The proposed architecture can be considered as a big set of equal channels - the "smart groups" of several pixels with read-out electronics and a digital microcontroller that can extract only the useful data and send it out. The working prototype of this facet element has demonstrated ability to measure distribution of speed and direction of optical flow thought its field of view in the very short time [5, 6, 7].

Keywords: facet vision system, programmable amplifier, signal processing, microcontroller.

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SIGNAL GENERATION AND READOUT IN MULTI BEAM DRONE POSITIONING SYSTEM

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The proposed multi beam drone position system does not use digital cameras during take-off, landing and goods delivery. The main idea is the application of the spatial structure of infra-red (IR) beams. These beams transmit coded data about the direction to the landing site in three-dimensional (3D) space.

This system contains parts: the first one is the illumination part. It is installed around a landing zone on the ground. The second part is the receiving part that is fixed on the drone [1-5]. The illumination part includes a power source, a control unit and two or more beam formation units (BFU), which illuminate low-energy IR beams. Each beam transmits digital codes that set the direction to the landing site in 3D space.

When forming a package of rays, it is necessary to calculate the length of the package, the width of one component of the signal, and the frequency of the signal. The length of the package is chosen by us, and the width and frequency of the signals must be coordinated with the frequency of the radiation receiver ($F_{res}=F_{em}$). This frequency is written in the documentation of the selected radiation receiver. The generation of a certain frequency can be done with the help of generation devices, hardware method or programming. In the case of [1-5], generation by software method using a microcontroller was used. The generation took place by turning on and off the LEDs with a certain time interval. Time is calculated as follows:

$$t_s = \frac{1}{F_{em}}.$$

Next, we need to set the width of one signal. To do this, using the documentation for the radiation receiver, you need to find out the time that the photoreceiver can receive the signal. Next, you need to calculate the number of pulses of a certain frequency:

$$N_{min} = \frac{T_{\min}}{t_s} \qquad N_{max} = \frac{T_{\max}}{t_s}.$$

where T_{min}, T_{max} – minimum and maximum time that the photoreceiver can receive the signal, respectively.

Having the parameters of a unit signal, it can be used to create a beam bundle.

The receiving unit receives these signals. The signal enters the radiation receiver, converts it into an electrical signal, which is fed to the microcontroller. In [1-5] signal processing is implemented using an interrupt. When a signal appears, the microcontroller switches to interrupt mode and executes the program recorded for this mode. When the next signal appears in the microcontroller, the interrupt flag acquires the value "1", the program checks this value after certain time intervals. If the value is "1", we write that there is a signal, if the value is "0", then there is no signal. Next, reset the interrupt flag to "0" and wait for the next signal. We do this until the whole package arrives. Further, this information is processed, and a conclusion is drawn regarding the position of the drone in space relative to the landing zone. The algorithm for calculating local coordinates is described in [6]

Keywords: LED, measurements, radiation sources, positioning system, landing system

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MOTORIZED FOCUS DRIVERS FOR DIGITAL MICROSCOPES

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Digital microscopes have become increasingly popular in various fields, such as biological research, medical diagnostics, and materials science, due to their ability to capture high-resolution images of microscopic structures [1-5]. One of the most critical components of a motorized digital microscope is a focus driver, which allows for precise control of the distance between the objective lens and the specimen. Motorized focus can also be combined with other automation features, such as autofocus units, motorized stages for specimen, motorized illumination units with optical filters and, etc. There are several types of motorized focus drivers that are commonly used in digital microscopes: servo, step, and piezo motor drivers [1-3].

Servo motor drivers use direct current motors, linear or rotation encoders and feedback loop to continuously adjust the position of the objective lens until it reaches the desired focus point. They are ideal for applications that require fast and precise focusing. Advantages of servo motor drivers are high speed, smooth movements, and good accuracy. The disadvantages are high price and complexity.

Step motor drivers can be programmed to move with definite increments. Their advantages are sufficient precision and repeatability, simple control, and compatibility with digital electronics. The disadvantages are noise and vibration.

Piezo motor drivers are incredibly precise, very stable and can fix the current position without power supply. On the other side, they are slow and very expensive.

The important parameters such as the range and speed of focusing, and the positioning accuracy and repeatability have to be considered for selection of focus driver.

Keywords: digital microscopy, focus driver, motorized focus, piezo-based focus.

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