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## DEVELOPMENT OF INFORMATION INTELLIGENT SYSTEM FOR MANAGEMENT OF SCIENTIFIC AND SCIENTIFIC-TECHNICAL ACTIVITIES HIGHER EDUCATION INSTITUTIONS

**Abstract.** The information system of scientific and scientific - technical activity management is offered. Systems architecture design stages are considered. The general chart model of precedents for the further expansion and the activity diagram have been constructed. The developed behavior, sequence, branching and processes synchronization have been presented, which allowed to create a system of scientific and scientific - technical activity management of the higher education institutions. Modern web - technologies that allow to create interactive web - pages have been analyzed. The developed interface for data entry at the reporting level of departments has been presented. The main page of the information system, which contains all the basic structural elements, have been designed, the transition to which is carried out using hyperlinks.

**Keywords:** information intelligent control system, intelligent system, semantic text analysis, scientific activity of the department.

### Introduction

Research in the HEI (higher education institutions) is a necessary element of teachers and student education activities. The structure of the university, as a rule, has a system of research units: laboratories at faculties and departments, public laboratories, research centers in the university structure, small businesses, which employ not only teachers and PhD students, but also students and project teams.

The importance of scientific work is presented primarily in the fact that the results and innovative professors and teachers' developments of higher education institutions have the shortest testing and implementation distance. They can be used in the educational process to enrich it, to develop new elective courses, textbooks and monographs. The scientific activity of a higher school teacher ensures the teaching trinity, science and practice, the realization of the cognitive and transformational function of science itself.

For effective organization management, it is necessary to use up-to-date data on its condition and the products quality. This task is also relevant for scientific and educational organizations. But evaluating their performance appears to be a difficult task, organizationally and technically at the same time. There are a large number of evaluation criteria, such as the total volume of scientific texts for the year, the number of publications, the Hirsch index, conference papers, the amount of performed work. Therefore, the question arises about the use of specialized automated systems for collecting, processing and submitting data on the scientific activities of research and teaching staff to solve these issues.

The management of scientific activity and innovation should include such areas as:

- planning and management of scientific research activities;
- accounting for the implementation results;
- results registration;
- financial management;
- preparation of reports on research activities.

With the help of the developed information system the collection and analysis of information on indicators of scientific, scientific-technical and innovative activity of scientific-pedagogical staff of the higher education institution is carried out. The collected information is used for the construction of analytical reports, as well as for the automated construction of scientific activity reporting forms.

Visualized analytical reporting allows you to review summary information for the selected period for all and individual departments as well.

Such process automatization of gathering information for reporting has several advantages. Using the same data saves staff time and makes reports consistent. Information about each work needs to be entered only once, after which the information is displayed in all reporting forms.

### The main material

In order to develop an information intelligent system for managing the university scientific and scientific - technical activities, an information system for managing scientific and scientific - technical activities of the department was designed and programmatically implemented, which should ensure the following functions:

- differentiation between the user and administrative parts of the program module (administrator/editor/users):
  - editor (can add/delete/change scientific publications, check the text for uniqueness, available to teachers or scientists registered by the administrator);
  - administrator (can add/delete/change scientific publications, check the text for uniqueness, and also has the right to add/delete new users, namely editors)
  - user (can review publications, reports on scientific, scientific-technical and innovative activities of the department)
  - a registered user must be able to freely enter the module for managing scientific and scientific-technical activities using an individual unique login and

password. When he logs in, he gets access to scientific publications (where he can add a new publication with the ability to add a co-author, select relevant categories and other details);

- generation of reports on scientific, scientific-technical and innovative activities automatically;

- the system should be able to check the uniqueness of a scientific publication;

- ensure the development or addition (replenishment) of new publications and their categories;

- include a system for planning the date and time of scientific material publication in advance, which will automatically publish the article on the specified date and time);

- the ability to change the status of a published article:

- private status (the publication will not be displayed in the information system, even if it was published earlier);

- public status (the publication will be displayed in the information system, even if it has not been published earlier);

- the ability of the administrator to clear the database of no longer up-to-date data;

- the ability to save all the stages of creating a scientific publication with the possibility of returning it to the selected version.

- informational presence of the department on the Internet, the availability of reports on scientific, scientific-technical and innovative activities and scientific materials;

- simplicity and ease of navigation, that is, an intuitive interface for both the student and the teacher.

To meet these requirements, an architecture design was carried out, which includes the following steps:

#### 1. Goals of system architecture design:

- analysis of interactions between analysis classes, subsystems identification and interfaces;

- clarification of the architecture, considering the possibilities of reuse;

#### 2. Introduced global packages:

- foundation classes (lists, queues, etc.);

- error handling classes;

- mathematical libraries;

- utilities;

- Libraries from other vendors.

#### 3. Design classes are defined:

- the analysis class is mapped to the design class if it is simple or represents a single logical abstraction;

- a complex analysis class can be divided into several classes, turned into a package or into a subsystem.

#### 4. Examples of possible subsystems:

- classes that provide a range of services (for example, security and protection);

- limit classes that implement a complex user interface or interface with external systems;

- various products: communication software (middleware, COM/CORBA support), database access, data types and structures (stacks, lists, queues), general utilities (math libraries), various application products.

#### 5. Highlighting architectural levels:

- Application Layer – contains elements of the application layer (user interface);

- Business Services Layer – contains elements that implement the business logic of applications (the most stable part of the system);

- Middleware Layer – provides platform independent services.

#### 6. Database design.

#### 7. Implementation of the system.

For a clearer representation of the designed software, a general model of a precedent diagram was built for further expansion (Use Case diagram).

This information system provides for three types of users (actors):

a) Editor (the editor can add/delete/change scientific publications, check the text for uniqueness, available to teachers or scientists registered by the administrator)

b) Administrator (administrator, can add/delete/change scientific publications, check the text for uniqueness, and also has the right to add/delete new users, namely editors)

c) Guest (guest, ordinary user is guests, can view publications, reports on scientific, scientific - technical and innovative activities of the department)

A system use cases diagram is shown in Fig. 1.

Diagrams describing the dynamics of the system include activity diagrams.

The Fig. 2 shows a diagram of the administrator's activity in the information system.

When modeling the behavior of a designed or analyzed system, it becomes necessary not only to present the process of changing its states, but also to detail the features of the algorithmic and logical implementation of the operations performed by the system. For this, an Activity diagram has been used. This type of diagram allows you to show not only the processes sequence, but also branching and even their synchronization. It allows you to design algorithms for the behavior of any complexity objects.

Designing the database, unique identifiers were defined - this is an attribute or a set of attributes and / or relationships that uniquely characterizes each instance of a given entity type. With full identification, an instance of this entity type is fully identified by its own key attributes, otherwise attributes of another entity, the father, also participate in the identification.

The following principles are used in the construction of the ER-model:

- the essences on the diagram are represented by rectangles;

- each rectangle can have different visual attributes;

- each entity must be assigned a unique name;

- entity names must be in the singular;

- links in the diagram are represented by lines going from one entity (table) to another;

- each connection is assigned a unique name;

- related tables are divided into parent and child; parent tables are displayed as rectangles with right angles, child tables are displayed with rounded ones.

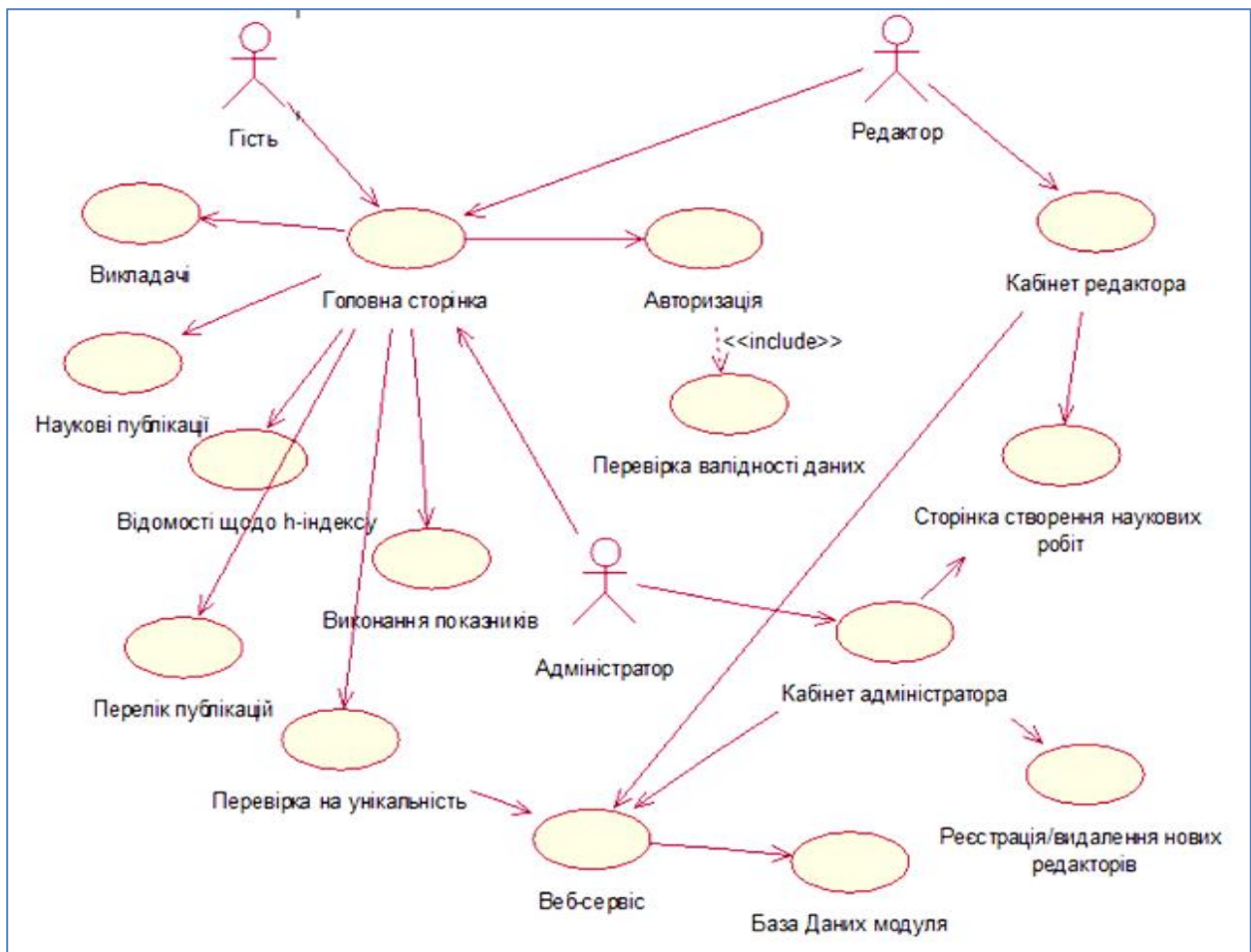


Fig. 1. Use Case Diagram

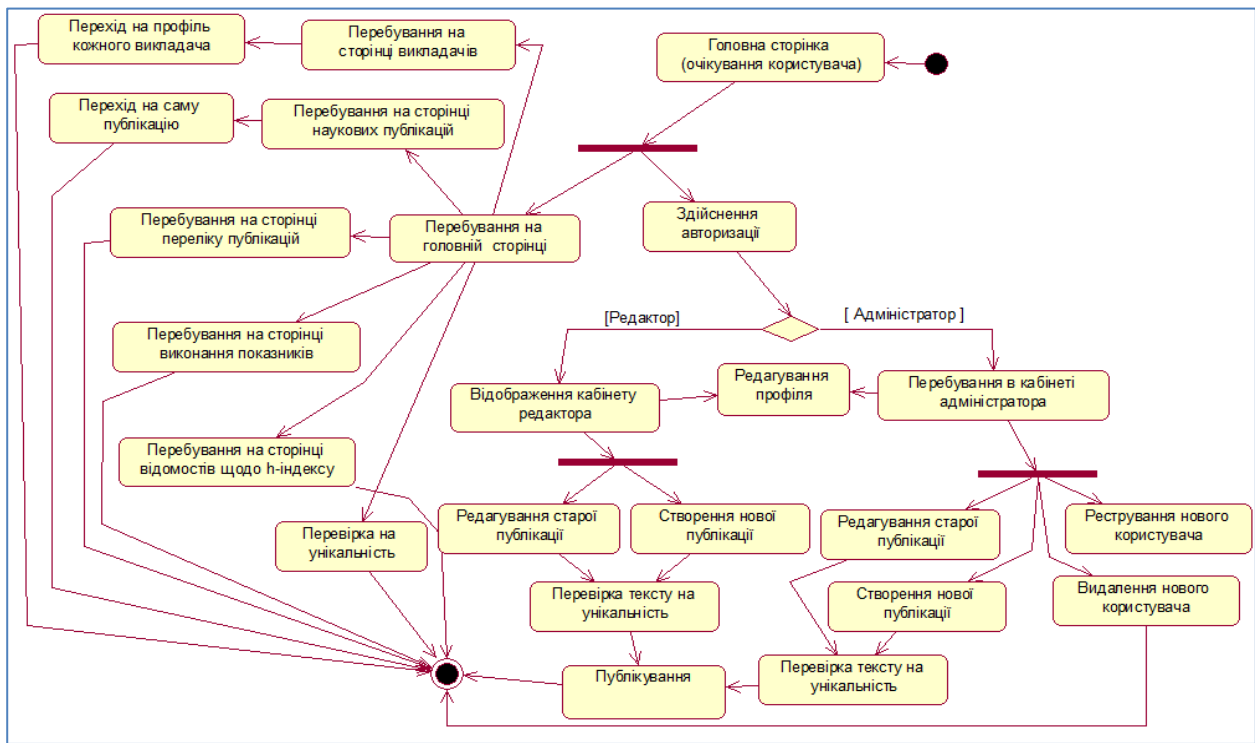


Fig. 2. Activity Diagram

WordPress uses several interconnected tables. For example, one page can have many comments. There are connections between them to each other. (Fig. 3).

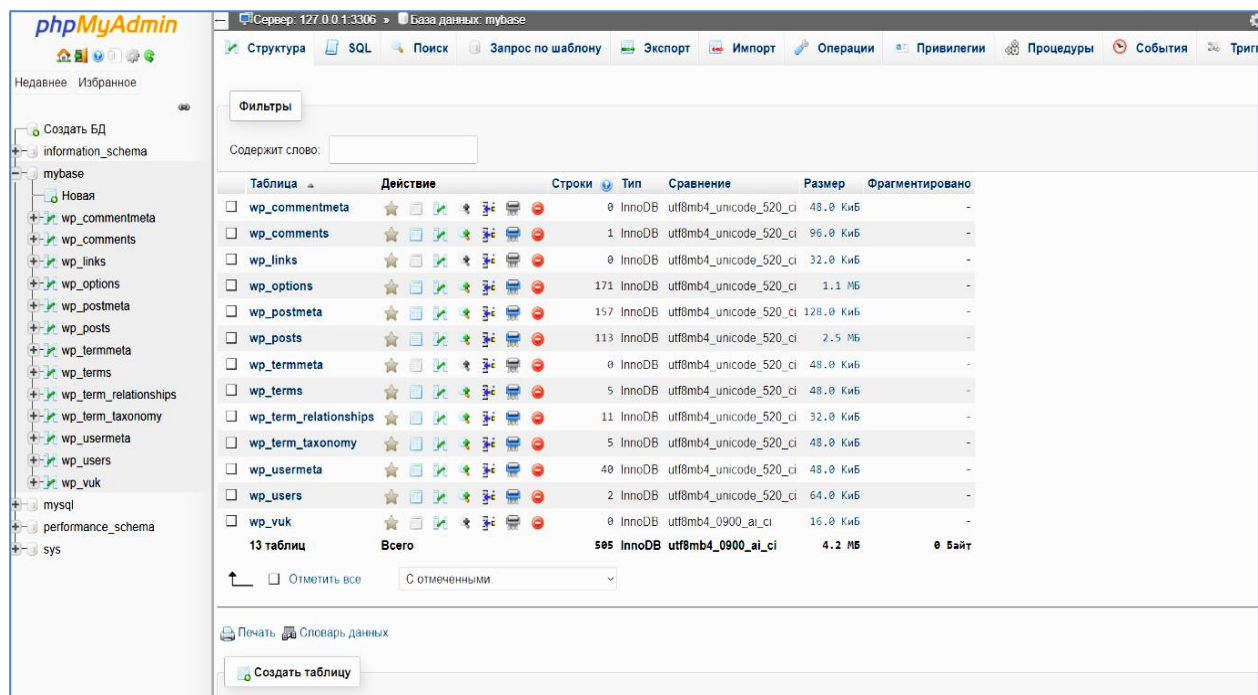


Fig. 3. Home page of the information system

Let's describe the database, it consists of the following main tables:

- a) wp\_users (table of users), it stores all user data:
  - user\_login (user login field);
  - user\_pass (user password field);
  - user\_nicename (user nickname field);
  - user\_email (user email field);
  - user\_registered (field of registration date of the student in the system);
  - user\_activation\_key (user activation key (sent to the mail to confirm registration));
  - display\_name (name to be displayed on the display);
- b) wp\_quiz\_additional (table of scientific publications saving):
  - user\_id (user id);
  - post\_id (post id, ie publications);
  - date (publication date);
- c) wp\_posts (posts table):
  - post\_autor (the post author, in this case administrator or editor);
  - post\_date (date of post creation);
  - post\_content (filling the post, for example, the text of a scientific publication);
  - post\_title (post title, for example, article title);
  - post\_modified (date of last changes in the post);
  - post\_status (post status);
  - post\_type (post type, for example, article, slider, home page content);
- d) wp\_postmeta (table for additional post data):
  - post\_id (post id, ie publications);
  - meta\_id (field for writing the custom field id);
  - meta\_key (field for writing the name of the custom field);
  - meta\_value (field for recording the contents of the custom field);
- e) wp\_cimy\_uef\_data (user category table):

- user\_id (user id);
- field\_id (category confirmation);

Most tables are linked to one or more others by a single field. This field will be a unique identifier for each record (example post\_id).

The main database encoding is utf8, collection utf8\_general\_ci. The choice of such an encoding was due to the need to use Cyrillic characters to display most of the text information, which allows the selected encoding. The length of the password field is 32 characters, this length was chosen because of the need to store a password hashed by the md5 system, which encodes exactly up to a size of 32 symbols. The scheme of the database is presented in Fig. 4.

The most efficient approach to designing a user interface is to design it by modeling the user's functions. At the beginning of the prototyping process, paper layouts of the interface were created, then screen forms were developed that simulated user interaction. It is desirable that end users actively participate in the interface design process. In some cases, users will help evaluate the interface. In others, they will help to find errors in itsex development [15].

To enter data at the reporting level of departments, an interface has been developed, shown in Fig. 5, 6.

The system is implemented in the form of an information system.

The content management system provides the administrator in the information system the ability to perform the following actions:

- a) adding and removing text;
- b) text editing;
- c) adding and removing graphics;
- d) editing supporting materials and appendices;
- e) adding and removing new and scientific works (articles, publications);
- f) registration of new users;

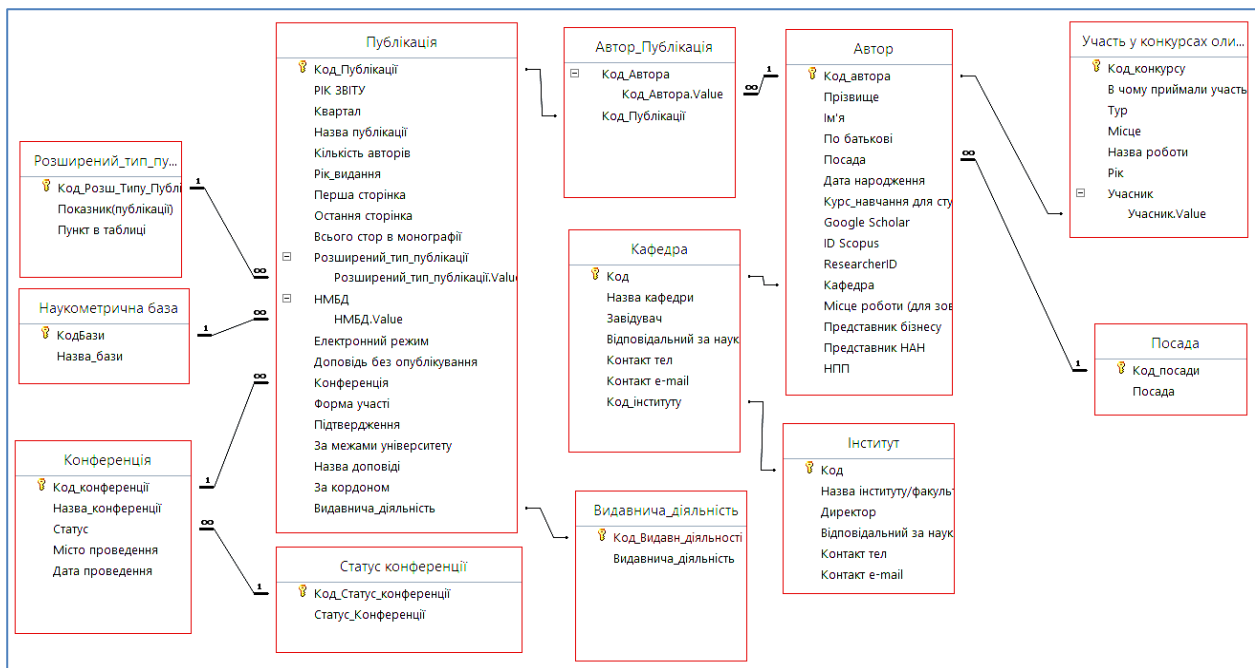


Fig. 4. Data scheme

g) managing the display of scientific, scientific-technical and informational publications;

h) adding and removing new categories for publications.

According to the developed structure, the main page of the information system was designed (Fig. 7). It contains all the basic structural elements, the transition to which is carried out using hyperlinks.

As planned at the stage of setting the task, the information system contains all the necessary structural and navigational elements.

The rules for accessing the system are defined for login.



Fig. 5. Interface for managing the departments scientific activities

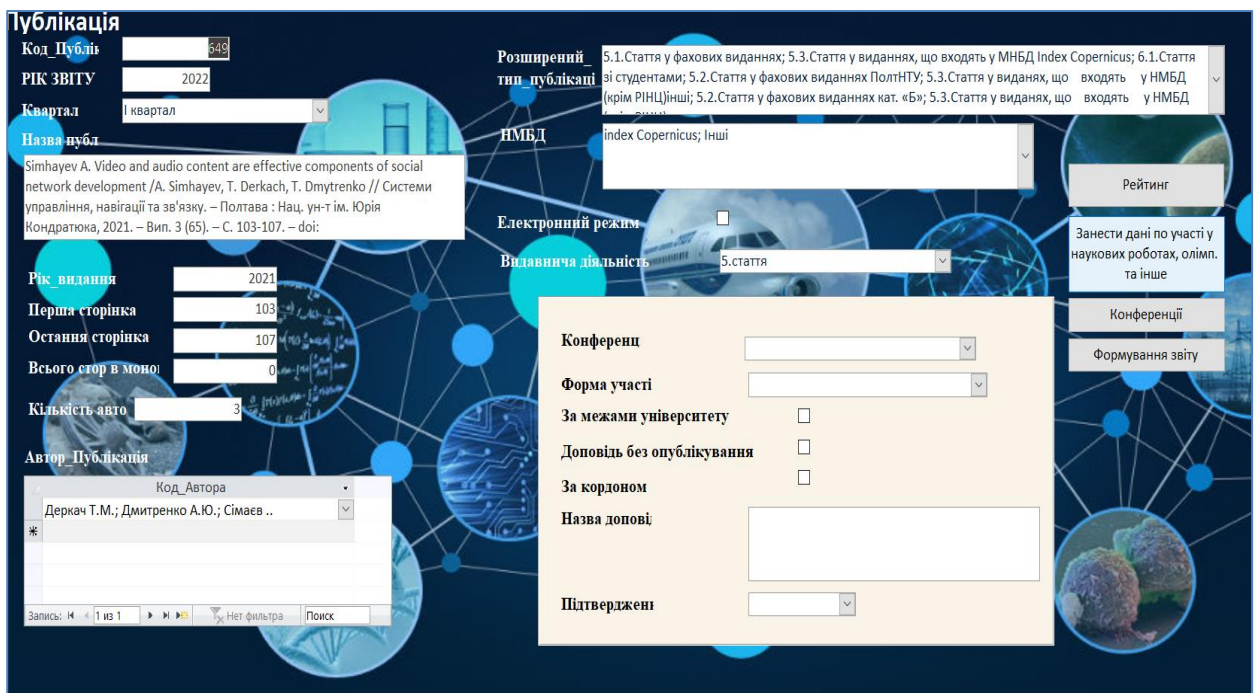


Fig. 6. Data entry interface for department reporting



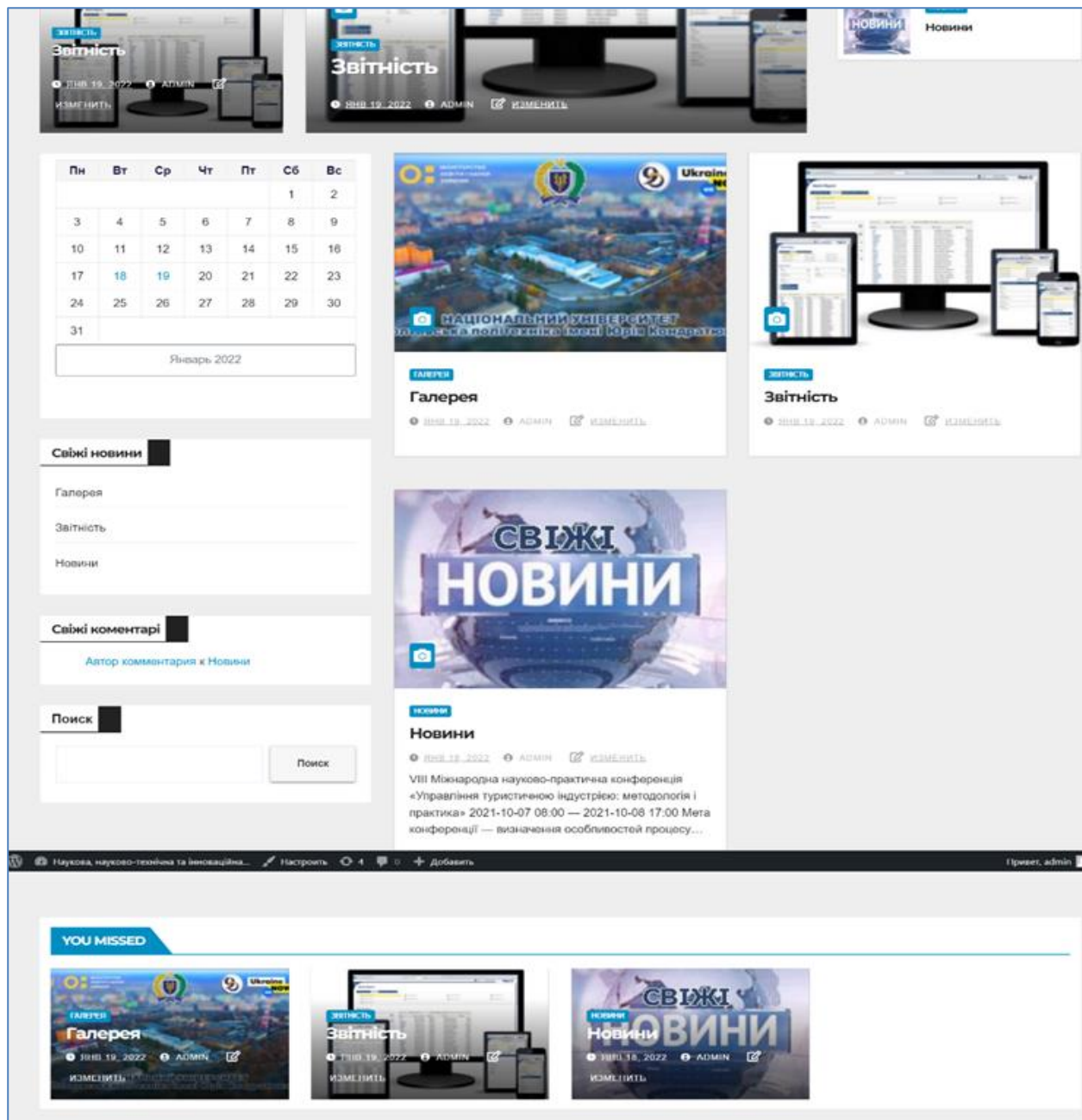


Fig. 7. Home page of the information system

## Conclusions

As a result, according to the reference terms, the behavior, sequence, branching and synchronization of processes have been developed, which made it possible to create a system for managing the scientific and scientific-technical activities of the university.

The introduction of a management system for scientific and scientific-technical activities of the department allows:

a) reduce the time spent on creating, maintaining various reports of scientific publications of scientific and pedagogical workers;

b) automation of data collection on h-index and the number of citations of scientific and pedagogical workers, graduate students and doctoral students on Google - Scholar Citations;

c) checking the uniqueness of a scientific publication using semantic text analysis (and instructions for using this function were also provided);

d) convenient possibility of adding (replenishing) new scientific papers and their categories;

e) the possibility of planning the date and time of scientific material publication in advance, which will automatically publish the article on the specified date and time);

f) the ability to change the status of a published article:

a. private status (the publication will not be displayed in the information system, even if it has been published earlier);

b. public status (the publication will be displayed in the information system, even if it has not been published earlier);

g) the ability to save all stages of the scientific publication creation with the possibility of its return to the selected version.

This information system is primarily aimed at teachers and scientists of the Western Military District, students and ordinary users.

The purpose of creating the module is to ensure the management of the scientific and technical activities of the department, which will greatly facilitate the teachers work.

This software product has the following development prospects:

a) the system can be applied in different areas,

since the system is not tied to specific scientific categories, and the administrator can create them independently, depending on the specified needs;

b) further self-checking of the text for uniqueness during the process of writing the article is possible;

c) implementation of other reports types, depending on the tasks.

During the developing a software product, modern web technologies have been selected and justified, which allow creating interactive web pages.

The developed information system fully satisfies all the requirements at the stage of setting the task and is ready for operation.

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#### Розроблення інформаційної інтелектуальної системи управління науковою та науково-технічною діяльністю ЗВО

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**Анотація.** Запропонована інформаційна система управління науковою та науково – технічною діяльністю ЗВО. Розглянуті етапи проектування архітектури системими. побудовано загальну модель діаграми прецедентів для подальшого розширення та діаграму активності (Activity diagram). Представлено розроблену поведінку, послідовність, розгалуження й синхронізацію процесів, що дозволило створити систему управління науковою та науково – технічною діяльністю університету. Проаналізовані сучасні веб – технології, що дозволяють створювати інтерактивні веб – сторінки. Представлений розроблений інтерфейс для введення даних на рівні звітності кафедр. спроектована головна сторінка інформаційної системи, який містить всі основні структурні елементи, перехід за якими здійснюється за допомогою гіперпосилань.

**Ключові слова:** інформаційна інтелектуальна система управління, інтелектуальний система, семантичний аналіз тексту, наукова діяльність кафедри