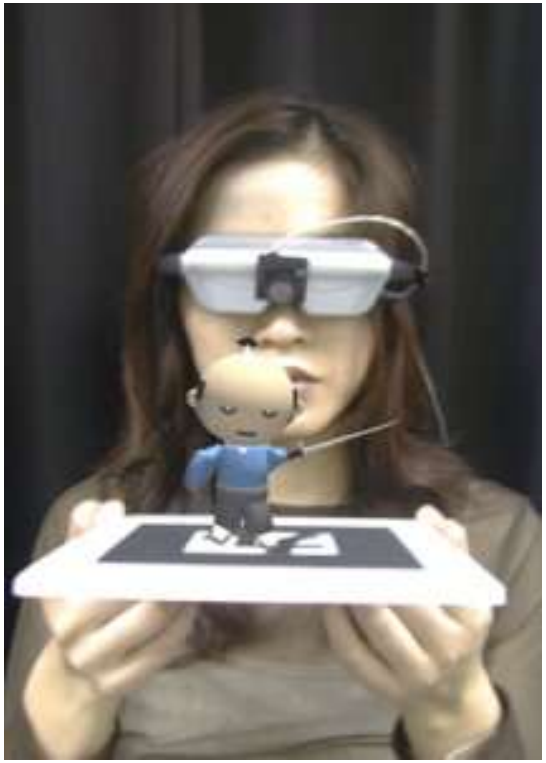
A benchmark data generation tool using walking simulation and virtualized reality models for evaluating AR visual tracking

○Koji Makita(*1), Tomoya Ishikawa(*1), Takashi Okuma(*1),
Thomas Vincent(*2), Laurence Nigay(*2), and Takeshi Kurata(*1)

(*1) Center for Service Research,
National Institute of Advanced Industrial Science and Technology (AIST), Japan
(*2) Université Joseph Fourier, France

KJMR2012
(14:40-15:00 April 13, 2012)

Research background : Camera parameter estimation for AR/MR



ARToolKit
(Kato, et al, IWAR99)

DTAM(*)
(R. A. Newcombe, et al, ICCV2011)

Ground truth data of camera parameters and feature points are needed for benchmarking.

TrakMark~

Benchmark Test Schemes for AR/MR Geometric Registration and Tracking Methods

Blu-ray Data discs
(We have distributed about
220 discs in ISMAR2011)

TrakMark2011
(in conjunction with ISMAR2011)

Packages in TrakMark (Open data)

Film Studio Package

NAIST Campus Package

Conference Venue Package

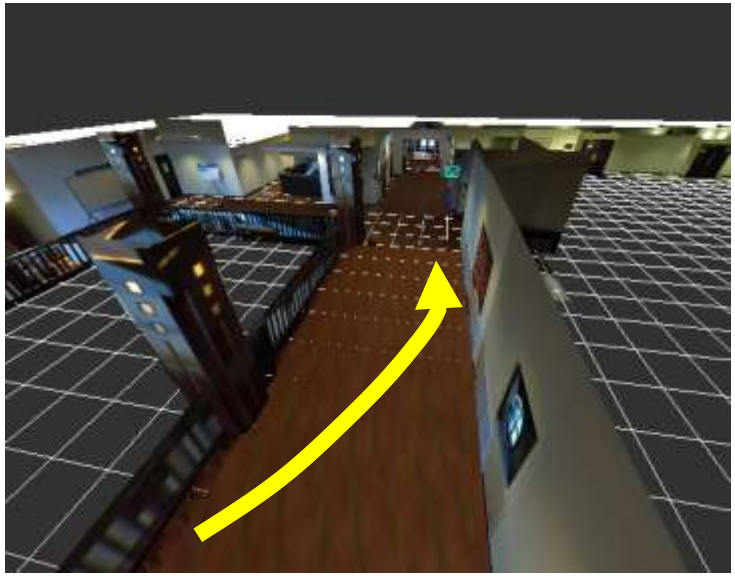
Making ground truth data is costly in real environment.

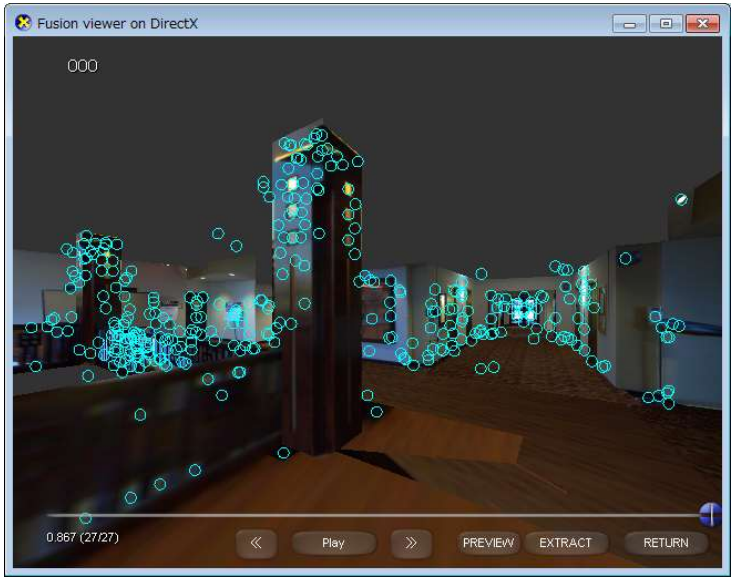
Objective

Developing a tool to generate data sets for benchmark using virtualized reality models

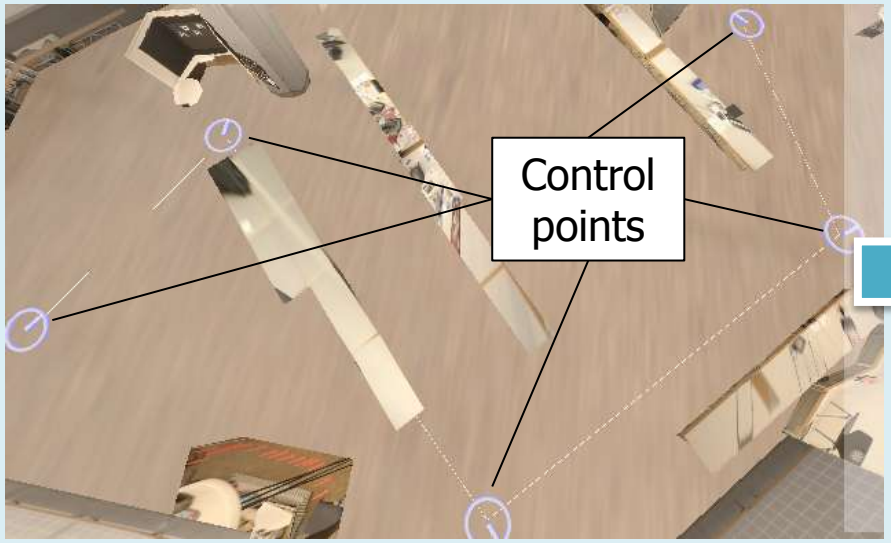
Merits of using virtualized reality models

- ✔Making ground truth data
- ✔Any camera path and any feature points

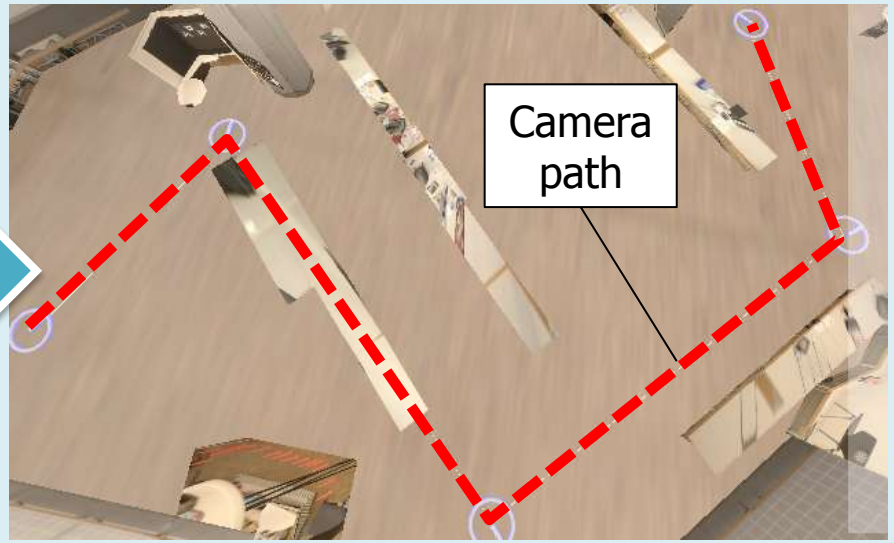




Outline of the tool



The user sets control points
on the ground plane.



Camera path is automatically generated
with linear interpolation.

Generated images
(Extrinsic camera parameters are available)

Generated interest points
(2D-3D correspondence of points are
available)

A benchmark data generation tool

Problem

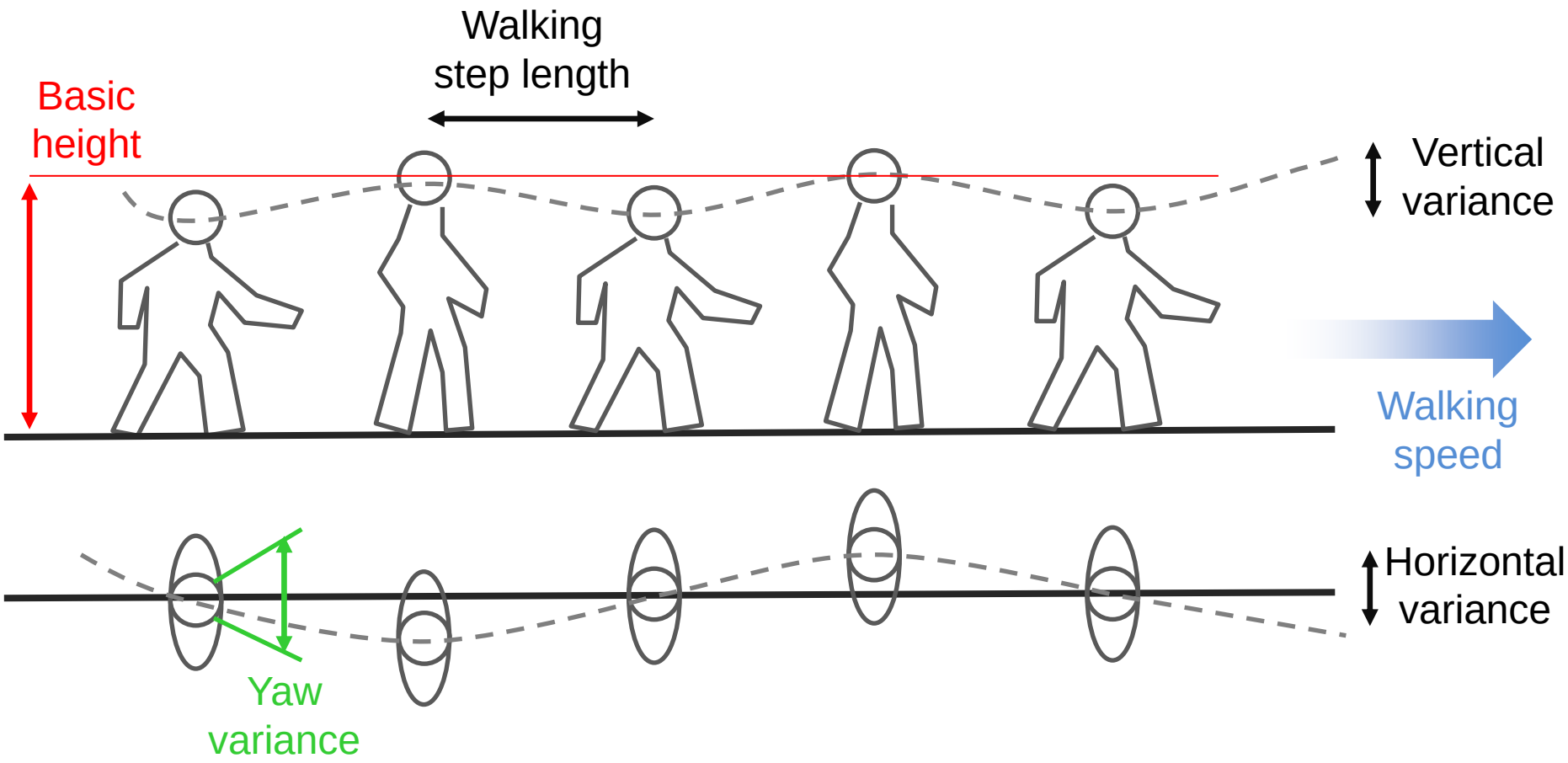
How to efficiently set walking movement?

Sample movies

(head mounted camera and hand held camera camera)

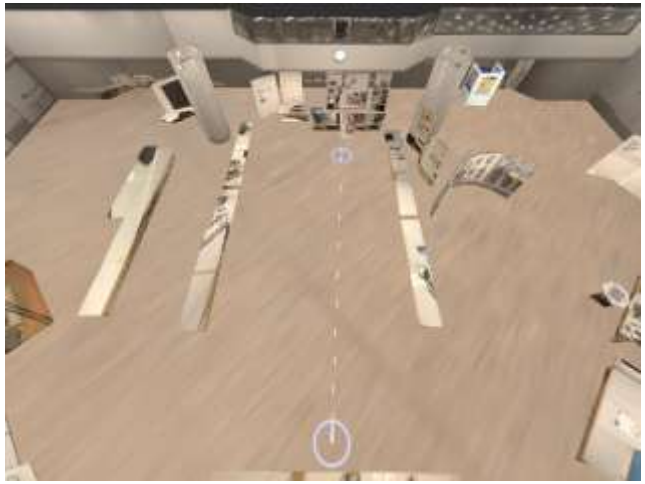
Our approach

Parameterization of walking movement



For generating extrinsic camera parameters,
interpolations between control points are used with these parameters.

Comparative result



Parameter settings
- Basic height
  1600 [mm]
- Vertical variance
  50 [mm]
- Horizontal variance
  80 [mm]
- Yaw variance
  1 [degree]
- Walking step length
  650 [mm]
- Walking speed
  900 [mm]

Output with linear interpolation

Output with walking motion

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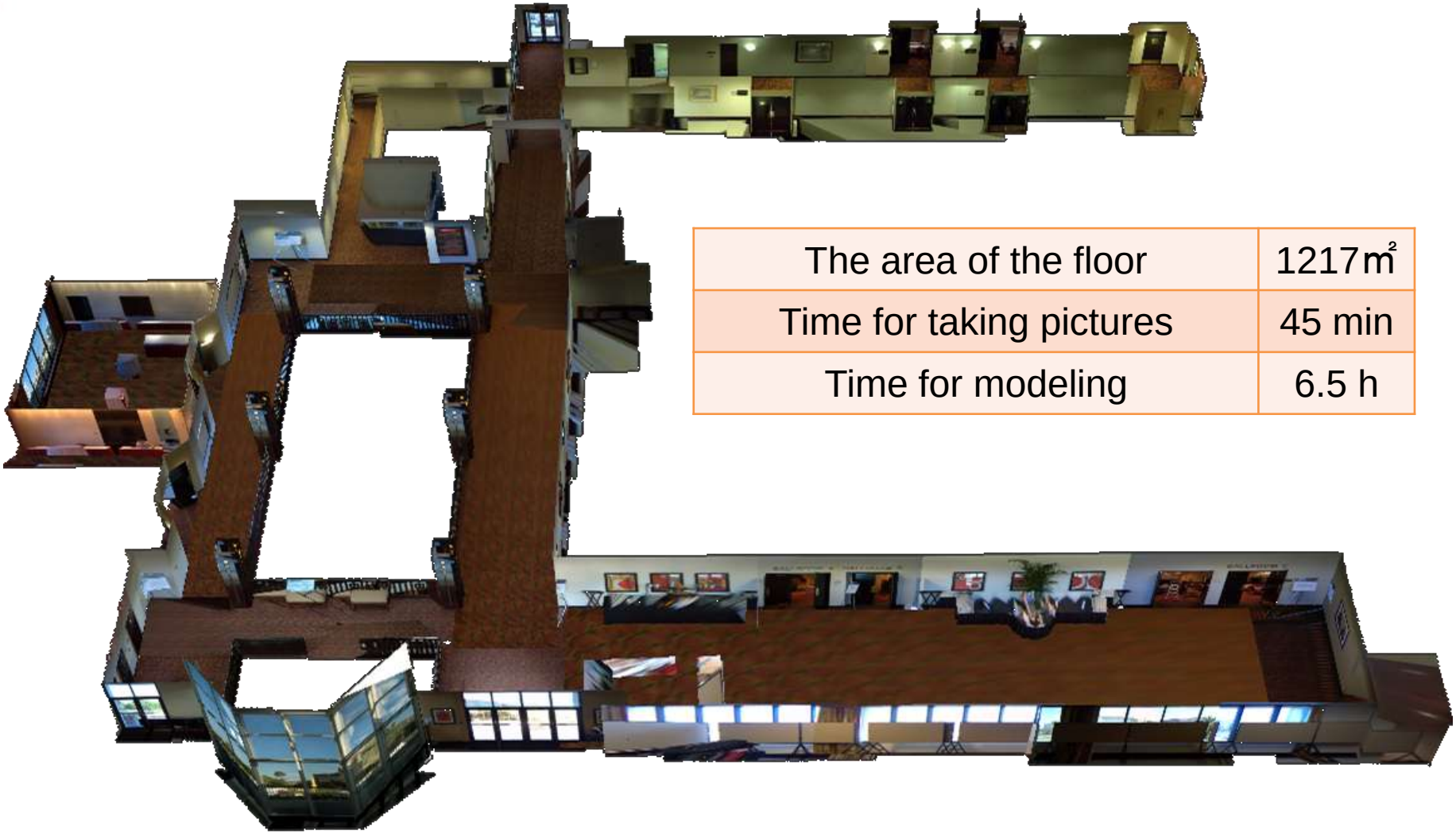
Demos…

A sample of virtualized reality model

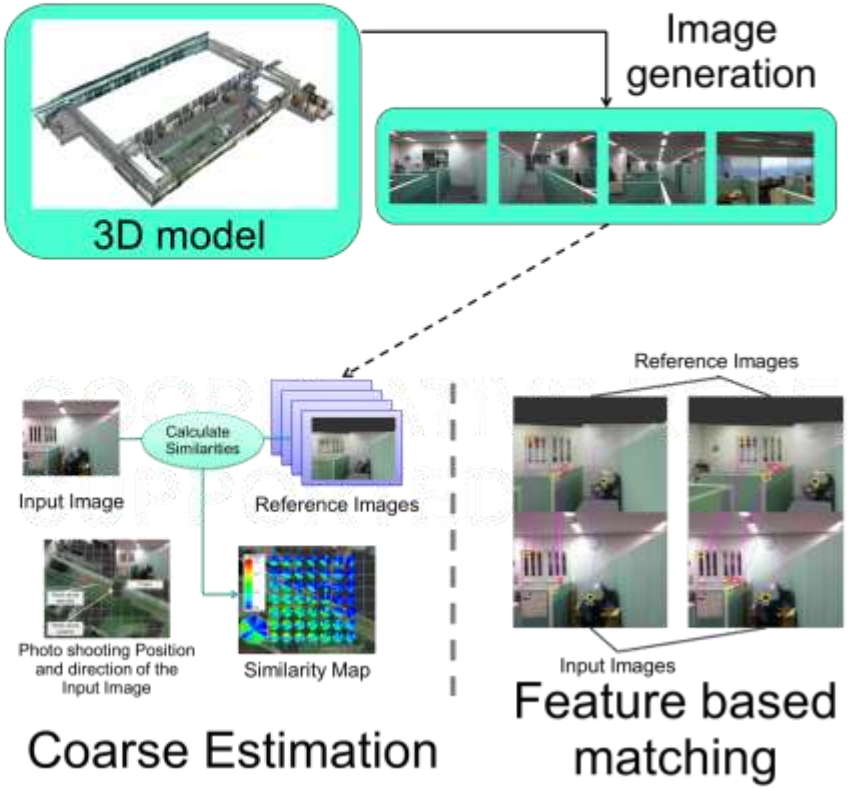


The area of the floor	1217㎡
Time for taking pictures	45 min
Time for modeling	6.5 h

The Venue of ISMAR2009

Model-utilization for related applications

- 3D model for image based tracking



- 3D model for map matching

- 3D model for Augmented Virtuality

Yataimura (Food mall in Kesennuma)

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ATC (Shopping mall in Osaka)

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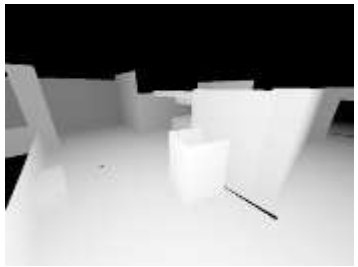
Applications

Simulations with depth data

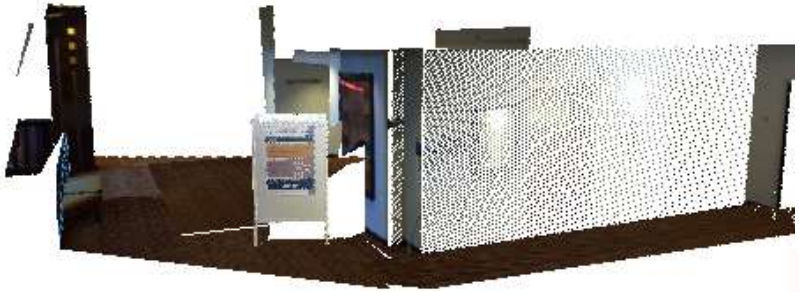
Mobile camera parameter estimation with stereo cameras in the environment.
(Hiroyoshi Tsuru et al, University of Tsukuba)

Stereo camera image



Depth data

Generated 3D Model



Matching

Mobile camera image

Evaluation

Estimated camera parameter

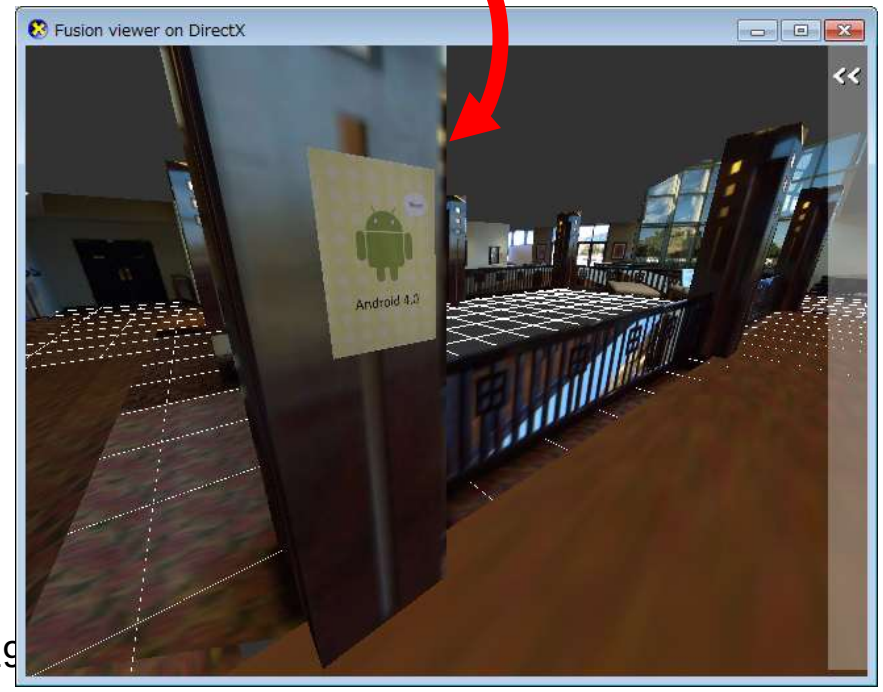
P_e

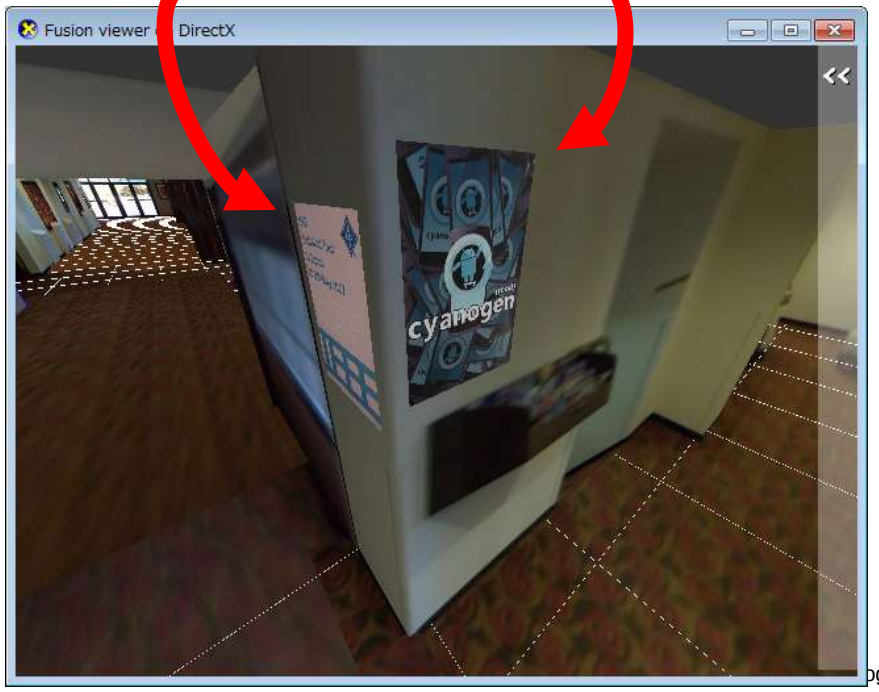
P_t

Camera parameter (Ground truth)

Simulations with additional contents

Camera parameter estimation with posters.
(Shiori Suetsugu et al, Ritsumeikan University)

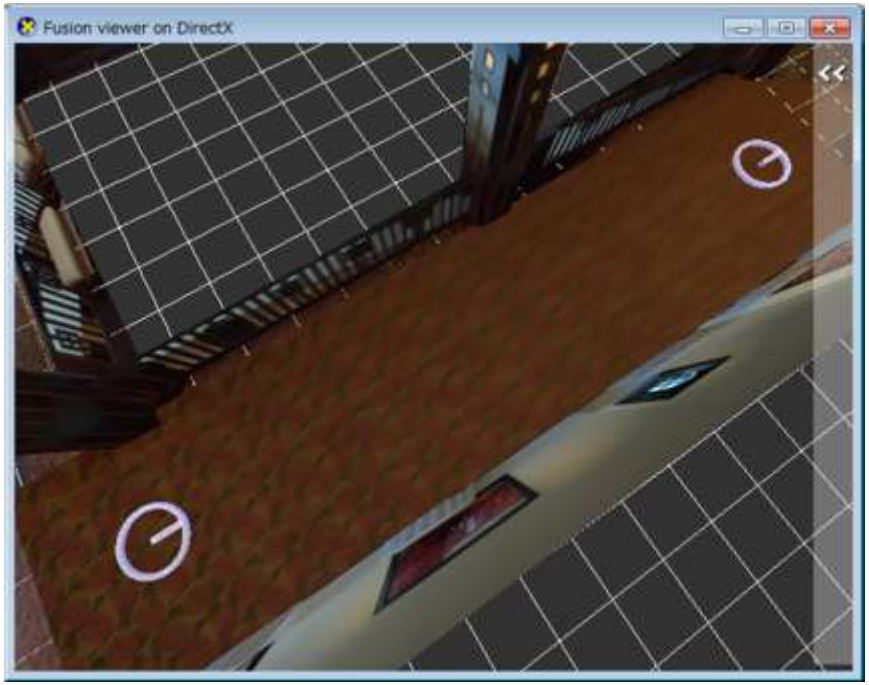


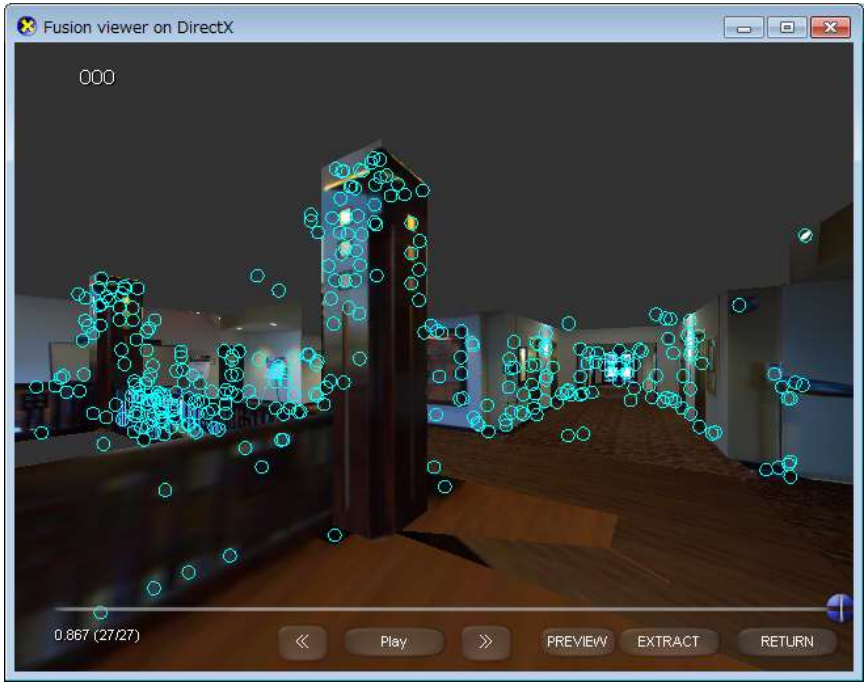


Conclusion

The tool for generating benchmark data sets

- Using virtualized reality models
- Generating camera parameters with human walking motion
- Interest points generation
- Output of depth data





Future works

- Additional functions of the tool
  - Motion sensors' data for camera parameter generation
  - Introducing camera effects
    - Blurring, Defocus, Specular, …
  - Additional object in model environment
    - Markers for visual tracking
    - Occluders (walking person, …)

Future works

- How to distribute the data sets
  - Which format is better for 3D models?
  - How to distribute the tool ?
    - Good data sets generated by the tool are to be added in TrakMark data sets
    - Provisions of parameter sets (for example, camera parameters) are acceptable for the tool
    - Too many versions of the tool / data sets are to be prevented …

Acknowledgements

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