

Self-Configured Optical-Electronic Station

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Abstract— In article definition of self-configured optical-electronic station of a robotics complex is given, process of a self-configuration and the results received in case of such method of functioning of optical-electronic station is described.

Keywords— robotics complex; self-configuration; optical-electronic station

I. INTRODUCTION

Robotics complexes developed now are applied to the decision both military, and civil tasks. Such complexes are equipped with a set of sensors which register different information. Extension of the nomenclature of sensors which are used in robotics complexes is dictated by the continual improvement of technology of obtaining information on a background situation on terrain and increase in complexity of tasks which are decided by a complex. The main source of information on change of a background situation is the optical device which accepts a signal in a visible or infrared range of lengths of waves. In a robotics complex the optical receiver of radiation is a part of optical-electronic station (OES). OES of a robotics complex includes the optical pickup or their set and computing block which executes data handling. There is a set of options of the hardware configuration of OES. The hardware equipment of OES of a robotics complex is defined by specifics of the solved task, financial possibilities of the developer or the customer, existing restrictions on use of some instruments and other conditions.

II. PROBLEM STATEMENT

In many cases some research-and-production organizations are engaged in development of one perspective robotics complex. Respectively, the hardware and program composition is designed without rigid coordination among themselves. Sometimes the customer completely supervises all development process, and sometimes on such inspection it hasn't enough time, and, occasionally, and profound knowledge of the theory of the hardware and program creation of robotics complexes. In that case, cost of a robotics complex can appear much uprated. A row of functions which are put by the developer in the software, can appear unrealized. For execution of all functions more efficient computing block with high clock rate of the central processor and higher resolution of a matrix of the optical device can be demanded.

In too time, the hardware composition which is implemented in a complex it can to appear excessive from the point of view of quality of an obtained signal (high resolution of a matrix of the optical device) and productivity (high frequency of the processor). Differently, the software which integrated into computing means of OES won't be to "use" all

the possibilities provided by the OES hardware composition. In this option cost of a robotics complex and its size and weight characteristics will appear uprated. It, in turn, will affect maneuverability, survivability and other tactical technical characteristics of a robotics complex.

The urgency of a scientific and technical problem of support of self-configurability of OES of a robotics complex depending on specifics of the solved task and the hardware composition of a complex is defined by the foregoing.

Self-configurability of OES of a robotics complex includes possibility of automatic creation of algorithms of the solution of the task, further formation of sequence of application of the constructed algorithms and intellectual decision-making for the subsequent actions depending on an environmental situation and requirements of the operator.

Strategy of unification of the software of any system brings in further the notable income to manufacturer, releases from laborious preparation of the considerable volumes of the accompanying documentation, reduces volume of carried-out preliminary tests of a product and its finite cost. Conclusive advantage of self-configured OES is independence of the OES hardware composition of a robotics complex. It is especially actual in case of serious restriction of the list of devices which are included into the hardware composition of a robotics complex, or existence of rigid requirements of the customer on a configuration of the hardware composition of a complex.

III. DEVELOPMENT OF SELF-CONFIGURED OPTICAL-ELECTRONIC STATION

The process model of a self-configuration of OES during monitoring of a background situation in the given sector is provided on fig. 1.

For development of self-configured OES it is required to solve the following problems:

- Design of mathematical models by means of which it is possible to evaluate influence of characteristics of the OES hardware composition on type of algorithms which are used in OES.
- Development of techniques of intellectual self-configuring of OES of a complex with use of neural net and methods of dynamic creation of algorithms.
- Development of the concept of parallel computings with use of the OpenMP [1] technologies for self-configuring of OES on multi-core processors.

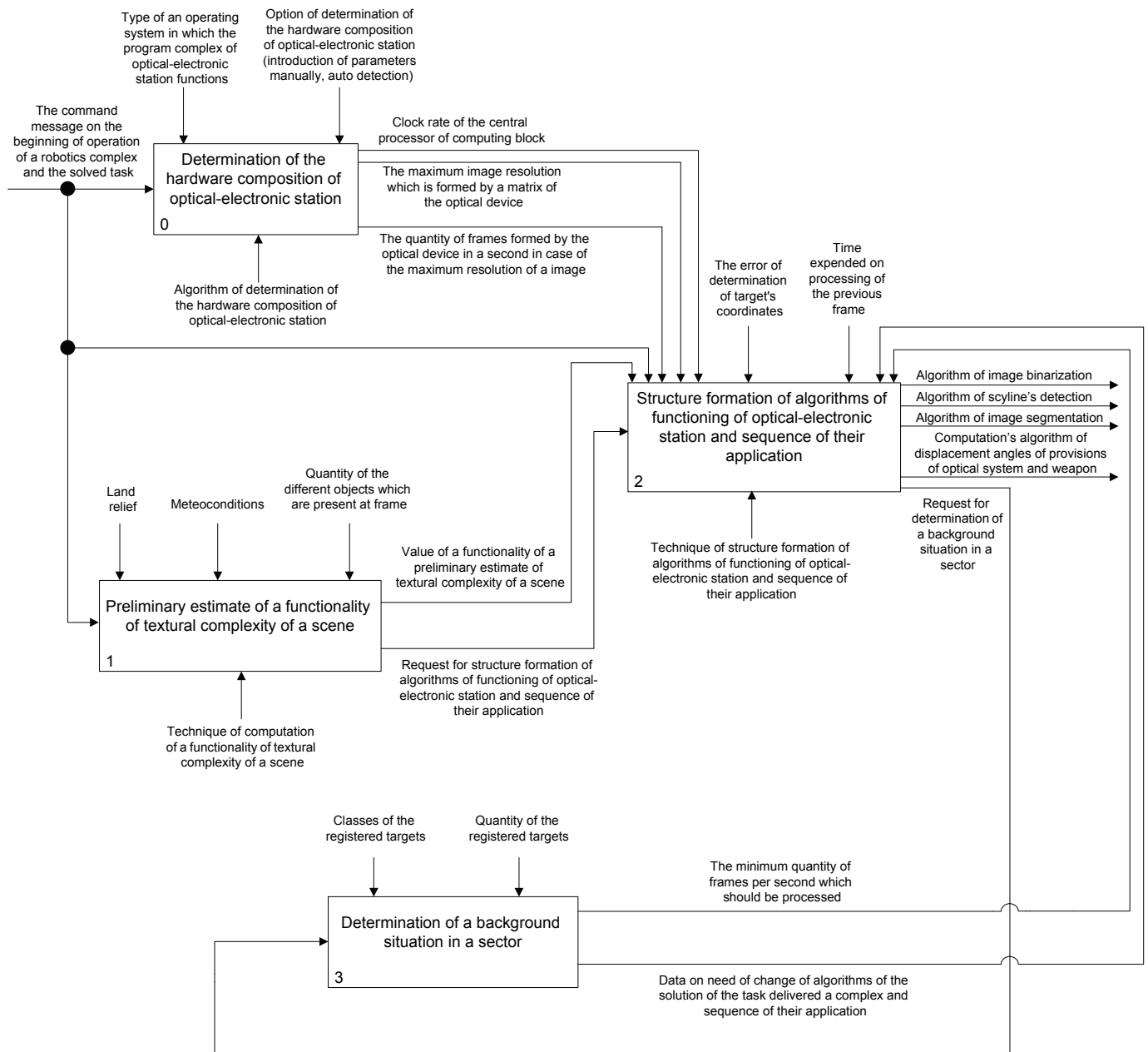


Figure 1. Class IDEFO model: process of a self-configuration of optical-electronic station during monitoring of a background situation in the given sector

By means of design of mathematical models, development of intellectual techniques of structure formation of algorithms of processing of video signal and sequence of their application it is possible to create the self-configured OES. The robotics complex equipped with such OES, will operate is adaptive to the current situation in a patrolled zone.

Process of a self-configuration of OES begins after receiving by processing system of video signal of the command message on the beginning of operation of a robotics complex and parameters of the task which solves a complex. In the beginning the OES hardware composition is defined by processing system of video signal. Along with it the preliminary estimate of a functionality of textural complexity

of a scene is executed. The data received after carrying out two above described procedures, are transferred in shaping unit of structure of algorithms of functioning of OES and sequence of their application. On an output of this unit algorithms of binarization, segmentations, determination of the skyline, computation of displacement angles of positions of the optical device and the weapon are created. The created adaptive algorithms of processing of video signal allow a robotics complex to be prepared for fractions of a second for actions in any background situation of a controlled segment, without losing thus high-speed performance and accuracy of determination potentially dangerous objects. After formation of the list of algorithms of processing of video signal and sequence of their application the request for determination of a

background situation in a sector for the subsequent adjustment of the created algorithms moves.

IV. CONCLUSION

Existence of self-configured OES of a robotics complex and new techniques of processing of video signal which are integrated into means of OES will allow to use effectively existing hardware basis with the maximum return. Lowering of expenses for creation of unified OES will allow to reduce the finite price of a product. Low cost of OES along with the hardware-software composition excluding a superfluous overpayment for functions in which there is no need, and

novelty of used algorithms of information processing play a crucial role in case of a choice of a robotics complex for the solution of a certain task.

Described self-configured OES is possible for using also as a part of piloted complexes of aircraft, unmanned aerial vehicles and other various systems of military and civil assignment equipped with optic instruments.

REFERENCES

- [1] Antonov A.S. Parallel programming with OpenMP technology use: Manual. – Moscow: Published MGU, 2009. – 77 p.