Investigation of the possibilities for planning the protection of the sites from the critical infrastructure and adequate response in the event of incidents near them

Ivanov Ivan [1], Nikolova Valentina [2], Yaneva Svetlana [3]
IMSETH-BAS-Sofia [1,2], Technical University of Sofia [3]
Email itoivanov@abv.bg[1],valya_g@abv.bg[2], svetlana_ianeva@tu-sofia.bg[3]

Abstract: The report examines the possibilities for using new intelligent sensors, hardware and software developments and their combination in planning the protection of critical infrastructure in a dynamic environment. The processing of data, with constantly changing parameters at the scene of the incident and its forecasting over time, using current data and data from past periods.
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1. Introduction

The modern development of technologies predetermines the use of various substances and materials, most of which, according to their physico-chemical properties, are flammable, explosive and toxic. Thousands of incidents occur each year in which chemicals are released into the environment as a result of an accident or natural disaster. Whether accidental or intentional, they can harm people and the environment and cause significant disruption with potentially dangerous widespread economic impacts. With the development of the production, use and storage of substances with different physicochemical properties, it inevitably leads to higher requirements for the protection of sites from critical infrastructure, as well as employees involved in limiting and eliminating incidents.

The report examines a theoretical study of the possibilities for using new intellectual sensors, hardware and software developments and their combination in planning the protection of objects from critical infrastructure in a dynamic environment, ie. data processing, with constantly changing parameters at the scene of the incident and its forecasting over time, using these data and a large database from past periods.

2. Planning the protection of sites from critical infrastructure

Planning the protection of critical infrastructure sites is a multifaceted process that requires careful study of possible scenarios for the development of incidents within them or in the immediate vicinity that may have a cascading effect. The existing forecast scenarios, despite the use of computer systems, are "static" in terms of input data, ie. the values of the ambient values such as pressure, temperature, direction and air velocity are set averaged over a given period or are taken as amplitude values. The results obtained are predictable and in a great deal of reliability overlap realistic scenarios in the past, on the basis of which to plan the protection of sites from critical infrastructure. The world's leading security developments, supported by national governments, develop and provide software developments that aim to support the protection of human health, the environment and the security of sites and in public education and protection planning.

Some of these software developments are provided free of charge, without any claims or they are negligible in terms of hardware support, aimed at promoting security requirements. Information is available for the software development, supporting the specialized training of the personnel who use it from the point of view of data entry and processing. Such software is developed by the United States Environmental Protection Agency - ALOHA. [1] To obtain correct data, it is necessary to verify the output data, which is entered manually. Data are entered on the type of chemical, its quantity, the conditions under which it is stored, the ambient temperature, atmospheric pressure, wind speed and direction. The software processes the data, visually showing the graph with the dangerous concentrations and the estimated size of the dangerous zones (gassing) (Fig. 1).

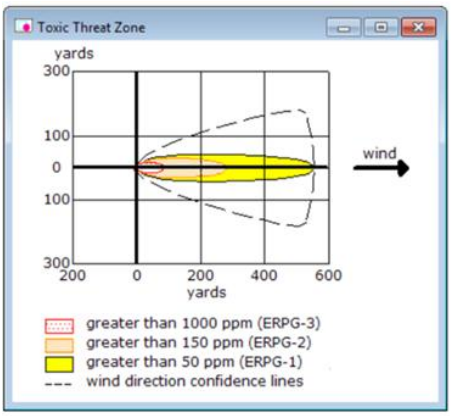

Fig. 1

The software also offers the ability to impose data on a geographic map, using the pads of Google maps, in scale (Fig. 2).

Fig.2

From the point of view of precision, the software is "stationary", ie. the data obtained depend on the initial data that are set, the imposition, the ambient temperature, the type of substance, etc., not taking into account the rapidly changing environment at the scene of the accident. [2-6] map, without reflecting the terrain, the presence of buildings and the change of parameters - feedback with the output data.

Current and future developments of such software capabilities inevitably require the use of the Internet (Internet of Thinks - IoT). The IoT consists of intelligent sensors connected to the network, collecting information and transmitting it through various channels for further processing. In addition to strictly specialized sensors - located in critical infrastructure, it is necessary to use a number of special sensors from portable devices built into smart watches, phones, tablets, clothing, etc., by employees at the scene of the accident, in order to obtain verified data with appropriate data transmission channels.

As the most promising channel in terms of coverage on the planet for data transmission can be used the Internet, due to its widespread use. High-speed Internet allows for extremely fast data transfer over unlimited distances. The use of the Internet as a global resource, a high-speed 5G or 6G data connection, and the availability of multiple sensors to automatically feed the output data to be processed and corrected in real time will contribute to a real picture in place of incident.

The use of large databases (Real data) coming from the sensors and already available data from various maps - geographical, relief, hydrography, soils, roads, buildings, population, industry, facilities with risk potential and other objects of critical infrastructure and their verified processing in order to obtain both a real instantaneous picture and a predictable one that changes over time, at predetermined intervals, according to the sensitivity of the sensors.

3. Conclusions

In conclusion, it can be said that the timely and adequate processing of data from sensors measuring real-time environmental parameters in and around the scene of the incident, the verification of data from the relevant software, the personnel at the scene and from the employees of the unified rescue system. Determines to a large extent the possibilities for planning the protection of the sites from the critical infrastructure and adequate response to incidents in and near them

The processing of all data from reliable and verified software will allow the preparation of "Forecast Analysis" with the possibility of clear visualization of the incident, determining its scale, as well as the best option for forecasting its development at specified time intervals. This, in turn, will contribute to taking swift and adequate decisions on the necessary measures, in terms of dispersing the threat, possible ways to eliminate it, protecting sites from critical infrastructure, providing countermeasures and the necessary resources for this purpose and last but not least preventive training and early warning and notification.

With the help of the described new intelligent sensors, hardware and software developments and the combination of them in planning the protection of sites from critical infrastructure in a dynamic environment will help assist in planning protection by taking into account and identifying threats to sites by providing re-verification of threats, vulnerability and risk of qualified personnel from the "designer of integrated security and protection systems" - through a set of elements operating under a single security concept, purposefully managed in a common information environment to ensure processes aimed at timely identification, analysis of outbreaks especially cascading effects through (preventive) response to prevent side effects. [7]

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