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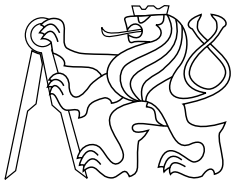

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Uniform Resolution Mirrors - Test Images

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Figure 1 shows raw images of a uniform grid [2] taken by the OSCAR 576× 768 CCD camera with the use of a (a) hyperbolic mirror, a (b) SVAVISCA uniform resolution mirror, and (c) a mirror to get a uniform resolution in radius for a normal camera. See [3] for more about hyperbolic mirror design and [1] for the design of the other two mirrors.

The mirror from the image Figure 1(b) is designed so that the image taken by a SVAVISCA camera should have as uniform resolution as possible. Similarly, the mirror from the image Figure 1(c) is designed so that the resolution along the radius, when measured from the center of the image of the mirror, should have a constant resolution. A constant resolution can be exactly achieved only at some distance from the rotational mirror axis and thus the images shown may not present exactly constant resolution as the distance of the grid is about 7 cm from the mirror axis while the distance for which the truly constant resolution should be obtained is in range of meters. See [1] for more.

Figure 1(d) shows image that would be acquired with a SVAVISCA sensor and the hyperbolic mirror. Figure 1(e) shows image that would be acquired with a SVAVISCA sensor and the SVAVISCA uniform resolution mirror. Only 110 rows corresponding to the retina of SVAVISCA sensor are shown. We can clearly see that the grid is almost perfectly uniform on Figure 1(e) as expected and that the camera itself is not visible in the image at all. Similarly, Figure 1(f) shows the image (a) in polar coordinates while Figure 1(g) shows Figure 1(c) in polar coordinates. It can be seen that the vertical separation of the grid lines is more uniform on the Figure 1(g) compared to Figure 1(f) as expected.

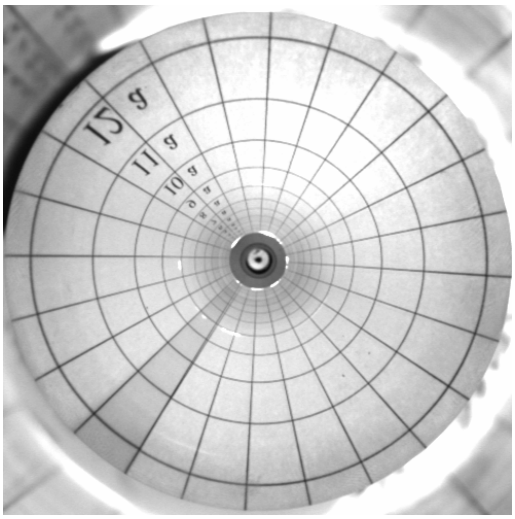
The preliminary experiments show that the mirror design was in principle successful and that we are able to produce mirrors with desired characteristics in order to control the course of resolution in the images according to the needs of tasks at hand.

References

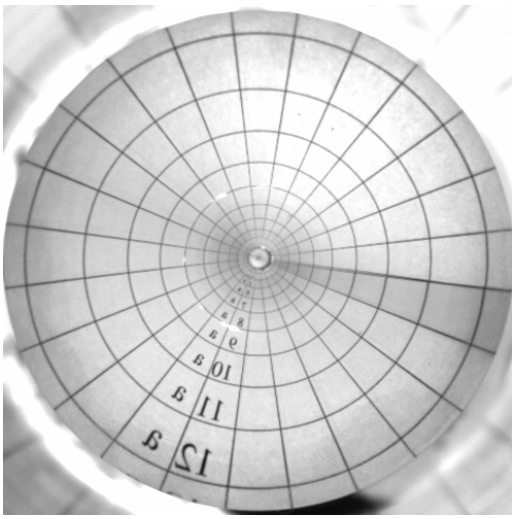
[1] Stefan Gächter and Tomáš Pajdla. Mirror design for an omnidirectional camera with a uniform cylindrical projection when using SVAVISCA sensor. Research Report CTU–CMP–2001–03, CAK–340–03–1–2001–02, Center for Machine Perception, K333 FEE, Czech Technical University, Prague, Czech Republic, January 2001.

[2] T. Pajdla and H. Roth. Panoramic imaging with SVAVISCA camera - simulations. Technical Report CTU-CMP-2000-16, Center for Machine Perception, Czech Technical University in Prague, 2001.

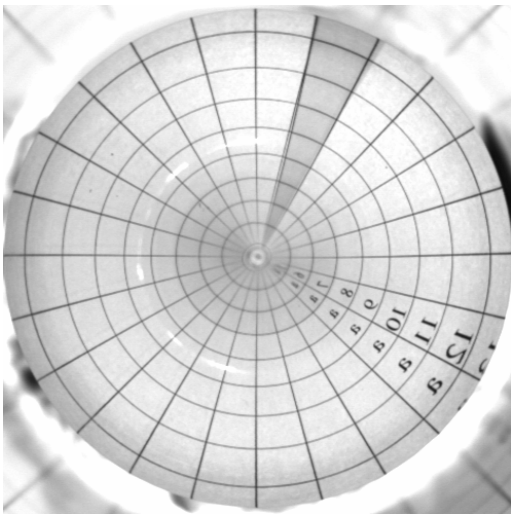
[3] Tomáš Svoboda. *Central Panoramic Cameras Design, Geometry, Egomotion*. PhD Thesis, Center for Machine Perception, Czech Technical University, Prague, Czech Republic, April 2000.



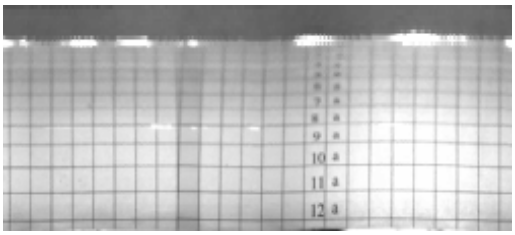
(a) Original hyperbolic mirror



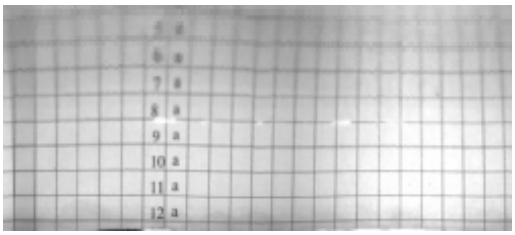
(b) SVAVISCA uniform resolution mirror



(c) The mirror to get a uniform resolution in radius for a normal camera

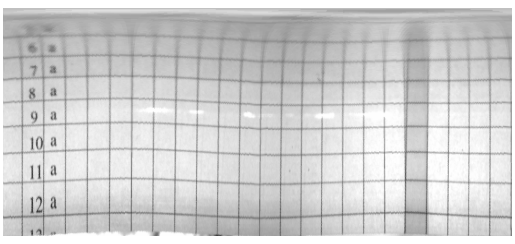


(d) SVAVISCA resampling of (a)



(e) SVAVISCA resampling of (b)

(f) image in polar coordinates



(g) image in polar coordinates

Figure 1: Raw and panoramic images from various mirrors