Optical Tracking II

Research project

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Overview

- Introduction
- Frustum reconstruction
- Low-cost optical tracking
- Conclusion and future work

Introduction

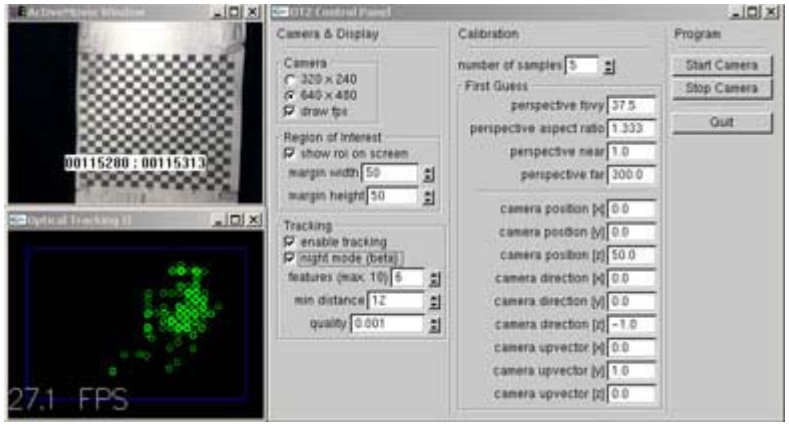
- Frustum reconstruction
  - ART
  - IR-beamer
- Low-cost optical tracking
  - webcams
  - cheap objects

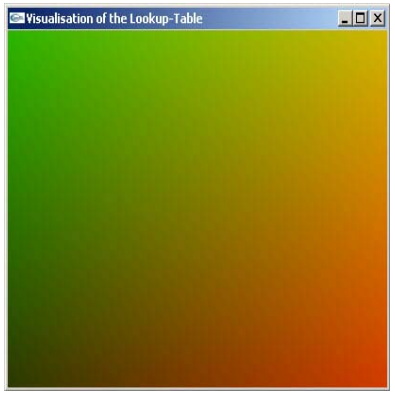
Introduction

- Prior work
  - Optical tracking 1
    - Multi camera approach
    - ARToolKit
    - LED-Tracking

Frustum reconstruction

- Image processing with OpenCV
- Laserpoint tracking
- Camera calibration
- Building a lookup-table



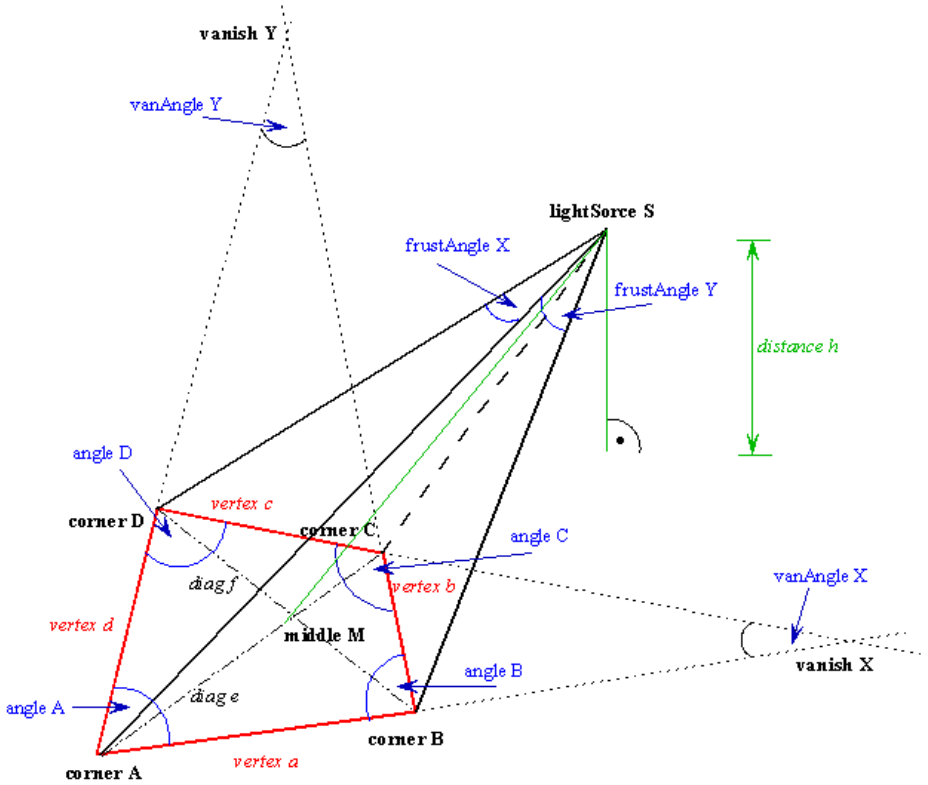


Frustum reconstruction

- head/hand tracking system
- Using a rack of IR-emitters
- Reconstruction out of the deformed figure

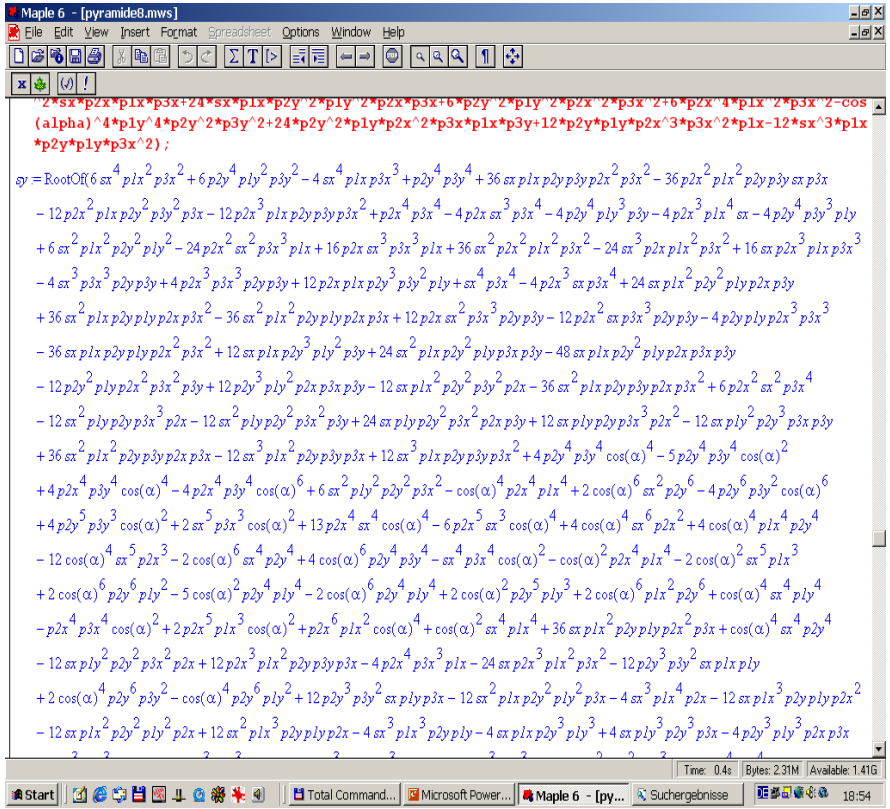
Frustum reconstruction

- First analytical approach
  - The angle of the opposing edges is same as the difference to the perpendicular



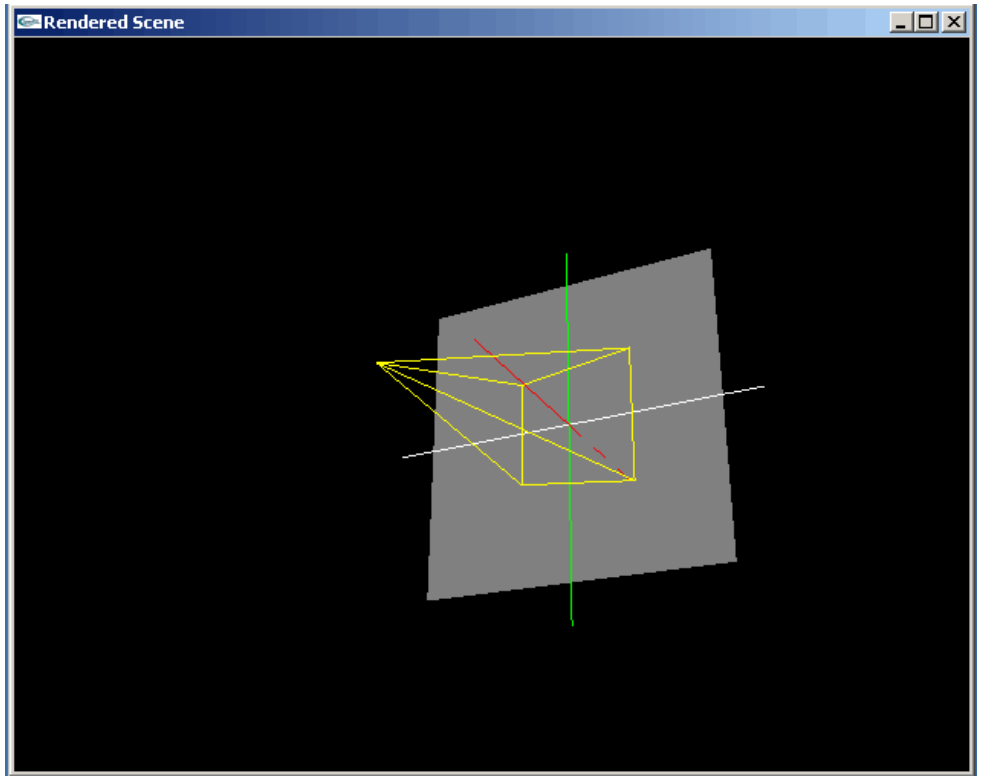
Frustum reconstruction

- Second analytical approach
  - Building a equation system from the ratio of edges and angles of the pyramid
  - Worked but unsolvable



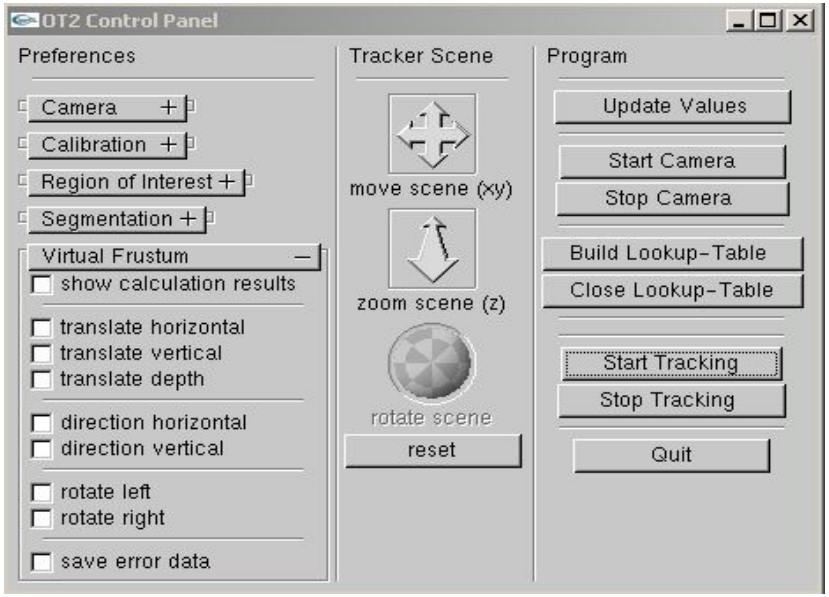
Frustum reconstruction

- Succeeded approach
  - Numerical solution
  - Powell's direction set method



Frustum reconstruction

- demonstration



Low-cost optical tracking

Low-cost tracking

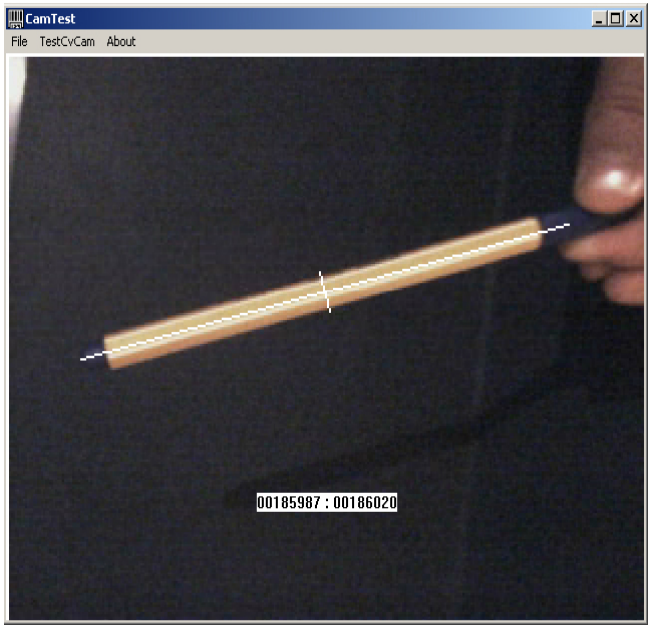
- cheap and simple components
  - webcams (Logitech Quickcam)
  - simple tracking devices (colored ball, fingertip, etc.)

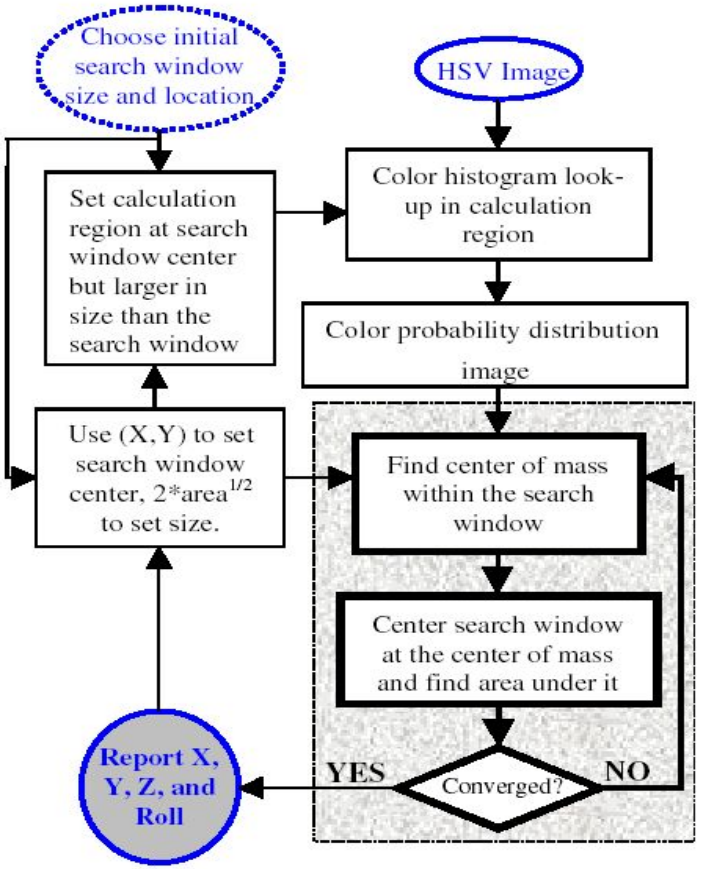
Low-cost tracking

- Image processing
  - recognizing objects in the video-stream
  - critical part: accuracy depends of good segmentation

Low-cost tracking

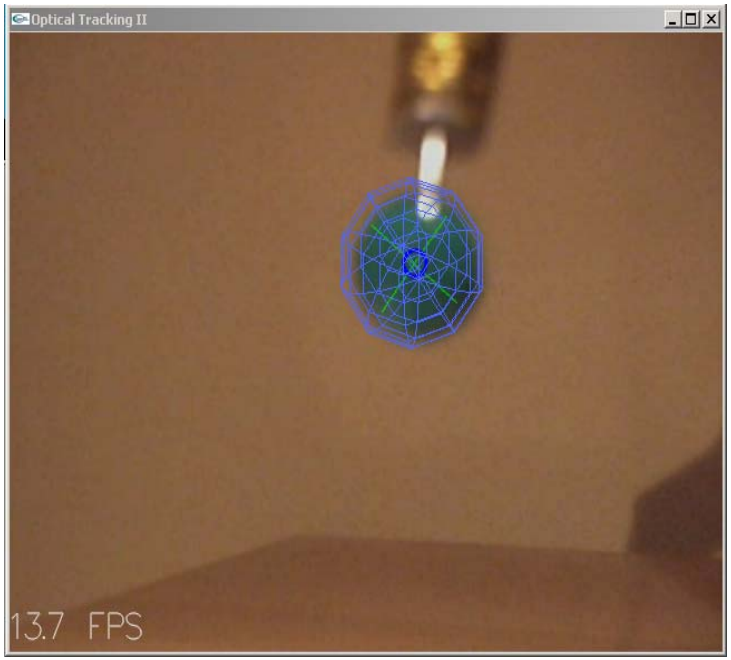
- Camshift algorithm

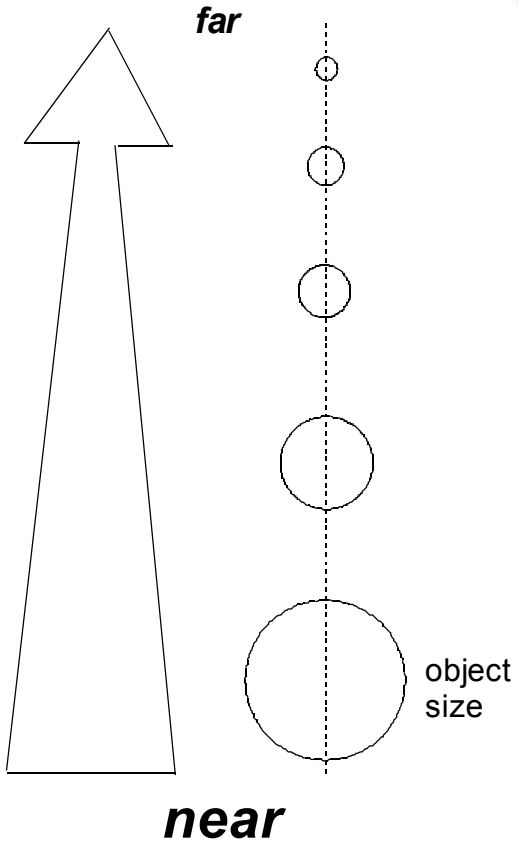




Low-cost tracking

- Single camera approach



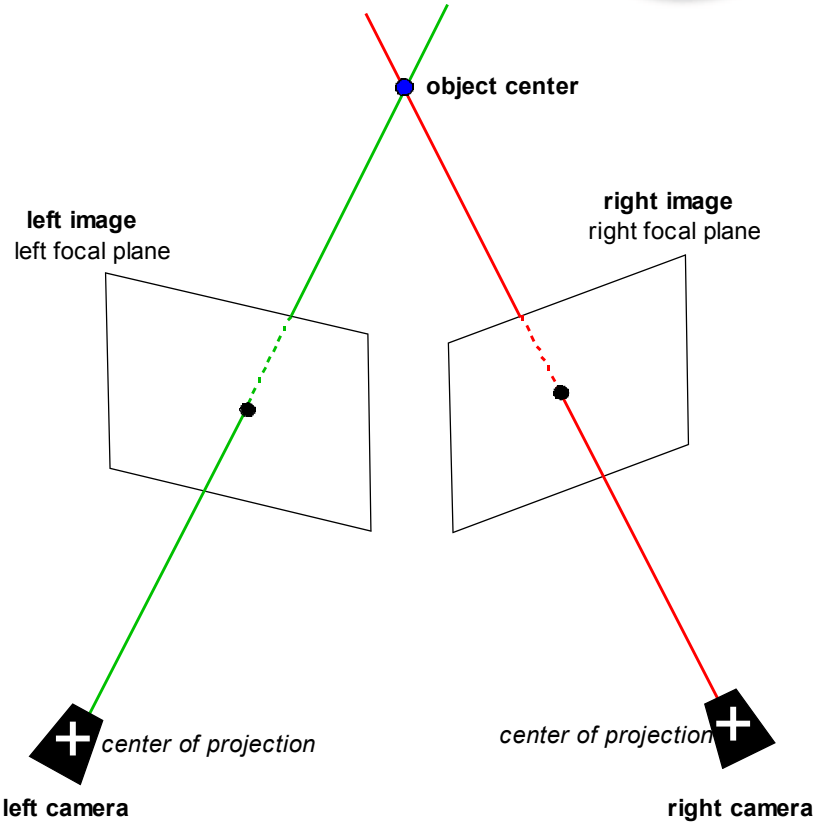


Low-cost tracking

- Draw-back single camera
  - object's size critical factor
  - camera resolution to low
  - deviation:
    - ~ 10 mm (10-20 cm distance)

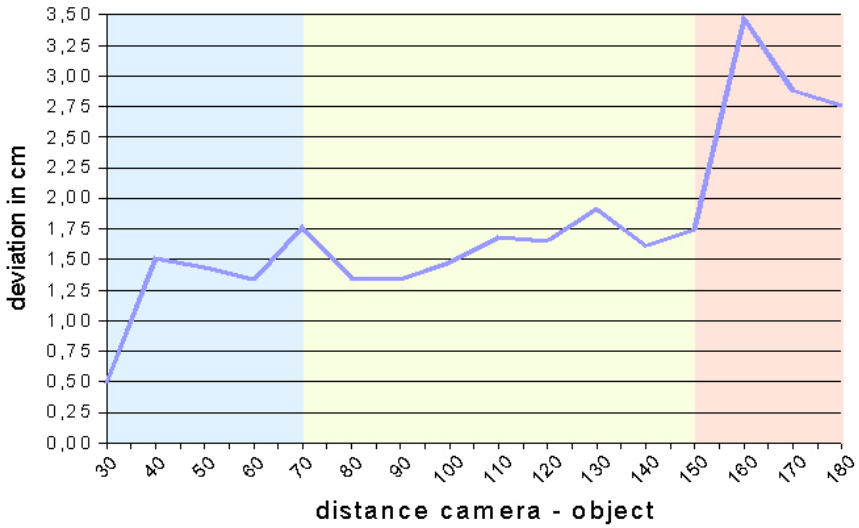
Low-cost tracking

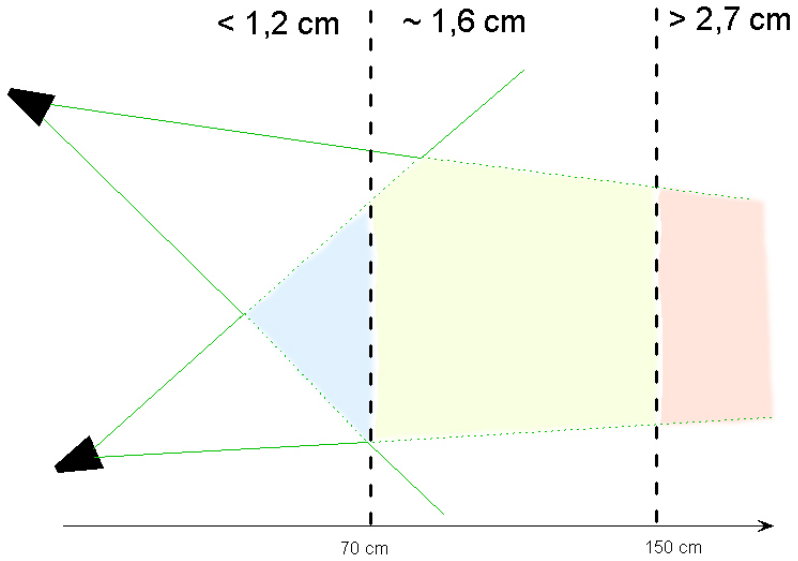
- Stereo camera approach
  - two computers
  - data exchange via TCP/IP
  - Stereo photogrammetry (triangulation)



Low-cost tracking

- Results
  - Accuracy:





Low-cost tracking

- Results
  - Performance
  - More hardware needed
  - restricted tracking-area

Objects	Fps
0	115
1	30
2	18
3	12
4	9,5

ATHLON XP 1800+

1024 Mb RAM

GeForce4 Ti 4600

Conclusion and Future work

Conclusion & Future work

- Three different approaches
  - efficiency
  - accuracy
  - complexity of calibration and installing

Conclusion & Future work

- Possible applications
  - Commercial use (e.g. ART)
  - Cooperation with Warhol-Shader project
  - Input device for the Virtual Showcase

Conclusion & Future work

- Suggestions for next project
  - Image processing: using other algorithms
  - Experiments with other tracking-devices

End of presentation