

SUMMARY OF Ph.D. DISSERTATION

School Science for Open and Environmental System	Student Identification Number	SURNAME, First name Uematsu Yuko
Title Estimation and Application of Vision-based Camera Tracking Using Planar Structures in the Real World		
Abstract In this thesis, we propose the camera tracking method using captured images of multiple planar structures in the real world, and the application systems for Augmented Reality. In contrast with previous camera tracking methods using multiple planes, our method doesn't require any relationship information of the planes because of constructing "3D Projective Space" which is defined by two reference images. We apply this method for AR registration and demonstrate that virtual objects can be overlaid onto input images of the real world frame by frame. By extending this method, "On-line AR System" using multiple planar markers is proposed. This system allows a user to place multiple markers at arbitrary positions and poses in the large space. The virtual object can be overlaid onto the real world in real-time. Moreover, the virtual object can move around the real world not only on the tabletop but also in the large room. AR applications extended this system are also proposed. "AR Baseball Presentation System" is an observation system of a virtual baseball game. Users place a real baseball field model on the tabletop and input a baseball game history (scorebook) into the system. Then they can watch the game by replaying with virtual baseball players on the field model in front of them. In "Interactive AR Bowling System", users knock down virtual pins by rolling a real ball. On the lane model, there are virtual pins generated with CG. Touching and rolling the real ball provide a sort of tangible feeling in this system. For improving the accuracy of pattern-based tracking, we also propose the tracking method with Particle Filter. By comparing the actual image with generated images by hypotheses, the best camera parameters can be obtained. Our method achieves more stable result than the related method. Finally this method is also applied to the system for mapping GIS information onto the user's images captured from the high place. By using satellite images, the user's camera is tracked and then GIS information is overlaid onto the user's image frame by frame.		