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Algorithm of learning methods on educational platforms using IoT technology

Abstract. *Today, Internet of Things (IoT) technologies are rapidly being introduced into all spheres of society. Actively using various devices, thereby making your life easier. The IoT market of Kazakhstan is to some extent the heir of technological solutions that have been actively developing in the republic for more than ten years. Improvements in devices make it possible for them to be able to hear, see, think, and sometimes act. For coordinated and efficient operation, devices must interact with each other as correctly as possible in order to make decisions quickly. With the development and spread of IoT, it increased significantly affects the structure of the modern world and affects almost all areas of our life, one of which is education. Today, with the development of this technology, special courses in this area have begun to be introduced. Thus, the traditional model of university education is changing. This article presents an analysis of various educational platforms using modern IoT technologies.*

Keywords: *IoT (Internet of Things), education, platform, curriculum, educational platform, teaching method.*

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Introduction

Nowadays, the Internet of Things has begun to influence our lives, including education and work. The Internet of Things is a concept that defines two or more devices that are interconnected and connected to the Internet so that they can be controlled distantly. The Internet of Things makes our daily tasks easier and more cost [1, p. 56].

Nearly 20 years after being first used as a problem-solving solution, the Internet of Things is entering the lives of many as the real physical infrastructure of hundreds of millions of new devices that work together and distribute data between them or over the Internet.

However, for many, IoT term means different things. For consumers, the Internet of Things is the new smart thermostat that secures camera connections, Smart TV-s, sensors, laptops, printers, or routers. Industries are using connected structures of sensors and pumps in smart manufacturing plants. Despite a roughly 20% overhaul (or 5 billion devices), 8.4 billion devices are connected in 2017, setting the stage for 20.4 billion device rollout by 2020, according to Gartner analyst firm.

New IoT products are enriching and simplifying life with targeted and context-sensitive, connected, smart devices. They reduce costs and improve efficiency in transportation, energy production, manufacturing, and education. This accelerates the growth of new industries and the education sphere: cloud computing, energy, automation, machine learning, and artificial intelligence. The biggest

obstacle to adoption concerns privacy and security. But what cannot be precisely defined, therefore, cannot be protected.

In recent years, IoT technology has been developing rapidly, and accordingly, high demand for the IoT specialty is expected, so universities have begun to introduce specialties in the direction of IoT, SMART.

Leading Kazakhstani universities – Eurasian National University named after L.N. Gumilyov and KazNU named after al-Farabi, together with the European Union have opened master's program in the specialty «SMART CITY Technologies» with a project the ERASMUS + [6].

This is an amazing breakthrough in this area, as many students from major universities have access now to knowledge that is only occasionally and not fully available on the Internet. Unfortunately, in order to learn the IoT, there are many necessary skills, such as software development, electronics, and big data analytics. Thus, a student who wants to join this burgeoning technology movement must face a learning overload from multiple domains.

Problems that a student has to face, which software to choose for use in the Internet of Things technology. Moreover, educators face the same challenges in developing an IoT course. They must take into account the different skills that the student will need to acquire, as well as the many different technologies that will be used. All this must be combined in a structured form, consisting of an auditorium and a laboratory.

As the need for the IoT specialty grows, the need for an IoT educational platform is therefore easy to identify. The teaching materials should include laboratories, projects, assignments, and theories. The platform should be dedicated to both the student and the teacher. For teachers, it can be a simple and convenient means of exchanging knowledge, simplifying the development of the Internet of Things. At the same time, students. should be encouraged by a platform that helps them maintain participation and enthusiasm for trying new projects. Such a centralized online place containing courses and projects will greatly help the learning process.

In this article, we analyze the structure of the algorithm of the method of teaching using educational platforms and our algorithm of teaching methods for creating educational platforms with the technology of the Internet of Things that we offer. Our proposed algorithm is web-based and allows teachers to download it, branch, and edit IoT-related materials such as books, slides, labs, projects, etc., and students can access this platform for free, and improve practical skills. This algorithm gives us the opportunity for students to receive 100% of the quality knowledge, as well as to acquire practical skills.

The research methodology is to analyze known open educational platforms for the study of the Internet of Things, their methods of functioning, and structures.

The aim of the study is to analyze the methods and structures of educational platforms for studying the technology of the Internet of Things.

Several existing educational platforms have been explored such as Coursera, Trinkercad. com., Udemy and Cisco.

Research methods

The following methods are used in the article:
- analysis and generalization;
- method of mathematical statistics;
- methods algorithm

The main part. Structures and methods of educational platforms

Nowadays, you can find many open educational platforms on the Internet that offer courses on the subject of the Internet of Things.

The first one is the Coursera platform. Coursera is an educational platform that partners with universities around the world. Students receive certificates from leading universities (Stanford, Yale, HSE, MIPT) and companies (Google, Yandex). The course offers a variety of IT courses, including the Internet of Things. At the request of the Internet of Things, the platform gave us 216 courses (paid and free) (Figure-1).

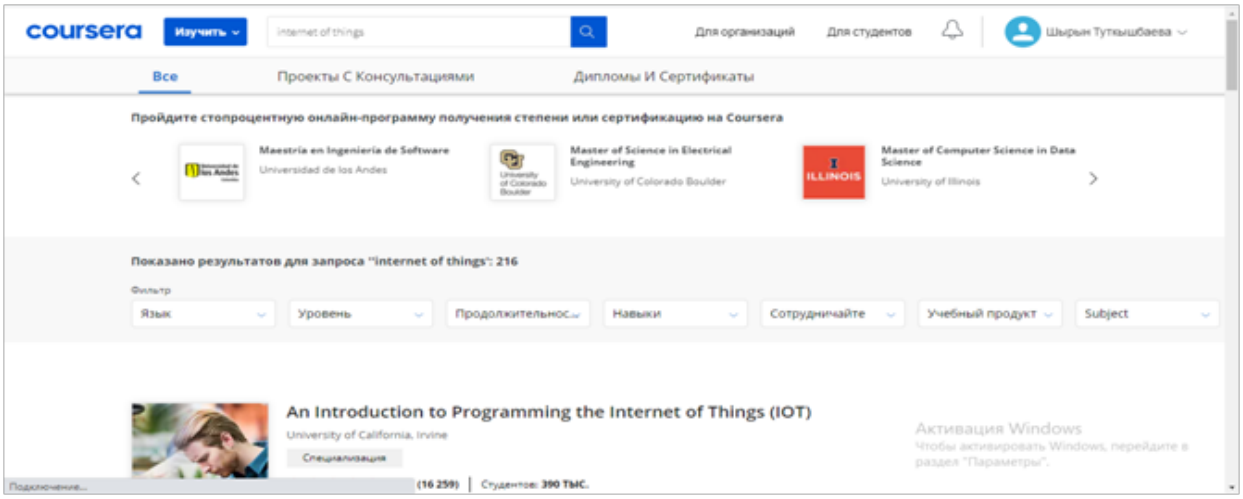

Figure 1. IoT Query in Coursera

The duration of the courses is usually 4 to 6 weeks. The huge advantage of this platform over other learning platforms is that there are many IoT courses available on Coursera. According to KAZINFORM with reference to the Ministry of Labor and Social Protection of the Population of the Republic of Kazakhstan, 40 thousand Kazakhstanis took courses of interest to them on this platform [2].

However, the platform offering professional courses has some drawbacks, most IoT courses are not free. Even if students make a payment decision, the platform does not provide an integrated development environment or a way to share projects and lab solutions between students who are taking the same course.

The next educational platform is Udemy.com. This platform was created in 2009 and offers several professional courses in the direction of the Internet of Things (Figure 2). Based on the course search result, the platform provides us with 120 courses. However, the biggest downside to Udemy is that it has no free courses and no IDE.

National Open University «INTUIT» is an organization that provides distance learning services through its website for several educational programs, many of which relate to

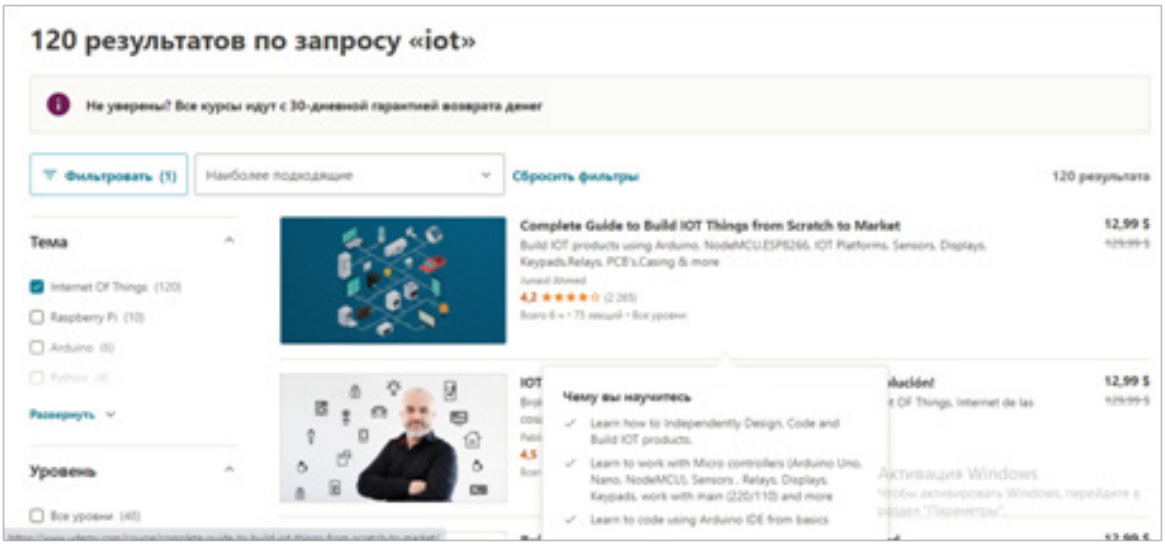

Figure 2. Request for an IoT course on Udemy.com

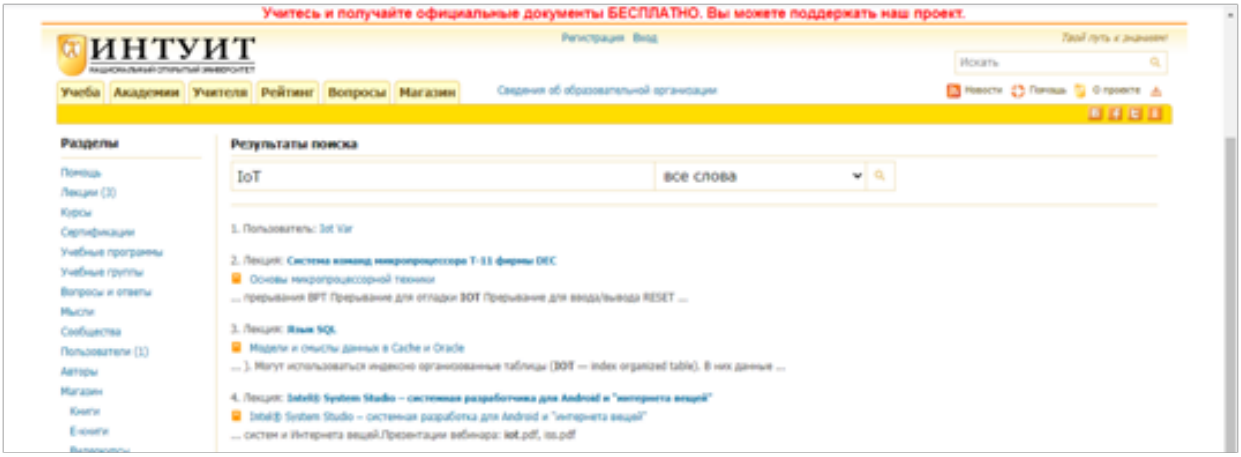

Figure 3. Search result in the Intuit platform

information technology. The platform contains several hundred open educational courses, after which you can receive an electronic certificate for free. In this platform, we did not find courses in the direction of the Internet of Things (Figure 3).

There are many more open educational platforms on the Internet. But we only looked at popular and frequently used platforms. Having analyzed the pluses and minuses of educational platforms, we noted that the algorithm and teaching methods are the same practice for them (Figure 4).

In this picture, we see that most educational platforms focus only on theory, If the student successfully passes the test and pays, the platform will provide him with a certificate of successful completion of the course. But we know that when creating any projects using IoT technologies, practical skills are required. Considering this part, many educational platforms opening do not improve practical skills.

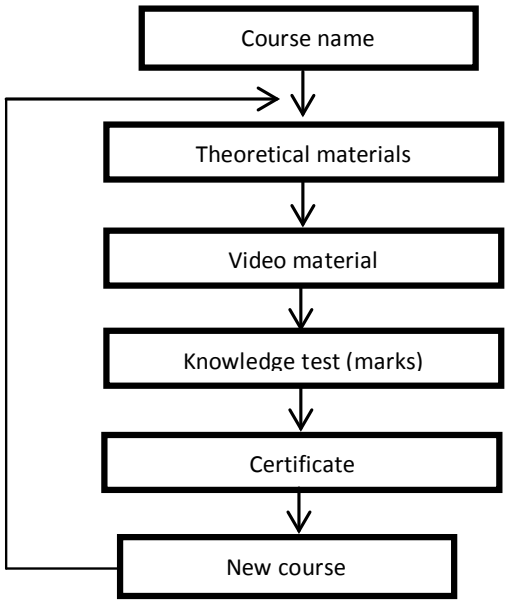

Figure 4. Algorithm structure teaching methods

Scientists from Tunku Abdul Rahman University, Yiqi Tew, Tiong Yew Tang and Yoon Ket Lee from Malaysia conducted a study on an improved educational platform with touch devices that use IoT features.

They offer us the following algorithm to test the practical work of the trainees. Using IoT technology, use software development kits (SDKs) in the OP to develop software code to read data and send it from sensors via a GPIO connection [3, p.12-13].

Scientists from Bangladesh offer us a non-traditional teaching approach. That is, the collaborative learning concept of teamwork can help trainees develop social interaction skills that stimulate critical thinking. It includes teaching and learning in which all subscribed course participants participate and work together to solve a problem [4, p. 89-93].

Another work by Sawti Jain and Dimple Chawla «Smart Education Model for the Future of Learning and Teaching Using IoT Technology.» It is a concept in which listeners from different parts of the world can participate in the same classes via a computer. Considering the power of intelligence and knowledge of more people

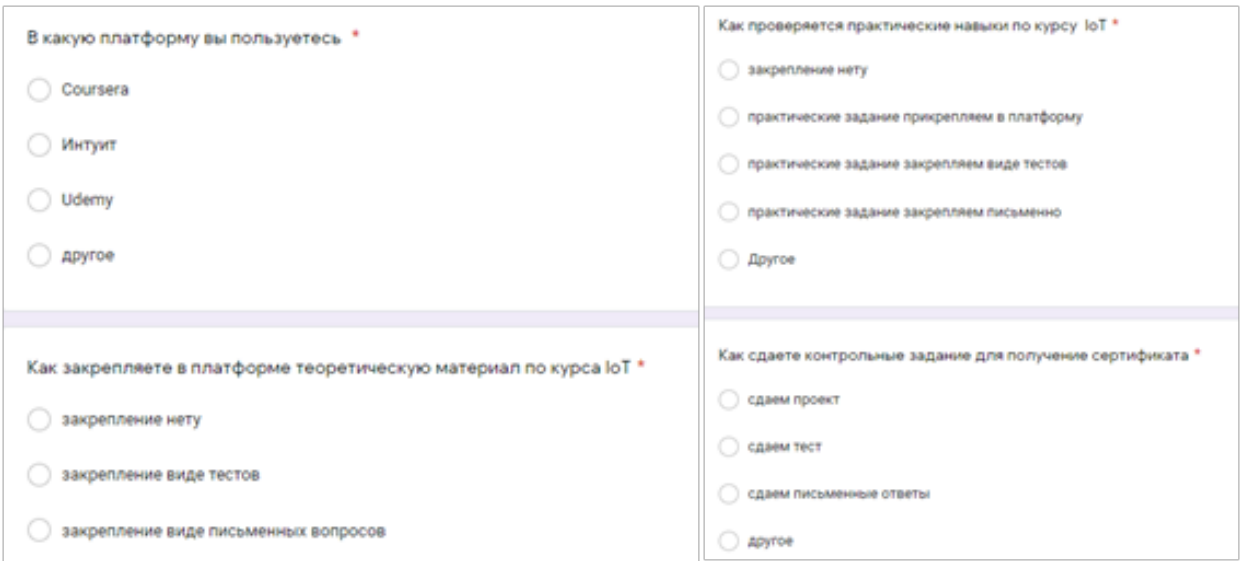

Figure 5. Questions questionnaire

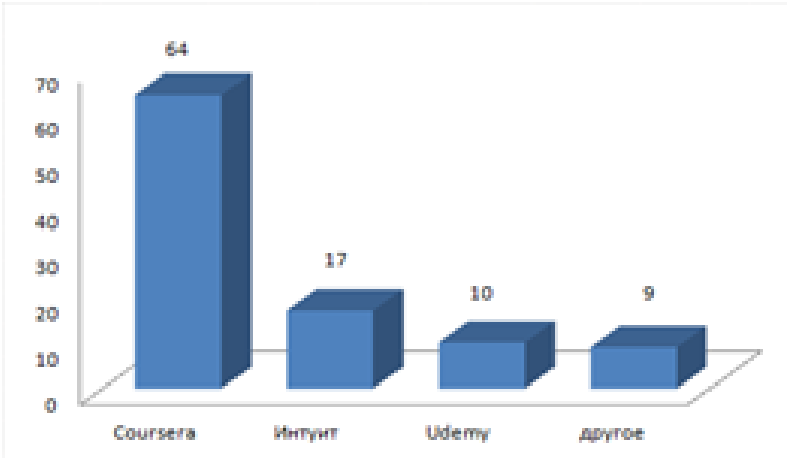

Figure 6. The result is the use of educational platforms

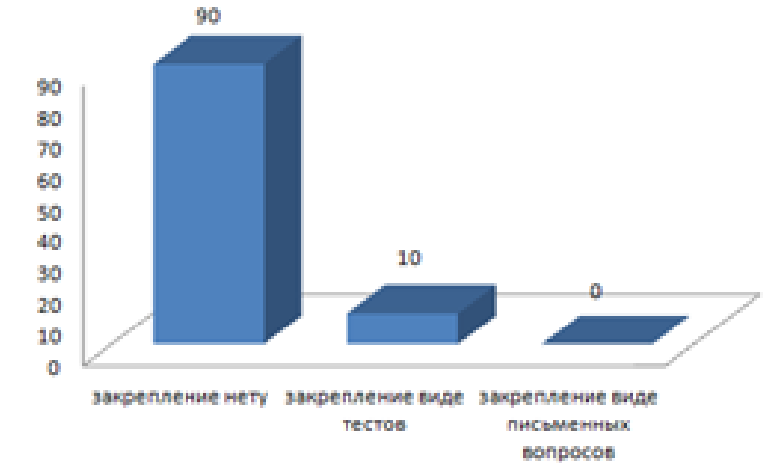

Figure 7. Result of the second question

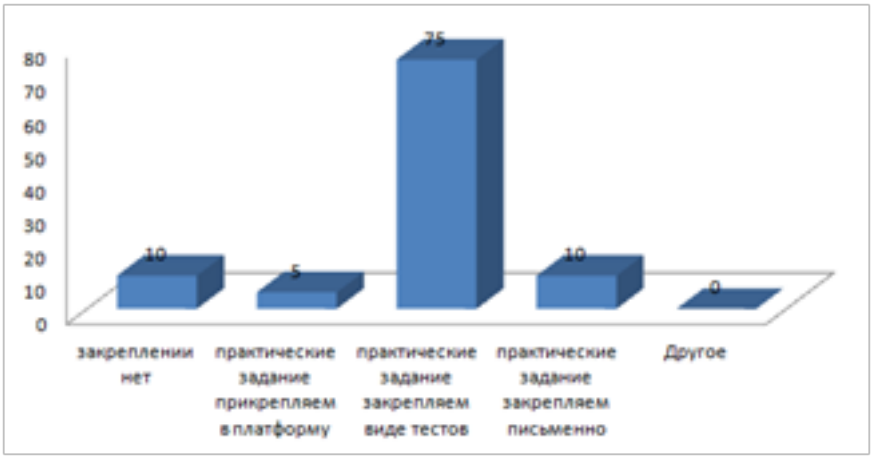

Figure 8. Result of the third question

and improving academic performance could be achieved by only one participant. It helps develop critical thinking skills and problem-solving techniques, facilitating interaction between listeners [5, p. 200-216].

Result of discussion

The study was conducted by a questionnaire using Google Forms. The study involved undergraduates and students majoring in «Smart-City», Computer engineering. 75 students and undergraduates participated in the study. When compiling the questionnaire, we indicated 4 main questions, the answers to which should reveal the most important aspects of the use of educational platforms. You can see the questionnaire questions in Figure 5.

During the study, it was determined that most students use the Coursera educational platform since the certificate of this platform can be useful for employment (Figure 6).

After processing the questionnaire data of the respondents, it was found that the consolidation of the material passed by the students is not carried out (Figure 7).

The analysis of the answers to the third question showed that, despite the students completing the test tasks, they do not form practical skills (Figure 8).

The overwhelming number of answers to the last question indicates that the measure of measuring the level of practical skills on educational platforms is the successful completion of testing. However, we believe that this is absolutely not enough for an objective

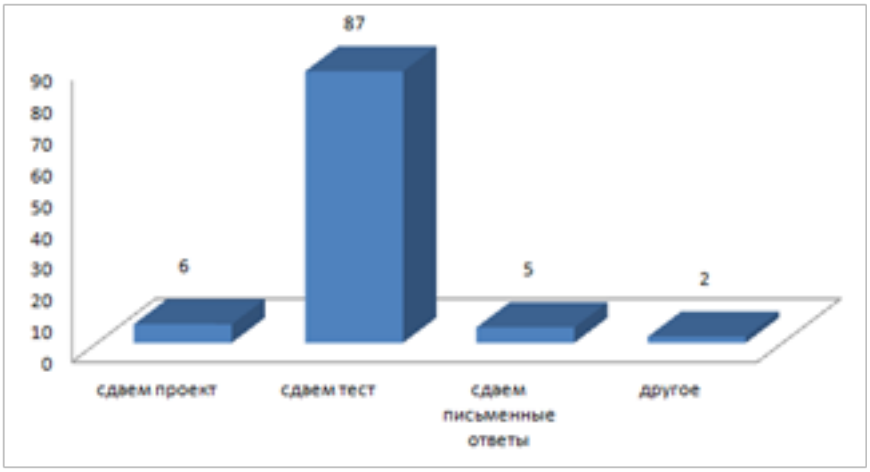

Figure 9. Result of the security question

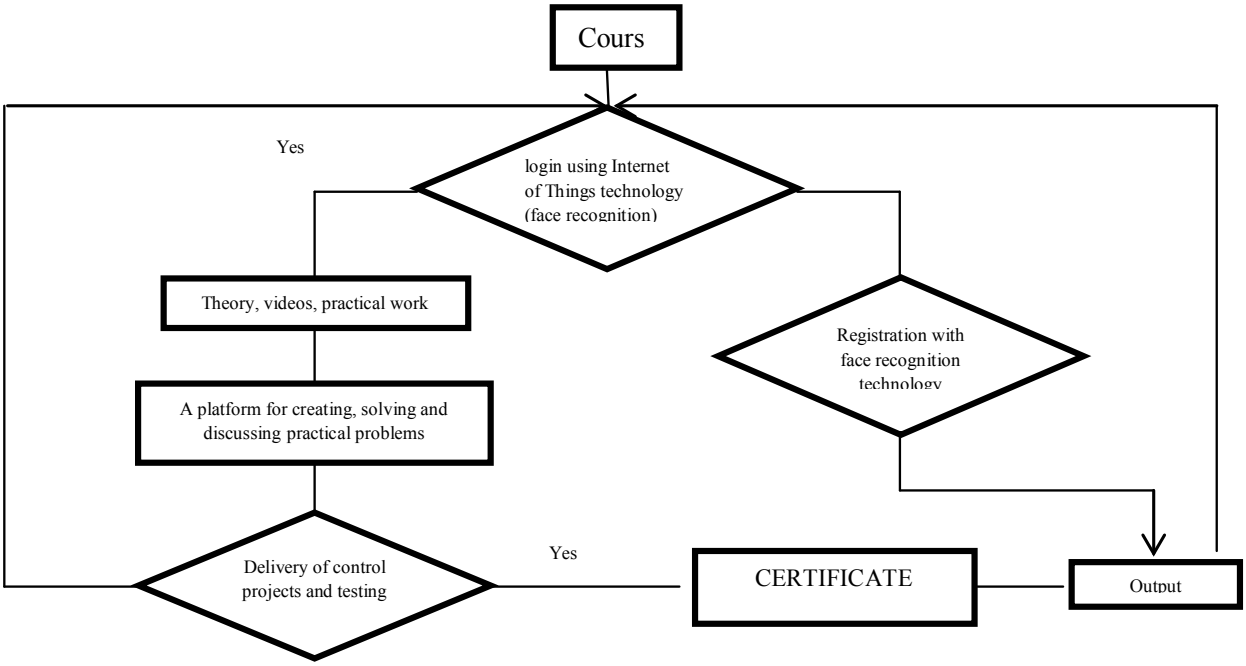

Figure 10. Algorithm of using with IoT

assessment of the practical skills of the student (Figure 9).

And what we want to say by this is that any information that is related to learning will eventually become a skill, skill, or knowledge for the student. Thomas Aquinos formulated the definition of skill in the category of quality. Soviet psychologist N.A. Bernstein described in detail in his scientific works the stages of the formation of motor skills. N.A. Bernstein wrote the definition for the term skill in such a way that these are automated components of a person's conscious action that are developed in the process of its implementation [8].

If a student cannot write program code or use equipment when performing laboratory work, then this indicates that he does not have the necessary skills.

As a result of our research, we concluded that students studying additional courses on online educational platforms consolidate theoretical knowledge, but do not acquire practical skills.

To overcome the violation of the learning paradigm of trainees identified here, we propose the following algorithmized solutions to this problem, it is shown in Figure 10.

The difference between this algorithm and those used in existing online educational platforms is that after successfully passing the test for theoretical mastery of the topic, the user is invited to perform laboratory and course assignments in a virtual environment. With the help of laboratory and course assignments, the user fixes and trains practical skills.

The second difference between these algorithms is the facial recognition system. Woody Bledsoe, a professor at the University of Texas, provided the first facial recognition experiment in 1960 [9]. We added this system to identify students. This increases the level of security that all theoretical and practical tasks provided are performed by a registered user.

The algorithm for teaching methods that we propose gives us the opportunity to improve the following factors:

- theoretical part;
- practical part;
- knowledge check – here we used automated generation of test questions from the database, which is offered to us in the article by A. Omarbekova and A. Zakirova [7].
- checking the spellings of the code;
- creation of projects;
- take a certificate.

Conclusion

During the study, it was determined that the existing educational platforms do not increase the practical skills of students. Since in our specialty we need to raise the level of qualification every time in the practical direction. With the help of the IoT system in the educational platform, it will help students to form and improve practical skills in specific areas.

In this aspect, the study showed that existing educational platforms need to add an IoT system. All this will be useful for all users of other fields to master a new direction of science.

In the end, we analyzed the existing platforms to determine their advantages and disadvantages, and finally developed a solution suitable for teachers and students, with the ability to share and contribute to educational materials for the Internet of Things.

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Оқу платформасында IoT технологияларын пайдалануды үйретудің әдістемелік алгоритмі

Аңдатпа. Бүгінгі таңда заттар интернеті (IoT) технологиялары қоғам өмірінің барлық салаларына қарқынды түрде енгізілуде. Түрлі құрылғыларды белсенді пайдалану, өмірімізді жеңілдетуде. Қазақстанның IoT нарығы белгілі бір дәрежеде республикада он жылдан астам уақыт бойы белсенді дамып келе жатқан технологиялық шешімдердің мұрагері болып табылады. Құрылғыларды жетілдіру оларды естуге, көруге, ойлауға және кейде әрекет етуге мүмкіндік береді. Үйлестірілген және тиімді жұмыс істеуі, құрылғылар тез шешім қабылдауы үшін бір-бірімен мүмкіндігінше дұрыс өзара әрекеттесуі керек. IoT дамып, таралған сайын, қазіргі әлемнің құрылымына айтарлықтай әсер етуде және біздің өміріміздің барлық салаларына әсерін тигізуде, олардың бірі-білім беру саласы. Бүгінде бұл технологияның дамуымен осы салада арнайы курстар енгізіле бастады. Осылайша, университеттерде оқытудың дәстүрлі моделі өзгеруде. Бұл мақалада заманауи IoT технологияларын қолдана отырып, әртүрлі білім беру платформаларын талдау ұсынылған.

Түйін сөздер: IoT (Internet of Things), білім, платформа, оқыту бағдарламасы, білім беру платформасы, оқыту әдістемесі.

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Алгоритм методов обучения на образовательных платформах с использованием IoT технологии

Аннотация. На сегодняшний день технологии интернета вещей (IoT) быстро внедряются во все сферы жизни общества. Активно используются различные устройства, тем самым облегчается жизнь. Рынок IoT Казахстана является в какой-то степени наследником технологических решений, которые активно развиваются в республике уже более десяти лет. Совершенствование устройств делает возможным их способность слышать, видеть, думать, а иногда и действовать. Для скоординированной и эффективной работы устройства должны максимально корректно взаимодействовать друг с другом, чтобы быстро принимать решения. По мере развития и распространения IoT все более значительно влияет на устройство современного мира и затрагивает практически все сферы нашей жизни, одной из которых является образование. Сегодня с развитием данной технологии начали вводить специальные курсы с этой областью. Тем самым меняется традиционная модель обучения в университетах. В данной статье представлен анализ разных образовательных платформ с использованием современных технологий IoT.

Ключевые слова: IoT (Internet of Things), образование, платформа, учебная программа, образовательная платформа, метод обучения.

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