



Infrastructure Construction Tool for Localization System Using Visual Markers

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Wearable Augmented Reality (AR)

A new method for displaying location-based information.
CG models or annotations are presented based on user's location.

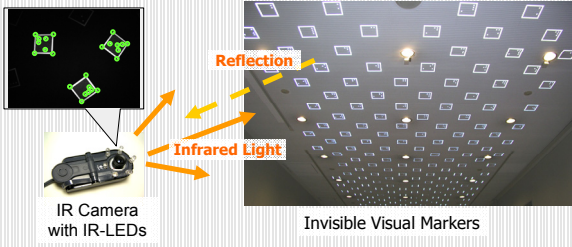



Wearable AR Guide System

Users' position and orientation are required.

- Outdoor : GPS + Gyro sensor
- Indoor : Visual Markers, IrDA markers, ultrasound, etc

Localization Using Invisible Visual Markers




IR Camera with IR-LEDs Invisible Visual Markers

It is necessary to measure 3D position information of markers in advance.

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Measuring Method of Visual Markers

- By hand
 - ✓ Simple and easy
 - ✓ Low accuracy
 - ✗ Much cost
- By a laser range finder
 - ✓ High accuracy
 - ✗ Expensive device
 - ✗ Much cost
- By images capturing visual markers [Baratoff, et al]
 - ✓ Online application
 - △ Using user's view camera



[Baratoff, et al]

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Objective

To assist constructing visual markers environment for localization easily

Approach of Infrastructure Construction Tool


- 1st phase : Localization of visual markers
 - The user captures high-resolution photos of markers.
 - The tool constructs markers' position information.
- 2nd phase : Assistance in repairing incorrect marker using AR
 - The tool assists a user in repairing the incorrect pattern of marker using AR technique.

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Outline of Infrastructure Construction Tool

1st phase
Localization of visual markers


↓ Photos, marker features,
intrinsic camera parameter



Estimating 3D position and orientation of markers

↓ Result of markers' localization

2nd phase
Assistance in repairing the incorrect pattern of marker using AR

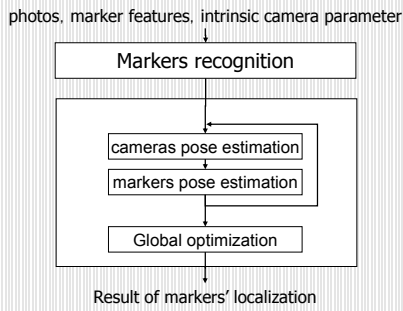


Annotating incorrect markers using AR

↓ Modified result of markers' localization

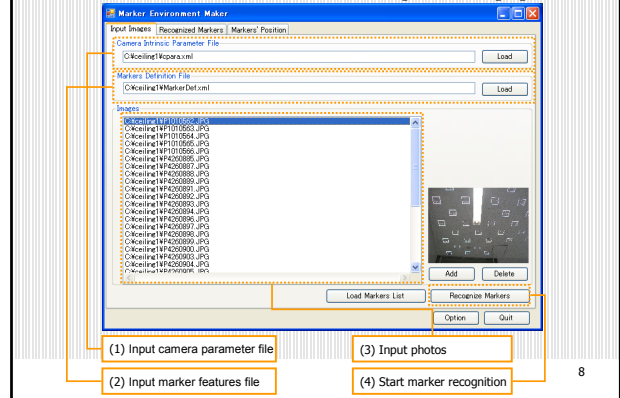
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1st phase: Localization of visual markers



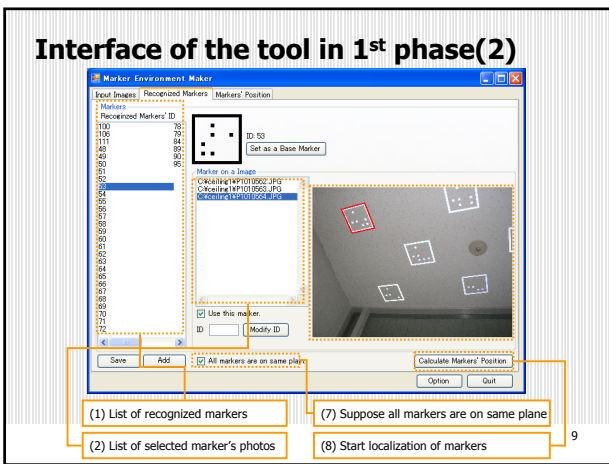
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Interface of the tool in 1st phase (1)



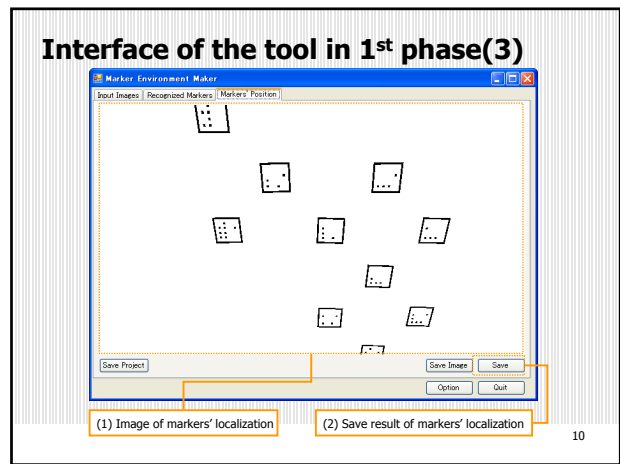
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Interface of the tool in 1st phase(2)



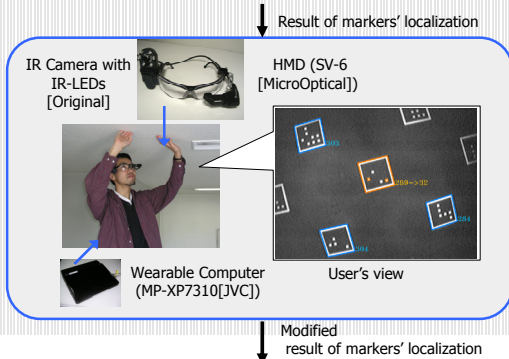
9

Interface of the tool in 1st phase(3)



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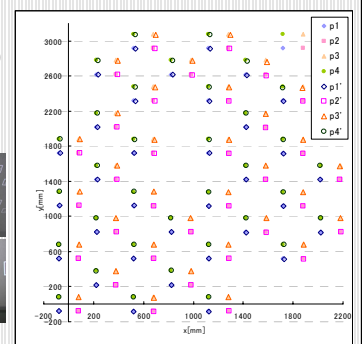
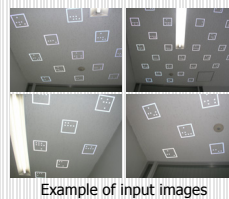
2nd phase: Assistance in repairing the pattern of incorrect marker using AR



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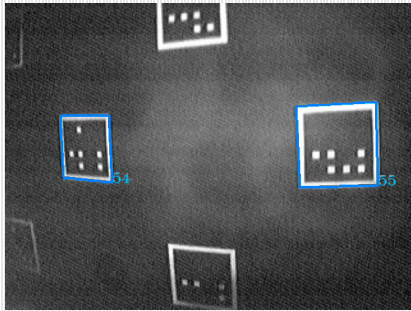
Experimental Result of 1st Phase

- Average : 6mm
- Standard Deviation : 5mm
- Image size: 2560 x 1920
- Marker size: 16 cm
- It was supposed that there were all marks on the same plane.



p1,p2,p3,p4:true position, p1',p2',p3',p4': estimated position

Experimental Result of 2nd Phase



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Conclusion

Infrastructure Construction Tool for Localization System Using Visual Markers

- The tool can estimate position in the accuracy of about 6 mm.
- The tool can assist a user in repairing the pattern of incorrect marker using AR technique.

Future works

- Indicating the position in which the photos should be taken
- Experiment of infrastructure construction in wide area

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