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Real-time Visual Tracking and Servoing Demonstration

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3D Visual servoing system

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Teaching Phase

- manual localisation of workpiece
- calibration of internal camera parameters
- teaching of task trajectory
  - position robot
  - store position

Runtime Phase

- part is placed in workcell
- automatically localised
- task trajectory is loaded from disk

Teaching: manual localisation

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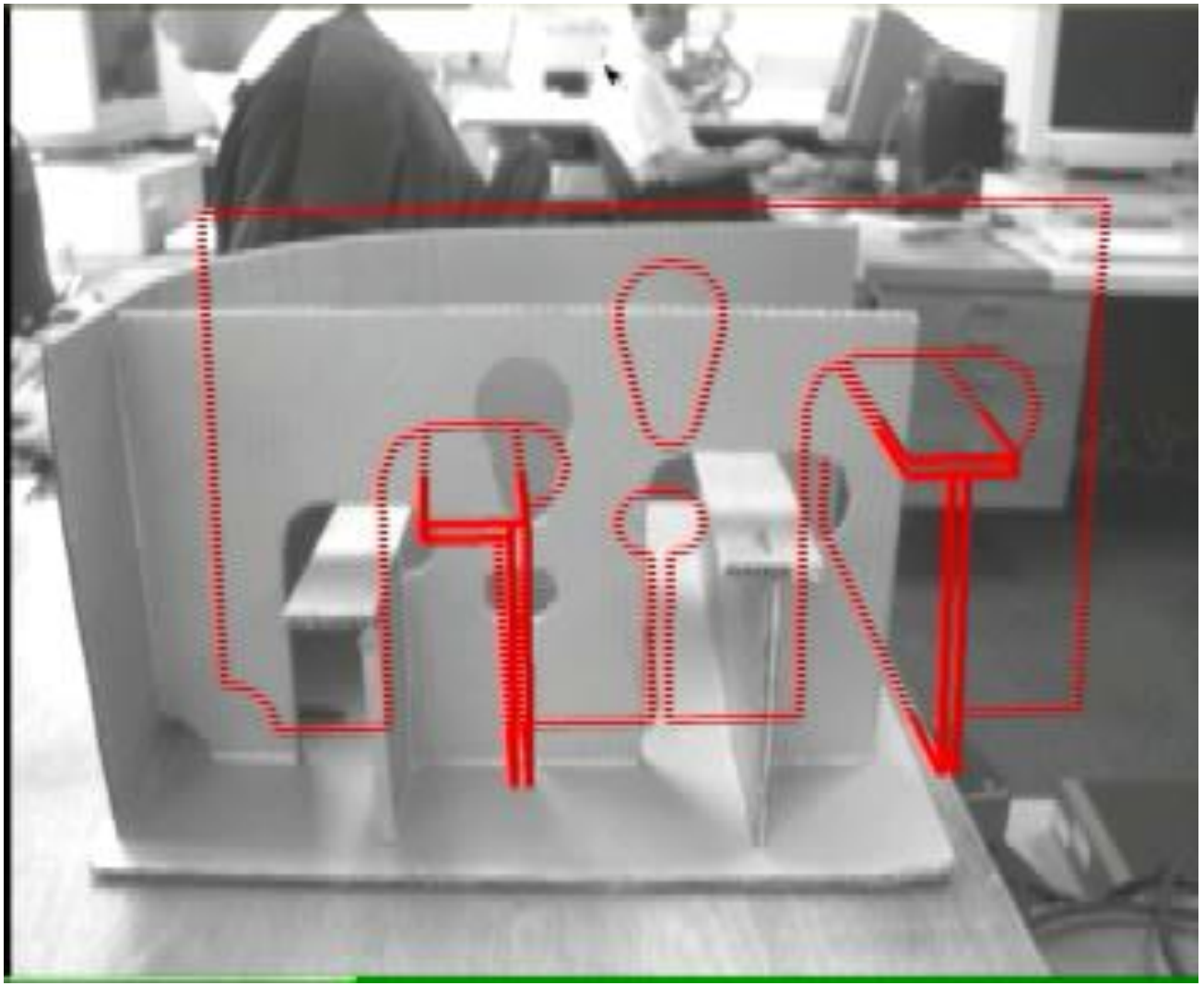

Teaching: camera calibration

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Teaching: task trajectory

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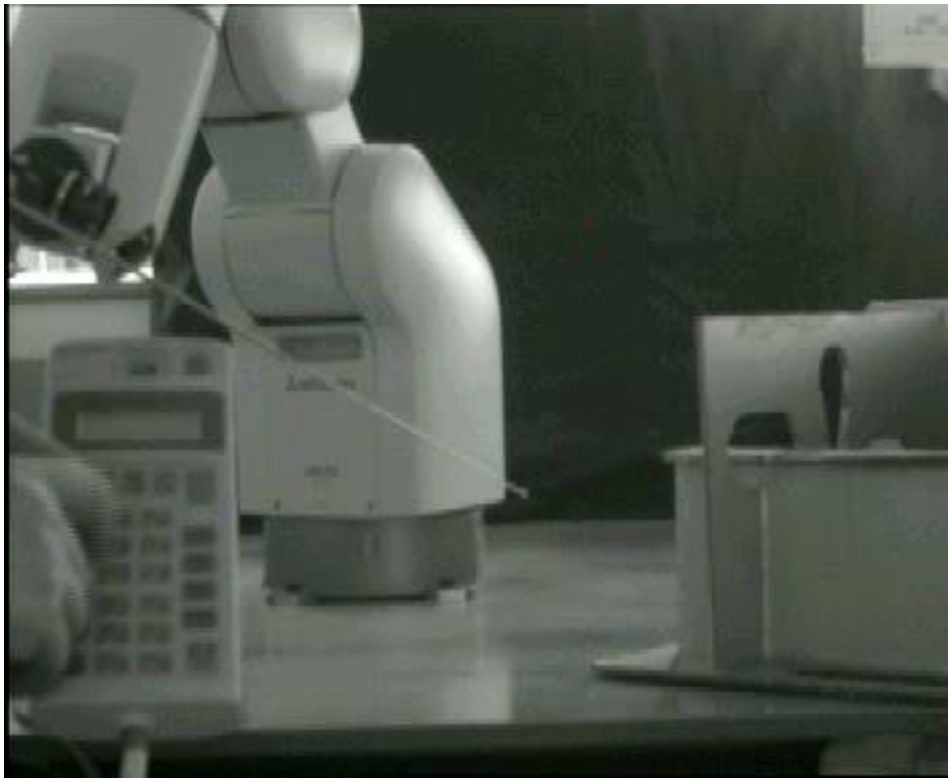

Teach: task trajectory

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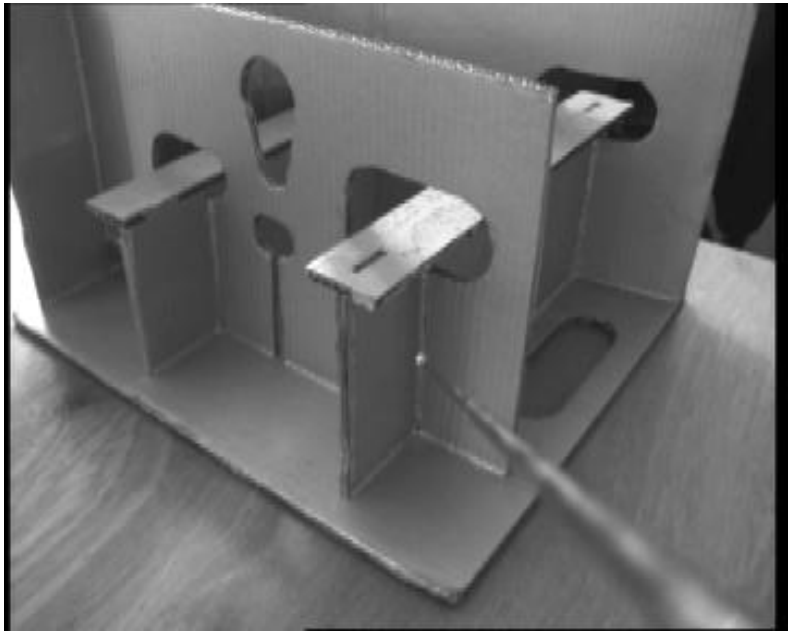
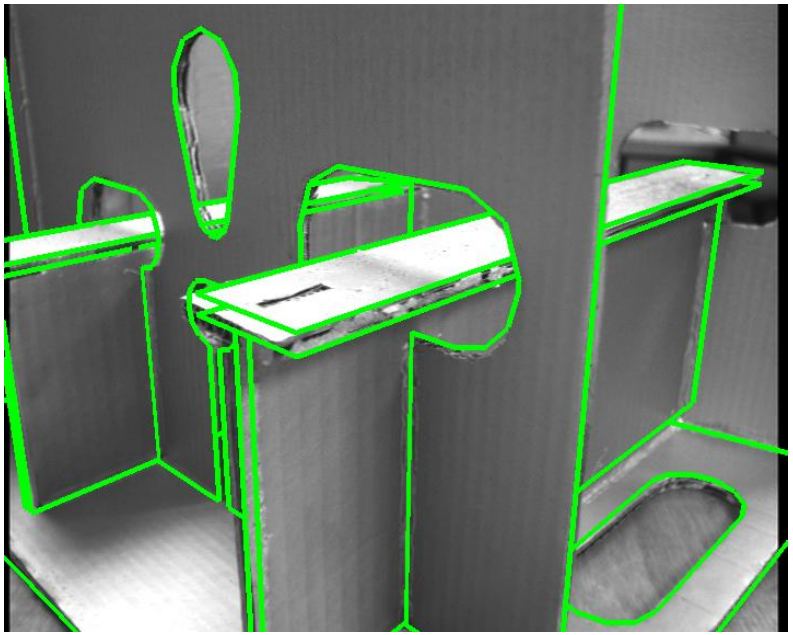
- Position 1: safe position





Teach: task trajectory

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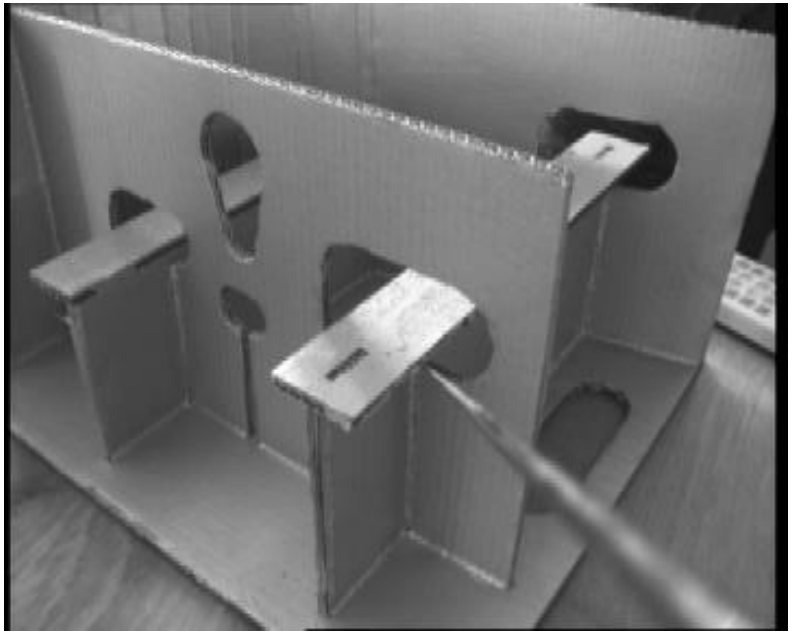
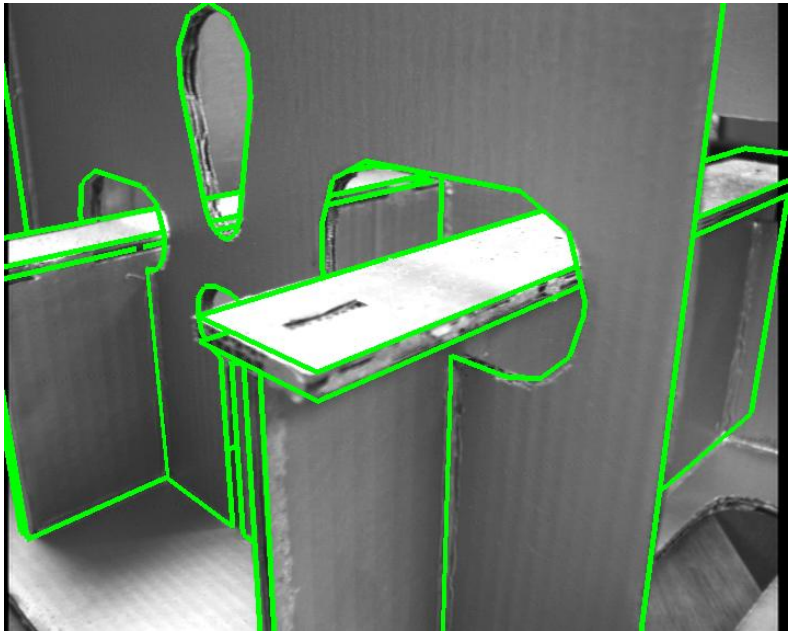
- Position 2: start of weld 1





Teach: task trajectory

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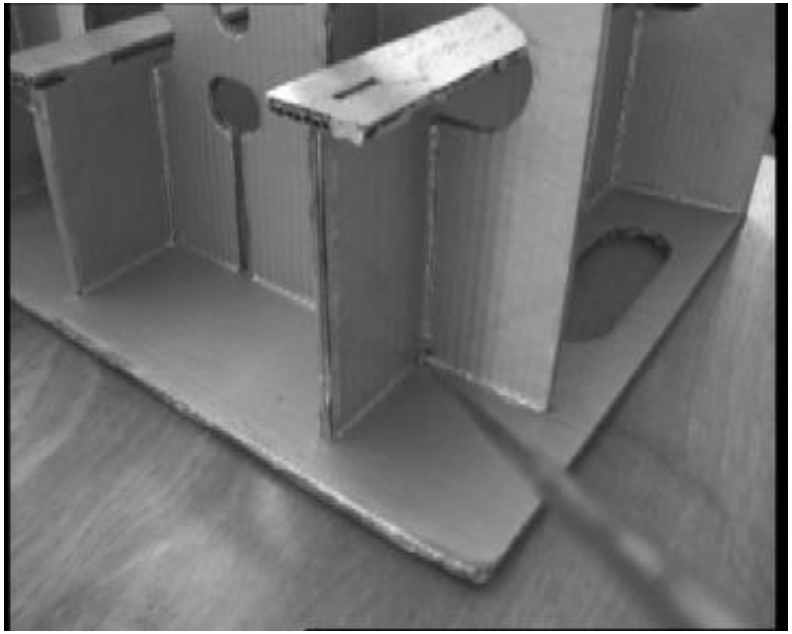
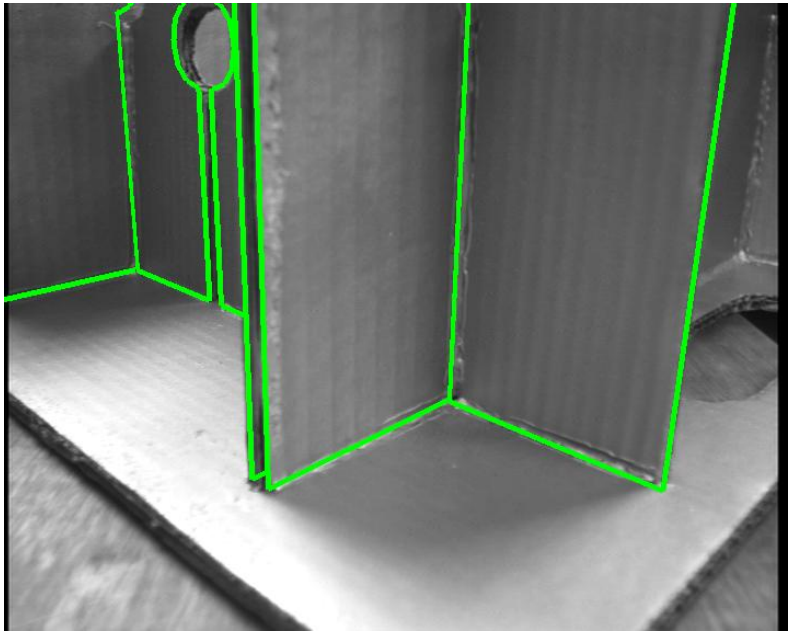
- Position 3: end of weld 1 - start of weld 2





Teach: task trajectory

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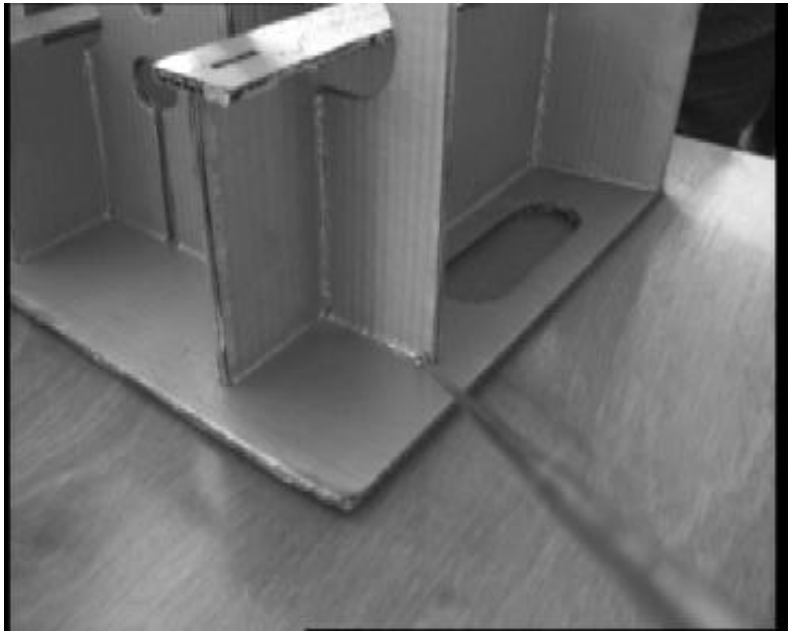
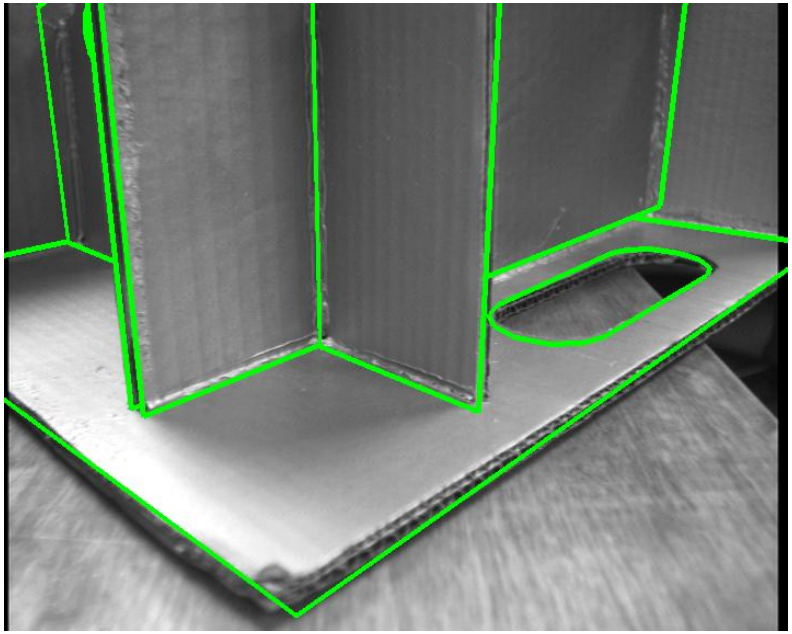
- Position 3:end of weld 2





Runtime: Automatic localisation

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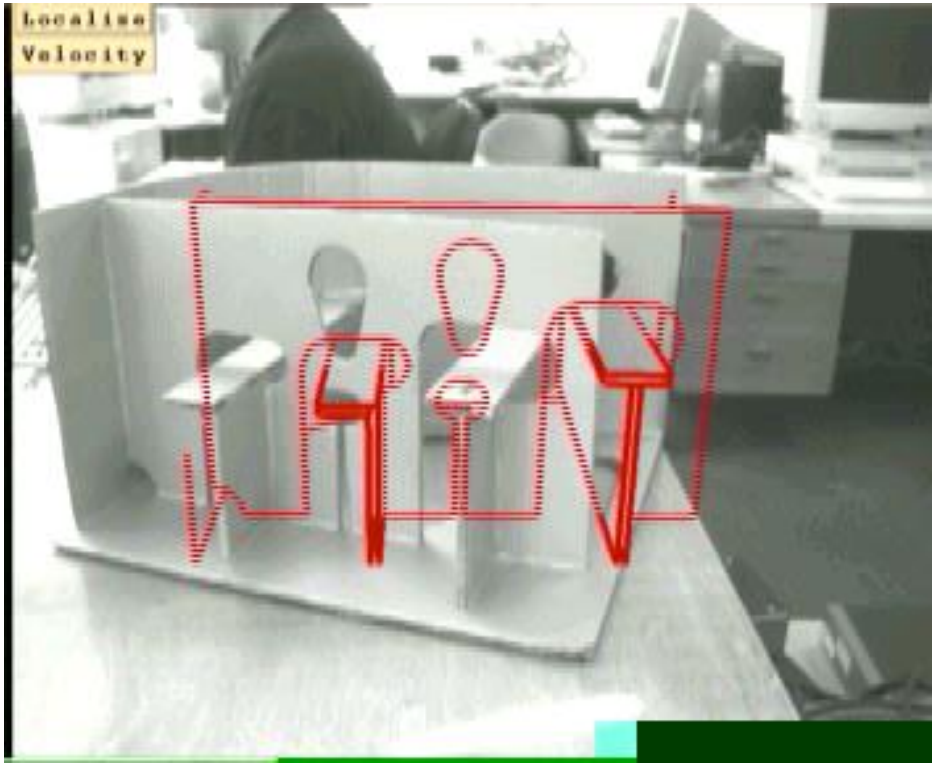

Runtime: perform task

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- Task trajectory is loaded from disk
- Task demo on videotape...

Assessment:

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- Successful tracking of Mock-up at PAL frame rate
  - Yes and also at field rate (50 Hz)
  - With 3 cameras can only achieve 85% of frame rate (~20Hz)
- Successful servoing of RV-E2 at 4Hz
  - Yes but faster not possible with current communications protocol
- Accuracy of positioning of end effector <0.5mm
  - static positioning of 0.12 mm
  - dynamic positioning only 0.5-1.0 mm
    - (hope to improve this with higher bandwidth controller)

Assessment:

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- Calibration of internal camera parameters to <2%
  - 1% accuracy achieved (f,a,u0,v0) - imposed skew=0
- Automatic localisation failure rate <5%
  - Success rate = 100% for small deviations from nominal position
    - small = translation < 5cm, rotation < 30 degrees
  - For larger errors obtain ~90% success rate

Real testing

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