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MODERN UNLANDED AIRCRAFT LANDING SYSTEMS

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The rapid development and spread of the use of UAVs in many spheres of public life, actualizes the development of methods of modern UAV landing systems, as landing is the most difficult stage of flight. Experts predict that the number of UAVs by 2020 will reach a fantastic number - 2.7 million [1]. This requires the creation of a large number of compact "airfields" for UAVs with equipment that ensures safe departure and landing even in difficult weather conditions. The use of GPS to ensure take-off and landing does not provide the necessary accuracy to determine the coordinates relative to the "aerodrome". Because most UAV sizes are 1 - 2 meters, and GPS-navigation of multicopters provides positioning accuracy of 10 - 15 meters [2], which is not enough for safe departure and landing. Therefore, these departure and landing operations are carried out under the control of the human operator, and this significantly increases the cost of transportation and does not eliminate operator errors.

Departure security and automation will lead to less stressful work for operators, who will now only be supervisors, and many carrier companies will be able to obtain permits to transport goods using UAVs (danger of landing and delivery are the most common reasons for failure to transport goods in some countries).

Now there are known many systems that can help UAVs automatically landing or taking off:

1. Systems that use cameras. The main principle is to obtain an image with further processing. The software then sets the position of the UAV relative to the landing site. Such systems can be of two types: those that use UAV cameras and those that use ground cameras and transmit a location signal to the UAV. The first must have a certain test object at the landing site (this may be a drawing, a set of light beacons, etc.). With the help of such test objects, you can find out the flight altitude, landing angle, position relative to the landing site and many other necessary information. [3] In the second type of camera systems, such a test object is the UAV itself. [4]

Camera systems are usually based on computer training, which complicates their development, and therefore, these systems can give some errors. The main disadvantages are the high price, the complexity of the system and the large weight.

2. Another type of landing system does not use a camera. Each of these systems has a different principle of operation. For example, the system described in [5] has two components. The first unit is located on the landing platform and initializes the signal in the form of a so-called "rainbow" in the IR range. The second unit is located in the plane or object we are landing, and consists of a spectrometer, and then the signal goes to the control unit. This system is accurate, can measure range, and is safe for pilots. This makes it possible to use it for both UAVs and manned aircraft. But the price and dimensions of such systems will be large.

The idea of the proposed system is based on the creation of a predetermined number of encoded rays of optical radiation in space, with which the object can determine its position in space relative to the illuminated parts. The solution to this problem is achieved by using modulated radiation sources as transmitters of certain codes to a certain area of space with a frequency equal to or approximately equal to the frequency of the receiver. The proposed method of positioning requires an optoelectronic system, which consists of two parts: radiating and receiving. The radiating part consists of a control unit for optical radiation source units, optical radiation source units with optical systems and a power supply unit. The receiving part consists of photodetector units with optical systems, a unit for calculating the position and a power supply unit. [6]

The technical result is the creation of a compact and economical optoelectronic system for landing UAVs using coded rays of optical radiation in space.

As you can see, there are many positioning systems in the world. Most of them are systems that use cameras. Although such systems have high accuracy, their use is sometimes more expensive than the machine they control, and these systems are large and difficult to create. Other systems do not use cameras, they are in most cases also accurate, but dimensional. The price for these systems is lower than the previous ones, but still high.

The proposed method has high accuracy, small size and low cost, easy to design and operate, so this device has all the prospects for further development and improvement.

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[4] Paulson, "Infrared Landing System For A Mini Remotely-Piloted Vehicle," SPIEDigitalLibrary.org/conference-proceedings-of-spie, 20 November 2019.
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