Informational Support of Effective Work of the Community Manager with Web Communities

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Abstract. This paper is devoted to solving the issue of creating a consolidated information resource for providing the community manager's effective work with web-communities. The main purpose of the work is to analyze the various sources of information about the activity of the community manager and to ensure the process of consolidation of the collected data into one information resource. The current state of the web communities and areas of activity of the community manager, its roles and function are analyzed. A system analysis of the research object and subject area was performed, and the main purpose of developing the consolidated resource was determined. Thus, as a result of the analysis of the object's information system based on the creation of DFD: the main function of the projected system described in the object being modeled; basic processes, defined data flows that are processed by defined processes; completed is the creation of a conceptual model of the system, which is a description of the object inherent in the rules, flows and data warehouses. A resource that is an information system that looks like a community of community managers is created. The basic potential of this resource is substantiated, which satisfies the information needs of users, enables them to share useful experiences, create publications, communicate and participate in discussions of certain issues. A user authorization system, content system, search tools, rating and distribution content, feedback system, forum, and site automation system have been developed.

Keywords: Community Manager, Community Management, Web Community, Content, Consolidated Information Resource.

1 Introduction

Today, online communities cover different areas of life. The number of participants increases daily. There is a problem in the way of development of web communities

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for their effective functioning, which prevents them from realizing their potential for knowledge accumulation and transfer. The community management will help solve the identified problem. This is a new activity that promotes communication and community development. The reason for creating a consolidated resource is that there is no such information resource yet that contains the information needed to make effective decisions in the web community management process. The consolidated information resource should contain information about the activities of the community manager and the community management in general.

2 Related Works

The term of "community manager" appeared in 2007. The first specialists of such a profile appeared in companies that own large-scale online games. It has helped to better understand the community and its needs, to resolve conflicts and to receive feedback to adjust plans for the further development of gaming virtual environments.
The community manager is a carrier of the ideas and ideologies of his brand, the companies with which he collaborates. He is responsible for forming (or identifying) loyal brand people, communicating with them, engaging them in communicating around the brand. The term of "community manager" goes beyond the existing knowledge and experience of using social networks, it is not a social media specialist, but a community manager.
Specificity of the activity of the community manager is best demonstrated in his roles:
Lawyer. He represents clients. This process involves monitoring, analyzing, and interpreting customer thoughts, bringing up-to-date issues beyond the community (for example, at the official level).
Evangelist. He promotes the thoughts and moods of customers, advertising events, products and updates (companies, brands, organizations).
Communicator. He encourages the community to engage in discussions, directing them into the right direction. He is a third party (mediator) in intra-community conflicts, and develops and implements specific discussion tactics.
Futurist. He collects, organizes and presents to the stakeholders' suggestions of the community and knowledge of her vision for the future.
Depending on the field in which this specialist works, he or she is subject to various requirements, according to which the community manager fulfills the above-mentioned roles, which are multifunctional.
The types of responsibilities that may entail a specific role as a community manager:

- *Content creation* – writing messages, articles, newsletters, communications and other content.
- *Content management* – content management, facilitating the creation of high-quality materials.
- *Retaining existing and attracting new members.*
- *Increasing participant activity* – creating surveys, encouraging participants to create content, conduct discussions, and respond to other participants' actions.

- *Social media marketing* is about engaging user traffic and engaging with the community through social platforms.
- *Offline Presence* – organize events and meetings for active community members.
- *Relationship with community members* – organizes events and meetings for active community members.
- *Implementation* – promoting the implementation of a community strategy for its effective functioning.
- *Distribution* – placement of content on several sites (cross-posting).
- *Advocacy* – representing the interests of the community (monitoring, analyzing and interpreting the views of community members).
- *User management* – user registration, user action management.

The types of community manager responsibilities can be expanded depending on the goals and needs of the community. The effectiveness of the community manager, based on its functions, can be evaluated by the following criteria:

- quantitative indicators of the growth of user community content;
- the number of user reactions to this content ("swearing", dissemination of information);
- dynamics of growth and outflow of community members;
- the number of conversions (for targeted communities, including communities with a commercial component).

Community management includes the ability to support communities across all Websites. The primary responsibility for ensuring the continued functioning of communities and for active engagement with its members lies with the community manager.

3 System analysis the object of study

Before creating a consolidated information resource, you need to build a goal tree that will ensure correct and consistent actions when creating a consolidated resource.
The main purpose of this study is to create a consolidated information resource to ensure the effectiveness of the community manager with web communities.
You can achieve this goal only after completing the following tasks: systematic analysis of the domain; choice of software solution; development of a consolidated information resource. Creating a CIR consists of three sub-goals, namely: systematic analysis of the subject area, selection of development tools, and development of a consolidated resource. The sub-objective of "System analysis the subject of study" involves the construction of the Data Flow Diagrams (DFD) and the Entity Relationship Diagrams (ERD) of a consolidated information resource. The sub-objective of "Choosing development tools" involves choosing the means of creating a database and site. As a result of this sub-objective, the tools for practical implementation will be selected.

The sub-objective of “Development of a consolidated information resource” involves the creation of a database and a site. The result of this purpose will be the practical implementation, the creation of a consolidated information resource.
It is advisable to use *data flow diagrams (DFD)* to effectively model the problem under study. We use diagrams as a means of modeling the functional requirements of the designed system.
The main purpose of DFD is to demonstrate how each process converts its input information to output, and to identify the relationship between those processes. In the diagrams, functional requirements are represented by processes and repositories associated with data flows. The DFD presented shows the main process – ***the operation of a consolidated information resource for community managers.*** At the same time there are such external entities as: User – acts as the main driver of the effective functioning of the CIR, which by registering has the right to create, edit and delete its own content, participate in discussions and search for information. Community manager – analyzes processes, organizes and filters the content, and provides recommendations for action to be taken. From the user to the CIR, the content (input stream) is received, and the publications (output stream) are returned. Recommendations (inbound stream) are received from the community manager to the CIR, and information about the completed actions (outbound stream) is returned.

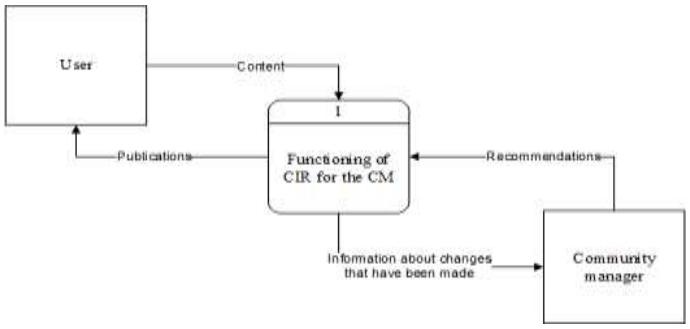

Fig. 1. Context Diagram (Functioning of CIR for the CM)

The following diagram describes the division of the first level (Fig. 2). The processes, the data flows between them, and the data warehouse are described here. The process of functioning of the consolidated information resource includes such basic stages as:

- content analysis;
- user identification;
- analysis of posts and comments;
- definition of topics;
- determining relevance;
- error checking;
- updating the content;
- working out the recommendations of the community manager;
- generating information for the community manager;

- issuing results.

As we can see from the diagram, the “Content analysis” subprocess receives a data flow such as: information content. The purpose of this process is to investigate the content and structure of the information content that has been received, which results in the analyzed information content stored in the “Information content” DB.
The *“User identification”* subprocess. The input data stream for it is: user information. The output data stream is: user identification information. As a result, we get information about the completed user identification stored in the corresponding database – “Users”.
The *“Analysis of Posts and Comments”* subprocess. The input data stream for it is: posts and comments. The output data streams are: posts; posts and comments. The purpose of this process is to investigate the content, structure and form of posts and comments.
The *“Theme definition”* subprocess. The input data stream for it is: posts. The output data stream is: topic-relevant information. The purpose of this process is to: check users’ posts for relevance with predefined keywords.
The *“Determination of relevance”* subprocess. The input data streams for it are: information on relevance; user information. The output data streams are: topicality information. The purpose of this process is: to determine whether the information provided corresponds to the information needs of users.
The *“Checking for errors”* subprocess. The input data streams for it is: posts and comments; information about relevance. The output data streams are: error information. The purpose of this process is to: check the content for spelling and punctuation errors.
The *“Updating of information content”* subprocess. The input data streams for it is: information about relevance; error information; recommendations. The output data streams are: information about updates performed; updated content. The purpose of this process is to investigate the information that has been received, to identify what needs to be done and to make certain changes, that is, to update it.
The *“Working out the recommendations of the community manager”* subprocess. In this process, the input data streams are the recommendations sent by the community manager, and the output data streams are already processed recommendations. The Community manager examines the content of the community and sends recommendations to the system regarding the need to make certain changes to the content.
The *“Generation of information for the community manager”* subprocess. In this process, the input data streams are the completed updates and the output data streams are the completed changes. The purpose of this process is to: generate information about actions that have been taken on the content.
The *“Issue of results”* subprocess. In this process, the input data streams are an updated content and the output data streams are publications. The purpose of this process is: to store the results of the completed content update and its subsequent publication.

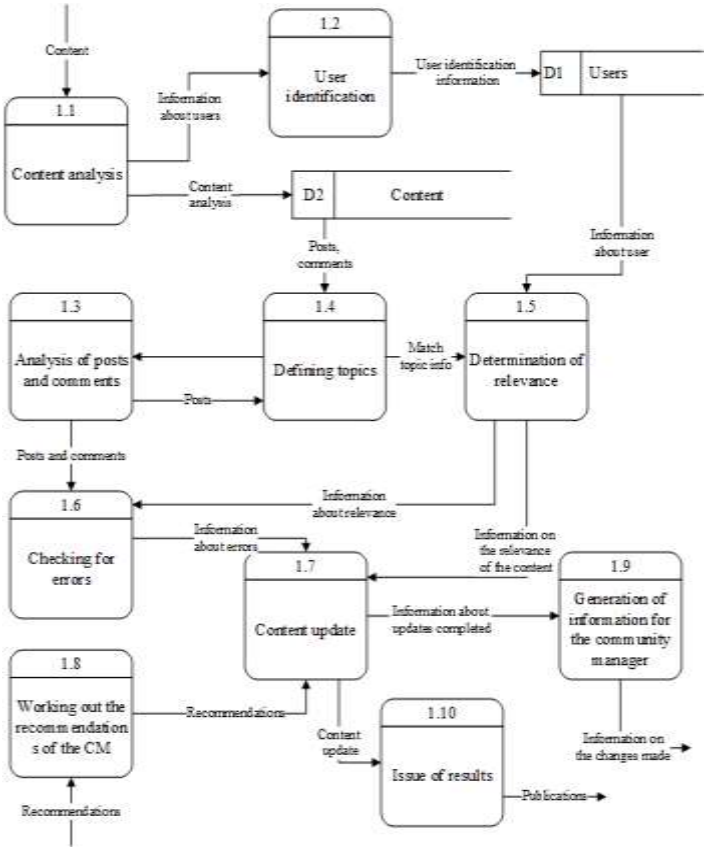

Fig. 2. Decomposition of the process "Functioning of consolidated information resource for the community manager"

The diagram (Fig. 3) shows the 2nd level of decomposition of the process of "Updating the content". This process involves the following subprocesses: identification of the content that needs some changes; content filtering, editing content, commenting on content, deleting, approving changes. This chart also shows the input and output data flows for this process. The *"Identification of information that needs some changes"* subprocess. The input data streams for it is: information on the relevance of the content, error information, recommendations. The output data streams are: content. The result is a content that needs change. The *"Content filtering"* subprocess. The input data stream for it is: content. The output data streams are: content that needs editing; content that needs commenting; information to be deleted. The result is a clear distribution of the content that is subject to change. The *"Content editing"* subprocess. The input data stream for it is: content that needs editing. The output data stream is: editing information. The result is an edited content. The *"Commenting on the content"* subprocess. The input data stream for it is: content that needs commenting. The output data stream is: comments. The result is a

commented content. The *"Delete"* subprocess. The input stream for it is: content to be deleted (spam, flames). The source stream is: deletes information. The *"Approval of amendments"* subprocess. The input data streams for it is: editing information; comments; removal information. The output data streams are: information about updates performed; updated content. As a result, we get an updated content.

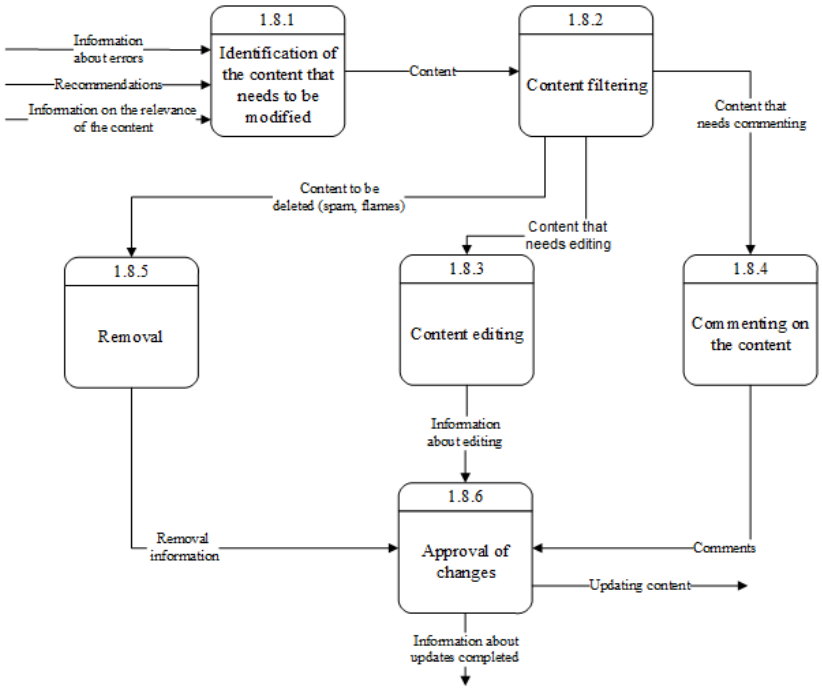

Fig. 3. The second level of decomposition of the "Content updates" process

Thus, as a result of the analysis of the object information system based on the creation of DFD it was determined: the main function of the projected system, described in the simulated object, the main processes, identified data flows that are processed by certain processes, completed creation. The Entity-relationship (ER) model provides a visual representation of the data model. Considering the needs of the users and the peculiarities of the functioning of the consolidated information resource, the database schema should contain the following entities:

- User;
- Community Manager;
- Content;
- Type of the content;
- Type of the community manager;
- Role of the user.

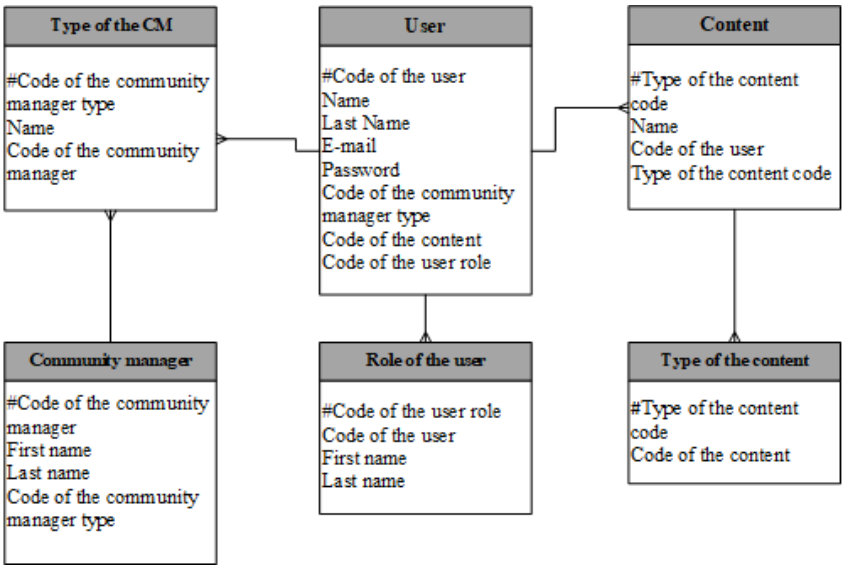

Fig. 4. The "Essence-connection" diagrams

The essence of the "User" (basic information about user), key attribute – Code of the user, required attributes – First name, Last name, E-mail, Password, Code of the community manager type, Code of the content, Code of the user role.
The essence of the "Community manager" (basic information about the community manager), key attribute – Code of the community manager, required attributes – First name, Last name, Code of the community manager type.
The essence of the "Content" (information about the content) key attribute – Type of the content code, required attribute – Name, Code of the user, Type of the content code.
The essence of the "Type of the content" (information about the appropriate content type) key attribute – Type of the content code, required attribute – Code of the content.
The essence of the "Type of the community manager" (means that a manager is one of the types) key attribute – Code of the community manager type, required attributes – Name, Code of the community manager.
The essence of the "Role of the user" (displays user affiliation to one of the roles) key attribute – Code of the user role, required attributes – Code of the user, First name, Last name.
The resource being developed is an information system that looks like a community of community managers. The main potential of this resource meets the information needs of users, enables them to share useful experiences, create publications, communicate and participate in discussions of specific issues. In turn, this resource will ensure the effective performance of its functions by this specialist, and thus ensure the effective functioning of the communities with which he collaborates.

The consolidated information developed can be used in any of the industries. Because any of the companies in order to succeed must be present online, but simply building a site or community is not enough. Therefore, there is an acute problem of effective operation and management of these sites, which will be solved by the management of the community – a new type of activity aimed at ensuring the effective functioning of the communities of their development and improving communication with its participants. The community manager is a manager who is able to work in any field and adapt to any audience.
The input data streams for the consolidation of information is the content obtained from various information sources.
The output data streams as a result of the site's functioning must be relevant information arrays that meet the needs of the users.
Knowledge generated through user participation and engagement processes will be the main result.

- structured information submitted;
- having a user profile system
- a well-established system of user interaction;
- availability of a content creation system;
- availability of information retrieval system.

4 The choice of methods and means of solving the problem

Consolidation is a set of methods and procedures aimed at obtaining data from different sources, ensuring the required level of information and quality, converting to a single format.
Consolidation is based on the process of collecting and organizing the storage of information in a form that is optimal in terms of its processing.
A key concept of consolidation is a source of information - an object that contains structured information that may be useful for a particular task.
The concept of “Consolidated information” encompasses multiple sources and systematically integrated multifaceted information resources, which are collectively endowed with features of completeness, integrity, consistency and constitute an adequate information model of the problem area for its analysis, processing and effective use in support processes.
The main stages of information consolidation are:

- obtaining information;
- data processing and information retrieval;
- transformation and synthesis of information, obtaining, structuring and storing information on a given topic.

Methods of information gathering:

- search for sources of information;

- observation of sources of information.

Search for sources of information – purposeful actions to identify sources of information, determine their main characteristics (reliability, consistency, timeliness, etc.) and analyze the meaning of the disseminated (transmitted) information.
Observation – purposeful actions to systematically retrieve information from identified sources through the selection and registration of distributed (transmitted) information.
Methods of obtaining information:

- traditional methods of analysis;
- formalized (content analysis).

Content analysis allows you to compare the content of many information sources and to analyze using quantitative methods (eg. diagrams, tables).
To create a consolidated information resource will be used content management system – CMS Drupal, which is free, contains more than 5000 modules to extend the functionality of the site, many visual templates (themes), a nice, clear interface, as well as customized for community sites. The relational database management system will use MySQL, which is free, primarily used to create dynamic web pages and is supported in many programming languages and is considered to be a good solution for small and medium-sized applications.

5 Results

In general, to implement the consolidated information resource, a user authorization system, a content system, search tools, evaluation and dissemination content, a feedback system, a forum, and a site automation system were created.
Before creating the consolidated resource, we conducted a survey of our users' activity on social networks. We have found that they are not very active in commenting and liking content. Their activity of 50% is not interested in content, 44% is interested and 6% is other. Therefore, our goal was to improve these metrics with the help of our consolidated resource (Fig. 5).

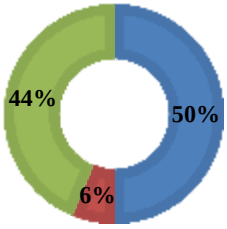

Fig. 5. Users' activity

The site contains publications that are relevant to its subject.
The main menu of the created resource consists of the following items: “Home”, “Publications”, “Forum”, “Contacts”.
“Home” – allows you to go to the main page of the site.
“Posts” – allows you to view your own created and created posts.
“Forum” – allows members of the community to participate in ongoing online discussions on a given topic.
“Contacts” – contains a feedback form.
The consolidated information resource implemented contains a structured collection of information from various sources that may be useful for a particular task.

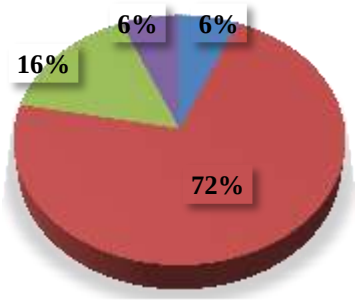

Fig. 6. Users’ mark

The consolidated resource we created helped reduce user activity. Users have become more aware of the use of the information resource (Fig. 6). We received 72% better ratings for filling the resource. The 16% of users started to write comments and give good feedback on the work of the community manager. The 6% of users started to support community discussions and the other 6% just visit our site.

6 Conclusion

A necessary and very important means of ensuring the existence and proper functioning of web communities is the continued management of the web community. Because the failure of managing both the content and the members of the web community can lead to poor performance or even collapse. For this reason, one of the important areas of work of organizations should be community management - a new type of activity aimed at ensuring the effective functioning of their communities and enhancing communication with its members. Effective community management can help turn web communities into an effective means of sharing useful information and accumulating knowledge, as well as making it a powerful tool for public opinion formation.

References

1. Fedushko S., Benova E. Semantic analysis for information and communication threats detection of online service users. Procedia Computer Science, Volume 160, 2019, Pages 254-259. https://doi.org/10.1016/j.procs.2019.09.465 (2019)
2. Fedushko S., Syerov Y., and Korzh R. Validation of the User Accounts Personal Data of Online Academic Community. Proceedings of the XIIIth International Conference "Modern Problems of Radio Engineering, Telecommunications and Computer Science" (TCSET'2016). Lviv-Slavske, February 23 – 26, 2016. pp. 863-866 (2016).
3. Syerov Yu., Fedushko S., Loboda Z. Determination of Development Scenarios of the Educational Web Forum. Proceedings of the XIth International Scientific and Technical Conference (CSIT 2016). 2016. pp. 73-76 (2016).
4. Markovets, O., Pazderska, R., Dumanskyi, N., Dronyuk, I. Analysis of citizens' appeals in heterogeneous web services CEUR Workshop Proceedings Volume 2392, 2019, Pages 184-198 1st International Workshop on Control, Optimisation and Analytical Processing of Social Networks, COAPSN 2019; Lviv; Ukraine; 16 May 2019 through 17 May 2019; Code 149063
5. Trach, O., Vus, V., Tymovchak-Maksymets, O.: Typical algorithm of stage completion when creating a virtual community of a HEI. In: 13th International Conference "Modern Problems of Radio Engineering, Telecommunications and Computer Science", TCSET 2016, pp. 849–851. Lviv-Slavske, Ukraine (2016).
6. Markovets, O., Vovk, N., Turchyn, Y., Smirnov, O. Model of informational support for social network administrators' content creation. In: Proceedings of the 2st International workshop on control, optimisation and analytical processing of social networks, COAPSN-2020, 2616, 125-136. Lviv (2020). URL: http://ceur-ws.org/Vol-2616/paper11.pdf
7. Zhezhnych, P., Markiv, O.: Recognition of tourism documentation fragments from web-page posts. In: Proceedings of the 14th International Conference on Advanced Trends in Radioelecrtronics, Telecommunications and Computer Engineering, TCSET 2018, pp. 948–951. Lviv-Slavske, Ukraine (2018). DOI: 10.1109/TCSET.2018.8336350.
8. Zhezhnych, P., Khymytsia, N., Lisina, S., Morushko, O.: Analysis of computer-based methods for processing historical information. In: Proceedings of the 12th International Scientific and Technical Conference on Computer Sciences and Information Technologies, CSIT 2017, pp. 365–368. Lviv (2017). DOI: 10.1109/STC-CSIT.2017.8098806.
9. Zhezhnych, P., Markiv, O.: A linguistic method of web-site content comparison with tourism documentation objects. In: Proceedings of the 12th International Scientific and Technical Conference on Computer Sciences and Information Technologies, CSIT 2017, pp. 340–343. Lviv (2017). DOI: 10.1109/STC-CSIT.2017.8098800.
10. Kanishcheva, O., Vysotska, V., Chyrun, L., Gozhyj, A. "Method of integration and content management of the information resources network", Advances in Intelligent Systems and Computing, Vol. 689, 2018, pp. 204-216. Conference Paper, Cited by - 35, DOI > 10.1007/978-3-319-70581-1_14
11. Arzubov, M., Shakhovska, N., Lipinski, P. "Analyzing ways of building user profile based on web surf history", Proceedings of the 12th International Scientific and Technical Conference on Computer Sciences and Information Technologies, CSIT 2017, Vol. 1, Art No. 8098809, 2017, pp. 377-380. Conference Paper, Cited by - 12, DOI > 10.1109/STC-CSIT.2017.8098809
12. Gozhyj, A., Chyrun, L., Kowalska-Styczen, A., Lozynska, O. "Uniform method of operative content management in web systems", CEUR Workshop Proceedings, Vol. 2136, 2018, pp. 62-77. Conference Paper, Cited by - 16

13. Sokolyuk O.M.: Inclusion of social networking services in the existing model of organization of students' learning. Information Technologies and Learning Tools 5(55), 55-66 (2016). doi:10.33407/itlt.v55i5.1494
14. Tang, Y., Hew, K.F.: Using Twitter for education: Beneficial or simply a waste of time? Computers & Education 106, 97–118 (2017). doi:10.1016/j.compedu.2016.12.004.
15. Thai, M., Sheeran, N., Cummings, D. J.: We're all in this together: The impact of Facebook groups on social connectedness and other outcomes in higher education. The Internet and Higher Education 40, 44-49 (2019). doi:10.1016/j.iheduc.2018.10.001
16. Pinchuk, O.: Perspective analysis of use of electronic social networks in learning environment, CEUR Workshop Proceedings, vol. 1614, pp. 680-686. http://ceurws.org/Vol-1614/paper_54.pdf (2016). Accessed 30 October 2019
17. Shafer, S., Johnson, M.B., Thomas, R.B., Johnson, P.T., Fishman, E.K.: Instagram as a Vehicle for Education. Academic Radiology 25(6), 819–822 (2018). doi:10.1016/j.acra.2018.03.017
18. Sokolyuk O.M.: Inclusion of social networking services in the existing model of organization of students' learning. Information Technologies and Learning Tools 5(55), 55-66 (2016). doi:10.33407/itlt.v55i5.1494
19. Hryshchuk, R., Molodetska-Hrynhchuk, K.: Methodological foundation of state's information security in social networking services in conditions of hybrid war. Information &Security: An International Journal 41, pp. 55–73 (2018)
20. Osaka, K., Toriumi, F., Sugawara, T.: Effect of direct reciprocity and network structure on continuing prosperity of social networking services. Computational social networks 4(1):2 (2017)
21. Richter, A., Koch, M.: Functions of social networking services. In: Proceedings of the International Conference on the Design of Cooperative Systems (COOP 2008), pp.87–98. Carryle-Rouet, Provence, France (2008)
22. Khymytsia, N., Ustyianovych, T., Dronyuk, I. Identification and Modeling of Historiographic Data in the Content of Web Forums.CEUR Workshop Proceedings Volume 2392, 2019, Pages 297-308 1st International Workshop on Control, Optimisation and Analytical Processing of Social Networks, COAPSN 2019; Lviv; Ukraine; 16 May 2019 through 17 May 2019; Code 149063.
23. Mishchuk O., Tkachenko R., Izonin I. Missing Data Imputation through SGTM Neural-like Structure for Environmental Monitoring Tasks In: Hu, Z.B., Petoukhov, S., (eds) Advances in Computer Science for Engineering and Education. ICCSEEA2019. Advances in Intelligent Systems and Computing. Springer, Cham, 2019, pp. 142-151.
24. Petrushka, A., Komova, M., Demydov, I.: Social networks as an alternative environment for the implementation of scientific communication. In: Proceedings of the 1st International workshop on control, optimisation and analytical processing of social networks, COAPSN-2019, 2392, 79-94. Lviv (2019). URL: http://ceur-ws.org/Vol-2392/paper7.pdf
25. Neskorodieva, T., Fedorov, E., Izonin, I. Forecast method for audit data analysis by modified liquid state machineCEUR Workshop Proceedings, 2623, pp. 25-35 (2020).