# STUDY OF HEAD MOTION CAPTURE ALTERNATIVE TOOL FOR VIRTUAL REALITY APPLICATIONS

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## 1 Context

The virtual reality technology (VR) have been successfully used in training, task learning, acquisition of specific skills. The Military Police of Santa Catarina have been using the technology successfully incorporated into the training process of their police (Rosa 2015). This technology is applied in training for highly complex activities, such as maintenance of electrical networks (Buriol, 2011), simulation of escape routes (Smith, 2012). According to Rosa 2015 (apud Demo) virtual reality presents a new paradigm, a tool for learning tasks, and acquisition of knowledge more aligned with the new information technologies. According to Monteiro (2015) experiences through the virtual reality, through their HMDs such as oculus Rift, for example, can gain dimensions hitherto unexplored by other means.

These HMDs, abbreviation for Head Mounted Display, are devices that aim to isolate the user from real-world, and give the feeling of immersion in the virtual world. It consists of a kind of helmet, adjusting two small screens on the user's head, one for each eye. These screens project images usually generated by three-dimensional computer graphics applications, intended to simulating a virtual environment. They are also provided with a user's head motion capture system (Kirner, Siscouto, 2007), so that whenever you turn your head, the virtual scenario can interact modifying the presented view.They are an extremely expensive equipment, difficult to setup and operation, and therefore its hard to popularizing the techniques and technologies of virtual reality for educational purposes. The main objective of this work is to test and improve an alternative technique to the head motion capture for Virtual Reality applications, with the goal of educational purposes. It is justified by finding ways to popularize, cheapen and spread the RV to its wide use as potentiating tool of learning, helping to make better teaching and learning, taking the education in our country to a new level, improving their effectiveness, and forming technicians, professionals , and better teachers.

## 2 Method

The system proposed in this work consists of an alternative device to capture head movements, placed at the user's head, a 3D virtual scenario that will run in real time, receiving user commands, and a projector, projecting this scenario into an apparatus, so that the browser can interact with the scene and conduct an immersive experience. The scientific method was trial and error, so that we make the system work in the proposed model.

We have tested a free license application called Freetrack. This application is used successfully in games and is based on an optical system to capture head movements, which tracks the position of LEDs using common cameras attached to the computer. These LEDs are mounted on a wire disposed at a certain distance so that they can be tracked and have its position read by the free track. For our experiment we also create a virtual scenario, modeled in 3DS MAX, and exported to a game engine called Quest 3D. There we seek make use of its tools, such as collision systems, and special camera systems, for creating a virtual tour of the scene, commanded by the user. We also use a very small projector, so all the structure can be mobile.

We found several problems during the tests, most related to intrusive lights, either caused by the projector or the environment, causing embarrassment and unwanted effects to the experience. We seek improvements, test solutions by changing the placement of the LEDs in relation to the projector, change settings in our Webcam, and different Webcam models. Also have texted the placement of filters, and the removal of camera internal filters. We ended up choosing to work with Infra-Red (IR) emission LEDs, and Nintendo Game Control Wii Remote as our IR capture camera.

## 3 Results

When we tested the set: Wii remote – LED IR - Freetrack - virtual scenario - projector, there was no kind of delay for the computer, head movements, and time response of the virtual system. It was found that the system worked without interference of lights of any kind, and solved all the problems of interference to the capture the LEDs position by free-track. The Wii remote worked at a high frame rate per second and low rates of jittering, showing amazing head motion capture.

We managed to have the vision of almost 360 degrees of scenery through the raised head movements. To assist the performance of these tests, we set certain keys on the keyboard, to help the virtual tour experiment. This configuration is performed within the 3D Quest. We use the arrow keys, so we could move front and side directions in the scene, with all rotating movements captured by the Free Track. We also set the right mouse button for the system to be switched on and off, for the system to stop to capture the movements of the head and return to pick them up when necessary. And this was made so we could fix the head position if we had done some very large rotary

movement. through this feature we can get 360 degrees of rotation in the virtual scene.

## 4 Conclusions

In conclusion we would like to reinforce the positive results of our experiment where we conclude that the Free Track was effective to capture the movements of the head and navigation through 3D virtual scene. There was no kind of delay with respect to the computer's response and the movements captured of the user's head. There was not any latency or "drift" or "Jiter", it was necessary to be accounted for. We also observed that thanks to the system with Wii remote and infrared LEDs, there was no kind of light interference, neither by the environment in which we perform the experiment, nor by the projector we used in the experience. So the experiment could be reproduced in any environment with any condition of light. Through the previously setted keyboard keys for communication between the user and the virtual scene, wet managed to get 360 head rotation degrees on the virtual stage. Therefore we conclude that the system can successfully capture the user's head movements, and effective to use in virtual reality applications, and now we will test improvements in the physical structure of head tracker.

## 5 References


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