ARWPA

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About ARWPA

ARWPA stands for Augmented Reality Weather Prediction Application. ARWPA is a Adobe Flash based weather prediction application, which makes use of Augmented Reality to present weather predictions.

To use this application, the user needs to have a functional webcam and needs to be able to show the marker in front of the webcam. Traditionally this would mean that a printed copy of the marker is required, but the marker may also be presented by other means, such as a handheld electronic display with sufficient backlighting.

This marker is used by the application to identify where a 3D model of the Netherlands will be displayed.

A weather prediction is for the current day, and ARWPA can display a weather prediction for each of the 12 capital cities of the provinces of the Netherlands. The user can select for which province capital he wants a weather prediction, by hovering his mouse pointer above the province he is interested in.

FLARtoolkit

A fundamental part of this application is the use of FLARToolkit, which is an open source code library for Augmented Reality in Flash.

In essence, this toolkit enables a programmer to track the position of markers via a webcam, allowing the programmer to overlay virtual objects onto these markers. In order to realize this functionality, FLARToolkit uses computer vision techniques to calculate the real camera position and orientation relative to a marker. FLARtoolkit is an ActionScript 3.0 port of the open source ARToolkit library, which is written in C/C++.

We chose to work with the FLARToolkit because we are more familiar with Actionscript 3.0 than with C/C++, and because of the fact that the application would have a greater potential user base, as it only requires a recent version of Flash Player, and a webcam to run.

Evolution of ARWPA

One other important code library we used is Papervision3D, a popular open source Flash code library, for creating 3D Flash applications. Through the use of the 3D modeling program Autodesk 3D Studio Max, and Papervision 3D, we were able to create a 3D province-map of the Netherlands, and imported it for use in Flash. This imported model could then be added as an object that would appear whenever the marker is identified by the application.

The next step was to load and parse RSS-data from the weather forecast website we decided to use for this project (www.accuweather.com). Luckily, the Flash library provides plenty of tools to load URLs, making this step relatively easy. What required more thought and planning though, was deciding how to store the parsed data efficiently, and which data we wanted to use exactly.

We decided which parts of the RSS data we would use, and stored it in different string arrays.

The textual part of the RSS weather prediction is displayed in various fields at the the top, and the left side of the screen.

We also wanted a visual presentation of some sort, accompanying the textual weather forecast, and we noticed that every RSS weather forecast included a small icon, which was coupled to the weather. We decided to store the URL to these icons, as they uniquely identified certain types of weather in a visual way. Eventually, we decided to use animations to depict weather forecasts, because we wanted a more visually exciting presentation.

For these animations we didn't want to use video. This because didn't want to have a separate video player inside the Flash player itself and it was our opinion that it would break up the whole "augmented" experience.
After a little searching, we found a collection of flash files containing the weather animations of HTC's touchflo3D weather application. These were perfect for our application.

After testing the application for a while, it became clear that from a usability perspective, it would be nice not to have to keep holding the printed marker in front of the webcam with one steady hand, while using the mouse with the other hand. We decided to add a button to toggle automatic tracking of the marker. This effectively means that the model is pinned at a certain spot (i.e. the last known location of the marker while tracking was enabled) whenever the tracking is turned off. The user can then put down the piece of paper, or device, on which the marker is being displayed and still view the weather predictions by hovering the mouse cursor above provinces. If for some reason, the user wants to enable the tracking again, he can click the tracking button to enable marker tracking.

Reflections

Although the tracking of a marker is done relatively fast and precise with FLARToolkit, compared to other solutions at the moment, it is still something requires a lot of power. The real camera position and orientation relative to markers need to be calculated and updated in real-time.

This is noticeable in ARWPA in it's current form, as the frame rate rarely goes above 15 frames per second, causing the animations to not play at their original speed. Part of the cause of this, may also be related to the fact that displaying a 3D model with many vertices is taxing on Flash applications.
Another factor that seems to slow the application is insufficient amount lighting around the webcam.

A factor that seems to speed up the application is the presence of a graphics card which can be used for hardware acceleration of calculations (a relatively new Flash Player feature).

If the calculation of marker related data can be sped up in the future, and the Flash Player gets faster over time, it will open the doors for many more advanced Flash-based Augmented Reality applications.

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