The Peerian Journal
Open Access | Peer Reviewed
Volume 18, May, 2023.
Website: www.peerianjournal.com
ISSN (E): 2788-0303
Email: editor@peerianjournal.com

Visualization Of Technological Processes For Management Purposes

R. Rahmonkulov[1]., Sh.T. Manshurov[2]
[1]Associate Professor of the Department of "Mechanical Engineering Technology" Tashkent State Technical University named after Islam Karimov, Almalyk branch, Uzbekistan.
E-mail: raimqul_raxmonqulov@yadex.uz
[2]Senior Lecturer of the Department of "Mathematics and Informatics" Tashkent State Technical University named after Islam Karimov, Almalyk branch, Uzbekistan.
E-mail: manshurov_sh@mail.ru

Annotation. This article is devoted to the application of specialized software for visualizing temperatures in technological processes. The article discusses the main tasks that can be solved using software tools, such as monitoring the temperature regime, identifying deviations, optimizing equipment operation, and others. In conclusion, it is noted that the development of technology for visualizing parameters in technological processes will contribute to increasing production efficiency, reducing the risks of emergency situations, and improving the quality of the products produced.

Keywords: temperature visualization, technological processes, specialized software, automation, data analysis, integration, production efficiency.

A literary review

Visualization of technological processes is one of the most important tasks of modern production. This method allows operators to control and manage technological processes in real-time and make prompt decisions in case of emergencies. Many researchers have addressed these issues, including A.V. Fedotov, A.I. Kuznetsov, A. Rudnev, V.A. Makarov, M.S. Tomashevich, and others [1,2,3].

The study by Makarov V.A. and Tomashevich M.S. "Visualization and analysis of temperature fields based on the Python software package" [4] explores the study of temperature fields using the mathematical method of temperature field propagation.

All of these problems can be solved by using specialized programs that allow for easy collection, processing, and visualization of temperature data in real-time. There are currently many software packages available to address these issues, including:

ThermoDAT - a program developed for the visualization and analysis of thermal data, which can be used in metallurgical processes.

Thermo-Calc - a program used for modeling the thermodynamic properties of metallic systems, visualizing their changes with changes in temperature, and more.

Main Part

The Peerian Journal
Open Access | Peer Reviewed
Volume 18, May, 2023.
ISSN (E): 2788-0303
Website: www.peerianjournal.com
Email: editor@peerianjournal.com

It is known that the problem of visualizing technological processes, including monitoring and displaying numerical values of certain parameters, can be caused by various factors, including difficulty accessing data, the need to use different file formats for data storage, incompatibility between different visualization systems, and network bandwidth limitations.

This article considers the use of specialized programs for visualizing temperatures in technological processes. They have several advantages. Firstly, such programs provide more accurate and reliable data display than traditional visualization methods, such as manually drawing graphs or using standard graphics editing software. Secondly, specialized programs can provide additional features, such as data analysis, report generation, and process automation, which significantly increases work efficiency. In addition, such programs have a simple and user-friendly interface, and there is no need to have special programming or data processing skills.

It is known that currently, the factors affecting technological processes are taken into account on a scientific basis, and there are many publications. However, all these developments are applied to technological processes to a limited extent for various reasons and remain unimplemented. Suppose we know the functional dependence of certain parameters in technological processes and control the process based on these regularities.

The features of software for visualizing parameters in technological processes may vary depending on the specific program. However, in general, such programs should have the following functional capabilities:

Data collection and storage: The software must be able to collect parameter data from various sensors and store it in a database.

Data visualization: the software should be able to display data on the numerical values of the parameters in an easy-to-understand format, for example, in the form of graphs or digital form.

Process control: The software should be able to control the process based on parameter data, such as automatically adjusting the pressure and temperature dependences according to the set parameters.

Data analysis: The software must be able to analyze the data, for example, identify dependencies between parameters and provide statistical reports. 5

Warning system: the software should be able to alert operators to possible problems in the process, for example, to signal the deviation of parameter values from the set values. 6

Integration with other systems: The software must be able to integrate with other systems, such as product management and quality control systems, to ensure data consistency and process control.

Data security: The software must ensure data security, for example, by protecting against unauthorized access or data loss in the event of a system failure.

Scalability: Software must be able to scale based on the amount of data and hardware capacity to operate efficiently in any environment.

The prospects for the development of technology for visualizing parameters in technological processes with the help of special programs are enormous. In today's world, more and more companies are striving to automate their production processes and improve work efficiency. In this context, the use of programs to visualize parameters is becoming more and more popular. Let us consider the above phrases on the example of studying the temperature dependences of the process. Such problems often arise in metallurgy, chemical technology and other technological processes. Below is one of the options for controlling the technological process using a program, the algorithm

The Peerian Journal
Open Access | Peer Reviewed
Volume 18, May, 2023.
ISSN (E): 2788-0303
Website: www.peerianjournal.com
Email: editor@peerianjournal.com

of which is compiled using functional dependence based on mathematical justifications. The block diagram of this algorithm is shown in Figure 1.

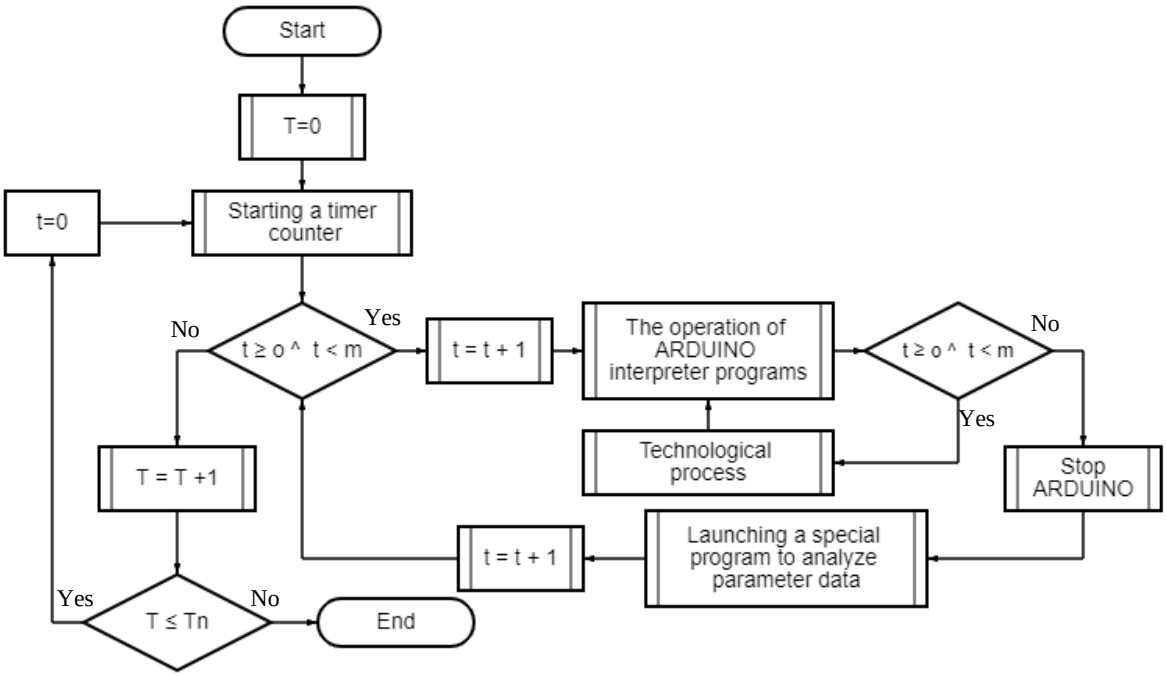

Figure 1. Block diagram of automatic control of technological processes based on scientific research.

The algorithm logic is as follows:
Launch the main timer, during which the technological process takes place;
Launch the secondary timer, which is triggered to replace the measurement parameter sampling based on technological logic;
Launch the measurement of the parameter with the transmission of numerical values of the technological process with recording on an external computer storage device.
At the end of the time for recording numerical parameter values, the program stops and transfers control to the program that analyzes the functional dependence. If the process is proceeding normally, that is, the deviation is within the permissible limit, then signal 1 (norm) is issued, otherwise, signal 0 warns of a deviation of the technological process from the norm. Here, together with the signal, the technological process can be continued or stopped. Below are the results of the process on the example of the ammonium dichromate decomposition reaction.
Below are the results of the process based on the example of the ammonium dichromate decomposition reaction.

The Peerian Journal
Open Access | Peer Reviewed
Volume 18, May, 2023.
ISSN (E): 2788-0303
Website: www.peerianjournal.com
Email: editor@peerianjournal.com

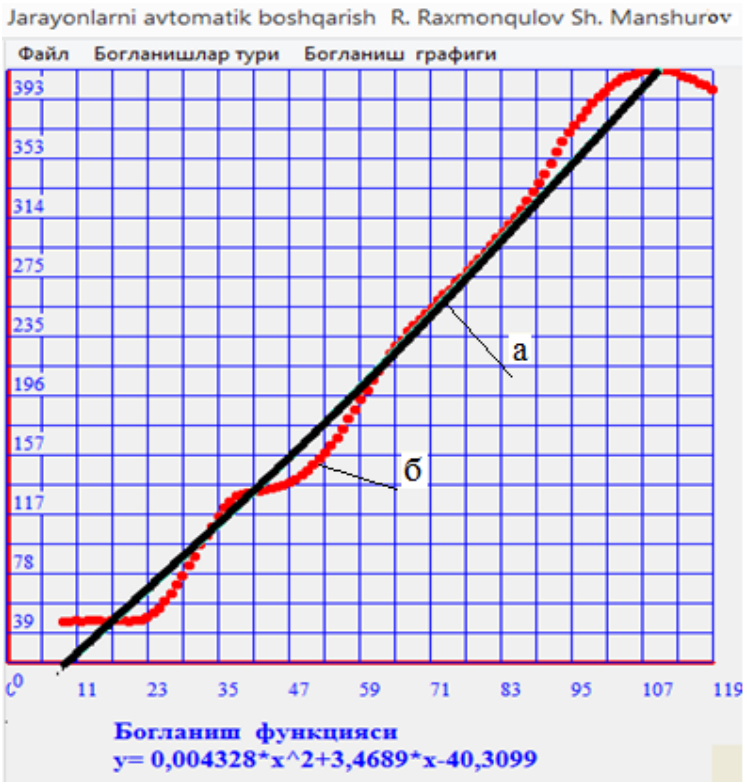

Figure 2. Combustion process: a) functional dependence found by the method of least squares $y(t) = 0.004328t^2 + 3.4689t - 40.3099$; b) graph of temperature changes in real time.

The Peerian Journal
Open Access | Peer Reviewed
Volume 18, May, 2023.
ISSN (E): 2788-0303
Website: www.peerianjournal.com
Email: editor@peerianjournal.com

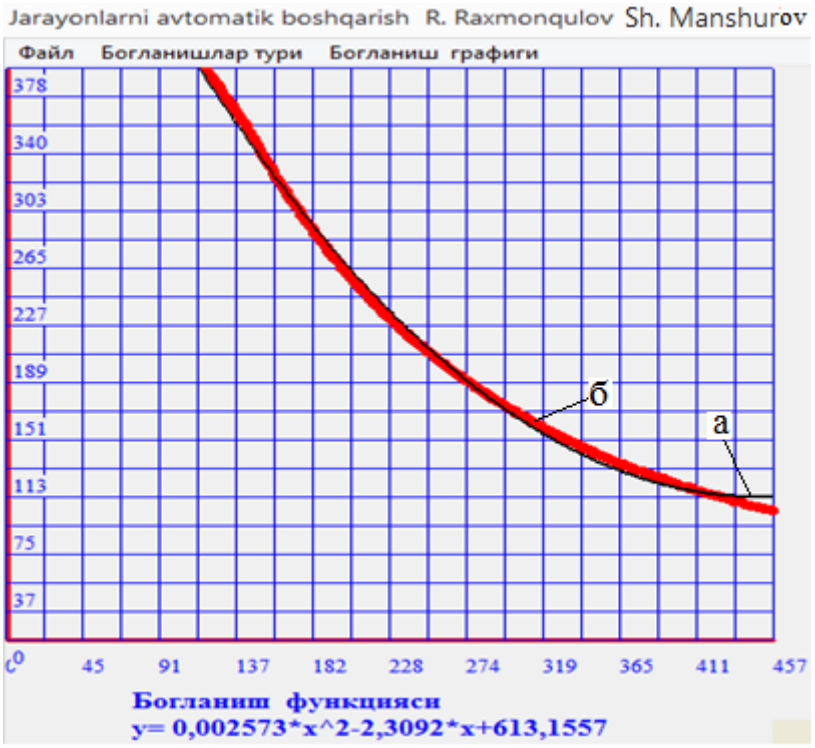

Figure 3. Cooling process: a) functional dependence found by the method of least squares $y(t) = 0.002573t^2 - 2{,}3092t + 613.15573099$; b) real-time temperature change graph.

The Peerian Journal
Open Access | Peer Reviewed
Volume 18, May, 2023.
ISSN (E): 2788-0303
Website: www.peerianjournal.com
Email: editor@peerianjournal.com

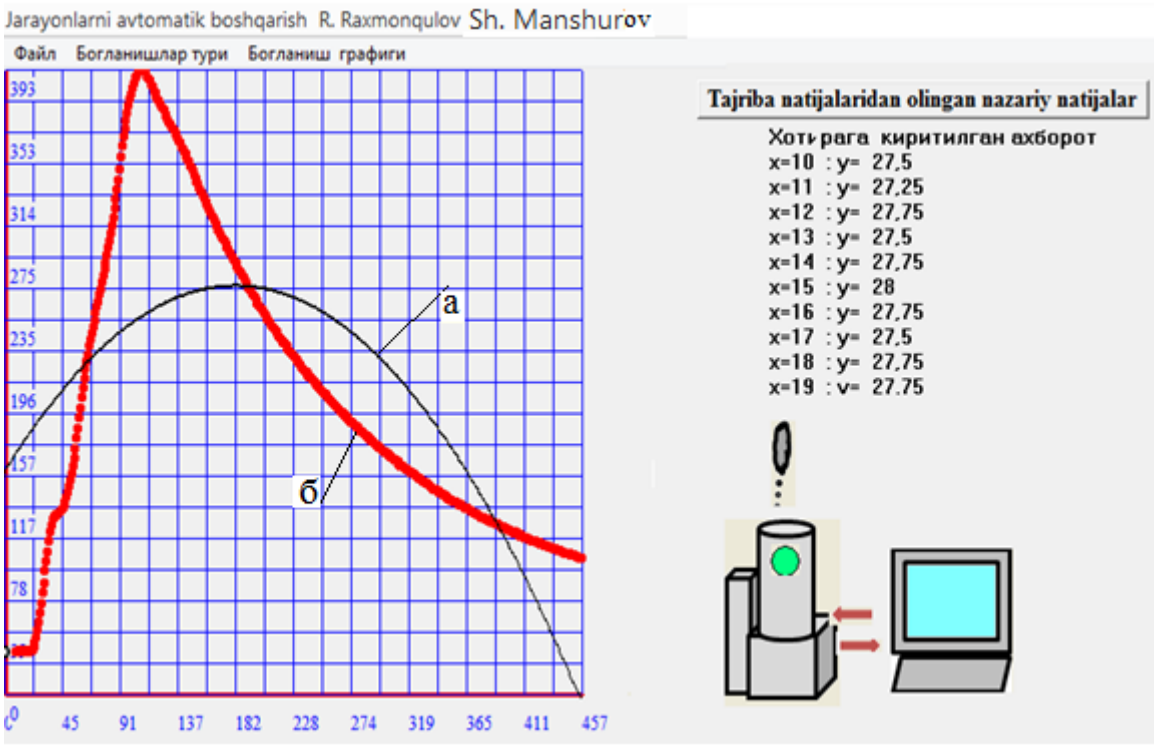

Figure 4. Average process of the decomposition reaction of ammonium dichromate, which is described by the functional dependence

$(t) = -0.003498t^2 + 1.2896t + 138.7565$

Figure 2 shows that during the combustion process of the ammonium dichromate decomposition reaction, there were deviations in some time intervals. As expected, the cooling process proceeded normally (Figure 3). Figure 4 shows the overall process of studying the reaction for further application of automatic control of the combustion process in the ammonium dichromate decomposition reaction.

Conclusion

Visualization in technological processes using specialized programs has several advantages, such as improving process control and monitoring, increasing efficiency and accuracy, as well as the ability to quickly detect problems and prevent emergencies. Thanks to the use of specialized visualization software, it is possible to automate data collection and analysis processes, which increases efficiency and accuracy of work.

References

1. Fedotov, A.V., & Kuznetsov, A. I. (2018). Development of a system for visualizing temperature fields in laser processing of materials based on the LabVIEW platform. Bulletin of Omsk State Technical University, (3), 38-44.

The Peerian Journal
Open Access | Peer Reviewed
Volume 18, May, 2023.
ISSN (E): 2788-0303
Website: www.peerianjournal.com
Email: editor@peerianjournal.com

2. Rudnev, A. (2016). Development of software for visualization of the temperature field of the human body based on thermographic camera. Abstracts of the international conference "Science and Youth".
3. Makarov, V. A., & Tomashevich, M. S. (2021). Visualization and analysis of temperature fields based on the Python software package. Systems and Means of Computer Science, 31(1), 69-81.
4. Isomatov, Y. P. L. (2022). RICHAGLI MEXANIZMLARNI LOYIHALASHDA, KINEMATIK XARAKTERISTIKASINI MATEMATIK MODELLASHTIRISH DASTURI. *Scienceweb academic papers collection*. https://www.ima.uz/Softs/Certificate?B210_APPL_NUMBER=20225072&TRACKING_CODE=807910032187e48ab8ae5e3199c4baa1&Certificate=True
5. Demchenko, S. V., & Kalinkin, V. I. (2019). Software for monitoring and visualization of the temperature regime during the design and operation of electrical equipment. Bulletin of Electromechanics, (3), 37-43.
6. Muravyev, I. V., & Tatarenko, A. I. (2017). Development of software for visualization of temperature fields during electric arc welding. Youth Scientific Bulletin, (3), 17-20. ISSN (E): 2720-5746 Page 171 -177.
7. R. Rakhmonkulov. About one task of compiling an algorithm of programs to create a problem situation in the educational process. European Journal of Interdisciplinary Research and Development. Volume-13 Mar. – 2023.Website: www.ejird.journalspark.org
8. Mirzakhmedov R. M., Rakhmonkulov R., Madusmonova N., Abdurakhmanova M. M., a program for sorption spectroscopic detection of rhenium ion in industrial wastewater. Registered in the state register of software products of the Republic of Uzbekistan dated 26.03.2022. № DGU 15286.
9. Suleymanova D. B., Rakhmonkulov R. To apply graphical information in a computer program, a program for converting it into numerical information. Registered in the state register of software products of the Republic of Uzbekistan dated 06.12.2022. № DGU 19992.
10. Raimkul Rakhmonkulov, Dildora Sulaymanova. The use of analytic geometry in the design a statics problem. European Scholar Journal (ESJ) Available Online at: https://www.scholarzest.com Vol.2 No. 11, November 2021 ISSN: 2660-5562
11. Sh.T. Manshurov, U.A. Utabov, A.Sh Abduganieva. Processing temperature data in C++ and saving to a file. Eastern Renaissance: innovative, educational, natural and social sciences. Toshkent, 2023, volume 3, No. 2.