Study on Errors in Estimating the 3D Gaze Point for Different Pupil Sizes Using Eye Vergences

Authors : M. Pomianek, M. Piszczek, M. Maciejewski

Abstract : The binocular eye tracking technology is increasingly being used in industry, entertainment and marketing analysis. In the case of virtual reality, eye tracking systems are already the basis for user interaction with the environment. In such systems, the high accuracy of determining the user's eye fixation point is very important due to the specificity of the virtual reality head-mounted display (HMD). Often, however, there are unknown errors occurring in the used eye tracking technology, as well as those resulting from the positioning of the devices in relation to the user's eyes. However, can the virtual environment itself influence estimation errors? The paper presents mathematical analyses and empirical studies of the determination of the fixation point and errors resulting from the change in the size of the pupil in response to the intensity of the displayed scene. The article contains both static laboratory tests as well as on the real user. Based on the research results, optimization solutions were proposed that would reduce the errors of gaze estimation errors. Studies show that errors in estimating the fixation point of vision can be minimized both by improving the pupil positioning algorithm in the video image and by using more precise methods to calibrate the eye tracking system in three-dimensional space.

Keywords : eye tracking, fixation point, pupil size, virtual reality

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