IMPROVING THE ASSESSMENT AND VERIFICATION OF WORKING CONDITIONS IN PREMISES WITH PERSONAL COMPUTERS

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Abstract. The paper considers the possibility of improving and accelerating the process of assessing appropriate working conditions in premises where employees use personal computers by creating appropriate specialized software. Such software can be used both to assess working conditions in existing premises and when designing premises with computers. The software evaluates the availability of sufficient working space, the correctness of the relative positioning of workstations, and the compliance of illumination in the premises with current standards.

Keywords: normal working conditions, illumination, personal computers, mutual arrangement of workplaces, sufficient working space, visual display terminal.

Анотація. В роботі розглядається можливість вдосконалення та пришвидшення процесу оцінки належних умов праці в приміщеннях, де працівники використовують персональні комп'ютери, шляхом створення відповідного спеціалізованого програмного забезпечення. Таке програмне забезпечення може використовуватись як для оцінки умов праці у вже існуючих приміщеннях, так і при проєктуванні приміщень з комп'ютерами. Програмний засіб виконує оцінку наявності достатнього робочого простору, коректності взаємного розташування робочих місць та відповідності освітлення в приміщенні діючим нормам.

Ключові слова: належні умови праці, освітлення, персональні комп'ютери, взаємне розташування робочих місць, достатній робочий простір, візуально-дисплейний термінал.

Introduction. Nowadays, computers are extensively utilized in various forms, including laptops, desktop PCs, and all-in-one systems. Their application is no longer confined to IT professionals. Specialists such as accountants, designers, architects, translators, teachers, and many others incorporate computer technology into their daily work. This widespread adoption of PCs is largely driven by the availability of specialized software tailored to different professional fields.

When setting up workplaces where computers are used, it's essential to create proper working conditions to minimize the negative effects of harmful occupational factors on employees' health. Specialized software (SW) can also assist in evaluating whether the working conditions for computer use are adequate, while also streamlining the assessment process. However, as noted in sources [1–5], there is currently a limited range of software solutions available in the field of occupational safety.

Utilizing specialized software enhances productivity, simplifies task execution, reduces the likelihood of errors, and significantly improves overall work efficiency. As

a result, developing a software solution to assess working conditions at computer-based workstations is a highly relevant task.

Analysis of the issue. When designing spaces where employees operate computer equipment for four or more hours during their workday, it is essential to adhere to the standards outlined in the State Sanitary Rules and Norms titled *Hygienic Requirements for the Organization of Work with Visual Display Terminals of Electronic Computers* [6]. This regulatory document sets forth the fundamental guidelines and requirements for organizing and designing rooms equipped with computers, including the proper arrangement of equipment, as well as standards for illumination, indoor climate conditions, and other environmental factors.

Purpose of the work: creation of software that speeds up the process of assessing working conditions when inspecting or planning premises where employees use personal computers and other types of visual display terminals of electronic computers.

Methods, materials, and research results. When arranging workplaces, the main rules are:

– the minimum area of one workplace must be at least 6 m2;
– the minimum volume of one workplace must be at least 20 m3;
– the distance from the back of one monitor to another must be at least 2.5 m;
– the distance between the side surfaces of two workstations must be at least 1.2 m.

Conventionally, such mutual planning of workplaces can be represented in the form shown in Fig. 1.

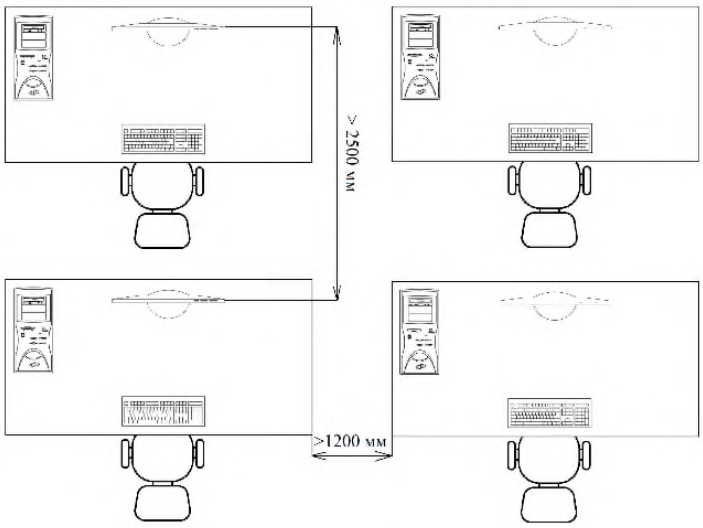

Fig. 1. Requirements for the mutual placement of workstations with computers

In addition to the proper arrangement of equipment in such environments, maintaining adequate illumination levels is critically important. This is due to the fact that extended and continuous computer use has one of the most detrimental effects on vision, with eye-related conditions being among the most common health issues faced by individuals who work with computers.

The standards for both natural and artificial illumination are defined in the Ukrainian building code *ДБН В.2.5-28:2018 Natural and Artificial Illumination* [7]. A study presented in [8] introduces a specially designed software package intended to assess the condition of natural illumination in indoor spaces, which can be applied when evaluating workplace conditions in such environments.

To facilitate the assessment of working conditions in existing computer-equipped rooms or in the process of designing new ones, a specialized software tool has been developed. The main interface window of this software is shown in Figure 2.

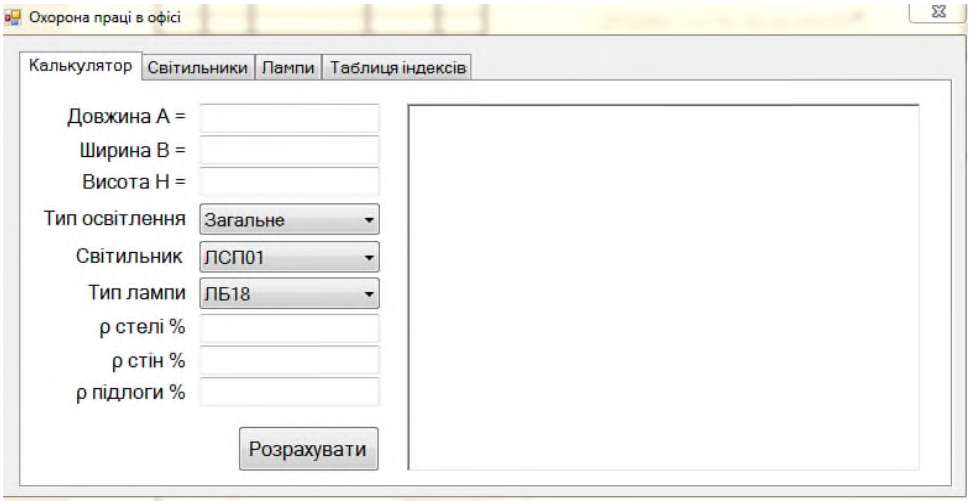

Fig. 2. Interface of the main window of the developed program

As illustrated in Fig. 2, the input parameters for the calculations include the room's dimensions (length, width, and height), along with data necessary for determining artificial illumination levels. These include the type of illumination system, the reflection coefficients of the ceiling, walls, and floor, as well as the type of luminaire and lamp used. The methodology for calculating the number of workstations is detailed in [9], while the artificial illumination calculation follows the luminous flux method in accordance with *DBN V.2.5-28:2018 Natural and Artificial Illumination* [7].

The software features additional tabs titled *Luminaires, Lamps,* and *Index Table*. By default, the *Luminaires* and *Lamps* tabs are pre-populated with several standard types, but users can modify this data by adding new entries or removing existing ones. The *Index Table* tab displays the luminous flux utilization factors used in the luminous flux method for determining uniform artificial illumination across the workspace.

Upon completing the calculations, the right panel of the program interface (Fig. 3) presents the dimensions of a single workstation (its width and length), the maximum number of compliant workstations that can be placed in the room according to the standards [6], as well as the required quantity of lamps and luminaires, and the estimated cost of illumination the space.

Conclusions. This paper presents a software application designed to assist in the planning of workspaces where employees regularly use computers. The tool determines the dimensions of individual workstations and their appropriate arrangement in accordance with current occupational health and safety regulations.

Additionally, it calculates the parameters of the general artificial illumination system within such environments.

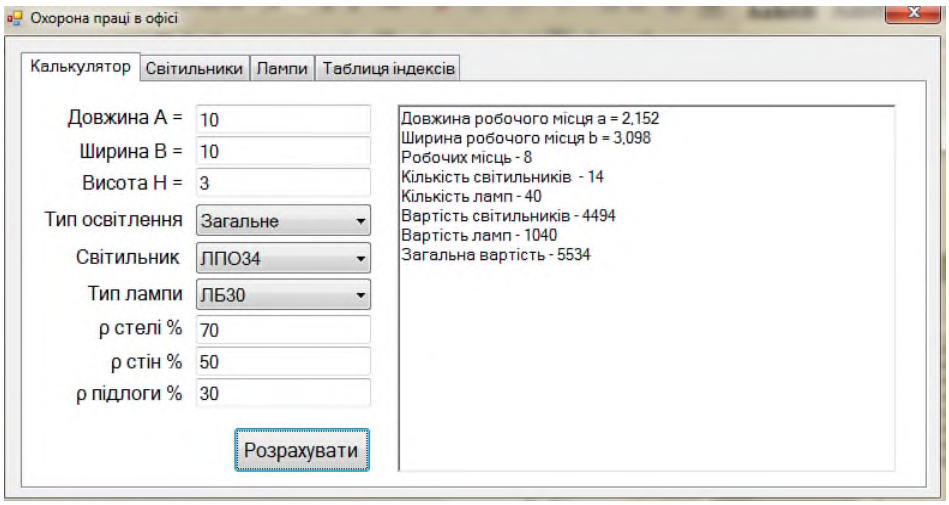

Fig. 3. Results of calculations performed in the software tool

The developed software can be utilized both during the design phase of new computer-equipped workspaces and for evaluating existing premises to ensure they meet the required working conditions for employees using personal computers or laptops.

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