



A hybrid opto-inertial Tracking System Prototype

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Final Presentation

Computer Aided Medical Procedures (CAMP) Technische Universität
München, Germany July 13, 2016

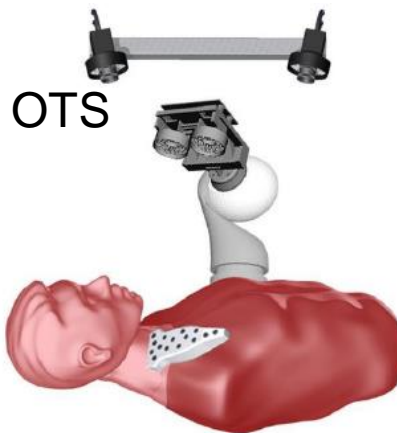
Project Outline

➤ Motivation

- Different Tracking Solutions
- Each have pros and cons
- Hybrid solution for overcoming limitations

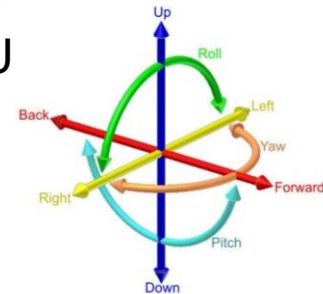
➤ Problem Statement

- To develop a software prototype that fuses the data streams of both an inertial measurement unit (IMU) and an optical tracking system (OTS)



6 degrees of freedom

IMU



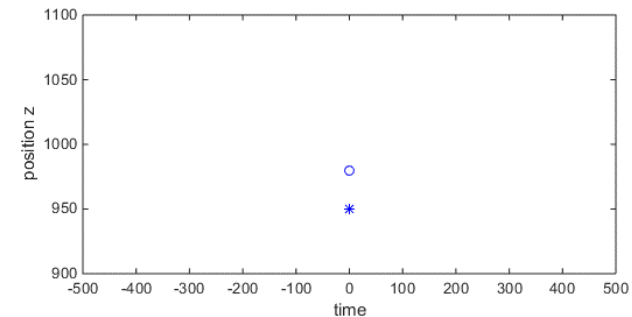
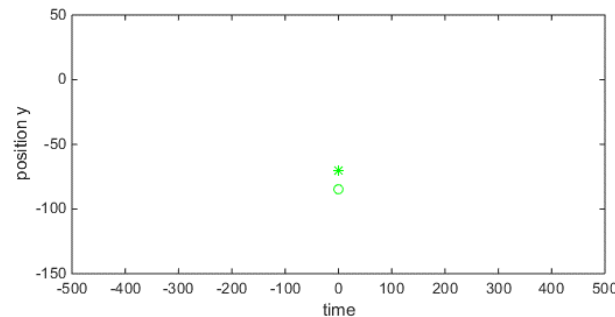
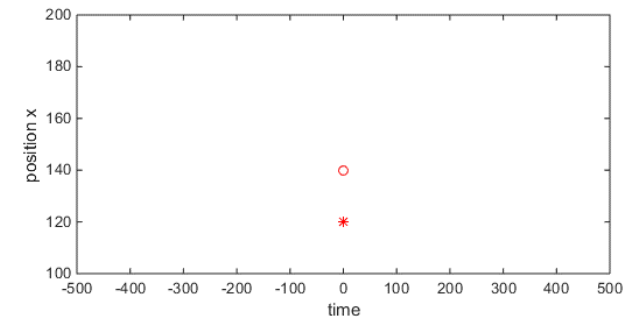
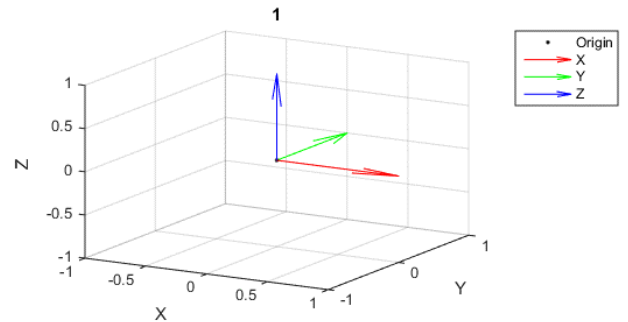
- Accelerometer: Left-Right, Back-Forward, Up-Down
- Gyroscope: Pitch, Roll, Yaw



Image Courtesies: B. Busam – Optical Tracking for Medical Applications(July 8, 2016)
[Slideshare](#) (July 8, 2016)

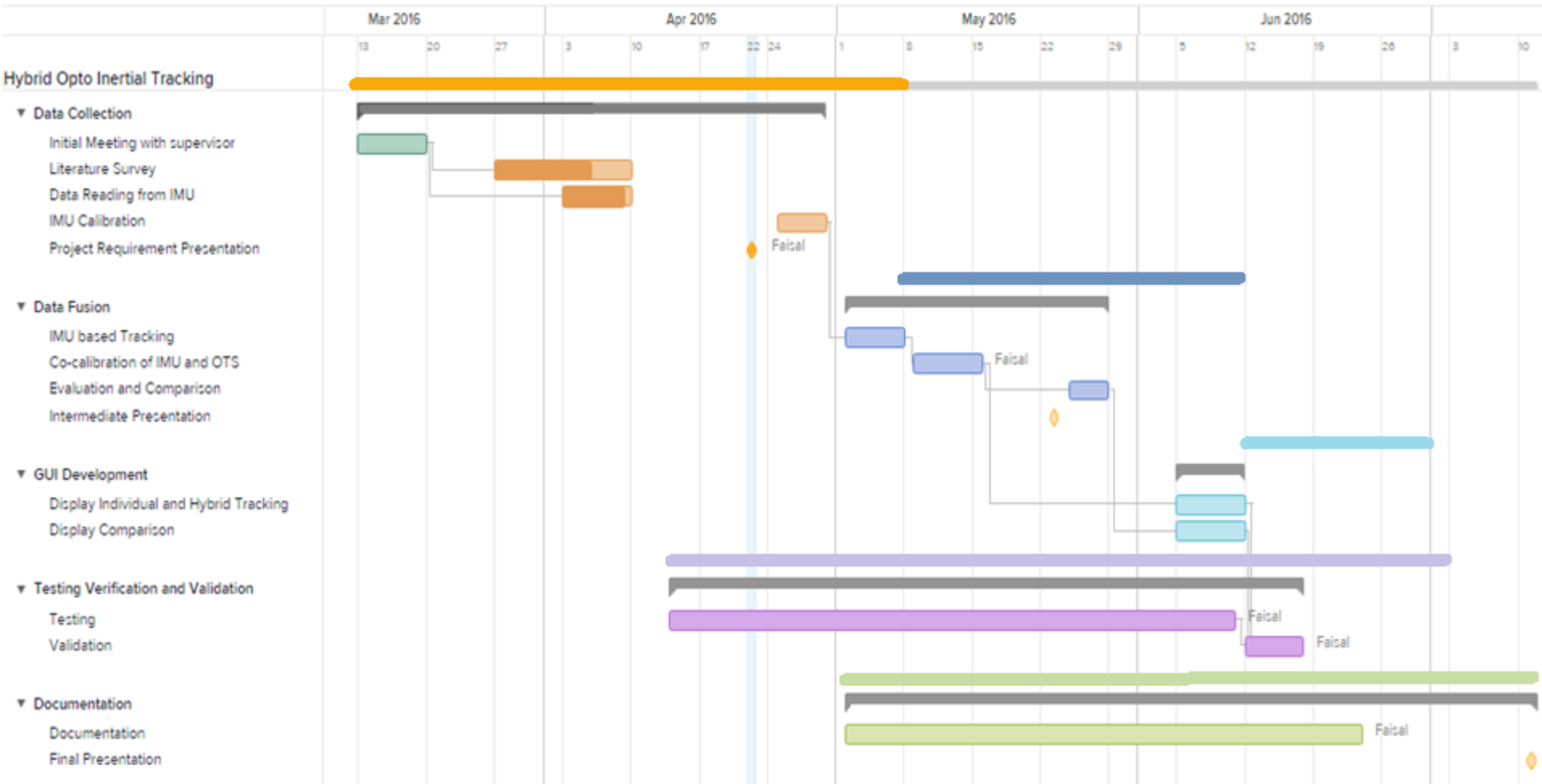
Project Outline

- Requirements and Specifications
 - Tracking
 - Tracking of device based on IMU data
 - Data Fusion
 - Evaluation
 - Compare results of IMU based tracking to OTS
 - GUI
 - Display individual + hybrid pose values

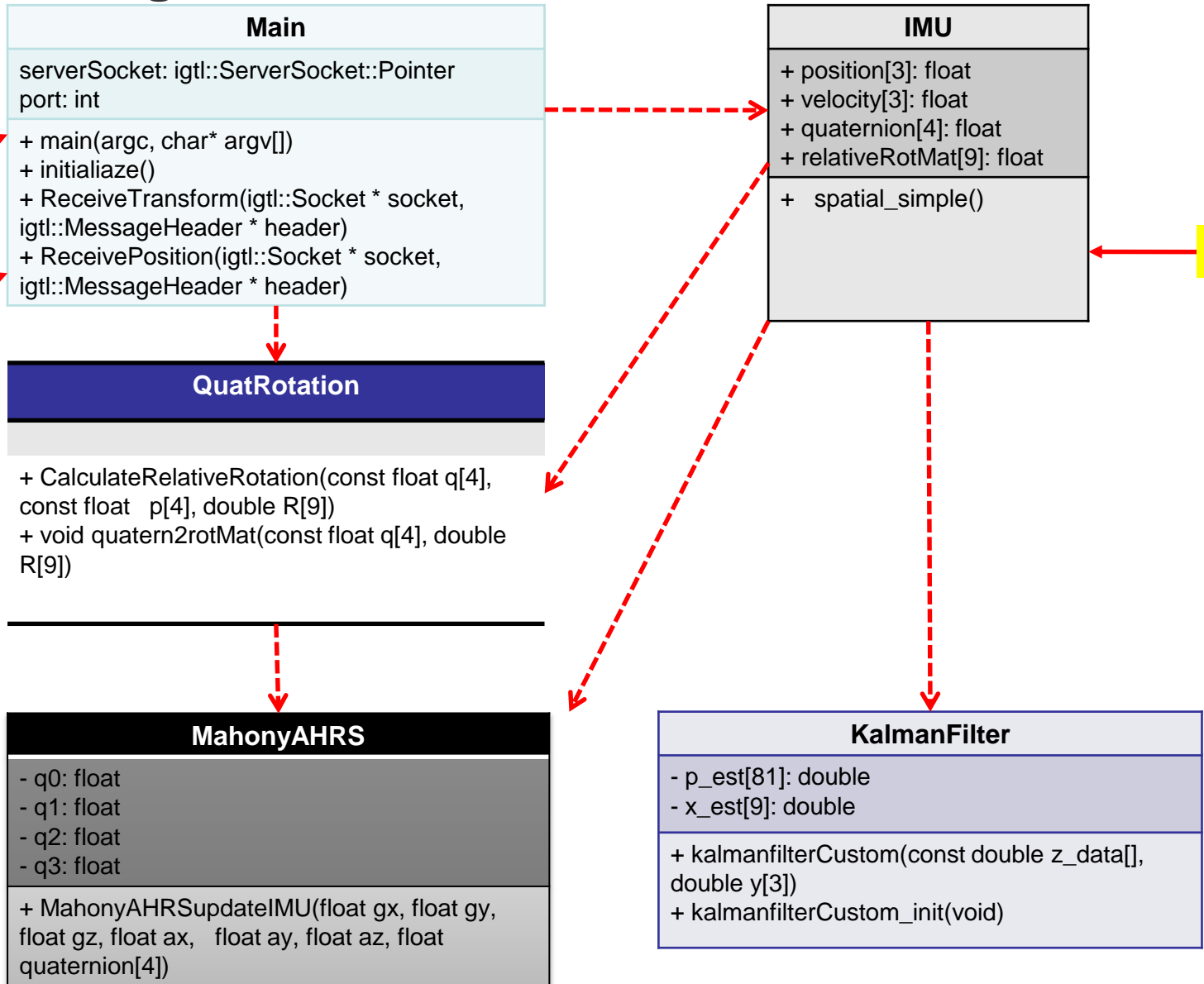


Project Outline

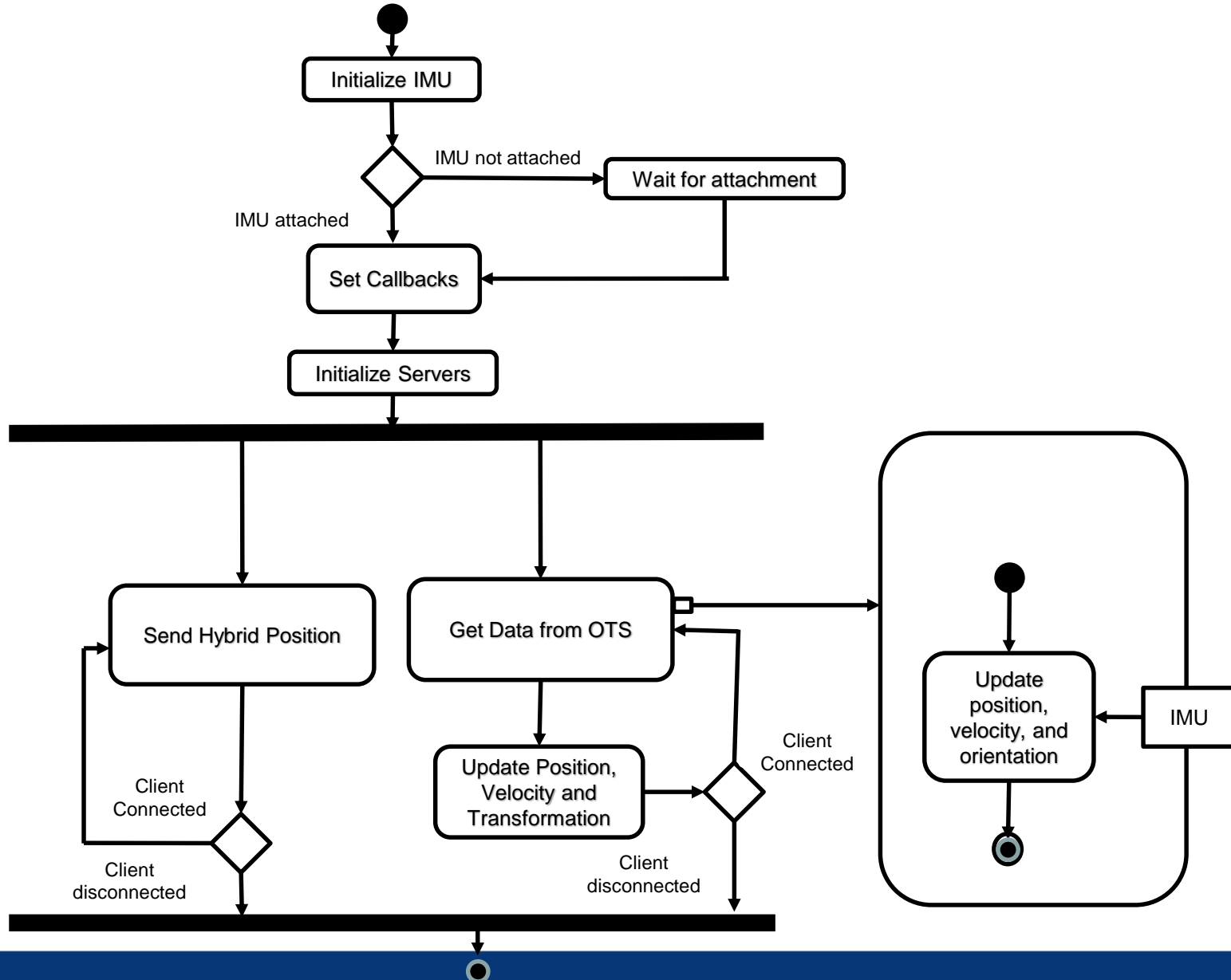
➤ Project Plan



Software Design UML Class Diagram



Software Design UML Activity Diagram

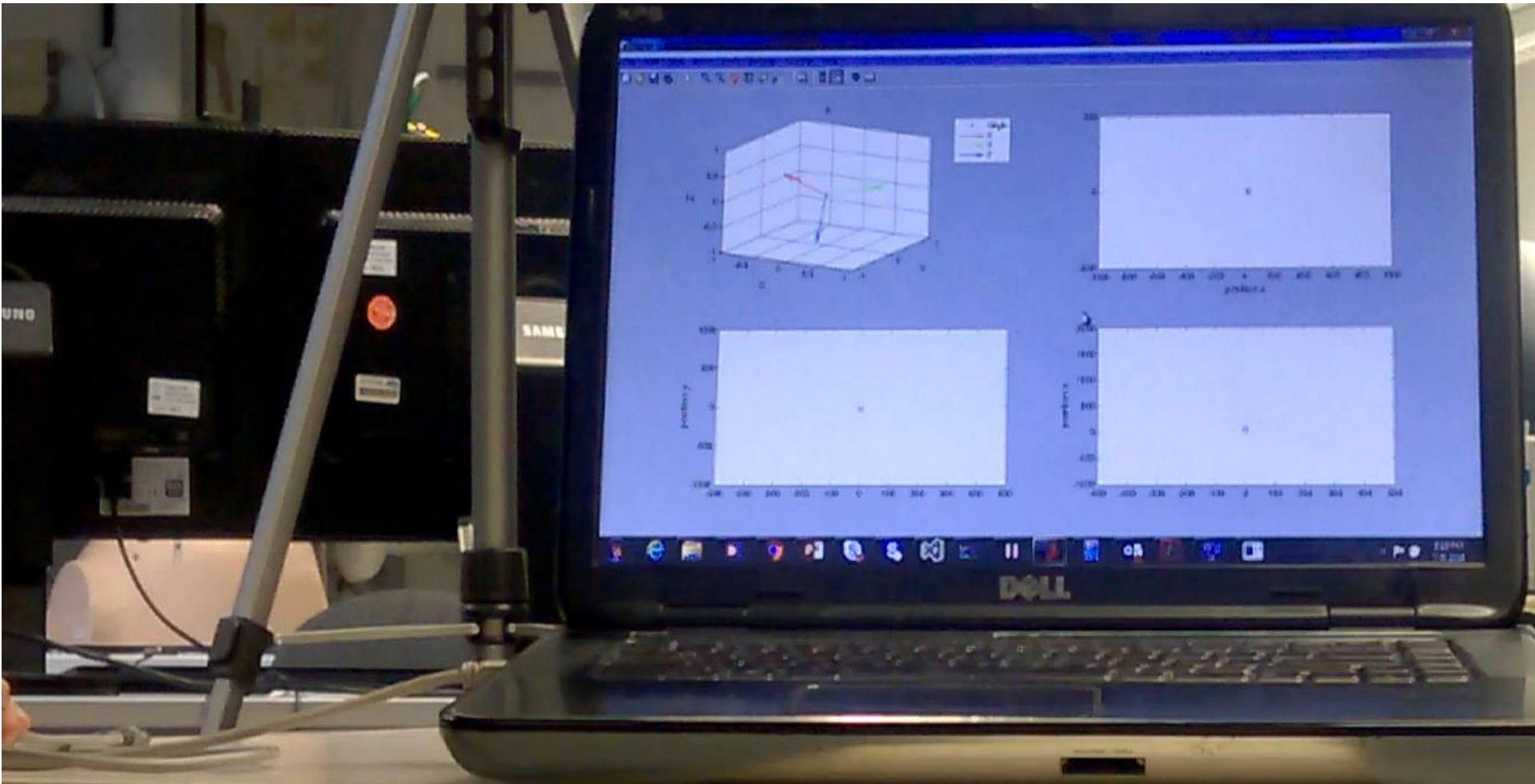


Software Design

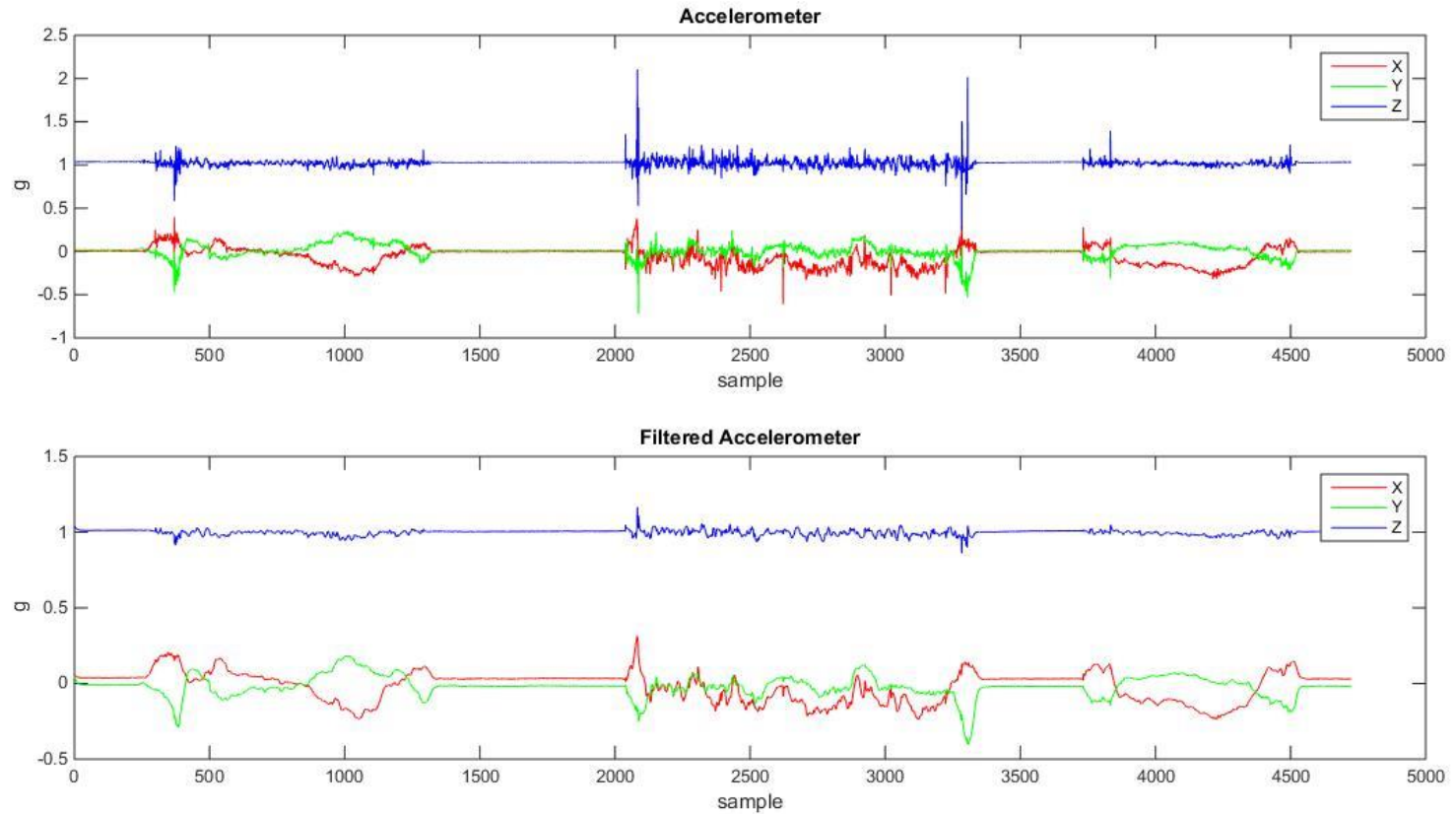
- Strategies
 - Server-Client: top-down
 - 6 DOF position estimation: bottom-up
- Server-Client Communication
 - OpenIGTLink Protocol, using TransfromMessage
- Separate Threads
 - OpticalServer, GUIserver, HybridServer
- Environment
 - Windows, Visual Studio, C++, phideget, OpenIGTLink, Matlab



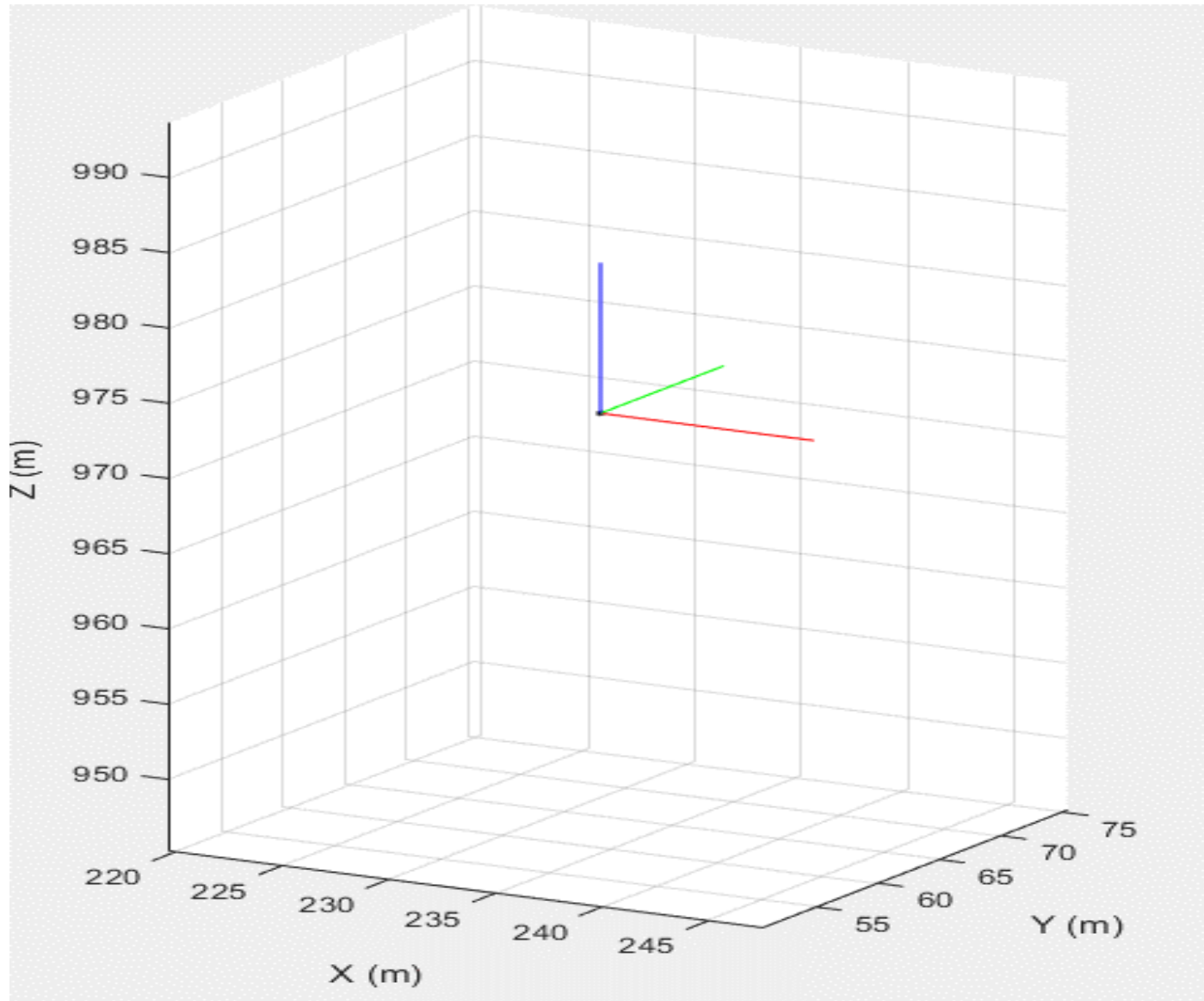
Project Results



Project Results



Project Results



Project Outlook

- All tasks completed
 - IMU Integration
 - IMU calibration
 - IMU Data filtering
 - Position and Orientation estimation
 - Server Implementation
 - Co Calibration of IMU and optical tracker
 - Data Fusion
 - Analysis
 - Visualization
- Future Work
 - Calibration of IMU from more readings
 - Accelerometer bias correction from optical data
 - Adaptive filtering of accelerometer data
 - More testing and evaluations
 - Navigation grade IMU



Project Retrospective

- Main Challenges
 - Underestimated tasks
 - Issues with third party libraries
- Tasks
 - All mandatory tasks completed
- 6DOF pose estimation, IMUs, OpenIGTLink, Kalman filtering, Software Project Management, Presentation Skills
- Lessons Learned
 - Integration of modules in different platforms



➤ Questions

➤ Comments

➤ Ideas

