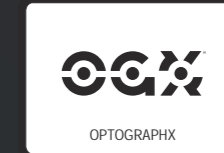
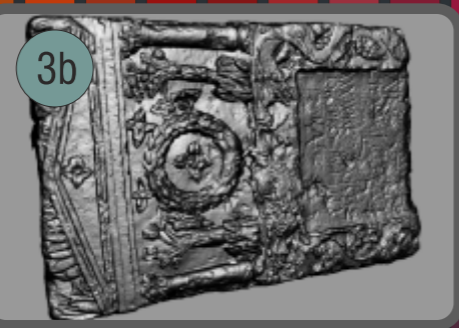
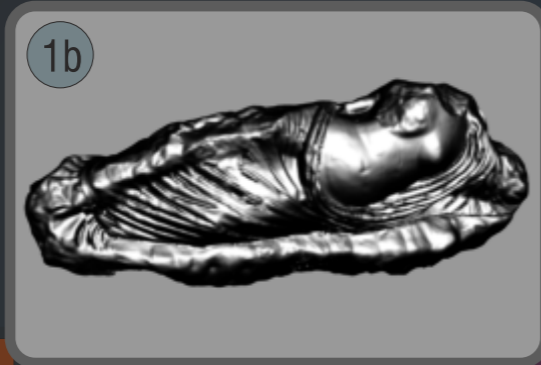


Exemplary results

(a - cloud of points, b - triangle mesh, c - photograph)

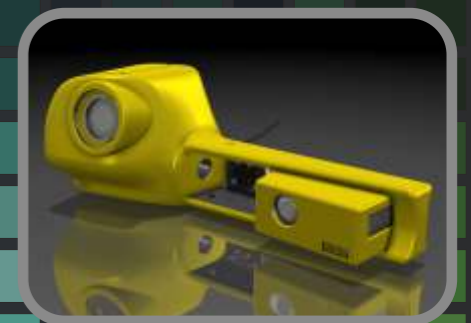
- 1 - Plaster-cast copy of roman sculpture presenting laying nymph
- 2 - Roman votive altar
- 3 - Roman sepulchral stela



Automated System for 3D Digitization
of Polish and European Cultural Heritage Objects (2007-2010)

built at Warsaw University of Technology, Faculty of Mechatronics by OGX research group

Project financed by Polish Ministry of Science and Higher Education



Nr	Number of directional measurements	Number of points	Measurement and processing time	Number of triangles	Point cloud to triangle mesh conversion time
1	87	912 529 592	140h 25m 28s	1 592 524	1h 09m 24s
2	49	137 196 542	18h 20m 30s	698 135	15m 21s
3	52	615 824 377	96h 8m 19s	1 083 245	42m 21s

Implementation:

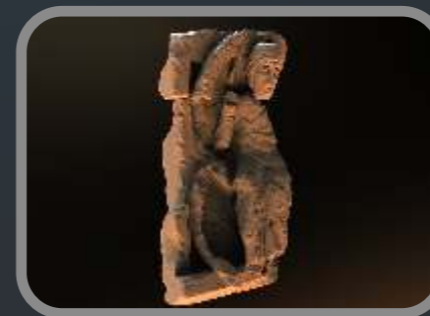
Warsaw University of Technology, Institute of Micromechanics and Photonics, OGX|OPTOGRAPHX
Sw. Andrzeja Boboli 8 Street, 02-525 Warsaw

e-mail: r.sitnik@mchtr.pw.edu.pl

Tel. +48 22 234 82 83

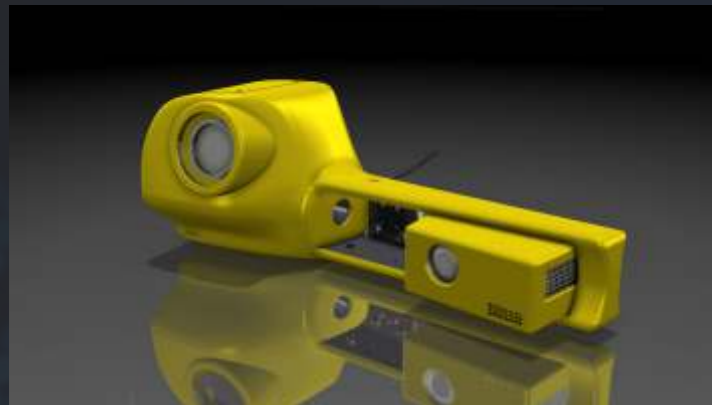
<http://ogx.mchtr.pw.edu.pl/>

Works of art digitized during the project:



The main aim of the project was to develop an automated system and methodology for 3D digitization of objects representing Polish, European and World cultural heritage. The developed system uses an optical full-field method of measurement with raster projection (so-called structured light method) and produces results in the form of a point cloud (x, y, z, R, G, B) which represents the sampled surface of an object. 3D Digitization of an entire work of art (by multiple directional measurements) is performed automatically with a robotized system, which allows to position the measurement head arbitrarily within the working volume. Additionally, many algorithms for data processing have been developed, none of them requiring any user interaction, which can lead to a close (eternal) copy of an object (highest precision of surface and color representation), a simplified copy for visualization purposes (with customizable precision of representation) or a copy for 3D printing. The developed system utilizes a database system for storing measurement results. Finally, a remote player for viewing digitized objects and their descriptions (retrieved from database) was implemented.

Parameters of measurement system:

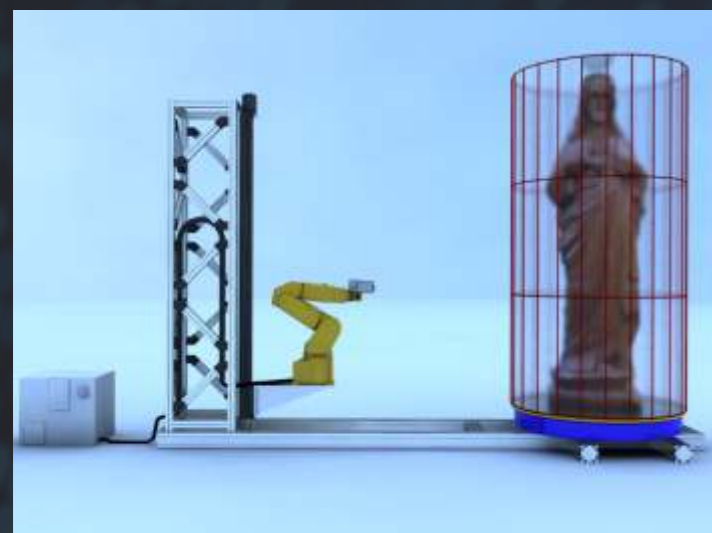


Measurement head:

- working volume: from 30mm x 20mm x 12mm to 600mm x 400mm x 300mm;
- measurement uncertainty: from 5µm to 50µm;
- time of measurement: from 5s to 30s;
- management: direct (keyboard and mouse) or remote (via network).

System parameters:

- working volume: 2.5m x 1m x 1m³;
- maximum object's weight: 2000kg;
- vertical column's range: 1520mm;
- robot used: FANUC LR Mate 200ic, maximum movement range: 704mm;
- collision detection: two-step software based (during calculations of measurement head's movement trajectory) and realtime, machine-vision based (during measurements and positioning of scanning device);
- processing unit: PC computer, 24GB RAM, Intel Core i7 980x, 12TB RAID6 storage.



Plaster-of-Paris copy of roman votive altar with latin inscription, dedicated to Esculapius and Hygieia, dated back to 2nd century AD. The original object was discovered in 1996 in Bulgaria, during excavations of remains of a stronghold of the first Italic legion. The inscription states that this altar was made by a medical officer working in the stronghold's valetudinarium (medical hospital).

Dimensions of the object are 286mm x 168mm x 168mm (height, width, depth).



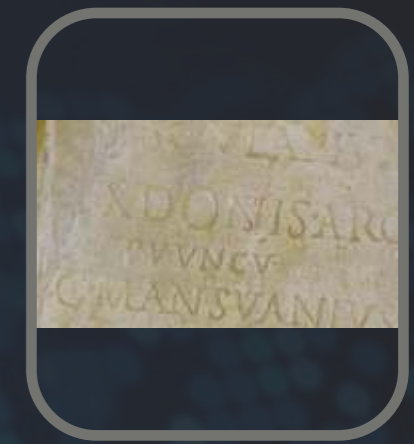
Roman votive altar with latin inscription

Typical data processing path:

Directional measurements



Close copy



Simplification and triangulation

