Development of a system for recording student achievement using a new information technology stack

E M Markushin, K E Ognegin, P S Polskaya, V A Shchedrin and A A Popov
Reshetnev Siberian State University of Science and Technology, 31 Krasnoyarsky rabochy avenue, Krasnoyarsk, Russia

E-mail: tolynbms@yandex.ru

Abstract. The article deals with the solution of a number of problems related to the distribution of increased state academic scholarships, such as: late submission of documents, lengthy consideration of applications, paper version of the submission of documents, which make the process of submitting complicated and reviewing applications and documents for increased state academic scholarships, thereby increasing the burden on members of the scholarship Commission and directorates of institutes. The purpose of this work is to increase the efficiency and accessibility of this process through an information system that will allow you to submit achievements for authentication and applications for increased state academic scholarships online, track your position in the rating in real time, and view the achievements of other students directly from the rating system. The system will be a client-server architecture developed using the representational state transfer approach. Information system design is implemented using a new stack of information design and development approaches. The article pays special attention to the design of the database and the interface part of the application.

1. Introduction
A scholarship is a monthly payment that is awarded for academic success. Basically, a student receives a scholarship if she or he has good or excellent grades, as well as for achievements in extracurricular activities, which include such types as: scientific, social, sports, creative. However, not all students have the opportunity to receive an increased state academic scholarship (ISAS) for their achievements, since a large number of people study at a higher educational institution (HEI), which leads to fierce competition. Thus, it is necessary to take into account the achievements of all students correctly.

Assessment of student’s achievements is based on the degree of their participation in events of various levels. All of the above activities allow you to gain new knowledge, skills, or consolidate in practice the knowledge gained at the University. Since the student is not able to objectively assess their achievements, various systems of independent assessment of the level of student achievement have been developed. Let’s look at a few of them.

Siberian Federal University has a rating system that allows you to quickly distribute scholarships based on student scores [1]. This significantly reduces the time for reviewing applications and the burden on the scholarship Commission. However, students do not have the opportunity to view the achievements of other students directly from the rating system.

Novosibirsk State University has documents and regulations that indicate the points awarded for each extracurricular activity [2]. Submission of documents is carried out personally by students to the...
Directorate of the Institute. All this complicates the process of tracking submitted documents by students.

At Moscow State University, points are calculated for each type of activity [3]. The student can see what place she or he occupies and how many points they received. If students do not agree with the scores, they can appeal. Candidates for ISAS apply to the academic Council for a scholarship. Discussion about the purpose of the scholarship is held with the participation of student organizations of the University. After that, the applications are sent to the information Department of the University, where the authenticity of the documents is checked.

Nowadays, there are a large number of methods for evaluating student achievement. The most objective is the point-rating system for evaluating achievements. Some universities accept and take into account student’s achievements only for a certain period of time, or add up points in all activities. In [4], the authors consider modern methods of accounting for students’ achievements, conduct a comparative analysis and come to the conclusion that the most objective system for accounting for students’ extracurricular achievements is a method where the rating for each type of extracurricular activity is calculated separately.

Despite the fact that many Universities use information systems for recording student achievements, some of them have significant drawbacks. An important issue at the moment is an accessible system for recording students’ achievements, reviewing applications for ISAS and distributing it online. It is much more convenient when a student can see her or his rating points and understand chances of getting a ISAS, as well as in case of disagreement with the assigned points, be able to challenge them.

The main goal of this work is to increase the efficiency and accessibility of the process of reviewing students’ achievements for the appointment of ISAS through an information system that will allow you to submit achievements for verification and applications for ISAS online, track your position in the rating in real time, and view the achievements of other students directly from the rating system.

It is assumed that the ISAS will be distributed by the designed system to students throughout the University, while the scholarship Commission will verify the authenticity of student achievements during each semester.

2. Methods
In order to formulate requirements for the system under development, it was necessary to analyze existing solutions. Based on the analysis, the main criteria for the system and its essence were formulated. Main functions of the system:

- Creation of creative collectives.
- Creating creative / social events of various levels.
- The introduction of the system of their achievements in various activities.
- Electronic sending of achievements for verification to members of the scholarship Committee.
- Electronic submission of an application for participation in the ISAS distribution competition.
- View your position in the ranking.
- Review the achievements of other rating participants.

Based on the criteria formulated, a diagram of use cases in the Rational Rose program is developed [5]. The Functionality of the designed information system assumes four roles (figure 1):

- Head of creative associations-creates creative teams and events.
- Student - is an active user of the system, maintains his portfolio, tracks the rating, has the opportunity to challenge the decision of the members of the scholarship Committee regarding the points awarded.
- Member of the scholarship Committee-checks students’ achievements for accuracy, and also confirms the points awarded by the system.
• Administrator—responsible for adding new users to the system, as well as for maintaining existing users.

Figure 1. Use case diagram.

All modern information systems involve working with information organized in the necessary structure—a database, so a large place in the implementation of this system is occupied by the design and development of the database. It will contain a large amount of processed and used data. To solve this problem, it is necessary to organize and structure the data set, which implies database design [6]. The database structure is a relational model that is designed using MySQL Workbench 8.0.19 [7].

The user application will be implemented using the classic client-server architecture using the representational state transfer approach [8]. This approach allows you to extend the client’s functionality by sending code from the server in the form of scripts. Using this approach, you can get the following benefits:

• Scalability.
• Reliability—achieved by avoiding the need to save information about the client's status.
• Simple interfaces.
• Portability of components.
• Performance—through the use of cache memory.

The server part is planned to be implemented using PHP, and the client part will be developed in JavaScript.

3. Results
Created on the basis of the developed UML-diagram of use cases, the ER-diagram of the database is able to store the entire volume of data of the future is. Includes the following tables (figure 2).
In order for the developed information system to be user-friendly and have the most complete functionality, it is necessary to adhere to the following requirements [9]:

Figure 2. ER-database diagram.
• Simple and intuitive interface to increase the user’s speed by reducing the time for reflection.
• Reduce the number of human errors by reducing the requirements for vigilance, increasing the legibility and visibility of indicators, blocking potentially dangerous user actions until confirmation of the correct action is received.
• The user interface should contain hints, informational messages, and reference documentation.

Based on the above criteria, the interface of the future information system was developed. The color scheme consists of various shades of blue, as this color is soothing and relaxing. The user should not feel any tension while working in this system.

The main menu of the system administrator page consists of the following elements:

• “Students” button.
• “Employees” button.
• “Feedback” button.
• User icon.
• Drop-down list with user settings.
• “Notifications” button.

When you click on the “Students” button in the system menu, a page opens with the “Add new user” button and the search bar (figure 3).

![Figure 3. Admin page interface.](image)

When you click on the “Add new user” button, a page opens with the student’s questionnaire, which the administrator must fill out in order to add a new user to the system (figure 4).
4. Discussion
The advantages of this information system are as follows:

- Simplified the process of applying for an increased scholarship by sending documents electronically through your personal account, which facilitates the process of creating and submitting documents for processing.
- It is easier for members of the scholarship Committee to assess the validity of the certificates provided, and the application processing time is reduced.
- Employees of the Directorate can track the achievements of students at their Institute.
- Automatic scoring system for student’s achievements.
- Rating system.
- The possibility of filing an appeal in connection with the disagreement of points awarded for certain achievements.
- The opportunity to learn about the work and achievements of other students.

5. Conclusion
As a result of the work, an information system was designed for recording student achievements, which solves a number of problems listed above. The system is universal and suitable for any University.

Currently, a web-based client application is being developed that includes all the functionality shown in the use case diagram (figure 1).

Further development of this work is associated with the expansion of the system by adding new functions that allow not only to take into account the achievements of students, but also to automate the work of the directorates of institutes.

It is also planned to collect and analyze statistics on the specified criteria for certain periods, which will allow you to clearly see changes in student activity for various types of achievements.
This solution will allow you to automate the considered process, which will have a positive impact on the development of student life and the University.

References
[1] Algorithm for rating students for awarding state academic scholarships in an increased amount for academic, research, social, cultural, creative and sports activities of SFU students Retrieved from: http://news.sfu-kras.ru/files/algoritm_s_ispravleniyami.pdf
[2] Documents and regulations that indicate the points awarded for each extracurricular activity of NSU students Retrieved from: https://www.nsu.ru/n/education/apply-info/scholarship/
[3] Scholarship support for MSU students Retrieved from: http://edu.msu.ru/finance/index.shtml
[4] Tapelina K A and Zhevalkina M I 2014 Analysis of modern methodologies and Web-based systems for recording achievements of the University students Mod. Sci. Resear. And innovations 10-1(42) 60-7
[5] Abramov F O 2013 Basic information about UM and, BOUML, diagrams of use cases (Volgograd: Volgograd state technical University) p 49
[6] GOST 20886-85 data Organization in data processing systems Retrieved from: https://internet-law.ru/gosts/gost/12548/
[7] MySQL Workbench 8.0.19 Retrieved from: https://www.mysql.com/products/workbench/
[8] Fielding R T 2000 Architectural Styles and the Design of Network-based Software Architectures (Irvine, California) p 76
[9] Polskaya P S, Ognegin K E, Markushin E M, Popov A A and Shchedrin V A 2020 Analysis of student achievement accounting systems Modern Science 4(1) 378-82