

PAPER • OPEN ACCESS

Information resources usability and split-testing features

To cite this article: I F Astachova *et al* 2020 *J. Phys.: Conf. Ser.* **1479** 012010

View the [article online](#) for updates and enhancements.

You may also like

- [Usability Testing for Android Radio Streaming Apps of Songgolangit FM](#)
Nur Aini Shofiya Asy'ari and Dihin Muriyatmoko
- [The application of Usability Testing Method for Evaluating the New Student Acceptance \(NSA\) System](#)
Muhammad Zamroni Uska, Rasyid Hardi Wirasmita and Muh Fahrurrozi
- [Usability testing on website wadaya based on ISO 9241-11](#)
I K R Arthana, I M A Pradnyana and G R Dantes



ECS
The
Electrochemical
Society
Advancing solid state &
electrochemical science & technology

DISCOVER
how sustainability
intersects with
electrochemistry & solid
state science research

Information resources usability and split-testing features

I F Astachova¹, K A Makoviy², Yu V Khitskova³ and N A Burakova⁴

¹ Informatics and applied mathematics department, Voronezh state university, University Square 1, 394018, Voronezh, Russia,

² Faculty of Economics, Management and Information Technology, Voronezh State Technical University, 20th anniversary of October st., 84, 394006, Voronezh, Russia

³ Economic department, Voronezh state university, University Square 1, 394018, Voronezh, Russia

⁴ Informatics and applied mathematics department, Voronezh state university, University Square 1, 394018, Voronezh, Russia

E-mail: prosvetovau@list.ru

Abstract. The article discusses the features of split testing and usability testing. The stages of these two types of testing are proposed. To create a web resource convenient for the user and practical for the business, analytics helps. Ergonomics test (usability testing) is a type of software testing that is aimed at exploring the convenience for users of a web page, user interface or device. At the end of the usability testing, a split (A / B testing) is performed (or not). A / B testing involves setting up two different options for a web page or landing page and sending the same amount of traffic to each page option. Then, the number of conversions for each option is measured and the best is revealed. The best option generates the most conversions. The stages of these two types of testing are proposed. An application is described that allows usability testing of information resources. The developed application supports the function of analysing images according to the main colour schemes, collect statistics selected by the user and upload their PC to an Excel document, independently define areas for collecting statistics.

1. Introduction

Websites and web applications are created to satisfy some human needs. The better these needs are met, the greater will be the profit of the owners of web resources. Therefore, the convenience and positive perception of the user of the site or web application is the main task in the development of such resources. These characteristics lead to sales increase or to working efficiency increase.

Evaluation of the design and facilities of the site or application is needed in the early stages of development. Preparing for usability testing takes most of the time from testing in general. This issue has been the subject of many scientific papers. [1,2,3].

Create a web resource user-friendly and practical for business helps analytics. Ergonomic testing (usability testing) is a type of software testing aimed at examining a web page, user interface or device in terms of ease of use. Usability testing measures the ergonomics of an object or system.

This testing mainly focuses on the simplicity of the user in the application, the flexibility in management and the ability of the system to perform its tasks.

Ergonomic testing focuses on a specific object or a small set of objects, while studies of human-computer interactions as a whole formulate universal principles. According to the HCD standard (Site:



ISO 9241-210: Human-centred design) there is a stage of design evaluation, it is in it that high-quality usability testing can be held.

At the end of the usability testing, a split is performed (A / B testing). A / B testing involves setting up two different options for a web page or landing page and sending the same amount of traffic to each page option.

Then, the number of conversions for each option is measured and the best is revealed. The best option generates the most conversions.

Once the best page option has been determined, the site or application is switched to this option to get the most conversions.

A / B testing differs from before and after testing. You measure the conversion rate on your site to set a benchmark with the help of before and after testing.

Then you create a new version to see if the conversion rate improves or decreases. The problem with this type of testing is that conversion rates vary from week to week, from different days of the week, seasons, etc. Therefore, it's not possible to know for sure whether the change in conversions is due to a new version or because of higher or lower traffic in a specific time period.

The article discusses the stages of creating an application for split testing, which will collect statistics on user activity on specific pages of the site, based on which it is possible to draw conclusions about the modernization of pages.

2. Stages of usability and split testing

Application development includes defining application configuration requirements that will allow.

1. Reading statistics from individual elements of the site.
2. The ability to independently specify areas for statistics collection.
3. Composition of the results and showing the results in the form of graphs.
4. Issuing tips on the colours of the pages of the site.

Various methods are used, when evaluating usability: heuristic methods of evaluation, formal tests, methods of thinking aloud, methods of cognitive walkthrough, informal testing, control experiment, sometimes surveys and other field studies [4]. In our opinion, when conducting usability testing, it is also possible to use the artificial intelligence method [5,6]. In addition, there are important criteria for evaluating usability and split testing:

- efficiency - the ability of a software product to allow users to achieve their goals with the necessary accuracy and consistency;
- performance - the ability of a product to provide users with the ability to spend the appropriate amount of resources depending on their effectiveness;
- satisfaction - the ability of a software product to satisfy users in a particular usage context.

We believe that it is logical to consider separately two separate tests: usability testing and split testing [7,8,9].

The main stages of usability testing are as follows (figure 1).

1. Definition of research objectives. The quality and the end result of usability testing will depend on how correctly and accurately the research objectives are formulated. It is inefficient to set many goals in one test. It is recommended that you select one goal for each test.
2. The choice of target audience. Usability testing is carried out with the help of people who are representatives of the target audience of the company and possibly visitors to its site. They should not see the new version of the site until testing. They are already used to using the updated resource otherwise. Testing with the help of a focus group is possible, it is used if the target segment is too small. The company determines independently the number of users who need to be tested. According to research by Nielsen and Landauer, five users will find 85% of the problems in usability and 15 people will find all 100% of the problems. Further studies have refuted this information and it is believed that it is better to rely on the opinion of at least 15 representatives of the target audience. For each new testing goal, it is necessary to recruit a new group of users. One goal may include 4-5 tasks.

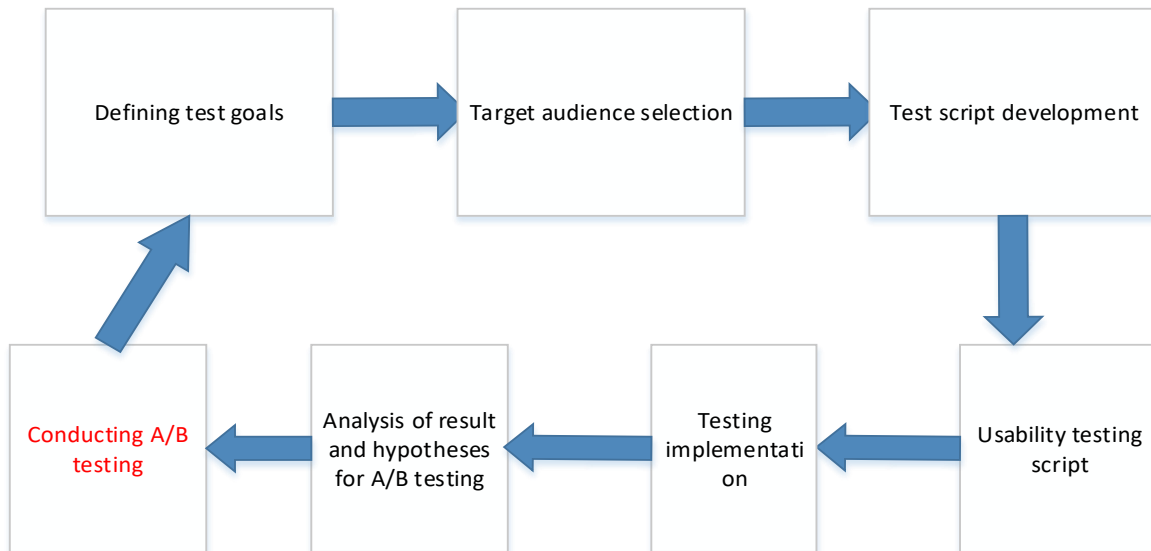


Figure 1. Usability testing stages.

3. Development of a testing script. You must determine in advance the path to the site or web application that the user will go through during testing to achieve his goal. You need to create tasks that users will comment on when interacting with the web resource at each step of the script. The script is usually designed for 15-20 minutes while the user is on the site. The purpose can be to compare your site with competitor sites.
4. Usability script testing for 2-3 representatives of the target audience. This step shows the understandability and logic of the test script for the user. Therefore, many believe that it is not necessary to involve representatives of the target audience here.
5. Implementation of testing. You must save a video recording with user testing. There are applications that allow you to do this automatically, for example, UserPoint.
6. Analysis of results and hypotheses for A / B testing. Here it is necessary to clearly describe all the difficulties that the consumer experienced in communicating with the site. Each conclusion should be considered when finalizing the application. Then hypotheses are put forward for split tests.

The split testing algorithm can be represented as the following steps (figure 2).

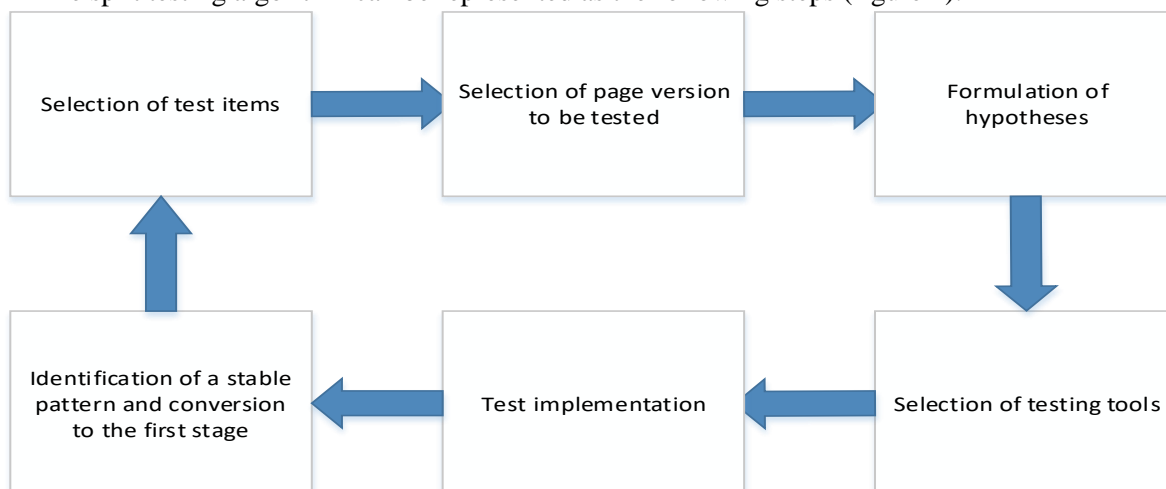


Figure 2. Split testing stages.

3. Features of developed application

The main features of the application are the following.

1. The choice of elements for testing. These may include: color schemes, latest news, a copy of the landing page, themes, video or lack of video, a call to action (a couple of options), pictures or their absence, page concepts. In our case, colour schemes can be determined before testing using the developed application. The developed application supports the function of image analysis according to the main color schemes.
2. Select options to be tested. It depends on the amount of traffic that the company generates, since a significant sample size is required for each group.
3. The formulation of hypotheses. Hypotheses about what, the interface will work better and why. It is necessary to take into account the opinion of all project participants.
4. Choosing a testing tool. There are a number of software products for solving testing problems. For example, Webalizer, SimilarTech, Visual Website Optimizer or Optimizely, Google Optimize. These tools will share web traffic. It is important that each visitor group is representative and completely randomized, because atypical trends in the data can distort the interpretation of the results. When using standard programs, a number of problems arise.

Most services are paid, which even an online marketing agency cannot always afford. As a rule, statistics collection services are limited in functionality. For certain types of testing, you need to use other programs. Important is the lack of the ability to extract your statistics and providing it to the customer in a form convenient for him. You must separately download the source data, which then only transfer to the next module. For all this, there are special editors, the development of which requires additional time. There is a problem of possible information leakage, which is very worrying for customers.

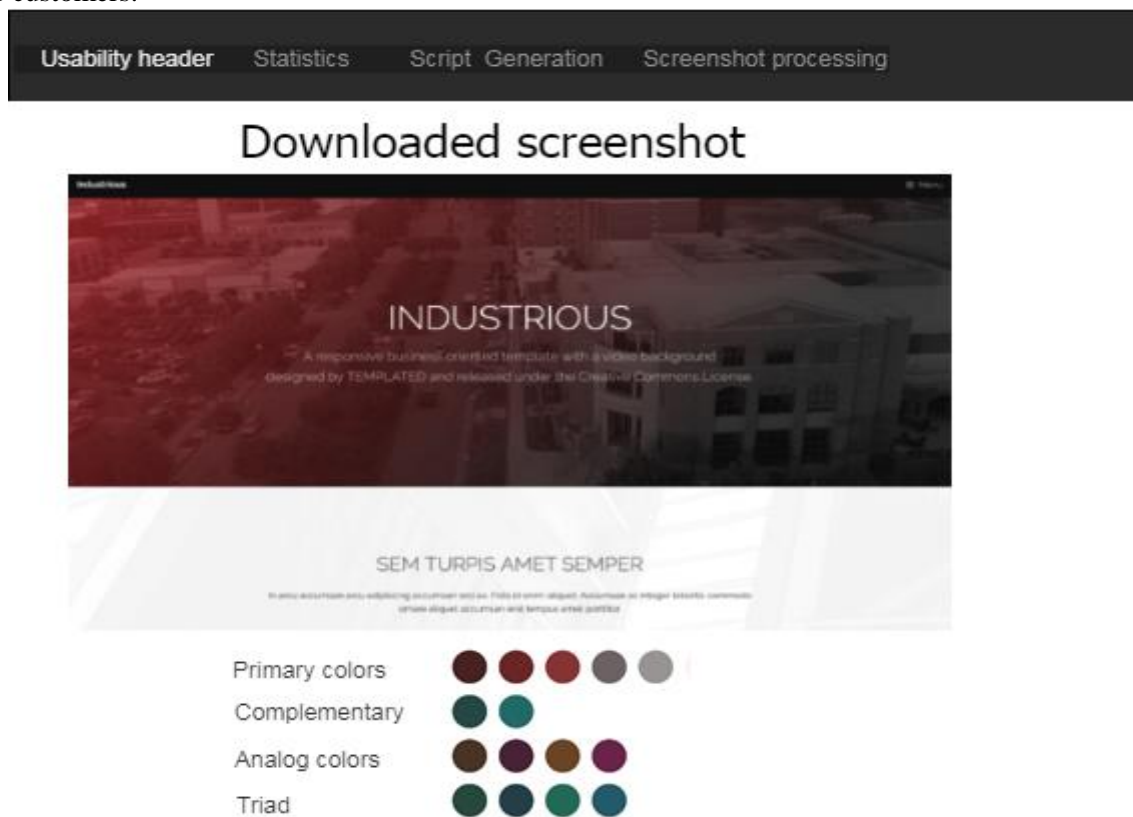


Figure 3. Screen view after processing the site page.

All information collected by the resources of the giants belongs to the resources themselves, and not to the user. Often site owners are concerned about the question of who will use them later. The developed module lacks these shortcomings. It allows you to carry out the following.

- Collection of statistics and its uploading on your own PC to an Excel document, providing the customer with statistics in the usual format for him. There is the possibility of compiling the results and showing them in the form of graphs. The created script allows you to collect statistics about user activity on specific pages of the site.
- There is an opportunity to draw B. The ability to independently specify areas for collecting statistics, there is the possibility of reading statistics from individual elements of the site.
- The ability to select colors.

The following tools were used to implement the software product: JavaScript programming language, jQuery library, Node JS, Mongo DB [12, 13]. Conclusions on the modernization of pages after this. JavaScript is a lightweight, interpretable, object-oriented language with many features and is best known as a scripting language for web pages, but it is also used in many non-browser environments. It is a prototype-based scripting language with many paradigms that is dynamic and supports object-oriented, imperative, and functional programming styles. JS works on the client side of the Internet, which can be used to develop the behaviour of web pages when an event occurs. Language constructs such as if statements, for and while loops, and switch and try ... catch blocks work the same way as in other languages (or almost like that). JavaScript can function as a procedural and object-oriented language. Objects are created programmatically in JavaScript by attaching methods and properties to other empty objects at run time, in contrast to the definitions of syntax classes that are common in compiled languages such as C++ and Java. After the object has been built, it can be used as a plan (or prototype) to create similar objects. Dynamic JavaScript features include constructing objects at run time, lists of variable parameters, function variables, dynamic scripting (via eval), self-analysis of objects (via for ... in), and source code recovery. There are many useful features in working with jQuery. For example, tasks, the solution of which usually requires the implementation of many boring routine operations, are extremely simplified. In addition, jQuery tools allow you to optimize the code, that is, the library allows you to achieve much more with a much smaller amount of code than if you use the browser DOM software interfaces. JQuery methods apply to entire groups of elements. The standard approach proposed in the DOM model, based on the template chain of select-repeat-change actions, is not required. The consequence of this is a decrease in the number of for loops in the code, and hence a decrease in the probability of errors in it. The jQuery library handles differences in the implementation of the DOM in different browsers (cross-browser issues). For example, users can not worry about the features of support for a particular tool, just formulate jQuery their wishes, and the library will independently provide compatibility with a specific browser. The jQuery library is open source. If the working principles of a tool are not entirely clear or the result does not match what was expected, you can turn directly to the library code in JavaScript and, if necessary, make appropriate changes.

5. The next step is the implementation of the test. You need to run the test until a stable pattern appears. the results may not be valid, the testing done will be a waste of time if you finish the test too soon. Unsuccessful test results do not mean that there are errors. To deal with the interpretation of the results will help methods of mathematical statistics.

6. You must go to the first stage of A / B testing and repeat the cycle again. Split - testing must be carried out on an ongoing basis in order to constantly improve the web resource.

Concerning the choice of the best combination of colors based on the color wheel.

The choice of the best combination of colors based on the color wheel is a circular arrangement of shades, close to the order of representation of colors in the spectrum of light colors in the developed application. You can use the color wheel to find color harmonies using the rules of color combinations.

Color combinations determine the relative position of different colors to find colors that create a pleasant effect [10]. The Itten's color wheel was developed in accordance with the laws of the theory of color, so it is an indicator of the correct combination of colors.

It was invented as a paint tool for aspiring artists. The Itten Circle Foundation is based on red, yellow, and blue. By mixing, all other colors and shades are obtained. The circle shows the parent properties of these primary colors. The triangles on the sides of the central figure are child tones. According to Itten's circle, green is the result of mixing yellow with blue, and orange is red with yellow, in turn purple is red with blue. The shell, in the form of a circle, describes the spectrum (the dependence of color on the light wave): from red (the longest wave) to violet (the shortest), the connection between its two ends provides a purple color that does not have a wave. It turns out that the purple tone combines positive and negative infinity, thereby describing the biological feature of the relationship of color with the human eye: if red and violet fall on the retina at the same time, we see a purple color. Accordingly, the following colors of the color wheel are called composite or secondary order, there are also three of them - this is purple, orange and green. These colors are obtained by mixing in an equal ratio of first-order colors [11].

By mixing the primary and secondary colors, we get 6 tertiary colors.

In any field (design, fashion, the art of photography), the combination of three colors according to the principle ($60 \times 10 \times 30$) is considered correct. This allows products of any profile to look organic and expressive.

The color wheel is a flat representation of the overall color model. In reality, people are not limited to 12 colors, but use thousands and thousands of shades. The full model looks like a ball, where the shades of the color wheel are the equator, and the poles are white and black. A circle spread contains information about the interaction of shades in a color ball: from pastel tones to dark. Inside this ball there is an axis: from white to black - medium-gray. This allows for any section of the ball to see the gradient from gray to light or dark tones of any color. If you imagine not a segmented ball, but a ball with a rainbow gradient, all possible shades will fit into it.

Inside each circle there is a figure; line, triangles, rectangle, square, hexagon, rotating the figure, we get the desired combination of color combinations.

There are several classic color combinations matched with Itten's color wheel.

Complementary color combination (complementary colors). Complementary, or complementary, contrasting are colors located on opposite sides of Itten's color wheel. This combination provides high contrast and a strong combination of colors - together these colors will look brighter and brighter.

Classical triad (triad). The classic triad is formed by three Itten colors equally spaced along the color wheel. To achieve harmony in the triad, take one color for the main, and use the other two for emphasis. This provides a high-contrast color scheme, but to a lesser extent than the additional color combination, which makes it more versatile. This combination creates bold, vibrant color palettes.

The analog triad. An analog color scheme is formed by three adjacent colors in a twelve-sector color wheel. This color combination is universal, but can be overwhelming. When using this scheme, it is possible to choose one color as the main, the second as supporting, and the third to be used for emphasis. You can balance a similar color scheme by choosing one dominant color and using the other two as accents.

There are other models of Itten's circle: contrasting triad, four-color classical harmony, four-color contrasting harmony Square harmony and rectangular harmony, etc. But we are considering three main models (complementary, triad and analog triad), it is on them that the selection of colors in the application we developed is based.

The developed application allows color analysis of the web resource page according to these three schemes (see figure 3., 4).

The user needs to upload a screenshot of the site page or a picture that needs to be laid out according to the color wheel diagrams on the screenshot processing page.

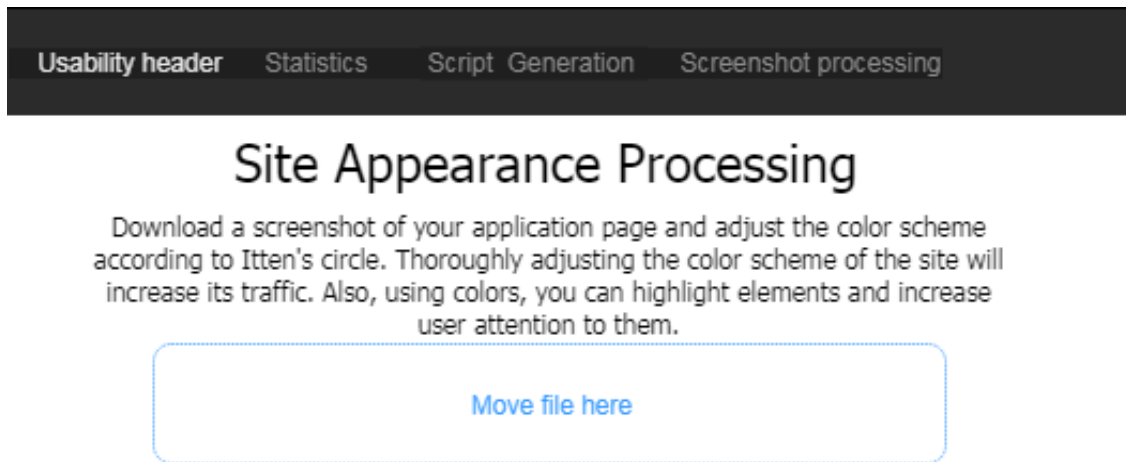


Figure 4. Screen view when switching to screenshot processing module.

After downloading the image, the uploaded photo and color schemes will appear, by which you can determine the further development of the web resource. As a result of the application, the following is obtained (see figure 4).

It is possible to choose three types of color combinations according to the color wheel. The final choice of colors is either through usability testing, or through split testing.

This function of the developed module can be used in those cases when it is revealed after collecting statistics that, for example, users rarely press the send message button because they cannot find it. In this case, you need to pay attention to the complementary scheme and select the colors from this group to highlight the button.

It is convenient to use this feature. The module can be used at the very beginning of application interface development. For example, it is often necessary to build on an existing corporate identity of a company. the main palette of the future application will be selected specifically for it.

The developed application will reduce your time and costs for this process. The program interface consists of three screens. They are divided according to the application modules (figure 5).

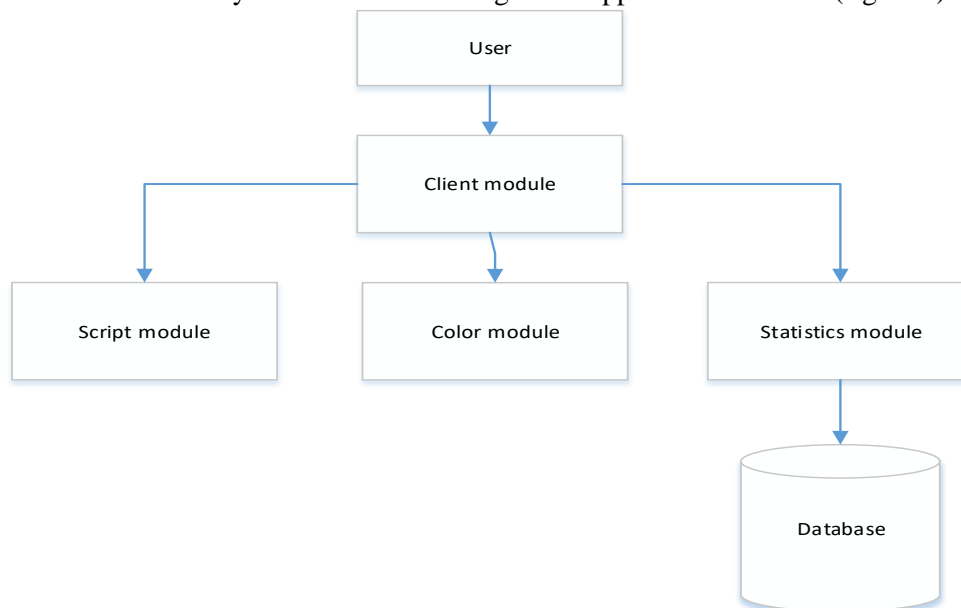


Figure 5. Scheme of interaction of program modules.

The first module will be responsible for collecting statistics on user actions in the client's web application of our product. you will need to specify the components of the web application for which you need to collect statistics to generate a script for monitoring client actions. After entering the necessary information, the module will create a JavaScript file that will need to be connected to the web application. The script will monitor the specified components and send the collected data to the server. The jQuery library is used to access elements. To use this library, you need to remember about the DOM (Domain Object Module) and browser events.

So, when the program starts, the user is prompted to determine the areas from which statistics will be collected. Here you must specify the classes of the web resource. For example, it can be registration, menu or contact classes (figure 6).

Usability header Statistics **Script Generation** Screenshot processing

Script generation

Here you can enter the classes for which you want to collect statistics. These classes will be used in the generated script, which will need to be connected to the html-page to track elements. All collected data will be sent to the server, after which statistics will be displayed.

Enter element classes here:

registration-area, registration-button, menu-button, order-area, FAQ-button, contact-link

Generate script

Figure 6. Screen for defining areas for collecting statistics.

The main page for the user is showing statistics. information is displayed in visual graphs and diagrams here (figure 7).

You can see more detailed information when hovering over points by the values of which statistics were collected.

The second module will be responsible for storing and displaying the collected statistics. Each client will have their own login and password from their personal account. He will be able to view, analyze, filter the collected data in his personal account. Next, the user himself chooses the priorities that are important for his site, the so-called KPI. It is necessary to analyze what is important for the business, to determine the goals that must be achieved by the web application for their choice.

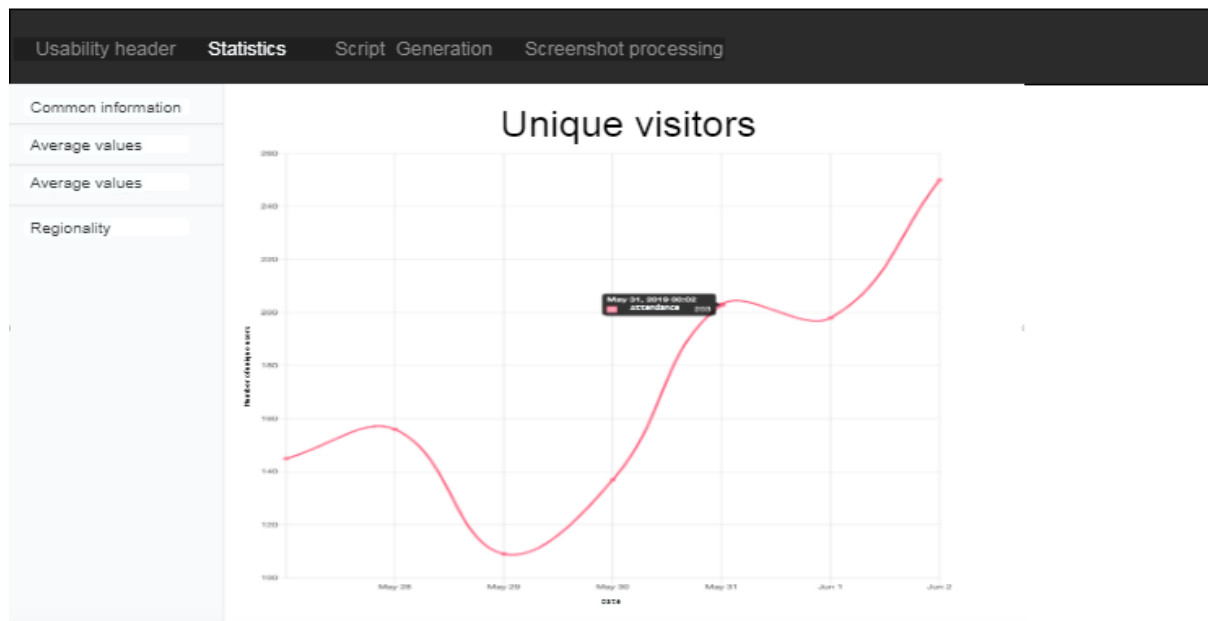


Figure 7. Screen for defining areas for collecting statistics.

The third module will be responsible for analyzing the downloaded screenshot of the web application. This module will analyze the color scheme and display to the client several suggestions for changes that can increase activity on the site. For example, it can be a form for processing orders or a catalog search. Technically, you first need to determine the point on the color wheel where exactly this or that color is located. After that, the program determines the remaining colors depending on the color scheme for a given deviation in degrees. For the development of the back-end part, the NodeJS environment was used. The basis for it was the JavaScript language and the V8 engine, which uses the Google Chrome browser. Having at its disposal many HTTP utilities and middleware, Express.js helps to create a reliable and fast API [14].

To implement the database, the Mongo DB system was taken [15].

4. Conclusion

Three test cases were passed to test the application. Test case number 1. Entering classes. Result: The script is saved on the user's computer. Test case number 2. Collection and conclusion of statistics. It is necessary to connect the generated script to the user's site and wait for some time, for which statistics should be collected. Result: Display statistics for previously defined classes. Test case number 3. Generation of color schemes. The program is supported by all operating systems, so the basic requirements are determined by the requirements of the operating system used. Result: the downloaded screenshot is displayed, its main colors and colors selected according to Itten's color wheel.

Despite usability and split testing, it is impossible to complete all test results and make the site or product as convenient as possible for everyone, without exception. First of all, you need to consider the most important changes regarding the conversion of your resource.

References

- [1] Paz F and Pow-Sang J A 2016 A systematic mapping review of usability evaluation methods for software development process. *International J. of Software Engineering and Its Applications*. **10(1)** C65-78.

- [2] Khajouei R, Zahiri Esfahani M and Jahani Y 2017 Comparison of heuristic and cognitive walkthrough usability evaluation methods for evaluating health information systems. *Journal of the American Medical Informatics Association*, **24(e1)** L5-LX.
- [3] Crossley P L 2019 Compression therapy device Washington. DC: U.S. Patent and Trademark Office. (No. 15/999.521).
- [4] Hussain A, Mkpojiogu E O and Kamal F M Mobile Experience Evaluation of an e Reader App. 2018 *Journal of Telecommunication, Electronic and Computer Engineering (JTEC)*. **8(10)** XI-XV.
- [5] Astakhova I F, Sukhoterin I V and Rodnishchev A Yu 2014 *Bulletin of Voronezh State University. Series: System Analysis and Information Technology*, **(1)** XC7-C3.
- [6] Astakhova I F, Falaleeva Yu L and Petrov K V 2009 *Bulletin of the Voronezh State Technical University*, **5(12)** CL6-7.
- [7] Hubbard E A, Venkatramani K, Anderson D P, Adiga A K, Hewgill, G D, and Lawson J A 2011. Dynamic coordination and control of network connected devices for large-scale network site testing and associated architectures. *U.S. Patent Application* (No. 12/462.600).
- [8] Cotton B *The Beginner's Guide to Conversion Rate Optimization (CRO)*:
<https://blog.hubspot.com/marketing/conversion-rate-optimization-guide>.
- [9] Gurinovich E Step-by-step usability testing or HCD design assessment
<https://habr.com/ru/post/124462/>.
- [10] Gonikman E I 2010 *Taoist paradigm of color Book 1 Fundamentals of color diagnostics: Theory and practice*. Veligor. Moscow.pp. CXII-CLXXVI.
- [11] Brandse M and Tomimatsu K 2013 Empirical review of challenge design in video game design *International Conference on Human-Computer Interaction*. Springer, Berlin, Heidelberg. pp. CCCXCVIII-CDVI.
- [12] Crockford D 2013 *JavaScript. The Good Parts*. Peter. Saint Petersburg, pp LXXX-CXXX.
- [13] Samkov G A 2011 *jQuery. Recipe Collection*. BHV-Peterburg. Saint Petersburg. pp. XCV-CD.
- [14] Brown I 2017 *Web development using Node and Express. Full use of the JavaScript stack* Peter. Saint Petersburg. pp. CLII-CCLIII.
- [15] MongoDB documentation: <https://docs.mongodb.com>.