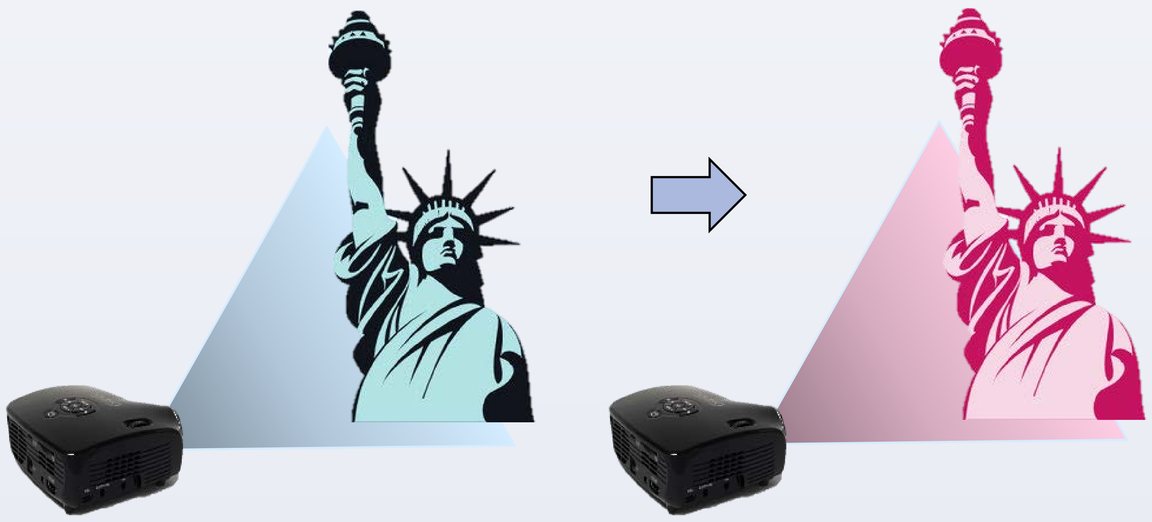
Projection Mapping for Free-form Surfaces

Seonghyeon Moon, Jineon Park, Jihoon Park, Inyoung Oh, Galam Song, Kwanghee Ko

Gwangju Institute of Science and Technology (GIST), Gwangju, South Korea

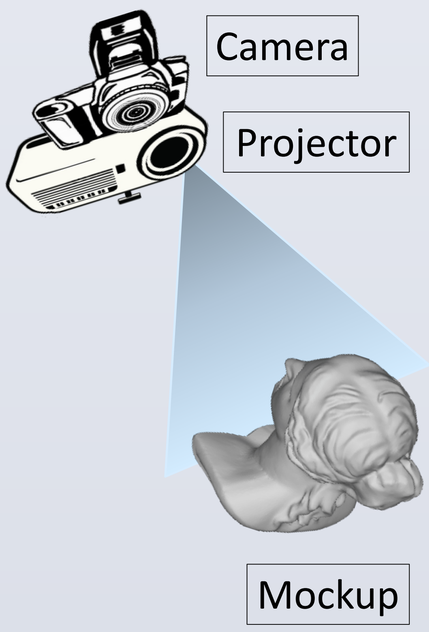
Problem

Given a free-form surface, implement projection mapping on the surface accurately.



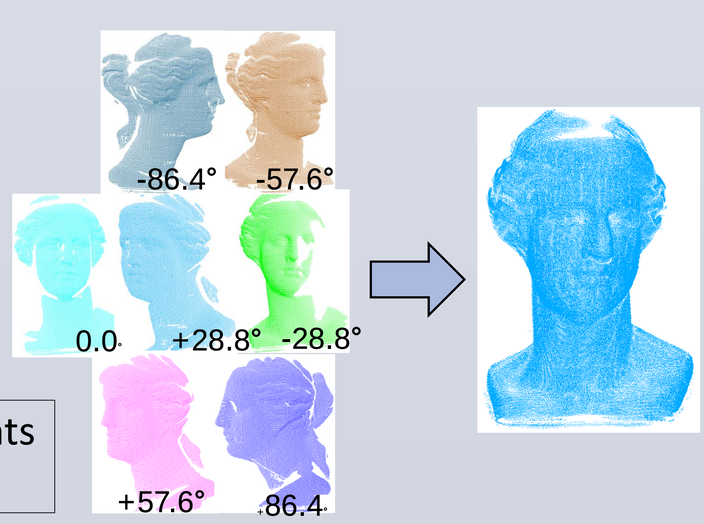
Proposed method

Our method consists of four steps scanning, reconstruction, registration and projection mapping. Firstly, for the scanning we used the structure light scanning approach suggested by [Moreno and Taubin 2012] because of high accuracy.



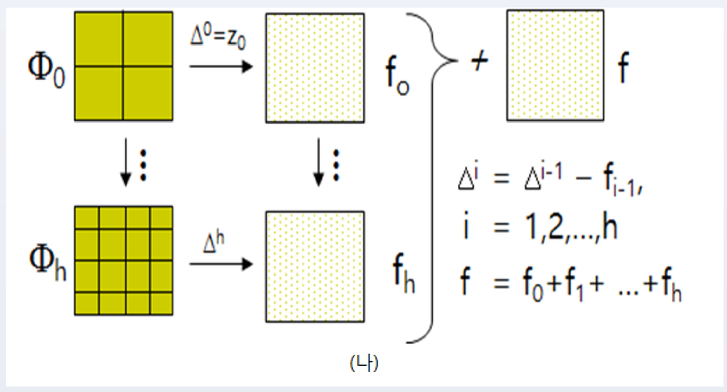
Mockup scanning using structure light

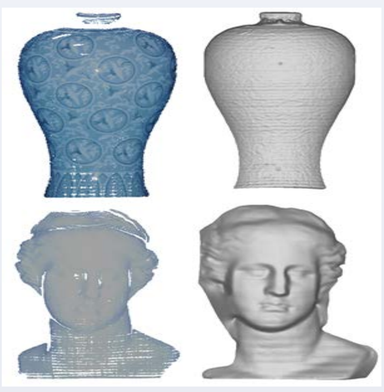
Nevertheless good accuracy of the structure light approach, it is very hard to attain good data from edge areas and there are missing data points in hidden areas. Therefore, the proposed method used multiple viewpoints to scan using a turntable. Then point clouds achieved from scanning are exploited for point-to-plane registration to produce one point cloud [Park and Subbarao 2003].



Scanning multiple viewpoints using a turntable.

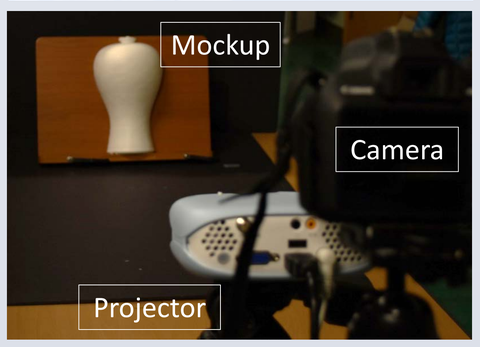
Point clouds achieved from scanning using the structure light have problems that produce local empty areas in places. To make up these problems multilevel B-splines method is applied [Lee et al. 1997].





Results

Using the above method, we make the point cloud data into a surface. This data is then projected through the projector parameters. As a result, a 2D image is mapped onto the free surface accurately. For the demonstrating the proposed method, a statue of the venus and a pottery are tested.



Conclusion

Since the structure light method is used, it is possible to acquire accurate three-dimensional information of small objects and the accurate image projection was possible by using the precise positional relation between the camera and the projector. In addition, partial problems caused by the structure light method are solved by using multilevel B-splines.

References

1. Lee, S. Y., Wolberg, G., and Shin, S. Y. 1997. Scattered data interpolation with Multilevel B-splines. IEEE Transactions on Visualization and Computer Graphics, 3.3 (Jul.-Sep.), 228-244.
2. Moreno, D., and Taubin, G. 2012. Simple, accurate, and robust projector-camera calibration. 3D Imaging, Modeling, Processing, Visualization and Transmission (3DIMPVT), 2012 Second International Conference on. IEEE, 2012.
3. Park, S. Y., and Subbarao, M. 2003. An accurate and fast point-to-plane registration technique. Pattern Recognition Letters 24.16 (Dec.), 2967-2976.