ПРИЛОЖЕНИЕ НА ТЕЛЕМЕТРИЧНИ ПОЖАРНИ ХИДРАНТИ ЗА МОНИТОРИНГ НА ВОДОСНАБДИТЕЛНИ И ПОЖАРОГАСИТЕЛНИ СИСТЕМИ

Ангел Илиев Ушев

Докторант ВСУ „Черноризец Храбър“

Резюме:

В статията е представена концепция на система за мониторинг на противопожарни водоснабдителни системи на базата на телеметрични пожарни хидранти. Подчертано е, че изследваната технология за мониторинг гарантира готовността на противопожарните водоснабдителни системи и предупреждава специализираните органи, когато пожарните хидранти не са във функционално състояние. Посочено се, че системата за мониторинг осигурява динамични данни, използвани за вземането на своевременни решения. Приложението на системата за мониторинг в службите по ПБЗН и ВиК позволява да се оцени и прогнозира състоянието на противопожарните водоснабдителните системи и се оптимизират хидравличните модели.

Ключови думи: противопожарни водоснабдителни системи, мониторинг, хидравлични модели, телеметрични хидранти

APPLICATION OF TELEMETRIC FIRE HYDRANTS FOR MONITORING OF WATER SUPPLY AND FIRE-FIGHTING SYSTEMS

Angel Iliev Ushev

PhD student at VFU "Chernorizets Hrabar"

Abstract:

The article proposed a concept of system for monitoring the firefighting water supply system based on telemetric fire hydrants. It's emphasized that the technology for monitoring ensures the readiness of the fire water supply systems and warns the specialized authorities where fire hydrants are not in a functional state. It's noted that the monitoring system provides dynamic data used for making timely decisions. The application of the monitoring system to fire safety and water supply and sewerage services allows to estimate and forecast the state of firefighting water systems and to optimize hydraulic models.

Keywords: fire water supply systems, monitoring, hydraulic models, telemetric fire hydrants

Introduction

The emerging global warming and sudden changes in weather conditions are key factors determining the map of natural cataclysms in the coming decades and, above all, the risk of fires. Globally, society suffers huge losses of human and material resources caused by fires. Fires are also one of the main reasons for the risk of premature death of the population. As a factor influencing the life of man and the environment, fires are the cause of atmospheric changes and impacts, generators of harmful substances, sources of climate change, landscape, soil erosion, change in the concentration of gases, etc. [1].

The main means of extinguishing fires is water. It has high heat absorption and heat resistance that is considerably higher than that of other non-flammable liquids, such as carbon tetrachloride and ethyl bromide. Only at a temperature higher than 1700 °C water vapor practically decomposes to hydrogen and oxygen. Extinguishing most materials (wood, plastic, rubber, etc.) by using water is safe as their combustion temperature does not exceed 1250-1300 °C. Water does not react with most solid and liquid combustible substances except alkaline and alkaline earth metals. When water enters the surface of the burning materials, it cools them and some of it evaporates [2]. Water, which has a high hidden heat of steam generation, consumes a lot of heat from the burning materials or the heated smoke.

Water losses in fire extinguishing systems, and particularly hidden and obvious leaks leading to pressure drops in fire-fighting systems and hydrants, can directly affect the efficiency and reliability of fire extinguishing, and can cause the loss of large material resources and human casualties [3]. That is why setting up a system for continuous monitoring of water pressure in fire extinguishing systems is an important condition for updating their condition and increasing their fire extinguishing capability and reliability.

Monitoring of water supply and fire extinguishing systems

The use of fire hydrants as a basic source of information on fire detection systems is not widely applied in the world practice. This is due to the main application of fire hydrants as a source of water used for extinguishing fires rather than as a source of information on the state of the fire-fighting and water supply system.

Modern development of fire hydrant constructions allows the developing of monitoring systems that inform both what the state of the fire hydrants and their adjacent water supply and fire extinguishing system is.

The monitoring system proposed in this article is based on the use of telemetric fire hydrants as sources of information [4].

The telemetric fire hydrant - Fig. 1 represents an incorporated in the water supply network stationary point for registering, measuring and signaling for changes in the characteristics of the fire extinguishing system.

Fig. 1 Telemetric Fire Hydrant

The device is energy-independent, uses renewable energy from the sun rays through solar batteries built into the top of the hydrant. The measuring column of the telemetric hydrant includes the following sensor nodes:

- Pressure, temperature and water sensors in the water supply system where the telemetric fire hydrant is installed;

- A sensor to detect the location of the telemetric fire hydrant;

Each sensor node in the widely used modern sensor networks includes a processor with built-in RAM, SD storage card, time synchronization GPS, and 3G data transfer modem at a rate of 4-5 KB/s. The I/O board supports sensors for different types of data, such as hydraulic parameters (pressure, hydrophone recordings, flow).

The sensor nodes are powered by batteries charged either by a solar panel (during daytime) or by an alternating current from a nearby street lamp. The nodes can be remotely controlled and configured differently depending on the specific needs. Individual parameters are usually measured at short, regular intervals (for example, 30 seconds) depending on the rate of change over time. The raw data transmitted to the platform by the sensor nodes are received by the IDEAS system by means of algorithms for registering and locating the emergency behaviour of the facilities in the water supply system.

Technical characteristics of the telemetric fire hydrant [5]:

- Measuring range: 0-20 bar;
- Overload: 150%;
- Degree of protection IP 68;
- GPRS Class 10 communication GSM 850/900/1800;
- Temperature range: -25 ° C ÷ +65 ° C;
- Package material: steel GJS-400-15 EN1563 (GGG-40);
- Measurement accuracy: +/-0,25.

Technical characteristics of the linear equipment of the fire hydrant monitoring system:

- Autonomous power supply with a resource of at least 2 years;
- After installation it provides the possibility of operation of the valves;
- Protection IP68 and impact package;
- Provides installation or removal of one unit of linear equipment for no more than 10 minutes;
- Has a built-in GSM module for data transmission to the server;

Advantages of the telemetric fire hydrant:

- The telemetric fire hydrant is installed in the existing water system.
- It makes a continuous, stable data exchange connection.
- It uses independent power supply through photovoltaic modules.

Field of Application of the telemetric fire hydrant:

- Continuous pressure measurement in water supply areas - current value;
- Real time hydraulic analyzes;
- Adjustment - maintenance of the pressure in the water supply areas by control valves - PMA (Pressure Managed Areas);
- Adjustment of pumps with proportional pressure.

Functions of the telemetric fire hydrant:

- Permanent pressure measurement;
- Viewing data in an Internet environment;
- Visual analysis of data for both current and past periods;
- Alarm functions:

➢ low pressure alarm in the water supply network to which the telemetric fire hydrant is connected;

➢ high pressure alarm;

The system for monitoring the state of telemetric fire hydrants by sensors mounted in the smart hydrant head processes and transmits information on the operation of the engineering pipelines constituting the water supply and fire extinguishing system [6]. Based on the analysis of the observed parameters and by using a software method, the state of the observed system is deduced and the signals are generated in due time. Internet, telephone and radio channels, GSM devices are used to communicate.

Controlling can be done both manually from the place where the telemetry fire hydrant is and from the control room (dispatching points of the operating companies and the fire safety services) by remote transmission of the commands. The information received from geographically dispersed fire hydrants in different places is controlled at the same time.

The main task of the monitoring system is to present complete and reliable information to the fire safety services on the location and efficiency of telemetric fire hydrants, their reliability to be used in specific situations, the hidden leaks leading to pressure drops in the respective zones of the adjacent water supply system, the ability of the system to provide reliable water supply and fire extinguishing [7].

It is possible to control the hydraulic characteristics of the water supply system through continuous monitoring of the state of fire hydrants.

The fire hydrant monitoring system consists of three subsystems: a basic information and performance control system and two information and action subsystems.

Basic system requirements include:

- Rapid identification of failures and their removal (24/7 on working days, weekends and holidays);
- Providing reliable and continuous operation of fire hydrants;

- Monitoring and regulation of the operating parameters of the water supply and fire-extinguishing systems and equipment;

The objectives of the monitoring system of the telemetry fire hydrants are the following [8]*:*

- Continuous monitoring of the state of water supply;
- Visualization of transients in pipelines through audiograms;
- Detection of failures in the system in the initial stage of their occurrence;
- Transfer of failure information to the decision-making center;

Conclusions

1. The necessity of introducing continuous monitoring of the fire-extinguishing system and its adjacent water supply system to reduce its emergency situation has been substantiated.
2. A monitoring system based on data from telemetric fire hydrants has been proposed.
3. The advantages of the proposed monitoring system have been presented.

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