

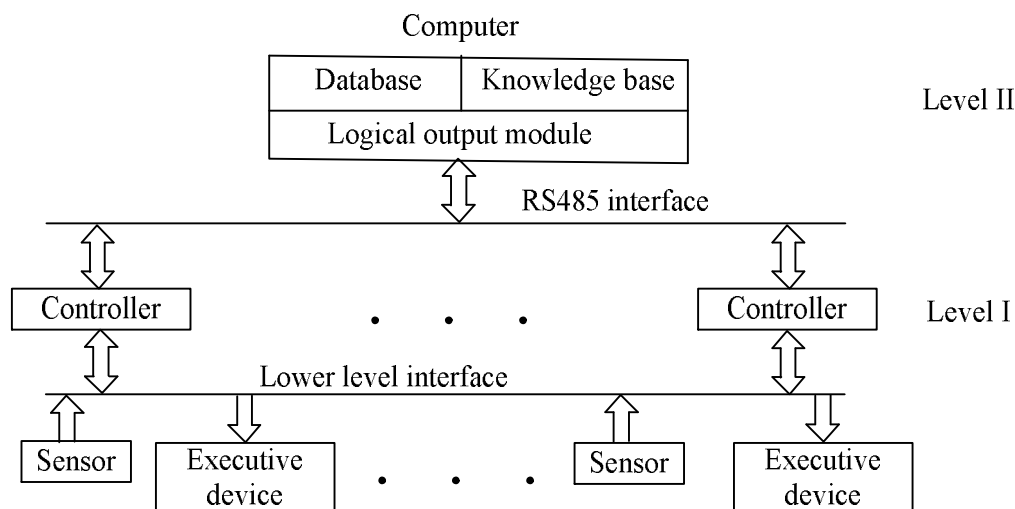
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## INTELLIGENT ALGORITHMS FOR AUTOMATION OF BIOTECHNICAL OBJECTS

**Abstract.** The agrarian sector of Ukrainian economy demonstrates stability in the filling of the state budget in recent years. Companies producing livestock and crop products on an industrial basis play an important role in this process. Noteworthy, poultry farms, greenhouse enterprises, factories for the production of mushroom products, grain farms are among them. Why the attention is paid to them? The share of energy in the structure of the production cost reaches 15-80% for poultry farms, greenhouse plants, mushroom growing plants, and therefore its reduction increases profit and this becomes the goal for such enterprises [1].

**Keywords:** Biotechnical objects, energy saving, intelligent algorithms, identification, fuzzy algorithms for information processing.

The specified tasks are implemented based on the introduction of computer-integrated automation systems using intelligent control algorithms (they are promising in terms where uncertainty is manifested, and these conditions are specific for objects with the biological component and randomly acting perturbations). A simplified, typical scheme for such a system is shown in Figure 1.



*Fig.1. Simplified scheme of the automation structure*

**Poultry farms.** Traditional automation systems for such enterprises operate without taking into account natural perturbations (mainly temperature), their evaluation, identification, forecasting, the market value analysis for products, energy sources. The application of the results based on the theory of games and statistical decisions makes it possible to form a management strategy leading to savings (9-10)% of energy based the use of payment matrices [2].

**Greenhouse enterprises.** The yield and quality of plant products in closed-ground buildings are significantly influenced by natural disturbances such as ambient temperatures and solar radiation. Their prediction is possible using of neural networks, while taking into account the quality of plant products as a feedback in control systems, operating based on intelligent algorithms, allowing getting the maximum possible profit [3].

**Cereal farming.** Grain farms in Ukraine are aimed at cultivating such crops as corn, wheat, barley, rape, etc. At the same time, spring introduction of fertilizers for nutrition is an extremely important factor, since it largely forms a crop. In addition, the time of fertilization is limited, and their cost is substantial. All of this requires new approaches to crop programming, which facilitates the possibility of maximizing

profits, which, in a market economy, is a key criterion for the efficiency. In addition, the protection of crops from pest requires significant costs, which also affects the production cost.

In addition, modern agriculture requires the introduction of fertilizers according to the needs of plants with anchoring to geographical coordinates, and harvesting – with minimum energy losses. This becomes possible due to the use of the so-called sheet diagnosis based on vegetation indices and the definition of the optimal routes for moving fertilizing and harvesting machinery. All this is implemented using unmanned technology, neural networks for the construction of mathematical models of vegetation indices distribution and dynamic programming for laying optimal routes.

Recently, considerable attention is paid to organic farming, which is explained by the high quality of the above products. At the same time, biological means of pest control become the main tool. Moreover, effective growth of entomophages in specialized boxes becomes possible only under conditions of high-precision maintenance of technological parameters at minimum energy costs in conditions of uncertainty (perturbation, incomplete information regarding the states of the biological component and the combined effect of various influences on them). Such a task becomes possible by using fuzzy information processing algorithms and forming management strategies on this basis.

Consequently, the use of intelligent algorithms for the automation of complex biotechnical objects makes it possible to save energy resources while ensuring the corresponding quality of production.

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