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METHODOLOGY FOR DESIGNING HARDWARE AND SOFTWARE FOR SENSORS OF MECHATRONIC MODULES

NURALIYEVA MUNISA BAXTIYOR KIZI,
2 - Course Student of Master Degree At
Tashkent State Technical University Named After Islam Karimov

ABSTRACT:

The article discusses the methodology for designing hardware and software for sensors of mechatronic modules. It analyzes the purpose and objectives of mechatronics as well as the structural composition for the design of mechatronic devices.

KEYWORDS: mechatronics, intelligent machines, design methods, computer controls, information processes, designing hardware.

INTRODUCTION:

Mechatronics is a modern area of science and technology that has been rapidly developing in recent years all over the world.

The goal of mechatronics is to create intelligent machines and moving systems (robots) with qualitatively new functions and properties. The subject of mechatronics is design and computer control methods, as well as new technological and information processes that ensure all stages of the life cycle when creating new modules and machines.

The task of mechatronics is to integrate knowledge from previously isolated areas (mechanics, computer control, information technology and microelectronics). A scientific and technical solution can be considered "mechatronic" if all the components do not just interact with each other, but at the same time the formed system has new properties [1].

Today, the market for high-tech products is subject to strict price / quality requirements for a new generation of machines. Mechatronics has already entered not only professional but also everyday life of a modern person. Household machines, automobiles, and digital devices are built on mechatronic principles. Therefore, in recent years, a number of global manufacturing firms have been promoting their new products to the market under the mechatronics brand.

The rapid development of mechatronics in the world is a natural process, which is caused by fundamentally new market requirements for the quality indicators of technological machines and moving systems. Recently, a class of machines or machine assemblies has been based on the use of the achievement of precise mechanics, including micro-and nano-sized. Consider the structural composition for the design of mechatronic devices:

1) Numerical control devices;
2) Means of providing information to people;
3) Converters (signal preparation devices);
4) input devices for data from a human operator;
5) Devices for logical and hardware coordination of some devices with others (adapters);
6) Sensors of the state of mechatronic devices;
7) Output mechanical link;
8) Electromechanical converters;
9) Controlled power supplies.

When mechatronic units (modules, links) are combined, a mechatronic machine is formed, which subsequently acquires the possibility of controlled movement. In the design of macro mechatronic devices, in general, the same methods and techniques are used as in the design of mechanical engineering and instrument-making products. The design of micro and especially nanomechatronic products is distinguished by significant specificity related

to the features of technology and modeling, calculation methods, skills and knowledge of the developer.

In design, the emergence of something new is by no means an unpredictable, uncontrollable, random event. The theory and practice of design have developed a special technology for the design search for new solutions, which rationalizes and accelerates this process.

This technology is called pre-project analysis and has a universal character, since valid for design tasks of the most varied class and type.

The essence of the pre-project analysis methodology in environmental design consists in dividing the research process of the situation proposed to the designer into a number of stages, independent in terms of goals and results of work:

1) Inspection, acquaintance with the situation, the context of the placement of the future object, the list of properties that it must possess. The technique of this stage: the study of analogues, review of literature data and real prototypes, clarification of their positive and negative qualities, formulation of direct tasks for further work.
2) The designer sets himself the task of perceiving the task as a problem, i.e. collision of contradictions between the circumstances of the future life of the object and the operational characteristics of its structures.
3) Comparison of proposals considering individual nodes of the problem, bringing them together into different options for a general solution, and choosing the most effective option among these options.

This is not a project yet, but a design concept, a fundamental design idea of a future project, but already containing its really imaginable forms: engineering, technical, spatial, procedural, etc.

All variants of the tasks of the compositional organization of environmental complexes can be divided into two groups: "design without analogues" - the creation of fundamentally new objects, where previously unknown technical, spatial and figurative parameters are synthesized; "prototype design" is the introduction of new qualities into the look or technical solution of objects and systems that are already familiar to the consumer. We are talking about the improvement, modernization of the proven method of organizing the environment, the adaptation of a worked out technical or spatial scheme to new tastes or circumstances.

Of course, the consumer in both cases receives a new type of service, a new product, a new solution to the environment. However, the nature of the project activities is far from the same.

The design of the functions of various elements of a mechatronic device should be carried out in such a way that the goals of the product's service purpose are achieved by the joint performance of these functions without duplication and with maximum effect (principle of synergetics) [2].

Achieve qualitatively new characteristics allows constructive integration of system elements into a single module. Combining components different in their physical essence in one device is a difficult task. Its solution is based on modern scientific and technical knowledge in the field of design, manufacturing technology and machine control, combined with engineering intuition and invention, without which a successful and original solution is impossible.

Further development of mechatronics will be determined by how effectively the assigned tasks will be solved in the development and production of mechatronic modules, systems and machines of a new generation. At the same time, the technical and economic efficiency of

modular design technologies is determined by the following main factors:- reducing the time and labor intensity of designing multi-axis mechatronic machines, relatively low price due to the high level of unification and standardization of elements and interfaces;- the ability to quickly reconfigure the system into a specialized machine for a specific technological task without functional redundancy;- increased reliability and maintainability of complex complexes during operation, since the modules are the object of serial production [3].

In the history of world engineering, mechatronic and robotics products are a relatively new product; their development is not excluded from the general development of engineering.

At the same time, there are many different views on the design of mechatronic and robotic devices. There are even more design methods and techniques governed by corporate, industry and even government regulations.

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