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ARTIFICIAL/ABSTRACT LANGUAGES AS AN ELEMENT OF INCREASING DRONE EFFICIENCY/RELIABILITY/SUSTAINABILITY ON THE BATTLEFIELD

Annotation. The presented results relate to the universal requirements and mandatory elements that determine the new capabilities of drones on the battlefield.

Keywords: drone, artificial language, efficiency, activity, battlefield.

Introduction. The drones are wide usage in combat operations. Many articles are on the control of drone movement, especially topology of trajectories and about abstract languages.

Transition to problem statement. Motivation. Today the anti-drone EWs are wide using. The jammers/drone identifiers (electromagnetic radiation of the drone itself) are the target. The need for constant communication/control with the drone operator is the target. The loss of control of the drone by the operator → shot down, crashed, self-destruction of the drone. The direction finding of signals to/from the operator, especially to the operator, as a drone has a wide radio signal pattern. It is needed the reduce signal exchange traffic by redistributing control between the drone and the operator.

Methodology. The drones are increasingly used as separate combat units (units) that replace the combat apparatus that was previously piloted by a person. However, it is not taken into account that the human role is to make decisions. Only in this a person cannot be replaced. There are already existing autopilots, automatic limiters, etc. for maneuvering moving objects (eg airplanes), automatic cars/taxis, etc. Taking into account all this, the constant drone-operator communication is no longer needed today. A human operator is needed only at the decision-making stage. That is, when you need to re-program/change the behavior of the drone. Here the re-programming/modification consists of replacing one piece of the drone's behavior with another piece that only changes part of the drone's behavior.

For people, language performs such a task. But every language is strengthened by learning. A person learns, brings to automatism some sets of actions (which correspond to given words/phrases). For this, a person often uses so-called "keywords" (=terms), which make up the so-called "professional language").

A drone control method based on artificial/abstract language. To form an artificial/abstract language, one must first formalize the activity of the drone.

It is necessary to formalize the separate operations that make up the activity of the drone.

For example, for an aerial drone, it can be: flight elements (course, altitude, aerobatic elements, etc.), activity elements (target to impress, attack trajectory, required weapon to use, etc.).

All such items must be programmed for the drone. Each of them should be marked with a separate "letter" of the alphabet of the language.

The "word" will then be a certain set of "letters" (which are performed by the drone in sequence). Let's emphasize that not all words are "allowed" in the sense that there will be "prohibitions" for certain "letters" to stand before/after certain "letters". This is quite obvious because not all elements of drone behavior can be performed sequentially, one after the other.

Thus, the "word" will correspond to a separate "element of typical tasks" that the drone can/should perform. This means that the "word" is an element of a higher order than the "letter".

Such "elements of typical problems" (="words") should already have a certain level of universality, that is, they can be used for a certain range of related problems and/or for a certain range of external conditions. However, it should be noted that in a number of cases it is possible to create "new words" that will describe the task of the drone only/exclusively for certain, fully specified conditions (they can be called "one-time words", and do not forget to delete them from the drone's memory after execution of this particular/specific task).

A "sentence" would then describe a fairly large (in some sense "closed") "fragment of a drone operation/activity)", or even the entire operation/combat task.

It is desirable to build "grammar" as analytical, when the "meaning/meaning" of the "word" will depend on its position in the "sentence".

Discussion and outlook.

Drone performs standard behavior/operations most of the time. Communication with a human operator is not necessary here.

For example, the approach of a drone to a target in the depth of defense requires the presence of a communication process only in a very limited number of points/fragments of its trajectory or moments of time.

The drone can transmit several photos for correction/non-correction of its further behavior. Such photos can be 1) compressed in volume, 2) transmitted at high speed (pulse), 3) transmitted by a narrowly directed channel. This will dramatically reduce the probability of 1) interception of information and 2) direction finding by the enemy.

Correction can also be done briefly using “letters”, “words” or “sentences”. For example, the correction may include the following flight elements: turn angle, required height, speed, etc. Transmitted correction, which uses an artificial/abstract language, is short-lived, secure (letter encoding may change frequently), use a narrowly directed channel.

The use of artificial/abstract language causes problems for the enemy to decipher. And replacing the encryption of individual letters will be an additional complication.

During combat, the use of artificial/abstract language allows the use of short signals, switching to other frequencies and other signal carriers (radio signals, lasers, acoustics, drone design fronts, etc.). At the same time, words can be repeated at different frequencies and by different means of communication.

The possibility of transmitting from the drone to the operator not a continuous video, but short fragments or even individual compressed photos. This reduces traffic volume, transmission time and increases management security.

Also in this case, information processing and selection of the (optimal) solution can be carried out on powerful computers of the command center. This will allow the use of much less powerful processors on drones.

There is a possibility of hardware multiplication/duplication of processors that arise in the process of training the drone. This allows you to record the learning results not as a program code, but directly into the drone's processor. As a result, this provides the possibility of serial production of a better "brain" for drones, which leads, as a result, to their cheaper price.

A part of the elementary operations of the drone will be performed “automatically”, that is, a person will not slow down the activity of the drone, as this excludes the human reaction time (which is several orders of magnitude greater than the “drone reaction” time and the influence of human emotions on both the reaction and the choice of an option decision).

In this way, both the cost reduction of drones and the improvement of the effectiveness of their combat use are achieved.

Aa similar approach can also be applied to coordinator drones, which will allow programming the behavior of an autonomous, hierarchically organized swarm of drones (see [1,2]).

References

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