

# Real-time Gaze Estimation

Project Management and Software Development  
for Medical Applications

## General Info

Project Title: Real-time Gaze Estimation

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## Project Abstract

Using an RGB-D camera, the goal of this project is to establish a pipeline for real-time gaze estimation based on a pupil tracking. A depth sensor observes a user's face and the eye is tracked. The gaze vector is estimated and visualized on screen.

## Background and Motivation

Gaze estimation has a vast field of applications reaching from attention estimation for marketing and empirical psychology to human-computer interfaces and virtual reality games. Moreover, for the diagnosis and treatment of specific eye diseases it can be a method of choice.

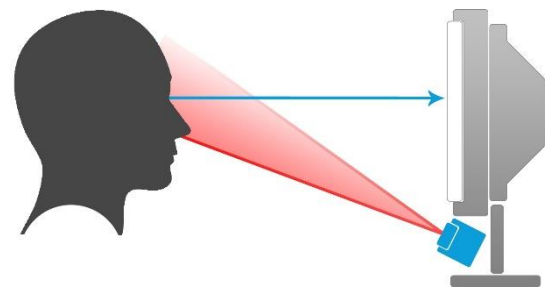
One key ingredient to estimate the users gaze is pupil tracking which correctly identifies the location to which the user pays most attention. This knowledge can be used either for passive measurements such as attention estimation or for active reaction by introducing a certain stimulus.

In this project, an RGB-D depth sensor is used to locate the user's pupil and estimate the gaze direction.

## Student's Tasks Description

After getting familiar with the hardware and the camera acquisition framework, the first target for the student is to study the existing pupil tracking algorithm and formulate the further problem geometrically.

A calibration procedure for screen-to-camera calibration is then implemented and tested in the scenario illustrated below.



*P. Geiger. 2014.*

Finally, a system prototype is set up to visualize the results and to allow for interactive real-time illustration of the principle.

After this project, the student can work with industrial camera hardware and gained some experience with real-time image processing and RGB-D cameras. The study of the human eye gives some bio-medical background of the human vision apparatus which has been embedded in in a 3D scenario. Moreover, the constant coordination with FRAMOS gives some insight into the working procedures in the industry.



## Technical Prerequisites

- Basic knowledge of C++
- Basic skills in linear algebra

Optional requirements that can also be learned during the project are:

- Real-time image processing
- Ability to work with versioning tools such as GIT

## References

D. Witzner Hansen, J. Qiang. "In the Eye of the Beholder: A Survey of Models for Eyes and Gaze". TMPAMI 2010.

A. Al-Rahayfeh, M. Faezipour. "Eye Tracking and Head Movement Detection: A State-of-Art Survey". RDS 2013.

A. George, A. Routray. "Fast and Accurate Algorithm for Eye Localization for Gaze Tracking in Low Resolution Images" IET CV 2016.