

INFORMATION SYSTEM FOR THE EDUCATIONAL CENTER

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The goal of the research of the qualification thesis is the development of an intelligent information system of the educational centre using the Python programming language and the Django framework, the SQLite database system, and the chatbot with artificial intelligence ChatGPT. The developed system should facilitate the interaction of different types of users with learning/training centres in order to acquire new necessary skills. As you know, from now on every day more and more educational centres are opening, which provide their services for the study of this or that ability. Due to the onset of the pandemic period, all such educational centres are transferring their classes to the online mode, and the actual need to solve this type of issue arises more and more often. In this work, an analytical review of literary sources is carried out, a comparison of known means of implementation, i.e., so-called analogue systems, is carried out; the actual functioning of this type of system is checked. In addition, a goal tree is being built, which clearly outlines the general goal, namely, the optimization of all processes of the educational centre. In addition, an equally important step is the description of requirements, which is carried out in this work using the RUP methodology for the intelligent information system of the educational centre. The category of users is also determined and a generalized model of system functioning in the environment is built. To develop the system, an analysis of possible methods and software tools for creating and deploying the system is carried out. The most optimal methods for this case are chosen, namely the method of software synthesis and the method of using ready-made solutions, because their application will provide an opportunity to develop a system from scratch using the necessary components and provide an opportunity to integrate an already ready-made system with an intelligent component. Next, a recalculation of possible options among the integration of ready-made intelligent components is carried out, and a chat system with artificial intelligence is chosen, because it will give users the opportunity to search for answers to their questions without leaving the system and facilitate the learning process for each of the users.

Key words: learning centre intelligent information system; intelligent component; website; user; student; teacher; learning centre; course; HTML; CSS; Python; Django; SQLite; ChatGPT.

Introduction

It is a known fact that day by day more educational institutions are starting to open their doors to provide their services for learning various skills. Actually, the relevance of the topic lies in the need for an intellectual system of educational centers, which will provide an opportunity to improve the quality of education provided to students, simplify the learning process, and obtain the most positive results at minimal costs. The implementation of an intelligent information system is an important tool for improving the effectiveness of training and improving the quality of education. In connection with the growth of the number of students and the growing need to improve the level of qualifications, educational centers must provide an effective and high-quality learning process. The developed system will provide an opportunity to present and update all necessary information for training, to register new users to the system and to analyze training results. Actually, the system is not only a space for placing all the necessary data, materials, links and users, but also an opportunity to analyze success, attendance and the quality of the education provided. The purpose of the study is to develop an intelligent information system of the educational center. The process of simplifying and improving the quality of education is the object of research, which also includes obtaining, processing and analyzing all the necessary data for the most effective process. The subject of the study is the methodology, methods and technologies of developing an intelligent information system of the educational center, which provide an opportunity to improve the effectiveness of the learning process as effectively as possible. The main tasks of the research to achieve the goal are as follows:

- Analysis of system user needs and requirements: Conducting research on what features and capabilities the system should have to meet user needs.
- Defining the structure and architecture of the system: developing the detailed structure of the system and its architecture, including the relationships between the various components of the system.
- Development of methods and algorithms for data processing: determination of optimal methods and algorithms for the collection, processing, storage and use of user data.
- Development of user interfaces: designing user interfaces to ensure convenient and efficient interaction with the system.
- Testing and Validation: Conducting system testing and validating its performance to ensure that the system meets all user requirements and needs.
- Implementation and support of the system: developing a strategy for the implementation of the system and ensuring its support and development in the future.
- Ensuring security and privacy: developing mechanisms to protect against unauthorized access to user data and ensuring data privacy, in particular, developing security policies, using encryption and user authentication methods.
- Analysis of effectiveness and impact on the learning process: conducting a study of the effectiveness of the system and its impact on the learning process to ensure that the system fulfills its tasks and improves the quality of learning.
- Study of trends and new technologies: monitoring the development of new technologies and trends in the field of education in order to improve the system and ensure its future development.

Taking into account all the features, approaches and needs of the developed system in the field of education among educational centers is a scientific novelty of the study, because the system will include the possibility of using artificial intelligence in educational needs, which, in fact, should improve, facilitate and optimize the learning process. The development of an intelligent information system of educational centers can provide a number of advantages and opportunities, such as:

- Improving the quality of learning: an intelligent information system can provide an individual approach to each student and provide recommendations for learning, which will contribute to improving the quality of learning.

- Efficiency: an intelligent information system can provide automation of learning processes such as creating a schedule, assigning homework and testing, which will reduce labor costs and ensure the efficiency of the training center.
- Cost optimization: an intelligent information system can ensure the efficient allocation of resources and optimize the costs of the training center.
- Convenience: An intelligent information system can provide convenient access to learning information that can be obtained from anywhere and at any time.
- Monitoring: an intelligent information system can provide monitoring of the educational process and collect statistical data that will help the educational center in developing a development strategy.

Analysis of recent research and publications

According to the scientific definition, a training center is a center that provides a service that in turn enables companies, groups of qualified individuals to create their own training materials that document the best practices and procedures of their founders. As teachers in these centers, their owners often recruit highly qualified specialists from their companies or even universities [1]. In the case where a university teacher is a teacher in a learning center, in addition to economic benefits, it also brings them modernization of their teaching style, developing concepts and information in such a way that students can comprehend them, and also help students to learn more deeply and retain what they have learned. studied As such, these centers assume the role of educational change agents. Such centers also try to help faculty with other challenges they may face, such as managing graduate students, course design, technical writing, testing new teaching methods, and designing better assignments and exams. Some centers can address learning difficulties on the students' end by providing support services for better learning and study skills. Some centers may also be involved in e-learning and similar movements. Although there are many information systems that offer different benefits, these programs are generally used by businesses. Here are some advantages of any information system you decide to use in your company [2]: through its research and development, the system will encourage innovation in commercial activities; automation will become possible by minimizing the steps required to complete a task; security support and modernization of hardware, software, data storage systems and network systems. The types of information systems that have the ability to change business processes include the following:

- Information Work System: An organization can use a variety of knowledge management systems to ensure a constant flow of fresh and updated information into the business and its operations. One of the knowledge management tools that facilitates the incorporation of fresh data or knowledge into operational procedures is a knowledge management system (KMS). In addition, SRH provides assistance and resources for various knowledge generation methods, artificial intelligence software, and group collaboration platforms for information sharing, among others. In addition, it uses images, drawings, etc. to convey fresh information. Computer-aided design (CAD) systems are often used by designers to automate the design process. With the help of advanced technologies, financial workstations are used to evaluate huge amounts of financial data [3]. Systems for presenting data using graphical and other platforms can be found in scientific, educational and business fields where virtual reality is used.

- Management Information System: By automating several tasks that used to be done manually, a management information system helps managers. for example, measuring and analyzing company performance, making decisions, creating business strategy and establishing processes. By learning roles and responsibilities, he also gives managers feedback. An important application that helps managers a lot is the information management system [4]. Here are some advantages of the information system: increase in business productivity and efficiency; presentation of an accurate representation of the organization's productivity; acceleration of product development, introduction of innovations and adding value to already existing elements; facilitating the planning of corporate processes and communication; enabling the company to offer a competitive advantage.

- **Decision Support System:** To enable automation of decision making or problem solving, a decision support system is an information system that analyzes business data and other information relevant to the firm. When difficulties arise during the management of the firm, the management hires her. A decision support system is typically used to collect data on revenue, sales, or inventory. A decision support system is a well-known information system used in various businesses [5].

- **Office Automation System:** An information system, known as an office automation system, automates a variety of administrative tasks, including documentation, data entry, and office operations, among others. In the office automation system, administrative tasks are separated from management tasks. Here are some examples of business operations that are carried out using this type of information systems: voice mail via e-mail; text processing.

- **Transaction Processing System:** The process of collecting, modifying and receiving transactions is automated by the transaction processing system. The peculiarity of this information system is that it increases the efficiency, reliability and consistency of commercial operations. This facilitates the smooth daily operation of businesses. Understanding how these systems are applied becomes easy to understand if you are familiar with many types of information systems [6].

- **Executive Support Program:** Senior executives can plan and manage their workflow and make business decisions using the Executive Support System, or SPC. Here are some of the distinguishing features of SPK: offering executives superior quality communications, enhanced computing power, and useful display options; the ability to access information through static reports, graphics and textual content on demand; being able to track performance, track competitive strategy and forecast trends.

In turn, an intelligent information system (IIS) is a computer system that can collect, process, analyze and interpret large volumes of data using various methods of artificial intelligence. IIS is a very powerful tool for solving complex problems and ensuring effective decision-making in various fields, including science, industry, medicine, finance, and others. The main characteristics of IIS include the collection of data from various sources, their processing using machine learning methods and other artificial intelligence technologies, as well as the possibility of automatic decision-making based on the collected and processed data. One of the key functions of an intelligent component is the possibility of automatic decision-making based on data analysis. The intelligent component of IIS can use different methods and algorithms for decision-making, depending on the context and purpose of the system. Overall, IIS is a powerful tool that helps organizations collect and analyze large amounts of data to make effective decisions. Over the past 30 years, this technology has developed significantly, so it is now extremely important to many industries and businesses.

The scientific approach to information systems of educational centers is determined precisely by the need to take into account the specifics of the activity of this type of system and rapidly changing market conditions. The primary source that was reviewed is “Design of a Learning Management System for Engineering Colleges” by A. Rajkumar and R. Sathish Kumar [7]. This article describes the design of a learning management system for technical colleges. The authors used such components as a video conferencing system, an e-mail system, a document management system, a virtual classroom system, and a student performance tracking system. They also used different learning assessment methods such as tests, homework and projects. This resource provides an understanding of how a variety of components and methods can be used to create a learning management system. In particular, the article describes the use of virtual classes, which can be useful for the system. In addition, the learning assessment methods described in the article can also be useful in designing a system for assessing students' knowledge in a training center system. According to the study conducted by the authors of the article, the use of virtual classrooms allows students to access course data from anywhere and at any time. This is especially important for students who cannot attend classes in real time due to various circumstances, such as illness, business trips, distance to the training center, etc.

The next source that was used is the article “Intelligent Information Retrieval Systems: A Review” by Pramod Kumar and Pushpa Mishra, published in the magazine “International Journal of Computer Applications” in 2012 [8]. In this article, the authors consider intelligent information search systems (Intelligent Information Retrieval Systems – IIRS) and their various approaches to solving the problem of information search. They describe various methods and techniques used in IIRS, such as the use of ontologies, classification, association, object relationship analysis, etc. In the context of the topic, this article can be useful for understanding the technologies and methods that can be used to implement an intelligent information system in a learning center. It provides information on various information retrieval and analysis methods that may be useful in developing such a system. In addition, the article also describes approaches to improve the quality of search, such as the use of intelligent agents and machine learning, which can be important for the effective functionality of the information system. The authors consider the issue of application of intelligent systems in training and education. They define such concepts as an intelligent system, a decision support system, an expert system, a training system, etc.

A publication by A. Mukherjee, S. Chakraborty, and S. Basu describes the design of a Learning Management System, (LMS) for open and distance learning [9]. The authors drew attention to the fact that the increase in the number of students in open and distance education necessitated the creation of such systems that would help teachers and students in managing the educational process. The article emphasizes that the important components of an LMS are: a course management system that enables teachers to create, edit, and grade courses, as well as provide access to them to students; a materials management system that provides storage, organization and distribution of materials used in courses; a grading system that allows teachers to evaluate student work and provide feedback on their work; a communication system that enables communication between teachers and students.

In the source D. Guralnik “Learning Management Systems” the authors consider open distance learning technologies and describe LMS as a system that enables students to learn at any convenient time and place [10]. The authors provide an overview of different types of learning management systems and their functionality. The article describes that LMS consists of three main components: a server, a database, and a user interface. It has many useful features for students and teachers, such as the ability to download and view lectures, send and receive messages, complete assignments, etc. In addition, the authors note that an LMS can be integrated with other systems, such as video conferencing systems and security systems. Such integration can significantly improve the quality of learning and enable more efficient use of resources. The source also details the architecture of the LMS and the main components such as the database server, the web server applications and frontend. The authors describe in detail the LMS capabilities for learning management, including the ability to create courses, provide access to learning material, conduct tests, and evaluate results. In addition, the paper explores the challenges associated with LMS implementation, such as the lack of standards, the complexity of integration with other systems, and the need for ongoing technical support. This article is useful for understanding the main opportunities and problems associated with the use of learning management systems, which is an important element in the development of an intelligent information system of a training center.

In an article by S. S. Tabrizi and M. A. Farsi, an empirical study was conducted on the use of learning management systems (LMS) in higher education [11]. The research focuses on how LMS use affects learning effectiveness and student and faculty satisfaction. The article established that the use of LMS significantly facilitates the educational process and provides better organization of educational material. In addition, the use of LMS makes it possible to ensure more efficient use of the time of students and teachers, and also contributes to the increase of interactivity and involvement of students in the educational process. Also, the article focuses on the study of the satisfaction of students and teachers with the use of LMS. As a result of the study, it was found that students and teachers were generally satisfied with the use of the LMS, but some problems were also identified, such as the complexity of using the LMS and the lack of sufficient support from the technical staff. Therefore, this article can be useful for those who are interested in the effectiveness of using LMS in higher education and have the goal of understanding how LMS affects the quality of the

learning process and the satisfaction of students and teachers. In this article, a study of the use of learning management systems in higher education was conducted. The authors drew attention to the fact that the growing popularity of learning management systems makes it necessary to analyze their use in education. The article describes the research methodology and the results of the analysis of five prominent learning management platforms used in higher education. Research has shown that learning management systems provide many benefits, such as facilitating communication between students and teachers, improving the effectiveness of learning and assessment, access to a variety of materials, and providing access to additional resources such as forums, blogs and chat rooms. However, the study also found that using learning management systems can be difficult for students and teachers, especially for those who do not have experience with these systems. The article also points out the importance of training users to work with learning management systems, as well as the importance of constantly updating and improving these systems.

In the article by G. Conole “The evolution of technologies: implications for the design and development of university classrooms” examines the evolution of IT and its impact on the design and development of university classrooms [12]. The author describes how IT changes over time and how it affects learning and education in general. In the context of work, this article can be useful for understanding how technology changes over time and how this affects the design and operation of learning management systems. For example, the shift from desktop computers to mobile devices can affect what features a learning management system should have and what interfaces are most user-friendly. Also, this article can help to understand what technologies may become relevant in the future and how they can be used to improve learning management systems.

In the article by G. Conole “The evolution of technologies: implications for the design and development of university classrooms” the author explores the relationship between the development of technology and the design and development of university classrooms. The article provides a retrospective review of the evolution of technologies used in university classrooms and their impact on approaches to the design and development of such classrooms. The author indicates that from the beginning of the 90-th. In recent years, a variety of technologies have emerged that can be used to enhance learning, such as video conferencing, network platforms, and learning management systems. Furthermore, the paper points out that the design and development of university classrooms must be adapted to such technologies to ensure maximum efficiency and effectiveness of learning. Thus, this article explores the impact of technology on the learning process and the design of learning spaces, which is tangential to the topic of managing the learning process with the help of learning management systems.

The market analysis showed that there are no systems for automating the work of specific training centers, except for those that have the function of automating the entire training center. At least, they are trying to fill this gap. Several popular solutions were found on the World Wide Web, namely:

1. Prometheus is a center of advanced learning in Kyiv, Ukraine, offering English language, programming and design training. The main goal of Prometheus is to provide students with the knowledge and skills necessary to build a professional career. Prometheus offers a variety of English language courses from beginner to advanced, as well as specialized courses to prepare students for international exams such as TOEFL and IELTS. Prometheus also offers programming and design courses. Programming courses include learning programming languages such as Java, Python, and JavaScript, as well as courses in website and mobile app development. Design courses include graphic design, interface design and website design. The Prometheus educational process is based on a personalized approach to each student. Each student receives an individual study program that takes into account his needs and level of knowledge. Prometheus also offers students the opportunity to participate in projects and internships in partner companies, which allows them to gain practical experience and expand their professional contacts [13]. The advantages include: the project is completely free for students; apps are available for different devices – PCs, tablets and mobile phones – so you can study on each of them; it is possible to study simply by having access to the Internet; the opportunity to study at a time convenient for the user – all platform support is available 24 hours a day.

Surprisingly, the disadvantages include: no direct contact with lecturers; the absence of an intellectual component in any form; the specificity of this system is a disadvantage, as only pre-registered courses are available.

2. ED-era is a Ukrainian educational center that offers online courses in various fields of knowledge. The center was created to provide quality education to Ukrainian students and youth, and the ED-era system includes a number of courses in various fields of knowledge, such as programming, finance, marketing and English. The main components of the ED-era system are video lessons, textbooks, tests and other aids that students can study at a time convenient for them. In addition, the system allows students to receive a course completion certificate after successfully completing tests and assignments. ED-era also offers students the opportunity to communicate with their professors and other students through a forum where they can discuss course material and ask questions. Each course has its own assessment system, which enables students to get an objective assessment of their knowledge and academic performance [14]. The advantages include: apps are available for different devices – PCs, tablets and mobile phones – so you can study on any of them; multi-platform system; the opportunity to study at a time convenient for the user – all platform support is available 24 hours a day; the opportunity to study simply by having access to the Internet. The disadvantages of the ED-era system can be considered that the courses can be focused on a narrow group of students, which makes them inaccessible to a wide audience. In addition, some courses may not have enough practical tasks, which reduces their effectiveness in teaching certain skills. And in fact, the lack of an intellectual component and the lack of direct contact with the lecturer are a drawback of the system.

3. Accemedin is an online learning system designed for use in educational institutions and business environments. The system supports learning from anywhere in the world and offers the opportunity to use various learning methods, including video lessons, interactive tests and web conferences [15]. The Accemedin system offers the following advantages: the project is completely free for students; apps are available for different devices – PCs, tablets and mobile phones – so you can study on any of them; the opportunity to study simply by having access to the Internet; the opportunity to study at a time convenient for the user – all platform support is available 24 hours a day. However, the disadvantages include limited functionality compared to other systems and the lack of some additional features, for example, a personalized approach to learning and feedback. Also, a not so important shortcoming of the system is its highly specialized nature, because it is designed exclusively for training in the medical field. Actually, because of this, the system lacks an intellectual component and lacks direct contact with the lecturer.

4. Go Higher is an online learning platform that provides users with the opportunity to receive quality education from the world's leading universities from anywhere there is internet access. System of training centers Go Higher includes over 500 courses across a wide range of disciplines, including business, technology, science and sociology. Courses can be studied online, as well as participate in interactive webinars and discussion forums with teachers and other participants. Every Go course Higher consists of video lessons, tests and practical exercises that help consolidate the acquired knowledge. After successful completion of the course, users receive a certificate from leading partner universities of the platform. In addition to training courses, Go Higher also offers a number of useful materials, including books, articles and other resources, to help improve knowledge and competence [16]. The advantages of the Go training center system Higher has easy accessibility and flexibility in choosing courses and study time. Users can study at a time convenient for them and choose courses according to their needs and interests. The platform also enables users to obtain certificates from the world's leading universities, which can play an important role in career development. Surprisingly, the disadvantages include: no direct contact with lecturers; the specificity of this system is a disadvantage, as only pre-registered courses are available. The disadvantage of this system is also that it contains only online lectures, without additional offline videos; the absence of an intellectual component in any form; some courses are designed for one-way study only.

5. Otmehalka is an online service for training and self-study [17]. The training center system has the following main functions: creating and editing courses; performing tasks and tests; Otmehalka.com

Progress Tracker; interaction with teachers and students; availability on different devices. The main goal is to ensure accessibility and convenience for all users in learning and independent work with the material. The platform was created to support the educational process for universities, educational institutions and self-study. The advantages include: free access; a large number of study materials; individual approach; adaptability; opportunities for interaction; constantly Updated Materials. As for the disadvantages, it can be noted that the interface can be a bit difficult for those who use the system for the first time. Also, at some stages, technical problems may arise that require the help of technical support. And in fact, the lack of an intellectual component and the lack of direct contact with the lecturer are a drawback of the system.

6. Coursera is an online learning platform that offers users access to courses from leading universities and companies around the world. Courses on the platform are taught by well-known scientists and experts in various fields, and are offered to users in an online format [18]. Each course on Coursera consists of a set of lectures and tasks that the user must complete in order to learn new knowledge. Some courses also include tests and other ways to assess knowledge. Coursera offers users a wide selection of courses from various fields such as science, business, technology, arts and many others. Most courses on the platform are free, but users can also purchase paid access to certain courses and programs. Users on Coursera can learn new skills at their own pace, as most courses are available online. In addition, most courses include forums, chat rooms, and other means of interaction that allow users to communicate with instructors and other students, ask questions, and receive help. Upon successful completion of the course, the user can receive a certificate that can be used to improve skills and find a new job. The advantages of the Coursera training system include the following: variety of Courses; quality of teachers; flexibility; interaction; certificates. As for the shortcomings, it can be noted only the absence of an intelligent component in any form and not the possibility of reorienting this system for use as a template for general commercial benefit.

Goal formulation and task setting

The general goal of the work is the development and implementation of an effective intellectual system for educational centers using modern information technologies. After analyzing the functioning of the system [19–26], namely its goals, the following points were identified:

- Unification of educational centers under one standard, you yourself saving money for educational centers.
- Facilitating the work of training center employees through the use of a documentation system in the system, which in turn will save time.
- Improving the quality of information provided to system users, thereby increasing demand. Minimization of misunderstandings for participants and users of training centers.
- Creating favorable conditions for teaching and studying materials during the course for system users.
- To achieve the goal, it is possible to use components such as:
 - Development of a system of an intellectual educational center based on modern software using all modern norms and approaches.
 - Connecting the database, which will make it possible, in turn, to scale the system to the largest possible size if necessary.
 - Placing the system on servers with uninterrupted access, for possible scaling and operation of the system in different time zones.
 - Connecting services like Matomo/Google Analytics to collect information about the most requested functions in the system. This will provide an opportunity to collect certain statistics and understand which components need to be directed to additional efforts to improve them.

Adding an intelligent component in any form. For example, adding chat with Artificial Intelligence to receive maximally fast answers to certain questions of the user or the system of recommendations, which in

turn is based on a neural network. The following resources are required for the implementation of compresses of this type with such conditions and ultimate goal: necessary hardware; shark software; a team of qualified developers; sufficient budget to complete the project in all its aspects. In order to begin the development of a system, first of all it is necessary to define and clearly form and establish the purpose of the system being developed. In this case, the goal is to develop a clearly defined intellectual information system of the educational center, which will guarantee stability and reliability of work under various types of loads. At the same time, the system should have a convenient interface, in fact, the operation with which should be as convenient, simple and intuitive as possible. The system should provide users with constant access to information about specific courses in the training center. The goal tree is used to plan all the steps (Fig. 1) necessary to achieve the goal.

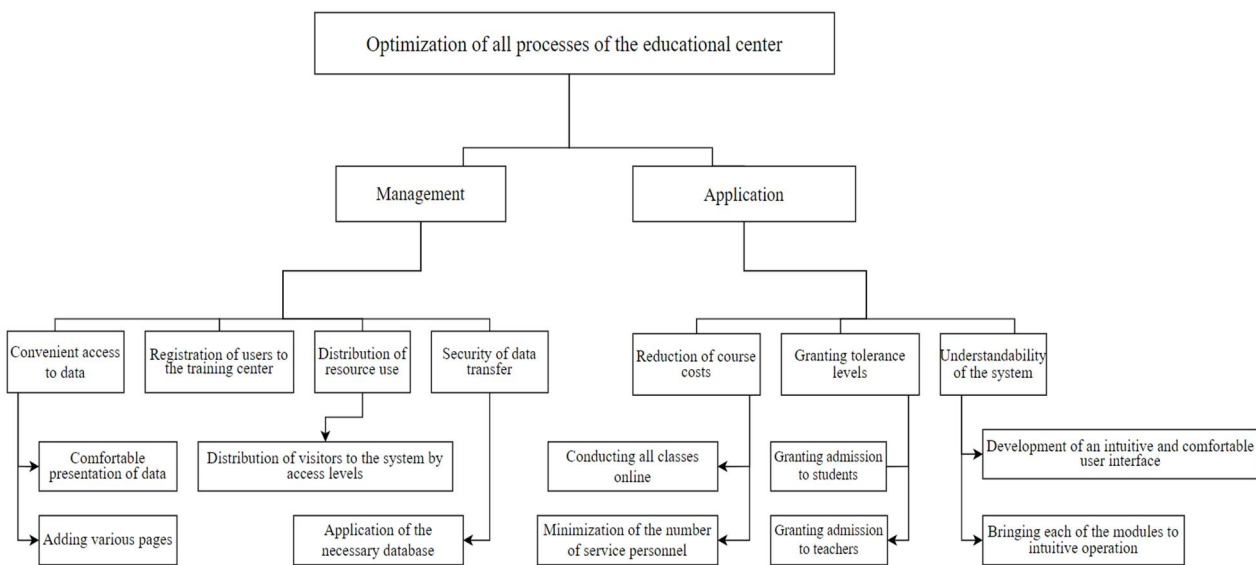


Fig. 1. Diagram of the goal tree of the intellectual information system of educational centers

After the goal tree is created (Fig. 1), the general goal is clearly defined and can be divided into two aspects: management; application. Management considerations for the following purposes: convenient access to data; user registration to the training center; distribution of resource use; security of data transfer. However, the application includes the following goals: reducing costs for conducting courses; provision of tolerance levels; comprehensibility of the system. The last level, reflective sub-goals, which in turn are necessary to fulfill the goals of the previous level, such as: comfortable presentation of data; adding various pages; distribution of visitors to the system by admission levels; application of the necessary database; conducting all classes online; minimization of the number of service personnel; granting admission to students; granting admission to teachers; development of an intuitive and comfortable user interface; bringing each of the modules to intuitive operation. That is, after the goal was determined, an analysis was conducted and a goal tree was created. It reflects the analysis of all the steps necessary to achieve the goals, that is, the main goals, subgoals, and aspects.

Presenting main material

Using IBM Rational Rose was built (Fig. 2) a diagram of use cases for the system of automation of work of educational centers. For the final construction of the use case diagram for this system, the following actions were performed:

1. Added two business actors named “Student” and “Teacher” respectively.
2. Added the actor “System User” to create a generalization relationship.

3. Added four business cases “Authorize in the system”, “Use the system” and “Make changes in the system”, which create a relationship with the stereotype << extend >>.

4. Added usage options: “Enter Login”, “Reset Password”, “Enter Login”, “Check Password”, “Grant Access”, “Authorize”, “View Tutorials”, “View Online Lecture”, “Submit Homework Using mail”, “Add a student to a particular course”, “Update links to manuals”, “Make changes to the course schedule”.

5. A dependency relation with << include >> stereotypes has been added to the “System User” actor, namely: “Enter login”, “Restore password”, “Enter login”.

6. A dependency relationship with << include >> stereotypes has been added to the “Authorize in the system” business case, namely: “Check password”, “Give access”, “Authorize”.

7. Include >> stereotypes were added to the business case “Use the system”, namely: “View manuals”, “View an online lecture”, “Submit homework by mail”.

8. A dependency relation with << include >> stereotypes has been added to the “Make changes to the system” business case, namely: “Add a student to one or another course”, “Update links to manuals”, “Make changes to the course schedule”.

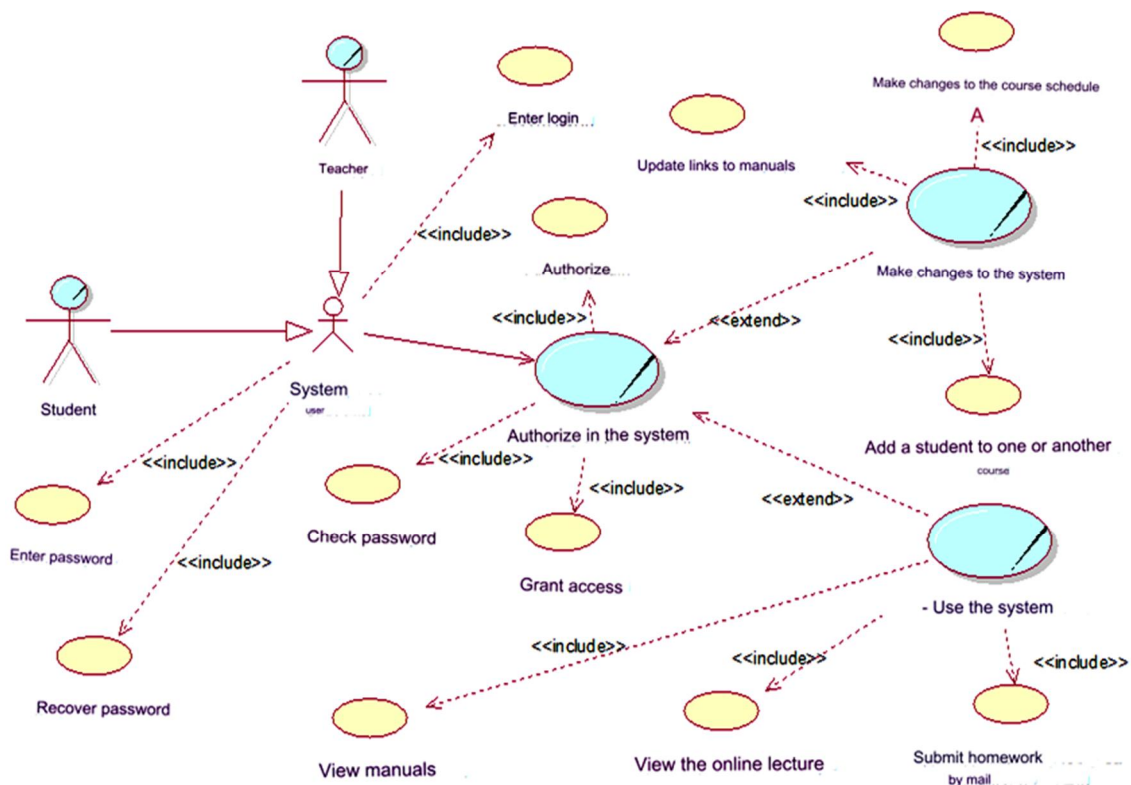


Fig. 2. Diagram of “LearningAC” use cases

For the final construction of the class diagram (Fig. 3), the following actions were performed:

1. Added two business actors named “Student” and “Teacher” respectively.
2. Added the “System User” actor to create a generalization relationship.
3. The following attributes have been added to “System User”: “Login”, “Password” with access modifiers private.
4. The following operations have been added to “System User”: “Enter login”, “Restore password”, “Enter login” with access modifiers public.
5. Added controller “Automation system” and two classes: “Using the system”, “Making changes to the system”.

6. The following operations have been added to “Automation system”: “Check password”, “Grant access”, “Authorize” with access modifiers public.

7. The following attributes have been added to “Using the system”: “Manuals”, “Lecture”, “Mail” with private access modifiers.

8. The following operations have been added to “Using the system”: “View manuals”, “View online lecture”, “Submit homework by mail” with access modifiers public.

9. The following attributes have been added to “System Changes”: “Students”, “Schedule”, “Links to manuals” with private access modifiers.

10. The following operations have been added to “Make changes to the system”: “Add a student to one or another course”, “Update links to manuals”, “Make changes to the course schedule” with public access modifiers.

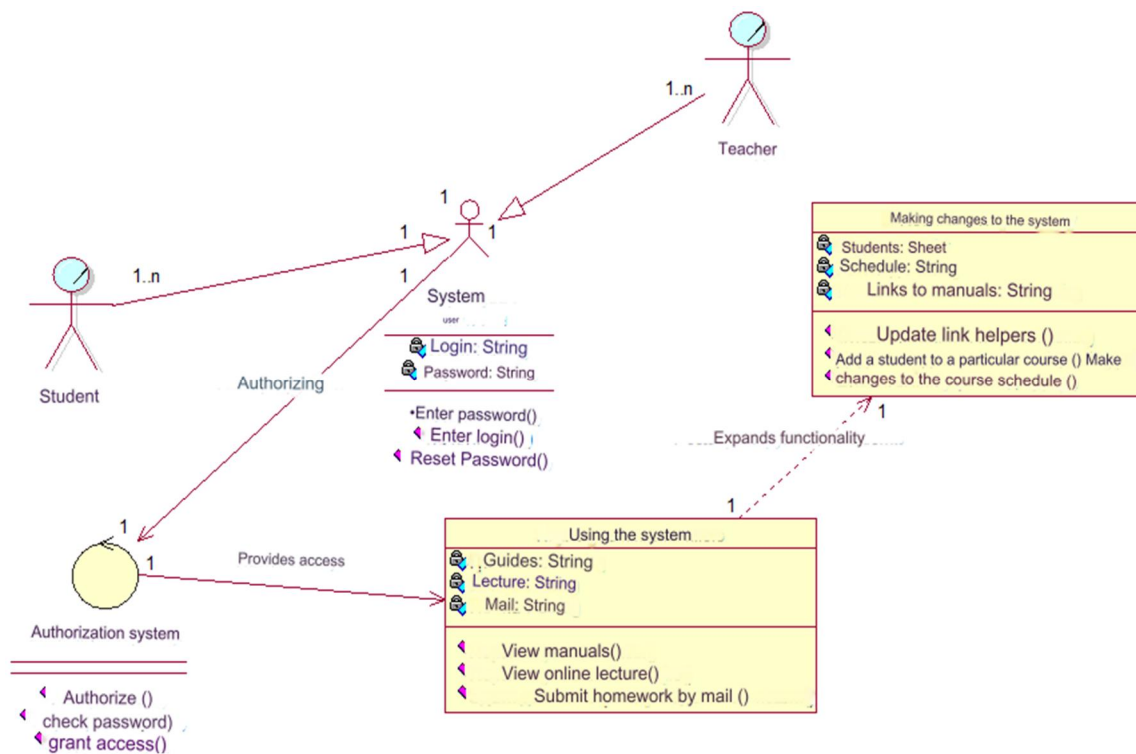


Fig. 3. “LearningAC” class diagram

To complete the construction of the cooperation diagram (Fig. 4), the following actions were performed:

1. Added instances of the business actor named “Student” and “Teacher” respectively.

2. The object of the “Automation system” class and active objects of the classes: “Using the system”, “Making changes to the system” have been added.

3. Added the object of the “Automation system” class and the messages “Enter password()”, “Enter login()”, “Restore password()”, which are combined with each of the business actors.

4. Added the following messages to “Using the System”: “View Tutorials()”, “View Online Lecture()”, “Submit Homework via Mail()” and a link connecting it to “Automation System” via messages “Check password()”, “Grant access()”, “Authorize()”.

5. The following messages have been added to “Make changes to the system”: “Add a student to a course()”, “Update links to manuals()”, “Make changes to the course schedule()” and a link connecting it to “Using the system”.

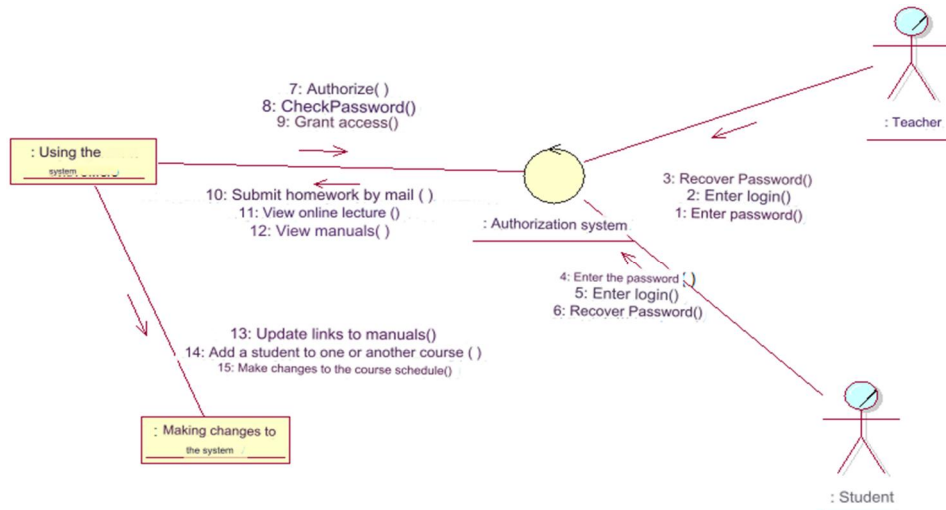


Fig. 4. “LearningAC” cooperation diagram

To complete the construction of the sequence diagram (Fig. 5), the following actions were performed:

1. Added instances of the business actor named “Student” and “Teacher” respectively.
2. The object of the “Automation system” class and active objects of the classes: “Using the system”, “Making changes to the system” have been added.
3. Added an object of the “Automation system” class, sequential messages “Enter password()”, “Enter login()”, “Restore password()” issued by each of the business actors.

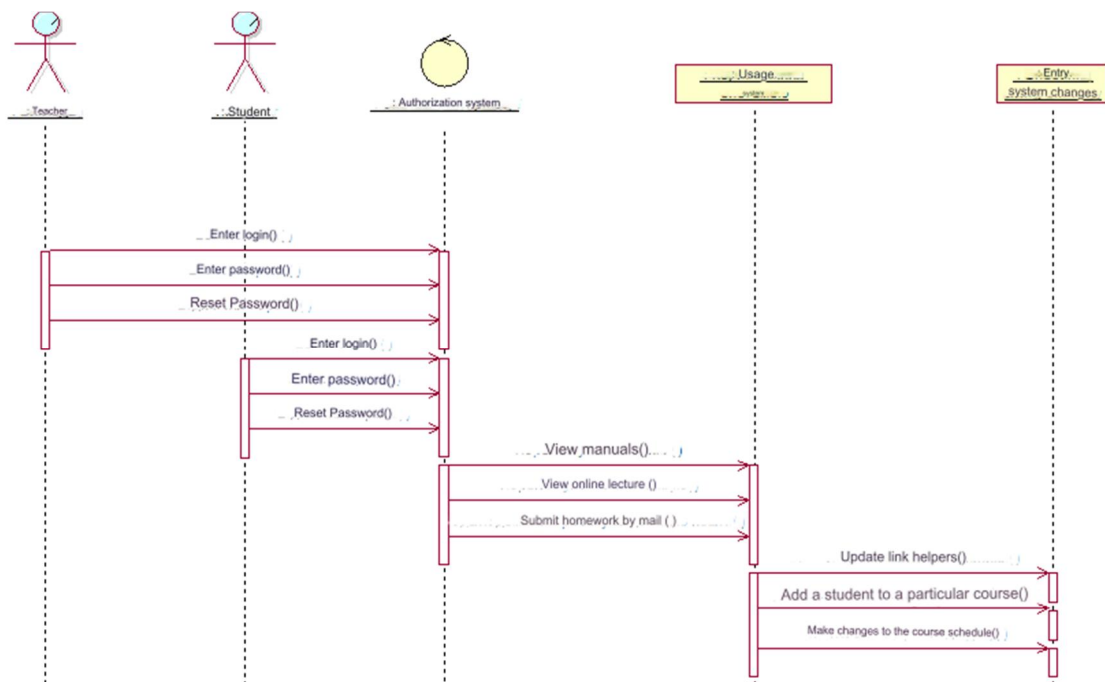


Fig. 5. “LearningAC” sequence diagram

4. Added the following sequential messages to “Using the system”: “View manuals()”, “View online lecture()”, “Submit homework via mail()” coming from “Automation system”.

5. The following sequential messages have been added to “Make changes to the system”: “Add a student to a course()”, “Update links to manuals()”, “Make changes to the course schedule()”, which come from “Using the system”.

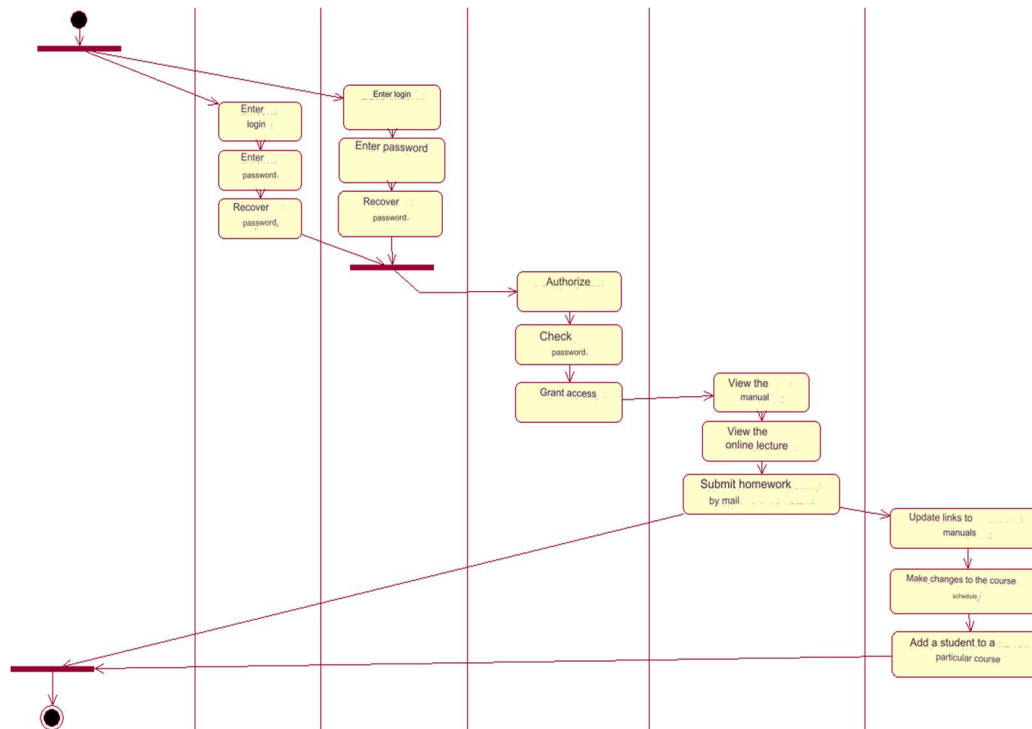


Fig. 6. Diagram of “LearningAC” activities

To complete the construction of the activity diagram (Fig. 6), the following actions were performed:

1. Added seven tracks named “System User”, “Student”, “Teacher”, “Automation System”, “System Usage”, “System Changes”.
2. On the “System User” track, the initial state of the action and horizontal synchronization, namely the division into parallel streams, have been added.
3. For each of the tracks, such as: “Student”, “Teacher”, added action states, such as: “Enter login”, “Enter password” and “Restore password”.
4. Added horizontal synchronization, namely merging of parallel streams “Student”, “Teacher”.
5. Action states “Authorize”, “Check password”, “Grant access” have been added to the “Authorization system” track.
6. Action states “View manuals”, “View online lecture”, “Submit homework by mail” were added to the track “Using the system” and branched to the next state and another vertical synchronization, which is located on the track “User of the system”.
7. Action states “Add student to a course”, “Update links to manuals”, “Make changes to course schedule” have been added to the track “Make changes to the system” and a branch has been made to another vertical synchronization, which is on the track “User of the system”.
8. Merged streams on vertical sync and added final action state.

To complete the construction of the component diagram (Fig. 7), the following actions were performed:

1. Added components of interaction with the system, namely: “Device keyboard” and “Device screen”, for which the Task stereotype is set body.
2. Added the “System Collaboration Devices” component with the Task stereotype Specifications.
3. Added the MainPage.html component with the Component stereotype, which in turn creates a dependency with the “System collaboration devices” component.
4. Added the “System Algorithm” component with the Package stereotype Specification, which in turn creates a dependency with the MainPage.html component.
5. Added the “System User” component with the Package stereotype Specification, with which, in turn, a dependency is formed with the components “Student”, “Teacher” with Package stereotypes body.

6. Added component “Making changes to the system” with Package stereotype Body, which in turn creates a dependency with the “System Algorithm” component.

7. Added the “System Usage” component with the Package stereotype Body, which in turn creates a dependency with the “System Algorithm” component.

8. The component “User documentation database of the training center system” with the Database stereotype has been added, which in turn creates dependencies with the components “Using the system” and “Making changes to the system”.

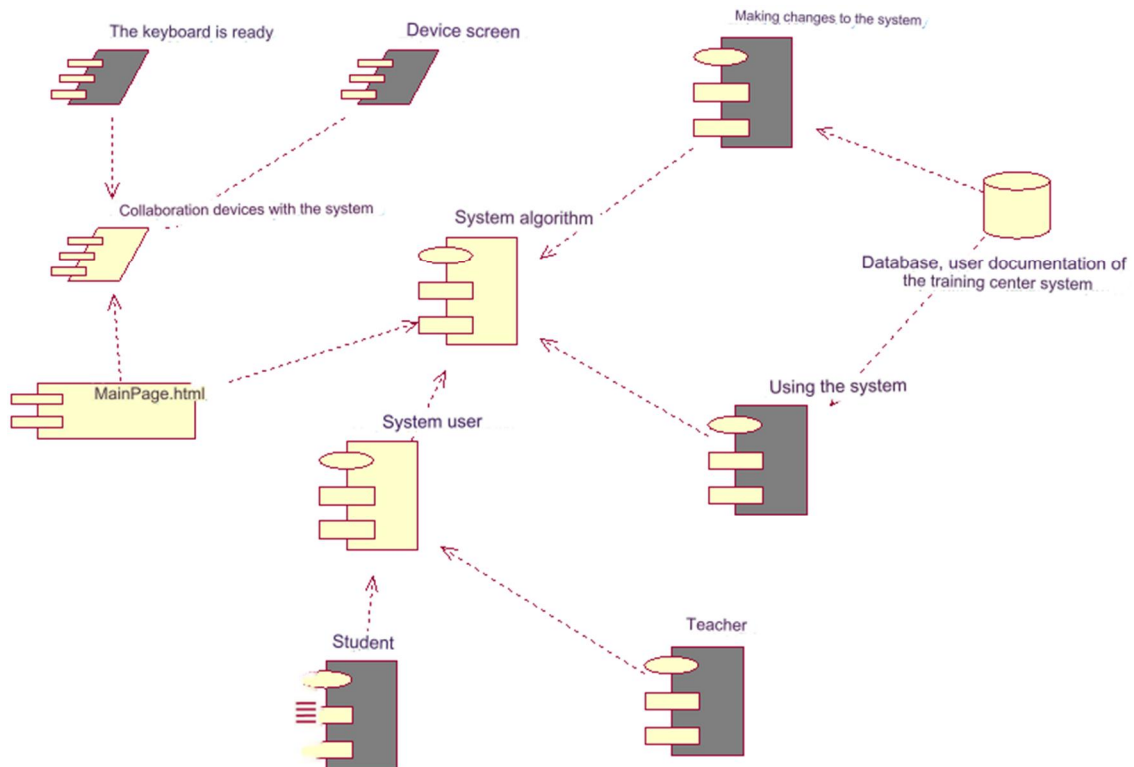


Fig. 7. Diagram of “LearningAC” components

Having determined the functionality of the system using the UML methodology, the next step is to formulate and justify the problem based on diagrams. Actually, it requires defining a set of requirements for the system, describing a set of input and output data, as well as details about how to achieve the goal. For the further use of JI in the design of PS, there is a need for a description of precedents, which in turn is most informative and useful in this case. The precedent scenario for the development of the PS for the intelligent information system of the educational center looks like this:

1. Precedent stakeholders and their requirements:

- Student – applies or intends to access services for providing certain courses in a particular educational center for personal needs.
- The teacher – develops the curriculum, sets the class schedule, provides students with the necessary materials, namely creates a link to GoogleDrive, and transfers all this information to the manager. Conducts classes and checks students’ homework. The Teacher can also include the Scary Teacher subtype – it actually belongs to the same category and subtype as the regular one, but is endowed with the ability to add new materials, register new students for the course, and fill PS pages with different types of content.

2. The PS user, i.e., the main actor of this case: is the manager of the LearningAC system, who works with clients, and later with students, thereby providing or, on the contrary, blocking students’ access to one or another type of courses. Fills the system with the necessary information, monitors the work and maintains system reporting.

3. Preconditions of the precedent (preconditions): PS must be active; System users must successfully complete the authentication procedure in LearningAC; The PS must issue a message about the correctness and readiness or problems with the operation of all subsystems.

4. Basic successful scenario:

- The necessary calendar plan of visits to the courses of the primary center is agreed by the teacher and handed over to the senior teacher.

- The necessary curriculum of courses and manuals is approved by the teacher and handed over to the senior teacher.

- The senior teacher of the educational center receives an application to add a future student to a particular course.

- The senior teacher provides the future student with a link to the page on which this user registers himself.

- The senior teacher receives a notification about the registration of a new one user in the system, and gives him access to certain courses.

- The registered student authenticates using the previously received link to the system, and gets access to the page with all the information about the previously chosen course.

5. Extensions to the main script or alternative threads:

- The senior teacher sends the application form of the client as a student for a certain type of courses back with a request for re-registration.

- The user of the system forgets the password for entering it.

- The user uses the password recovery function using mail.

- After receiving a message to the mail to which the user is registered in the system, the user copies the new temporary password generated by the system and enters the PS.

- After logging into the system with a new temporary password, the user opens the menu of the personal account, chooses to change the password in it, and replaces it with the one he considers necessary.

6. Post-conditions (postconditions):

- Data from student registration in the system and for its specific course are stored in a separate database for further processing and work with them.

- Based on the received data, the PS manager forms reports for management.

- PS gives a “signal” in case of any errors during its operation or signals the readiness to register new students for one or another course.

7. Special SV:

- It is necessary to ensure 100 % reliability and serviceability of LearningAC.

- It is necessary to ensure the timely delivery of necessary documents and manuals to the educational center.

- It is necessary to ensure the correct operation of all links posted on the course pages, namely links to training manuals, online lectures and contact information for connecting students with teachers.

8. List of necessary technologies and additional devices:

- LearningAC must be designed as hardware with permanent Internet access/output.

- LearningAC must have a convenient and reliable user authentication process.

- LearningAC must have a password recovery feature for any type of user.

- The database system should clearly reflect all changes to the manager, who makes important amendments that can significantly change the learning process and students' access to certain courses in the educational center.

- LearningAC should support multi-platform, i.e., be able to work not only on one specific type of device.

The input parameters of the system are such as: Visitors parameters; Parameters of educational materials; Teacher parameters; System efficiency and availability indicators. The initial parameters of the intelligent system of the educational center are as follows: The system of the educational center for the placement of all the necessary information for both the visitor and the teacher of the center; Introducing an intelligent component in the form of an auto-advice system for users, or a chat based on artificial intelligence; Analysis of the system, users, and materials in real time. To develop an intelligent information system of the educational center, it is necessary to analyze the possible methods of solving the problem for creating and deploying the system. However, in general, the following methods can be considered:

1. Machine learning methods: This is an approach to creating intelligent systems that involves the use of data-based learning algorithms to automatically learn and identify patterns in data. Machine learning can be used to create user recommendation systems, predict student success, identify learning problems, intelligent search, classify and cluster data. For example, you can use training with reinforcement (reinforcement learning) to create a system that will recommend optimal courses to users based on their profile and learning history. Advantages of the machine learning method for the intelligent information system of the educational center: automation of learning processes and assessment of students' knowledge; the ability to use machine learning to personalize learning; the possibility of automatic selection of recommendations to students regarding which courses or materials are most useful for them; the possibility of using machine learning to predict student success, as well as to identify problem areas, which will allow you to quickly respond to them and offer the necessary help. Disadvantages of the machine learning method for the intelligent information system of the educational center: the need for a large amount of data to train the models, which can be a difficult task for a training center; the difficulty of choosing and configuring models for specific tasks; the need for large computing power for training and the use of models, which can require significant costs; the need for constant monitoring and support of the system to prevent possible errors that may occur as a result of incorrect settings or insufficient data.

2. Expert systems: This is an approach to creating intelligent systems that involves the use of expert knowledge in the form of rules and procedures for decision-making. Expert systems can be used to automate decision-making in the educational process, for example, when determining the effectiveness of educational programs, selecting teachers, etc. The expert system method is one of the traditional approaches to solving artificial intelligence problems, which consists in creating computer programs containing knowledge and expert experience in a certain field. Let's consider the advantages and disadvantages of using the Expert System method for the intelligent information system of the educational center. Advantages: Efficiency; Cost-effectiveness; Reliability. Disadvantages: Limitation; Complexity; Impossibility of self-learning; Low flexibility; Low efficiency in solving complex tasks.

3. Software Synthesis Method: This method involves creating software from scratch using a variety of development tools, programming languages, and libraries. When using this method, you need to take into account that software development takes a lot of time and resources, so it is suitable for projects that have a large budget and a long implementation period. Advantages of the software synthesis method for the intelligent information system of the educational center: Development speed; Minimum number of errors; High accuracy. Disadvantages of the software synthesis method for the intelligent information system of the educational center: Limited flexibility; High difficulty; Limited support.

4. Data collection and analysis methods: We may use data collection and analysis methods to collect and analyze information about users, courses and other parameters to help create recommendation systems and improve the quality of learning. Advantages of data collection and analysis methods for solving the problems of the intelligent information system of the educational center: Obtaining valuable information; Rational use of resources; Flexibility. Disadvantages of data collection and analysis methods for solving the problems of the educational center's intelligent information system: The need for clearly defined objectives; Complexity of processing large volumes of data; Insufficient data quality.

5. Method of using ready-made solutions: This method consists in using ready-made solutions, such as ready-made software products, modules, frameworks and libraries. By using this method, you can save

time and money because you don't have to develop software from scratch. However, it should be borne in mind that ready-made solutions may not fully meet the needs of the project and their use may limit the possibilities of expanding and changing functionality. Advantages of the method of using ready-made solutions for the intelligent information system of the educational center: Development speed; A high quality; Low development cost. Disadvantages of the method of using ready-made solutions for the intelligent information system of the educational center: Limited functionality; Dependence on suppliers; Security risk.

Each of these methods can be used to build an intelligent information system of the educational center, but for implementation it will be most optimal to use not one, but two methods at the same time, namely: the method of software synthesis and the method of using ready-made solutions. The choice of the software synthesis method can be justified by the fact that it will provide an opportunity to develop the system from scratch, namely: it will provide an opportunity to choose the necessary tools, patterns and tools, which in turn will provide an opportunity to design and develop the system as quickly as possible, with a small number of errors and shortcomings, and most importantly – with high accuracy and compliance with all assigned tasks. Also, choosing a method of using ready-made solutions can be justified by the fact that it will provide an opportunity to integrate already existing and ready-made modules that contain an intelligent component. As a matter of fact, it makes it possible to reduce development time, increase quality and minimize costs for the implementation of an intelligent component. Intelligent components can be useful in improving the efficiency of training centers. Possible options for components that can be used in the intelligent information system of the educational center include the following: Recommender Systems; Automated grading systems; Machine Learning Systems; AI Chat System. Among the possible intelligent components for integration, a chat system with artificial intelligence was chosen, because it provides all possible answers to users' questions, and therefore, if the request is correctly formed, it can in a certain way replace the systems of recommendations, automatic evaluation and machine learning. Moreover, systems of this type are now very common and their integration should not cause difficulties. A website was chosen to support multi-platform, minimal labor and time-consuming system development. In addition, the system will have the possibility of easy updating, easy data collection and easy integration with other systems, which will actually provide an opportunity to apply the method of using ready-made solutions. Thus, the combination of the chosen method, the intelligent component and the interface is the best among the proposed options, which was chosen for further development. The name of the implemented system product is – Intelligent information system of the educational center, or the working name "LearningAC". The system is implemented in the form of an interface called a website. Actually, the means for writing these or other parts of the book were: HTML in conjunction with CSS were used as tools for writing the front-end part; Python was used to write the backend part. The framework for the development of this system was Django in connection with the built-in web server, which in turn performed the role of the server part of the project. The method of using artificial intelligence was used as an intelligent component, and ChatGPT served as AI. The main purpose of the intellectual information system of the educational center is to facilitate the learning process for both teachers of educational centers and students. Therefore, the presence of intuitive user registration is necessary in this system, which will be used to filter all users at different levels of admission. Actually, the distribution of admission levels will be checked and implemented by a user who belongs to the type of senior teacher. Users of this type are bound by the obligation to fill courses with educational materials, conduct analysis and data collection for grouping reports, monitor the overall operation of the system. Functionalities that must be present in the intelligent information system of the initial center include the following: Logging in; Displaying the correct information for users with different access levels; The option of filling the system, namely with information about the course and teachers using different types of content.

In the form of a website, the system of functioning of the intellectual information system of the educational center is implemented. The operating system includes software for transferring data to a web server, a database system, and an interface (Fig. 8).

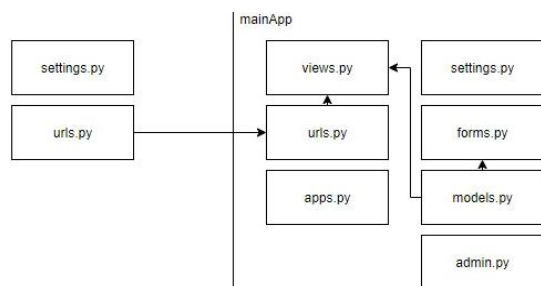


Fig. 8. Backend structure of the system



Fig. 9. System architecture

According to the MVT pattern, there was a division of the main block of implementation and implementation outside of it. The implementation of the backend part outside the main block includes the following files: Settings.py is a file with all general system settings; Urls.py is a file with all system URLs.

The main block of backend implementation includes the following: Views.py is a file with parameters that are distributed to the main pages of the website; Urls.py – file duplication outside the main block to comply with Data Driven Testing (DDT) principle; Apps.py is a file with all applications for the correct operation of the system; Settings.py – file duplication outside the main block to comply with Data Driven Testing (DDT) principle; Forms.py is a file with all the forms present in the system; Models.py is a file with all models present in the system; Admin.py is a file created to access and work with the database with a certain kind of permission for users.

The intelligent information system of the educational center is created according to the client-server architecture (Fig. 9). Thus, a device with any web browser that supports modern standards serves as the client part. WWW, a local network or the Internet will perform a connection in this chain. The built-in Django web server and the SQLite database management system will act as the server part for the educational center's intelligent information system. The next and no less important step during the implementation of this system is the design and construction of the database. For correct construction, normalization was used, which in turn is a process by which the database is divided into smaller, independent relations in order to reduce data duplication and avoid anomalies when entering and changing data. Since SQLite is chosen as a database management system, taking into account all its features and conditions, a database was created for the intellectual information system of the educational center with such entities (tables), such as:

- CourseGroup is a table that stores information about and about all possible groups. The table contains the following columns: group_id – serial number of the group; group_course_info – information about the group; group_students – list of students of the group.

- LibraryData is a table containing all the necessary information about the so-called reference library of the educational center. The table contains the following columns: row_id – serial number of the cell; row_type_info – cell filling type; row_info – filling the cell with the necessary information; row_author_id – serial number of the author who made changes to the cell; row_creating_time – the time of making the last changes to the cell.

- Schedule is a table for storing data about the schedule of all available courses, classes for certain groups of the educational center. The following columns can be attributed to the table: course_id – serial number of the course; group_id – serial number of the group; schedule_description – detailed description of the schedule cell for the selected course and group; schedule_info – additional information about making changes and corrections to the schedule.

- UserStudent – measure of necessary data for users of the “student” type of the educational center system. The table fields include the following: student_id – student serial number; student_login – student login; student_password – student password; student_access – student access level.

- UserTeacher – measure of necessary data for users of the “teacher” type. The following can be attributed to the table elements: teacher_id – teacher's serial number; teacher_login – teacher login;

teacher_password – teacher password; teacher_description – a detailed description of all necessary information about the teacher; teacher_courses – fixed teacher courses; teacher_permission – teacher permission level.

- LearningAC is a table of the same name with the name of the system of learning centers, which serves as a measurement of data about the functioning of the system as a whole. The following columns can be attributed to the table: id – serial number; student_id – student serial number; teacher_id – serial number of the teacher; schedule_id – serial number of the course schedule; library_id – serial number of the link library cell; group_id – serial number of the group.

After a detailed review of all the tables, fields and their restrictions, using SQLite tools, the database operation scheme for the intelligent information system of the educational center was depicted in Fig. 10.

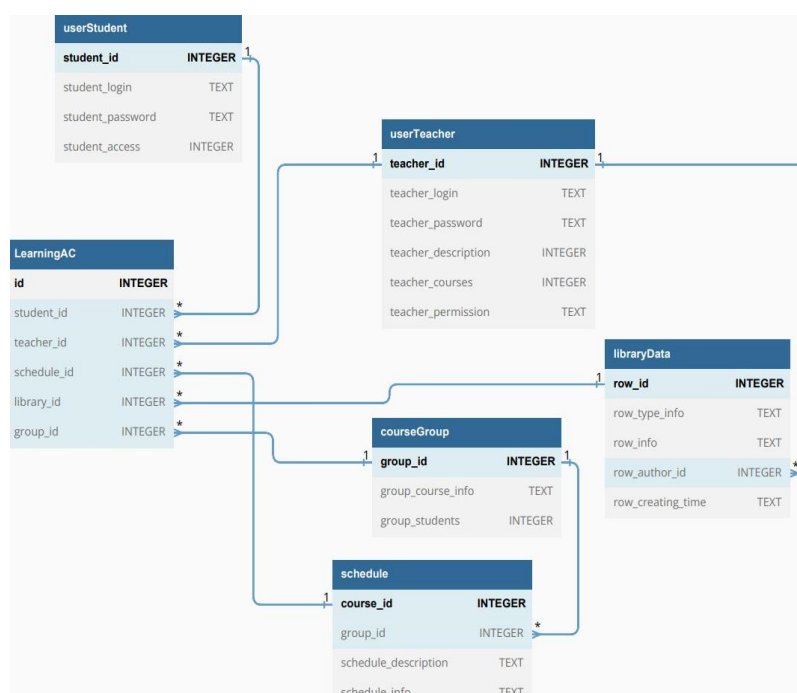


Fig. 10. Schema of the LearningAC database

Input data for the intelligent information system of the educational center: User data, such as first name, last name, e-mail, telephone, etc.; Data about the type of user, who can be a student, teacher or former teacher; Data on courses for which the user has registered or wishes to register; Data on the user's success in previous courses (if any); Other personal data that may be required depending on the specifics of the training center. Output data for the intelligent information system of the educational center: Schedule of courses for which the user has registered or wishes to register; A links page where the user can view all the necessary links for the course; The content of the courses, to which the user can go and view all the entered educational information; Making changes using the database, after adding new users, courses or teachers; Information about the number of hours the user spent on training; Information about teachers; Other personalized data that may be useful to the user.

If the intelligent information system needs to be deployed locally, then for this you need such tools as: Windows operating system, the latest version of the Python programming language, the Django framework, the OpenAI library, a stable Internet connection, a web browser that supports all modern requirements. After downloading the system archive, it is necessary to unpack it and go to the "DjangoQuestionnaire/Questionnaire" folder. Next, you need to start the Windows PowerShell console in the "Questionnaire" directory (it is necessary to hold down the "Shift" key and right-click on an empty place in the folder). After that, a context menu with the option to open the Windows PowerShell window will appear. The next step is to open the Windows PowerShell console from the context menu and enter the

following commands step by step: `python manage.py makemigrations`, `python manage.py migrate`, `python manage.py runserver`.

After manipulating the commands, the console should return the URL of the website that will be the result of a successful deployment. Finally, copy the returned URL into any web browser that meets the above requirements and open the system. In turn, the Windows PowerShell console should not be closed, because it is the server for the intelligent information system of the educational center. The educational center's intelligent information system implemented as a website includes the following main pages: Link library (a library of links to all necessary resources); Teachers (a page with information about the teaching staff of the educational center); Schedule (schedule of courses); Chat (a chat room with artificial intelligence); Administrating (the system administration and maintenance page). In each of the main pages of the system there are the following: Site navigation menu for easy navigation of site pages, Display the name of the authorized user and Option to log out and sign out as a registered user. The main page in the navigation bar is "Teachers" (Fig. 11). It lists information about each of the available users of the training center in the form of a list, which in turn will display a short biography, a concise description of the course to which the teacher is attached, and available contacts for maintaining communication with the teacher. Also, after clicking on the name of any of the teachers, the schedule of classes of a particular teacher will open.

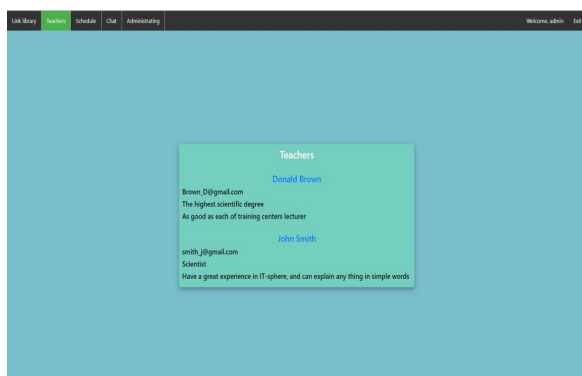


Fig. 11. "Teachers" page

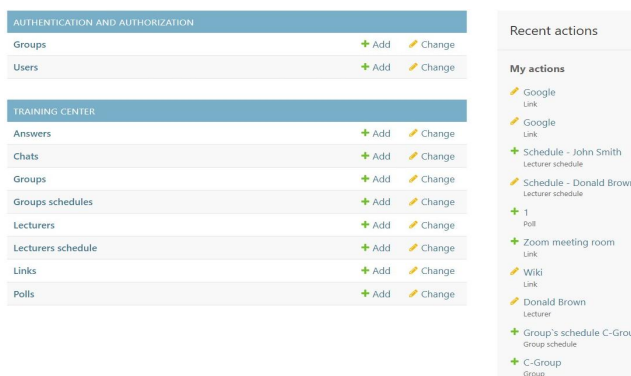


Fig. 12. "Administrating" page

Next, the "Schedule" page follows, which actually contains the training center's schedule for the group to which the authorized user belongs. Several groups can be placed on the page, if the user is registered for several courses at the same time. Thus, after clicking on the desired group, a clearer schedule of classes, deadlines and other educational processes of the selected course will be displayed. The penultimate page in the navigation bar is "Chat" – this is a page in which the user of each level of admission has the opportunity to ask any questions to the artificial intelligence and receive the expected answer. The last option in the navigation menu is the "Administrating" page (Fig. 12), to which only specific users have access (If a user without access to the appropriate level accidentally came across this page, the system will again ask the user to authorize to check the availability of access). This page has a functionality that made it possible to make changes to the database, which in turn will be displayed in the system after they are saved. Also, on this page there is an opportunity to grant permissions, add and fill the rest of the pages with content and edit them.

Conclusions

The intelligent information system of LearningAC educational centers was created and implemented. Based on the Rational methodology Unified Process, the design of the intelligent information system of the educational center was carried out on the basis of diagrams, which in turn show how the created system should function. According to the methodology, the main actors were identified and six diagrams were developed, namely: Diagram of use cases; Class diagram; Diagram of cooperatives; Sequence diagram; Activity chart; Component diagram. Each of the diagrams, in turn, was built according to UML standards

and using the Rational application Rose. Their construction gives a clear understanding of how exactly the functioning and course of the main events in the intellectual information system of the educational center will take place. An equally important step is to conduct an analysis of possible methods and means of solving the problem. After conducting a comparative analysis, the necessary methods, intelligent components and the interface of the developed system were selected. The necessary tools and means for the development of an intelligent information system of the educational center were also listed, namely: Django Framework, Python, MVT Pattern, HTML, CSS, SQLite, ChatGPT API. For each of the listed software tools, a clear comparative description with existing analogues was made, all the advantages and disadvantages of this or that tool were reviewed and argued. Each of the tools is thoroughly justified taking into account the needs of the system, and used for the further development of LearningAC. Next, the general information of the developed system was taken into account and described, where its basic parameters were indicated. Emphasis is placed on functional assignments, where the basic functions are listed. No less important was the description of the logical structure: the backend structure of the system was described with an extensive explanation of each of the files; describes the architecture and server part of the system with a detailed description of each component. The structure of the database was taken into account as an equally important part of the development, and its possible connections with entities were studied. In conclusion, the analysis of the control example was carried out, where the obtained results of the system operation were demonstrated with an extensive description of the given interface and available user interactions. As a final result, after conducting the analysis of the control example, the full functionality of the intellectual information system of the educational center was tested and tested, and the effectiveness and correctness of all the embedded possibilities were confirmed. So, the development of the LearningAC system has been successfully implemented, because thanks to the clear execution of the tasks, the result of this work is a full-fledged intellectual information system of the educational center, which will provide its users with the opportunity to simplify the educational process, increase the level of teaching due to the minimization of costs.

References

1. V. Lytvyn, V. Vysotska, L. Chyrun, & L. Chyrun, (2016, August). Distance learning method for modern youth promotion and involvement in independent scientific researches. *First International Conference on Data Stream Mining & Processing (DSMP)*, 269–274. IEEE. DOI: 10.1109/DSMP.2016.7583557
2. Piccolo, Gabriele; Pigni, Federico (July, 2018). Information systems for managers: with cases (Edition 4.0 ed.). Prospect Press, p. 28. ISBN 978-1-943153-50-3.
3. What is Information Systems or Information Services (IS)? Definition from Techopedia. URL: <https://www.techopedia.com/definition/1027/information-systems-or-information-services-is>.
4. What is IS? URL: <https://www.techtarget.com/whatis/definition/ISinformation-system-or-information-services>.
5. Information Services. Directory. Australian Government. URL: https://www.directory.act.gov.au/ccexternal_5.1/webdir/cgi-bin/.
6. Information Services. Ramsey County. URL: <https://www.ramseycounty.us/>.
7. Rajkumar A., & Sathish Kumar R. (2016). Design of a Learning Management System for Engineering Colleges. *International Conference on Electrical, Electronics, and Optimization Techniques*, Chennai, 358–362.
8. Singh L. & Bhatt R. (2020). Implementation of Learning Management System: A Systematic Review. *11th International Conference on Computing, Communication and Networking Technologies*, Kharagpur, India, 1–6.
9. Mukherjee A., Chakraborty S., & Basu S. (2015). Design of a Learning Management System for Open and Distance Learning. *International Conference on Computational Intelligence and Networks (CINE)*, Bhubaneswar, India, 111–115.
10. Guralnik D. (2009). Learning Management Systems, *International Conference on Systems, Man and Cybernetics*, San Antonio, TX, USA, 3632–3637.
11. Tabrizi S. S. & Farsi. M. A. (2015). An empirical study of learning management systems in higher education. *International Journal of Information and Learning Technology*, Vol. 32, No. 4, 207–220.
12. Conole G. (2008). The evolution of technologies: implications for the design and development of university classrooms. *Journal of Educational Technology & Society*, Vol. 11, No. 3, 1–11.
13. Prometheus. URL: <https://prometheus.org.ua/about-us/>.

14. EdEra. URL: <https://www.ed-era.com/courses/>.
15. Accelerator of Medical Information. URL: <https://accemedin.com/>.
16. Gohigher. URL: <http://gohigher.org/about/>.
17. Otmehalka. URL: <https://en.otmehalka.com/>.
18. Coursera – We envision a world where anyone, anywhere has the power to transform their lives through learning. URL: <https://about.coursera.org/>.
19. Jurafsky D., & Martin J. H. (2019). *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition*. Pearson. New Jersey, USA. 3rd edition .
20. Shakhovska N., Vysotska V., & Chyrun, L. (2017). Intelligent systems design of distance learning realization for modern youth promotion and involvement in independent scientific researches. *Advances in Intelligent Systems and Computing*, 175–198. Springer International Publishing. DOI: 10.1007/978-3-319-45991-2_12
21. Shakhovska N., Vysotska V., & Chyrun L. (2016). Features of e-learning realization using virtual research laboratory. *XIth International Scientific and Technical Conference Computer Sciences and Information Technologies, CSIT*, 143–148. IEEE. DOI: 10.1109/STC-CSIT.2016.7589891
22. Bublik M., Slava O., Vysotska V., Kolyasa L., Vlasenko O. World Universities Strategic Analysis Based on Data from the QS World University Rankings. *CEUR Workshop Proceedings*, Vol. 3373, 354–375.
23. Slyusarenko N., et. al. (2021). Professional competence building of the entrepreneurs through improving the quality of business education. *International Journal of Entrepreneurship*, 25(7).
24. Vaskivska, H. O., Palamar, S. P., Vlasenko, O. M. (2019). Health in the civic students' value system: empirical analysis. *Wiadomosci lekarskie* (Warsaw, Poland: 1960), 72(10), 1947–1952.
25. Veres Oleh, Ilchuk Pavlo, Kots Olha, Levus Yana, Vlasenko Olha (2022). Recommendation System for Leisure Time-Management in Quarantine Conditions, *CEUR Workshop Proceedings*, Vol. 3312, 263–282.
26. Basyuk T., et al. (2022). Features of designing and implementing an information system for studying and determining the level of foreign language proficiency, *CEUR Workshop Proceedings*, Vol. 3312, 212–225.

ІНФОРМАЦІЙНА СИСТЕМА НАВЧАЛЬНОГО ЦЕНТРУ

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Мета дослідження – розроблення інтелектуальної інформаційної системи навчального центру засобами мови програмування Python і фреймворку Django, системи баз даних SQLite та чат-ботом зі штучним інтелектом ChatGPT. Розроблювана система повинна полегшити взаємодію користувачів різних типів із навчальними/тренінговими центрами задля здобуття нових

необхідних навичок. Як відомо, сьогодні з кожним днем відкриваються все нові та нові навчальні центри, які надають свої послуги з вивчення тієї чи іншої здібності. В зв'язку з виникненням пандемії всі такі навчальні центри переводять свої заняття в онлайн-режим і власне потреба вирішення такого типу питання виникає все частіше. У роботі здійснено аналітичний огляд літературних джерел, виконано порівняння відомих засобів виконання, тобто так званих систем-аналогів, перевірку на актуальність функціонування такого типу системи. Окрім цього, побудовано дерево цілей, в якому чітко окреслено загальну мету, а саме – оптимізацію усіх процесів навчального центру. Крім того, не менш важливим кроком є опис вимог, який здійснюється у цій роботі за допомогою методології RUP для інтелектуальної інформаційної системи навчального центру. Здійснено також визначення категорії користувачів та побудову узагальненої моделі функціонування системи в навколишньому середовищі. Для розроблення системи проаналізовано можливі методи і програмні засоби для створення та розгортання системи. Вибрано найоптимальніші методи для цього випадку, а саме метод синтезу програмного забезпечення та метод використання готових рішень, адже їх застосування дасть можливість розробити систему з нуля на необхідних компонентах та інтегрувати вже готову систему з інтелектуальним компонентом. Надалі перераховано можливі варіанти інтегрування готових інтелектуальних компонент та вибрано систему чатів зі штучним інтелектом, адже це дасть користувачам змогу шукати відповіді на свої запитання, не покидаючи системи, та полегшить навчання для кожного з користувачів.

Ключові слова: інтелектуальна інформаційна система навчального центру; інтелектуальна компонента; вебсайт; користувач; студент; викладач; навчальний центр; курс; HTML; CSS; Python; Django; SQLite; ChatGPT.