

Acquisition and Use of 3D photorealistic models for virtual fieldtrips and exercises

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Dr. Xueming Xu and I have been developing a unique 3D photorealistic mapping of geology, creating virtual models at centimeter accuracy and resolution. We have used a variety of combinations of GPS, laser rangefinders and scanners and digital cameras. I am chairman of an NSF initiative INTERFACE (INTERdisciplinary alliance for digital Field data ACquisition and Exploration) to build a series of regionally distributed centers with key expertise and equipment who will then train other academic groups. Geologic virtual models have been created in Spain, Mexico and Ireland as well as the US. These are all at important geologic outcrops. Oil companies have used our models for reservoir characterization studies and virtual field trips. We have been working with our structural geologist by capturing virtually a series of very famous outcrops along I-35 in Oklahoma where schools from a long distance visit because they are such great examples of various aspects of geology. The concept is to utilize them for teaching thus demonstrating how these could be used. We assisted the Association of Engineering Geologists in Texas in building a virtual model of the geology in a famous area called Dobbs Valley near Mineral Wells. They wanted to use it when they had their geology field trip in July, to be able to take a computer in the field and virtually “fly around” the cliffs on the computer so that more could be seen. We worked on it with undergrad and graduate students and it was a great success, the first time this has ever been done. In addition in 2004 two fieldtrips being led by department faculty with the American Association of Exploration Geologists will use our models there and along I-35 in that manner as an assist in their visits to those locations. We have been unsuccessful in getting funding for educational applications since what we do is so unique these agencies do not know how such models can be used because such models have not been available previously. We are confident that what we do is unique in method and quality. The fact we actually model the camera geometry as opposed to rubber sheeting makes ours the most accurate method. That is the reason why we can seamlessly mosaic multiple images on 3D terrain rather than only a single image (as rubber sheeting does). Rubber sheeting was inadequate at an earlier stage of our research, and we eventually abandoned this approach. Projects with as many as 42 integrated photos in geology and over a hundred in man made structures have been successful. They have been viewed and interpreted in a variety of visualization systems including oil companies and universities with high end CAVE systems but are also effective in systems such as our own GeoWall. We have been also been capturing a variety of models besides geology. We have captured Mt. Rushmore very effectively, intending to create a virtual field trip. We have been working with the City of Rowlett forensic specialists in testing the use of our virtual modeling of crime scenes. A real crack house was setup with an officer acting as a body with fake blood to determine how that would be captured photorealistically in 3D. We mapped inside and out the Alamo in San Antonio cooperating with the Daughters of the Texas Republic and the curators. It was done as a test of the use of the virtual approach for historical documentation. The data set is complete to surfaces and photos are now being applied. Such a data set is extremely large and challenged our software and hardware. We also mapped part of a Dallas rapid

Transit (DART) railroad tunnel as a test of this application with their cooperation as well as their engineering contractors. Low cost visualization and geometric analysis software is not available which is a problem. We need to get feedback in ways to utilize this methodology and associated products.