Automated system of remote holding competitive and assessment procedures

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Abstract. At present, organizational and reporting activities during the admission of exams, the defense of students' FQPs, dissertations using on-line services and videoconferencing are carried out manually and require laborious routine work of their organizers. The purpose of the work is to develop a web application that provides automation of events during the assessment and competitive procedures in on-line and off-line modes. The design of a formal educational or scientific attestation event is carried out according to the model of expert competitive assessment of objects: collection of evaluated objects - selection of evaluation criteria - expert evaluation of objects. The creation of a web application is realized using the latest technologies for developing single-page web applications (SPA). The use of the developed web application allows organizing the procedure for expert assessment of objects / subjects in real time in conjunction with video communication systems. The organizer can be any user who takes on the role of a moderator of the event. The attracted experts can, in parallel with the video presentation of the participants, familiarize themselves with their materials, give marks in real time according to the criteria set by the organizer. Experimental testing of the developed application showed the possibility of its application in carrying out various competitive and assessment procedures in education. The resulting software product can be widely used in the educational process of any educational institution and its development is not laborious.

1. Problem and purpose
Modern challenges that have provoked the transfer of the educational process to a distance format, actualize the issues of automating remote assessment and competitive procedures. For example, organizational and reporting activities during the admission of exams, the defense of students' FQPs, dissertations using various types of online services and video conferencing are carried out manually and require unjustified labor and time expenditures of members of certification commissions.

In this regard, it is of interest to create automated systems for expert monitoring of educational resources, remote assessment and competitive procedures in educational institutions. From the standpoint of automating the assessment of the quality of objects and subjects, educational resources will include: object resources (traditional and digital courses, teaching tools and methods, lessons, information systems, software products, educational projects, term papers and theses, etc.), subject resources (pupil, student, teaching staff). As a rule, measures for monitoring educational resources in educational institutions are carried out by expert, manual, non-automated methods.
The aim of the work is to develop a real-time web application that provides automation of monitoring of educational resources using remote assessment and competitive procedures in on-line and off-line modes.

The main functions of the web application are: the organization of an assessment or competitive event, the formation of assessment criteria, the collection and placement of the evaluated educational resources, the formation of the composition of experts and the organization of their access to the examination materials, the examination in real time or offline, summing up the results in accordance with a scale determined by the organizer.

2. Literature review
Currently, as a rule, the main and most common tool for organizing monitoring of the quality of educational resources are various learning management systems – LMS. This is software for creating, managing and placing educational materials within distance learning [1]. It should be noted that although initially LMS were created specifically for distance education, the breadth of their technological profile allows the use of these systems, including for assessment activities.

Moodle is considered one of the most common LMS. Moodle (Modular Object-Oriented Dynamic Learning Environment) is an e-learning course management system. It is a free web application that provides the ability to create e-learning sites. The web application is written in PHP. The first version was released in 2002 [2].

Moodle has a whole set of various extension modules that allow both to closely integrate the platform into the existing infrastructure of an educational organization, and flexibly interact with content of various types, including organizing testing and other assessment activities. However, a large amount of outdated code, volume, complexity in setting up and overloading a web application cause difficulty, both during its adjustment and during operation [3].

Another popular LMS is OpenOLAT (Online Learning and Training) [4]. Like Moodle, it is open source, free software. OpenOLAT has the following functions for organizing assessment activities:

- Organization of assessment, including the editor of surveys, tests integrated into the courses;
- Detailed assessment tool;
- Export of tests to MS Word;
- Import of questions from Excel;
- Statistics tools

OpenOLAT is a complex modular system. Each OpenOLAT installation can be individually expanded and thus adapted to the needs of the organization and integrated into existing IT structures.

There are other similar LMSs, including proprietary paid ones [5]. However, the main task of LMS is to organize distance education, and already as a by-product - the possibility of organizing assessment and competitive events.

There are also various proprietary systems used within universities, but their consideration is impossible due to their closed nature. These systems are very common, but they are difficult to configure and place. Since the organization of assessment and competition events is not the main function of these systems, this affects the flexibility and functionality when organizing such events.

It is also essential that at the moment, it was not possible to find a ready-made open platform on the network, which would allow organizing assessment and competitive events in real time with the involvement of experts. At the same time, the request for this system is relevant, since there are a large number of events at various levels that require automation and assistance in organizing competitive and evaluation procedures, for example: scientific conferences, seminars, various educational competitions, etc.

In the context of the COVID-19 coronavirus pandemic, the request for a system that allows you to quickly organize remote competitive and evaluation procedures has become especially relevant. The
educational process switched to a remote format, which led to the need to organize such events as exams, defense of graduation qualification works and defense of dissertations, on the Internet, in real time.

An open digital environment for the organization of assessment and competition events satisfies this demand.

3. Development methods and tools
The basic concept of cloud technology for assessing and competitive procedures for the quality of educational resources is based on the projective-recursive technology of creating complex intelligent systems [6]. The final evaluation mechanisms are based on the expert-statistical method.

The design of a formal educational or scientific attestation event is carried out according to the model of expert competitive assessment of objects: collection of evaluated objects - selection of evaluation criteria - expert evaluation of objects.

The creation of a web application is realized using the latest technologies for developing single-page web applications (SPA).

The cross-platform “.NET Core” is used as a framework, which allows you to run a server web application in operating systems of the GNU/Linux family and reduce hosting costs. It also uses object-relational data mapping technology to abstract from Entity Framework Core database management systems. The main component responsible for dynamic page rendering and appearance is Blazor Server. Real-time communication is provided by SignalR technology, just like Blazor Server, it uses the WebRTC protocol. All of these technologies are part of “.NET Core” and are distributed under a free software license.

4. Results
The use of the developed web application (ASKO https://asko.narchuganov.ru) allows organizing the procedure for expert assessment of objects/subjects in real time in conjunction with video communication systems. The organizer (administrator) can be any user who takes on the role of the secretary (moderator) of the event. The attracted experts can, in parallel with the video presentation of the participants (or after), familiarize themselves with their materials using the built-in file viewer, give grades in real time according to the criteria set by the organizer.

To use the functions of the web application, you need to register with an account of the required type:

- Manager;
- Participant;
- Expert.

The manager has the ability to create a competitive or evaluation event, set it up, moderate and summarize. The participant can submit his project by signing up for the selected competition and after completing the evaluation procedure, get the result. The expert is appointed by the Manager and given the opportunity to evaluate all projects submitted for the competition.

The application has real-time functions. The manager on the page of the assessed project can observe the current progress of the examination. Experts can also see how other experts are assessing, provided that this option is provided by the Manager in the competition settings.

The most attractive procedure for the current situation (pandemic) is the procedure for evaluating online speeches, defenses of FQPs and dissertations. For example, consider the JITSI video conferencing platform (meet.jit.si).

After going to the videoconference site, the user is automatically offered a generated link for all participants in the event.

It is noteworthy that in JITSI the link is valid for an unlimited amount of time, even if the organizer is not connected. Therefore, any user at any time can contact any participant who also connects via this link.
If you use other video communication platforms, you should indicate in the description of the competition various data for connecting to the video conference.

After the start of the event, the video link assessment procedure is performed in the following order:

1. The organizer announces the speaker;
2. The speaker introduces himself, talks about his work;
3. Experts listen to the presentation and get acquainted with the project materials in the ASKO system (in accordance with the instructions for the Expert);
4. Experts can start the assessment or ask questions via video link and simultaneously assess in the ASKO system.

The developed web application can provide an important and useful service for many projects. Let us consider its application within the framework of the project "An innovative program for preparing teachers for professional activity in a digital school" [7]. The project provides for the training of trainees using an online course. The course program contains an integral system for assessing the learning outcomes of teachers, multi-criteria expert assessment of their completed educational projects. At the same time, each listener, after exhibiting his work, must evaluate at least 2 works of his colleagues using specially developed criteria.

In the process of such a mutual assessment, remote educational interaction of students is organized. As a result, students gain experience in network interaction, update theoretical knowledge, and gain experience in criteria-based assessment. The developed web application is included as a necessary component of the portal (http://digital-teacher.kspu.ru), created for organizational and managerial activities for the implementation of the teacher training program for network project activities.

5. Conclusion
Here are some examples of the possible use of the developed web application:

- Automation of the state final certification (defense of graduate qualification works of students). For each member of the certification commission, an evaluation form is submitted with the accepted quality criteria for FQP. Such an event can be held in person (in the traditional format of FQP defenses, each expert must have a laptop with the application turned on), or remotely under videoconferencing conditions.
- Competitions for the best electronic educational resource developed by the specialists of the educational institution (e-course, electronic textbook, software product, etc.).
- Assessment of the quality of a modern lesson at school in terms of ICT. The quality of mega-lessons, online lessons and classroom-lesson models of blended and e-learning in schools is being assessed.
- Competition of research projects of university students. A set of criteria and indicators of the quality of scientific student work should be created, and possible formats for the electronic submission of projects should be determined.
- Rating of professional activity of an educator. In this case, it is necessary to form a base of indicators of scientific, educational and organizational and managerial activities of an employee of an educational institution.

Experimental testing of the developed application was carried out for some procedures: holding a competition of students' scientific papers, assessing the quality of video lessons at school, remote oral examinations, etc. Mastering the software product is not laborious and can be widely used in the educational process of any educational institution.
Acknowledgments
The study was supported by the Krasnoyarsk Regional Science Fund under the project, “An Innovative Program for Preparing Teachers for Professional Activities in a Digital School Based on the Projective-Recursive Approach”, (Application code: 2019051004951).

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