

Build
HITLabNZ



Tutorial

Making Augmented Reality Accessible for Everyone

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ABOUT BuildAR

BuildAR is a program that allows you to create your own 3D augmented reality scenes. Augmented Reality (AR) is a technology that lets you interact with the real world and virtual objects at the same time. 3D models are overlaid on the real world as seen through your computer's webcam, making them appear to part of your surrounding real environment.

BuildAR uses marker-based camera tracking, which means that the 3D models appear attached to physical printed markers you can design yourself. By creating a set of these markers and a set of 3D models you can build your own augmented reality scene. You can create your 3D models in almost any modelling program or download them from the internet.


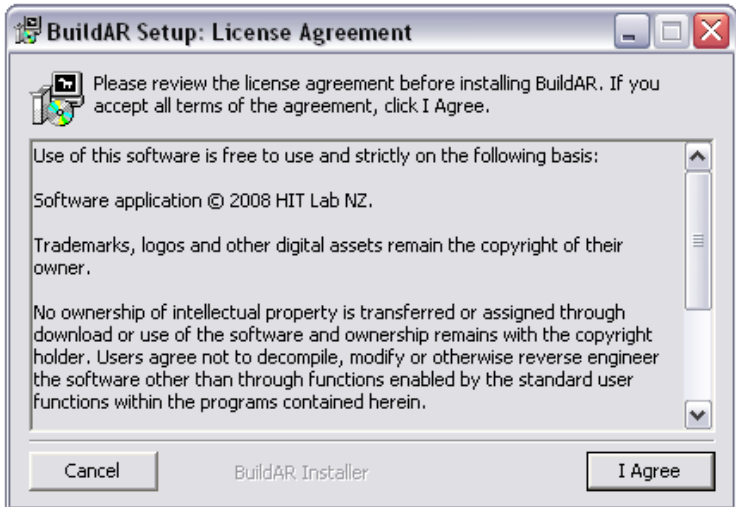
BuildAR provides an easy to use graphical user interface that simplifies the process of authoring AR scenes, meaning that you do not need to be a programmer or computer expert to create AR scenes. In fact, BuildAR is perfect for all those interested in AR for entertainment, education, marketing, research, design, architecture, and so on. For example, one type of AR experience you can create with BuildAR is a MagicBook. A MagicBook is a real book where markers have been added to the pages. This allows the traditional content of the pages to be enhanced with new 3D virtual content.

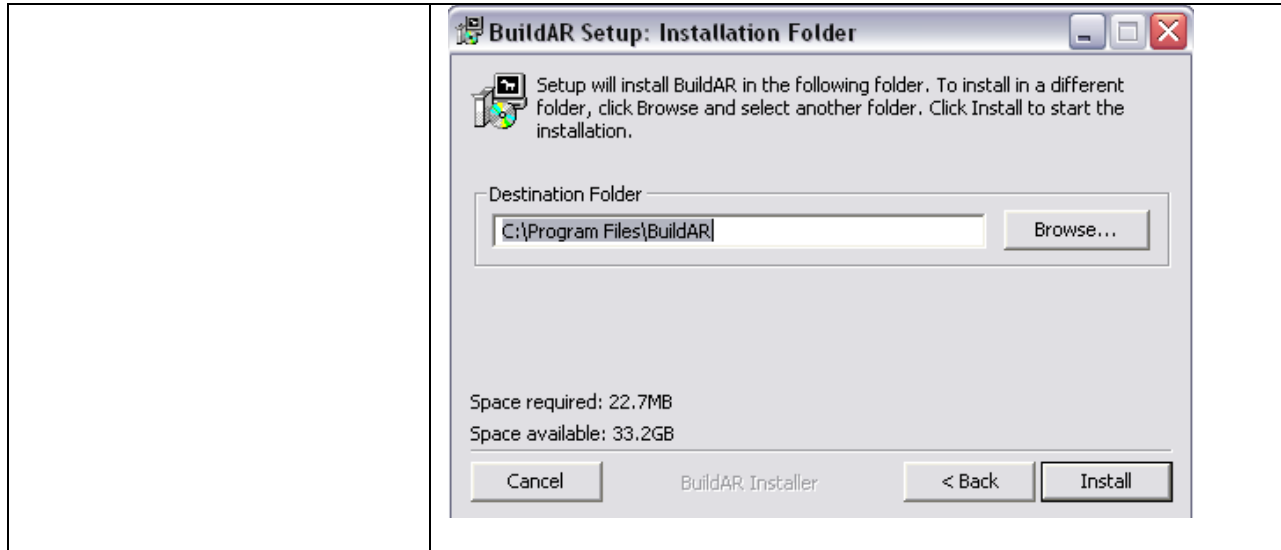
BuildAR supports the following features:

- scaling models
- loading 3d models in a variety of file formats
- positioning models relative to real markers
- user customizable tracking patterns
- windowed or full screen viewing model
- loading and saving of AR scenes
- support for a variety of camera image resolutions

BuildAR is a product of the Human Interface Technology Lab NZ, based at the University of Canterbury, in Christchurch, New Zealand.

BuildAR TUTORIAL

Part 1 – Installation	
<p>In order to use BuildAR you first need to download and install the software. BuildAR currently only runs on the Windows operating system (XP, Vista, Windows 7). To use the software you will have to have a camera connected to you computer and also have access to a printer to print out tracking markers.</p>	
<p>1. Download BuildAR The BuildAR software can be downloaded from the HIT Lab NZ website;</p>	<p>http://www.hitlabnz.org/wiki/BuildAR</p>
<p>2. Run the setup file Double click on the installer file icon</p>	 BuildAR_Installer_1.1
<p>3. Read and agree to term and conditions</p>	 <p>The screenshot shows a 'BuildAR Setup: License Agreement' dialog box. It contains the following text: 'Please review the license agreement before installing BuildAR. If you accept all terms of the agreement, click I Agree.' Below this, it states: 'Use of this software is free to use and strictly on the following basis: Software application © 2008 HIT Lab NZ. Trademarks, logos and other digital assets remain the copyright of their owner. No ownership of intellectual property is transferred or assigned through download or use of the software and ownership remains with the copyright holder. Users agree not to decompile, modify or otherwise reverse engineer the software other than through functions enabled by the standard user functions within the programs contained herein.' At the bottom, there are 'Cancel' and 'I Agree' buttons.</p>
<p>4. Install the Software Click the install button and wait while the software installs. The setup may take around 30 seconds.</p>	



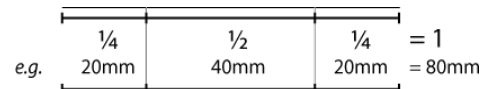
Part 2 – Creating Markers and Using 3D Objects

The two main items you interact with in BuildAR are printed markers and 3D virtual models. In this part of the tutorial you will learn how to create your own 3D markers and use 3D models.

a. Creating Markers

Markers are square patterns you print out and display to the camera. The BuildAR software uses computer vision software to recognize the patterns and calculate the position of the real camera relative to the printed pattern. Once the position of the real camera is known then a 3D model can be drawn relative to the real marker. 3D models are virtual objects that will appear to be attached to the markers, creating your augmented reality experience.

Printed markers for BuildAR should look like the picture on the right. They are black and white squares with a thick border, and a unique pattern in the center. Different markers have different patterns inside. There should be enough white space around the outside of the black square so that the marker can be easily found by the computer vision software.



You can download some markers from <http://www.hitlabnz.org/wiki/BuildAR>

As the image shows, the pattern in the middle of the square should be twice the width of the boarder of the square.

You can create your own markers by drawing a pattern in an image editor and then loading it into BuildAR to create the pattern template. The image in the middle of the square can be in colour or black and white, but bold black and white designs work best,

Make a square image, add shapes or text, and save it as a 16 colour bitmap file for use by BuildAR. In Part 4 we show how to use this bitmap image to create a pattern template.



b. Using 3D Objects

In order to use a 3D model in BuildAR, you need to ensure that your model is in one of the supported file formats. Some of the common supported formats are listed here. The recommended file format is the OpenSceneGraph .ive file format.

Other file formats can be used, but the quality of the importers for these other formats varies, sometimes they can produce strange normals, or missing textures/ animations.

- **IVE (native file for OpenSceneGraph) – Recommended**
IVE is the native file for OpenSceneGraph (www.openscenegraph.org). OpenSceneGraph is the tool that reads and writes IVE files.

If you are using 3Ds Max you can export your scene directly to IVE by installing OSGExp plugin to your 3Dmax http://sourceforge.net/apps/mediawik...itle=Main_Page

Other supported file formats include:

- **3DS (3D Studio file)**
- **LWO (Lightwave)** →
- **OBJ (Wavefront Object)**
- **STL (Stereolithography)**
- **FLT (OpenFlight)**

But the quality of the importers for these other formats varies, sometimes it can be strange normals or missing textures/ animations.

Download some 3D objects used in this tutorial at <http://www.hitlabnz.org/wiki/BuildAR>

Part 3 – Learning the Interface

In this part of the tutorial we present the various parts of the interface.

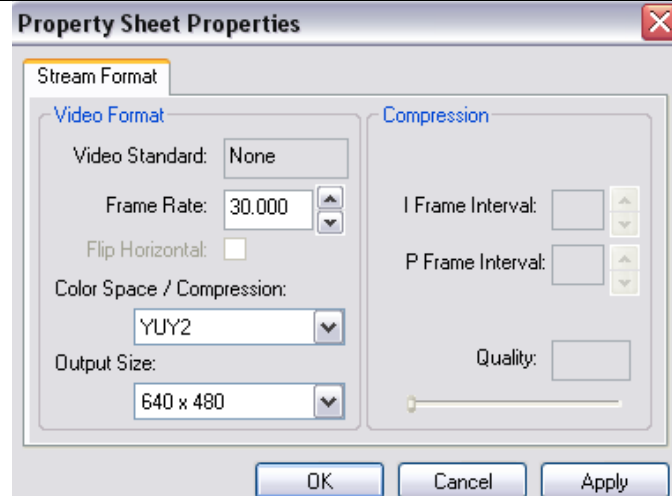
Starting the Software

Make sure your webcam is plugged-in and working.

Run **BuildAR** and the webcam setup dialog will appear.

Here you can **set the capture resolution and frame rate**.

An output size of **640 by 480** pixels, at **30 frames per second** is a reasonable choice.



Once the camera dialog box disappears the BuildAR interface will appear. The BuildAR interface is made up of four main components:

a. Scene Tree

The scene tree shows which markers and 3D objects currently make up the scene

b. Live View

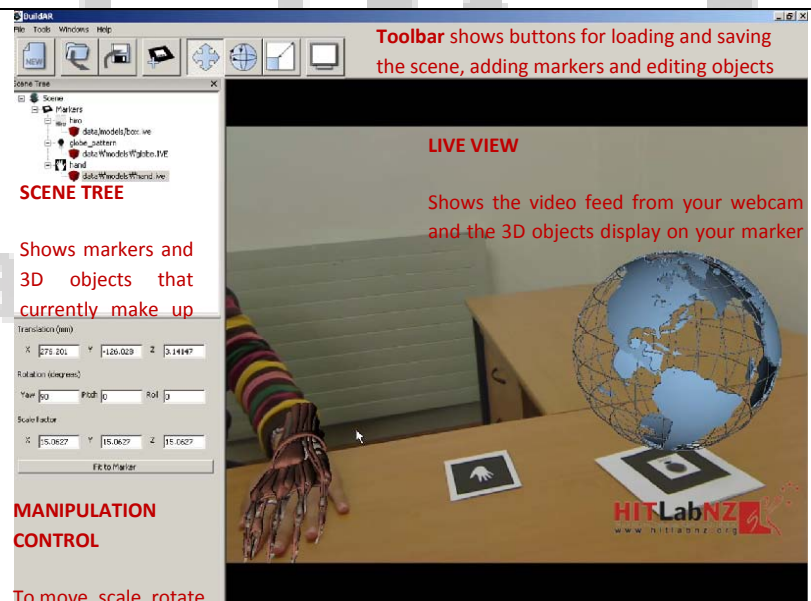
The live view shows the video feed from your webcam and the 3D objects displayed on your markers in real time

c. Manipulation Control

The manipulation control panel allows you to move, rotate, and scale the 3D models in your scene

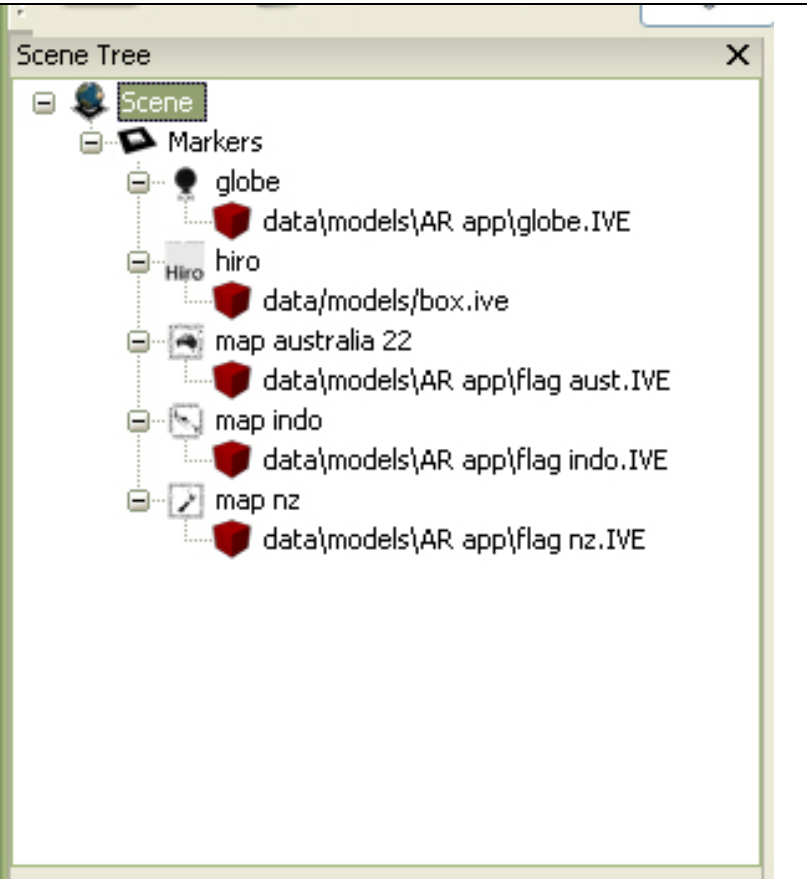
d. Toolbar

The toolbar has buttons for loading and saving the scene, adding markers and editing objects



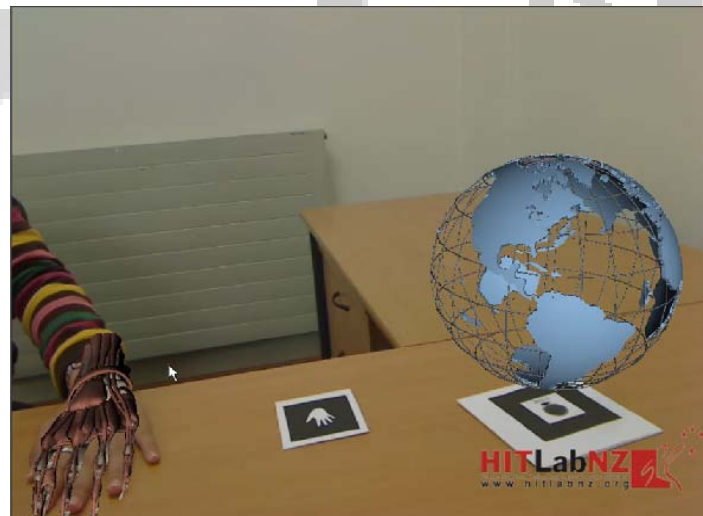
a. Scene Tree










The scene tree shows which markers and 3D objects currently make up the scene. The tree is a list of markers, each with an object underneath them. Markers and object can be added or deleted from the Scene Tree.



b. Live View

The live view shows the video feed from your webcam and the 3D objects displayed on your markers in real time.



<p>c. Manipulation Control</p> <p>The manipulation control panel which allows you to move, rotate, and scale the 3D models in your scene by entering position, rotation or scale numbers into the panel.</p>	
<p>d. Toolbar</p> <p>The toolbar has buttons for loading and saving the scene, adding markers and editing objects</p>	 The New button resets the scene. All loaded markers and models are cleared.  The Open button opens a file dialog where you can select a previously saved scene to load. The new scene will replace the current scene.  The Save button opens a file dialog where you can select a file to save the current scene to.  The Add Marker button opens a file dialog where you can select one or more pattern definition files to load.  The Translate button puts the interface into translation mode, so that models can be moved relative to the marker they were added to.  The Rotate button puts the interface into rotation mode.  The Scale button puts the interface into scale mode.  The Fullscreen button sets the AR view to fullscreen mode.

Part 4 – Step by Step Instructions for using BuildAR

In this final part of the tutorial we provide step by step instructions for using BuildAR.

The list to the right shows the key steps in creating an entire AR scene using BuildAR.

BuildAR Step by Step

- a. Generate Patterns in BuildAR
- b. Load models onto markers
- c. Move, rotate, and scale the models
- d. Save and load the augmented reality scene

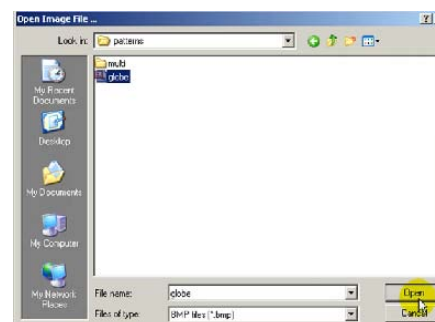
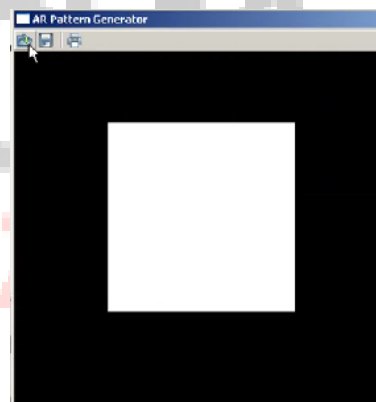
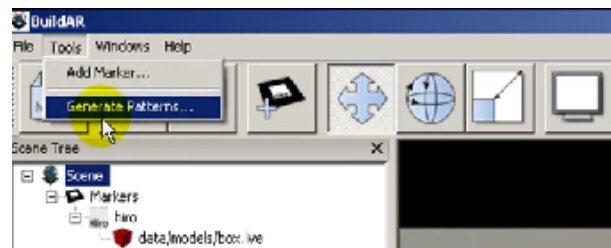
a. Generating Pattern in BuildAR

Before tracking patterns can be produced the images you want to track must previously have been made in an image editing tool (see part 2a).

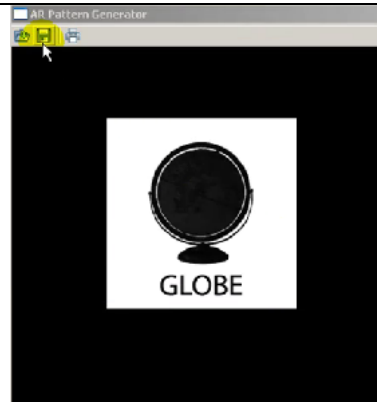
Once you have the images you want, go to the **tools menu** and choose **generate pattern**

You will see the **AR Pattern Generator window**

Open the BITMAP file that you've created before, and this will appear in the centre of the AR pattern square.



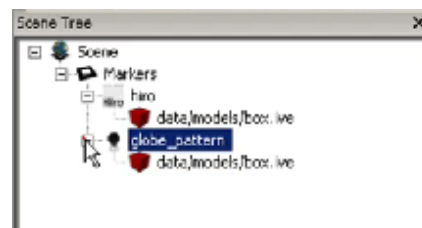
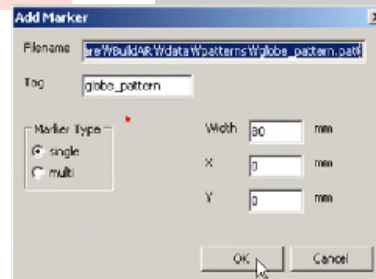
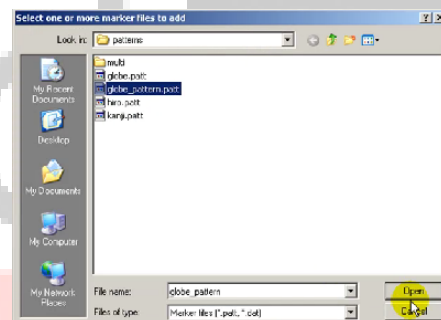
Save the **pattern file** and **print** out the **marker**. The pattern file will be saved with a **.patt** extension.



Then, you need to **add** the **marker to the scene**

Click the **button 'add marker'** on the **toolbar**

Select the **pattern file** you just saved.



The pattern file will be **added to the scene tree**.

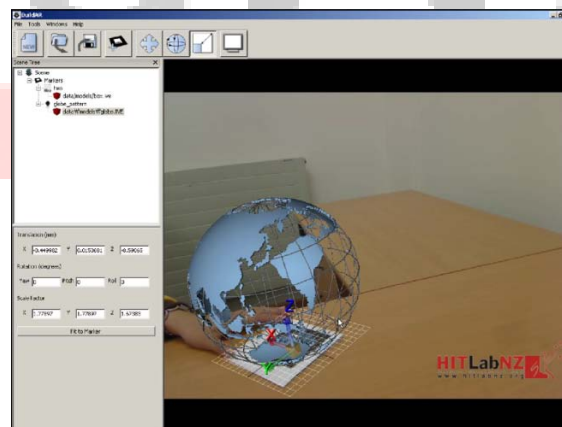
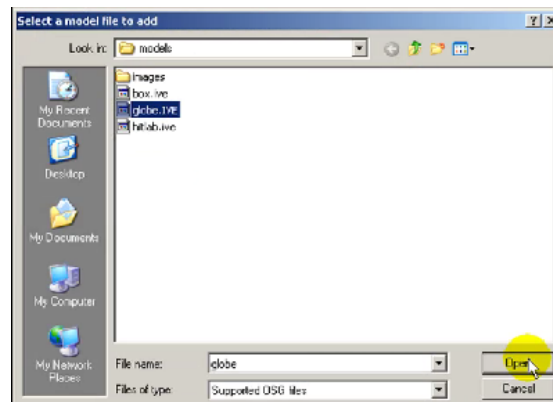
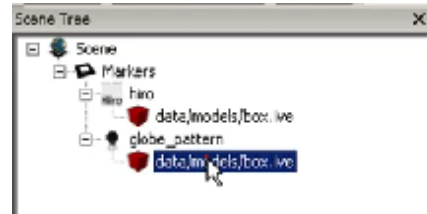
b. Load models on markers

Once you have added a new pattern to the scene then you also should load a 3D model onto the pattern marker.

To do this, **double Click the plus sign next to the marker** in the scene tree to show the name of the 3D model. Initially, the model will be a default blue cube.

Double click on the 3D model item to bring up a file selection dialog. **Open the 3D model** that you want to be displayed on the marker.

You should now **see the 3D model in the live view** on top of the marker.



c. Moving, rotating, and scaling models

Usually you will want to adjust the way the 3D model appears on the marker. For example, changing the model position, scale or rotation.

You can **use the manipulation control panel** and type in new positions, rotations and scales



manually or simply click on the 3D object in the live view and use the 3D widget buttons on the toolbar.

Repeat these steps to add more markers and 3D objects to your augmented reality scene.



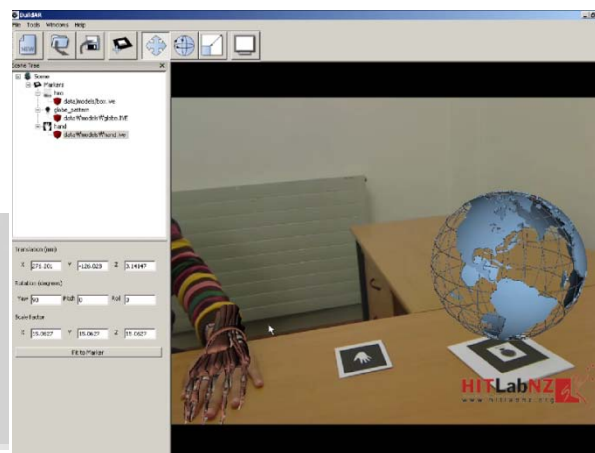
The **Translate** button puts the interface into translation mode, so that models can be moved relative to the marker they were added to.



The **Rotate** button puts the interface into rotation mode.

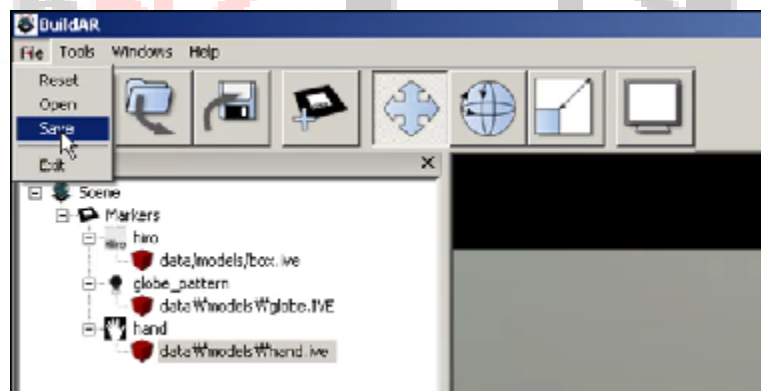


The **Scale** button puts the interface into scale mode.



d. Save and load the augmented reality scene

Once you are finished editing the scene, you can **save** the whole **scene** to an XML file. You can then **reopen** and **edit the scene** later.



ABOUT US

HIT LAB NZ

BuildAR was developed by the staff and students at the Human Interface Technology Laboratory New Zealand (HIT Lab NZ), a research centre at the University of Canterbury in Christchurch, New Zealand.

The HIT Lab NZ is developing and commercializing technology that improves human computer interaction and by doing so unlocks the power of human intelligence.

The HIT Lab NZ conducts research with new emerging technologies such as Augmented Reality, Next Generation Video Conferencing, Immersive Visualization, and Perceptual User Interfaces. Interaction Design techniques are used to adapt these technologies to the needs of end users and solve real world problems.

The end goal is to improve the user experience with technology.

For more information about the HIT Lab NZ see <http://www.hitlabnz.org/>

THE TEAM

BuildAR Developer : Julian Looser
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Desi Dwistratanti Sumadio
Hyun Tae Lee
Jihyun Kim
Joohyun Kim
Katy Bang

USEFUL LINKS

BuildAR Website <http://www.hitlabnz.org/BuildAR>

HIT Lab NZ Website <http://www.hitlabnz.org/wiki/Home>

BuildAR Demo Download <http://www.hitlabnz.org/buildar/main3.html>

BuildAR Tutorial Video and PDF <http://www.hitlabnz.org/buildar/main4.html>

AR Application Examples Download <http://www.hitlabnz.org/buildar/main3.html>

Community Sharing – Forum <http://www.hitlabnz.org/buildar/forum.html>

Contact Us http://www.hitlabnz.org/buildar/main5_2.html