

5.9 Crossing the Virtual World Barrier with OpenAvatar

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Abstract

There are multiple standards and formats for 3D models in virtual environments. The problem is that there is no open source platform for generating models out of discrete parts; this results in the process of having to “reinvent the wheel” when new games, virtual worlds and simulations want to enable their users to create their own avatars or easily customize in-world objects. OpenAvatar is designed to provide a framework to allow artists and programmers to create reusable assets which can be used by end users to generate vast numbers of complete models that are unique and functional. OpenAvatar serves as a framework which facilitates the modularization of 3D models allowing parts to be interchanged within a set of logical constraints.

1.0 INTRODUCTION

Virtual world, game and sim developers often want to be able to generate Avatars (models which represent users in a virtual world). Until now there has been no Open-Source code project to generate 3D models with sufficient quality. Unless sufficient money was spent to create a proprietary system for that virtual world, users were limited to pre-generated models. This has been the case in many Enterprise virtual worlds and military simulations. This added the burden of creating all the end user assets on the 3D artists and led to multiple end users sharing the same avatar model due to the limited choices available and not having a photo realistic avatar to match their face. There is interest in the user's association with the avatar regarding immersion [1,]. Thus avatars with the user's



Figure 1. Collection of Female Avatars

face tends to increase the immersion in the environment for all the users.

Modularity is a major benefit in the process of generating models. For example, a human model could have endless combinations of garments that the model could be representing. This is not just a simple matter of changing the skin, but also changing the mesh of the model; simply swapping out the skin for a man wearing a suit to jump suit will be detrimental to the aesthetic of the model and its believability. There are strong demands and advantages to having models where the components can be swapped out according to the context. Take an instance where a user may have their face modelled to their avatar. If they switch contexts, such as moving from being a pilot to a doctor, they would still be able to keep their face. This would give the user a greater sense of ownership and allow them to associate more with their avatar, further immersing them within the virtual world. OpenAvatar is not just limited to Avatars which are representations of humans in a virtual environment; they can be used to model anything from furniture to vehicles to animals.



Figure 2. Avatars from leading provider

There is a need for a high quality 3D model generator that uses an industry standard which can be accepted by tools commonly

used by artists. There are other vendors who offer high-quality models and face-capture technologies; however there was no end-to-end solution which incorporated these technologies in a reusable way.

Another problem was that models were not easily customised in-world, which limits the reusability of the models. There existed no open source means of separating parts of a model from the whole and swapping them in and out. This limits the reusability of models and creates more work for artists developing assets for 3D environments.

Currently there exists no open source software for compiling models from their discrete parts; OpenAvatar plans to fill this niche.

3.0 SOLUTION

OpenAvatar was designed to solve the issues mentioned earlier. It provides an open specification which allows artists to separate models into discrete components which are then bound to a skeleton. OpenAvatar uses COLLADA (.DAE) [2] files which is an open format for 3D models. COLLADA files can be easily exported by popular tools used in industry such as Maya and 3DS Max.

The process starts by having the artist create a whole 3D model and binding it to a skeleton for animation, though not all models will be animated, the skeleton is used as the foundation on how the model is to be assembled by the OpenAvatar compiler.

Collada is used due to its open specification; more importantly the XML structure of COLLADA allows it to be stitched together by the OpenAvatar compiler. Also, it can easily be converted

into the runtime format specific to that environment.

As not all 3D models are static and will be animated; Collada supports the BVH animation format conforming to standards used in the industry.



Figure 3. Comparison of OpenAvatar and Leading provider

4.0 OPEN SOURCE

Releasing the OpenAvatar SDK publicly under an open source MIT licence is integral to its adoption. The source code is made available for modification and integration with existing platforms. As there are a wide variety of platforms and use cases it make sense to have the code released so that developers and tailor it to their applications.

The OpenAvatar public SDK is entirely free to use for commercial and non-commercial purposes alike. We hope this free model serves as an incentive for adoption and testing allowing the public SDK to develop and suit the needs of users and developers alike.



Figure 4. Collection of Male Avatars

5.0 PROCESS

The process for creating a model for use in OpenAvatar is very similar to creating a model for any other 3D interactive platform. However for the model to be compliant to OpenAvatar it must have certain design considerations

The Model must have a skeleton; this is a given if the model is animated, however even if the model is static it will require a skeleton to be compatible with OpenAvatar.

The artist starts by creating the model as they normally would in the tool of their choice. After they create the model they bind the discrete components to the skeleton.

The skeleton is what guides the OpenAvatar compiler. It makes sure that the right parts go in the right places. The skeleton is important; however it does not work alone. OpenAvatar also uses XML files to dictate the compilation of the model.

The first of these XML files is the Archetype file. Archetype files serve as the contract between OpenAvatar and the artist. Archetype files stipulate what a model must have; they also stipulate what is optional for

that model. For example a model of a human must have a head, however whether that model has a backpack would be optional.

Archetype files are contracts, they may seem constrictive, but they actually allow for more variety and re-usability with regards to 3D models. For example a 3D platform could have an Archetype for a human, with a standard set of animations. Users can then upload their custom models which comply with the archetype file. Similarly mature, developed archetypes scan be used as a specification to artists who may be subcontracted, giving them a firm direction on how their models must be designed. The benefits from this are many. A client may not be restricted to one provider for their models, as long an artist can familiarise themselves with the archetype they can create the model. Artists can also create a model based on the archetype confident that it will integrate into the environment.

The next XML is a DNA file. The DNA file is the actual implementation of the Archetype file. The DNA file contains the references of the DAE files and which part of the model those DAE files belong to. For example a discrete part such as the left leg will refer to the leg DAE file. DNA files also contain the references to the skins of a particular component.

When compiling the model, OpenAvatar checks the DNA and the Archetype files against each other. The compilation will happen only if the required parts of the model are included and there are no parts included that should not be there.

6.0 BENEFITS

Re-usability is a tenet of OpenAvatar. To have faces of individuals swapped out of a

model would save time and money. This serves another qualitative benefit. User avatars which can retain their faces serve to further immerse the user in the virtual world or simulation.

Encapsulation is another aspect of OpenAvatar. Protection of intellectual property (IP) is a consideration when it comes to 3D models. If client wishes to have accessories for a specific model made; however does not want to release IP to the designer, it can be problematic. Archetype files can rectify this by providing the framework for which the 3D artist can create that accessory.

Though Collada is used in this server-side application, there is no need to release Collada files to end users as many real time 3D engines use custom runtime mesh formats. These formats can usually be generated automatically from the Collada file. This presents an additional opportunity where OpenAvatar generates Collada models that are then generated into runtime models for multiple platforms.

The resulting Collada file may be stored by

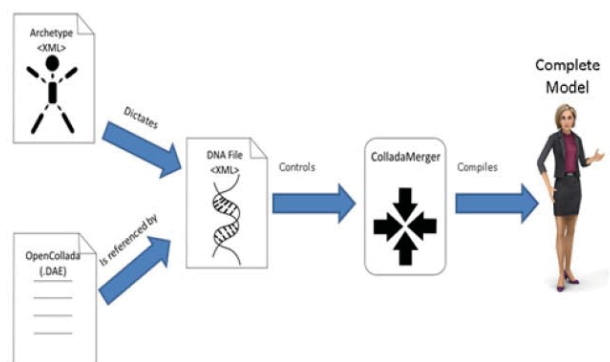


Figure 5. Overview of Compilation

the system to be used for future regeneration of runtime files or as an archive if desired.

Finally, OpenAvatar abstracts the end user decisions away from any mesh format. In the event that procedurally generated models become possible, then the OpenAvatar DNA files could be used to regenerate user avatars utilizing the new procedural approach. Users can seamlessly experience a content quality upgrade without having to go back and remake their decisions.

7.0 WHAT'S NEXT

OpenAvatar lends itself to many possible implementations. The DNA and Archetype constructs allow for standardization which can streamline collaborative work generating models.

A virtual world could have a web interface which would allow users to upload their custom avatars and models to give them greater creative control over how their world looks and feels. This would give a greater feeling of ownership to the user.



Figure 6. Interface for customisable avatar

While not every user of a virtual world is a 3D artist, OpenAvatar could serve an interface where models can be taken apart, have their parts replaced and reassembled.

The benefits to this are that avatars can be specifically assembled by users who do not come from a 3D artist background.



Figure 7. Facial expressions in action

The DNA file serves to facilitate re-usability; specific components can be hosted on the internet. An example use case could be that people's faces are hosted on a server whereby later they can be downloaded and modelled onto a different outfit. The benefits are that time and money can be saved as well as giving the user greater association to their avatar.

It is possible for the Archetype file to facilitate a marketplace. The Archetype file enables a concrete definition of component parts in an open specification; with an open specification and the use of Collada, 3D artists can create discrete components to popular archetypes and sell them. Conversely those looking to buy can put out a tender for a specific part to a model can release a "mannequin" which will serve as a base for 3D artists to create parts for the model. The open specification will allow any 3D artist to submit their design to the client for their consideration. For example Company X is looking for some new

backpacks for their models; they put up a mannequin which serves as the base for which this new backpack will be designed. Artists can then submit various models for the client's approval. The use of Collada and Archetypes would allow for "Crowd-sourcing" of 3D models. Note, the marketplace is enabled by OpenAvatar specifications but the SDK itself does not provide a marketplace.

8.0 CROSS-PLATFORM COMPATABILITY

Using Collada as the format for storing models in OpenAvatar, it inherently supports the ability to transfer an avatar to another virtual world. As a result user's can move between virtual worlds while retaining their avatar. By supporting this, it could create a greater exchange between virtual worlds; users will now have greater ease to retain their avatar and identity. They would not have to "start afresh" if they wanted to visit someone else in another world to share an experience. Collada files can be used to import models into second life.

A variation on that concept is the ability to retain their face; technologies like FaceGen allow a user to give their avatar their face. Though COLLADA can be converted into the run-time format of the platform, transferring a whole model from one environment's art direction to another might not make sense. For example, taking a user's avatar from a fantasy environment where he is a barbarian warrior over to more modern contemporary environment where he may be playing the role of a policeman would disrupt the believability of the world.

OpenAvatar's ability to separate a model into discrete parts allows a specific part to be taken and replaced onto the model which suits that world. The Archetype and DNA

files can facilitate this and allow it to be done procedurally and automatically. This means that the user need not configure his avatar to the new world, or some controlled configuration on the user's part can be allowed; to extend our previous example, the barbarian warrior may require a haircut before he can don the policeman's uniform.

9.0 CONCLUSION

OpenAvatar is an open source software and specification that aims to streamline the development and integration of models into virtual worlds. By using COLLADA which is an open specification, models compiled by OpenAvatar can easily be converted into the run-time format of the virtual world they will be deployed in.



Separation of models into discrete

Figure 8. An OpenAvatar avatar inworld

components will allow more reusability of 3D assets. Instead of building whole models, individual parts for the model can be built and be swapped in and out as the situation dictates. Similarly a model has a greater ease of being customised by the user or the virtual world.

Archetype and DNA files serve as contracts to standardise models ensuring that they are built to a certain specification, but also give security, ensuring that models will adhere to the skeleton and then can be rigged and animated when deployed in the virtual world. An agreed upon archetype can

serve as a standard for which additional parts and accessories can be created by 3D artists, enabling a wide variety of parts and accessories for that model. Using COLLADA as the format for storing the models, OpenAvatar aims to be compatible with various virtual world providers. With portable avatars the ease at which users can transfer between worlds increases, allowing for greater interaction between virtual worlds.

To conclude, OpenAvatar hopes to enable greater ease of generating models procedurally and give a specification with the Archetype files. Doing this will give the virtual worlds industry a framework with which to collaborate and grow as an industry

10.0 REFERENCES

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