

**Proceedings**

**The Sixth IEEE and ACM  
International Symposium on  
Mixed and Augmented Reality**

**November 13-16, 2007  
Nara, Japan**

**Sponsored by  
IEEE Computer Society  
The Virtual Reality Society of Japan**

**In cooperation with  
ACM**



**Los Alamitos, California  
Washington · Tokyo**

# Table of Contents

## Sixth IEEE and ACM International Symposium on Mixed and Augmented Reality

<b>Message from the General Chair</b> .....	<b>ix</b>
<b>Message from the Program Chairs</b> .....	<b>x</b>
<b>Organizing Committee</b> .....	<b>xi</b>
<b>Steering Committee and Area Chairs</b> .....	<b>xii</b>
<b>Program Committee</b> .....	<b>xiii</b>
<b>Additional Reviewers</b> .....	<b>xv</b>
<b>Award Committee</b> .....	<b>xvii</b>
<b>Support</b> .....	<b>xviii</b>
<b>Workshop</b> .....	<b>xx</b>
<b>Tutorial</b> .....	<b>xxii</b>
<b>Keynote Talks</b> .....	<b>xxiv</b>
Upscaling and Downscaling Augmented Reality <i>Dieter Schmalstieg</i>	
Mixed and Augmented Reality in Broadcasting <i>Seiki Inoue</i>	
<b>Dinner Talk</b> .....	<b>xxv</b>
Where's the Reality in Augmented Reality? <i>Mark Billinghurst</i>	
<b>Invited Paper</b>	
Experiences with Handheld Augmented Reality .....	<b>3</b>
<i>Dieter Schmalstieg and Daniel Wagner</i>	
<b>Session 1: Applications 1</b>	
Laser Pointer Tracking in Projector-Augmented Architectural Environments .....	<b>19</b>
<i>Daniel Kurz, Ferry Haentsch, Max Grosse, Alexander Schiewe, and Oliver Bimber</i>	
Urban Sketcher: Mixed Reality on Site for Urban Planning and Architecture .....	<b>27</b>
<i>Markus Sareika and Dieter Schmalstieg</i>	
Augmented Reality-based factory planning - an application tailored to industrial needs .....	<b>31</b>
<i>Katharina Pentenrieder, Christian Bade, Fabian Doil, and Peter Meier</i>	
<b>Session 2: Interaction</b>	
Face-to-Face Tabletop Remote Collaboration in Mixed Reality .....	<b>43</b>
<i>Shinya Minatani, Itaru Kitahara, Yoshinari Kameda, and Yuichi Ohta</i>	
Visual Hints for Tangible Gestures in Augmented Reality .....	<b>47</b>
<i>Sean White, Levi Lister, and Steven Feiner</i>	

A 3D Flexible and Tangible Magic Lens in Augmented Reality -----	51
<i>Julian Looser, Raphael Grasset, and Mark Billinghurst</i>	
AR-Jig: A Handheld Tangible User Interface for Modification of 3D Digital Form via 2D Physical Curve -----	55
<i>Mahoro Anabuki and Hiroshi Ishii</i>	
<b>Session 3: Scene Modeling</b>	
Semi-automatic Annotations in Unknown Environments -----	67
<i>Gerhard Reitmayr, Ethan Eade, and Tom Drummond</i>	
Automatic Reconstruction of Wide-Area Fiducial Marker Models -----	71
<i>Manfred Klopschitz and Dieter Schmalstieg</i>	
Automatic contour model creation out of polygonal CAD models for markerless Augmented Reality -----	75
<i>Juri Platonov and Marion Langer</i>	
Semi-Automatic Generation of Appearance-based Edge Models from Image Sequences -----	79
<i>Jeremiah Neubert, John Pretlove, and Tom Drummond</i>	
<b>Session 4: Human Factors</b>	
Visual Longitudinal and Lateral Driving Assistance in the Head-Up Display of Cars -----	91
<i>Marcus Toennis, Christian Lange, and Gudrun Klinker</i>	
Evaluating Display Types for AR Selection and Annotation -----	95
<i>Jason Wither, Stephen DiVerdi, and Tobias Höllerer</i>	
An Evaluation of Graphical Context as a Means for Ameliorating the Effects of Registration Error -----	99
<i>Cindy Robertson and Blair MacIntyre</i>	
<b>Session 5: Applications 2</b>	
An Industrial Augmented Reality Solution For Discrepancy Check -----	111
<i>Pierre Georgel, Pierre Schroeder, Selim Benhimane, Stefan Hinterstoisser, Mirko Appel, and Nassir Navab</i>	
Visualization of Spatial Sensor Data in the Context of Automotive Environment Perception Systems -----	115
<i>Marcus Toennis, Rudi Lindl, Leonhard Walchshaeusl, and Gudrun Klinker</i>	
Laparoscopic Virtual Mirror for Understanding Vessel Structure: Evaluation Study by Twelve Surgeons -----	125
<i>Christoph Bichlmeier, Sandro Michael Heining, Mohammad Rustae, and Nassir Navab</i>	
Contextual Anatomic Mimesis	
Hybrid In-Situ Visualization Method for Improving Multi-Sensory Depth Perception in Medical Augmented Reality -----	129
<i>Christoph Bichlmeier, Felix Wimmer, Sandro Michael Heining, and Nassir Navab</i>	
<b>Session 6: Tracking &amp; Sensors 1</b>	
Feature Tracking for Mobile Augmented Reality Using Video Coder Motion Vectors -----	141
<i>Gabriel Takacs, Vijay Chandrasekhar, Bernd Girod, and Radek Grzeszczuk</i>	
Real-Time Object Tracking for Augmented Reality Combining Graph Cuts and Optical Flow -----	145
<i>Jonathan Mooser, Suyu You, and Ulrich Neumann</i>	

Ninja on a Plane: Automatic Discovery of Physical Planes for Augmented Reality Using Visual SLAM -----	153
<i>Denis Chekhlov, Andrew Gee, Andrew Calway, and Walterio Mayol-Cuevas</i>	
A Method for Predicting Marker Tracking Error -----	157
<i>Russell Freeman, Simon Julier, and Anthony Steed</i>	
Initialisation for Visual Tracking in Urban Environments -----	161
<i>Gerhard Reitmayr and Tom Drummond</i>	
<b>Session 7: Information Presentation</b>	
Hear-Through and Mic-Through Augmented Reality: Using Bone Conduction to Display Spatialized Audio -----	173
<i>Robert Lindeman, Haruo Noma, and Paulo Gonçalves de Barros</i>	
Human-Centered Development of an AR Handheld Display -----	177
<i>Raphael Grasset, Andreas Duenser, and Mark Billinghurst</i>	
Dynamic Adaptation of Projected Imperceptible Codes -----	181
<i>Anselm Grundhoefer, Manja Seeger, Ferry Haentsch, and Oliver Bimber</i>	
Interactive Focus and Context Visualization for Augmented Reality -----	191
<i>Denis Kalkofen, Erick Mendez, and Dieter Schmalstieg</i>	
<b>Session 8: Architecture</b>	
A Two-by-Two Mixed Reality System That Merges Real and Virtual Worlds in Both Audio and Visual Senses ----	203
<i>Kyota Higa, Takanobu Nishiura, Asako Kimura, Fumihisa Shibata, and Hideyuki Tamura</i>	
A Wide Field-of-view Head Mounted Projective Display using Hyperbolic Half-silvered Mirrors -----	207
<i>Kiyoshi Kiyokawa</i>	
A System Architecture for Ubiquitous Tracking Environments -----	211
<i>Manuel Huber, Daniel Pustka, Peter Keitler, Florian Ehtler, and Gudrun Klinker</i>	
Measurement of absolute latency for video see through augmented reality -----	215
<i>Tobias Sielhorst, Wu Sa, Ali Khamene, Frank Sauer, and Nassir Navab</i>	
<b>Session 9: Tracking &amp; Sensors 2</b>	
Precise Geometric Registration by Blur Estimation for Vision-based Augmented Reality -----	221
<i>Bunyo Okumura, Masayuki Kanbara, and Naokazu Yokoya</i>	
Parallel Tracking and Mapping for Small AR Workspaces -----	225
<i>Georg Klein and David Murray</i>	
Deformable Surface Augmentation in Spite of Self-Occlusions -----	235
<i>Vincent Gay-Bellile, Adrien Bartoli, and Patrick Sayd</i>	
A Fast Initialization Method for Edge-based Registration Using an Inclination Constraint -----	239
<i>Daisuke Kotake, Kiyohide Satoh, Shinji Uchiyama, and Hiroyuki Yamamoto</i>	
Retexturing in the Presence of Complex Illumination and Occlusions -----	249
<i>Julien Pilet, Vincent Lepetit, and Pascal Fua</i>	

**Posters**

Initializing Markerless Tracking Using a Simple Hand Gesture -----	259
<i>Taehee Lee and Tobias Höllerer</i>	
Visually Elegant and Robust Semi-Fiducials for Geometric Registration in Mixed Reality -----	261
<i>Ryuhei Tenmoku, Yusuke Yoshida, Fumihisa Shibata, Asako Kimura, and Hideyuki Tamura</i>	
Webtag: A World Wide Internet Based AR System -----	263
<i>Mark Fiala</i>	
Mosaicing a Wide Geometric Field of View for Effective Interaction in Augmented Reality -----	265
<i>Seokhee Jeon and Gerard J. Kim</i>	
Adaptive Augmented Reality Using Context Markup and Style Maps -----	267
<i>Erick Mendez and Dieter Schmalstieg</i>	
A High-level Event System for Augmented Reality -----	269
<i>Jean-Luc Lugin, Remi Chaignon, and Marc Cavazza</i>	
Accelerating Template-Based Matching on the GPU for AR Applications -----	271
<i>Yannick Allusse, Raphael Grasset and Mark Billinghurst</i>	
ARMO: Augmented Reality based Reconfigurable MOck-up -----	273
<i>Yoon-suk Jin, Yang-wook Kim, and Jun Park</i>	
Overlay what Humanoid Robot Perceives and Thinks to the Real-world by Mixed Reality System -----	275
<i>Kazuhiko Kobayashi, Koichi Nishiwaki, Shinji Uchiyama, Hiroyuki Yamamoto, Satoshi Kagami, and Takeo Kanade</i>	
Vesp' R – Transforming Handheld Augmented Reality -----	277
<i>Ernst Kruijff and Eduardo Veas</i>	
Reliving Museum Visiting Experiences on-and-off the Spot -----	279
<i>Takashi Okuma, Masakatsu Kourogi, Nobuchika Sakata, and Takeshi Kurata</i>	
Identifying differences between CAD and physical mock-ups using AR -----	281
<i>Sabine Weibel, Mario Becker, Didier Stricker, and Harald Wuest</i>	
A Framework for Tangible User Interfaces within Projector-based Mixed Reality -----	283
<i>Yuan Yuan, Xubo Yang, and Shuangjiu Xiao</i>	
Visualizing Occluded Physical Objects in Unfamiliar Outdoor Augmented Reality Environments -----	285
<i>Benjamin Avery, Wayne Piekarski, and Bruce Thomas</i>	
Efficient Extraction of Robust Image Features on Mobile Devices -----	287
<i>Wei-Chao Chen, Yingen Xiong, Jiang Gao, Natasha Gelfand, and Radek Grzeszczuk</i>	
<b>Author Index -----</b>	<b>289</b>