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System of Detection and Scanning Bar Codes from Raspberry Pi Web Camera

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***Abstract*— This work is focuses on the problem of detecting and scanning bar codes in video stream. The block diagram of a system identifying bar codes in panoramic images using Raspberry Pi 2 Model B was developed. The program algorithm of the system detection and scanning bar codes video stream for Raspberry Pi was proposed. It is established that systems can be used in industry, medicine, and in the control system.**

Keywords—*Raspberry Pi; bar code; structural scheme; algorithm; OpenCv*

I. INTRODUCTION

Using bar codes are dictated by the extremely large volume of supplies, territorial scattering of interconnected organizations and enterprises, insufficient information on the properties of the product on its packaging and in the accompanying documentation, the lack of reliable and timely information on the receipt of goods to the buyer [1-4]. The most commonly used today are linear bar codes for reading information, the disadvantage of which is that they can submit only small volumes of relational (several dozen characters). To represent larger volumes of information, it is necessary to construct bar code with a two-dimensional structure, for reading it is necessary to apply a two-axis scan - horizontally and vertically. When working with linear bar codes a computer database is needed. The use of two-dimensional barcode allows us to abandon such a base, since the code capacity is sufficient to store complete information about the object [5-8]. In view of this, two-dimensional bar codes should be the subject of a solid scientific research to build effective systems for controlling the movement of objects in a particular system.

Bar code is a sequence of black and white stripes containing certain information in a suitable form for reading by technical equipment. Requirements of introducing bar codes dictated by the extremely high volume of deliveries, territorial dispersion of interdependent organizations and enterprises lack information about product features on the packaging and accompanying documents. Today the most commonly in using are linear barcodes for reading information [9,10]. Panoramic photography can take pictures from 180° and more, so it can capture at this frame a large number of products with bar codes. Then, these images will be scanned and recorded in the database. Then it's possible to run other bar codes in the frame [10,11].

II. GRAPHIC DIAGRAM AND STRUCTURAL SCHEME

Taking into account all the requirements and physical structure of the work, a graph-diagram the algorithm of program working was created (Fig. 1.). After running the system, connection is established between Raspberry Pi and monitor, in particular, whether there was a connection of ports. If the connection does not successfully complete, the user will be notified about it. Raspberry Pi 2 Model B receives data from the camera, after which the data is analyzed. These data are transmitted to Raspberry Pi via USB interface. Immediately checks were data transmitted and received, if an error occurred somewhere, it will be reported. After the transfer of packets occurred, the basic algorithm of the system executes. The system performs its basic function, transmits data via Ethernet interface. The packets are transmitted and the verification is again performed, or the packets are converted (transferred). Then results, must be shown on the screen. After that, the cycle will repeat until the verification, connection of ports and connection to the monitor. The cycle continues until the power is turned off. According to the graph-diagram of the algorithm of the program was written program for the system working (Fig.1).

Data from Raspberry Pi screens are transmitted using a special program VNC Viewer. Raspberry Pi is a hardware platform on which was installed operating system Linux. Therefore, for programming and reprogramming any system the monitor to unicameral computer, or laptop/ computer with the installed program VNC Viewer and log into the system using IP - address that's assigned Raspberry PI is needed [12,13].

After starting work the microcontroller is turned on. After the initialization of USB to work with its protocol and data transmission (bytes, bits). The camera sends start readiness messages to Raspberry Pi. The central processor that works with the USB adapter and the Ethernet adapter. Raspberry Pi works with these adapters via USB protocol. The image is taken from a USB camera, then this picture turns black and white (Math Grey) to search for BAR codes, checks are made if there has been a conversion, it will be informed about the user and the system will stop working.

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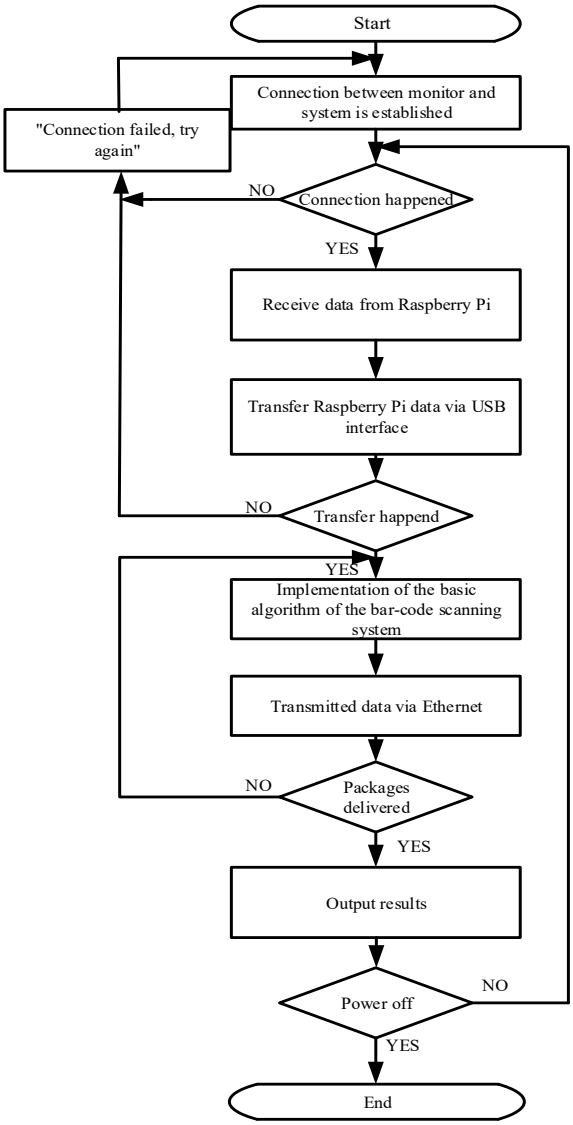

Fig. 1. Graphic diagram of the main algorithm of the device

The next step is to look for BAR codes on a black and white (symbol), and again check whether the BAR code was found, if it was found, then the program work continues, if no then the system notifies that nothing is found and it's work stop. The next stage for the system is the recognition of bar - codes (symbol <- get _ type; symbol <- get _ data;) at this stage starts Library Zbar. h, which works by dividing the image into black and white contrasts, looks for the beginning of the bar code, then defines the lines by their thickness and decodes the image and outputs the result by pre-writing it into the database. In case of not storing an image, it will be reported. It is possible that the image is not clear and the system is difficult to detect BAR is the code, in this case, the system of actions is as follows, a screenshot of the image is made, which on the screen and then the user determines independently what this BAR -code is and whether it is there at all. (Fig. 2.) [13].

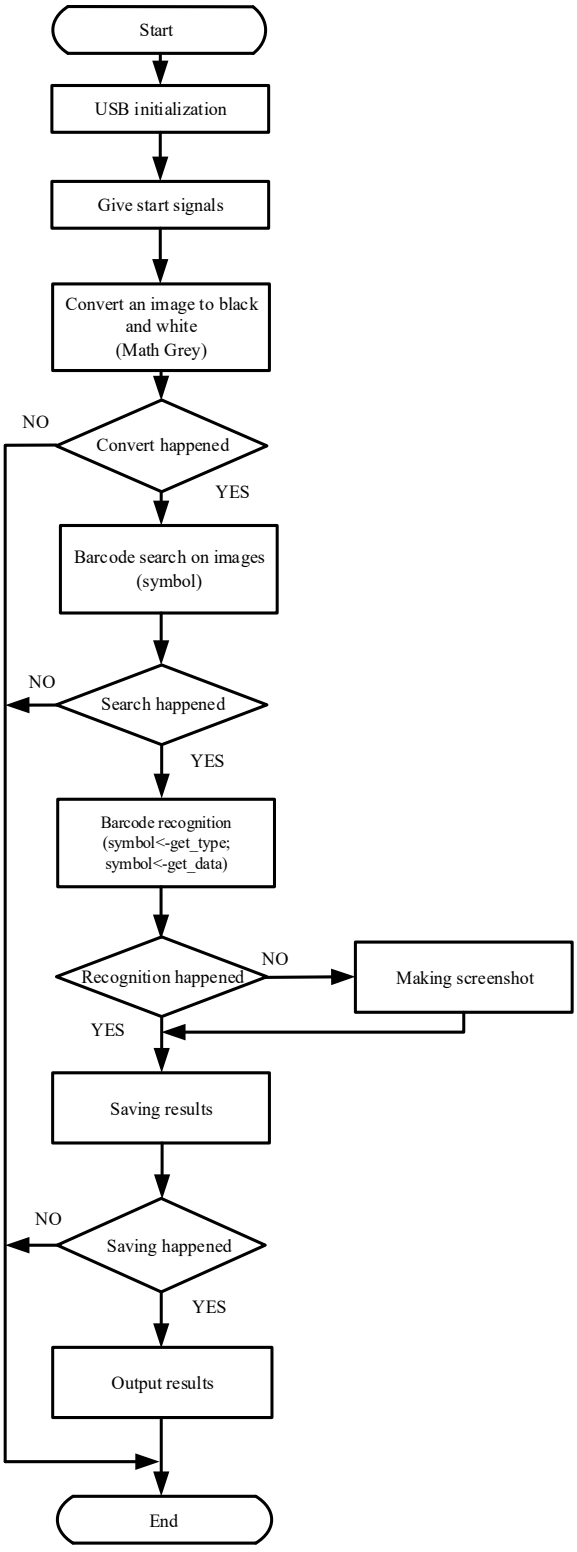

Fig..2. Graphic diagram of the main algorithm of the system

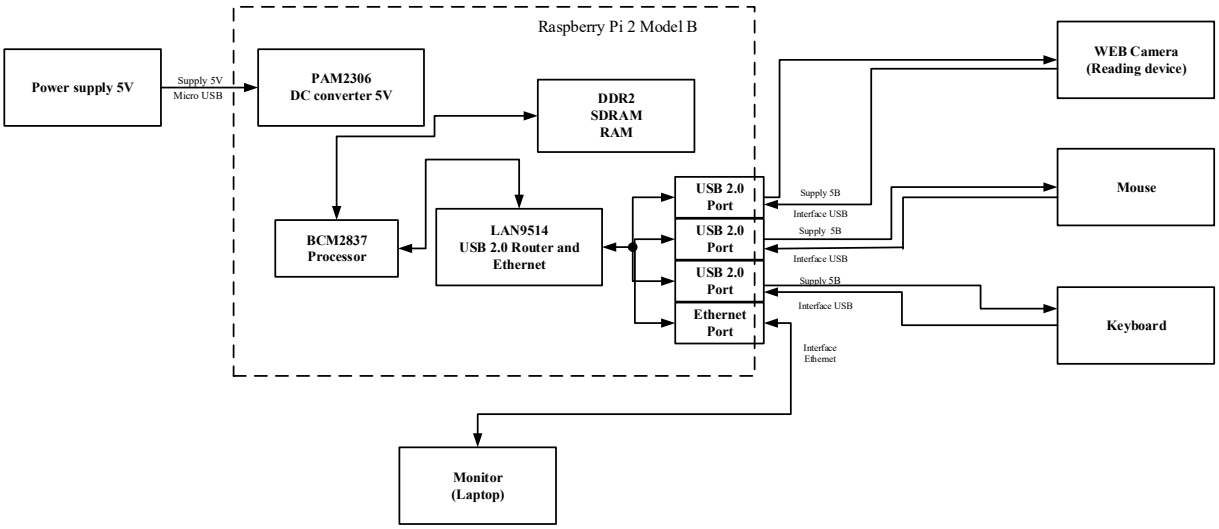

Fig. 3. General view of the structural scheme

For the correct operation of this system it is necessary to implement the structural scheme of the device. The block diagram of the device includes (Fig. 3):

1) Unicameral Raspberry Computer Pi;
2) Power supply 5V;
3) WEB camera (it is also a device recognition bar code);
4) Mouse and keyboard to control the input;
5) Output and control of this system;
6) Monitor (or laptop screen) for outputting information.

III. RESULTS

After the system was implemented according to the algorithm and the block diagram. was conducted the experiment on cameras with different resolutions, namely the 3 megapixels camera (Logitech C920-C), 5 megapixels (CBR CW-835M Black / Silver) and 12 megapixels (Genius WideCam F100 Full HD) camera. The experimental data of this experiment are listed in the Table 1.

The results of the study are shown in this picture. The chart shows that for cameras with different resolution the most optimal scanning distance of 30 cm. This is a scan resolution of 3 megapixels camera is 6 ms for 5 megapixels - 3 ms for 12 megapixels - 2 ms. The speed depends on the resolution of the camera. Graph of dependencies on Fig. 4. where is depicted as with different cameras, in which different resolution scan time is changed. Results of program's is on Fig. 5.

Results of research in various resolutions are presented in Table 1. Performed studies showed the robustness of the main device management system, and also confirmed the feasibility of its use. Two-dimensional bar coding of information as one of the most promising computer technologies is increasingly used in production and everyday life of a person. The main advantage of this technology is the rapid, accurate and reliable input of information into the computer system by scanning bar code images.

Table 1. RESULTS OF RESEARCH IN VARIOUS RESOLUTIONS

3 megapixels	Distance to the object	Time for scanning	**5 megapixels**	Distance to the object	Time for scanning	**12 megapixels**	Distance to the object	Time for scanning
	0	1,6		0	1,6		0	1,6
	10	1,5		10	1,2		10	0,9
	20	0,8		20	0,7		20	0,5
	30	0,5		30	0,3		30	0,2
	40	0,6		40	0,3		40	0,3
	50	0,7		50	0,5		50	0,35
	60	0,9		60	0,75		60	0,5
	70	1,1		70	0,8		70	0,8
	80	1,2		80	0,85		80	0,8
	90	1,3		90	1,1		90	0,9
	100	1,5		100	1,2		100	1

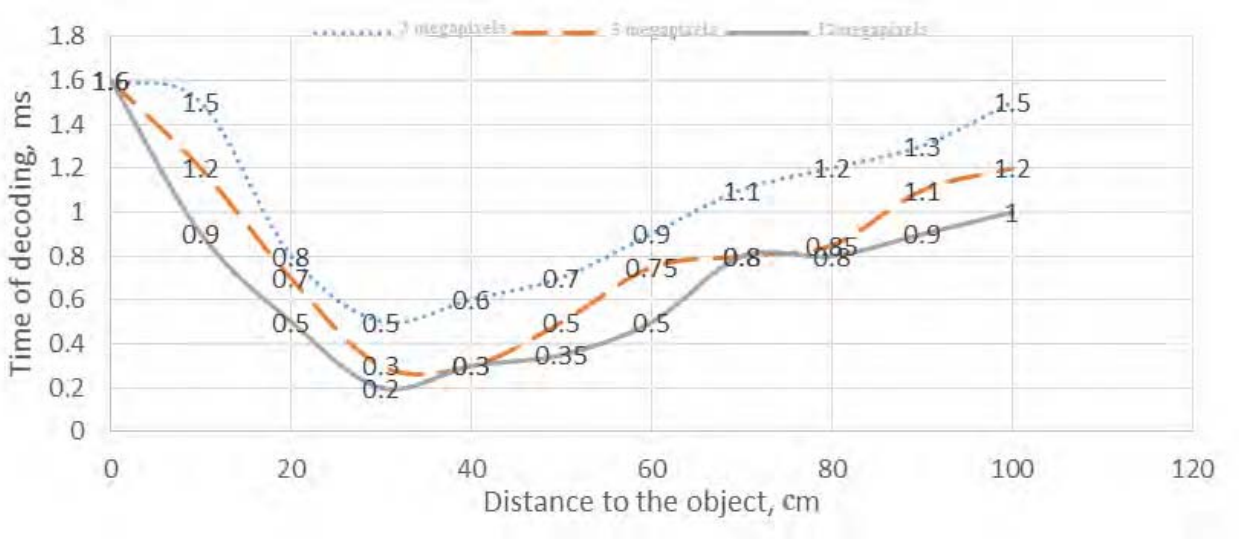

Fig. 4. Graph of dependencies

Fig.5. Results of program's work

IV. CONCLUSIONS

The structural scheme of detection and scanning bar codes in images for Raspberry Pi, and the algorithm of the program is the best option for proper system work, the optimal distance is 30 cm for identification and recognition, speed depends on the resolution of the camera.

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