

## ABSTRACT

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### **The possibilities of estimating the pupil position in HMD goggles with MEMS scanning eye tracker based on physical and in silico studies**

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The aim of the doctoral dissertation was to investigate whether it is possible to create an eye tracking system with a similar accuracy to commercially available devices, but with higher speed and lower computational requirements. The analysis of the state of knowledge and available on the market devices allowed for the selection of a scanning solution based on MEMS mirror as the optimal technology.

The author analyzed the available tools for eye tracking system prototyping and developed their own solutions. Based on the assumptions for the designed solution, three original methods for analyzing the acquired data were developed. The author's VR simulator software based on the Unity platform was used both to design virtual measuring stations and to simulate data. MATLAB software was used to prepare algorithms and mathematical models for data analysis. Based on the developed tools and measurements on a physical platform, a series of studies were carried out to investigate the impact of individual system parameters and their geometric relationships on analysis time and accuracy of pupil position estimation.

In the last stage of the work, a conceptual design of the proposed eye tracking system was presented, along with its achievable parameters. In summary, the presented results confirm the possibility of developing an eye tracking system based on a scanning MEMS mirror, which could operate on a smaller amount of data (compared to traditional vision systems), with analysis speeds higher than commercial solutions, but with a similar accuracy of pupil position estimation.

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