

Digitizing embossed 3D surfaces of collections item using photometric stereo device

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The objective of the paper is to present device and software developed for digitization of surface topography of precious objects utilizing so called photometric stereo technique. The principle of the photometric technique is based on relation between apparent brightness of the point on the object's surface and its orientation towards incident light which can be further elaborated into knowledge of the surface topography. This technique is especially suitable for documentation and analysis of objects with relief surface otherwise difficult to capture because of minute height differences and sublime details beyond the capabilities of contemporary techniques based on stereoscopic principles. The reason, why photometric technique can overcome this limitation is that the topography of the object's surface is derived from measurement of light intensity, therefore resolution depends on ability of device to distinguish intensity levels, not on spatial resolution. Technical implementation consists of collimated illumination system integrated into computer controlled stage making possible automatic capturing of object's surface under various illumination conditions. Images recorded by digital camera are processed using custom written computer code. Automatic processing is taking advantage of the robustness based on redundancy, i.e. more images captured under known illumination acquired, the more complete and reliable data set is acquired for final topography model combined with surface texture. In results section some objects' topographies are presented showing suitability of the technique for 3D documentation. The technique can also be used to monitor surface's degradation processes like rust, development of crust, etc.