REMOTE INFORMING THE USER
ABOUT WORK OF THE APPLICATION

Salamatin I.M., Salamatin K.M., Sinev M.A.

JINR, FLNP, Joliot-Kurie 6, Dubna, Moscow reg., 141980 Russia

Introduction

The need for the remote informing the user about events that occur during operation of the computer application that occurs in some cases: physical experiments with a large exposure time, the control of technological processes, pending the completion of work of computer programs, etc. In the case of long-running nuclear-physical experiments in the radiation environment, the operator is forced to leave the experimental room. There is a need to have the latest information about the experiment – about state of the installation and the recorded data because the absence or tardiness of this information may lead to partial loss of experimental data, samples, etc. In the case when the basic setting is a reactor or accelerator, the price of such losses is high.

Traditional and versatile way for remote information collection and management – is the use of computers and Internet tools. However, in this case, either the operator will be "bound" to a workplace with a computer, or there is a threat to the receipt of alarming information with delay. In this regard, we considered the possibility of using mobile devices to inform users about the status of the working application and the data. Currently there is a large range of such devices.

Considered the following ways of informing users via mobile devices:

1. SMS messages to mobile phones and tablet computers (tablets) that connect to a cellular network;
2. IM messages (Skype, Whatsapp, Viber, ICQ, Jabber, etc.);
3. a special mobile application running via PUSH notifications;
4. unified Web interface for mobile devices.

Each of these methods has its own advantages and disadvantages. The most rapid and corresponding to the large part of the users requests is a software solution that uses an SMS message. For detailed informing of users was implemented unified interface with remote data pre-processing.

The work is done for use when performing experiments at a Research nuclear installation IBR-2 and the accelerator IRENE in the Laboratory of neutron physics of JINR. However, this approach may be of interest when working with other applications.

1. Using a mobile phone

The use of mobile phones for information releases the user from routine duties of monitoring the condition of automatically operating program or system. To inform the user we developed software component SMSinformer which uses SMS messages. Component made in the form of an executable program, which can work in the next modes:

1. Console mode. The most simple in terms of integration of functions of SMS alerts in the existing software. In this mode, the program takes the parameters of the call type and the

event text, checks for "white" and "black" lists to filter events and is responsible for sending SMS messages if necessary.

2. Mode of program which is running concurrently with any application. In this case, the maximum composition of events, which can be transferred to a message is limited to the list defined in the programming component, and may be changed only by editing the component. Within the originally envisaged in the program list it is possible to prevent the transmission of a message about any of the events or to prevent re-transmission of similar messages.

3. Work within the software system for automation of experiments (SAE). The special means named DiCME [1] connect component SMSinformer to the complex of TySSA-system (*Typical Spectrometry System for Automation*) [2]. In this case, the composition of the transmitted information is determined by the composition of the events generated by the components of SAE, and the settings performed by the user of the system.

1.1. **In the first mode** we have opportunity to announce the following events:

1. "The system works". The message is transmitted at set intervals of time. If absent the next such message, it means stopping of the computer.
2. "Power reset". This message is transmitted when loosed the power of the IBR-2 reactor.
3. "Power restored".
4. "New file". Event indicates that a new file is recorded to the specified directory (when you configure a program, you specify the directory and file name extension).
5. "The file is lost". Event indicates that during of specified by settings time interval we have not received a new file.

Information about reset and restore reactor power is taken from the site of the nuclear Research facilities at IBR-2. At reset of the power of the IBR-2 dampers of neutron channels are automatically closed, and opening them requires the intervention of the commissioner of the experimenter. Therefore, timely information helps to reduce the loss of time using a basic installation.
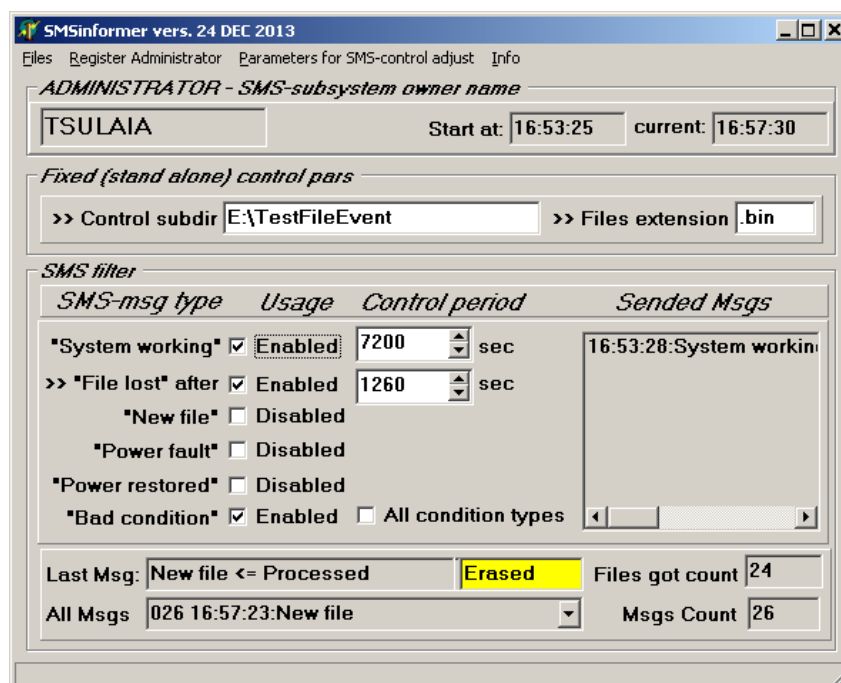

Fig. 1. The user interface window of the program SMSinformer.

Fig. 1 shows a user interface window used in customizing SMSinformer for operation in the first mode.

In the component SMSinformer use categories Administrator, Developer, Operator that allows you to send alarm information to the staff member whose participation in the normalization of the status of the application more effectively. Auxiliary window are for registration to potential subscribers, specifying their functions, the registration of the administrator in the payment system, etc. The text of the received SMS message contains the event type, the text and the sending time (may differ from time of message receipt) and have, for example, the following:

    From: +79251234567
    Date: 21/01/2015 19:56
    Text: <19:52; Warning>: File Lost

1.2. The second mode is intended for use with software SAE developed in accordance with the technology described in [1,3]. Such systems control the number of devices, which determine data recording conditions. Each device is responsible for a specific condition, the sum of terms (the number of the target enable or disable the polarization of neutrons, etc.) determines the status of the installation. As a rule, during the experiment, the data is registered with multiple states of the installation, determined by different conditions and their values. Therefore, failure in the formation of the specified conditions results in the loss of some data. Timely receipt of information about the device failure and the intervention of specialists in a number of cases allows to exclude such losses. Fig. 2 shows the algorithm for connecting of components to SAE.
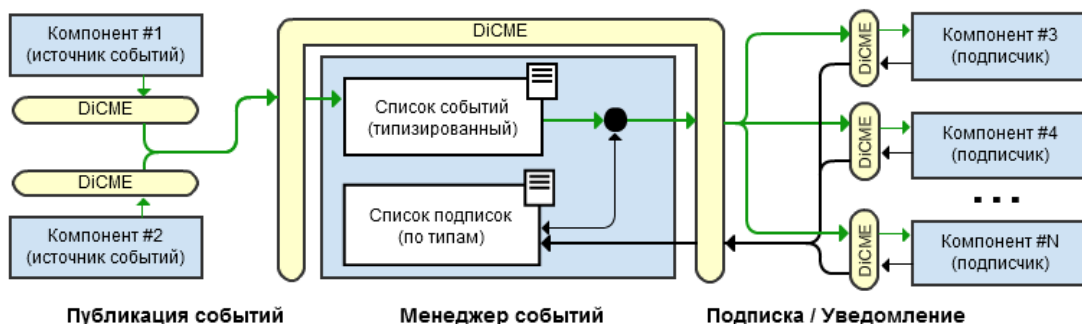

Fig. 2. The scheme of work of event Manager component in DiCME when performing auxiliary operations.

When you run a component SMSinformer it sends a broadcast message containing its unique identifier (GUID). DiCME receives this message and records SMSinformer in the registry of the active components. The next step SMSinformer sends to the event Manager, which is part of DiCME, user-configurable list of events that it will handle. When the event occurs (registration file, the error occurs in the work, etc.) component that logged the event sends information about it to the event Manager. Information about events that are "put up" SMSinformer is passed to as they arise.

2.   The use of remote data pre-processing

2.1.   The control algorithm of the spectra data. To verify the correctness of the recorded in the experiment data the visual inspection of their spectra in the general case is not enough.

An additional algorithm based on the accounting standard error of number of registered neutrons is used. On the axis of channel numbers range user can select an arbitrary number of intervals. For each spectrum obtained once the i-th measurement, component calculates the sum $S_{i,j}$ of samples of the j-th interval. Calculated relations:

$$Lt = m*S_{i,j}/S_{0,j}$$
$$St = m*S_{i,j}/S_{i-1,j}$$
$$M = M*J*S_{i,j}/S_{s,j}$$

Here $S_{s,j}$ is the sum of the spectra obtained in the J-th measurement, m is the normalization coefficient. The ratio Lt characterizes the "long-term" stability conditions of measurement, St – "short", M characterizes the compatibility of this measure with the total spectrum. The calculation is performed for all of selected intervals. In the case when the value

$$|Lt-L0| \text{ or } |St-St-1| > k,$$

where k is the standard error and it is set by the user, component generates a warning signal (event). As this signal is generated, a warning message is displayed and organized feedback from subsystem data logging without stopping data logging.

This simple algorithm allows for a series of consecutive measurements to identify files that have been measured with the unauthorized changes the efficiency of the detector, background radiation level, the division value of the energy scale, the output of the other influencing parameters within the limits of acceptable values, etc. effects, and exclude them from the final data.

2.2. User interface. The component can be loaded on a remote computer connected to the data logging subsystem with a known IP address and transferred to the automatic analysis. In this case, the protocol for joint analysis of data is provided to the user after the file is recorded.
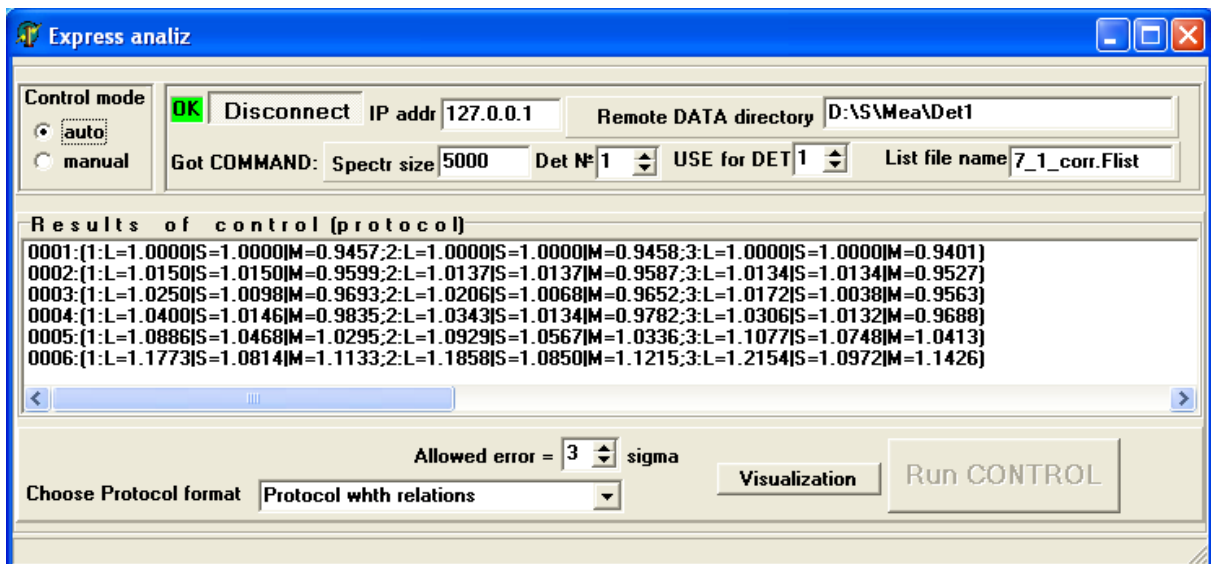

Fig. 3. The user interface component of the EA in the automatic mode of operation.

Fig. 3 shows the user interface for the automatic mode of control. The mode selection is done via the controls auto/manual in the field Control mode. To connect with program of experiment management, you should set its IP address (IP addr field) and press Connect. In case of successful connection will appear on the left label is OK on a green field.

To configure auto mode, the user sets the allowable deviation value k standard errors (pitch error Allowed) and a list of intervals of control. To compile the list of intervals of control and the formation of an archive of these lists can be used cursors software for visualization of spectra.

In the course of the experiment, this program results in the field of control (Protocol) presents the results of monitored data (one line for each file). Used 3 printing format control:

• protocol with '+ / - ' for each interval, the symbol '-' denotes the violation criteria specified in the field Allowed error;
• protocol with relations – contains normalized relations L,S,M;
• protocol with sum values – contains the values of the sums on the basis of which obtained the relations L,S,M.

2.3. The work of the EA component in dialog mode control. After the completion of the experiment and in-depth mathematical treatment of data, you may need a more thorough analysis of the data. For additional analysis and research methods for correction of reported results in the EA used interactive mode, which allows offline-mode to repeat the analysis for other control parameters.

A list of registered data files can be divided into two parts: used and removed from the analysis. As the process of analyzing the program opens additional controls. Given the opportunity to manipulate the contents of the file lists the individual measurements, amounts, visualize and save different combinations of individual files and file amounts received for edited lists. The names of files the program automatically generates and provides the ability to correct them.

Simultaneously with the explored list can be downloaded under "associate" list. All manipulations of editing will be performed synchronously over both lists. You can visualize and save the files and the files of the amounts provided and to the associated list.

Conclusion

Experience in the use of funds described in the experiments with spectrometers [4, 5] showed that message to mobile phone ensure minimal delay in receiving information, which is especially important in the case of failures in the operation of the devices forming the registration of experimental data. Other (mobile or stationary) devices are used for obtaining of detailed information about the event or data processing. The proposed means used to reduce loss of time of basic installation and to improve the reliability of recorded data. The work performed in the I. M. Frank LNP of, JINR.

Literature
1. *Salamatin K.M.* DiCME – distributed environment interaction components of the automation system experiments for low energy physics // Software engineering, 2014. No. 3, p. 3-11;

2. *Salamatin I.M., Salamatin K.M.* Network technologies in software systems automation of neutron spectrometry // journal of Applied Informatics, 2014. No. 5(53), p. 60-80.
3. *Ignatovich V.K., Salamatin I.M., Salamatin K.M., Senner A.E.* Automation of experiments in the field of neutron spectrometry with the use of web technology // Information technology, 2014. No. 12, c.63-68.
4. *Tsulaia M.I., Salamatin I.M., Sirotin A.P. et al.* The Kolkhida Setup Upgrade // "ISINN-21" (Alushta, Ukraine, May 20-25, 2013), Dubna, E3-2013-40. Dubna: JINR, 2013, p. 77.
5. *Enik T. L., Mitsyna L. V., Popov A. B. et al.* AURA Setup Testing at the IREN Neutron Beam // "ISINN-21" (Alushta, Ukraine, May 20-25, 2013), Dubna, E3-2013-40. Dubna: JINR, 2013, p. 33.