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DEVELOPMENT OF AN ALGORITHM FOR CREATING SOFTWARE USING THE METHOD OF CALCULATING THE FORCES AND MEANS REQUIRED TO EXTINGUISH A FIRE BY A VOLUMETRIC METHOD

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ANNOTATION

The article provides information about scientists who conducted scientific research on the development and implementation of methods for calculating the forces and means required to extinguish a fire, creating a control system for forces and means at the scene of a fire. Furthermore, the data used in the development of the algorithm for creating software is presented. "The developed algorithm for creating software using the method of calculating the forces and means required to extinguish fires related to the release of flammable and flammable liquids to the ground is presented. The methodology for calculating the forces and means required to extinguish a fire by a volumetric method and the sequence of its inclusion in the software are also shown on the example of the performed computational operations.

KEYWORDS: *fire, emergency, computer programs, methods for calculating forces and resources,*

INTRODUCTION

Today, large-scale scientific research is being conducted all over the world to find scientific and technical solutions to existing problems in improving firefighting. In this regard, various modern firefighting techniques, equipment and devices, liquid and powder fire extinguishing agents obtained from local raw materials are being used in firefighting practice. In order to eliminate the fire in a short time with minimal losses, great attention is paid to the correct and rapid calculation of the forces and means required for extinguishing the fire.

LITERATURE REVIEW

In-depth scientific research is being conducted abroad on the development and practical implementation of computer programs for calculating forces and means for eliminating emergency situations and extinguishing fires. Research on the development and practical application of methods for calculating the forces and means required for extinguishing a fire was carried out by Ivannikov V.P., Klyus P.P., Terebnev V.V., Podgrushniy A.V., Grachev V.A., Terebnev A.V., Smirnov V. A., Semenov A.O. and others [1-8]. Research on the creation of a system for controlling forces and means at the scene of a fire was carried out by Kimstach I. Y., Devlishev P. P., Yevtyushkin N. M., Blinov S.N., Saulova T.A., Terebnev V.V., Bondarenko M.V., Danilenko A.S., Povzik Y.S. and others [9-14].

Research on the development and implementation of computer programs for calculating forces and means for eliminating emergencies and extinguishing fires, methods for calculating the forces and means required for extinguishing fires, and the creation of a system for controlling forces and means at the scene of a fire were carried out by A.H. Kulodoshev, E.E. Sabirov, S.S. Sultanov, M.B. Musakhodzhiev, K. Nortillayev, S.T. Zuparov and others [15-20]. As a result of these studies, certain positive results were achieved in the direction of improving the methods for calculating forces and means for eliminating emergencies and extinguishing fires. However, research on the creation of software using the method of calculating the forces and means required for extinguishing fires in a volumetric manner using information technologies has not been carried out to a sufficient extent.

RESEARCH METHODOLOGY

The algorithm for creating the software was developed using the following data: the required consumption of the foaming agent mixture, the number of GPS-600 medium-duty foam generators required to provide the amount of foaming agent mixture, the required amount of foaming agent, taking into account the reserve for the successful elimination of burning petroleum products, the number of fire trucks delivering the foaming agent to the fire scene, the total amount of water required to extinguish the fire, the number of protective devices to be deployed to prevent the fire from spreading to other adjacent buildings and structures, the total water consumption required for fire extinguishing and protection, the water supply of the enterprise, the number of personnel and crews required to extinguish the fire, and other information.

Conducted research and their discussion. Air-mechanical foam has the necessary amount of stability, fine particles, viscosity, cooling and insulating properties to extinguish solid materials and liquids, volumetric filling of the burning room (with medium and high-expansion foam) and surface fire extinguishing. SVP (SVPE) air-foam nozzles are used to

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deliver low-expansion foam, and GPS foam generators are used to deliver medium and high-expansion foam. Volumetric fires are characterized by the rapid impact of heat fluxes on obstacles. For fires controlled by ventilation, a gas layer consisting of smoke gases is formed between the torch flame and the surface of the obstacle, the combustion process develops under an excess of oxygen in the air and approaches the conditions of fires in open space. For fires controlled by a combustible load, there is no gas layer consisting of smoke gases between the flame and the obstacles.

Therefore, air-mechanical foam is used to extinguish the fire in a volumetric way. Medium-density air-mechanical foam has the necessary stability, fine particles, viscosity, cooling and insulating properties to extinguish solid materials and liquids, fill the burning room volumetrically (with medium and high-density foam) and extinguish the fire along the surface, and GPS foam generators are used to deliver this foam.

The volumetric fire extinguishing method is used in pumping stations, cable tunnels, subways, basements with a complex structure, and to fill a burning reservoir with foam. The calculation of the required number of forces and means is carried out based on the volume of the room and the standard time for extinguishing the fire, using a coefficient that takes into account the deformation of the foam as it moves through the room.

The method for calculating the forces and means required for extinguishing a fire by the volumetric method was introduced into the software in the following sequence, and the software performs the calculation operations in the same sequence:

1. The number of generators required for extinguishing a fire by the volumetric method is determined:

$$N_{GPS\text{-}600} = V_{yerto'la} / V^{o'chir.}{}_{GPS},$$

here: $V_{basement}$ - length, width and height of the basement section, m; $V^{delete}{}_{GPS}$ - volume filled with foam using one GPS-600 generator [16; 146-p.].

2. The amount of foaming agent required to extinguish a fire is determined by:

$$V_{khqm} = N_{GPS\text{-}600} \cdot Q^{khqm}{}_{GPS} \cdot 60 \cdot \tau_{o'chir.vaqti},$$

here: $N_{GPS\text{-}600}$ – Number of GPS-600 generators required to extinguish the fire; $q^{GPS}{}_{khqm}$ - The foaming agent transfer consumption of the GPS-600 generator, l/s [16; 146-p.]; $\tau_{o'chir.vaqti}$ - Estimated time to extinguish the fire, minutes [16; 77-78-p.]; $k^{zaxira}{}_{khqm}$ - reserve coefficient of foaming agent required to extinguish a fire, hours [16; 76-77-p.]; 60 - Convert minutes to seconds.

3. The actual water consumption required to extinguish a fire is determined:

$$Q^{water}{}_{in\ practice} = N_{GPS\text{-}600} \cdot Q^{water}{}_{GPS},$$

here: $q^{water}{}_{GPS\text{-}600}$ - Water transfer consumption of GPS-600 generator, l/s [16; 146-p.].

4. The water supply of an enterprise is determined in 2 ways:

Method 1: If there are fire hydrants on the premises of the enterprise:

$$Q^{ring}{}_{pipe} = (V_{water} \cdot d_{branch})^2.$$

Here: V_{water} – speed of water movement through the pipe, m/s [16; 159-p.]; d_{branch} – diameter of water pipe, mm.

If it is $Q^{ring}{}_{pipe} > Q^{water}{}_{general}$, the object is considered to be supplied with water, if it is the opposite, it is considered not supplied with water.

Method 2: if there are water pools on the premises of the enterprise:

$$W_{demand} = Q_{delete\ request.} \cdot 60 \cdot \tau_{shutdown\ time} \cdot K_{reserve}.$$

Here: $Q_{delete\ request.}$ - amount of water required to extinguish a fire, l/s; 60 - convert minutes to seconds; $\tau_{shutdown\ time}$ – Estimated time to extinguish the fire, minutes [16; 77-78-p.]; $k^{water}{}_{reserve}$ - Water reserve coefficient in relation to the calculated amount for extinguishing a fire [16; 76-77-p.].

If $W_{demand} < 0{,}9\ W_{demand}$, then there is enough water to extinguish the fire, otherwise there is not enough water to extinguish the fire.

$$W_{demand} < 0{,}9 \cdot W_{(reservoir)}.$$

Here: 0,9 – coefficient indicating that the remaining 10% of the water in a pond cannot be withdrawn [16; 205-p.].

5. The number of personnel required to extinguish the fire is determined:

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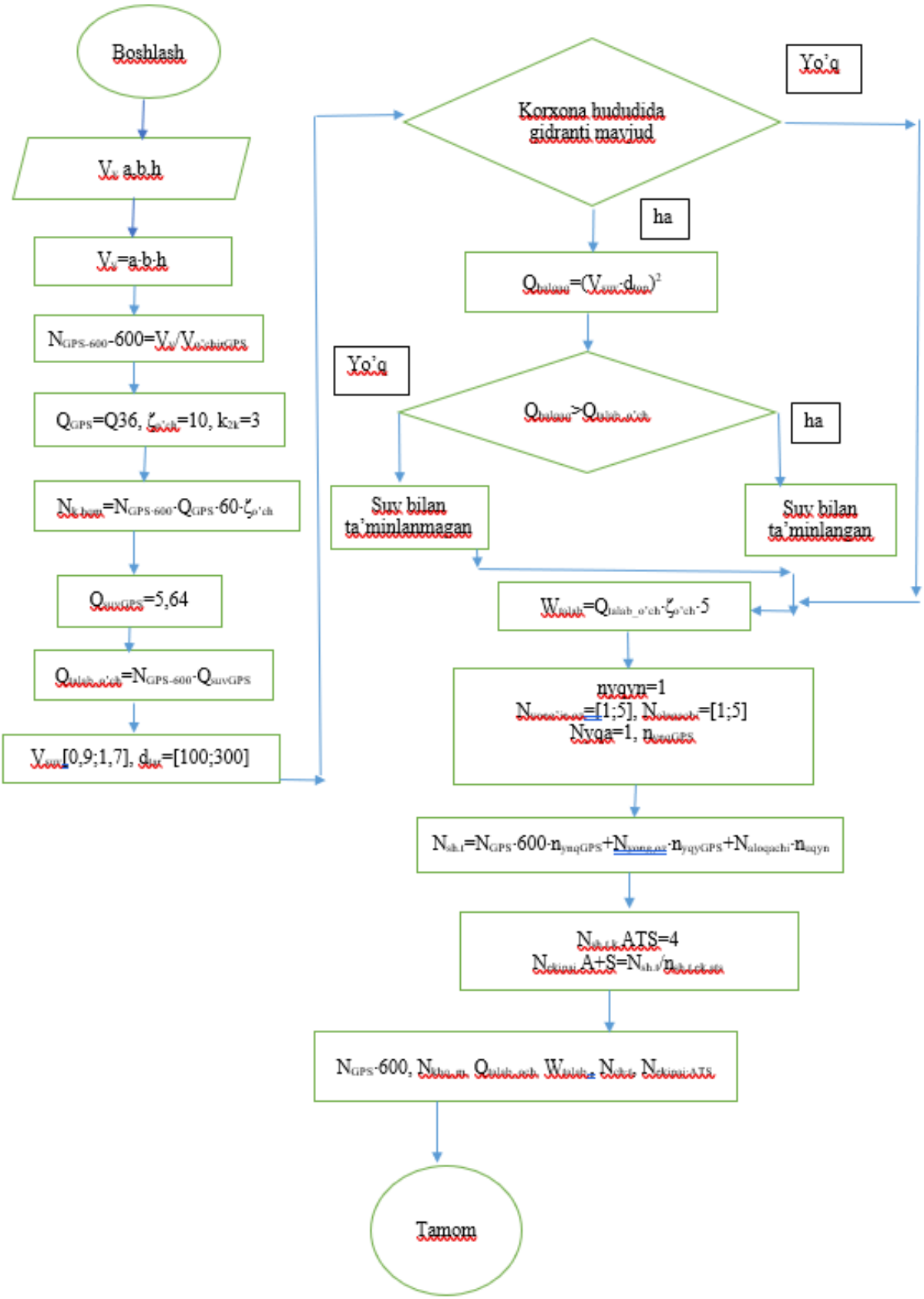

Figure 1. An algorithm developed to create software using the method of calculating the forces and means required to extinguish a fire using a volumetric method

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$$N_{sh.t.} = N_{GPS\text{-}600} \cdot n_{human} + N_{yeng.naz.} \cdot n_{odam} + N_{communicator} \cdot n_{human}.$$

Here: $N_{GPS\text{-}600}$ – Number of GPS-600 generators required to extinguish the fire; n_{human} – number of personnel working with the lever [16; 208-p.]; $n_{yeng\ nazorat}$ – The number of personnel, forces, and assets controlling the lanes is determined by the number of lanes in the lane. [16; 208-p.]; $n_{communication.}$ – the number of communicators [16; 208-p.].

6. The number of crews required to extinguish the fire is determined:

$$N_{ekipaj\ ATS} = N_{sh.t.} / n_{sh.t.\ ek\ ATS}.$$

Here: $n_{sh.t.\ ek.\ ATS}$ – The number of personnel in a tanker truck, the garrison's combat budget is mainly concentrated in firefighting tanker trucks, therefore the average number of personnel in one crew is assumed to be 4 people. [16; 210-p.; 1; 91-p.].

An algorithm was developed based on the above formulas. The algorithm is shown in Figure 1.

CONCLUSION

In the fourth paragraph, entitled "Development of software using a method for calculating the forces and means required to extinguish fires associated with the spillage of flammable and combustible liquids on the ground," an algorithm for developing software based on a method for calculating the forces and means required to extinguish fires associated with the spillage of flammable and combustible liquids on the ground and software based on it are created.

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