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CORRELATION-EXTREME NAVIGATION SYSTEM BASED ON MORPHOLOGICAL ANALYSIS

Relevance of research topic is caused by the fact that the comparison of images based only on the brightness characteristics is not sufficient sometimes, but morphological comparison considers also geometric characteristics.

Purpose of research is to disclose the principle of work and efficiency of Correlation-Extreme Navigation System (CENS) based on morphological analysis.

Unmanned Aerial Vehicles (UAVs) always contains Global Positioning System (GPS) and Inertial Measurement Unit (IMU). It usually has the ability to perform automatic navigation along planned waypoints. Nevertheless, if the GPS signal becomes unavailable, the state estimation solution provided by data from IMU alone drifts in time and will be unusable. Correlation-extreme navigation is one of alternative solution in such case and may be additional source of data fusion in the integrated navigation complex.

The principle of CENS operation is based on a comparison of image of the Earth's surface or current image and reference one received in advance. The core problem of modern image analysis is the need to consider the probabilistic nature of the real image, to account a priori information, to ensure the robustness of image analysis procedures with respect to various kinds of noise.

Images of the same scene may significantly differ from each other during varying the conditions of their registration, such as lighting, optical properties of the object surface, characteristics of the environment, etc. This fact complicates the scenes analysis by their images, because the relationship between the location of objects and distribution of brightness in the field of view is mixed.

However, if all sorts of images of the scene can be described by a certain class of transformations carried out over a certain image of the scene, then it is natural to consider the maximal invariant of the class of transformations as the characteristic of objects shapes in the image.

Since this invariant usually not restore objects form, it is called a form of image, and image analysis methods, based on this idea, are called morphological ones.

Suppose there are two images of some area and objects thereon, obtained in winter and summer. Let it is necessary to distinguish object, which is absent on one image but distinguishable on the other. The difficulty lies in the fact that a change in the conditions of registration leads to changes in the image, which is often more important than the appearance/disappearance of objects in some area. Morphological methods can successfully cope with this task. Analysis shows that the difference in the registration conditions leads to substantial differences in brightness. But it is possible to find morphological difference of the same

images that will select the object, which appeared on the scene and is not associated with changes in the conditions of observation.

The method of morphology is a unified approach to the description, development and use of image analysis algorithms, based on the brightness and geometric characteristics of the image. It leads to the distinguishing basic distinction between simple correlation coefficient assessment and morphological one. The first compares images as brightness functions, but morphological correlation coefficient characterizes correlation between brightness of the first image and geometrical form of second image.

Therefore, advantage of morphological method is associated with the possibility of improving the integration of image registration conditions. Introduced by morphological analysis the notion of «form» significantly enriches the radiometric properties of reference image, making possible to build a more robust detection algorithms.

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AUTOMATED CONTROL SYSTEM OF ENERGY SUPPLYING IN INDUSTRIAL BUILDINGS ON THE BASE OF SOLAR PANEL

The alternative energy producing and supplying are deeply studied by scientists and researches of many countries. A solar panel offers one of a benefit solution to the energy savings. The solar panel can be defined as a set of solar photovoltaic modules electrically connected and mounted on a special supporting basement. Each photovoltaic module is a packaged, connected assembly of solar cells. The solar panel can be used as a component of larger photovoltaic systems. The goal of the latter is to provide various consumers as municipal, commercial and residential facilities with ecologically generated and economically delivered friendly electricity.

It is know these solar assembles are rated with direct current output power according to standard conditions and ranged from 100 to 320 watts. Such solar cells can be packaged on one base and include solar cells assembling. The efficiency of a module determines the area of a module given the same rated output – an 8% efficient 230 watt module will have twice the area of a 16% efficient 230 watt module. A single solar module can produce only a limited amount of power; most installations contain multiple modules. The typical assembly of a photovoltaic