Improving the usability of a video-see-through head-mounted display

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1 INTRODUCTION

THE past summer during my internship I developed a basic video-see-through viewer for a headset prototype developed in the CVC[1], the main goal is to improve this viewer making it expandable for future modules and reduce the adverse physical reactions that it produces can produce to the users[2]. It has to be said that this research project is focused mainly in the software, the prototypes and other hardware aspects will be out of our concerns and will be developed by others researchers of the CVC.

2 OBJECTIVES

First we will be developing a software that will be capable of capture an stream from a stereo camera and display it in real time. The software will show one camera stream in each half of the screen, also the headset will enable only to each eye to see one half of the screen, all of this will simulate the stereo effect, creating a depth effect. Another goal is to prepare this software to be easily expandable with new modules in the future.

Secondly, as is commonly known, using head mounted displays can cause a variety of adverse physical reactions, since this headset will be used while working, these symptoms will reduce the concentration and the effective working hours. For that reason reducing these adverse physical reactions is a priority. To archive this goal, we will try to apply two techniques:

- Accommodation-Vergence: As is reported in these[2][3] articles the mismatch between accommodation and vergence in head mounted displays causes a conflict on the expected depths increasing the feeling of discomfort and dizziness. One idea to reduce this effect is to dynamically move the position of screen frames as the focus changes from closer to distant objects and vice versa. To archive this we will use a neuronal network that will be able to discern between indoors and outdoors, also we will need the depth map obtained via the stereo camera setup.
  In addition to this, a progressive change from one focus to the other may be needed, as a big change in focus can induce sickness to the user.
- Depth of field (DoF) blur: Recent investigations[1] suggest that applying a DoF blur to a scene viewed using a head-mounted display can reduce visual discomfort, the challenge here is that our project has to make this DoF blur in real time in a real world environment, in contrast to the developed in that investigation that were computer generated scenes. To archive this we are going to use disparity map and the information obtained by a neural network that discerns between indoor and outdoor environments.

Thirdly, as the headset will be used in workplaces, the idea of adding data to the environment, could improve the work-flow and the work efficiency. For this reason we think, that adding a third camera to the headset can add valuable information that can be mixed with the environment. For example with adding a infrared camera, we can warn to the user with a mark or a color objects too hot to be touched.

Finally if is feasible we will try to do several user testing sessions to compare between the different versions of the developed software and the different headsets developed. The main goal of this sessions will be to evaluate if the developed software works and if it reduces the sickness feelings of the users.

3 METHODOLOGY

4 PLANNING

4.1 Investigate the state of the art

4.2 Improving the viewer

4.3 Disparity map

4.4 Accommodation-Vergence

4.5 Depth of field blur

4.6 Third camera

4.7 User Testing

REFERENCES

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APPENDIX