Immersive Telepresence System with a Locomotion Interface Using High-resolution Omnidirectional Videos

Sei IKEDA, Tomokazu SATO,
Masayuki KANBARA and Naokazu YOKOYA

Nara Institute of Science and Technology, Japan

Appearance of the Presentation System

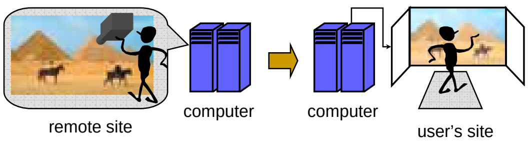
Telepresence System using Real Image

offline phase

Generation of contents

online phase

Presentation of contents



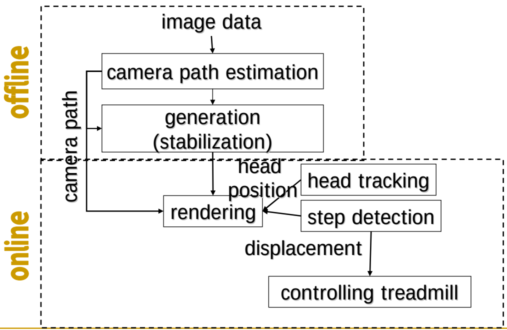
Problems in each phase

- To Reduce Human Cost
- To Increase a Sense of Presence

Feature of the Proposed System

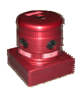
- Contents generation
  - Image acquisition using Omnidirectional Multi-camera System (OMS)
  - Camera path estimation
- Contents presentation
  - Locomotion interface
  - Head tracking

Flow of the Proposed System



Acquisition of Images using OMS

OMS : Omnidirectional Multi-camera System



Ladybug (Point Grey Research)

- six XGA camera units
- 15 fps video
- 75% full spherical view

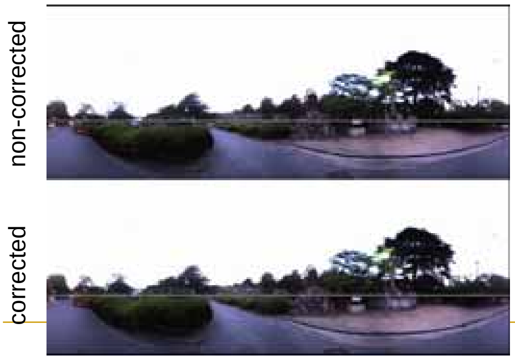
input videos

Calibration

- lens distortion・camera pose
- limb darkening・color balance

panoramic video

Correction of Camera Shake Effect



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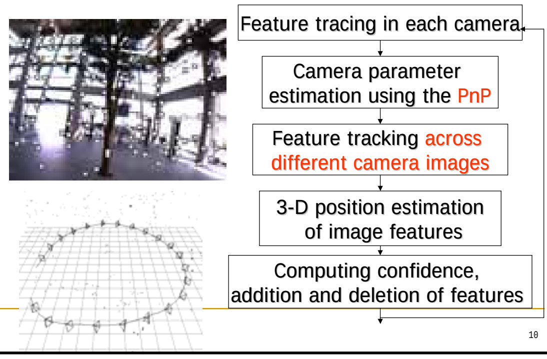
Camera Parameter Estimation



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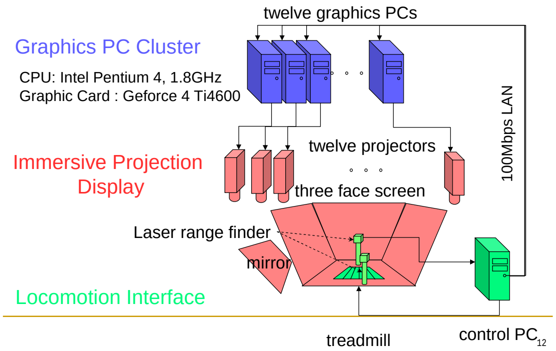
Immersive Display with Locomotion Interface



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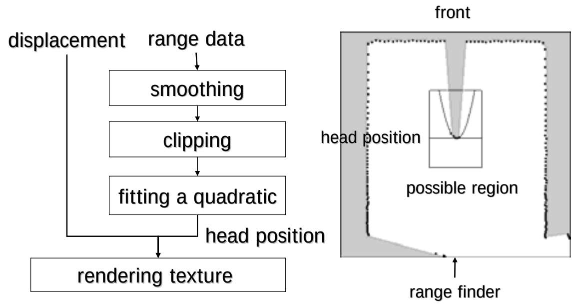
Head Tracking from Range Data



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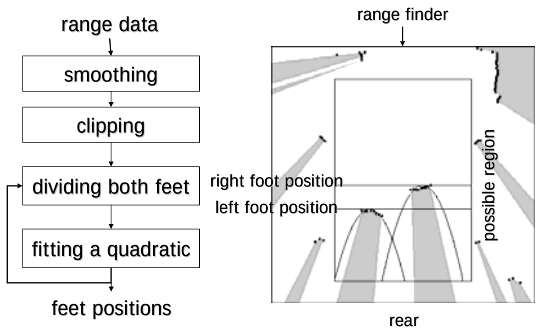
Step Detection from Range Data



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Evaluation using Questionnaire

Objective : To confirm validity of the improvements

A) Stabilization
B) Head tracking

Method : Comparison between two systems

"Which of systems do you feel more sense of presence of the remote site in?"

- The proposed system P
- System X for comparison

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Setting for Experiment

System X

A) Stabilizing is not implemented.
B) Head tracking is not implemented.

Contents

- About 20m course of outdoor scene

Subjects

- 10 people
- No knowledge about the detail

Result of Evaluation

System X	P < X	X = P	X < P
(A)	0	2	8
(B	1	7	2

Additional Condition :

The subjects should stop walking once.

System X	P < X	X = P	X < P
B	2	3	5

X < Y : Y gives us more sense of presence than X.

X = Y : Neither.

Summary

- Proposed telepresence system
  - Offline phase
    - Image acquisition using OMS
    - Stabilization using estimated camera path
  - Online phase
    - Locomotion interface
    - Head tracking
- Conclusion
  - We have improved telepresence system
  - Head tracking is effective in the case a user often change the speed.
- Future work
  - We should increase the number of subject.