MIXED REALITY
MODEL ALIGNMENT TOOL

INSTRUCTIONS

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http://mixedreality.nus.edu.sg

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QUICKSTART:

1. Print out the marker pattern in the accompanying .pdf file. Mount it on a flat card surface.

2. Start the alignment program

3. Select the camera source – for most users this will be "windows video stream" – you should now see the live video feed from your camera

4. Point the camera at a marker object – you should see a blue teapot drawn on top of the marker

5. To open a model file, click the open icon () and select the model file of choice.

6. The position of the model can be manipulated using the move icon (). With the left mouse button depressed, the x and y position of the object can be manipulated. With the right button depressed, the z position of the object can be manipulated.

7. The rotation icon () and scaling icon () allow the objects orientation and size to be manipulated in a similar way. The uniform scaling icon () allows the size of the object to be simultaneously varied in all three dimensions.

8. When the model position is satisfactory, the transformation can be saved using the save icon (). When displayed with software written in the MXR Software Development Kit, the transformation will be loaded automatically so that the object appears in the appropriate position.

INTRODUCTION

Need for model alignment in mixed reality

In mixed reality applications, we aim to take three dimensional computer graphics objects and place them in the real world so that they have the appearance of being stable. Unfortunately, when 3d models are designed in packages such as 3d Studio Max or Maya, their scaling, position and orientation are not necessarily suitable for display in the real world. In order to superimpose the object on a flat surface, we require that it is oriented so that the vertical axis of the object is aligned with the Z-direction, and the origin of the co-ordinate system of the object is at its base so that it sits correctly on the objects surface (see Figure 1).

This model alignment problem is handled in the MXR SDK by associating a small file with each model, with the extension ".medInfo". This file is created by the alignment utility and is automatically loaded when a model file is read into a program. The object is then pre-transformed by these values before any manipulation by the user in the program. This transformation applies to all instances of a model loaded into the program, and is separate from any position manipulation that is applied within the program to any particular instance of the model. For example, one model may be displayed simultaneously at two different positions. In this case, both instances of the model are transformed by the values in the file so they lie at the centre of the co-ordinate frame. They can then be offset relative to each other so that they appear at different positions.

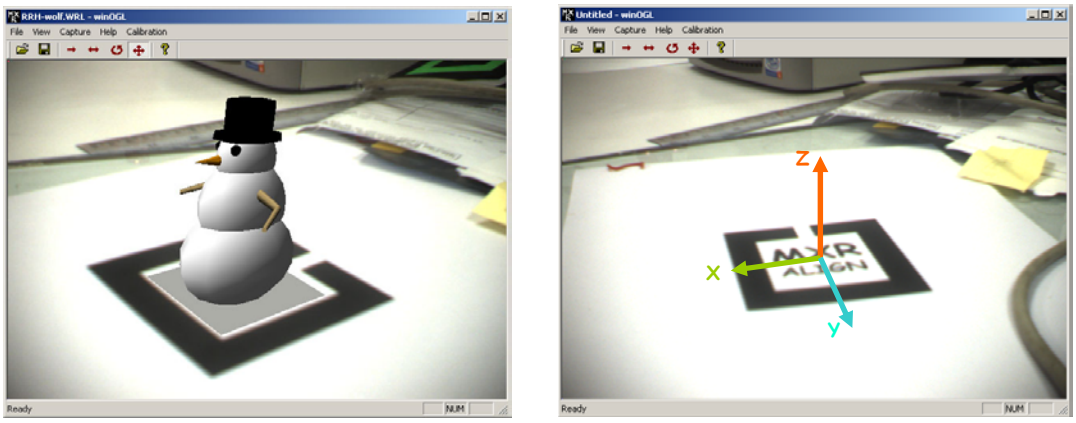

Figure 1. When correctly aligned, the object should sit so that it appears to be on top of the marker (A). In practice, this means that it must be moved in to the co-ordinate system of the marker (B).

INSTRUCTIONS

Getting Started

Before starting the alignment utility, the user should print out the .pdf file containing the marker pattern that is included with the alignment utility. This will be used to help place the model files. Upon startup, the program will display a "tv noise" static background. The user should select the appropriate video source from the "camera" menu. For most users this will be "windows video stream". The live video feed should now be displayed in the window.

When the camera is pointed at the marker, a test object (the Utah teapot) is displayed on top of the marker (see Figure 2). When the camera moves, the position of the teapot should remain fixed relative to the marker. The aim of the alignment utility is to make other models to stay on the surface in the same way. If the teapot does not appear on the surface, or the display is not stable, then please consult the Troubleshooting section of this document.

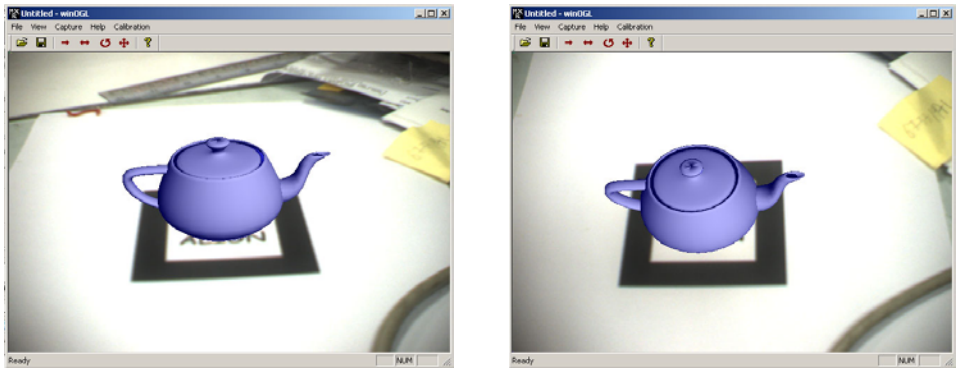

Figure 2. Upon initialization, a test object (the Utah teapot) is rendered onto the surface of the marker. As the camera moves, the test object remains fixed to the surface of the model. The aim of the alignment utility is to manipulate three-dimensional models so that they similarly appear to be fixed on the surface of the model.

Loading a Model

To load a model, press the "Load" icon () and select the model name. For tutorial purposes, we suggest that you try the vrml model of the snoman, "snoman.wrl". After the model is selected, the live display will show the model, but it is clearly too small and at the wrong orientation and position relative to the marker (see Figure 3). A square patch is displayed on the surface of the marker so that it is easy to distinguish when the model object is being drawn "below the surface" of the marker – i.e. behind the marker position in space.

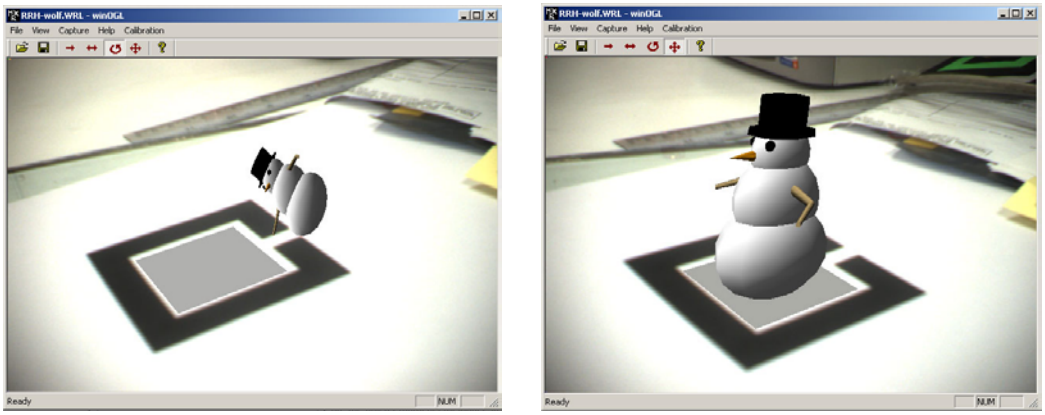

Figure 3. The model is clearly not well aligned with the marker (A). By manipulating the model using the alignment program it is possible to rescale and rotate it so that it appears at a sensible size and position (B).

Adjusting Model Position

To adjust the model positions, select one of the manipulation icons from the toolbar. From left to right, these allow you to translate ( ), scale ( ), rotate ( ), and uniformly scale ( ) the object. For example, the translate button allows the user to move the object so that it lies at the centre of the marker. When the left mouse button is depressed, moving the mouse in the x- and y-direction manipulates the x- and y-position in the co-ordinate frame of the marker respectively. When the right mouse button in depressed, the z-position of the object can be varied.

Saving Model Position

When the model is a reasonable size and is oriented correctly on the marker surface, the transformation can be saved by clicking the save icon ( ) in the toolbar. This will create the file "modelname.medinfo" in the same directory as the model itself. If the model is re-loaded into the program, this file will be read and it will appear in the same position.

Note on Storage of Transformations

Note that for each model file, this program creates a second file with the extension ".medInfo". If the user wishes to copy the model file and move it to a different folder, the associated ".medInfo" file must also be copied and moved or the transformation information will be lost.

Troubleshooting

Test object (teapot) not appear -

If the teapot does not appear, this may be because the calibration information for the camera is wrong. The program intelligently guesses some values for the camera calibration parameters. However, if the camera is unusual in some way these may be incorrect and more accurate calibration information is needed. In this case, the calibration information can be changed by selecting "Edit Calibration Info" from the "Calibrate" menu. The calibration parameters can either be edited directly or a camera calibration file can be loaded. These files are created with the Camera calibration tool.

Test object is unstable –

There are two likely causes to this problem. Firstly, the calibration information may be incorrect (see previous answer). Secondly, the lighting of the object may be inappropriate – if the gain of the camera is set inappropriately, or the room is unusually dark of bright. The simplest way to resolve this problem is to move the object into more normal imaging conditions – if the output from the camera looks "normal" to the eye then the video stream should be appropriate for use with the tracking software.

Other Problems -

In case of other problems, please feel free to mail our technical support and we will attempt to resolve the issue: mrlab@yahoogroups.com