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THE STUDY OF INTELLIGENT SYSTEMS IN INDUSTRIAL FOOD AUTOMATION

Abstract. In the development of an intelligent control system for basic production in the food and chemical industry, it is necessary to build an integrated and robotic control system that allows you to effectively optimize, computerize the food industry and transform food products into a clean ecological product.

The main task of managing such an intelligent system is artificial intelligence, which can significantly improve packaging, increase shelf life, combine the cycle using algorithms and improve food safety by making a more transparent management system.

The novelty of the article lies in the development of an intelligent process control system based on a mathematical and integrated model that allows you to calculate temperature, humidity, amount of pesticides and filter out substandard primary product at the stage of purification and dehumidification due to the intelligent NGS system. The experiments were carried out on the TIA Portal V14 software on a stand in the laboratory. The process of dehumidification and filtration of the intelligent system was also implemented on a stand in a laboratory chamber that could measure temperature and relative humidity. The measurement of the temperature inside the product and the change in humidity after filtration were recorded during the experiment. A system was created on the basis of experimental data of a mathematical model and a computer system that allows calculating humidity parameters and in time to exert a regulatory influence on one of the control channels and thus optimize the process parameters.

Keywords: intelligent system, automation, automated technological process, food industry.

Introduction.

Food enterprises are an important element of the national economy, since not only the quality of life of the population depends on them, but also the food security of the whole country.

The use of artificial intelligence in the food industry, which recommends huge savings of capital with maximum use of resources by reducing human errors. Artificial intelligence with data science can improve the quality of restaurants, cafes, online delivery networks, hotels and catering outlets by increasing production using various algorithms. Artificial intelligence can significantly improve packaging, increase shelf life, combine the cycle using algorithms and improve food safety by making a more transparent management system. With the help of artificial intelligence and machine learning, the future of the food industry is completely based on intelligent technological process, robotic agriculture and drones.

It is well known that food or diet is vital for a person and can be described as the best result of leading a healthy nation. Food industry products play an important role for the development of any country. It also plays a significant role in the development of the country's economy, as well as the global economy. Therefore, the quality of food products and their safety with proper distribution are extremely necessary. Over the past few decades, newly developed technologies such as artificial intelligence (AI) have achieved good results to achieve the desired goals. Therefore, it is important to explore aspects of smart agriculture based on AI and advanced food industry.

Such methods satisfy social needs and ensure timely delivery of quality products. Using these modern technologies, the food industry can produce a large amount of food in less time, which will increase the company's economy exponentially.

Methods and models.

The food industry is gaining a new pace of development every year.

Computers and other microprocessor technology introduced into the food industry contributed to the fact that the industry began to use the latest, technically sophisticated automated control systems. It was they who led to the fact that the entire production process at the food industry enterprises was integrated into a single whole.

The important roles of artificial intelligence in the food industry can be divided into two classes: one is food safety management, and the other is food quality management.

Using a computerized system based on a mathematical and integrated model, the food industry can study and make sure that the most favorable conditions, such as the selection of the primary product, monitoring of the quality of products, temperature control, humidity control can be improved, which will ensure the superiority of food products.

With the development of technology, the food industry is also using tools based on modern technologies so that production can be increased. One of the tools developed by various research groups is called the NGS System.

With the development of technology, the food industry also uses tools based on modern technologies so that production and the finished product can be increased.

One of the methods of the intelligent system is the NGS system - an intelligent method that improves the production process by maximizing utility and uniformity. It accurately and at high speed evaluates the primary product due to sensors and lasers on the installation. Due to the cycle, the NGS method weeds out the substandard product at the filtration stage. The NGS method in the food industry is controlled by a highly accurate and technologically advanced system. The captured image is processed by a high-performance workstation for maximum attention to the pixels of the green stripe related to the loop line.

Due to the large size of the area captured by the input devices and the numerous processing lines, outstanding typical centerline tracking is achieved. It evaluates the resulting image according to the grid pattern of the truth of the quality of the product of the earth with the area of the line of the primary product. Then the received information is processed and used for evaluation and compares the parameters with the help of regulatory action.

Experimental studies of the technological process. An experimental method of an intelligent system.

Measuring instruments are chosen when developing normative and technical documentation for products and technological processes, introducing measuring instruments during testing, designing automatic control systems and automated process control systems, equipping production control departments and laboratories at industry enterprises with measuring

instruments. The selected measuring instruments should ensure the control of technological parameters, product quality indicators and equipment condition indicators with a given accuracy.

The main conditions for the selection of measuring instruments for product quality control, technological parameters and equipment condition indicators are the technical and economic feasibility of using the selected measuring instrument.

Technical feasibility is determined by the main metrological and operational indicators of the measuring instrument. The main metrological indicators include error, measurement limits, range of readings, scale division price, stability of measuring instruments, sensitivity, and the main operational indicators are transportability, simplicity of design, ease of maintenance, reliability, maintainability and safety.

When choosing measuring instruments, the maximum use of measuring instruments that are rational for these conditions, regulated by state industry standards and enterprise standards, as well as the possibility of using information and measurement systems, automated process control systems based on microprocessor technology should be ensured. Control over the correctness of the choice of measuring instruments used for metrological support of the technological process is carried out during the metrological examination of normative and technical documentation (technological instructions, technical specifications, etc.).

At the same time, one of the main tasks of metrological examination is to establish the completeness and correctness of the requirements for measuring instruments, including non-standardized (industry-specific measuring instruments).

Let's consider the functional scheme of an intelligent system in the food industry. Artificial intelligence-based systems are widely used in almost every part of the technology. This makes it possible to effectively optimize problems, computerize the food industry and transform food products.

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Intelligent decision-making systems based on artificial intelligence consist of various tools and methodologies. These tools and technologies are used to analyze every aspect of food products, such as fruits and vegetables, on the input channel.

Conventional systems are able to characterize good and bad products only by their appearance. The technological scheme of the intelligent control system for basic food industry productions is shown in Figure 3

Based on this technological scheme of an intelligent control system, it can be applied to any food production of raw materials.

Discussion of the results.

Artificial intelligence plays an important role in the food industry for various purposes: modeling, forecasting, optimization of technological processes, a management tool, a classification and sorting tool, a basis for sensory assessment, a quality control tool, including using sensors such as electronic nose, tongue and machine vision. All this makes it possible to advance in solving complex problems of the food industry.

Automation provides the following main advantages:

- 1) the time spent on maintenance is reduced;
- 2) more precisely, the required technological mode is supported;
- 3) operating costs are reduced (for electricity, water, repairs, etc.);

4) increases the reliability of the installations.

Production processes in the food industry can be considered as a set of sequential technological operations related to the preparation of raw materials, its direct processing and the receipt of finished products. A wide variety of operations are used in the food production process. These operations are considered in detail only in special studies on individual industries. Despite this, the following general processes can be distinguished: fermentation, heat treatment, dehydration and distillation.

The algorithm of the system is a clear and precise sequence of actions that will ensure the operation of the machine. To begin with, let's define the tasks into which the work of the automaton is divided:

- drying of the product;
- product filtration;
- the process of washing from contamination of the product;
- purification from the acidity of the product;
- receipt of finished products.

For additional protection from dust, wind and moisture, windows will be installed on the machine body.

For each operation performed, a function was written that will be used in the general code of the system operation program when controlling on Arduino Uno. To achieve this goal, it is necessary to create a control, for this purpose a description in the form of a finite automaton was used – a model of a device with a finite number of internal states.

Conclusions.

At this stage of the research work, the functional scheme of automation, the technological process of an intelligent system in the food industry were presented, which accurately indicate the advantages and implementation of AI for food enterprises.

In the current scenario, the food industry uses a basic level of artificial intelligence. Every day the role of AI becomes vital due to its ability to improve hygiene, food protection and waste management system.

In the future, artificial intelligence will change the food industry because it has great potential to provide reasonable and healthier productivity for customers and employees.

The use of artificial intelligence and machine learning in the field of food production and catering enterprises is already taking business to a new level, minimizing human errors in production and, to a lesser extent, the amount of remaining product.

This ensures low packaging and transportation costs, increased customer satisfaction, fast service, voice search and more personalized orders. These business advantages can also be used by large food enterprises, which will bring obvious benefits in the long term, and most importantly will bring the health of the nation.

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