

# Design and Construction of a Popularizing Internet Resources System Using External Ranking Factors

Taras Basyuk<sup>1</sup>, Andrii Vasyliuk<sup>1</sup>

<sup>1</sup> Lviv Polytechnic National University, Bandera str.12, Lviv, 79013

## Abstract

The article analyzes the existing approaches and software tools for popularizing Internet resources using external ranking factors. As the analysis showed, today there is a lot of software that provides tools for automating the promotion of Internet resources, but all of them are characterized by such main disadvantages as: commercial application, lack of recommendations for promotion and, in most cases, limited functionality. The work carried out was aimed at developing an algorithm for popularizing Internet resources using external ranking factors, which was reflected using the algebra of algorithms and optimized by the number of uniterms. The system was designed using an object-oriented approach in the CASE tool IBM Rational Rose. The analysis of the available methods for solving the task was conducted, the class of tasks that will be solved by each of them was determined, and the tools that would ensure maximum efficiency were selected for the implementation of each of the functions of the system being developed. The system was designed using modern software tools, namely, Angular was used to implement the client part, and the server part was designed using the ASP.NET Core Web API. The performed verification of the work confirmed the correctness of the obtained results and the possibility of its application. Further research will be aimed at creating related software modules in order to expand functionality and test their work.

## Keywords<sup>1</sup>

Internet resource, popularization, algebra of algorithms, ranking, search results

## 1. Introduction

The popularization of Internet resources appeared along with the emergence and rapid development of search engines and consists in a complex of work with external and internal factors in order to increase incoming targeted traffic and determine ways to bring the site to the top positions of search results. At the same time, internal search engine optimization is understood as actions aimed at improving the structure of the site and its content. External optimization, on the contrary, determines the formation of the site's reputation 'in the eyes' of search engines, that is, building up the link environment, increasing the visibility of the resource, etc [1,2].

The main goal of all search engines is the ability to display the user links to the most relevant sites containing exactly the information that the user is looking for in accordance with the entered query [3]. The degree of semantic correspondence of the texts of the site to the corresponding search query is called relevance [4], and the process of assigning the display order in the search results, for a particular query, is called site ranking [5]. There is an interesting fact that at the initial stage of the global Internet development, it was enough for a webmaster to enter a topic, description and keywords in the meta tags of the site for the search server to consider it relevant to this subject area. However, the number of websites began to grow rapidly and in order to bring them to the top of search results, SEOs began to add irrelevant keywords to the site's subject. This situation contributed to the improvement of ranking

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EMAIL: Taras.M.Basyuk@lpnu.ua (T. Basyuk); Andrii.S.Vasyliuk@lpnu.ua (A. Vasyliuk)  
ORCID: 0000-0003-0813-0785 (T. Basyuk); 0000-0002-3666-7232 (A. Vasyliuk)



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algorithms [6], which led to fierce competition in the search engine optimization market. Given, the actual task is to study the field of popularization of Internet resources, with the aim of their popularization using external ranking factors.

## 1.1 Analysis of recent researches and publications

The analysis of research [7-9] showed that there is a direct relationship between the position of the site in search engine rankings and the number of visitors. Namely, the sites that occupy the first positions receive an average conversion rate of 36.4%; sites in the second position receive 12.5% CTR; the third search engine position receives 9.5% CTR.

**Table 1**  
Conversion rates by Google search results according to Optify

Rank #	Average CTR	Median CTR
1	36,4%	25%
2	12,5%	9,1%
3	9,5%	7,1%
4	7,9%	5,5%
5	6,1%	3,8%
6	4,1%	2,7%
7	3,8%	2,6%
8	3,5%	2,0%
9	3,0%	1,8%
10	2,2%	1,5%

To be in the first place in Google, according to Optify, means to receive the number of conversions to the site equal to the traffic from the second to the fifth position inclusive. Optify has concluded that reaching a top position or even increasing a position from second to first position can triple traffic [10]. Given that, the next steps in the study were to analyze the main ways of promotion. Many works were studied [11-13], which helped to show the presence of a significant amount of research based on internal factors of promotion, namely, the rules of building a semantic core, design, design features, and so on. With regard to external factors, this area not studied enough because most of the mechanisms that regulate it, work in accordance with patented approaches [14].

The analysis of modern software showed that the market of these systems is extremely developing and contains many systems, a brief analysis of the most famous:

- Ahrefs is an automatic site promotion service that minimizes user involvement by relying on the latter to determine promotion tactics and strategies. Advancement using Ahrefs can be divided into three stages: compiling the semantic core; work with links (rent, purchase); assistance in optimizing resources. Using a special module, you can select a list of relevant key queries, then calculate the cost of promotion and estimate possible traffic. With Ahrefs, you can also purchase links for relevant key queries [15]. The main disadvantages of the system are: the inability to configure link purchase filters, lack of tracking tools for the position of the website and the significant amount of commission.
- PromoPult is an internet marketing system, the feature of which is the promotion of Internet resources on certain high-frequency queries, aiming to attract targeted visitors. The result is a group of links that meet certain criteria. In addition, the resource provides tools for pre-audit, attendance, additional queries and content generation [16]. Disadvantages include: high cost of commission (for high-frequency and low-frequency requests the commission is up to 25%, low quality of anchor generation).
- Moz Pro – is an automated site promotion service, which includes automatic selection of recommended keywords, advanced statistics services, recommendations for improving the project, the availability of a system for technical analysis of the site. Disadvantages include: low quality of

anchor generation, lack of influence on the behavioral characteristics of users, lack of funds for the purchase of contextual links [17].

- SEOHammer is a service for automatic site promotion, based on the filtering of Internet links by certain parameters, the result of which should be effective Internet links. The basic technology is built on the evaluation of the so-called donor-link-acceptor chain. In addition, SeoHammer allows you to intelligently select queries, purchase links and monitor their quality [18]. The main disadvantage of the system is the significant amount of commission.
- KW Finder is a system that contains a significant set of tools for automatic site promotion. In many ways, it is similar to the PromoPult system, as it also places links on well-known exchanges. In addition, it provides a choice of keywords for promotion on high-frequency, medium-frequency and low-frequency queries [19]. Among the disadvantages identified: the complexity of interaction, lack of recommendations for promotion and the commission.
- SEMRUSH is a service with a wide range of functionalities, including tools for promotion budget analysis, automatic receipt of resources, multiple forms of payment, a large number of affiliate programs, viewing and analyzing statistics separately for home and internal pages, no restrictions on investment levels [20]. The disadvantage is the significant amount of commission (20% when selling links), complexity of the interface. The analysis shows that there are many similar systems, but they have significant disadvantages, which are determined by both limited functionality and commercial use. Given the fact, that the urgent task is to create a system for promoting the Internet resource using external ranking factors.

## 1.2 The main objectives of the study and their significance

The aim of the study is to design and construct a system for promoting Internet resources using external ranking factors. It is necessary to analyze both the relevance of the pages (determines the degree of compliance of the information on the search query) and ways of ranking links (determined by the number of links from other resources to the pages of the studied Internet resource). Improving positions according to these criteria is the main goal of search engine optimization and will help the latter to get into the TOP search engine results.

To achieve this goal, it is necessary to solve the following main tasks: to analyze existing approaches and software tools used in the process of search engine optimization; build an algorithm for the analysis and promotion of Internet resources using external ranking factors and present it using the algebra of algorithms; determine the basic requirements for the system and carry out its design and construction using modern software tools.

The results of the study solve the current scientific and practical problem of creating software for monitoring and promotion of Internet resources using external ranking factors.

## 2. Major research results

Analysis of the commercial Internet resources development on the World Wide Web has shown that today almost every company faces a problem how to promote their product. And for each situation the set of technologies and tools can be radically different, namely some companies can use the tools and develop successfully, others can use the same tools and have only losses. Among the tools of Digital Marketing are: CPC, SMM, SEO. The first two tools have been analyzed in details in previous studies, which show their strengths and weaknesses and features of usage. In this study, we will focus on the features of SEO, which is to attract traffic from organic search results. Proper search engine optimization is a slow and long-term tool that gives 'natural', long-term results and is the most powerful means of promotion [21].

The peculiarities of external search engine optimization are: increasing the citation index (depends on the volume and importance of web resources that point to the web page and helps to raise the relevance of the site in terms of search engines); increase the weight of the resource pages, which determines its popularity and authority as a source of information (the weight increases due to incoming links and decreases due to outgoing) and the formation of an anchor list (contains a list of all links

leading to the page, for successful external optimization is of great importance is the quality of links). The values of these parameters vary depending on the individual resource, so in order to form a universal approach to promotion, an algorithm to promote Internet resources using external ranking factors was formed, which was presented using the apparatus of algebra algorithms [22]. The first stage in the implementation of the algebra of algorithms is the description of uniterms and the synthesis of sequences. Formed uniterms: G - uniterm for setting search promotion goals; B - uniterm of concept and analysis of competitors; A(s) - uniterm of analysis of page load speed analysis; P - uniterm of popularization in thematic media; Z - uniterm of attracting the target audience by forming a reference environment; R - uniterm for estimating the number of transitions to the studied resource; K - uniterm of application of crowd marketing methods; Vb - uniterm of use of link exchanges; Col - uniterm of creation of collaboration with common on thematic results; Sres - uniterm of support; M - uniterm of audit and promotion of the mobile version of the Internet resource; A(p) - uniterm of analysis of the reference mass of the Internet resource; D (q) - uniterm of inquiry research; O - uniterm of optimization for voice requests. As a result of using the apparatus of algebra of algorithms, the following sequences were synthesized:

$S_1$  - sequence of system operation in case of increase in the number of transitions:

$$S_1 = \overbrace{G, B, A(s), P, Z, R, K, Vb, Col, M}$$

$S_2$  - sequence of system operation in case of reduction of number of transitions:

$$S_2 = \overbrace{G, B, A(s), P, Z, R, Sres, M}$$

$S_3$  – general sequence of system operation:

$$S_3 = \overbrace{L_1, L_2}$$

where  $L_1$  – elimination of the check for increasing the number of conversions,  $L_2$  – elimination of checking the resource in the search results, which have the following form:

$$L_1 = \overline{S_1 ; S_2 ; u_1?}$$

$$L_2 = \overline{S_4 ; S_5 ; u_2?}$$

$S_4$  – the sequence of the system operation at the time of the Internet resource ‘reference mass’ analysis:

$$S_4 = \overbrace{L_1, A(p), D(q)}$$

$S_5$  – the sequence of the system in case the resource falls into the search results:

$$S_5 = \overbrace{L_1, O}$$

As a result of substitution of eliminations  $L_1$  and  $L_2$  into the general sequence of functioning of system  $S_3$  we will receive the following algebra of algorithms formula:

$$S_3 = \left( \overline{S_1 ; S_2 ; u_1?} \right) ; \left( \overline{S_4 ; S_5 ; u_2?} \right)$$

The next step is the substitution of the corresponding sequences and the elimination of  $L_2$ :

$$S_3 = \left( \begin{array}{c} \overline{S_1 ; S_2 ; u_1?} \\ \overline{\left( \begin{array}{c} L_1 \\ A(p) \end{array} ; \begin{array}{c} L_1 ; u_2? \\ O \end{array} \right)} \\ D(q) \end{array} \right)$$

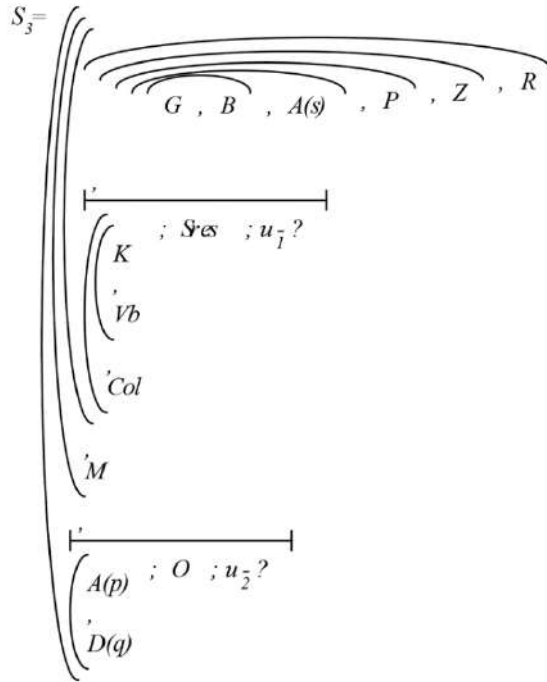
After substituting the eliminations  $L_1$  we have the following formula:

$$S_3 = \left( \begin{array}{c} \overline{S_1 ; S_2 ; u_1?} \\ \overline{\left( \overline{S_1 ; S_2 ; u_1?} ; \overline{S_1 ; S_2 ; u_1?} ; u_2? \right)} \\ A(p) \\ D(q) \end{array} \right)$$

Take out the elimination of  $L_1$  as a sign of the sequencing operation. One of the last stages is the substitution of sequences  $S_1$  and  $S_2$ :

$$S_3 = \overline{\left( \begin{array}{c} \overline{\overline{S_1 ; S_2 ; u_1?}} ; \overline{\overline{S_1 ; S_2 ; u_1?}} ; u_2? \\ \left( \begin{array}{c} A(p) ; O ; u_2? \\ D(q) \end{array} \right) \end{array} \right)}$$

Using the properties of the algebra of algorithms [22], we make common uniterms for the sign of the elimination operation, resulting in a formula describing the algorithm of operation:



Given the above algorithm, the main stages of promotion are: analysis of page load speed, analysis of the link environment of the resource (external links), audit of the mobile version of the resource, resource analysis using BM25 and BERT algorithms.

Page load analysis is determined by the Largest Contentful Paint (LCP), which shows the time it takes to display content in the visible part of the screen and is used to demonstrate the usefulness of the page to the end user. According to data [23], the limit values of this parameter are up to 2.5 s. Depending on the obtained results, either further performance optimization or detailed audit of internal elements of the resource and hosting parameters is performed.

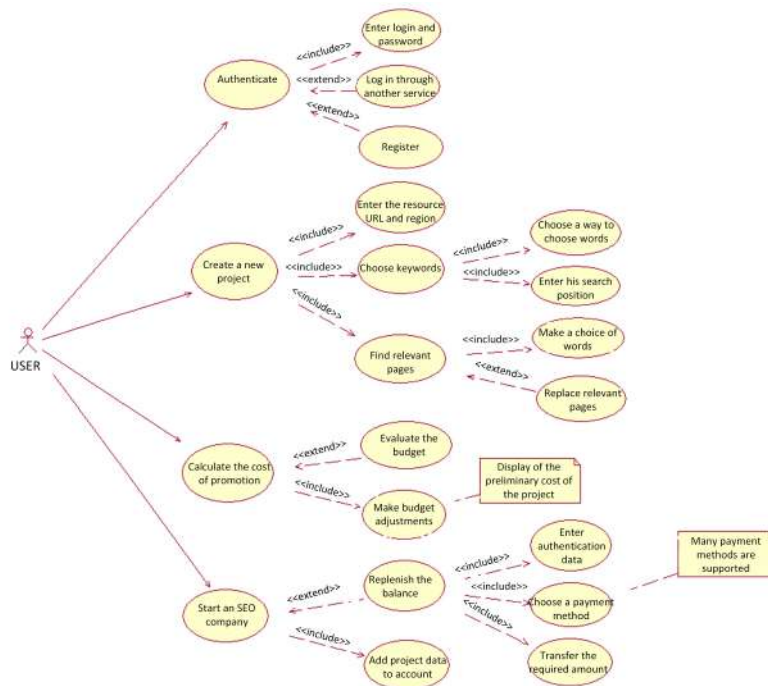
Formation and analysis of the link environment of the Internet resource is to increase the number of links to the studied Internet resource to improve its ranking in search engines. There are the following external links: natural (useful information for users and usually posted on thematic resources) and leased (in most cases, they are used for search engines to increase the level of promotion). In case of satisfactory indicators regarding the quantity and quality of the link environment, it is necessary to use the following methods: crowd-marketing (is to promote the site by posting comments containing links to the resource in thematic forums or social networks); link exchanges (resources for selecting quality sites for selling / buying links); mutual exchange of links (Internet resource acts as both a donor and an acceptor). In carrying out this activity, it is necessary to take into account the operation of the algorithm "Google Penguin" [6], which is used by the search service to combat poor quality linking environment. Getting under the influence of the latter contributes to a significant reduction in the ranking of the Internet resource. Therefore, in the process of creating a link environment, it is necessary to choose donors who have high-quality content, related topics and a high rate of unique content.

Along with the desktop view, the mobile version of the resource is important, so auditing the latter is an integral part of modern search engine optimization. The importance of the mobile version is confirmed by the Mobile First algorithm [24], according to which the ranking of resources is carried out by mobile versions, regardless of the type of device the search query is implemented. This issue was discussed in detail in [25], which presents the features of such promotion. An important indicator that must be directly taken into account in the process of promotion by external factors is BM25 [26], which is a ranking function used by search engines to organize documents by relevance. This feature estimates the frequency of a query in each document without considering the relationships between content keywords. For example, there is a query  $Q$ , containing keywords  $(q_i)$ , then the BM25 function determines such an assessment of the document  $D$  relevance of  $Q$  request.

$$score(D, Q) = \sum_{i=1}^n IDF(q_i) \cdot \frac{f(q_i, D) \cdot (k_1 + 1)}{f(q_i, D) + k_1 \cdot (1 - b + b \cdot \frac{|D|}{avgdl})} \quad (1)$$

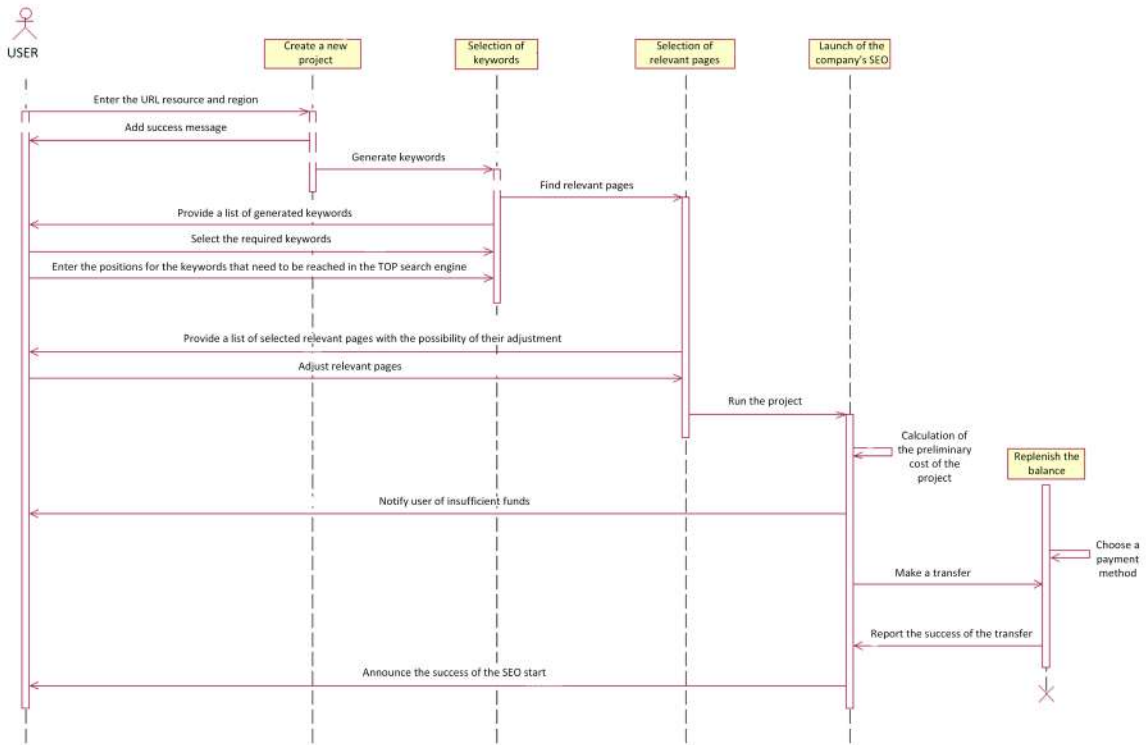
where  $f(q_i, D)$  – word frequency  $q_i$  in  $D$  document;  
 $|D|$  – page size (number of words);  
 $avgdl$  – the average page size in the collection;  
 $k_1, b$  – 'free coefficients', the average values of which are 2 and 0.75, respectively.

$IDF$  – Inverse Document Frequency (IDF)  $q_i$  word, defined as the logarithm of the total number of pages in a collection to the number of documents that contain the corresponding keyword. Given (1), it can be concluded that the larger the page size, the less relevant it is. Therefore, it is necessary to optimize it, which relies on the mechanisms of internal promotion. The BERT (Bidirectional Encoder Representations from Transformers) algorithm is used to analyze the context of user search queries in the Google search engine [27]. This algorithm works on the principle of clarifying the content of the website with the user's request. At the same time, the greatest influence is exerted on the ranking of search results when using voice search technologies and the construction of advanced search snippets, which must be taken into account in the process of search engine optimization. As can be seen from the study, conducting these operations for manual analysis of the state of the Internet resource and ways of its search engine optimization is extremely time-consuming. Thus, it is advisable to use automated tools for promotion, which on the one hand increase productivity, and on the other hand allow real-time monitoring of possible changes. Given the development of a prototype system, in addition to analyzing the resource and reflecting its main characteristics, will provide recommendations for optimization using external ranking factors. The next step in the study was to design a system using an object-oriented approach. At the beginning of the design, a diagram of use cases is created, which is shown in Fig.1.



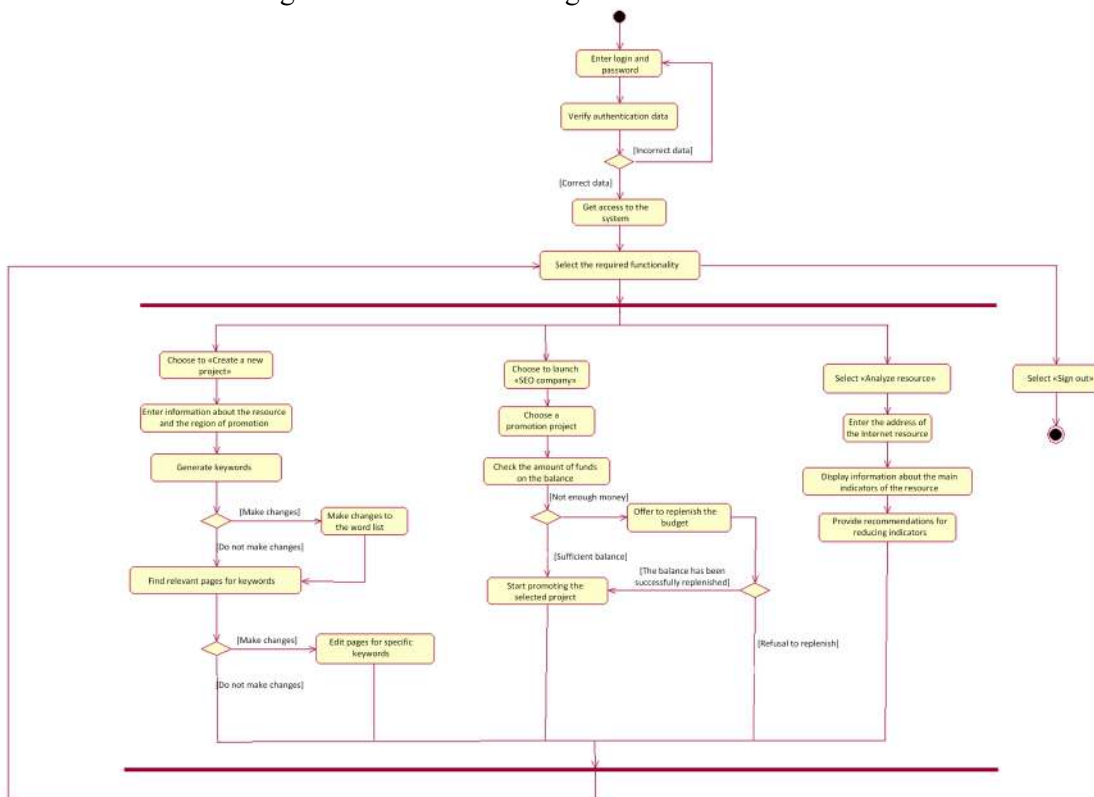
**Figure 1:** Diagram of use case

The main external entity is: the user (gets limited access to system resources and contains tools for changing profile data, adding tasks / comments / launching an SEO company, etc.). The functions of the system are: selection of keywords according to the topic, analysis of the Internet resources' competitors, analysis of page load speed, formation of a link environment, audit of the mobile version, etc. In order to show the interaction of the objects ordered by the time of their appearance, the sequence diagram shown in Fig. 1 was used. 2. The diagram implicitly has a time axis, which allows you to visualize the time relationship between the transmitted messages. This diagram shows the User Actor and the objects that represent a typical system scenario. The 'Replenish balance' object is created not at the initial moment of time, but as needed to ensure the replenishment of the account, and is destroyed after the successful completion of this operation. After successful completion of all these steps, an SEO company is launched.



**Figure 2:** Sequence diagram

So as to describe the basic procedures and business processes, a diagram of the activity presented in Fig.3 was constructed. It reflects the dynamic aspects of system behavior and helps to describe the features of construction using direct and inverse design methods.



**Figure 3:** Activity chart



The main purpose of the developed system is to determine the polarization indicators of the Internet resource, provide recommendations for promotion, determine the overall strategy of promotion and, accordingly, obtain the desired results regarding the placement of the site in the TOP search results. Based on the analysis, the main functions of the system were identified:

1. Creating a project: involves the registration of a new project for further promotion in search engines. At this stage, the customer must specify the name of the site he wants to promote, its URL and select the region in which you want to promote it.
2. Analysis of Internet resources of competitors: involves analyzing the content of sites that the search engine displays on the relevant keyword or phrase. That means that traffic indicators and relevant pages are analyzed, the number of resources containing relevant links is counted. After that, the customer will be provided with information about competing sites, which will simplify the choice of the necessary promotion strategy.
3. Analysis of page load speed: page load speed affects the conversion of Internet resources. In particular, if the page loads in more than 5 seconds, most potential visitors will simply leave it without waiting for the process to end. It is planned to use the PageSpeed Insights plugin to determine it [28].
4. Generating keywords: involves generating keywords by which the search engine will find the customer's Internet resource. The system will analyze the content of the resource and generate the necessary list of keywords. At the same time, the customer needs to decide on the purpose of promotion (TOP 5, TOP 10), which will stop the purchase of new links, thus saving the budget for promotion.
5. Creating a link environment: involves the selection of reliable and high-quality donor links (sites) that will provide the maximum number of conversions to the required resource and thus promote it in the TOP search engine results.
6. Estimation of the cost of the resource promotion: involves calculating the approximate cost of promoting the resource for certain key queries. The user enters a keyword or phrase and the system gives the cost of output of the TOP-10 search engine resource for this query.
7. Selection of relevant pages: is to display the corresponding page of the resource depending on the search query. Namely, depending on the location of the latter (title / title / main part), the analysis and display of potential search results relevant to users is performed.
8. Generation of text links: generation of texts that will contain links with anchors (keywords) specified by the customer. For example, a customer wants to promote their site on a specific request. After entering the appropriate keyword, the system will generate a dozen of small texts with this keyword, which will be a link to the promoted page.
9. Search for broken links', links that lead to a non-existent resource. They can occur due to inattention of editors and site administrators when posting, editing and deleting site materials; changing the structure of site links and the lack of correct redirects from the old structure to the new one. This feature involves periodic checking of links to the customer's resource. If broken links are found, the customer will be issued a message, and the broken link will be removed from the corresponding resource.
10. Monitoring of the Internet resource: involves the output of relevant information on the state of popularization of the resource. Output is carried out in numerical indicators and graphical display.

The next stage of the study was the choice of means of implementing the system of popularization of the Internet resource using external ranking factors. The developed promotion service is divided into client and server part. The Angular framework was used to write the client part, which is based on the graphical user interface, and the server part was written using ASP.NET Core Web API technology. The choice in favor of Angular [29] was made taking into account the following features: when creating templates in Angular, it is used a declarative programming paradigm (allows you to build an Internet resource from a set of modules) and provides tools for its modification in the process of updating or expanding functionality; availability of a significant number of ready-made solutions that allow you to solve various problems; Angular uses two-way linking: any changes to the user interface are immediately reflected in the program objects and vice versa. The framework itself monitors browser events, model changes and user actions on the page to immediately update the desired templates.

As for the server part, the use of ASP.NET Core was associated with cross-platform and high-performance product that supports cloud application development tools. In addition, this technology

supports the Model-View-Controller (MVC) template, Razor Pages technology (a programming model that simplifies and improves the efficiency of web user interface creation) and provides easy integration with common client platforms, including Angular and libraries. The interaction between the Client and the Server is based on the RESTful architecture [30]. REST (REpresentational State Transfer) is an architecture for building distributed hypermedia systems, including universal methods for processing and transmitting resource states over HTTP. REST to date has virtually supplanted all other approaches, including design based on SOAP and WSDL. For a distributed system to be considered a REST architecture, it must meet the following criteria [30]: Client-Server, Stateless, Cache, Uniform Interface. The REST architecture itself is not tied to specific technologies and protocols, but in the realities of the modern web, building a RESTful API almost always involves using HTTP and any common resource representation formats, such as JSON, XML. After selecting the development tools, the system was designed, the main window of which is presented in Fig.4. On this page, there is an opportunity to get acquainted with the functionality of the developed system.

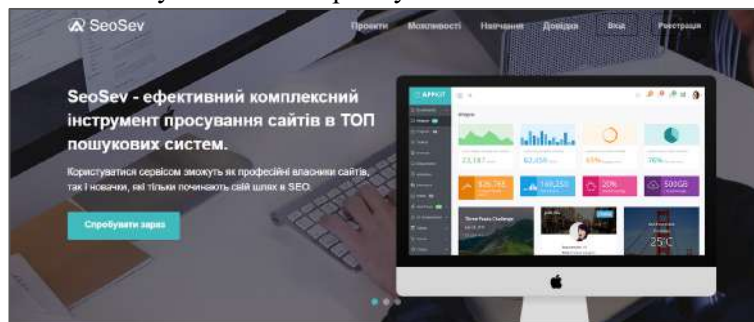


Figure 4: The main program window

The user has the opportunity to analyze the Internet resource by various indicators, entering its URL in the appropriate field (Fig.5). The author's resource <https://photo-lviv.in.ua/> was chosen for the analysis.

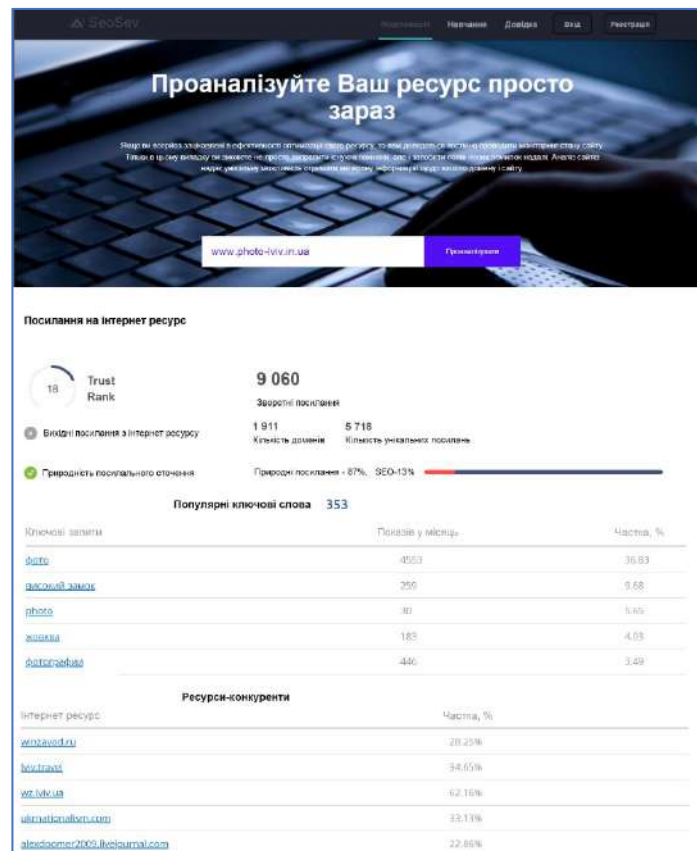


Figure 5: The results of conducted analysis

The main functionality of the intelligent information system for popularization of the resource includes: implementation of SEO-promotion and providing recommendations for improving the structure of the Internet resource. To start an SEO campaign, you need to create a new project by logging in or pre-registering with the system. After successfully logging in, on the Projects tab, select Add New Project. The process of creating a new project is divided into several stages. First, the user needs to enter basic information about the resource, the region of promotion, select the sources of links and the main search engine (Fig.6).

The screenshot shows the 'Профіль проекту' (Project Profile) form in the SeoSev system. The form is divided into two main sections: 'Основна інформація' (Basic Information) and 'Спеціальні налаштування' (Special Settings). The 'Основна інформація' section includes fields for 'Адреса ресурсу' (Resource Address) with the value 'http://photo-viv.in.ua/', 'Назва проекту' (Project Name) with the value 'SEO', and 'Регіон' (Region) with the value 'Україна'. The 'Спеціальні налаштування' section includes a dropdown for 'Вибір основної ПС' (Main Search Engine) set to 'Google' and a dropdown for 'Тип анкорів' (Anchor Type) set to 'З оточенням' (With context).

Figure 6: Filling in the project profile

Next is the transition to the further stage: the selection of keywords for which the site will be displayed in the relevant search engine. The information system generates a list of possible keywords, according to the theme of the site (Fig.7).

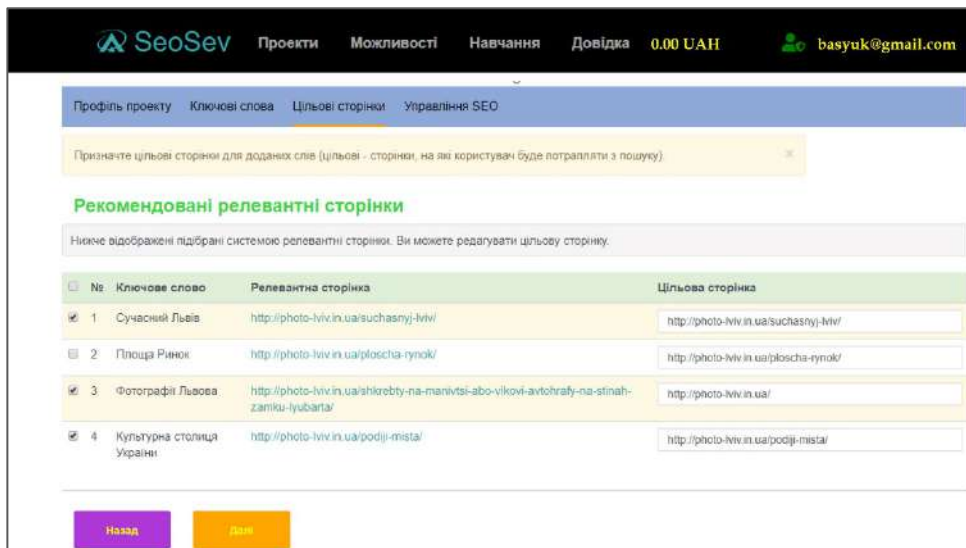
The screenshot shows the 'Рекомендовані ключові слова' (Recommended Keywords) section. A message states: 'Додайте слова для популяризації (вручну або з рекомендованих) або просто перейдіть далі - Система автоматично вибирає слова'. Below this is a table of recommended keywords:

№	Ключове слово	Входження
1	Сучасний Львів	4
2	Відкрили пам'ятник	4
3	Мистецтво Львова	3
4	Площа Ринок	3
5	Львів	19
6	Невідомий Львів	3

At the bottom of the table, there are links: 'Показати ще 6 слів' and 'Показати всі слова'. A purple button labeled 'Додати слова' is located at the bottom left.

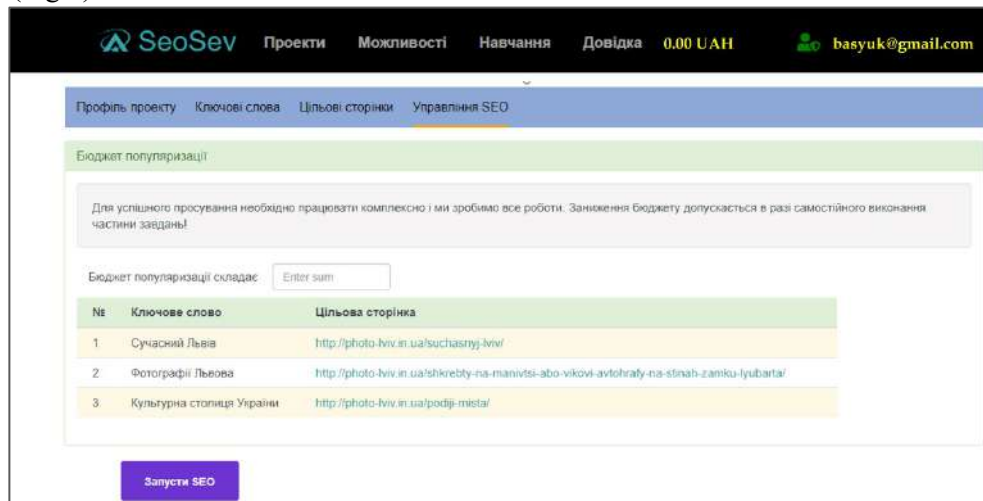
Figure 7: Automatically generated keywords

The user independently selects the necessary words from the list, makes adjustments and adds them to the project if needed. Users have the ability to add their own keywords. The next step is to select relevant pages for keywords. The system automatically generates a relevant page for the keywords selected in the previous step, the subject of which best corresponds to a particular word (Fig.8). This allows the user to make adjustments to the generated relevant pages.



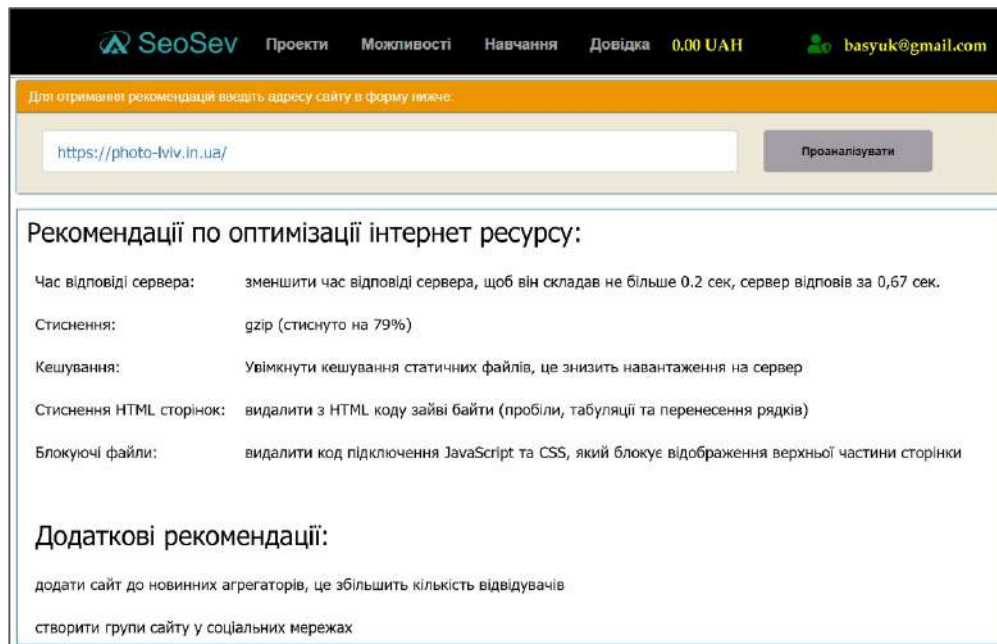
**Figure 8:** Selection of relevant pages

After successfully completing all the steps above, the user has the opportunity to run the project for promotion (Fig.9).



**Figure 9:** Launch of a project for promotion

This will automatically calculate the expected budget of the SEO-campaign and if there are insufficient funds on the user's balance, it will be proposed to replenish it. All created projects will be displayed in the personal account of the user, with the possibility of flexible management. In addition to the paid promotion campaign, the designed system provides tools for analyzing the Internet resource and making recommendations to improve its search positions. In order to do this, enter the address of the researched resource in the appropriate field. After the analysis, the window will display recommendations for improving the efficiency and optimization of the page (Fig.10).



**Figure 10:** Recommendations for page optimization

Following these recommendations will allow the Internet resource to rise in search results using optimization factors.

### 3. Conclusion

The article shows that there is a relationship between the position of the site in search engine rankings and the number of visitors, namely the resources that occupy the top positions in search engine rankings receive the highest level of conversion. According to the analysis, today there is a lot of software that provides tools to automate the promotion of Internet resources, but they are all characterized by such major shortcomings as: commercial application and limited functionality. Further work was aimed at developing an algorithm for popularizing Internet resources using external ranking factors, which was reflected using the algebra of algorithms and optimized by the number of uniterms. The next step in the study was to design a system using an object-oriented approach. The design results are presented in the form of a set of diagrams showing the main functionality of the system. The system was designed using Angular (for the client part) and ASP.NET Core Web API (for the server part). The developed prototype of the information system provides tools for analysis and promotion of Internet resources using external ranking factors, provides flexibility in creating projects and setting up a notification system. Further research will be aimed at creating related software modules to expand the functionality and test their work.

### 4. References

- [1] J. Grappone, Search Engine Optimization (SEO): An Hour a Day, United States, Wiley Publishing Inc., 2013.
- [2] A. Alpar, M. Koczy, M. Metzen, SEO - Strategie, Taktik und Technik. Springer Gabler, 2015.
- [3] T. Basyuk, "The Popularization Problem of Websites and Analysis of Competitors". in: Shakhovska N., Stepashko V. (eds) – Advances in Intelligent Systems and Computing II. CSIT 2017. Advances in Intelligent Systems and Computing, vol 689. Springer, Cham pp. 54-65, doi:10.1007/978-3-319-70581-1\_4.
- [4] E. Enge, S. Spencer, J. Stricchiola, R. Fishkin. Mastering Search Engine Optimization, O'Reilly Media, 2015.

- [5] K. Thackston, SEO Copywriting Flow: Creating a Steady Stream of Rankings & Conversions, CreateSpace Independent Publishing Platform, 2012.
- [6] M. Haynes, Your Google Algorithm Cheat Sheet: Panda, Penguin, and Hummingbird, 2014, URL. <https://moz.com/blog/google-algorithm-cheat-sheet-panda-penguin-hummingbird>.
- [7] L. Chyrun, V. Vysotska, V. Lytvyn, Specifics Informational Resources Processing for Textual Content Linguistic Analysis. In: Perspective Technologies and Methods in MEMS Design (MEMSTECH 2016) : Proc. of XII-th Int. Conf., 20-24 April, 2016, Lviv-Polyana, Ukraine, 2016, pp.214-219.
- [8] T.Khor, Keyword Relevance in Search Engine Optimization, GRIN Publishing, 2014.
- [9] T. Basyuk, Influence of readability on popularization of internet resources // Computational Linguistics and Intelligent Systems. Proceedings, Vol. 2, Proceedings of the 2nd International conference, COLINS 2018. Workshop. 2018 pp. 146–156.
- [10] V. Tellalyan, What is No 1 position on Google worth and how organic CTR changed over the past 10 years?, 2018, URL. <http://www.velizaratellalyan.com/seo/what-is-position-one-on-google-worth-organic-ctr-over-past-10-years/>
- [11] G. Kennedy, Seo: Marketing Strategies to Dominate the First Page (SEO, Social Media Marketing), CreateSpace Independent Publishing Platform, 2016.
- [12] D. Amerland, Google Semantic Search: Search Engine Optimization (SEO) Techniques That Get Your Company More Traffic, Increase Brand Impact, and Amplify Your Online Presence, United States, Que Publishing, 2013.
- [13] T. Basyuk, A. Vasyliuk, V. Lytvyn, Mathematical Model of Semantic Search and Search Optimization, Proceedings of the 3rd International Conference on Computational Linguistics and Intelligent Systems (COLINS-2019). Volume I: Main Conference, Kharkiv, Ukraine, April 18-19, 2019, Vol-2362: pp.96-105.
- [14] A. Clarke, SEO 2022 Learn Search Engine Optimization With Smart Internet Marketing Strategies: Learn SEO with smart internet marketing strategies, CreateSpace Independent Publishing Platform, 2021.
- [15] Ahrefs, URL. <https://ahrefs.com/>
- [16] PromoPult, URL. <https://promopult.ru/>
- [17] Moz Pro, URL. <https://moz.com/products/pro>
- [18] SEOHammer, URL. <https://www.seohammer.ua/>
- [19] KW Finder, URL. <https://kwfinder.com/>
- [20] Semrush, URL. <https://www.semrush.com/>
- [21] Searchengineland, Yahoo's ROBO Study: Search Has Big Impact On Offline Purchases. URL. <http://searchengineland.com/yahoos-robo-study-search-has-big-impact-on-offline-purchases-11832>.
- [22] V. Ovsyak, Algorithms: methods of construction, optimization, probability research. L'viv: Svit, 2001. (In Ukrainian).
- [23] A. Mokalis, J. Davis, Google Analytics Demystified, CreateSpace Independent Publishing Platform, 2018.
- [24] B. Bentz, Relevance Raises Response: How to Engage and Acquire with Mobile Marketing, SkillBites, 2016.
- [25] S. Dewanjee, The Mobile-First SEO Publisher, 24by7Publishing, 2020.
- [26] N. Venkat, Gudivada Computational Analysis and Understanding of Natural Languages: Principles, Methods and Applications, North Holland, 2018.
- [27] S. Ravichandiran, Getting Started with Google BERT: Build and train state-of-the-art natural language processing models using BERT, Packt Publishing, 2021.
- [28] PageSpeed Insights, URL. <https://pagespeed.web.dev/>.
- [29] D. Uluca, Angular for Enterprise-Ready Web Applications: Build and deliver production-grade and cloud-scale evergreen web apps with Angular 9 and beyond, Packt Publishing, 2020.
- [30] J. Webber, S. Parastatidis, I. Robinson, Rest in Practice: Hypermedia and Systems Architecture, O'Reilly Media, 2010.