Збірник наукових праць. Серія: Галузеве машинобудування, будівництво

Academic journal. Series: Industrial Machine Building, Civil Engineering

http://journals.pntu.edu.ua/znp
https://doi.org/10.26906/znp.2019.52.1698

UDC 004.9:371.3

The scientific and technical activity module development for the department of structures from metal, wood and plastics

Dmytrenko Tatyana[1]*, Dmytrenko Andriy[2], Derkach Tatyana[3], Klochko Lina[4]

[1] Poltava National Technical Poltava Yuri Kondratyuk University https://orcid.org/0000-0002-6755-3000
[2] Poltava National Technical Poltava Yuri Kondratyuk University https://orcid.org/0000-0002-8715-7646
[3] Poltava National Technical Poltava Yuri Kondratyuk University https://orcid.org/0000-0001-8062-9105
[4] Poltava National Technical Poltava Yuri Kondratyuk University https://orcid.org/0000-0002-6064-2887
*Corresponding author E-mail: dmitr_tat@ukr.net

The problems of society informational support, which demand the creation of modern information management systems for different objects were considered. Particular attention was paid to the detailed description and analysis of existing services for keeping records of scientific activity in higher educational institutions. The necessity of module creating for management the scientific and technical activities, which will allow to optimize the procedure for conducting reports on scientific, technical and innovative activities, to expand the possibilities for the results analysis, to ensure transparency and objectivity in the procedure of evaluating the teachers' activities, was revealed and explained. The developed sections of the technical enquiry were given. On the basis of the conducted research the software implemented module for management the scientific and technical activity of the department.

Keywords: informational intellectual control system, intellectual module, semantic analysis of the text, scientific activity.

Розроблення модуля управління науковою та науково-технічною діяльністю кафедри конструкцій з металу, дерева та пластмас

Дмитренко Т.А.[1]*, Дмитренко А.О.[2], Деркач Т.М.[3], Клочко Л.А.[4]

[1, 2, 3, 4] Полтавський національний технічний університет імені Юрія Кондратюка
*Адреса для листування E-mail: dmitr_tat@ukr.net

Розглянуто проблеми інформатизації суспільства, яке вимагає побудови сучасних інформаційних систем управління різними об'єктами. Проаналізовано теоретичні та методологічні аспекти вдосконалення ведення звітності у вищих навчальних закладах. Особливу увагу приділено детальному опису й аналізу існуючих сервісів ведення обліку наукової діяльності вищих навчальних закладів. Виявлено та обґрунтовано необхідність створення модуля управління науковою й науково-технічною діяльністю, який дозволить оптимізувати процедуру ведення звітів про наукову, науково-технічну та інноваційну діяльність, розширити можливості для аналізу результатів, забезпечити прозорість і об'єктивність у процедурі оцінювання діяльності викладачів. Наведено основні критерії автоматизованої інформаційної системи. Представлено розроблені розділи технічного завдання. Передбачено виконання вимог реалізації інформаційної системи у вигляді Web-додатка. Наведено опис концептуальної схеми за допомогою узагальнених конструкцій блоків та розроблену ER-модель. Розраховано мінімальну конфігурацію сервера. На основі виконаного дослідження запропоновано програмно реалізований модуль управління науковою та науково-технічною діяльністю кафедри конструкцій з металу, дерева та пластмас (КМДіП), у якому враховано недоліки існуючих інформаційних систем управління. Система забезпечує публікування наукових матеріалів, можливість перевірки тексту на унікальність і генерування автоматичних звітів, що значно полегшить роботу викладача чи наукового діяча, виконує розмежування користувальницької та адміністративної частин програмного комплексу, автоматичне формування звітів про наукову, науково-технічну й інноваційну діяльність та надає можливість розроблення чи додавання (поповнення) нових публікацій і їх категорій.

Ключові слова: інформаційна інтелектуальна система управління, інтелектуальний модуль, семантичний аналіз тексту, наукова діяльність.

Introduction

Nowadays the question of present interest is the system creation for management the departments of higher educational institutions scientific and technical activities. Universities in Ukraine and abroad are involved to solve this problem, but the exact analogues that meet all the requirements of the given technical enquiry, has not been found. Thus, this problem is becoming more and more important [6] due to the general rapid development of science and technology and the national education systems redeveloping which require up-to-date solutions and the introduction of advanced models, tools, methods and technologies for creation modern intelligent information management systems, in particular, management of scientific and technical activities of the department [7, 8].

One of the promising areas of informational support is the development of resource management systems for companies and enterprises (ERP-systems). Now, the question of present interest is the computer support systems for managing universities and education quality creation. The most of countries of the European Union and beyond it deal with this problem. This is due to the constant redevelopment of national education systems, the Bologna process development as well as the complexity of the subject area.

Considering the business process of quality assurance, it is based on the «Standards and Guidelines for Quality Assurance in the European Higher Education Area» developed by the European Association for Quality Assurance in Higher Education on the direct request of Education Minister of the European countries Conference signed by the Bologna Declaration. The European Association for Quality Assurance in Higher Education is an organization that aims to maintain and increase the quality of European education to a high level [9].

Review of research sources and publications

The investigation of theoretical and methodological aspects of improving the reports in higher educational institutions with the help of information systems is reflected in the works of many native and foreign scholars. The core and importance analysis of information systems in general has been carried out by a number of western authors [13], [15 – 19]. The current state of the information systems development and their classification are presented in the works [20 – 22]. The basic requirements for information systems are given in the works [23 – 26]. At the same time, there is a need to develop and implement a specific information system to automate the departments scientific work accounting.

Definition of unsolved aspects of the problem

For the effective work of the department teaching staff of higher educational institutions, there is a need to create an information intellectual system project to manage the scientific-technical activity.

The scientific and technical management module enables to optimize the procedure for keeping reports on scientific, technical and innovative activities, to reduce the costs of department scientific activity organizing by optimizing the use of all department resources, improving staff production performance and efficient management of the paid scientific research services provision. It promotes the development of academic freedom by ensuring the activity transparency of all parties involved in the system.

Problem statement

The task of this research is to design and implement the module for the department of structures from metal, wood and plastics scientific and technical activities management. The main purpose of this development is to create a web-module that has the functions of publishing scientific materials and automatically generate reports for the department of structures from metal, wood and plastics.

The aim of the research is to improve the quality of subdivision research activity, to provide scientific materials publication, to check possibility of the text for uniqueness and automatic reports generating, which greatly eases the work of teachers or scientists. Target audience is teachers, researchers, students, school leavers, and people interested in this information, etc.

Basic material and results

The main criteria for the project of automated information system are shown in Figure 1.

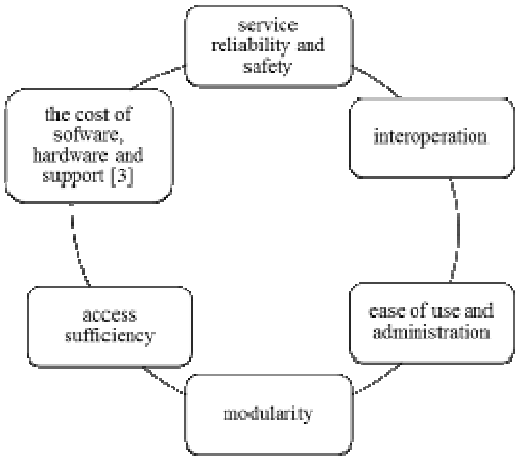

Figure 1 – The main criteria of automated information system

For the first time the application of software content management system with advanced set of tools of information and training Web-portals, which contains software means for department scientific and technical activity management has been developed during conducting this research. The overview of existing information resources for creating the key model features of the program module for scientific and technical activities of the department, an analysis of the existing services (Figure 2) has been carried out and their features and disadvantages [4, 5] have been determined.

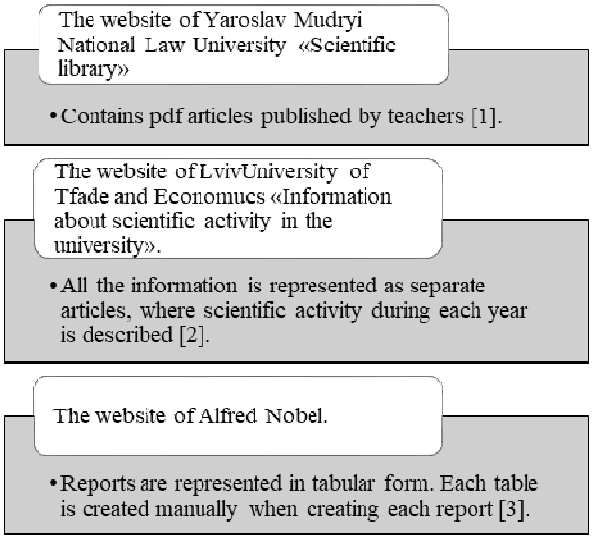

Figure 2 – The examples of existing services

At the stage of the information system designing, the main sections of the technical assignment have been defined (Figure 3).

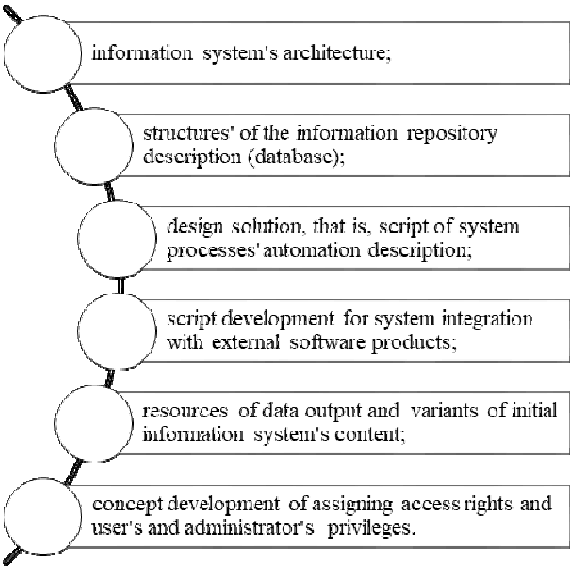

Figure 3 – Main sections of technical specification

During system development meeting the requirements of the information system implementation as a Web-application has been anticipated. The content management system should provide the administrator with the ability to perform the actions shown in Fig. 4. An important function of interface design is the usage prediction of a specific function, the description of the function itself and the error messages processing, the search for the necessary information.

As designing of useful and spacious information is an important thing for the user, and then it should be evaluated at the same level as the system architecture or program code. Messages design takes a lot of time and effort.

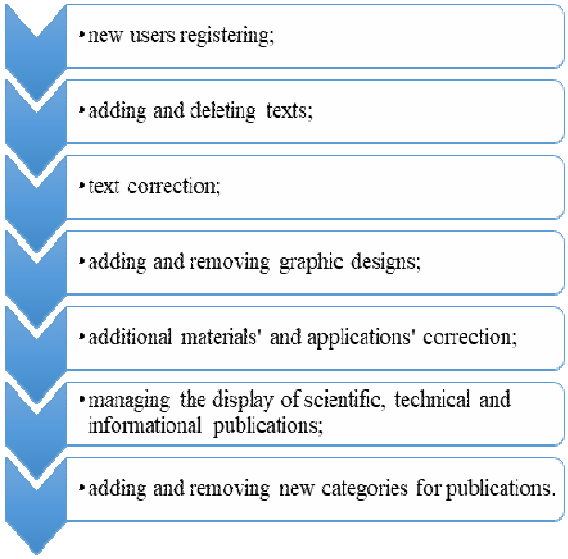

Figure 4 – Administrator functions

Error massages handling is one of the means of user training to work with the system. Having accidentally executed a certain error action, the user should receive a message in an intuitive form, what exactly the user did wrong and what to do to fix this error.

Searching for information is a mean of providing the user with the information in a large amount of other information. Therefore, this function should be provided in the system interface in a convenient place. An example of its usage in the system is the form of logging into the system, having entered data, the user receives the corresponding message and the hyperlink with the help of which the problem can be solved.

To accomplish the assigned task, a convenient module structure has been designed and developed, which is presented in Figure 5. Technical activities of the department, UML models were used.

For more precise presentation of the projected software, it is necessary to make a general model diagram of precedents for further expansion (Use Case diagram).

The precedent diagram visually reflects a variety of interaction scripts between actors (users) and precedents (cases of use); describes the system functional aspects (business logic).

The module for managing the scientific and technical activities of the department for the information intellectual system «Portal-Department» is implemented in the language of PHP-7, MySQL, Open Server, CMS Wordpress [14]. The number of users can vary from 1 to 100 (depending on the number of teachers or scholars who are registered on the website). The peak of activity on the server occurs during end-of-term exams. Therefore, in order to determine the hardware configuration, the peak traffic on the information system was determined. Also, such parameters as the number of hardware cores (processors), the amount of RAM, the required traffic-carrying capacity of the network channel.

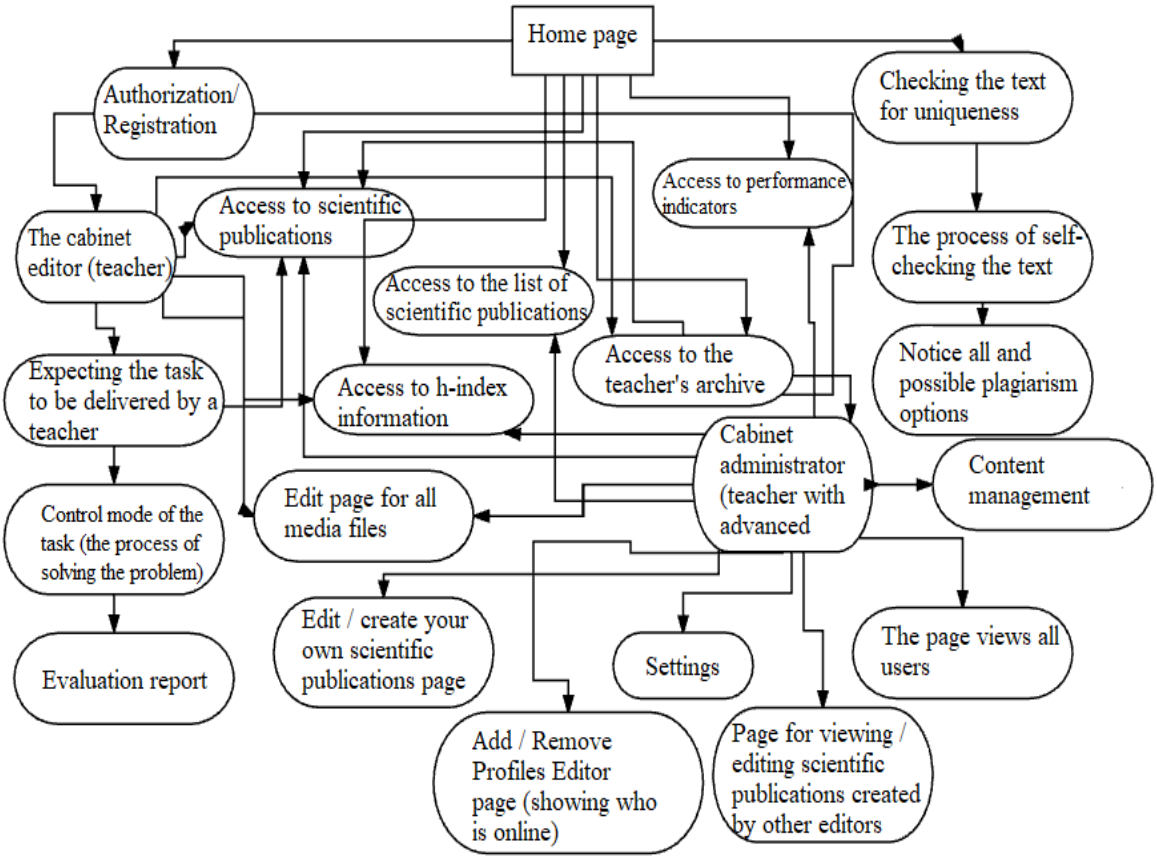

Figure 5 – The automated system structure

For more detailed module design and to simplify the calculations, the following simplifications are introduced (Figure 6).

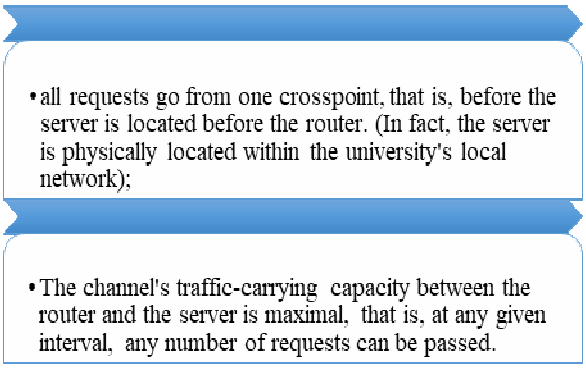

Figure 6 – Simplification for calculations

According to this, the minimum server configuration was calculated [10]: the number of cores - 4-8, 8 GB of RAM, 2-10 Mb/s traffic-carrying capacity, web server Apache 32 MB, DBMS-MySQL 32 MB.

Reliable operation of the software complex is provided by (Figure 7).

The diagram of the system usage options is shown in Figure 8.

For the usage variants the following notions are used:

-- subject as an external entity, interacting with the system; it can be a man, a device or another system;

-- usage aspect as a mean provided by the system;

-- one-sided association, as an interaction, directed from one subject or aspect to another;

-- generalization from one subject or aspect to another.

To display the series of objects and the messages which they exchange with each other, the interaction diagrams were made.

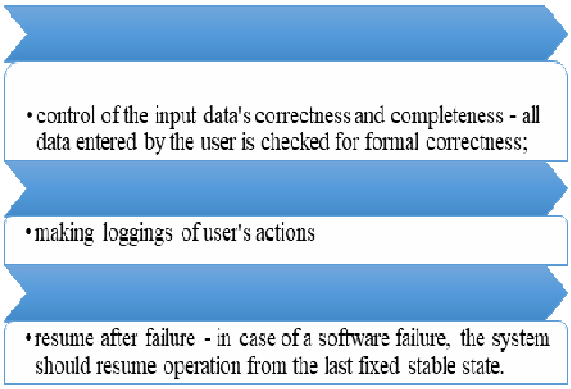

Figure 7 – Ensuring the reliability of the software system

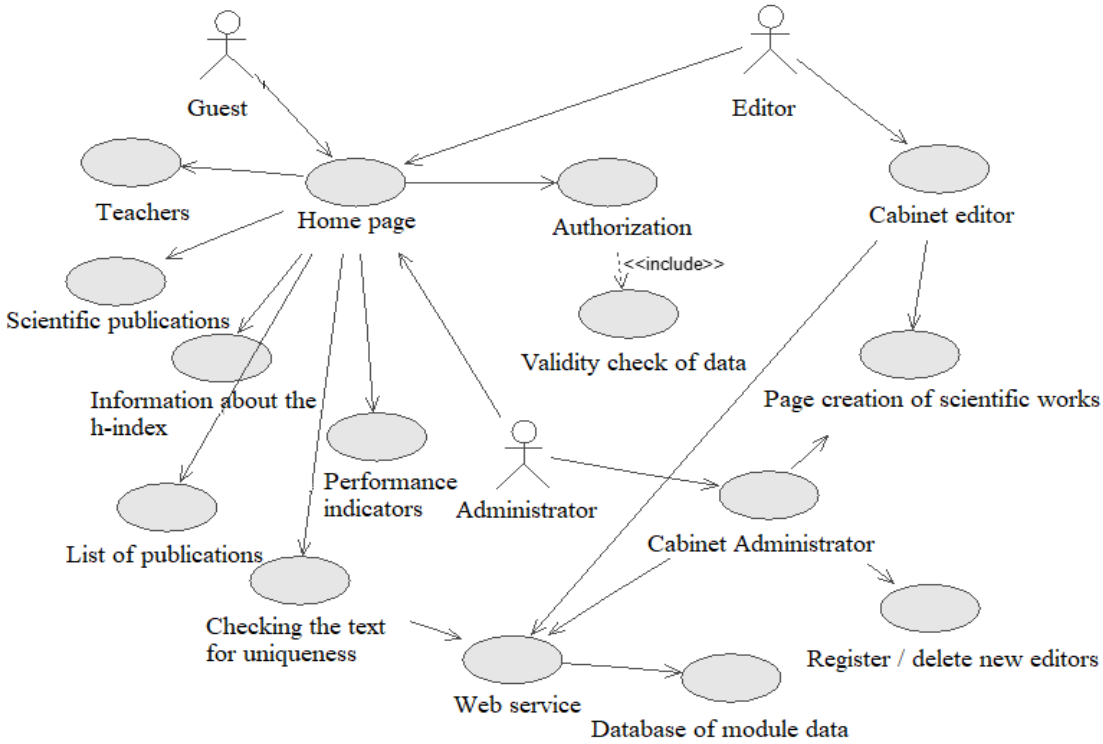

Figure 8 – The Use Case Diagram

Activity diagram is a diagram that shows the decomposition of some activity into its constituent parts. Figure 9 shows an activity diagram for the administrator's website.

The presented system of the department of structures from metal, wood and plastics is aimed at teachers and scientists, students and ordinary users. The purpose of its creation is to provide management of the department scientific and technical activities, which greatly facilitates the work of the above-mentioned users. During the software product development, modern web-technologies have been selected and substantiated, which enable to create interactive web- pages.

During an information system database designing the ER-model (entity-relationship diagram) has been developed, which enables to describe conceptual diagrams with the help of general block constructions. On its basis the data diagram has been made (Fig. 10) [11, 12].

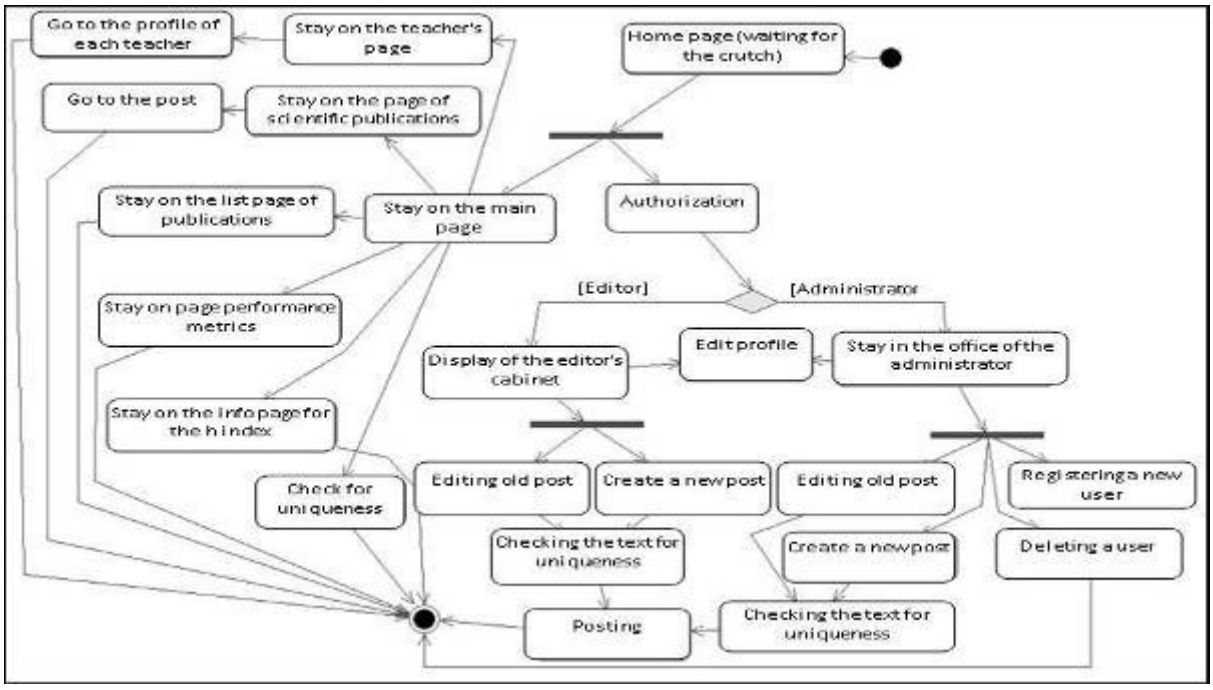

Figure 9 – Activity Diagram

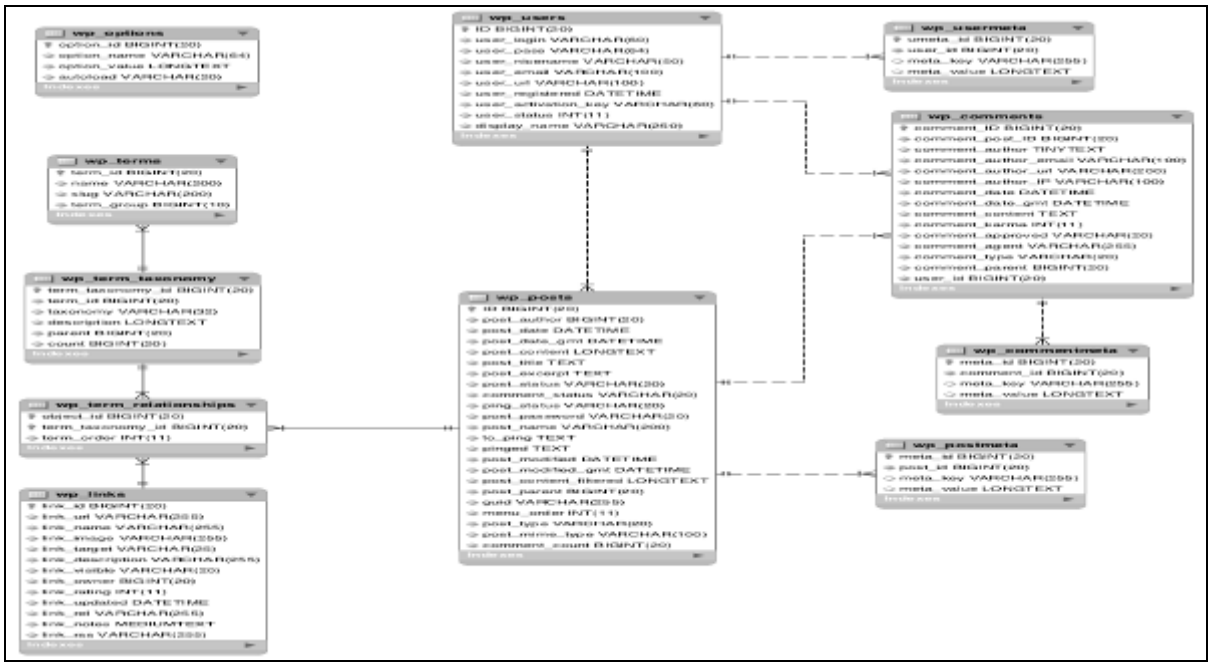

Figure 10 – The «intent - link» model

Conclusion

The result of the research was the development and program implementation of the module for the department of structures from metal, wood and plastics scientific and technical activities management.

The disadvantages of existing information management systems have been considered in this system, namely it provides scientific materials publication, the checking possibility of the text for uniqueness and automatic reports generating, which greatly eases the teacher's or scientist's work.

Information system provides the implementation of the following functions:

1. Division of the user and administrative part of the program:
   1.1. Editor (can add / delete / edit scientific publications, check the text for uniqueness, available to teachers or scientists who have been registered by the administrator);
   1.2. Administrator (can add / delete / edit scientific publications, check the text for uniqueness, and has the rights to add / remove new users, namely editors);
   1.3. Ordinary users (they can view publications, reports on scientific, technical and innovative activities of the department)
   1.4. Registered teacher or scientist should have the possibility of free access to the management module of scientific and technical activities using individual unique logins and passwords. When logged in, he/she accesses scientific publications (where he/she can add a new publication, with the ability to add a co-author, select the appropriate categories and other details);
2. Automatic generation of reports scientific and technical and innovative activities;
3. Providing development or addition of new publications and their categories;
   3.1. Status changes of published articles - private status (the publication dol not appear on the website, even if it has been published previously) or public status (the publication is displayed on the website, even if it has not been published previously).
4. An administrator's ability to clean the database from irrelevant data
5. Information presence of the department on the Internet, availability of reports on scientific and technical and innovative activities and scientific materials;
6. Simplicity and comfort of navigation, that is, an intuitive interface.

Among the possibilities of this intellectual module, the following can be highlighted:

- automatic generation of reports on scientific, technical and innovative activities;
- checking the text for uniqueness.
- automatic publication of the article at the specified date and time.

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