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**ELECTRONIC DOCUMENT EXCHANGE AND DIGITIZATION
OF THE ATTESTATION PROCESS RELATED TO SCIENTIFIC
DEGREES**

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Abstract. The paper describes the development of the "Complex-analytical information system of scientific degrees" for electronic document exchange and digitization of the attestation process for scientific degrees in the field of attestation of highly qualified scientific and scientific-pedagogical personnel, modules that make up the system, their functions, also information security of the system, requirements for functions performed by the system, client-server architecture of data processing in information system.

Keywords: attestation process, digitization, Ph.D., DSc, information security, architecture, client-server, analysis, decision support, monitoring.

Introduction

The broad introduction of IT technologies in the attestation process of highly qualified scientific and scientific-pedagogical personnel and digitization of this area is of great importance in the context of modern innovative development. "Acquiring digital knowledge and modern information technologies is in demand for us. This allows us to take the shortest path to the ascent. After all, information technology is penetrating deep into all spheres today in the world." [1]. Relevant tasks related to the digitization of the attestation domain have been identified in different Presidential documents on the development of the digital economy and the introduction of e-government, including Address to the Supreme Council of the Republic of Uzbekistan on

January 24, 2020, and Decree No. PF-5953 "On the State Program for the Implementation of the Strategy of Action for the five priority areas of development of the Republic of Uzbekistan in 2017-2021 in the "Year of development of science, education and the digital economy" of March 2, 2020, Decree of the President of the Republic of Uzbekistan dated April 28, 2020, Resolution PQ-4699 "On measures for the widespread introduction of the digital economy and e-government" and the Decree of the President of the Republic of Uzbekistan the number of No. 6079 "On approval of the strategy" Digital Uzbekistan - 2030" and measures for its effective implementation" dated October 5, 2020. Digitization of the attestation process via the widespread introduction of modern information technologies serves to guarantee openness and

transparency of its function, to create the most convenient, optimal, and time-saving opportunities for information exchange.

Moreover, the creation of the "Complex-analytical information system of scientific degrees" within the system of "Electronic Supreme Attestation Commission (SAC)" by digitizing the process of submission and certification of scientific degrees (Ph.D., DSc) is an important part of the certification of highly qualified scientific and scientific-pedagogical personnel [4].

Main part

The world attaches great importance to the implementation of processes such as the provision, reception, systematization, and processing of information through information and communication technologies according to the best international experience. Accordingly, this is among fundamental factors in ensuring the level of competitiveness in the context of globalization, creating the most convenient, optimal, and least time-consuming way to exchange information by standardizing and digitizing all information-related processes.

Viewed in this way, the introduction of a "Complex-analytical information system of scientific degrees" in the process of attestation of scientific degrees, on the one hand broadly implements the digital economy to the sphere, on the other hand, eliminates the fragmentation of systems in the information space of the industry and optimize them and finally serves as an important technological basis to increase

the quality and effectiveness because of its speed [7].

Systems development objectives

The objectives of developing a "Complex-analytical information system of scientific degrees" are:

100% digitizing the process of exchange of all attestation documents related to scientific degrees between scientific councils, higher education institutions, scientific organizations, and the SAC;

100% electronic acceptance of attestation documents for scientific degrees;

regulation the information flow of on the attestation of highly qualified scientific and scientific-pedagogical personnel;

digitizing the whole process of the relevant expertise of attestation documents for scientific degrees;

creating a user profile for the scientific secretary of the scientific council awarding scientific degrees;

creating a user profile that complete the functions of the responsible staff of the SAC (monitoring, scientific expertise, expert commission, etc.);

managing and archiving the received attestation cases on scientific degrees based on the indicated criteria;

maintaining an electronic folder of attestation cases of scientifically certified persons;

monitoring the attestation cases on scientific degrees, providing the decision-making options, intellectual analysis of data, introducing intelligent search techniques [12].

Systems development objectives

The functions of the “Complex-analytical information system of scientific degrees” are [4]:

submitting electronically the defense of dissertation documents of the applicants for publishing on the SAC website [6, 10];

electronic submission of post-dissertation documents by applicants;

electronic review of the process of normative-technical and scientific expertise of documents received on scientific degrees;

digitization of consideration process of attestation works on scientific degrees in the disciplinary commission;

digitizing the process of consideration of attestation works on scientific degrees in the expert council;

computerization of the certification process for scientific degrees.

recommending intelligent solutions that automatically generate data to help decision-makers when reviewing attestation cases on scientific degrees.

Modules, functions, and characteristics that form the system

The system consists of "Module for publishing dissertation defenses of applicants on the website of the SAC", "Module for submission of post-dissertation documents", "Module of acceptance/distribution of attestation cases on scientific degrees", "Module for approval of attestation cases of scientific degrees", "Module of normative and technical expertise of attestation works on scientific degrees, submission to the disciplinary commission and expert council", "Module on the organization of the work of the disciplinary commission on attestation of scientific degrees", "Module for the formation of the expert council conclusions on the attestation of scientific degrees", "Module for conducting the meeting of the Expert Council on the attestation of scientific degrees", the system administrator module, settings and additional modules (Figure 1).

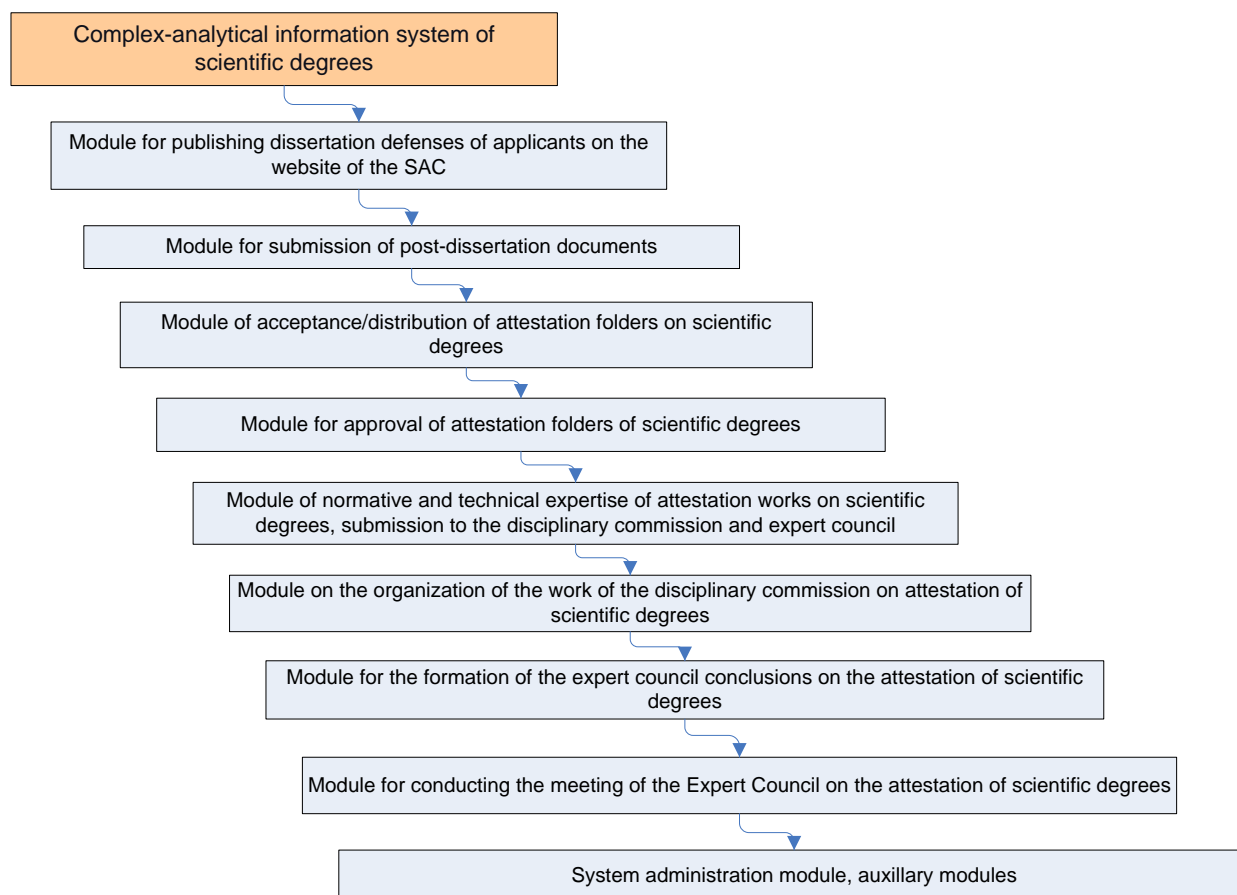


Fig. 1. Basic software modules of "Complex-analytical information system of scientific degrees"

"Module for publishing dissertation defenses of applicants on the website of the SAC". Starting from the date of the decision to accept the dissertation for defending an Scientific Secretary of the Scientific Council submits documents to the SAC through this system for publication on the SAC website within a certain period that was determined in the charter [14].

"Module for submission of post-dissertation documents". When Scientific Council makes a positive decision on the defense of the dissertation the attestation case, consisting of relevant documents, is sent to the SAC through this system.

"Module of acceptance/distribution of attestation cases on scientific degrees".

Acceptance/distribution of attestation works related to scientific degrees (Ph.D., DSc) is carried out by the responsible officer of the monitoring department. This module concerns the reception, generalization, accounting of documents of attestation case on scientific degrees received by the SAC, distribution to the relevant specialists of the department of scientific expertise, the introduction of daily attestation case received by the chairman of the SAC.

"Module for approval of attestation cases of scientific degrees". The attestation work of the received scientific degrees (Ph.D., DSc.) is approved by the Chairman of the SAC for sending to the responsible executors in this module.

"Module of normative and technical expertise of attestation works on scientific degrees, submission to the disciplinary commission and expert council". Carrying out the attestation work on the received scientific degrees (Ph.D., DSc) by the department of scientific expertise of the SAC, such as normative and technical expertise, submission to the disciplinary commission and expert council is given in this module [2,3].

"Module on the organization of the work of the disciplinary commission on attestation of scientific degrees". The work of the Procedural Commission for Attestation of Scientific Degrees (Ph.D., DSc) is organized by the Secretary-General in this module. After carrying out normative and technical expertise the attestation work on scientific degrees the established procedure is conducted by the disciplinary commission.

"Module for the formation of the expert council conclusions on the attestation of scientific degrees". In this module, the scientific secretary of the expert council performs the practice of forming the conclusions of the expert council on the attestation work on scientific degrees (Ph.D., DSc). The attestation work on scientific degrees is reviewed at the meeting of the expert council after passing the normative and technical expertise.

"Module for conducting the meeting of the Expert Council on the attestation of scientific degrees". In this module, the Chairman of the Expert Council will hold a meeting of the Expert Council on the attestation of scientific degrees (Ph.D., DSc). The attestation work on scientific degrees is considered

and discussed at the meeting of the expert council of the normative-technical expertise, in the order of the disciplinary commission. At the Expert Council, it is recommended to be awarded a scientific level in the Presidium of the SAC.

The system administrator module. This module deals with the control of the system, registration of educational institutions and scientific organizations, the formation and updating of the list of disciplines, specialties, granting access to the scientific secretaries of the Scientific Council, and management of system users.

Additional modules (auxiliary data generation module, system translation module, search module, report module, archiving module). Additional modules serve to ensure the integrity of the system [8]:

a) *Auxiliary data module.* This module allows you to enter, edit, delete auxiliary references (classifiers) required for the system. The following auxiliary directories are formed: list of countries, list of regions, nations, educational institutions and scientific organizations, etc.;

b) *System translations module.* This module stores the keywords required for the language of the user interface and their translations. If a new word is added to the user interface by the system administrator, it is translated into the appropriate language (Uzbek-Latin, Uzbek-Cyrillic, Russian, English);

c) *Search module.* In this module, the search operations are performed by filtering the data in the user interfaces of the system or entering a keyword. The following are taken into account in search filter parameters: the type of

scientific degree, specialty code, applicant full name, case submission structure (HEI / SEI);

d) Report module. In this module, you can create reports on different levels of scientific degrees: Statistics of applicants for scientific degrees in the scientific domain, statistics of applicants for scientific degrees in the field of specialization code, statistics of those who were approved for scientific degrees in the field of HEI/SEI [9, 11].

e) Archiving module. In this module, there is an opportunity to archive information on scientific degrees: Attestation case on scientific degrees, conclusions of the attestation work on scientific degrees in the review process.

Information security of the system

To ensure information security, the necessary protection measures are taken at all modules and stages of operation of the system. The following priorities of information security are taken into consideration in the development and implementation of the system [8]:

integrity, reliability, the relevance of information, protection from harmful external influences, and protection against unauthorized access and alteration;

information is protected from unauthorized entry and embezzlement.

Logging in is protected by a login and password, and the system administrator has the opportunity to change the rights granted to each user connected to the system at any time. When using a password to log in, the following requirements are set:

using capital and lowercase letters when entering a password (for example, a-Z, A-Z);

it is intended to use numbers and symbols while entering a password along with letters (for example, 0-9, !@#\$%^&*);

the password must be at least eight letters long.

The number of attempts to log in is limited, and if the number of attempts increases, the system will be blocked for a certain short period. The rights of users in the system are determined by their role in the system. It is envisaged that all actions of users in the system will be automatically recorded in the relevant audit logs.

Requirements for functions performed by the system

The general requirements for the functions performed by the system are as follows: formation of an authenticated system users, use of a multilingual feature of the user interface, availability of a flexible data structure for storing metadata and full texts of electronic documents, formation of a database of attestation papers and its activities, the availability of ways to integrate into information systems within e-government, the analysis of data following the requirements [5, 15]. The client-server architecture of data processing in information systems in graphical form is presented in Fig. 2.

Systems analysis, methods of intellectual analysis of information, information and mathematical modeling, set theory, data processing methods, mathematical statistics, object-oriented programming methods, software design

methods, database management system design methods are used in the development of information systems [13].

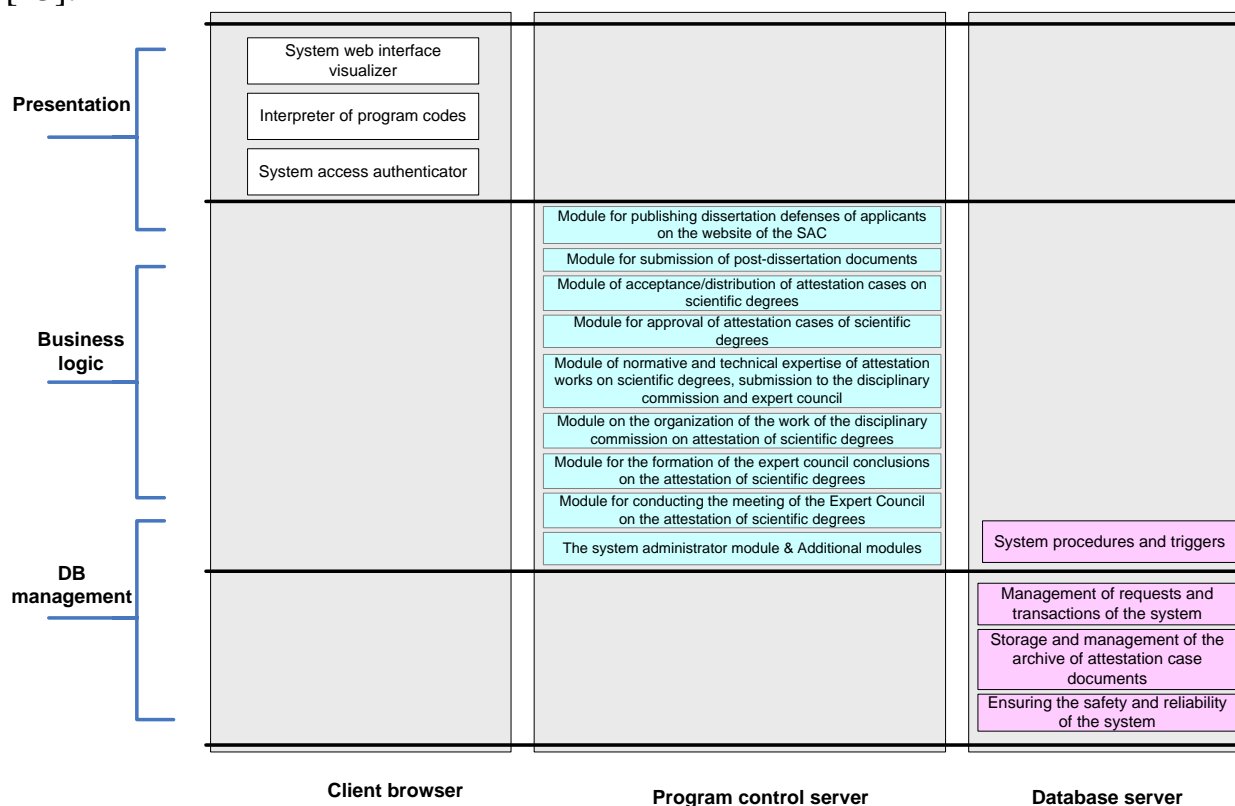


Fig. 2. Client-server architecture of data processing in information systems

Conclusion

Developed a "Complex-analytical information system of scientific degrees", consisting of 15 software modules for the digitization of attestation documents for the degrees of Doctor of Philosophy (Ph.D.) and Doctor of Science (DSc). Expert conclusion of the Ministry of Information Technologies and Communications of the Republic of Uzbekistan No. EZ-10-8/3949 was obtained for the document of the terms of reference for the development of the system. Letter No. 01-16-03/1320 was received from the State Unitary Enterprise "Cyber Security Center" on the provision of information security of

the system. It was noted that the terms of reference of the information system meet the requirements of regulatory legal acts of the Republic of Uzbekistan in the field of information and communication technologies based on the results of the expertise.

The user interface of the information system is implemented in 4 languages (Uzbek-Latin, Uzbek-Krill, Russian, English). Systems analysis, data analysis methods, information and mathematical modelling, set theory, data processing methods, mathematical statistics, object-oriented programming methods, MVC technologies, software design methods, database management

system design methods were used in the development of information system.

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