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 on 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:

![Graph showing deviation in cm against distance camera-object with intervals for accuracy: < 1.2 cm, ~ 1.6 cm, > 2.7 cm.](image)
Low-cost tracking

• Results

  - Performance
  - More hardware needed
  - restricted tracking-area

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ATHLON XP 1800+
1024 Mb RAM
GeForce4 Ti 4600

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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