IDENTIFICATION OF AN OBJECT NUMBER IN SYSTEMS OF ECOLOGICAL MONITORING

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We analyze here the problems of identification of the objects arbitrarily distributed in space by recognizing their numbers. The drawbacks of the existing identification systems are shown as applied to the problems of ecological monitoring of the environment. A device is proposed for recognition of an object number, which operates as a part of a lidar system and has no the above drawbacks.

The problems of ecological monitoring of the environment are closely related to the problems of investigation into physics of the World Ocean and air basin, their fauna and flora. In this case the list of the parameters under study has been considerably extended. However, a mere increase of the data bulk of the ecological monitoring systems makes it impossible to solve the problem of construction of ecological map of a locality.[1] For constructing a map we need to refer the obtained data coordinates to the territory, i.e., to the location of a measuring facility.

In the case of a stationary and a quasi-stationary location of sondes (e.g., a mobile system of ecological monitoring) it is sufficient to identify the current location of a sonde, operating at the moment, by determining its number. In actual practice the number of any object is determined, as a rule, by one of the following methods,[2,3] namely, by assigning a running number to an object or by transmitting a number by the object itself.

We consider the above methods as applied to the peculiar situation with the systems of ecological monitoring. Identification of the object by assigning the running number is widely used in the navigation systems. It is based on the sounding of space using radar systems or a challenger with a directional antenna.[4] As applied to the problems of monitoring, the systems of this type should operate with an active response, because the effective scattering cross section can be very small. However, the use of an active response is only sometimes possible due to a limited battery resource. Moreover, for preparation of the ecological map the availability of a running number of a sonde is insufficient since in the measurement process a sonde can move (a version of a mobile system), and, hence, its running number varies. All these shortcomings make impossible the use of the above method of object identification in mobile systems of ecological monitoring.

The number is often determined by its immediate transmission using an object itself. This can easily be implemented and does not require large expenses for equipment.[5] However, in the systems of ecological monitoring several tens of sondes can be used simultaneously that imposes strict requirements on the electromagnetic compatibility of the system. Consequently, for reliable identification of an object it is essential to introduce either the time-sharing, i.e., to synchronize the operation of all existing sondes or the frequency separation of channels that makes the system more complicated. In addition, the immediate transmission of number imposes the requirements on the system noiseproof. Hence the object identification by the immediate number transmission is not always applicable in the systems of ecological monitoring.

This paper describes the results of the development of a device for object identification by its number, being a part of a mobile system of ecological monitoring free from the above drawbacks.

In modern practice it is well known that the atmospheric monitoring, in particular, of the atmospheric transmittance over vast areas is convenient to perform using lidar complexes. The idea of the atmospheric transmittance monitoring is in the measurement of intensity of incident and reflected laser radiation. In this case the distance, travelled by light, is known or it is measured during the experiment.

The results of measurement of the intensity and transmission range are processed using the Lambert-Bouguer law[6] that enable us to obtain the unknown quantity: the atmospheric transmission coefficient. To decrease the parasitic scattering and absorption by an object (a building, a power transmission line support, and so on) acting as a reflector, a corner reflector (CR) is used. An omnidirectional (in the general case) block of photodetectors (BPhD) is placed immediately adjacent to a CR. BPhD converts a sounding lidar pulse to an interrogation signal of a

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sonde number (Fig. 1). The interrogation signal arrives at the delay line (DL) whose value depends on the sonde number. Thus delayed interrogation signal triggers a radio transmitter (RT), which emits a response radio pulse (to a sounding lidar pulse) or a special code group to increase the noise protection.

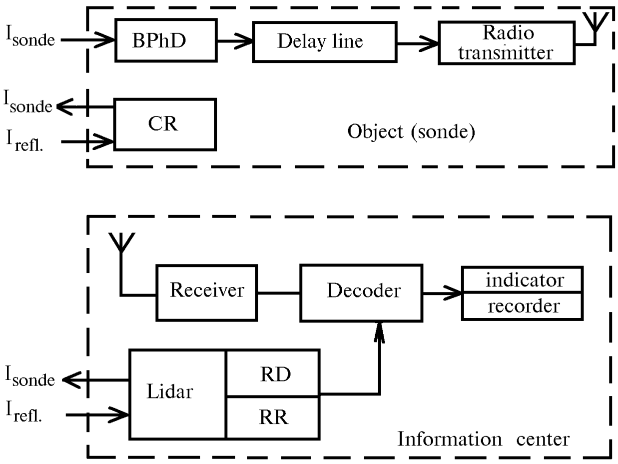

FIG. 1. Block diagram of the device for identification of an object number.

The response pulse, emitted by a sonde, is detected using a radio receiver (RR) located at a point of data acquisition (the lidar is also located at this point). Then the pulse arrives at a decoding unit intended for a sonde number decoding. The data on a sonde number are stored in the delay of input of a response radio pulse relative to a reflected one from the corner reflector and detected by an optical detector of lidar radiation. The time diagrams of operation of the device for determining the object number are presented in Fig. 2.

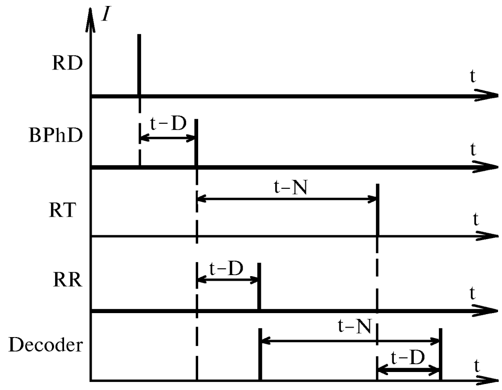

FIG. 2. Time diagrams of functioning of the device for identification of an object number.

A decoded sonde number arrives at an indication and recording device.

The advantages of the above-mentioned device are its simplicity and economy as well as the lack of disadvantages inherent in traditional systems for identification of an object number.

Field experiments have demonstrated the feasibility of such a device operation.

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