METHOD OF CALCULATING THE DIMENSIONS OF UAVS IN PIXELS

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To calculate the size of the UAV in pixels on your monitor, you need to know some initial data: the size of the matrix of the image reading device (camera), the focal length, the distance to the object, the actual size of the object and the size of the monitor.

DPI (dots per inch) indicates the number of dots found within one inch line of scanning or printing. For monitors and displays, PPI (pixels per inch) is used. While PPI is the correct term when referring to monitors and other displays, both terms are often used interchangeably. PPI or DPI is a description of the pixel density on a monitor screen. A higher pixel density means there will be more pixels for every square inch of your screen.

Pixel density is a significant factor as it determines the quality of your image, and a higher pixel density generally produces a better image. However, the pixel density also depends on the screen size.

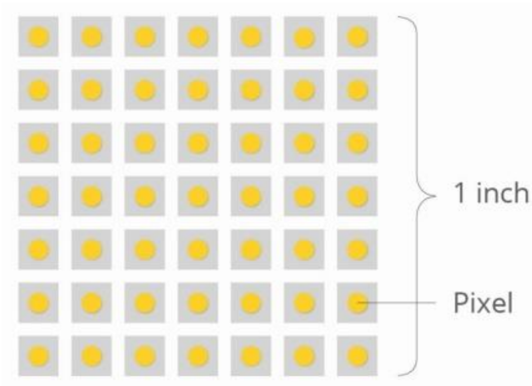

Figure 1. Pixels per inch

Resolution: 1080p or 1920 x 1080 is an interlaced monitor resolution that is marketed as the first resolution to take full advantage of the full range of HD capabilities. 1080p is currently the standard definition for television, internet streaming services, video games, and smartphones. Twip is the typographic unit of measure equal to one twentieth of a point (Twentieth of a Point). Twip is 1/1440 inch (exact) or 1/567 centimeter (approximate). Changing the scale increases or decreases the number of pixels (dots) per inch, and since the number of twips in an inch is constant, the number of twips in a pixel also changes proportionally. At the standard 100% scale it is 96 dpi and 15 twips per pixel, at 125% (the so-called "average") - 120 dpi and only 12 twips per pixel, etc. hus, increasing the scaling factor reduces the number of twips in a pixel,

while the screen resolution, contrary to common misconception, does not in itself affect the ratio between twips and pixels. You can set a huge screen resolution of 3840 × 2400, while keeping 15 twips per pixel and vice versa, choose 250% scale for 800 × 600 resolution, thereby reducing the number of twips per pixel to 6. Knowing the size of the monitor, you need to divide the width and height of the image by resolution. Then the resulting values need to be multiplied by 1440. For example, we have a 100 × 100 drawing with a resolution of 96 dpi. Then its size in twips is (100/96 · 1440) × (100/96 · 1440), that is, 1500 × 1500.
It is known from optics that

$$\boldsymbol{\beta} = \frac{\boldsymbol{F}}{\boldsymbol{d}}, \qquad (1)$$

where β – linear increase, F - focal length, d - distance to the object.

Having determined the size of the UAV image on the matrix, we find the ratio of the matrix to the monitor and then calculate the size of the object on the monitor. Sizes can be either centimeters or inches. Further, according to the algorithm, we translate the dimensions into pixels. Taking as a sample a camera with a full-frame matrix 36 × 24 mm, with a focal length of 105 mm, a drone measuring 25 × 15 cm and a distance of 100 m to it, we find the value of the UAV in pixels on our monitor, measuring 34×19.5 cm. This will be match 1134 × 680 twips, translate to pixels. You can also calculate the speed in pixels per second, knowing the speed of the object in km / h. A speed of 28.8 km / h will correspond to a speed of 18.3 pixels per second.

In conclusion, we have an algorithm for recalculating the dimensions of a UAV or other object into pixels and centimeters (inches) on the monitor, as well as the possibility of reverse recalculation of values from pixels or centimeters (inches) to find the real dimensions of a UAV or other object in the field of vision of the observation device. Moreover, we have the ability to recalculate the real speed of the object in the speed of the image on the monitor, according to the same principle. The obtained data can be used for further algorithms for video tracking of objects.

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