

# Visual Attention Analysis in Surgical Scenes Utilizing HoloLens 2 Eye Tracking

Project Management and Software Development  
for Medical Applications

## General Info

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## Project Abstract

The objective of this project is to leverage the HoloLens 2 augmented reality (AR) headset with integrated eye tracking technology<sup>1</sup> to develop a 3D heat map, visualizing how visual attention patterns change during surgical procedures. You will use eye gaze to track the gaze of surgeons and analyze the tracking data to enhance our understanding of where and for how long surgeons direct their visual attention during surgeries. This insight is crucial for the design of medical AR user interfaces, which aim to provide high usability and safety.

## Background and Motivation

Eye tracking can reveal opportunities for improving the ergonomics of surgical user interfaces.<sup>2</sup> Through analysis of surgeons' visual attention on their operating room environment, the specific anatomical structure present during the surgery and their medical tools, we are able to understand which information is relevant to the user at which point in the surgery. This allows us to tailor user interfaces to the surgeons' needs and helps us to not only improve the user experience, but further the accuracy and efficiency of surgeries. The result of this project – if done well – will be used in future research projects with clinicians to assess visual attention and cognitive load<sup>3</sup> to create context-aware AR user interfaces.

## Student's Tasks Description

1. Build a 3D surgical scene of spinal fusion surgery in Unity.
2. Use the [Extended Eye Tracking SDK](#) for HoloLens 2 to get gaze information.
3. Create a 3D heat map that visually represents gaze location and duration by coloring the virtual object meshes in the 3D surgical scene.
4. Write C# scripts for efficient recording and storing of the tracking data.
5. Analyze the visual attention patterns using Python.

After project completion you will have learned how to build mixed reality applications, how to leverage the power of gaze to understand human visual attention and its relevance for user interface design.

## Technical Prerequisites

Familiarity with Unity is preferable  
Good C# or C++ programming skills  
Basic Python programming skills

## References

- 1) Kapp, S., Barz, M., Mukhametov, S., Sonntag, D., & Kuhn, J. (2021). Arett: Augmented reality eye tracking toolkit for head mounted displays. *Sensors*, 21(6), 2234.
- 2) Erol Barkana, D., & Açıık, A. (2014). Improvement of design of a surgical interface using an eye tracking device. *Theoretical Biology and Medical Modelling*, 11, 1-18.
- 3) Joseph, A. W., & Muruges, R. (2020). Potential eye tracking metrics and indicators to measure cognitive load in human-computer interaction research. *J. Sci. Res*, 64(1), 168-175.