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Intuitively Annotating User's Gazed Objects for Wearable AR Systems

Vision and Media Computing Lab.
COE Promoted Student Researcher
Ryuhei Tenmoku

Background - Wearable Computers Augmented Reality

Wearable computer "MIThril"(MIT)

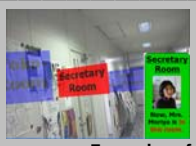
- **Wearable Computers** are computers which can be equipped by the user.

- **Augmented Reality (AR)** is techniques which can overlaying CG on the real scene image.

Augmented reality system "KARMA" (Feiner et al. 1991)

Wearable Augmented Reality System (WARS)

- The system can present position-based information in **wide area**.
- The system presents annotation overlay images to the user **intuitively**.

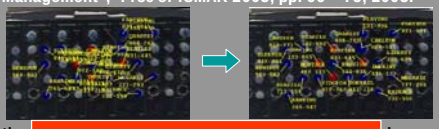


Examples of annotation overlay images

Overview of WARS

View Management for WARS

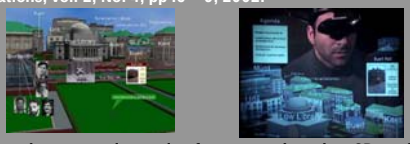
•Azuma et al.:"Evaluating Label Placement for Augmented Reality View Management", Proc of ISMAR 2003, pp. 66 – 75, 2003.



Preventing … vironments

Focusing on how to arrange annotations on AR scenes

•Bell et al. … phics and Applications, Vol. 2, No. 4, pp .6 – 9, 2002.



Rearranging annotations using free spaces based on 3D models

Research Purpose

Focusing on how to intuitively present links of annotations and their target objects

Conventional method

Annotation overlay image

Proposed method

Object highlight image

Occlusion complement image

Annotation emphasis images

Proposed method (1/2)

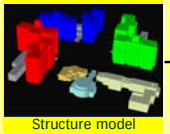
Input data — Output images

Conventional method

Real scene images
User's position and orientation
Annotation data

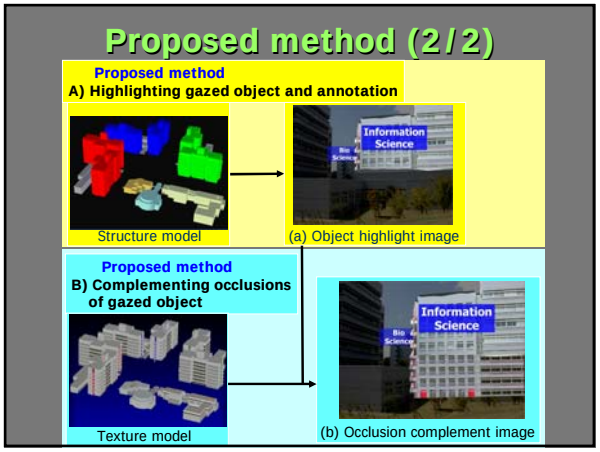
Annotation overlay image

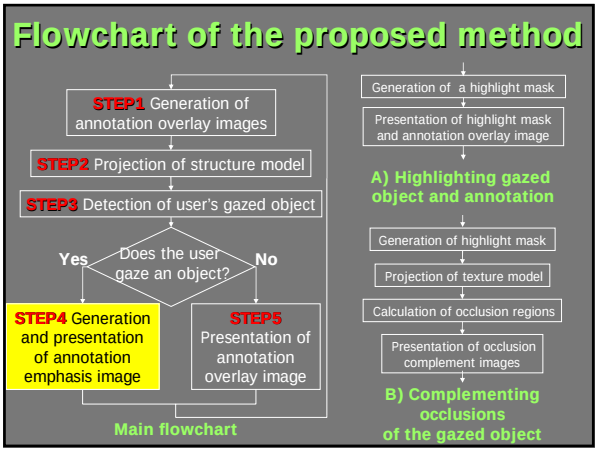
Proposed method
A) Highlighting gazed object and annotation

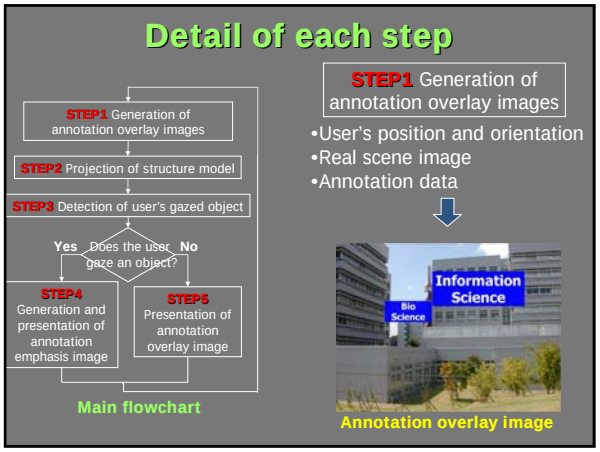


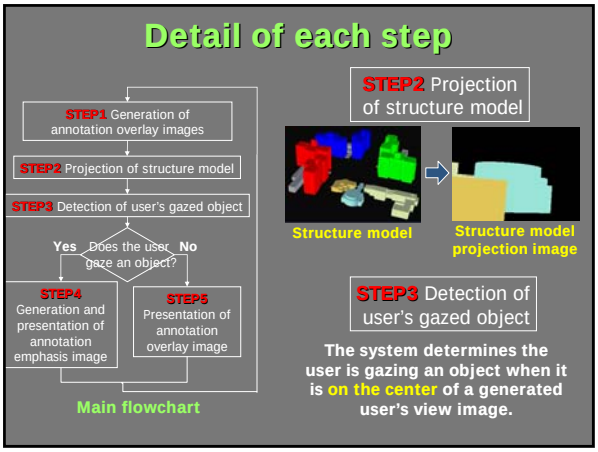
Structure model

(a) Object highlight image


Proposed method (2/2)
Proposed method
A) Highlighting gazed object and annotation
Structure model
(a) Object highlight image
Proposed method
B) Complementing occlusions of gazed object
Texture model
(b) Occlusion complement image


Flowchart of the proposed method
STEP1 Generation of annotation overlay images
STEP2 Projection of structure model
STEP3 Detection of user's gazed object
Does the user gaze an object?
Yes
No
STEP4 Generation and presentation of annotation emphasis image
STEP5 Presentation of annotation overlay image
Main flowchart
Generation of a highlight mask
Presentation of highlight mask and annotation overlay image
A) Highlighting gazed object and annotation
Generation of highlight mask
Projection of texture model
Calculation of occlusion regions
Presentation of occlusion complement images
B) Complementing occlusions of the gazed object


Detail of each step
STEP1 Generation of annotation overlay images
STEP2 Projection of structure model
STEP3 Detection of user's gazed object
Yes
Does the user gaze an object?
No
STEP4 Generation and presentation of annotation emphasis image
STEP5 Presentation of annotation overlay image
Main flowchart
STEP1 Generation of annotation overlay images
•User's position and orientation
•Real scene image
•Annotation data
Annotation overlay image


Detail of each step
STEP1 Generation of annotation overlay images
STEP2 Projection of structure model
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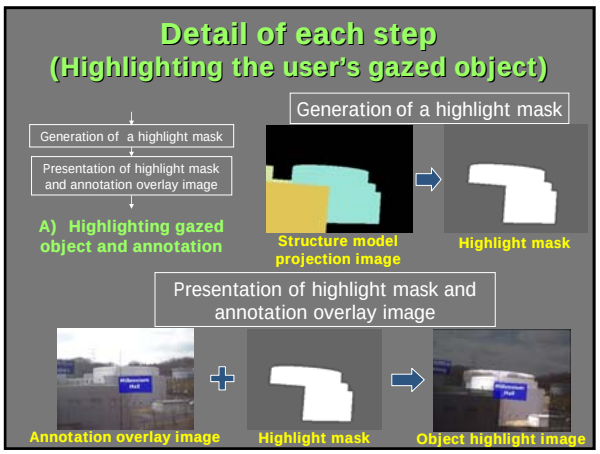
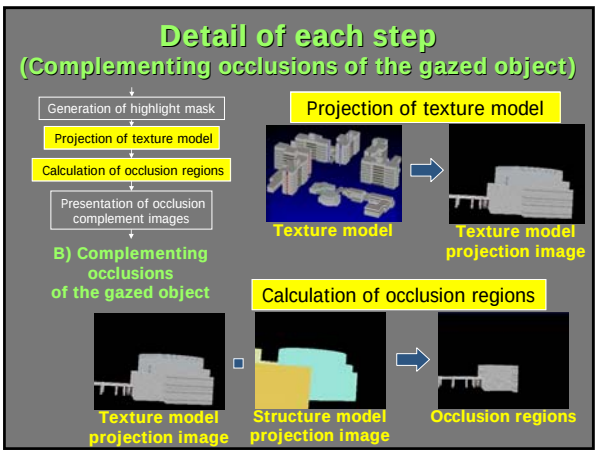
Yes
Does the user gaze an object?
No
STEP4 Generation and presentation of annotation emphasis image
STEP5 Presentation of annotation overlay image
Main flowchart
STEP2 Projection of structure model
Structure model
Structure model projection image
STEP3 Detection of user's gazed object
The system determines the user is gazing an object when it is on the center of a generated user's view image.


Detail of each step
(Highlighting the user's gazed object)
Generation of a highlight mask
Generation of a highlight mask
Presentation of highlight mask and annotation overlay image
A) Highlighting gazed object and annotation
Structure model projection image
Highlight mask
Presentation of highlight mask and annotation overlay image
Annotation overlay image
Highlight mask
Object highlight image


Detail of each step
(Complementing occlusions of the gazed object)
Generation of highlight mask
Projection of texture model
Calculation of occlusion regions
Presentation of occlusion complement images
B) Complementing occlusions of the gazed object
Projection of texture model
Texture model
Texture model projection image
Calculation of occlusion regions
Texture model projection image
Structure model projection image
Occlusion regions

Detail of each step
(Complementing occlusions of the gazed object)

Generation of highlight mask
↓
Projection of texture model
↓
Calculation of occlusion regions
↓
Presentation of occlusion complement images

B) Complementing occlusions of the gazed object

Presentation of occlusion complement images

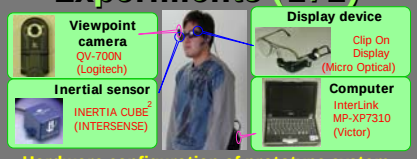

Annotation overlay image


Highlight mask

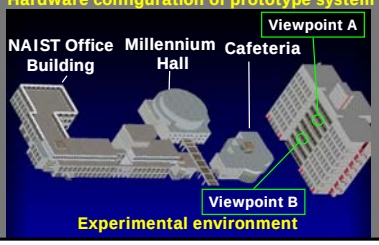

Occlusion regions


Occlusion complement image

Experiments (1/2)



Hardware configuration of prototype system



Experimental environment

Experiments (2/2)

A movie file will be presented.

Summary and Future Work

- **Summary**
  - **Proposing an intuitively annotating method of user's gazed object**
    - Highlighting user's gazed object and annotation
    - Complementing occlusions of user's gazed object
- **Future Work**
  - **Applying the proposed method to WARS**
  - **Decreasing influences of positioning errors for emphasizing annotations**