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SOFTWARE FOR SCANNING THE BRIGHTNESS OF THE RASTER IMAGES PIXELS

Abstract. A web-application for scan by program way of the analog oscillograms raster images when measuring the parameters of pulsed signals is described. As a criterion for selecting scanning points the maximum brightness of pixels on the signal lines of the oscillogram raster image is using.
Keywords: raster image, RGB code, pixel, pixel brightness, scan data, oscillogram.

Statement of the problem and purpose of research. Raster image is a rectangular matrix in the rows and columns of which are the smallest elements – pixels [1]. Color, brightness and transparency are the main parameters of pixels. To set the color of pixels, the RGB code is used, with the help of which 16 million color shades specified by this code are formed as a mixture in different proportions of three base colors: red, green and blue. The contribution in pixel color of each of base colors has 256 levels, which can be present as decimal numbers from 0 to 255. The brightness of pixel is defined as the sum of the base colors contributions. Black color has the lowest brightness 0, white color has the highest brightness 765. Pixel opacity has 256 levels. A fully opaque pixel has opacity 255, a fully transparent pixel has opacity 0. Significant opportunities for receiving the information about the pixels color parameters are gave the Canvas technology [2], which makes it possible to implement vector graphics on web pages using the object-oriented programming language JavaScript.

For raster image built-in the canvas, using the *getImageData()* method and the *ImgData* object with the *data[]* property, one can get information about the base colors contribution to the color of pixel and calculate its brightness. The brightness of pixel can be used as a criterion for programmatically selecting the scanning points in web applications used for measure the electrical signals parameters by the analog oscillograms raster images [3].

The purpose of this work is to create software for scanning the pixels brightness of raster images in order to select the points with maximum brightness corresponding to lines of signals on the raster images of analog oscillograms.

Major part. In paper [3] present the software for measuring the instantaneous values of voltage and current of pulsed signals by scanning the oscillogram raster image. Scanning is performed by click in points of raster image selected visually on the signal lines of oscillogram. As shown in [4], the scanning of the oscillogram raster image can be performed programmatically if to use the maximum brightness of pixel on the line of signal as a criterion for choosing the scanning point. This work is a development of work [4].

The software described below implements processing algorithm of the analog oscillogram raster image consisting of the following stages: 1). Loading image into a browser window and its build into the canvas; 2). Drawing a vertical line crossing the oscillograms of impulse signals, along which the brightness is scanned; 3). Scanning the RGB code of pixels along the line and calculating their brightness; 4). Construction of the brightness distribution curve and determination of the points number in which this curve has maxima; 5). Construction of the brightness spectrum along the scanning line; 6). Performing filtering of the brightness spectrum in order to determine the coordinates of points with maximum brightness lying on the impulse signals lines of oscillogram. 7). The output of points coordinates with maximum brightness.

It note that the vertical line drawn on the oscillogram raster image corresponds to the moment of time for which the instantaneous values of voltage and current of pulse signals are determined from the values of coordinates obtained by scanning.

The software was created using the languages HTML5, CSS3, JavaScript and the Canvas technologies. Fig. 1 shows the starting view of the program window with loaded the analog oscillogram image of voltage and electric current pulses.

At algorithm step 2, the user places cursor above the line of voltage pulse and presses the left mouse button. On the event of *mousedown*, a script is executed that uses the *pageX* and *pageY* properties of the *event* object to determine the x_b, y_b coordinates of the top end of vertical line segment along which the scanning is performed. These coordinates are assigned to the corresponding variables of program. Further, while holding the key, the user moves the cursor below the line of electric current pulse and releases it's. On the event of *mouseup*, a script is executed that assigns the coordinates x_e, y_e of the lower end of the line segment to the variables of

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program. This script, using Canvas, draws a vertical line between the points with coordinates (x_b,y_b) and (x_b,y_e).

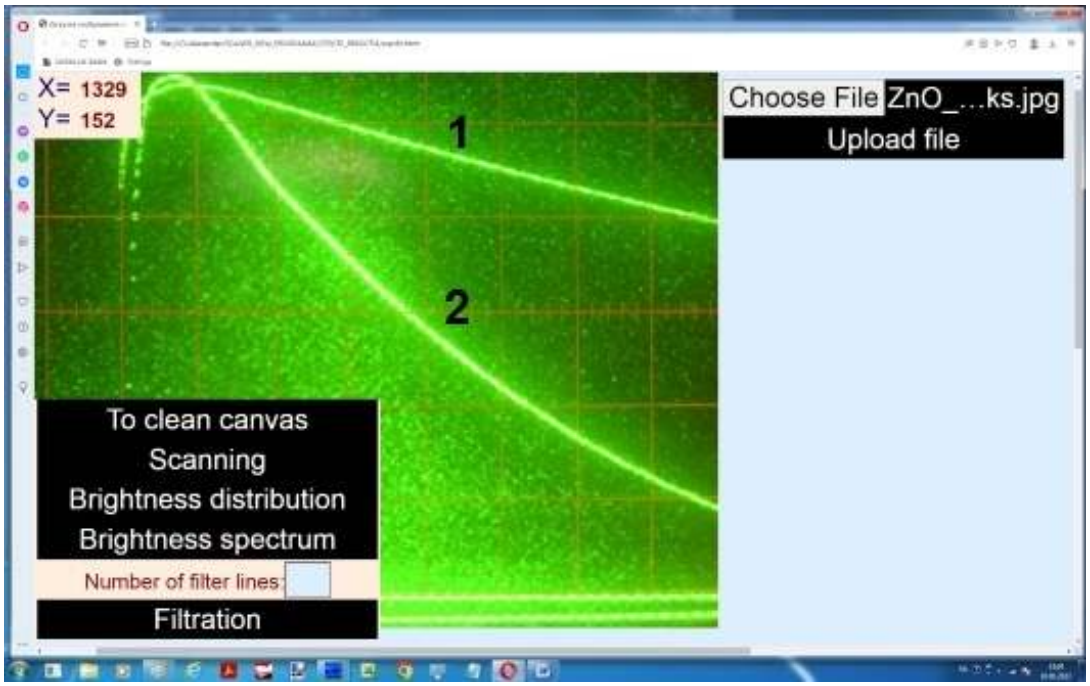

Figure 1 - Web page of the program with loaded the oscillogram raster image of the voltage (1) and current (2) pulses

The scanning of components of the pixels RGB code along selected segment of vertical line the script of program makes wich executed at the "Scanning" button press. This script uses the *getImageData()* method and the *data[]* property of the *ImgData* object. In script a cycle is organized on the coordinate *y* with a step of 1 pixel in the interval $y_b \le y \le y_e$ at constant x_b value. In the cycle, based on the scan data, the brightness of each pixel localized on the segment of vertical line is calculated. The value of the pixel coordinates y_i ($0 \le i \le N$-1) and their brightness are stored into the arrays *yscan[]* and *intens[]* of program. Script counts the number of pixels *N* in segment of vertical line and displays a message about it in the dialog window opening by *alert()* method.

When one press the "Brightness distribution" button, a script is executed that finds the element with the maximum brightness *inm* in the *intens[]* array and forms the array with relative brightnesses by performing the transformation: *intens[i]=intens[i]*300/inm*. This script based on the change in sign of the differences *intens[i]-intens[i-1]* and *intens[i+1]-intens[i]* determines in cycle over the array elements *intens[i]* the points, where the brightnesses distribution curve has a maximum. Using this data, the script creates the array of maximum brightnesses *intensmax[]*

and the array of coordinates *yscanmax[]* corresponding to points where the brightness distribution has a maximum. This script counts the number of k_{max} peaks in the brightness distribution curve and displays value of k_{max} in dialog window using the alert() method. Fig. 2 shows view of the program window after pressing the "Brightness distribution" button. As one can see, the brightness has highest values within the areas of the lines intersection of impulse signals with a segment of the vertical line highlighted on the oscillogram raster image. In these areas there are points with maximum brightness the coordinates of which (x_U, y_U), (x_I, y_I) the program must find. These coordinates can be used to calculate the instantaneous voltage and current of pulsed signals.

The brightness spectrum is used to find the points with maximum brightness. It builds on the basis of the data arrays *yscanmax[]* and *intensmax[]*. Script executed at pressing the “Brightness spectrum” button draws the brightness spectrum using the means of Canvas technology (Fig. 3).

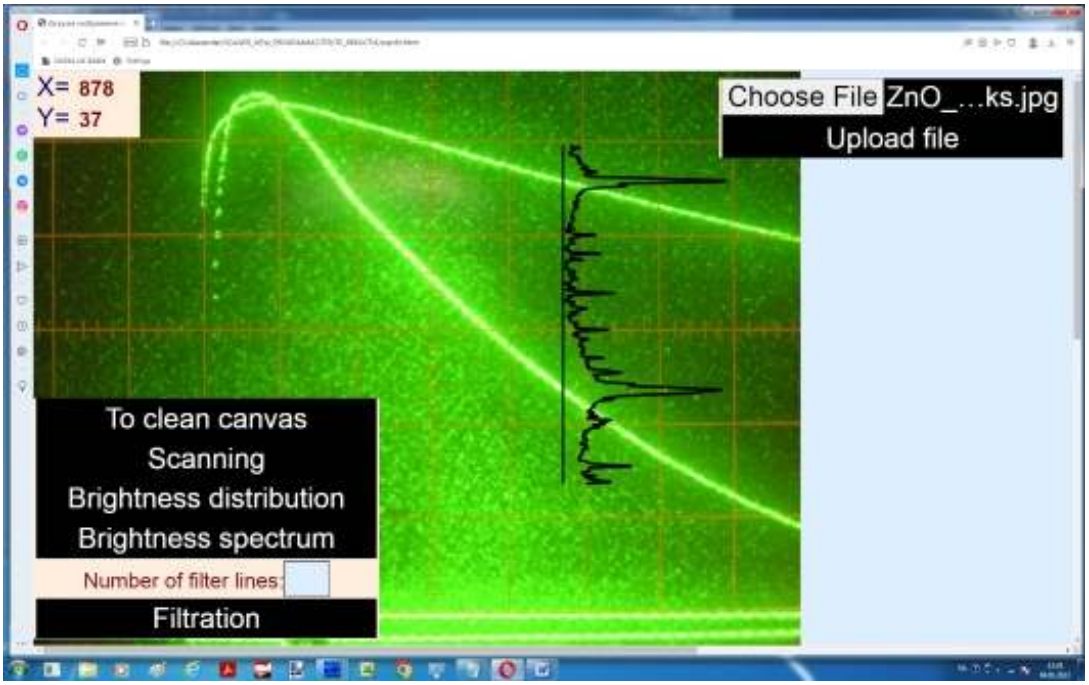

Figure 2 - View of the application web page after successively pressing of buttons "Scanning" and "Brightness distribution"

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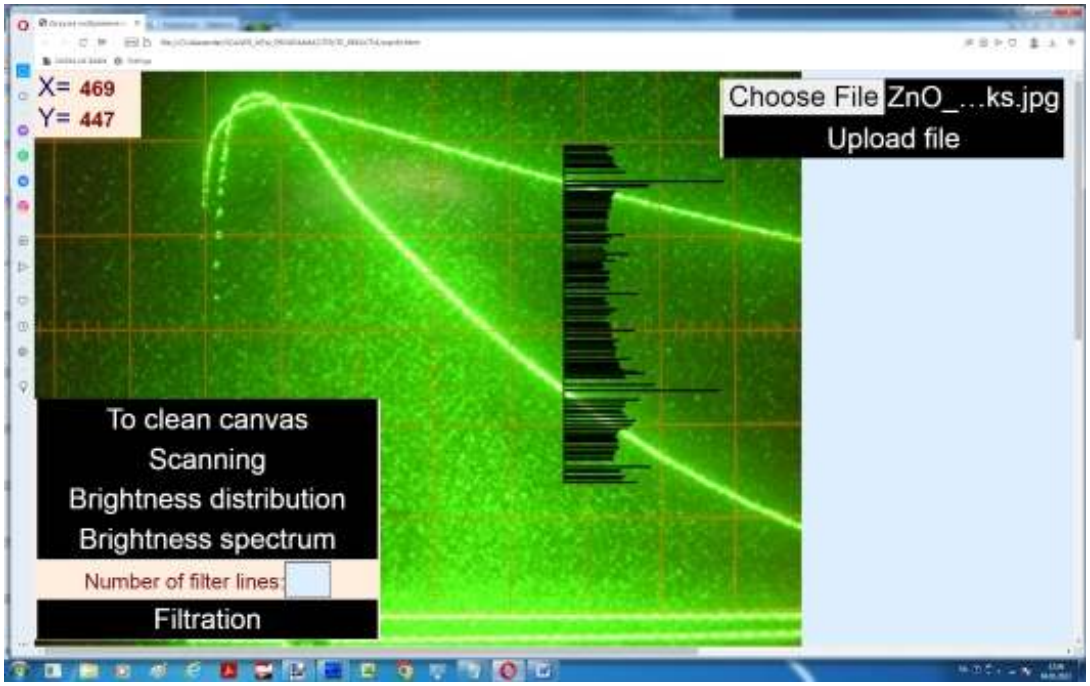

Figure 3 - View of the application web page after pressing of button «Brightness spectrum»

To find the points with maximum brightness on the impulse signals lines, the program carries out the filtration of brightness spectrum. For this a form field of text type is used, preceded by the inscription "Number of filter lines", and the "Filtration" button. For filtration quantity of the impulse signals lines *n* on the oscillogram raster image enters into the form field of text type. The script executed when the "Filtration" button is clicked divides the *intensmax[]* and *yscanmax[]* arrays into n groups. In each group there are k_{max}/n elements. The maximum brightness value and the coordinates of pixel with this brightness is determined for each groups. The program draws the spectrum with lines of maximum brightness and displays the values of pixel coordinates with maximum brightness (x_U, y_U), (x_I, y_I) (Fig. 4).

Thus, the described web application can be used to create programs based on it with automatic (programmatically) scanning of the analog oscillograms raster images at measuring the electrical signals parameters.

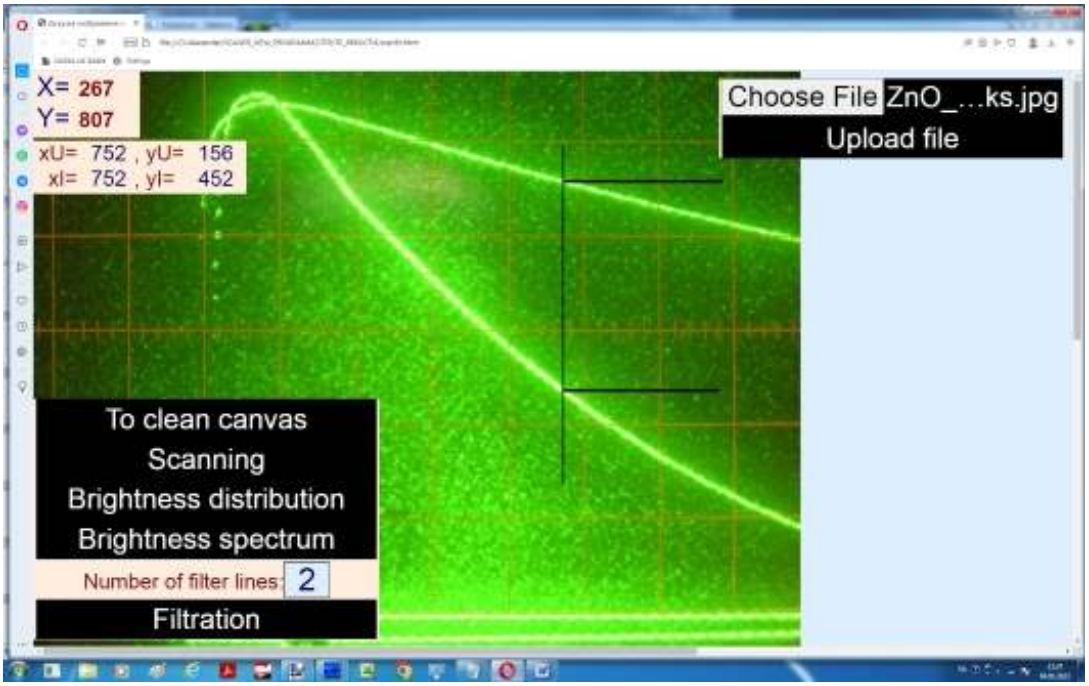

Figure 4 - Application web page at the final stage of execution

Conclusions. Using languages HTML 5, CSS3, JavaScript, and Canvas technology, a web application was created for automatic scanning of the analog oscillograms raster images at measuring the pulsed signals parameters. As a criterion for selecting of scanning points, the maximum brightness of pixels on the lines of signal in the oscillogram raster image has used.

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Програмне забезпечення для сканування яскравості пікселів растрових зображень

Параметри електричних сигналів можна з високою точністю виміряти з растрового зображення осцилограми, отриманої фотографуванням цифровою фотокамерою з екрану аналогового осцилографа. Вимірювання здійснюється шляхом сканування растрового зображення осцилограми.

Метою даної роботи є створення веб-застосунку для програмного сканування растрових зображень осцилограм при вимірюванні параметрів імпульсних сигналів. Критерієм вибору точок сканування є максимальна яскравість пікселів на сигнальних лініях растрового зображення осцилограми. Програма, використовуючи цей критерій, вибирає точки з максимальною яскравістю, які лежать на відрізку вертикальної лінії, що перетинає сигнальні лінії, і повертає координати цих точок. Координати можна використовувати для розрахунку миттєвої напруги і струму імпульсів, представлених на осцилограмі.

Веб-застосунок створено за допомогою мов HTML5, CSS3, JavaScript та технології Canvas. Інтернет браузери є програмним середовищем для його виконання.

Ключові слова: растрове зображення, код RGB, піксель, яскравість пікселя, дані сканування, осцилограма.

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