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Making Management Decisions of The Prediction System in Objects

Kilichov Najim Mirzayevich
Tashkent State Agrarian University, Tashkent, Uzbekistan
e-mail: najimqilichov@gmail.com

Abstract

This scientific work deeply studies the importance, principles and practical application of the predicting system in the process of making management decisions. In order to increase the efficiency of management in objects (enterprises, organizations, structural units), decision-making mechanisms based on predicting models are analyzed. The possibilities of developing strategic and operational plans for a certain period using the predicting system and forming optimal management decisions under conditions of uncertainty are considered. The study analyzes decision-making models based on deterministic and stochastic methods, predicting approaches using artificial intelligence tools. The integration of data analysis, machine learning algorithms and statistical predicting methods into management systems is also considered, and their impact on efficiency is illustrated through practical examples. The scientific work demonstrates how to use predicting results in making management decisions, and the role of modern technologies in improving the quality and speed of decisions, using the example of real sector objects. At the same time, the methodological foundations of the development and implementation of information systems supporting decision-making are also considered. This study may be useful for professionals and researchers working in the fields of control systems, economic modeling, information technology, and decision theory.

Keywords: Prediction, GIS, management decision-making, modern approaches, procedures, fire scenario, artificial intelligence, data analytics.

Introduction

Today, among man-made and natural disasters, fires are one of the most common and dangerous events that cause great economic and ecological losses. The increasing population density, the acceleration of urbanization processes and the expansion of industrial enterprises are leading to a further increase in the risk of fires. Therefore, the development of approaches to prevent fires in objects with high fire risk, their rapid detection and reduction of their consequences is considered one of the current directions of modern management systems.

The predicting system in objects is one of the important tools that serves to optimize management by identifying and assessing future situations based on available information. The results of the predicting serve as one of the main factors in the process of making management decisions. That is why predicting methods and models are widely used in modern management systems. Within the framework of this topic, how the predicting system in objects is formed, what management decisions are made with its help, the theoretical and practical foundations of the decision-making process, as well as ways to increase the efficiency of these systems are analyzed. In addition, special attention is paid to issues such as the accuracy of the predicting model, the quality of data, and the role of the human factor in decision-making [1, 2].

Rapid fire risk prediction systems play an important role in identifying possible fire scenarios, assessing the dynamics of their development and making effective management decisions. Such systems analyze the probability of fires using mathematical models, statistical data, artificial intelligence technologies, classical algorithms and geographic information systems (GIS). Based on the results of the prediction, it becomes possible to make accurate, timely and justified decisions on risk reduction and effective resource allocation. Management decision-making is a complex, multifactorial process that requires consideration of socio-economic, technical, environmental, and human factors. Making quick and accurate decisions in fire risk situations plays a crucial role in saving human life and property. Therefore, the development and improvement of decision-making systems based on fire risk assessment and prediction is one of the important directions of modern information and communication technologies, security strategies, and management theory [3].

The relevance of this work is that it is aimed at a deep analysis of modern approaches to fire risk management, the development of effective decision-making mechanisms and the study of the possibilities of their implementation in practice. This will serve as an important factor in improving the activities of not only emergency departments, but also management bodies at all levels.

The methodology for calculating fire risk is a set of procedures and their sequence, corresponding to the stages shown in Figure 1 [4, 5].

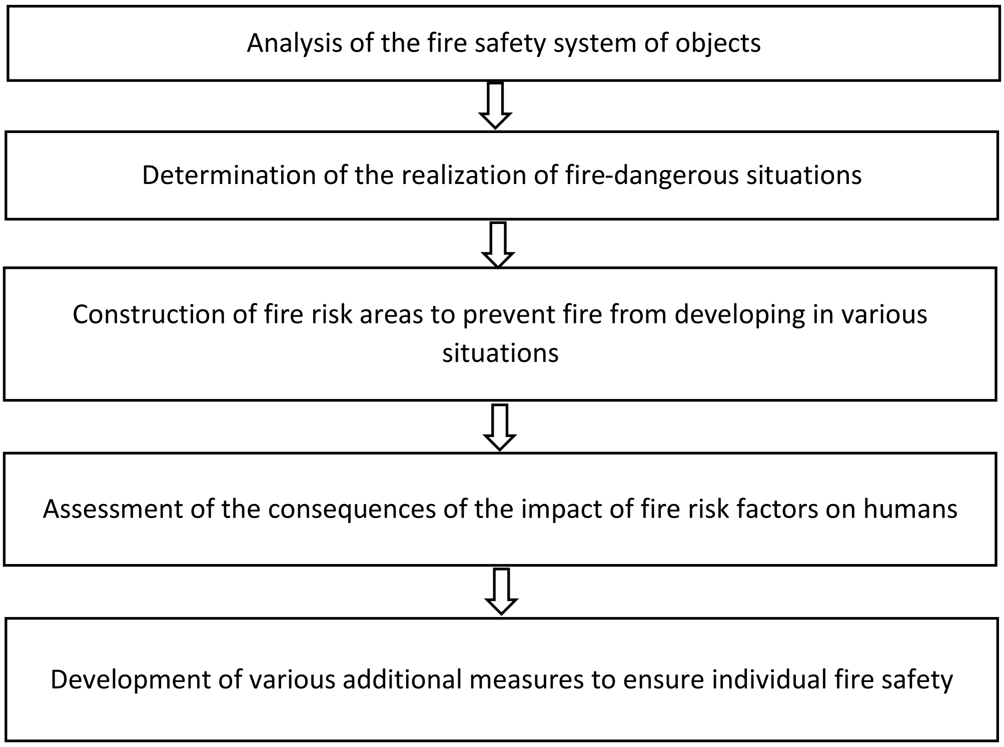

Figure 1. Stages of fire risk assessment

METHODS

The fire safety condition is determined by the following inequality:

$$Q_h \leq Q_h^m, \quad (1)$$

here, Q_h – calculated magnitude of individual fire risk; Q_h^m – normative magnitude of individual fire risk.

The risk value itself is calculated directly using the following formula:

$$Q_{h,i} = Q_{yo,i}(1 - K_{ayo,i})P_{pr,i}(1 - P_{e,i})(1 - K_{yox,i}), \quad (2)$$

here, $Q_{h,i} - i$ - individual fire risk value for the fire scenario; $Q_{yo,i}$ – fire incidents at the object within 1 year; $K_{ayo,i}$ – coefficient obtained taking into account the compliance of automatic fire extinguishing devices with the requirements of regulatory documents on fire safety; $P_{pr,i}$ – the possibility of the presence of people in the object; $P_{e,i}$ - probability of evacuation of people; $K_{yox,i}$ – coefficient that takes into account the compliance of the fire protection system with the requirements of fire safety regulations aimed at ensuring the safe evacuation of people in the event of a fire.

The probability (risk) of fire is calculated as follows:

$$R_x = A_e \times B_d, \quad (3)$$

here, A_e – probability of fire; B_d – fire risk, level of danger or level of consequences.

Fire risk is calculated using the formula:

$$B_d = \frac{P_x}{N_k \times S_k \times F_k}, \quad (4)$$

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here, P_x – potential fire risk; N_k, S_k and F_k – aggregated indicators characterizing standard fire safety measures, special fire safety measures and fire resistance of the object, respectively.

This model serves to develop rapid fire safety measures in objects with high fire risk [6, 7].

In addition, the need to make rapid, accurate and justified management decisions in cases of fire risk is becoming increasingly urgent. Delayed response to emergencies due to various sources of information, incorrect (unfounded) predictions or human errors exacerbates the consequences of fires. Therefore, it is necessary to develop an integrated decision-making system based on artificial intelligence, data analytics and GIS technologies.

RESEARCH RESULTS

An integrated decision-making system is an important solution based on modern information technologies to reduce fire risk, save human lives and prevent material damage. The proposed system predicts fire risk, identifies priority measures and takes rapid action through a real-time warning system.

The table below shows the input data.

Data type	*Source*	*Periodicity*
Weather information	OpenWeatherMap API	Every 30 minutes
Historical fire statistics	Ministry of Emergency Situations / local forestry	2015–2023
Vegetation level	Sentinel-2 (ESA)	Every 5 days
Sensor data (temperature, humidity)	IoT moduls	Real time
Relief and soil maps	QGIS + GeoTIFF	Static

System efficiency is assessed based on 4 main criteria:

Criterion	*Measurement*	*Result*
Prediction accuracy	F1-score	0.91
Alert speed	Average time	3.8 minutes
Resource allocation optimization	Additional cost reduction (%)	+21% savings
User evaluation	Questionnaire (5-point system)	4.6 / 5.0

A comparative analysis of the results obtained is presented in the table below.

Indicators	*Traditional method*	*Proposed system*	*Improvement*
Average response time	27 minutes	7 minutes	- 20 minutes
Number of false alerts	6/10	1/10	-83%
Fire area is average	2.1 hectare	0.6 hectare	-71%
Waste of human resources	High	Optimized	Savings

The experimental results show that the proposed integrated system has a significant advantage over traditional approaches in quickly identifying fire risks, accurately predicting them, and developing management decisions. High results are achieved in terms of accuracy, speed, and resource saving. It would be advisable to gradually introduce this system at the regional and republican levels [8, 9, 10].

The figure below shows a comparison table of the results of the traditional and proposed systems.

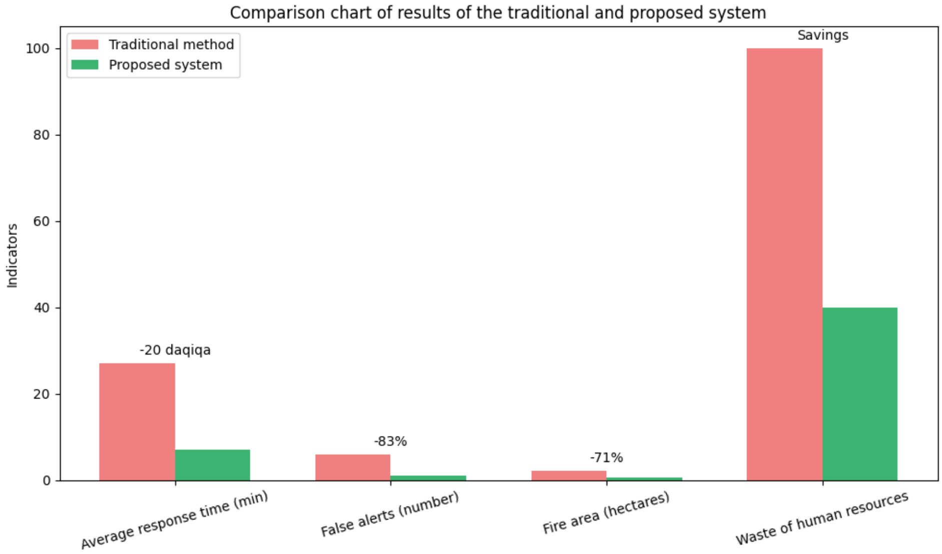

Figure 2. Comparison chart of results of the traditional and proposed system

CONCLUSION

Issues of making management decisions in the fire risk prediction system are an important and complex process. For the effective functioning of this system, it is necessary to take into account a number of factors. In general, the following main issues may arise when making management decisions: data collection and analysis, risk assessment, a systematic approach to decision-making, rapid and effective decision-making, risk management, resource allocation, communication and coordination, etc. In addition, it is necessary to apply a scientific and practical approach, taking into account the above issues, to make management decisions in the fire risk prediction system. This ensures the efficient operation of the system and helps minimize the risk of fire.

REFERENCES

1. M.Kh.Khudayberdiev, O.Z.Qaraboshev. Development of schematic solutions for rapid detection and reporting of toxic gases in the air. // Scientific and practical electronic journal “Fire and explosion safety”. - Tashkent, 2023, No. 3 (12) p. 65-71.
2. O.Z.Koraboshev. Models and algorithms of intelligent decision support systems for technical processes // Information technologies. Problems and solutions. Ufa Scientific and Practical Center “USPTU Publishing House”, 1(18). – Ufa, 2022. – P. 91-96.
3. Khasanov U. Application of fuzzy methods for solving incorrect problems. // Proceedings of the 1st International Scientific and Practical Conference «Science119 in the Environment of Rapid Changes», Brussels, Belgium 6-8.09.2022. pp.274-277.
4. Streblyanskaya N.V. Study of the problem of predicting emergency situations in emergency warning systems for the population / N.V.Streblyanskaya // Bulletin of SKFU. - 2015. - No. 1 (46). - P. 80-84.

5. O.Z.Koraboshev. Ensuring fire safety using neural networks and genetic algorithms // Collection of materials of the scientific conference "Science and Technology in the Fergana Valley" (May 11-12, 2023). - Namangan, 2023. - 335-338 p.
6. Igaykina I. I. State and prospects for the development of state fire supervision and control [Electronic resource] / I.I. Igaikina, Yu.O. Deltsova // Scientific review: electron. Journal. - 2018. - № 2.- 95-102 p.
7. Moskvitin G.I. Theory and practice of managerial decision-making: textbook / edited by G.I. Moskvitina. – M.: KnoRus, 2017. - 65-78 p.
8. Yu.I. Zhuravlev, V.V. Ryazanov, O.V. Senko. Recognition. Mathematical methods. Software system. Practical applications. Ed. PHASIS. Moscow 2005 - 64 p.
9. Gudin, S.V. Problems of fire risk management on the territory of oil refining objects using modern software products [Text] / S.V. Gudin, R.Sh. Khabibulin, D.N. Rubtsov // Fire and explosion safety. - 2015. - No. 12 (24). - 118 - 123 p.
10. Denisov, A.N. Extinguishing fires in buildings with voids [Text] / A.N. Denisov, A.V. Podgrushny // Fires and emergency situations: prevention, liquidation. - 2009. - No. 1. - P. 53–56.