ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 9| Issue: 7| July 2023|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2023: 8.224 || ISI Value: 1.188

FEATURES AND APPLICATION OF ROBOTIC LABORATORY DEVICES

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ANNOTATSION

This article discusses the problem of using elements of robotics in the educational process of physics in higher military education, as well as the features of using robotic laboratory equipment in laboratory work in physics in higher military education. Emphasis was placed on the development of creative activity of cadets and students through the introduction of elements of robotics into education.

KEYWORDS: ***elements of robotics, educational technology, the study of physics, robotics in teaching and physics practice, robotics training modules, robotics educational projects, robotics, laboratory equipment robotics, robotics experiments, robotics lessons, robotics objects, NXT 2.1. Data logging, MINDSTORMS.***

Elements of robotics have been used in the world education system for 15 years. Robotics education is considered as a means of forming the engineering thinking of cadets and students of the higher military educational institution, getting them interested in creativity and applying it in practice, increasing their interest in engineering activities, professions and specialties.

For the development of robotics education, the following sufficiently complex educational issues should be put before the higher military educational institution:

1. Updating the resources of polytechnic learners, taking into account the direction of technical innovations such as robotics;

2. Organization of introducing innovations into the industry using robotics elements;

3. Organization of conducting a number of scientific and research works aimed at the development of robotics education.

Knowing the basics of robotics should be one of the main links of education for cadets and trainees of higher military educational institutions, and should also be included in the curriculum. Such reforms are being implemented in a number of developed countries of the world. For example, in the higher military educational institutions of the USA and Great Britain, preparing cadets and trainees for the development of technical projects with the help of robotics is considered a promising task.

Competition-based robotics is developing day by day in our country, thematic events are being held and mostly young people who are engaged in technical creativity participate in them. But the number of participants among cadets and trainees of the higher military educational institution is significant.

The Resolution of the President of the Republic of Uzbekistan No. PQ-5032, signed on March 19, 2021, "On measures to improve the quality of education in the field of physics and develop scientific research", talks about "ensuring the inextricable connection of scientific research in the field of physics with production, expanding the scope of scientific work aimed at solving problems in economic sectors". Based on the modern requirements for the training of specialists in fire safety and technosphere safety, it is undoubtedly an urgent issue to analyze and improve its quality [1].

In addition, M. G. Ershov's generalization of the results of scientific research works entitled "Ispolzovanie robototechniki v prepodavanii fiziki" and "Vozmojnosti ispolzovaniya obrazovatelnoy robototechniki v prepodavanii fiziki" conducted by M.G. This technology structure consists of 3 components[2,3]:

1. As an object of study;

2. As a learning tool;

3. As a means of increasing the creativity of cadets and listeners.

In addition

The use of robotics elements in the teaching of physics in higher military educational institutions was experimented for the first time at the higher educational institution in the city of Ferm of the Russian Federation. The experience was related to the study of robotics in the field of applied technical knowledge. The experience lasted for 3 years. Based on the experience, thematic educational modules were developed and included the following educational materials:

1. Learning the elements of robotics through physical foundations;

2. Carrying out physical experiments using robotics elements;

3. Creation of robotic technical object models as physical and technical applications;

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4. Carrying out robotic laboratory work at various levels;

5. Organization of project work on robotics.

Each module includes theoretical information, instructions, methodological recommendations, as well as photo and video materials on assembling robotic devices, computer programs. Each element of the module is inextricably linked with the science of physics and is aimed at expanding and deepening the knowledge of cadets and listeners in science.

It will be necessary to develop a curriculum as an object of learning robotics in the educational process. The structure of such programs is divided into 2 contents:

1. System of knowledge about robotics;

2. Experience of educational activities in accordance with the system.

In the first part, it is necessary to consider the physical operation of ready-made robotic systems at different stages of practice, while in the second part, it is necessary to study the main elements of the technology of applying robotic technologies. The second content provides for the formation of basic skills in designing and constructing robots with a simple structure and making them [2].

The above-mentioned content should become an object of study within the framework of various subjects of the curriculum (physics, mathematics, informatics, etc.). The role of physics in the study of robotics by cadets and students can be analyzed as follows:

1. Physical principles of the functions of robotics elements and the possibilities of higher military educational institutions in their study;

2. Physics laboratory experiments organized on the basis of robotics elements;

3. Possibilities of making modeling technologies and robotic devices and organizing these activities within the framework of science education.

The analysis shows that studying the physical basis of the operation of robotic systems is one of the main tasks of higher military educational institutions.

In order to learn the elements of robotics, the following issues should be included in the physical science curriculum:

1. Information on the history of robotics and its development prospects, the role and importance of robotic systems in the modern technological environment;

2. Fundamentals of the philosophy and methodology of robotics, characteristics of a robot as a technical object, types of robots, laws of robotics;

3. Computer and natural modeling of robots based on a cybernetic model of a robot, basic approaches to the design of robotic systems, special kits for making robotics and special software;

4. Modern solutions and technologies in the field of making and programming robots.

In the course of research, the principles and structure of the main devices that perform the work of each system of the robot cybernetic model are analyzed. As a result, information on basic physical phenomena and laws is developed for teachers of physics teaching the principle of operation of these devices [3].

If we pay attention to the scientific and research work being carried out today, we can see that robotics is widely used in their implementation. The need to use robotics in conducting scientific research is determined by the important functions of the robot as a technical object. A robot can replace a person in extremely heavy, continuous, dangerous and difficult experimental work. The advantages of robotic experimental devices undoubtedly include better research quality, a wide range of data recording and high accuracy.

Forming the skills of cadets and trainees on robotics experience is currently an urgent task. In general, adding a fully robotic experience to the science curriculum is critical. It will be convenient to record and process data in automatic mode, as well as manage experience. Such a robotic device must perform important mechanical actions and adapt to the required mode of operation. For example, controlling the temperature of the objects being studied, bypassing resonance frequencies, controlling the parameters of the electrical circuit, ensuring that the pressure of the gas in the tank is kept constant, etc. The quality of measurements increases due to the use of data-gathering sensor systems in conducting robotic experiments. An opportunity to automatically influence the learning object will appear. The accuracy of given exposure parameters increases, the possibility of automatic control of these parameters appears. The presence of electronic elements in the hardware part of the control system of the robot, as well as the availability of its modern software with the speed of the computer, achieves a quick reaction to external influences and a high sensitivity of internal changes in the robotic system.

The reaction of the robotic system to any impact can last for a certain time. The robotic experimenter is able to automatically manage and control the state of its internal system according to various parameters. For example, the accuracy of the angular rotation of the shaft of the electric motor of the educational robot is 10, which provides a sufficient amount of rotation balance of the object being studied, the smoothness of the forward movement of a mechanical part, and the strict periodicity of its vibration.

As an example, we can cite some robotic laboratory devices. It serves to study the dependence of the oscillation period of the spring pendulum on its mass and the stiffness of the spring. The experiment is carried out in two stages. A series of mechanisms are activated to ensure that the mass of the pendulum changes due to an increase in the number of loads, and as the stiffness of the spring increases, its elasticity decreases. Disequilibrium of the system and emergence of free oscillations occurs automatically. The period values of the oscillations of the spring pendulum are displayed on the microprocessor screen with the help of special modern software.

It is possible to display the results of the experiment graphically. System sensors monitor the experiment in the given mode. The experiment can be repeated several times, while the values of the loads and the stiffness of the spring can be changed. Based on the results of this experiment, students can draw conclusions about the laws of oscillation of a spring pendulum.

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As another example, a model of the protection system was developed to prevent the overheating of the reactor of nuclear power plants and, as a result, the occurrence of fires. The protection unit of the reactor was assembled based on the use of sensors (Super Pro Prototype Sensor) based on the designers and connected to the Mindstorms microprocessor unit. The protective unit has a separate button for turning off the reactor, and a switch-switch for switching the reactor to unprotected mode. The possibility of turning off the protection unit made it possible to model the accident process of the Chernobyl NPP in the pump start-up model. A flame detector was used in the system for fire protection. When the sensor went off, the reactor was put into nuclear shutdown mode, the siren went off, and a rescue robot arrived in front of the reactor with an infrared sensor to find the source of the fire.

Important educational functions of robotics have been identified during current scientific and technical research. It is important for the teacher to know and expand these functions, which directs them to their use in the educational process. Let's take a look at these features:

1. Teaching function - teaching cadets a new and socially important technical culture, acquiring modern polytechnic knowledge and skills, and achieving the necessary and necessary technical and technological competitiveness by engaging in robotics.

2. Developmental and educational function - the application of robotics education in the educational process forms a set of mastering and understanding processes in cadets (sensing, thinking, imagining, speaking, etc.). The uniqueness of this effect is related to the high level of motivation in robotics. Direct manual labor and practical skills of independent solving of certain technical issues and advanced actions in solving them are the main factors of such effects [4].

The project activities of robotics cadets should always be connected with subjects in the educational process. It is appropriate to support such activities with robotics Olympiads. This ensures the creative qualities of robotics projects and raising team activity to higher levels. Implementation of disciplinary and interdisciplinary robotics projects by cadets and trainees is one of the important areas of application of robotics in the educational process.

As a result of the conducted research, we draw the following conclusions:

1. The technical creativity of cadets and trainees of higher military educational institutions is related to the development trends of the infrastructure of robotic facilities.

2. Pedagogical experiment-testing will allow robotics to be included not as an additional education, but as a basic education, and to find solutions for its effective use.

3. It became clear that in the application of robotics there is a need for necessary textbooks on physics, robotics education kits and special software. Restoration of the connection between technology and natural and mathematical sciences increases the effectiveness of the educational process.

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