The Virtual and Augmented Reality Group (GRVA)
Federal University of Uberlandia, Brazil
– Laboratory Presentation –

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GRVA/UFU: Augmented and Virtual Reality Research Group

ABSTRACT
The purpose of this paper is to present the Virtual and Augmented Reality Group (GRVA) at Federal University of Uberlandia, Brazil. The laboratory’s research focus and research strategy are some of the items taken into account in this report. In addition, recent accomplishments achieved by the Group are also discussed.

Keywords: Virtual and augmented reality, Electric and biomedical engineering, Software engineering development.

1. RESEARCH FOCUS
Our research laboratory is a well-known center in Latin America for its VR and AR applications in Electrical and Biomedical Engineering. Thus, its main research focus is on how Virtual and Augmented Reality issues (such as immersion, navigation and collaboration) can be explored to support medical and industrial applications, not only in training, education and simulation, but also in automation and control of engineering processes.

Currently, 40 researchers compose the Group. With twenty years of existence, the Group has achieved the number of 58 MSc and 10 PhD professionals, more than 400 articles in conferences, 30 book chapters, 2 books and 60 articles in periodicals.

2. RESEARCH STRATEGY
Virtual and Augmented Reality projects are characterized by the rapid evolution of technology and by the need for clients’ feedback, during the whole project lifecycle. Thus, in the past years, researchers at the lab have created an Agile methodology for developing research and software [1]. Weekly meetings are arranged for discussing goals related to each project.

Furthermore, the group leaders are conscious that research and technology are close to market demands. Therefore, there is a constant search for Call for Participation in research projects, in sponsoring agencies. Local visits to different companies are also elaborated. In some cases, research collaboration with companies is established.

Actually, an enterprise known as CGW – Computer Graphics Works is currently working with GRVA in a project sponsored by a national electric power concession company, as presented at Section 3.1.

3. RECENT PROJECTS
3.1 VRCEMIG: A VIRTUAL REALITY SYSTEM FOR REAL TIME CONTROL OF ELECTRIC SUBSTATIONS
The objective of the VRCEMIG system is to allow field events to update the reality of the control center of a Brazilian electric energy company – CEMIG. So is the opposite: changes in the components from the control center updates electric component behavior in the field. This strategy also allows the energy company to save time and money during learning phase. In fact, the apprentices can operate different substations from a specific point (company’s control center), similar to a flight simulation system. That is the novelty of this Virtual Reality application. Moreover, this virtual environment allows users to explore different possibilities without compromising their safety, in training mode [1].

Along with the CGW Company, the system developed here will allow users to navigate, explore the conditions of electrical components and to control a virtual electric substation. To do so, they can use different input/output devices as shown in Figure 1.

Figure 1: CEMIG’s Director evaluating the system (left) and one of the corresponding system’s view (right) [2].

3.2. ON THE USE OF AUGMENTED REALITY TECHNIQUES IN A TELEREHABILITATION ENVIRONMENT FOR WHEELCHAIR USERS

The rapid technology evolution brings new challenges: with robust control strategies and a wide range of features available, the adaptation of users to electronic chairs’ control is not trivial. Thus, a training phase becomes an essential part of the overall rehabilitation process. For this training to be effective, it is necessary
to expose the user to the same difficulties faced in the real world.

Thus, the main objective of this project is to investigate the application of Augmented Reality techniques on wheelchair users, by means of a tele-rehabilitation process. To achieve this purpose, a prototype that will allow communication between three different environments is being developed. It is composed by 1) a training environment, in which the wheelchair and the real/virtual barriers will be positioned; 2) a control environment, in which the training environment is presented for the user, who re-motely controls the chair; 3) a supervision environment, in which the health professional can follow exercises execution by the patient and access performance reports.

An outline of the main components of the proposed solution is shown in Figure 2.

Further development of this project includes the use of brain waves by patients with severe conditions. Initial experiments have shown that it is possible to train such individuals to control movements of a wheelchair with such biomedical signals (EEG) [4], shown in Figure 3.

3.3. PROTOCOLS OF VIRTUAL REHABILITATION FOR WOMEN IN POST-OPEERATIVE BREAST CANCER STAGE

Women who have had breast cancer and mastectomy and axillary dissection surgery, may present some consequences that hinder the performance of daily life activities, reducing self-esteem and affecting other psychological issues. Combining Virtual Reality and natural interface, a serious game has been developed for rehabilitation of patients with breast cancer in post-operative stage, with the aim to improve motor and cognitive abilities. The game has been designed to be an interactive and motivating tool for the treatment and prevention of complications of this surgery. The interaction between user and game is done dynamically through infrared motion capture device, to enable the exercises without requiring devices on the hands or body. The application is on trial, with a group of patients who had mastectomy, to validate the use of the game, to compare the improvements and their efficiency [5].

On this environment, patients have performed 8 protocols of different exercises during 30 minutes. All of them related to those used in rehabilitation of upper limb and trunk specific, as shown in Figure 4.

Figure 2: Wheelchair training solution outline [3].

Figure 3: Wheelchair training solution outline.

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REFERENCES


