

Training of specialists for implementation of the agriculture digitization programme

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Abstract. The paper discusses the prospects of the economy and agriculture digitalization, the problems of training qualified IT-specialists in the field of computer technology for the implementation of this task. Also, briefly discussed the main aspects of the training of such specialists, as well as the technology of their training, which forms an interest in the engineering profession.

Keywords: AIC digitization, digital economics, computer equipment, pedagogical technologies, project method.

Currently, in connection with the implementation of the economy digitization programme [1,2], more and more attention is being paid to the use of information technologies in various spheres of economic activity. In turn, the digitalization of the agro-industrial complex (AIC) is one of the key areas of development of the digital economy program.

At the moment, the authors tend to highlight the following areas in the digitalization of the AIC:

- Creation of digital platforms that will directly bring together producers and consumers, as well as provide an opportunity for users to monitor the status of the purchased product in real time [3].
- The use of biomashsystems [4] based on neural network technologies and big data processing.
- The use of CNC machines in the AIC, production robotization [5].
- The use of “smart” sensor systems in agriculture that ensure high efficiency of land use [6].

Today, solutions in the field of AIC digitalization are based on the use of modern computer technology. However, the implementation of the digital economy program faces the problem of a lack of qualified engineering personnel. This problem should be solved at the level of higher educational institutions, by strengthening the involvement and internal motivation of students to receive education, and, as a result, improving the fundamental education in the field of computer technology. That is impossible without the implementation of new pedagogical technologies.

The aforementioned areas of AIC digitization increase the requirements for the qualifications of university graduates, this leads to the need to incorporate elements of the professional unit disciplines into the first year curriculum, simultaneously with the study of basic disciplines. Since this is a matter of engineering education, it is advisable to begin the education of the future engineers by the

formation of the real computing systems design process concept with the subsequent deepening of the knowledge and skills, acquired in the study of special subjects at senior courses. According to [7,8], the design process of any computing system consists of the following steps (Figure 1):

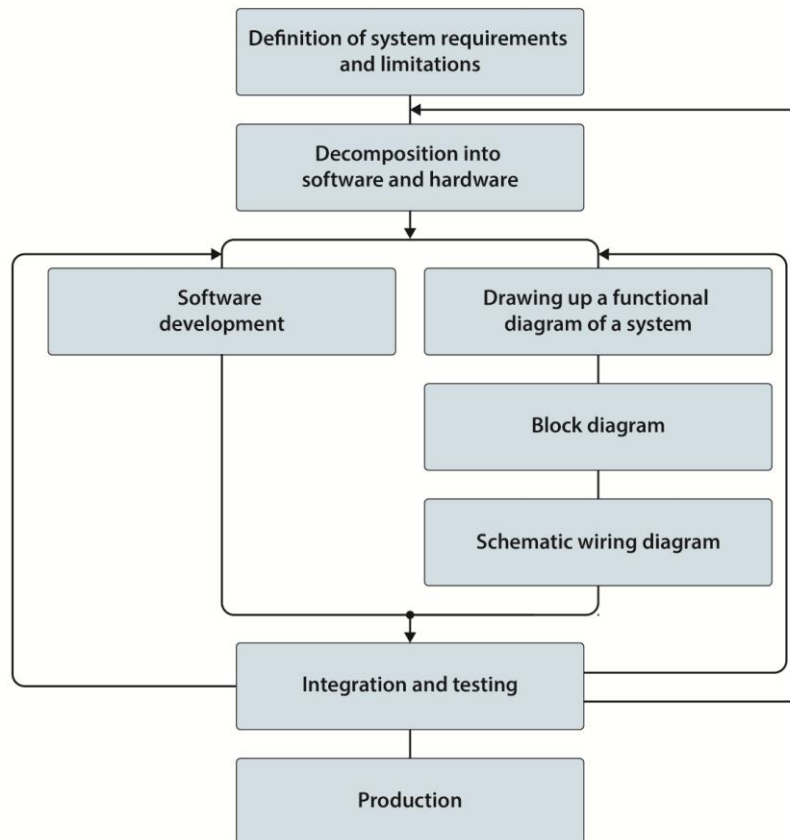


Figure 1. The generalized process of computing systems designing.

In the case of building an educational process in full accordance with the process of designing computing systems, it is advisable to apply the project method, but not as it is, but with the addition of certain adjustments.

These adjustments are due to:

- different levels of students' education on the start
- the need to form basic knowledge of the computing systems work principles, which should be the same for all students by the end of the course.

Subsequently, this will contribute to a better learning of new knowledge gained in special subjects.

In the current practice, most of the projects ends with theoretical research in the subject area and preparation of a certain report, and have no practical implementation. Such a situation often demotivates students, creating the impression of excessive theorization of the material being studied and the lack of practical benefits of the education received. This problem, of course, requires a solution, which may consist in the full coverage of all the stages of the computing systems design, bringing it to a laboratory (experimental) prototype. In this case, apparently, we should start with a consideration of the generalized structure of the computing systems (Figure 2).

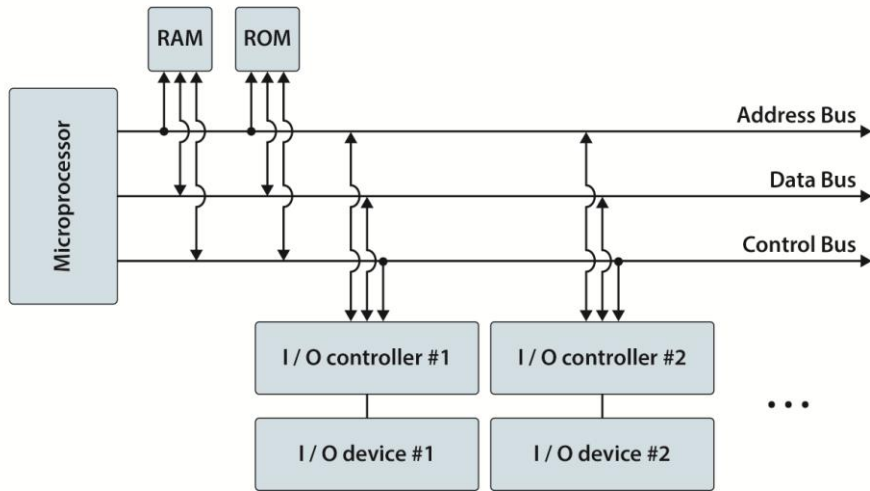


Figure 2. The generalized structure of the computing systems.

To solve the problem of formation the same set of knowledge for all first-year students, which will serve as a basis for further education, subject to the mandatory practical consolidation of the material, it is proposed to use the generalized structure of the computing systems as a block diagram (Figure 1) [9]. The use of the most simplified and abstract entities will allow students to form a scalable system of knowledge.

Here it is necessary to dwell on the input-output devices, which can be divided into the following large groups:

- data collection devices (usually sensors),
- actuators (motors, relays, etc.),
- user interface (display, buttons, speakers, etc.).

Thus, the structure of the computing system becomes more detailed (Figure 3) and becomes the only limitation in the students work.

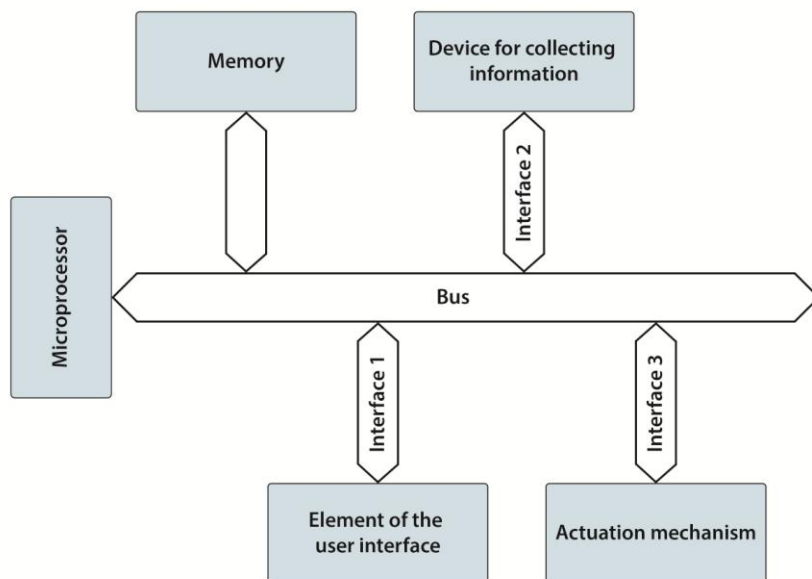


Figure 3. The structure of the computing system.

This preserves the adaptability inherent in the project method. The proposed structure of the computing system provides the full coverage of the subject area, leaving space for students to do when performing projects - they can vary the number and type of the I/O devices during project at their own discretion, changing the program part and the set of functions performed by the system accordingly.

Students can implement in the form of a laboratory (experimental) prototype various systems for automating the activities of enterprises when carrying out projects using the proposed methodology, including the systems for monitoring and managing AIC facilities. Below is a typical design task.

Example. Automation of measuring the weight of agricultural products.

Develop a subsystem for automatic weighing of the harvested crop in transport. This subsystem should perform the following functions:

1. Monitor the position of transport with agricultural products on the scales.
2. Notify the driver about the need to adjust the position of transport.
3. To collect data on the time of departure and arrival of transport, the weight of agricultural products.
4. Send data to the server to collect statistics.

The task involves the development of a system that includes:

- user interface elements
- data collection devices
- devices for storing and sending information to the server.

Obviously, this system fits perfectly into the main trends in the AIC digitalization. The data transmitted to the digital platform server can be used by the Ministry of Agriculture of the Russian Federation and the Federal State Statistics Service of the Russian Federation for collecting statistics, the consumer can observe in real time the production of the purchased goods. The use of neural network technologies elements in the analysis of these data will provide opportunities for forecasting and making decisions on improving the efficiency of use of agricultural resources.

The proposed pedagogical methodology implies the possibility of implementing in the works of first-year students both elementary nodes and full-fledged and complex systems, for example, greenhouses, poultry houses, farms that are fully and automatically serviced; contributes to the formation of a sustainable set of basic, fundamental knowledge about the development of such systems, activates the professional and personal growth of students in the University.

In turn, improving the quality of engineering training and the possibility of a wide range of applications of computer equipment in the real conditions of agriculture is one of the ways to solve the tasks set by the Digital Economy Programme.

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