3D Talking Heads : Image Based Modeling at Interactive rates using Structured Light Projection

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Real Time Depth Extraction

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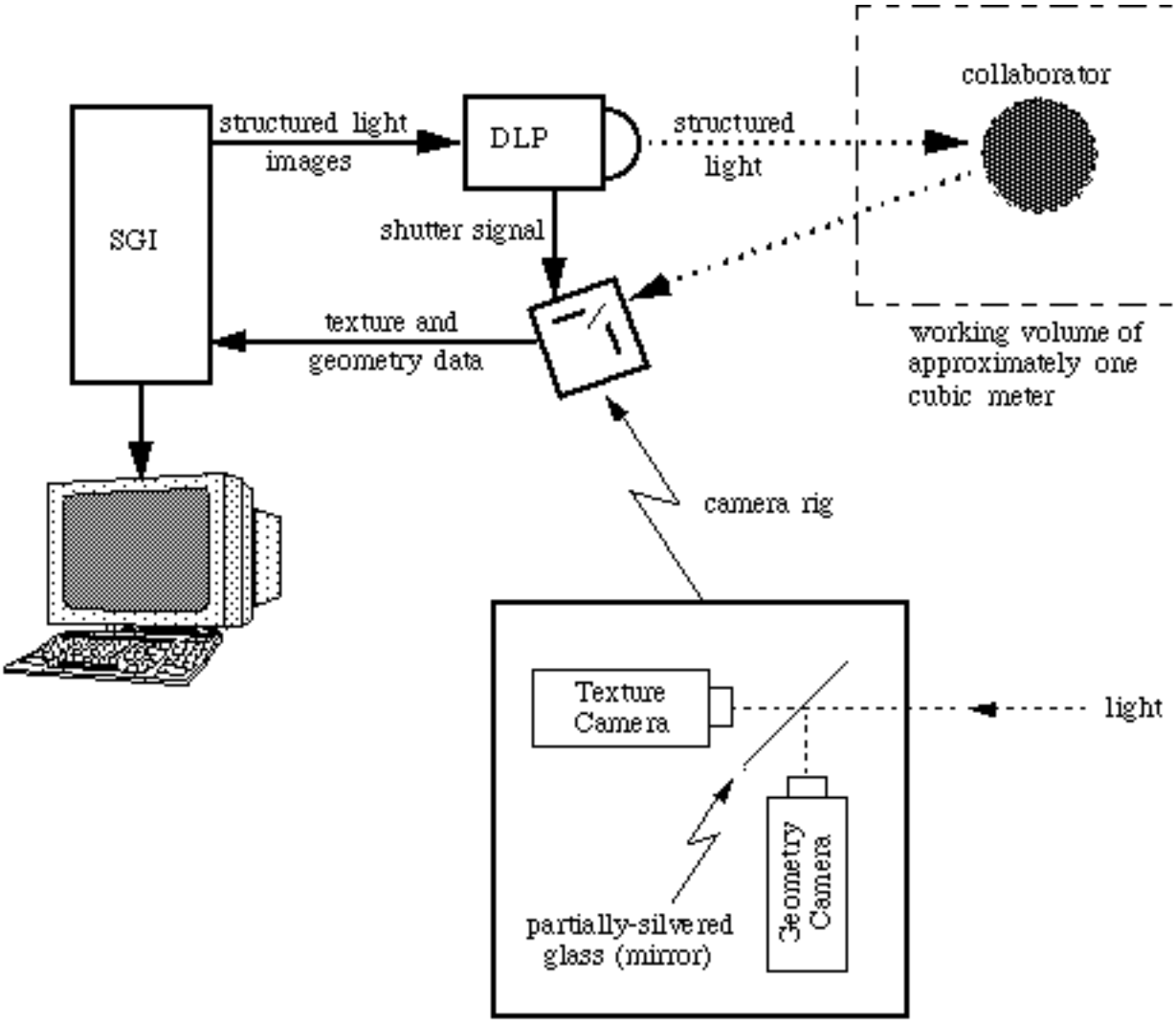
The 3D talking head project at UNC allows participants at remote sites to be seen in 3D rather than as flat video images in application such as teleconferencing.



The collaborator at remote site is scanned by a combination of active light projector (DLP: Digital light projector) and a syncronized video camera. The video camera is a combination of two cameras, geometry and texture camera, which share their optical axis. The acquired 3D information about the scene is represented as a 3D computer graphics model at the host.

The underlying difficult correspondence problem from stereopsis is often reduced by projecting structured light patterns. We currently use binary coded vertical bars. A camera looks at a set of patterns to distinguish between all the projected vertical bars. To distinguish between 512 projected columns 9 patterns are required.

The 3D world coordinates of points on the surface of scene objects are computed by triangulation of the projected plane of individual column of the projector and rays incident on each camera pixel. The major challenge is to calibrate the environment and to set up the calculations in such a way that triangulation for computing 3D world coordinates is efficient. We have reduced this to 7 accesses for lookup plus 3 adds and 6 multiplications at each pixel. This can also be parallelized very easily.

We hope to make the projected patterns imperceptible to human eye. Binary image of the pattern and its inverse are projected in quick succession. This appears as a uniform grey level. A camera synchronized to the projector however can detect the pattern by capturing only the first half duration.

(Insert here two images with inverse patterns projected and also the same scene with constant field illumination.)

We anticipate that real time imperceptible extraction and display of 3D environments with people will not only enhance the sense of presence in teleconferencing but will also inspire a variery of new applications among which we plan to pursue telemedicine and distributed collaborative design.

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