



Project Proposal

Project Management and Software Development for Medical Applications

General Info

Project Title: Visualizing the volumetric accuracy of medical tracking solutions

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Project Abstract

The project aims to develop a software framework that is capable of visualizing the accuracy of a generic medical tracking system interactively in a way that the user can observe potential tracking errors and the system accuracy in certain spatial regions. Such a framework helps to compare different tracking solutions and eases the decision process for an appropriate tracking system for a specific medical task.

Background and Motivation

Accurate position and orientation information in real-time is compulsory for many computer aided medical procedures including a wide variety of clinical interventions and diagnostic imaging techniques. For the success of various operations and exact medical diagnosis that rely on pose information it is therefore important to gather suchlike information precisely.

For these tasks, different tracking solutions such as electromagnetic and vision based systems are used in different medical domains. Except for the precision given by the manufacturers, the reliability of such systems remains sometimes unknown. In particular the accuracy in certain spatial regions is often not measured though this can be crucial for

the outcome in many applications as for example fine needle guidance or surgery planning based on 3D ultrasound scans.

The project partner FRAMOS wants to establish a framework which is capable to visualize the accuracy of different tracking solutions in order to compare systems and decide on the most suitable for a specific medical task.

Student's Tasks Description

The student develops a framework that evaluates and visualizes the accuracy of a generic tracking system. This framework is then used to analyse the FRAMOS Optical Tracking System (OTS).

An interactive heat map or a similar graphical representation of spatially changing data is used for the visualization to illustrate both the tracking error and the system accuracy.

For the application of the framework, the student plans on how to evaluate the system parameters and specifies a testing process. Existing stereo calibration routines and the tracking algorithms of the FRAMOS software framework are used to get 3D pose information of an observed test object.

After this project, the student is able to work with the stereo calibration toolbox of MATLAB and the FRAMOS software framework. Some experience with a clinical software interface such as OpenIGTLink is made and a visualization framework has been implemented and documented. Moreover, the constant coordination with FRAMOS gives some insight into the working procedures in the industry.

Please send the completed document to achilles@in.tum.de before the project proposal deadline on October 1st, preferably earlier. Please note that this proposal will be evaluated by the BMC coordinators and will be assigned to a student only in case of acceptance.



Technical Prerequisites

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

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

- Insight into a framework to create a graphical user interface such as MATLAB GUIDE or Qt
- Basic knowledge of image processing and some experience with openCV
- 2D/3D computer vision expertise
- Ability to work with versioning tools such as SVN / GIT

References

Sun, Cooperstock. "Requirements for Camera Calibration: Must Accuracy Come with a High Price?". WACV 2005

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