Adapting Information Through Tangible Augmented Reality Interfaces

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ABSTRACT

Tangible augmented reality interfaces offer a hands on approach for examining objects and exploring the associated information. We describe two tangible augmented reality interfaces that can expose the adaptation of information presented to users about objects in augmented reality environments.

Keywords

Augmented Reality, Tangible Interfaces, Open Hypermedia

1. INTRODUCTION

Tangible Augmented Reality [3] is the application of tangible user interface techniques [2] to Augmented Reality (AR) environments. It is a physical interaction metaphor that attempts to take advantage of users' existing experience of manipulating objects in the real world.

Such interfaces are particularly suited to museum scenarios. It is important that information presentation systems are accessible to all types of museum visitors, especially novice users. Often, the information being presented is complex and detailed so it can be challenging to display in an a easy to use way. Tangible augmented reality allows natural, intuitive interfaces that offer a hands on approach for both examining museum artefacts and exploring the associated information. AR offers interesting display approaches as real and virtual objects can be presented next to each other. For example, objects similar to or related to a museum artefact could be shown, even if they are stored elsewhere.

We have developed two interfaces for viewing textual information overlaid on object features in augmented reality environments. These interfaces explore methods for users to adapt the amount and type of information that is displayed using tangible augmented reality techniques [4].

Figure 1: ARToolKit Environment

Our interfaces have been developed using the ARToolKit, an AR library designed for the rapid development of AR applications. It provides computer vision techniques to calculate a camera's position and orientation relative to marker cards so that virtual 3D objects can be overlaid precisely on the markers [1]. We are using a video see-through HMD, where the video from the camera mounted on the display is overlaid with the virtual imagery and shown on the HMD. The user views the real world through the video displayed on the HMD. This process is illustrated in Figure 1.

2. INTERFACES

We are using an Open Hypermedia link server to provide the textual descriptions, which are presented in the form of labels placed around the object close to their respective feature. Leader lines are drawn between each feature and the label. We provide a mechanism for selecting labels so that labels can be concealed when unselected, reducing visual clutter when many detailed labels are visible. Selection is performed using the orientation of the object, so that the label closest to the centre of the screen is selected. This selection process is animated: as a label is selected it slowly grows larger and the previously selected label slowly shrinks.

Augmented reality environments offer great possibilities for displaying the relationships, i.e. links, between objects. Whenever two objects with active links between them are visible, the links are drawn with an elastic line from the source to the destination features, with the description being displayed in the middle of the line. Links between anchors on the same object can be drawn as a curved line with descriptive label in the middle. Active link labels drawn between the two objects can no longer be selected by rotating the object as before, so the size of active link labels is controlled by moving the anchor objects.

Open Hypermedia link structures can be large, complex networks. When adaptation techniques are used the complexity of the resulting information space is increased. It is desirable to allow users to not only control the visible hyperstructure, but also the process of adaptation that generates each view. We have developed two tangible augmented reality interfaces that expose this adaptation process in novel, powerful ways, overcoming the limitations of traditional approaches. For demonstrating our interfaces we have chosen to present information about various aircraft, which could be useful in a museum scenario. Various virtual aircraft models are presented on ARToolKit markers, and the users are able to pick up and manipulate the aircraft using the markers.

2.1 Recipes of Context

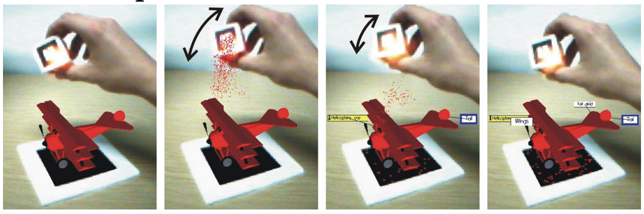

Figure 2: Sprinkling labels onto an object

Our first interface is based on the notion of shaking information particles onto objects, thus altering the amount of detail presented in the labels. As users shake an information container marker, particles fly towards any visible objects, in our case aircraft models. As particles land on an aircraft model information labels pop up on that object, increasing in detail as users continue to shake the information container. If users wish to reduce the level of detail they can shake the aircraft marker so that the information particles fly off.

We provide different information shakers for different areas of information, so that users can add labels describing the avionics, armament or trivia about an aircraft by shaking from the respective shaker. Giving users the ability to mix and match the information they view about an object is very powerful, as they can discover different recipes of information that appeal to them. This offers the possibility of mixing information in the labels' contents, for example trivia snippets can be added to descriptions of avionics or armament features.

2.2 Rays

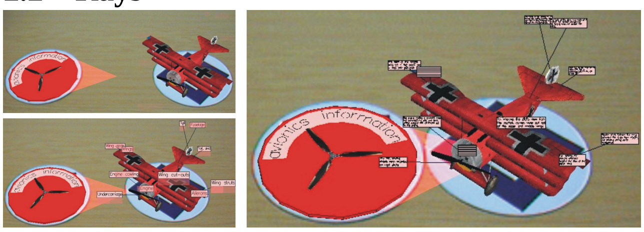

Figure 3: Rays: distance affects the level of detail if information applied

Our second interface replaces sprinkling with spatial proximity. The distance between objects and information container markers, mounted on circular disks, modifies the amount of detail presented in the labels. When the information container is far from an aircraft it has no effect, but as it is moved towards it the labels pop up and increase in detail. When both markers are alongside each other the maximum information level is presented in the labels.

Rays are drawn from each information container to indicate how much of that particular type of information is applicable for an aircraft, with ray length giving an idea of the amount available. When there is no available information, no ray is drawn. For example, a military aircraft would generally have a long ray for armament information, no ray would be drawn for a civil aircraft to indicate that there is no available information.

Users need to activate and deactivate the information container to avoid affecting the level of information when they wish to focus on an object's labels. This is achieved by hiding the information container markers when they are not required, either by turning them upside down or placing them outside the camera's view.

3. CONCLUSIONS

Tangible augmented reality interfaces are powerful tools for displaying and manipulating virtual objects in the real world. We have presented two interfaces that go beyond simply displaying objects and related information, and actually allow users to control the information that is presented to them. The level of control offered results in a complex underlying information space, yet the interfaces remain natural and intuitive to use. Users that have tried our systems have enjoyed using familiar, everyday gestures such as sprinkling, even with a crude gesture recognition system due to the constraints of the optical tracking system employed in the ARToolKit.

4. REFERENCES

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