



A virtual multi-view Optical Tracking System

Project Management and Software Development
for Medical Applications

General Info

Project Title: A virtual multi-view Optical Tracking System

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Project Abstract

Using a stereo-vision Optical Tracking System (OTS), the goal of this project is to build a first prototype framework to overcome the line-of-sight issue by using a moveable tracked planar mirror. The planar mirror provides a second virtual camera system in the virtual mirror space that moves while the mirror is moved. With multiple-view-geometry principles this information is added to the original stereo system data to enable a reliable and robust multi-view tracking system.

Background and Motivation

Modern surgical interventions often need systems to track one or multiple medical instruments or imaging devices to spatially localize or fuse data streams to provide necessary information to the physician.

In the operation theatre, line-of-sight issues arise naturally due to persons or objects in the vision cone of optical tracking systems. To overcome such problems, sometimes electromagnetic tracking systems are used. These systems suffer from various problems such as electromagnetic interference or spatial accuracy restrictions. This is why optical systems are preferred in a wide variety

of interventions. However, the line-of-sight problems remain.

For this to overcome, the project partner FRAMOS wants to use a specifically tracked mirror to insert a second virtual stereo camera system to provide tracking information from another viewpoint.

Student's Tasks Description

The first target for the student is to implement the generic OpenIGTLink interface via TCP/IP that enables the communication with the FRAMOS OTS to collect 6D pose data from the original optical tracking system.

The tracking of the mirror and the tool is then realized with a dedicated sequence within the FRAMOS Software Framework (FISS) using the graphical interpreter language provided in FISS.

Having calculated the 6D mirror pose, the virtual camera position is estimated and the virtual data stream is fused with the real pose information.

In a defined test scenario, the prototype is finally tested and the performance is evaluated in different occlusion setups.

After this project, the student is able to work with the FRAMOS software framework. Some experience with a clinical software interface such as OpenIGTLink is made and a real-time camera pose estimation and data fusion has been implemented and documented. Moreover, the constant coordination with FRAMOS gives some insight into the working procedures in the industry.



Technical Prerequisites

- Basic knowledge of MATLAB / C++

- Basic skills in linear algebra

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

- Basic knowledge of image processing and some experience with openCV

- 3D computer vision / multi-view expertise

- Basic understanding of projective geometry

- Ability to work with versioning tools such as GIT

References

Hartley, Zisserman. "Multiple View Geometry in Computer Vision". Cambridge University Press. 2003.

Zhang, Zhengyou. "A flexible new technique for camera calibration". PAMI 2000.