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WEB-SERVICE FOR OPTIMIZING THE WORK OF SECONDARY SCHOOLS

Pasternak I., Hryhlevych M. Web-service for optimizing the work of secondary schools. Web-service for optimizing the work of secondary schools helps teachers and school administrations to organize the learning process, saving a lot of time. The article considers some problems of imperfection of modern education and develops a web service that solves them.
Key words: optimization, school, teacher, web-service.

Пастернак І.І., Григлевич М.І. Веб-сервіс для оптимізації роботи загальноосвітніх навчальних закладів. Веб-сервіс оптимізації роботи загальноосвітніх навчальних закладів допомагає вчителям та адміністрації шкіл організувати навчальний процес, економлячи багато часу. У статті розглянуто деякі проблеми недосконалості сучасної освіти та розроблено веб-сервіс, який їх вирішує.
Ключові слова: оптимізація, школа, вчитель, веб-сервіс.

Education is one of the most important branches of human activity. It is the educational quality of a person that corresponds to the future of the services provided by him, because the development of the necessary skills is paramount. Improving the quality of education is definitely developing in all other areas. Getting education by human begins at school. The school provides basic knowledge, without which it is impossible to master any profession. One of the methods to increase the efficiency of the school is optimization.

In today's world, the term "optimization" can be heard in any field of activity, because it is primarily an identification of the concept of "development". Human labor with many benefits does not mean that a better result is required to work. Optimizing the desire to get unnecessary processes in the course of work, without which you can work.

The best example of optimization is Henry Ford's invention of the conveyor in 1913. After the innovation in production, the process of assembling a Ford "Model T" car was reduced from 12.5 to 6 hours. That is, during the same working hours, workers were able gather twice as many cars as before. The quality of these cars wasn't getting worse, and there have been positive changes in this regard. Because each person had his or her own place on the assembly line and was solely responsible for assembling specific universities, his or her skills improved at an extremely rapid pace.

Another striking example of successful optimization is the world's most famous fast food chain McDonald's. At the end of the 40s of the 20th century, the company underwent large-scale changes aimed at fully optimizing the work of the institution (at that time it was the only one). The McDonald brothers closed their restaurant for 3 months and focused on action plans and design. The idea was that employees did not have to make unnecessary movements, fulfilling customer orders. Periodically, they selected their employees on the tennis court, where they marked the areas that corresponded to different places in the kitchen. They were asked to take their positions and imitate their usual work. When the shortcomings of the location of the working areas were identified, McDonalds redrawn, taking into accounting their mistakes, and then such a scheme all at first and so on in a circle, until they reached the ideal. During the experiment, many options for the placement of kitchen appliances were considered, all interactions between employees were considered, and as a result, the best scheme of the institution was developed. Thanks to this, fantastic results were achieved - the service time of one client was reduced from 15 minutes to 30 seconds, that is 30 times less.

Modern technologies optimize work much more efficiently. With the development of computer technology, there are more and more opportunities to automate many processes, even in some cases, technology can completely replace human labor. For example, we can see an electronic menu in many restaurants, where we choose dishes and pay for our order, and then pick it up when the order number is displayed on the board. That is, there is no need to interact with the cashier, computer do everything for him. It also manifests itself in buying flowers online, booking apartments, buying goods in online stores and more.

Today, educators are full of different tasks. Many of these tasks are not related to teaching the material to students, they prevent educators from doing what is primarily intended for their work. This web service will take over most of the work, thus relieving the staff of the school, and they in turn will have more time to devote to its students. After conducting research, it became known that similar services are not very effective in this regard, because their functionality for the most part simply replaces the usual work with electronic, rather than simplifying it.

During the development, an analysis of existing web services designed to optimize and manage the work of the school. The most popular among them are: Yedyna Shkola, Evolution and SMLS. We will conduct research based on the presented web services.

Yedyna Shkola. This service is recommended by the Ministry of Education and Science of Ukraine. The functionality is based on the entered electronic journal, in other words the service provides the teacher with extra clerical work, such as grading separately in the journal and diary. The system will display it wherever needed. Also, using this service, lists of students for each subject will be automatically generated, so the class teacher does not spend more time to complete the journal for each subject.

Evolution. It is a learning management system based on the student's personality. The idea of its developer is not only to automate the processes used to conduct a lesson or assess students, but also in certain analysts, monitoring the interest of students in different schools. At the same time, the most important task of the service is to create the formation of the student's personality, to see his strengths, these interests, and so on.

SMLS. Full name "School Management and Training System". The essence of the service is the distributed roles of participants in the educational process and the interaction between them. The service has a very wide range of features, which includes viewing the schedule, information about the school, the menu of the school canteen, the route of the school bus, and human resource management, statistics, reporting and more. It is more like a complete network for school staff and students.

In the above versions, the functionality is aimed directly at the learning process, such as conducting a lesson, filling out a journal and things like that. These things, of course, simplify the work of the teaching staff of the school, but they involve only the replacement of physical processes by electronic ones, and human participation in these processes is not greatly reduced.

The web service developed in this article focuses on processes in which human participation can be optimized to a much greater extent. Some features of my web service may not seem important in the educational process to focus on. However, this is why they need to be optimized, because spending precious time on them has a negative impact on the workload of teachers, principals and other school staff. Table 1 lists the advantages and disadvantages of the web services described in this article.

Tab. 1. Comparing current web service with similar services.

Web-service	Advantages	Disadvantages
Web-service developed in this article	The web service optimizes school activities that spent a lot of time, which greatly simplifies the work of the school. It contains only those functions that will relieve school staff from overburdening, and the rest of the work will be performed by school staff in the usual way. This allows you to quickly integrate the web service into the learning process.	It does not act as an e-school service. It has only the functionality that saves time.
Yedyna Shkola	The service provides digital activities of school.	It is not aimed at optimization and its use does not greatly simplify the work of school staff.
Evolution	The service aimed at powerful analysis of school	The functionality of the service almost does not include

	subjects and the formation of the student's personality.	the learning process.
SMLS	It has a wide range of functionality, covering all areas of school activity.	The service has many extra features that are used very rarely.

The web service developed in this article will help teachers to do their job without hassle. The idea of the web service is to relieve participants of unnecessary worries so that they can focus purely on education: the teacher - directly on the delivery of material in an understandable and accessible form, and the student - on obtaining and consolidating knowledge.

In the future, it will be possible to expand the functionality so much that most of the usual work for teachers now will be performed automatically. This will primarily improve the quality of education, as facilitation of work will significantly relieve the learning process and the teacher will have more opportunities to pay attention directly to students.
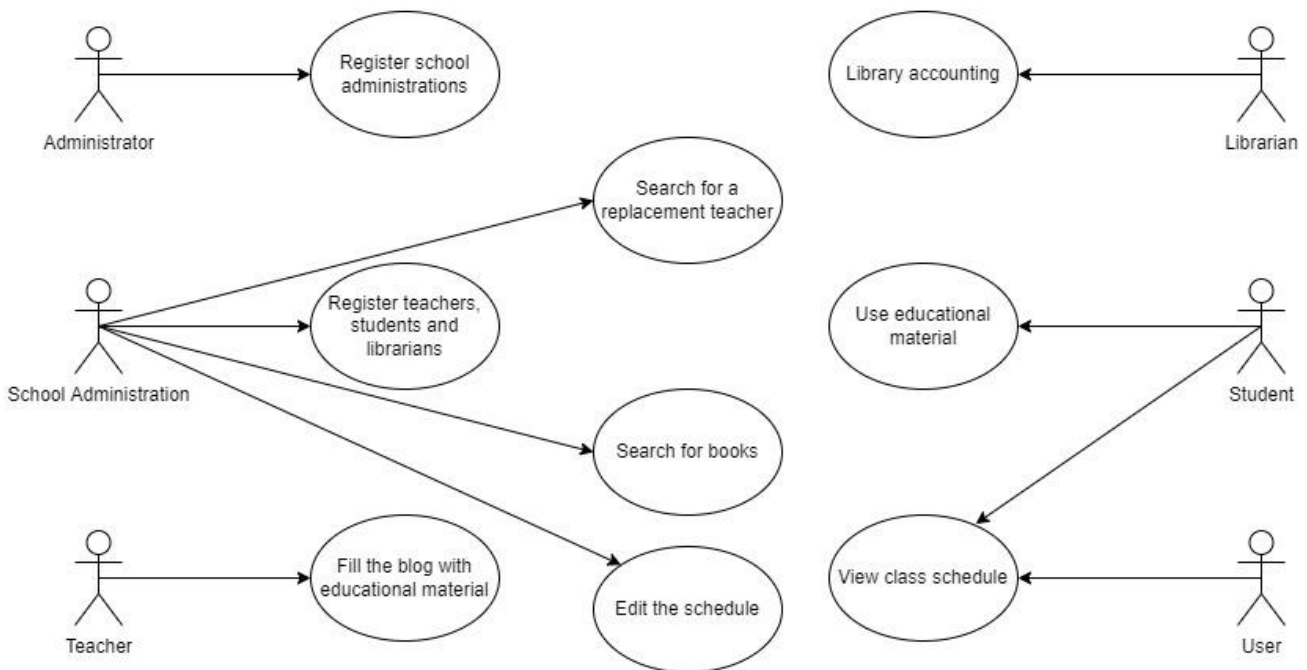

Fig. 1 – UML use-case diagram.

Unified modeling language (UML) is used to design the web service. In fig. 1 you can see a use-case diagram. This chart allows you to visually show features that are available to specific types of users. User roles can be as follows:

• Administrator - a single administrator for the entire web service. His role is to create and remove schools, appoint the school's account;

• School Administration - one such account per school. Appointed by the administrator. Performs the most important functions of school management, is also responsible for the appointment of teachers, students and librarians;

• Teacher;
•Student;
• User - any user who has not been logged in.

Different functions are available for each user role. Features include:
• Register school administrations;
• Register teachers, students and librarians;
• Search for a replacement teacher;
• Search for books;
• Edit the schedule;
• Fill the blog with educational material;

• Library accounting;
• Use of educational material;
• View class schedule.

The key functions of the web service are "teacher replacement search" and "book search". These features involve the use of a search algorithm for nearby schools that have something in excess that the current school lacks. This algorithm is a valuable unit, because it can be used in the future to create many useful features for secondary schools, which indicates a good prospect for this web service. Finding the right resources in other schools takes a lot of time, which can be spent on improving educational material or other important processes of educational activities. This web service will do this job in seconds. Search for nearby schools using the Google Maps service. Each school has its own address and, accordingly, coordinates on the map. The Google Maps API calculates the distance and travel time from the current school to each in the system, and then sorts by distance (Fig. 2).

Teacher replacement search (Fig. 3). The task of this algorithm is to simplify the procedure for finding a teacher who is currently free from work in other schools. The algorithm will be based on the schedule of teachers and the location of the school. The process of finding a teacher will take into accounting the time spent in the lesson, the time on the way from the school where the teacher works to the school where he will replace his colleague, as well as the time on the way back. The result of the sequence of algorithms will be a teacher who, according to the above criteria, is best suited to replace another teacher. This feature is relevant right now. With the onset of the Covid-19 pandemic, the problem of replacing teachers for some time is becoming increasingly important. Finding a free teacher in nearby schools saves time on school logistics.

Book search (Fig. 4). The task of this algorithm is to replace human resources and optimize time spent searching for excess textbooks in other schools. The algorithm will be based on the accounting of textbooks in schools maintained by a librarian. As a result of the sequence of actions of this algorithm, a school or a list of schools will be published, where you can get textbooks for students who did not have enough of them.
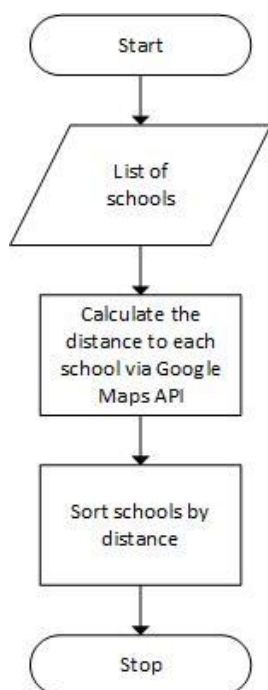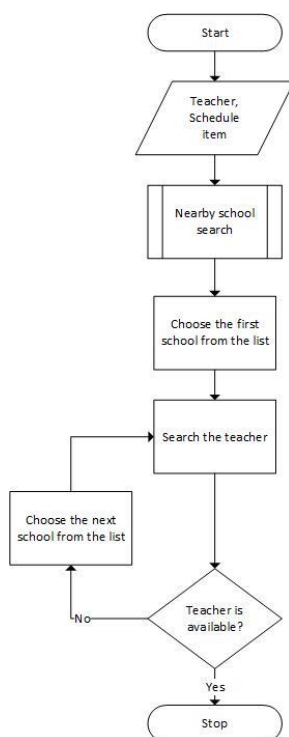

Fig. 2 – Nearby school search algorithm.

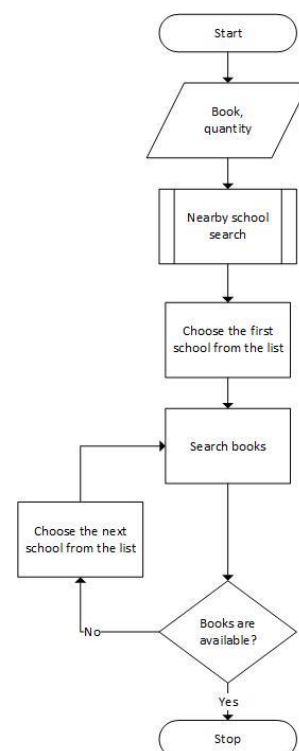Fig. 3 – Teacher replacement search algorithm.

Fig. 4 – Book search algorithm.

The client-server architecture was chosen for the software implementation of the web service. The client part is implemented in the form of a web page in HTML, CSS, Javascript using the Javascript framework React JS, and the server part is written in Java using the Spring framework. The Postgres relational database was chosen as the database. Implementation of communication between client and server parts is presented in the form of REST API using HTTP protocol. Data is transmitted in JSON format.

Many modern web services now work on this principle, as such web services are extremely convenient to expand, adapt to different platforms, etc. In the future, on the basis of the server part, you can make more than one client. For example, you can develop applications for various operating systems, including mobile.

Figure 5 shows a sequence diagram. It shows communication between user, client (web-page), server (app developed in Java), database and Google Maps service.
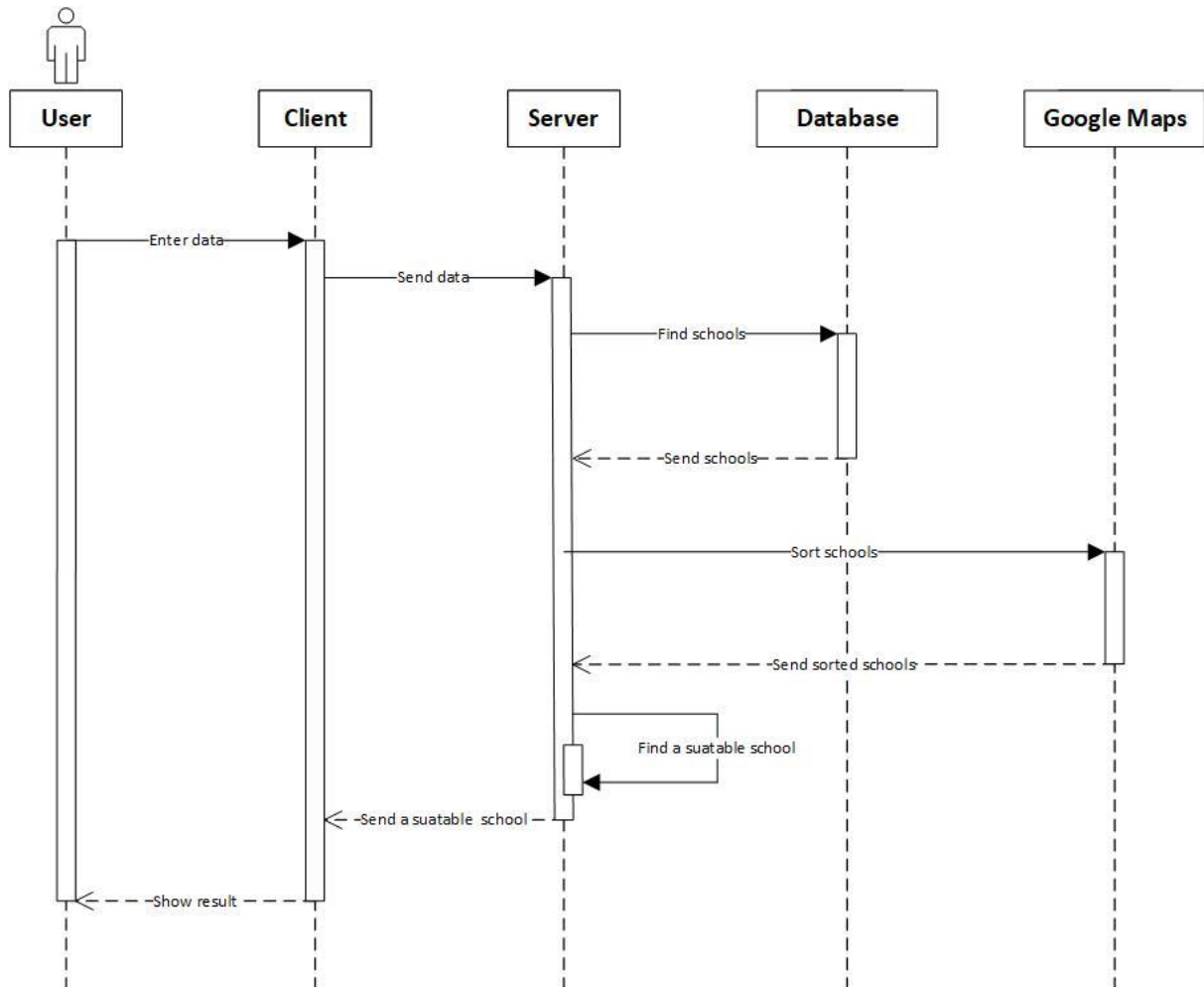

Fig. 5 – UML sequence diagram.

Figure 6 shows a class diagram. It shows the architecture of the components of the web service. User, Admin, SchoolAdmin, Student, Teacher and Librarian classes are responsible for functionality that is only available to specific users who have certain roles. School class represents a school with own schedule, represented by Schedule class. ScheduleItem class is a component of Schedule, represents a school lesson. There is a composition of School, Schedule and ScheduleItem classes. Post class represents a teacher's post. Library class represents a library with books. Book class represents a book. Library and Book classes make a composition.
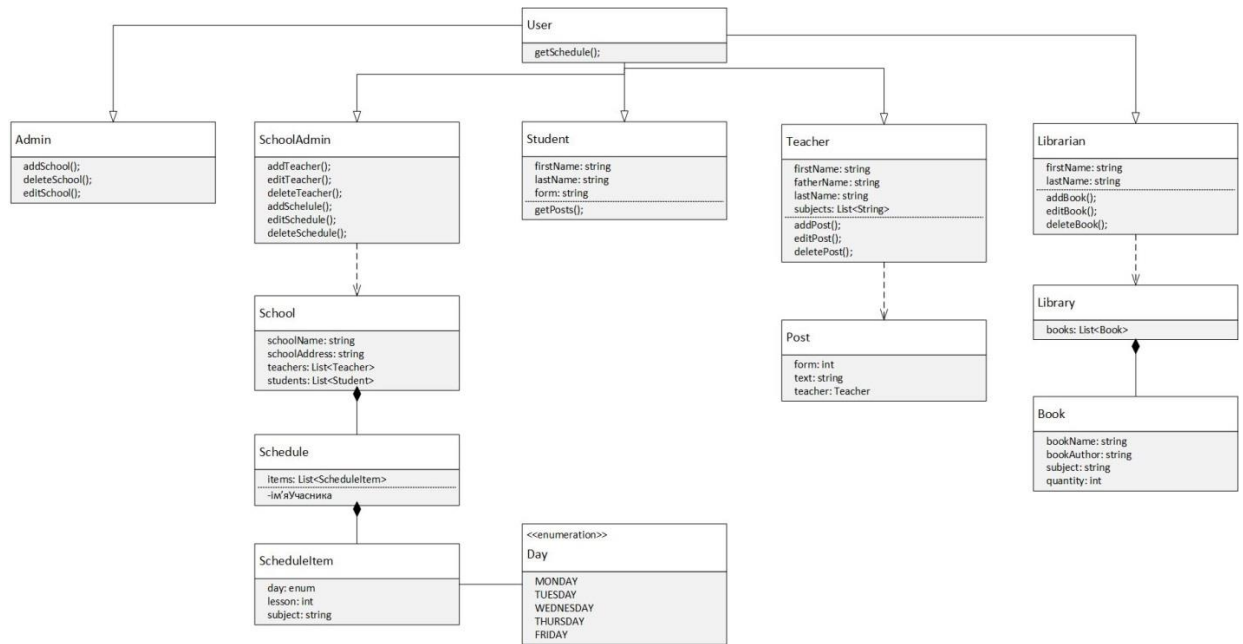
Fig. 6 – UML class diagram.

After the development of the web service, its work was tested. The time spent on key features took a few seconds. Without the use of a web service, the time spent can be more than an hour. Therefore, the web service developed in this article fully fulfills the task and solves the problem posed in the article.

Conclusion. The article develops a web service to optimize the work of secondary schools. The analysis of similar services is carried out, the problems which they solve, and also processes which still need realization are defined. A model of web service functioning has been developed. The technologies of web service development are given. The perspective of the web service developed in the article is assessed.

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