head movement in order to detect cervical pathology linked to movement inconsistency. During January – March 2019 a team of 6 last years students developed a phone application that was able to capture head movement based on an interactive VR experience, send the data by mail and exploit it through a desktop application.

1. INTRODUCTION

Osteopath can detect a wide variety of pathology just by looking and feeling the a patient moves his head left and right, the idea behind the application is that anyone could be able download it, run it, put it in a VR head set, performs some test and ave a reach a diagnostic. Thus simplifying the job of osteopaths across the world but also extending their reach.

2. USABILITY AND REQUIREMENTS

The phone application was designed to be usable for both Doctors and patients, as a phone application it's important to capitalize on the fact that most people would be able to use it at the condition they also have access to a VR headset for phones. With that in mind, the application was developed with a simplistic design, light duty performance and requires little to no knowledge in basic software use.

2.1. Platform

Unity was chosen as the main support for the application, being a modular graphic engine that performs well. We also focused our development effort towards android phone, the main reason for that is the budget submitting, deploying and maintaining an application on the Play Store from Google is the cheapest solution. It is worth noting that the maintaining budget for this application was zero. Thus the application should require no external server to run.

Unity does not natively provides support for VR phone on android so we used GoogleVR library as third party package. We also used external module to develop things like drop down menus.

In the end our application was runnable on any Android phone who have both gyroscope and accelerometer and relying on Android Kitkat 4.1+. It was not oriented for heavy duty phone necessarily

2.2. Blending 2D and 3D VR

One of the most interesting aspect of this project was blending 2D, when the user is using the main menu, and 3D VR when the user is actually performing the test. The application could be not be as easy to use as it is now despite the fact that the user will need to repeatedly put in and pull out his phone from the VR head set. The fact that the user need to customize the testing phase means that it needs menus with slider and empty field, which are hard to use in VR, forced us to develop this duality between 2D and 3D VR.

3. FUNCTIONALITY

3.1. Global Architecture

The main goal was to have a target going left and right as the user follows it with the head. But the an actual necessity to customize the test parameters like, the distance the target travels, her speed and the distance between the target and the user. There is also a need for the player to enters a number of personal information so that he can keep track of his own record and a need to manage the files captured.

This why the user is met with a menu when he starts the application, so he can enter the parameters he want, then that the test and, after he did the test, we gave to possibility to come back to the menu so he can manage the file captured.

3.2. Main Menu

The main menu was designed to give the player customization possibility upon the the test phase as well as file management capability. It was split in 3 sub-menus for clarity.

The first tab is dedicated to parameters who will impact the test recording like the speed of the target, the number of laps it will perform, the maximum angle it will

reach, the distance between the player and the target and the amount of time the target will pause between each laps.

The second tab is dedicated to adding data about the user who is performing the test. The field Genre, Pathology as well as date of birth was made to in prevision that the data will be used to train a neural network so any user can add label to his data. It's necessary to differentiate gender and age in the captured data as it impacts who cervical pathology affects the human body.

The reason that we give the user the possibility to also add their name, last name and birth date is that also those information are hashed into the captured file so that anyone can keep track of his data. But it's impossible to reach the owner of a given data solely based on the HashID.

Finally the last tab is dedicated to file management. Each captured file appears as a single item and the user have the possibility to delete it or to send it via email.

3.3. Test Environment

As the user push the buttons “Start VR Test”, he has to put his phone into the VR headset and put the headset on.

The player is met is both the target and a button allowing him to get back to the main menu. The issue being is that there's no button in VR, thus we had to give the user ability to click on that button without directly interacting. The solution we found is to start a count down when the user starts looking at it and the trigger the button only when the countdown reaches 0.

We used to same technique to initiate to target movement, the user have to look at it for 3 seconds before it starts moving. One thing to know is that the first movement for middle to left is not recorded, the recoding starts after the first pause and only happens when the target moves.

We also worth noting that test who are interrupted, when the user lose the target for instance, are still recorded and noted as “I” in their name.

4. CONCLUSION

We were glad to deliver an application that most people can access to study and inspect their cervical. If you are looking to inspect and study data captured by our application we recommend using the application developed in 2018 by N7 students. In the near future we have no doubt that the neural network we developed will be able to distinguish healthy and affected patient.

5. REFERENCES

Unity3D : *https://unity3d.com/fr*