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USING ROBOTIC TOOLS IN DEVELOPING TECHNICAL CREATIVITY OF STUDENTS

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Abstract: *The use of innovative techniques and technologies is required to find a practical solution to problems in the socio-economic and educational spheres on a global scale. Currently, in developed countries such as England, Germany, Korea, Russia, France, Japan (LegoMindstorms, LegoWeDo, Huna, Arduino, Matrix), students of different age groups are engaged in robotics, robotics elements are used to develop students' technical creativity competencies. issues are being researched in leading universities and educational centers of developed countries [2, p. 4]. In the world, a number of researches are being carried out on the effective use of robotics elements in the development of the technical creativity competencies of schoolchildren, and the improvement of the technical creativity competencies of students.*

Key words: *technical creativity, technique, technology, modern tool, robotics elements, Arduino board.*

I. Introduction

One of the important tasks of the modern school is to direct the development of students' creative initiative and independence, construction and rationalization skills. In this regard, the role of technical creativity in the formation of a well-rounded person is increasing [68, p. 74]. The need to develop technical creativity in the initial period of education is confirmed by many years of experience of scientists, teachers and psychologists.

II. Literature review

Currently, technical education is one of the important aspects of economic development trends. In this situation, it is a requirement of the time to widely introduce and develop the achievements of technical education in the educational process of general education schools [4, p. 5]. In this sense, it should be noted that the application of the achievements of robotics, widely used in the education system of developed countries, to the educational process of the comprehensive schools of our Republic is one of the most urgent issues today. Forming a person capable of setting independent educational goals by applying modern scientific and technical achievements in the educational process, developing methods of education, monitoring and evaluating scientific and technical achievements, working with various information sources, evaluating them, on this basis, the task of educating a creative student capable of independent thought and observation is solved.

Today, robotics in education can be considered as interdisciplinary classes that combine science, technology, engineering, creativity, programming and help to develop technical creativity from kindergarten [1, p. 16]. This process led to the fact that robotics began to be taught in secondary schools as part of technology classes or extracurricular activities (clubs) for elementary school students to engage in creative activities.

III. Analysis

Developing students' interest in inventive and research activities in the process of engaging in technical creativity is one of the most urgent issues today [9, p. 819]. For the implementation of these tasks, students of general secondary schools should create the necessary environment in the educational process, taking into account their age, develop the skills to analyze the use of robotic devices in production processes, acquire the necessary theoretical knowledge and use them. it is necessary to be able to use it in practice.

Based on the experience of developed countries, it is necessary to implement the following goals and tasks in the field of robotics in general education schools of our Republic.

Technological goals:

• creation of a modern educational environment for teaching design, models, elements of schematic engineering and the basics of programming, formation of inventive skills;

• to study the available opportunities for children to succeed in school and extracurricular educational institutions [10, p. 14374].

Based on these goals, the organization of robotics training in secondary schools has the following advantages:

• implementation of an approach to the interactivity of the information environment, multi-functionality and other directions of activity;

• ability to provide multi-functionality and proactive approach;

• increasing the flexibility of the structure of the educational process;

• formation of information and communication technology literacy.

Observations have shown that students with high interest look for ways to solve problems with their own ideas when faced with different levels of difficulty. Continuity of technical creative activity serves to increase children's interests. Continuity can be observed in the design of labor tools of different levels of complexity.

Approaches to the application of robotics elements in the development of technical creativity of schoolchildren can be different. Based on the experience of developed countries, the development of club plans that include robotics elements suitable for the age categories of high school students. Repetition, systematization, generalization and use of the knowledge acquired in various subjects in the process of learning and building educational models of robots for students to learn the elements of robotics and use them when necessary.

At present, in the teaching of physics, informatics, and technology subjects in general secondary schools, based on the concept of modernization of technical education, it is necessary to fully reveal the possibilities of each subject in mastering the basics of robotics. The content, teaching methods, methodology and technology of using robotics tools in the educational process

in providing the technical educational direction of teaching in these subjects implies conducting research as a special pedagogical research [4, p. 5]. Today, in our Republic, research on the use of robotics elements in the development of technical creativity of students is at the initial level. In this regard, there are a number of tasks that need to be solved.

IV. Discussion

As one of the areas of technical training of students, the mastering of educational materials on robotics, strengthening of knowledge in the subjects taught in general secondary schools, formation of practical skills and qualifications, training of students in modern serves the development of technological competences. Students will acquire modern knowledge. Robotics plays an important role in interdisciplinary integration. Knowledge gained from robotics technology, physics, informatics, mathematics, drawing and other subjects is remembered [6, p. 18]. This knowledge plays an important role in understanding the principles of operation of robots and in their independent design and construction by students. The integration of knowledge gained from mathematics, computer science and technology is of particular importance in the implementation of many projects.

In the near future, the development of robotics will lead to significant changes in people's lifestyles. Their living conditions become easier. In a new environment, a green person will need a new level of thinking and behavior, readiness to maintain and update modern robotic equipment. In this regard, two socio-pedagogical problems have been identified in the science of pedagogy, the solution of which is associated with important socio-economic and political effects:

1) training of qualified personnel for the production of robots and robot systems;

2) formation of classes of users of robotic environment services and development of their socio-technological culture.

As a result of the observations, there are tasks awaiting the following solution for the development of students' technical creativity based on the elements of robotics:

1. Establishing the development of pedagogical mechanisms for teaching robotics elements in methodical associations of teachers in district and regional public education departments.

2. Educational robotics "... as a new interdisciplinary field of school students, which integrates knowledge in the fields of physics, mechatronics, technology, mathematics, informatics and allows students of different ages to be involved in the process of innovative scientific and technical creativity".

3. Developing directions, methods and techniques for using robotics tools for students in high school.

4. Creation of educational and methodical manuals intended for the use of robotics by students of different ages in the educational process. To create working groups for the creation of textbooks and training manuals for students on robotics based on the educational and regulatory documents of the general education schools of our republic and to start their activities.

5. Dissertation research related to the problem of organization of educational process using elements of robotics in general secondary schools is still at the initial stage. The publications

of the authors of these studies mainly include specific experiences of the use of robotics tools in the high school educational process. Elimination of general pedagogical and methodological problems of using robotics tools in extracurricular activities with schoolchildren.

6. With the current pace of development of robotics research in foreign countries, focus on mutual integration of the research conducted in this field in our Republic. Focusing on the wider application of STEM (Science Technology Engineering Mathematics) education to the educational process based on foreign experiences [8, p. 57].

7. To take into account that the content, methodology and technology of the use of robotics in the implementation of technical education in the secondary school will be the subject of systematic and directed research in the methodology of teaching subjects in our Republic. Using robotics not only in extracurricular activities with students, in the effective organization of the educational process, but also in the mastery of each subject, taking into account the versatility of robotics as a field of technical knowledge.

The study of the elements of robotics as a direction of technical innovation is included in the content of the programs of physics, computer science, mathematics, technology, etc. taught in general secondary schools, as well as in the programs of optional lessons and extracurricular activities with students. should be included. Each high school, taking into account its orientation, should develop a comprehensive program to include elements of robotics in the technical training of schoolchildren. The purpose of such a program is the formation of technical culture necessary for school graduates to effectively work in the robotics environment in the near future.

While studying and analyzing information on scientific and technical achievements in the classroom and extracurricular activities, information on the types of robots intended for use in various branches of production can be used. There are opportunities to use such opportunities in physics and technology classes. This can be done as follows:

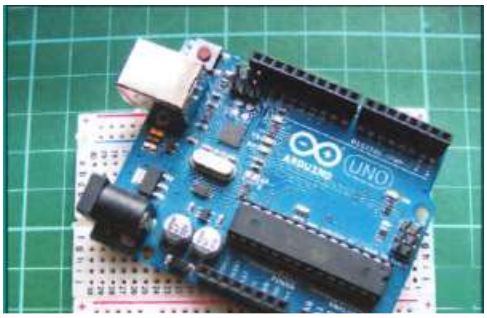
- techniques and technologies used in various spheres of society's life;
- modern experimental equipment that can be used in the educational process;
- robotic tools intended for use in the educational process.

Learning these technical tools can be done in different ways. In the first method, students are first given detailed information about the elements and design of the robotics device. It will be analyzed what kind of tasks it can perform. Next, the current model of this type of robot will be presented. Using this method, it is possible to learn about robots that are designed to perform tasks ranging from simple tasks to complex technological tasks. The working process of their main working elements is studied by students.

The second method. In the process of organizing classes using this method, the teacher offers students assignments for independent work. Students must assemble a robot model that has a specific design and is designed to perform specific functions. Students should be given a task that will help them master the subject material independently. Design Assignments If there are construction kits for students to assemble a robot, it is possible to assign as homework the task of assembling a robot with a design. The teacher can organize such tasks during extracurricular activities. As a result of regular use of such methods in training, students can develop the skills of

independent design of various devices. This serves to increase their interest in various fields of science and technology.

Students can be given a task to assemble a motion sensor during class sessions. The teacher gives appropriate instructions and necessary recommendations to the students. Each student is given information on how to complete the assignment.



In this task, students will build a motion detector system using a passive infrared sensor. Also different from this device, for example: sending messages through light, changing the place of something, "Welcome home!" when you approach the entrance door. can be used to perform such tasks as the text appears.

2-picture:

Necessary components: Arduino board, LED, layout board, piezo transmitter, passive infrared motion sensor HC-SR501 (picture 1).

Operation: This project is based on the operation of the HC-SR501 sensor. The sensor should be installed in such a way that when a person appears in front of it, the LED lights up and the piezo transmitter sounds (pic. 2). It can be adapted and used for other purposes [3, p. 72].

Any piezo distributor will do for this project. The main thing is to observe the polarity: the red wire should be connected to the 5 V power supply, and the black wire to the ground wire. Other similar motion sensors will fit our project, but it's important to check your model's contact sensor location, as their classification files may differ. All sensors must have a power source, a ground connection, and an output for data transmission.

The contacts are not visible on this model, but if you remove the outer lens (which is held in place by screws and can be easily removed), you can see the contact marks as shown in Figure 3.

3-picture:

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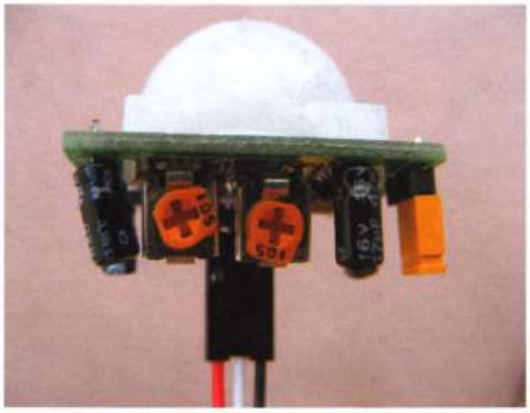
4-picture:



A motion sensor with a lens removed.

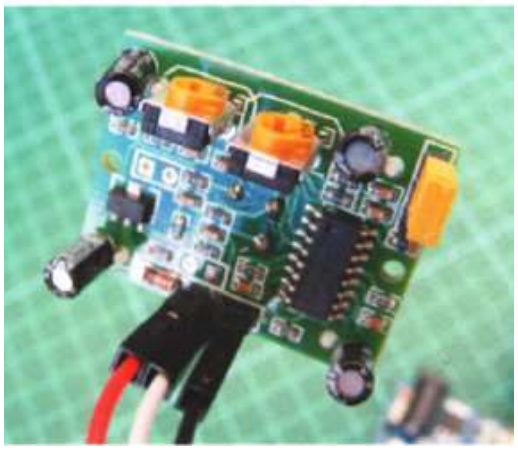
Two orange potentiometers on the sensor allow you to adjust it. In the case of the sensor shown in Figure 4, when an object is detected, the left potentiometer goes from HIGH mode, controls the operation time and allows you to set this time in the range of 5 to 200 s. If an LED is connected to the output, the potentiometer determines whether it will be lit for 5 to 200 seconds, depending on the setting level. The right potentiometer limits the detection of the object in the range from 0 to 7 m [5, p. 73].

Potentiometers-motion sensors. The left potentiometer sets the output to HIGH (5-200 seconds); and the right potentiometer controls the sensitivity of the sensor (0-7 meters). The sensor records the infrared radiation emitted by warm objects. The crystal material inside the sensor immediately detects infrared radiation. When it reaches the set level, it drives the output signal of the sensor [7, p. 81].

The Arduino board accepts this signal as a voltage, so it can be used to turn on an LED. The device should be installed in such a way that it emits a sound signal when it is working.

The device can be assembled in the following order:

1. Connect the 5V and GND contacts of the motion sensor to the power bus and ground of the breadboard, correspondingly, these buses must be connected to the corresponding contacts of the Arduino board. Connect the OUT sensor pin to pin 2 of the Arduino board (see picture 5).



5-picture:

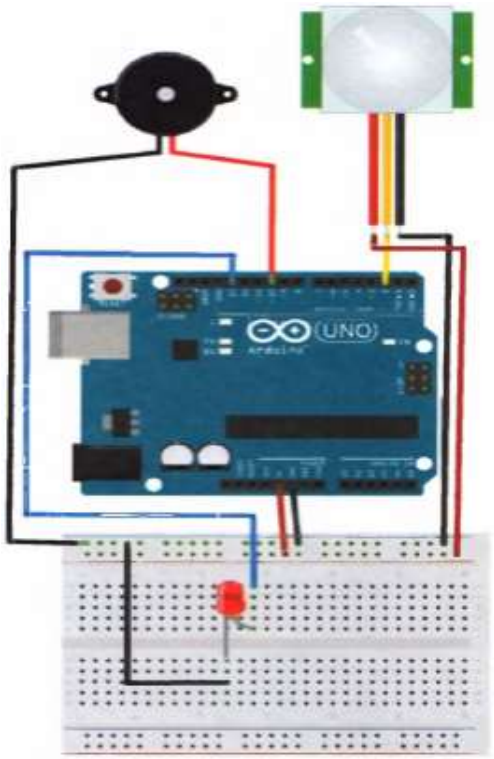
A motion sensor connected to an interconnecting device

2. Install the LED on the breadboard and connect the long leg (anode) to pin 13 of the Arduino board, and the short one to the GND pin. In this project, you won't need a resistor to make the LED work.

3. Connect the piezo distributor: the red wire to pin 10 of the Arduino board; connect the black one to the GND contact.

4. Make sure your circuit matches the schematic in Figure 6, then load the code for this project into the Arduino memory.

From the examples given above, it can be seen that students' interest in science and the use of educational materials and teaching tools related to robotics in the development of technical creative abilities show the practical application of physics. Students will understand information about the structure and operation of various devices based on the science of physics. Also, providing them with such tasks in the performance of various homework and assignments will help them develop competencies in designing and constructing various devices.



Picture 6: Schematic diagram of a motion sensor

V. Conclusion

As above, as students develop the skills to connect various circuits, they can learn to connect more complex circuit circuits or learn to connect various peripheral devices. The use of robotics elements in teaching subjects in physics classes plays an important role in students' thorough mastery of science-related educational materials, assimilation of knowledge in accordance with state educational standards.

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