Evaluating Experiments of Highlighting User-viewed Objects for Wearable AR Systems

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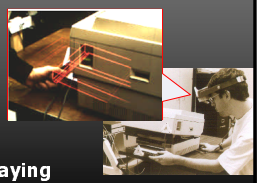
Background - Wearable Computers Augmented Reality

Wearable computer "MIThril" (MIT)

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



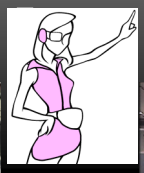
- **Augmented Reality (AR)** is techniques which can overlaying CG on the real scene image.

Augmented reality system "KARMA" [Feiner et al. 1991]

Wearable Augmented Reality System

- The system can present position-based information **in wide area**.
- The system can present texts, images, and 3D models to the user **intuitively**.


MARS [1999]



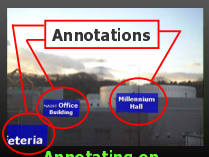

Tinmith [2003]


ARCHEOGUIDE [2001]

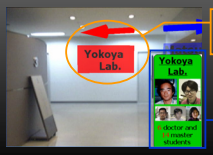

ViewWear [2003]

Annotation Overlay Techniques

Annotating on the user's view to tell location-based information



Annotating on background objects

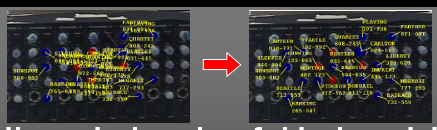


Annotation (for navigation)

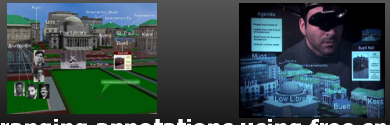
Detailed information

Annotating for navigation

View Management for WARS

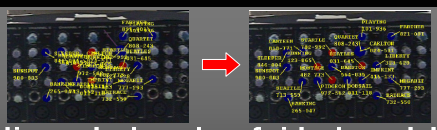


Preventing mutual overlap of virtual annotations in AR environments [Azuma et al., 2003]



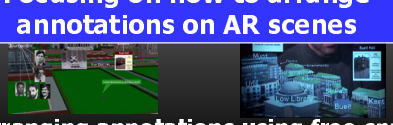
Rearranging annotations using free spaces based on 3D models [Bell et al., 2002]

View Management for WARS



Preventing mutual overlap of virtual annotations

Focusing on how to arrange annotations on AR scenes



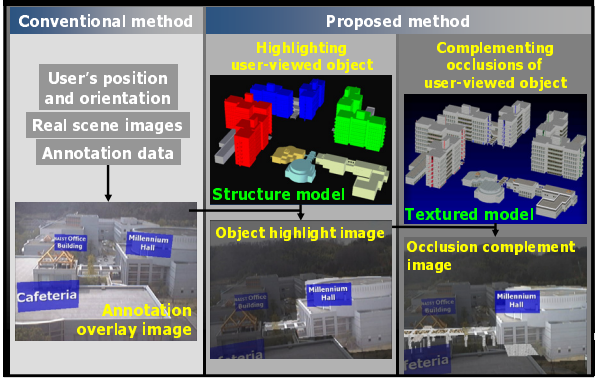
Rearranging annotations using free spaces based on 3D models [Bell et al., 2002]

Our Research Purpose

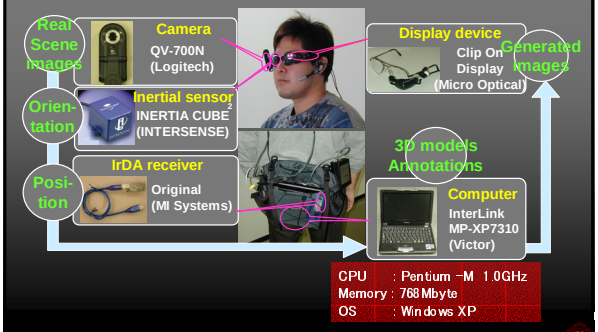
Focusing on how to intuitively present links of annotations and their target objects

Generating two kinds of images emphasizing user-viewed object and corresponding annotation

Outline of the Proposed Method



Dataflow of the wearable system



Video of the proposed method

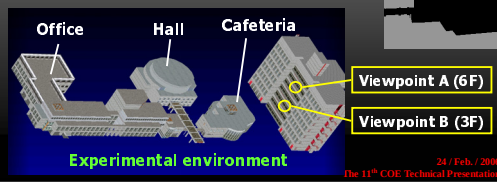
Highlighting gazed object and annotation

Quantitative Evaluation of highlighting the User-viewed Object (1) Outline

Comparing (b) estimated regions of the user-viewed object with (a) manually selected ones

Quantitative Evaluation of highlighting the User-viewed Object (2) Environment

- 240 * 320 sized images are input.
- 5 times experiments were held for 6 cases (3 objects ×2 viewpoints) respectively.
- The average accuracy rates were evaluated.



Quantitative Evaluation of highlighting the User-viewed Object (3) Result

Case	Pixel count of (a)	Pixel count of (b)	Pixel count of (a) ∧ (b)	Accuracy rate* [%]
Cafeteria (6F)	41432	41170	39565	95.5
Office (6F)	8987	8828	7026	78.1
Hall (6F)	19928	22304	18082	90.7
Cafeteria (3F)	42227	48913	40935	97.0
Office (3F)	2172	1684	1407	64.7
Hall (3F)	12751	14401	12015	94.2

* Pixel count of (a) ∧ (b) / Pixel count of (a)

(a) 

(b) 

Quantitative Evaluation of highlighting the User-viewed Object (4) Discussion

Case	Pixel count of (a)	Pixel count of (b)	Pixel count of (a) ∧ (b)	Accuracy rate [%]
Cafeteria (6F)	41432	41170	39565	95.5
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- The accuracy rate decreases according to the size of the object region.
- The proposed method is effective because the accuracy rate is over 60% in any cases.
- There are two main factors of the estimation errors : the differences between real scene and 3D models, position and orientation errors

Summary and Future Work

- **Summary**
  - Proposing a new view management method for AR scenes
  - Quantitative evaluation of estimating object regions
- **Future Work**

  Decreasing influences of position and orientation errors for estimating object regions