Variable Shadow Screens for Imaging Optical Devices

Effective dynamic ranges would be increased.

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Variable shadow screens have been proposed for reducing the apparent brightnesses of very bright light sources relative to other sources within the fields of view of diverse imaging optical devices, including video and film cameras and optical devices for imaging directly into the human eye. In other words, variable shadow screens would increase the effective dynamic ranges of such devices.

Traditionally, imaging sensors are protected against excessive brightness by use of dark filters and/or reduction of iris diameters. These traditional means do not increase dynamic range; they reduce the ability to view or image dimmer features of an image because they reduce the brightness of all parts of an image by the same factor. On the other hand, a variable shadow screen would darken only the excessively bright parts of an image. For example, dim objects in a field of view that included the setting Sun or bright headlights could be seen more readily in a picture taken through a variable shadow screen than in a picture of the same scene taken through a dark filter or a narrowed iris.

The figure depicts one of many potential variations of the basic concept of the variable shadow screen. The shadow screen would be a normally transparent liquid-crystal matrix placed in front of a focal-plane array of photodetectors in a charge-coupled-device video camera. The shadow screen would be placed far enough from the focal plane so as not to disrupt the focal-plane image to an unacceptable degree, yet close enough so that the out-of-focus shadows cast by the screen would still be effective in darkening the brightest parts of the image.

The image detected by the photodetector array itself would be used as feedback to drive the variable shadow screen: The video output of the camera would be processed by suitable analog and/or digital electronic circuitry to generate a negative partial version of the image to be impressed on the shadow screen. The parts of the shadow screen in front of those parts of the image with brightness below a specified threshold would be left transparent; the parts of the shadow screen in front of those parts of the image where the brightness exceeded the threshold would be darkened by an amount that would increase with the excess above the threshold.

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to: Innovative Technology Assets Management JPL Mail Stop 202-233 4800 Oak Grove Drive Pasadena, CA 91109-8099 (818) 354-2240 E-mail: iaooffice@jpl.nasa.gov Refer to NPO-30621, volume and number of this NASA Tech Briefs issue, and the page number.