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THE ROLE OF IoT TECHNOLOGIES IN MONITORING THE ENVIRONMENTAL IMPACT OF INDUSTRIAL ENTERPRISES IN THE KHOREZM REGION

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Abstract. In this article, we examined the use of wireless sensors and IoT (Internet of Things) technologies to monitor various industrial enterprises that emit harmful substances into the atmosphere and ambient air in the Khorezm region. Many industrial enterprises are located far from urban areas, and their negative impact on the environment in rural areas was studied.

Keywords: sensor, IoT, air, control

Introduction. Among the increasingly modern developing countries of the world, controlling harmful substances and various pollutants emitted into the atmosphere and ambient air is one of the problematic situations facing each country. Currently, improving the weather on Earth and maintaining it in one mode is considered very difficult. Because in developed countries, the contribution of industrial enterprises to the prosperity of the state is very high. Therefore, the economy of developed countries depends on many large industrial enterprises, and the construction of large industrial enterprises is rapidly underway. As a result, the ecological threat to the population and the biosphere of the whole world is increasing. Controlling this growing ecological threat, preventing it or reducing the level of danger is one of the urgent problems. In our article, a number of proposals have been developed to control the harmful substances emitted into the atmosphere and environment by industrial enterprises located in rural areas, using the Internet of Things and wireless sensors mentioned above, which have a negative impact on the ecology, atmosphere and ambient air. Several scientific studies are being conducted by world scientists in this regard. Because this is one of the problems that needs to be seriously considered today. Most of the pollutants emitted into the atmosphere and environment by industrial enterprises in the Khorezm region are dust generated by oil and oil plants, flour factories, automobile factories, cotton factories, brick factories and construction processes. The types of substances emitted from them are as follows. SO2, NO2, O2, PM2.5, PM10, PM1.0, CO and CO2. These harmful substances are the main harmful substances polluting the air on Earth. Some of these pollutants can persist for many years and migrate across large areas of soil before reaching water resources, where they can pose ecological or human health threats [1].

Literature review and methodology. Many developed countries have developed a number of measures to significantly reduce the levels of harmful substances and air pollution in the environment, atmosphere and ambient air, and as a result, many positive results have been achieved. In the USA [2], Europe [3] and China [4-6], due to a number of regulations related to ambient air, improvements in modern technologies and the transition to cleaner fuels, some reductions in the impact of some particulate matter on air quality have been achieved. For example, significant reductions in SO2 emissions have been

observed. SO2 concentrations were very low in large parts of Europe [7]. Some underdeveloped regions of Kazakhstan continue to suffer from high levels of air pollution due to weak environmental regulations for the metallurgical industry and coal-fired power plants. Modern emission control technologies that require and provide local application methods are not available. [8] Over the past decade, the Chinese central government has made several changes and amendments to prevent frequent manipulation of data. [9] At the same time, several national reforms have been implemented in the field of environmental air monitoring and monitoring [10]. However, in recent years, many cases of falsification of data by environmental air monitoring stations have been exposed. [11]. In Khorezm region, environmental, atmospheric and environmental pollutants are emitted into the air by vehicles in urban centers, as well as by factories and enterprises located in rural areas. If we implement these controls with the widespread use of wireless sensors and IoT technologies, we can gain a number of advantages. We will present the permissible limit values of air pollutants emitted into the atmosphere and ambient air based on literature data. The permissible limit values of harmful substances in the air, mg/m3. are listed in Table 1. The indicators shown in this table limit the amount of waste emissions from industrial enterprises so that the amount of harmful substances in populated areas does not exceed the RECHM. Its procedure and rules are set in GOST-17.2.3.03-78 and are calculated taking into account such data as air pollution from other sources, the height of exhaust stacks, wind direction and the speed of their mixing in the air, and the amount of harmful deposits deposited from it during the day. [12].

Construction work is developing rapidly in various parts of the world. Today, construction work is also increasing significantly in our country. However, the negative impact on ecology and the environment is also high. Pollution from various types of recyclable and non-recyclable household waste generated during the construction process is mainly related to construction materials and construction waste, improper management of the construction site, improper disposal of waste, land damage and soil erosion, etc. The problems of atmospheric and ambient air pollution during the construction process mainly include dust. [13].

Results. Work has begun on the identification of various harmful substances emitted using devices consisting of wireless sensors in the ecology of the Khorezm region and the detection of harmful substances in the ambient air, and results have been obtained on some of them. The information on these results is given based on the characteristics of the wireless sensors used. For example, the measurement range: O2-0 to 25 ppm, CO-0 to 10,000 ppm, CO2-0 to 50 vol.%, NO-0 to 4,000 ppm, NO2-0 to 500 ppm, SO2-0 to 5,000 ppm. The program determines the values on the LCD screen and stores them in the memory block. The program code was written for the Arduino microcontroller to display the values on the LCD screen and store them in the memory block. If the limit is exceeded, it will inform about the name and value of the gas separately for each gas and the words "The specified limit has been exceeded!" If it is within the limit, it will display only the name and value of the gas on the LCD screen. The algorithm for this is shown in Figure 1.

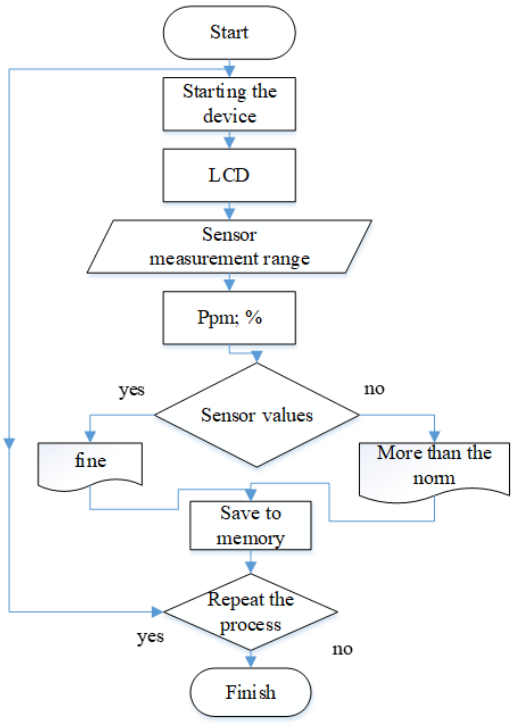

Figure 1. Algorithm for sensor detection range.

If we focus on the general structure of wireless sensors in our research work, we can divide the wireless sensor into 4 main parts. They are the sensing system, the digital output circuit, the wireless communication system, and the power supply system. Each part performs its own function. The first part, the sensing part, performs the functions of sensors that detect various harmful gases, adjusts analog signals, and converts analog and digital signals. The digital output system transmits the signals from the sensing system and the wireless communication system to both devices in the form of digital signals according to their characteristics. The wireless communication system serves to establish communication with the second device and transmit the received data. The power supply system serves to provide the aforementioned systems with electricity. These can be local electricity, various types of storage batteries, and solar panels. Figure 2.

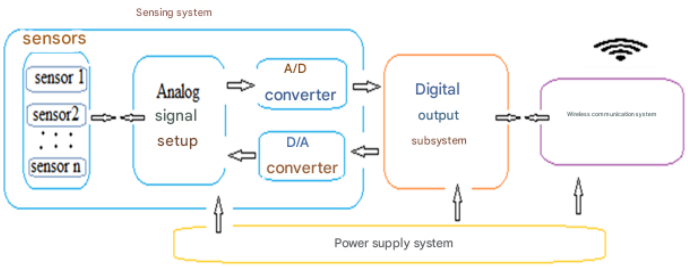

Figure 2. General structure of a wireless sensor.

In recent years, wireless sensors have continued to innovate and improve their performance. This includes the detection of various gases, smart lighting, a number of smart sensors used in smart homes, waste identification and management, etc. [14]. In our scientific research, it was observed that mobile communication base stations also release harmful substances into the atmosphere. The reason for this is that when local electricity is disconnected from the base station, diesel generators located at the station start up and carbon dioxide gas is released. [15-18].

Conclusion. Based on the above-analyzed articles and our scientific research, it can be said that preserving and protecting ecologically clean areas in all regions of the world is a huge task facing every society and humanity. To solve these urgent problems, it is necessary to find solutions using modern information technologies. Because, nowadays, there are many wireless smart sensors and data transmission technologies based on the Internet of Things, and scientists around the world are widely using them in life. There are several achievements in monitoring ambient air. This creates opportunities for monitoring human health and air quality in the biosphere, including monitoring atmospheric air in various conditions.

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