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SCHEMATIC ASPECTS OF PROCESSING BLOCKS OF INFORMATION IN THE ALARM SYSTEM

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The operation principle of a standard alarm system is considered. The block diagram of the alarm system is defined A6-04. The schematics analysis of the main components of this system is given. The ways to improve modern alarm systems are shown.

Now automatic systems of protection are gaining an increasing popularity. The development of automatic protection systems is connected with the fact that every year the requirements of mankind grow and the cost of property increases. In addition, everyone wants to protect their property. The first systems of protection were invented in Ancient Egypt and Japan and had nothing in common with present security systems. Let's consider some outstanding inventions which laid the foundation of modern alarm systems. The first and most important invention was electric current and devices related to it. Thanks to electricity people got an opportunity to transfer information to considerable distances in seconds. Another invention was the creation of a photo cell which could distinguish violators in a zone of protection and switch on the alarm. Then sensors of various physical quantities were invented. They were incorporated in alarm systems improving their functionality. A standard security system includes the following set of sensors:

- motion sensors (IR sensors detect the infrared radiation emitted or reflected from an object, if no motion is being detected, the relay contact is closed, if motion is detected, the relay opens, triggering the alarm; ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object; microwave sensors);
- glass break sensors (acoustic sensors);
- automatic door open/close sensors (such sensors use galvanomagnetic converters or magnetically operated sealed switches);
- smoke detectors;

Modern security systems can also include sets of other sensors if needed. Modern protection systems differ in the quantity of protected zones, system control flexibility, ergonomics. Security systems use wireless data channels, for example GSM, GPRS, radio link, Wi-Fi. However Wi-Fi channel is used only in home security systems as it allows to manage the security system by means of the smartphone. Thus, alarm systems are widely used in industrial enterprises, offices, shops, public institutions and organizations, and also in private houses – “smart home” systems. Let's analyze the block diagram (figure 1) that shows A6-04 alarm system and schematics features of the data processing block.

A signal from sensors goes to the sensing control block from which it is transferred to the information processing block. The information processing block makes calculations and forms output signals which go to the block of the formation of the notification. The information processing block also arm and disarm the security system, activate light and sound signals in case of intrusion. The block of the formation of the notification generates signals of various levels, both analog, and digital, as these signals go on various devices (for example

calls, buzzers and blocks of the secondary signaling – GSM modules). The specialized power unit feeds the system. There is also an emergency power accumulator which is built into the alarm system.

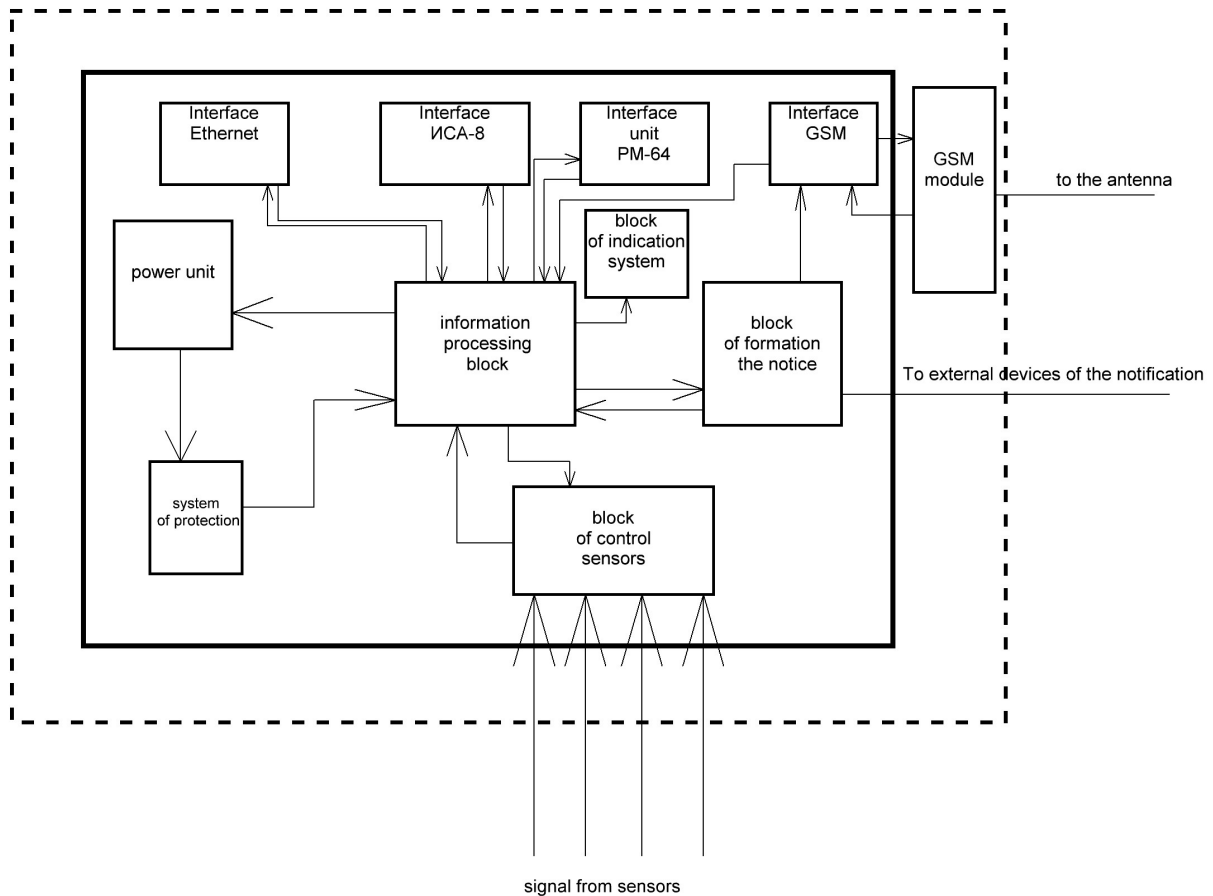


Fig. 1. Block diagram of the information block of processing system of the alarm system

In the diagram there is also a set of interfaces to communicate with various control units. Let's consider each of them. Interface PM-64 represents the interface system which connects the control and measuring (adjustment) panel to the information block. It transfers the security system into different modes. In fig. 2 [3] this panel is presented.



Fig. 2. Control panel

The module of coordination IF-ETHERNET creates distributed systems and transmits data within the local Ethernet network by means of the TCP/IP or UDP protocols [2]. Interface ИСА-8 allows contacting the owner of the security alarm system via the telephone line.

Thus, it is possible to allocate some main units that need updating:

- Information processing block;
- Block of the formation of the notification;
- Sensing control block.

We will consider in more detail the information processing block. Microcontroller ATmega 8 is used to increase of the speed as it is functional, flexible and convenient in use. A couple of registers are connected to the microcontroller to simplify processing and communication with other devices. In the information block there is a

memory chip to store command signals coming from various sources, for example, programming can be carried out by means of PR-1 panel, the command-driven panel or specialized programming units. Thus, due to microcontroller ATmega 8 the delay of signals has been reduced. However, to increase signal processing speed we need to update the program part of the block. The diagram of the information processing block is given in figure 3.

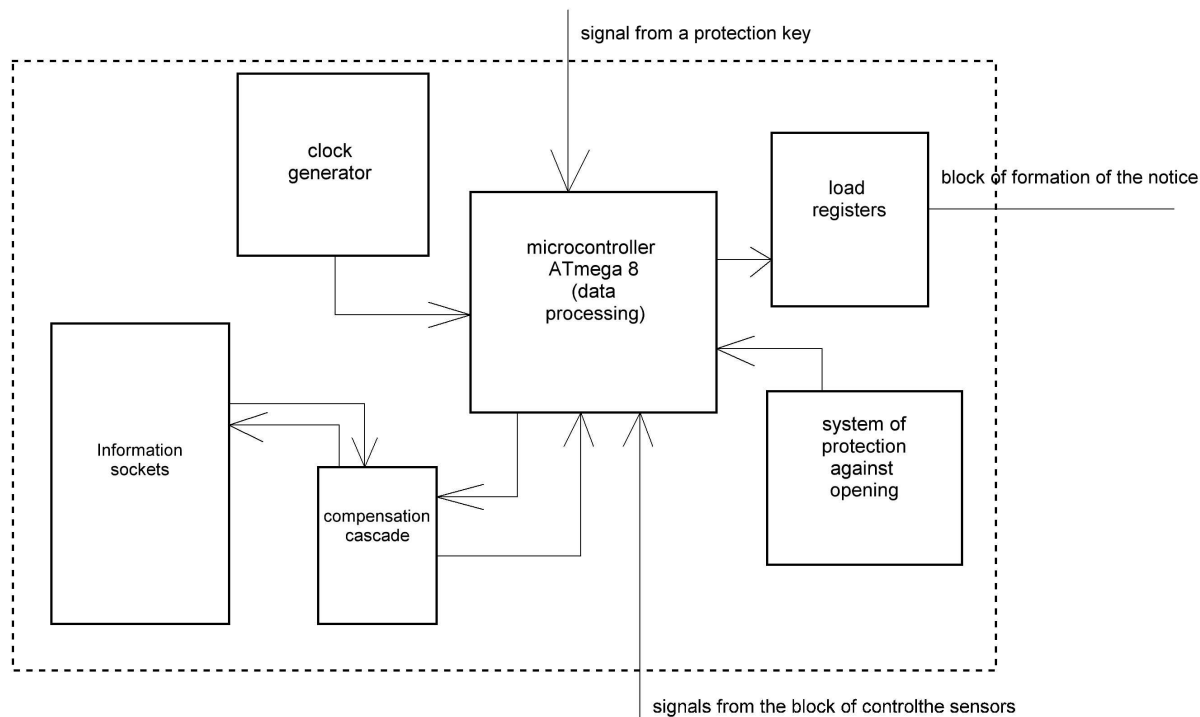


Fig. 3. Block diagram of the module of information processing

The sensing control block represents a set of sockets to which alarm wires from various sensors are connected. It also includes a set of various intensifying devices and proofreaders for noise elimination in a signal. Due to the use of intensifying and correcting cascades it is possible to increase the functionality of the whole system. In the given alarm system there are three sensors, two of which (a motion sensor and a glass break sensor) need strengthening and correcting of an output signal. The schemes of the corresponding intensifying cascades are given in fig. 4, 5.

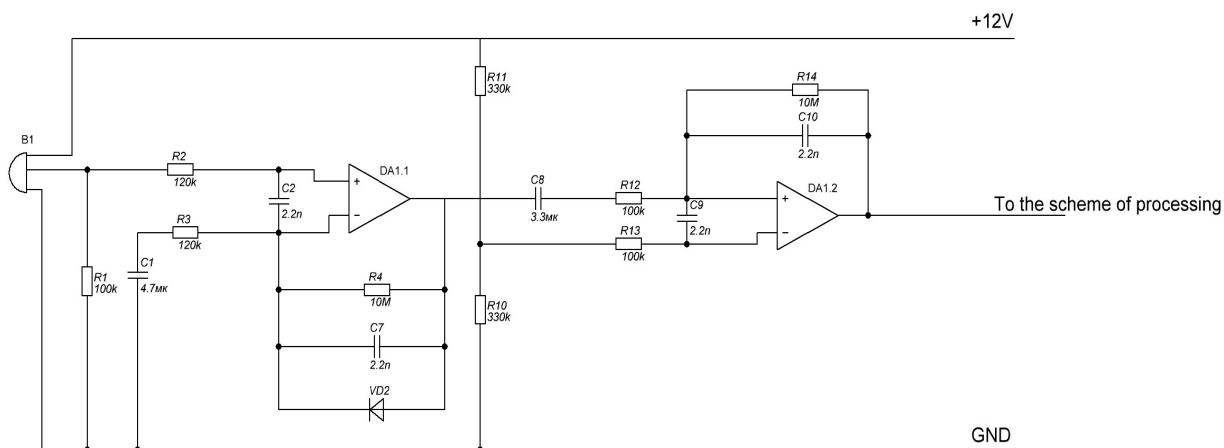


Fig. 4. Electric circuit of strengthening of the motion sensor [6]

To improve the characteristics we choose precision (measuring) operational amplifiers which give both noise reduction and stabilization of the sensor and a sensitive element. Stabilization of sensor parameters normally requires about 5 seconds, however if we apply operational amplifiers LM2904 and OPA2348, this time decreases to 0,5 – 1 seconds. It should be noted that these operational amplifiers have an essential shortcoming – they are extremely sensitive to static electricity which makes them very vulnerable. To overcome this lack it is necessary to cover the chips of amplifiers with antistatic varnish.

The block of the formation of the notification is responsible for signals which will notify in case of break-in. The studied system has a set of channels for the notification. These schemes represent DAC or ADC which form a certain signal at the exit. In the studied alarm system there is a GSM module, so it is also necessary to form a certain signal (inquiry) for it. In the studied system the formation block is constructed on the principle of consecutive approach that gives the chance to establish a good compromise between speed and accuracy.

Security systems must be able to resist to breaking and bypassing the system. For this purpose information security methods are used. In the given alarm system special registers for storage of protection requisites are used (passwords, codes, etc.). It also includes special schemes which interrupt information transfer in communication lines at emergency situations.

To increase protection against electromagnetic fields it is necessary to use screens from materials with high electric conductivity (for example, steel, copper, aluminum, brass). They are in the form of sheets not less than 0,5 mm thick or a grid with cells no more than 4 x 4 mm.

Notification channels are an important part of the alarm system. They include sound, light and information systems of notification. The GSM system has become very popular recently as they are simple to use. In the studied system the GSM module is also installed. The block diagram of the GSM module is submitted in figure 6.

The control element of the device is the ATmega 168 microcontroller of the Atmel company [4]. The signal of violation of the mode of safety goes from the block of formation of the notification to the GSM module. Then a text message is sent by the SIM900 module. This GSM module is connected to the main payment of the alarm system by means of the XP4 socket [2].

GSM modules have a number of shortcomings concerning information security:

- active attacks (the GSM equipment can be exposed to attacks of the equipment imitating the work of base stations);
- impossibility to determine the reliability of data;
- weak enciphering algorithms.

Thus, the local Interface of the GSM module and the area of data transmission to a base station are not properly protected. In fig. 7 the block diagram of data transmission on the GSM channel with designations of security of areas is submitted.

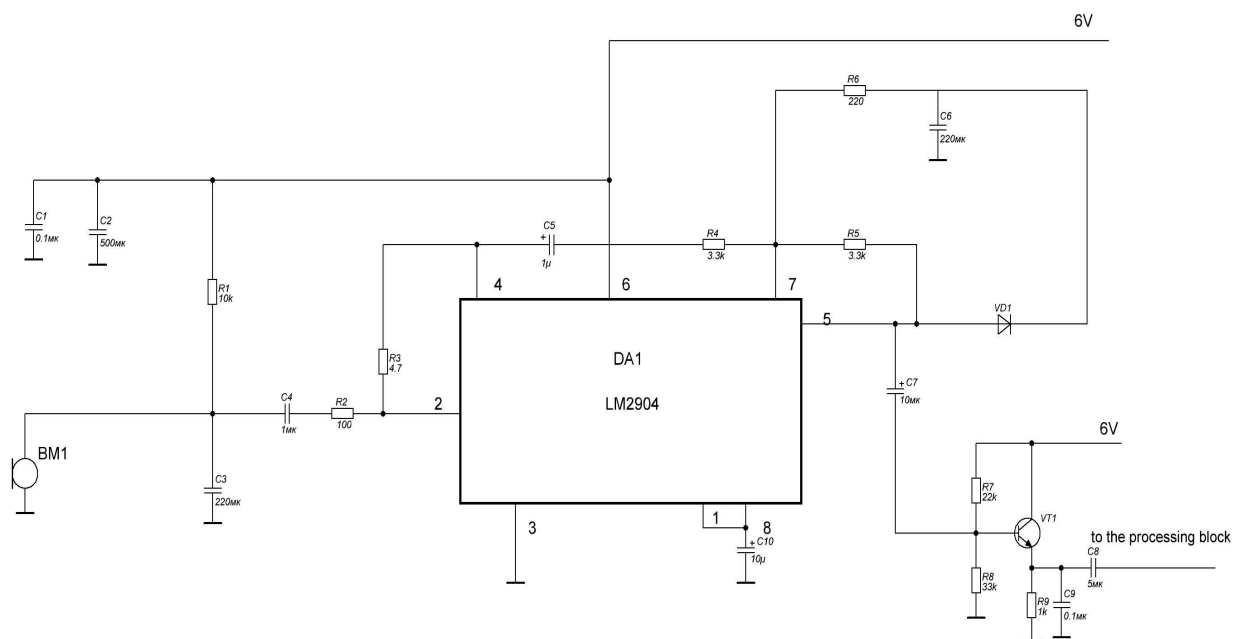


Fig. 5. Electric circuit of the sensor of breaking glass

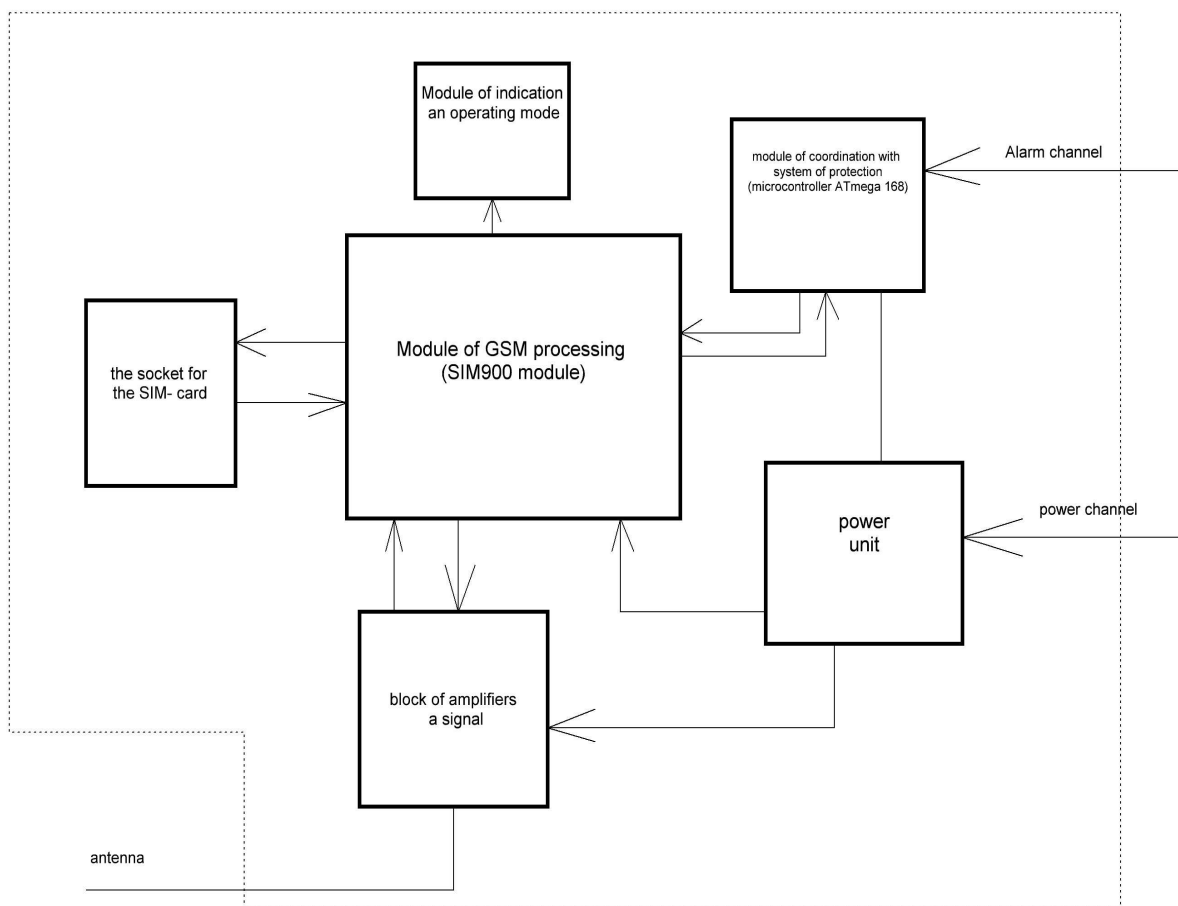


Fig. 6. GSM module electric circuit

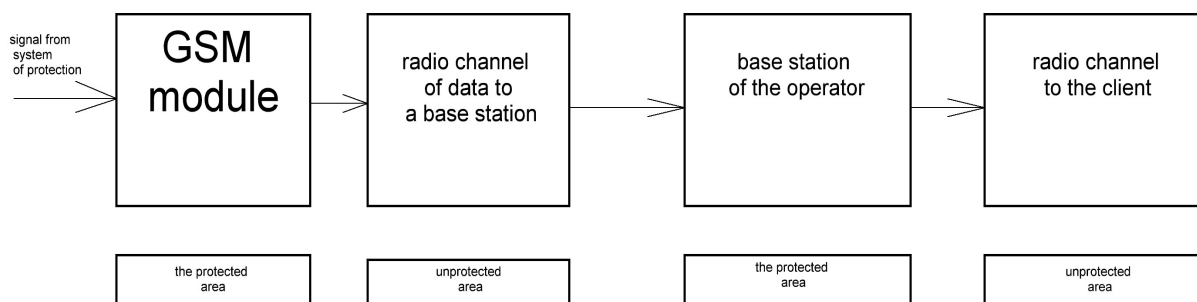


Fig. 7. Data Transmission Process

One of the most widespread methods of increasing protection is the use of the SSL protocol. The SSL protocol is the cryptographic protocol providing safe data transmission on a network. Certain SSL tunnels which provide protection against encroachments [5] are created. And as a result we get the system presented in fig. 8.

Thus, the only unprotected channel is a communication channel from a base station to the client. However SSL – enciphering can be used here. To do this it is necessary to address a telecom operator and connect this function.

GSM modules are constantly improving and their functionality is increasing. It is possible to manage the whole security system via the GSM-channel. As a result we get the dual transfer and reception channel. However to connect this function we need both hardware and software means which makes the device more complex. In the studied module we can get such a dual channel, but we need additional software for the SIM module.

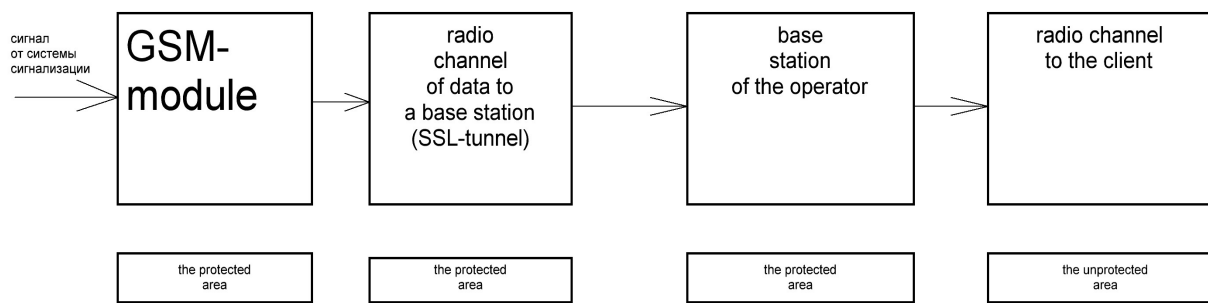


Fig. 8. SSL enciphering

Let's consider GSM modules on J2ME. Java ME (J2ME) is a powerful built-in platform intended for mobile devices and security systems. It allows expanding functionality of GSM modules. Its advantages are the following:

- high level of safety and security of the system according to certificates of X.509;
- built-in debugging facilities;
- high stability, lack of system resets;
- means of difficulty of perception of a code.

Developers can build in the GSM module appendices on the JAVA platform with several peripheral interfaces [6].

In summary let's mention some of the problems which developers of security systems should solve to increase reliability and to reduce unauthorized access to the protected perimeter. Further development of security systems (including the studied A6-04 system) needs more modern and functional element base. Then full microprocessor information processing will be possible. It, in turn, will allow using more modern algorithms of signal processing.

One more important moment is energy consumption reduction. A big problem for security systems is autonomy, i.e. independence of power supplies. It is necessary to look for alternative sources of electric energy more carefully. It is necessary to avoid the breakings connected with loss of electric energy from a network.

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PAYMENT RECEIPTS IMAGE PROCESSING FOR DATA INPUT AUTOMATION WITH MOBILE DEVICES

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In this paper we propose an approach for payment receipts image processing obtained from the camera mobile devices. The main steps of the algorithm and the experimental results are presented.

Modern specialized optical character recognition solutions (OCR), developed by ABBYY or Nuance allow organizing complex optical input of financial documents with the help of special scanners or ordinary appliances for making digital images (such as a home scanner, a camera etc.). Despite the fact that all financial institutions try to get