Using Aerial Photographs for Improved Mobile AR Annotation

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Annotation of outdoor scenes is an important part of mobile augmented reality research. Generally, the situated content displayed by a wearable system is carefully constructed offline using many different technologies, including modeling programs, GIS data, and aerial photographs. This demo focuses on annotating an outdoor scene from within the wearable system, providing an appropriate interface to allow accurate markup in a mobile context. To reduce the amount of manual work that must be done by the user, we have modified our system to use aerial photographs of the region in conjunction with the wearable's acquired data. This allows the user to accurately place 3D annotations from a single position without a pre-existing scene model. The accuracy of our annotations are dependent only on the resolution of the aerial photographs, and the accuracy of the user's interaction.

This system should be entertaining as a demo to a wide range people. Users with little or no knowledge of outdoor AR will be interested in the general visualization of registering virtual objects with the real world in an outdoor wearable setting. More knowledgeable users will find our theme of Anywhere Augmentation interesting. In keeping with this theme we annotate features using only widely available pre-existing information, like aerial photographs, as well as novel interaction techniques, and commodity hardware.

Using our application users will be able to annotate three different types of generic features, corners, edges and regions. These different types of features are very general and can be used to create many different kinds of annotations such as adding contextual information, or outdoor modeling. We also give the user two different ways to make an annotation. They can manually pick the feature they are trying to annotate on the aerial photograph, or the system can look for the type of the feature they are trying to annotate along the user's view ray. For instance, if a user is trying to annotate corner features the system will look along the view ray for the best visible corners in the aerial photographs and suggest those to the user for annotation.

A demo of our system proceeds as follows: A user puts on the wearable system somewhere outdoors. They then use the aerial photographs to help calibrate both their position and orientation. Once calibrated the user's position and orientation will be tracked with a hybrid tracking system using GPS, inertial orientation tracking, and vision based tracking. Users can then choose what type of annotation they want to make (in this case edges), and whether they want to manually annotate features, or use the semi-automatic feature detector. Annotation is then done with just a few simple steps. First the user looks at the feature they would like to annotate (upper left), centering it in their field of view. Then, if using the manual annotation mode they correct the distance (upper right and lower left) and orientation (lower right) of the annotation. If the user is using the semi-automatic annotation mode they instead first check to see if any of the detected annotations are correct, and if so simply select the correct one. If none are correct then the user is able to use the manual annotation interface as a fallback to annotate the desired feature. For our demo we would likely leave the computer on a table and tether the user to it. Other conference attendees could then also see what the user sees without actively trying out the system.