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ALGORITHM OF THE SYSTEM FOR MONITORING INFORMATION ABOUT PRODUCTS IN GRAIN PRODUCTS ENTERPRISES

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Abstract
In this article, the types of products stored in grain products enterprises are divided into classes, and the types of grain products are shown. Special sensitive devices allowing to separate grain products by types were analyzed and selected. The process of monitoring grain products in the storage warehouse is described through a structural scheme. Based on the structural scheme, the monitoring system operation algorithm was developed.

Keywords: grain products, storage warehouse, barcode scanning, data monitoring.

Introduction

It is known that grain crops include crops such as wheat, rye, barley, oats, corn, millet, rice, and buckwheat. These crops are grown primarily for grain - the main agricultural product, from which bread, pasta, confectionery products, etc. are produced. Also, grain is used for animals in pure form and in various mixtures - mixed feed; for technical purposes: starch, amino acids, medicines, alcohols and other products are produced from it. Grain has high nutritional value and caloric content, is well stored, easy to transport and process. These qualities of grain were known to people in ancient times, and therefore grain crops were the basis for the development of grain farming. Wheat is known from the 7th millennium BC, rice is known from the 3rd millennium BC; one of the oldest plants is corn, which was cultivated by the natives of America long ago. Currently, more than half of the world's arable land is occupied by grain crops. They are grown on all continents [1].

As you can see, grain is the most widely grown product in the world. This leads to the increase of warehouses that store grains and enterprises that process grains and receive various products from them. It is important to store grains in order to ensure the same demand for grain products during the rainy season. Depending on whether grain and grain products are stored for a long or short time, appropriate requirements are naturally imposed on the normative rules of storage. There are many types of storage, one of which is cold storage. This method is second in popularity after dry storage. In this case, losses are also minimized. However, it is slightly inferior to this dry method in terms of pure economics. Therefore, it is usually used directly on farms or small areas.

The storage process is also important in enterprises that process grain and receive various products from them. Cereal products are mainly stored in bags and sent to relevant enterprises. Automating the process of grain products storage, automatic monitoring of the amount of products is one of the urgent tasks of today. In this article, the project of monitoring the amount of products in grain storage warehouses is proposed and an automatic monitoring algorithm is developed.

Materials and Methods

During storage of grain and grain products at low temperature, as well as during drying, the activity of all types of microorganisms slows down. With this method of storage, it is cooled to a temperature of t=5-10°C and lower. Passive methods are usually used to create such conditions. That is, the warehouse is simply equipped with a ventilation system [2].

Complexes intended for the storage of wheat, barley or oat products must be equipped accordingly. In addition, it is necessary to strictly observe the technologies of grain storage, reception and delivery. Storage volume should be done as rationally as possible, if necessary, storage areas are disinfected before placing grains and grain products [3, 4].

Cereal products stored in enterprises include wheat flour, pasta, various confectionery products, types of feed for animals, etc. In addition to keeping these products clean, it is important to continuously monitor their quantity automatically in warehouses. This monitoring allows us to monitor the amount of products in our warehouse, how much is left, how much stock is available at any time, and also prevents confusion and theft regarding the amount of products.

It is convenient to store grain products in bags, each bag has a certain weight and is placed in warehouses in a sorted form.

Grain sacks are made of linen and other coarse fabrics. Nylon and polypropylene bags are used for grain storage in elevators - they are durable and resistant to moisture [5].

Dense packaging that does not allow the passage of air and moisture has a positive effect on the quality of grain products. In addition, the longer the grain products are stored, the more active the positive effect of plastic packaging becomes. Since 100% polyethylene prevents the ingress of moisture, cereal products retain all their properties.

All bags of cereal products must have a special color code corresponding to the product category. Each color provides complete information about the product. This is important in the monitoring process.

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In order to directly monitor the available grain products in grain products enterprises, it is first necessary to know the type of products. In addition, it is necessary to have information about how many kilograms of bags the products are packed in and what color bags they are packed in. Analyzing grain products in enterprises, we present the following classification (Fig. 1):

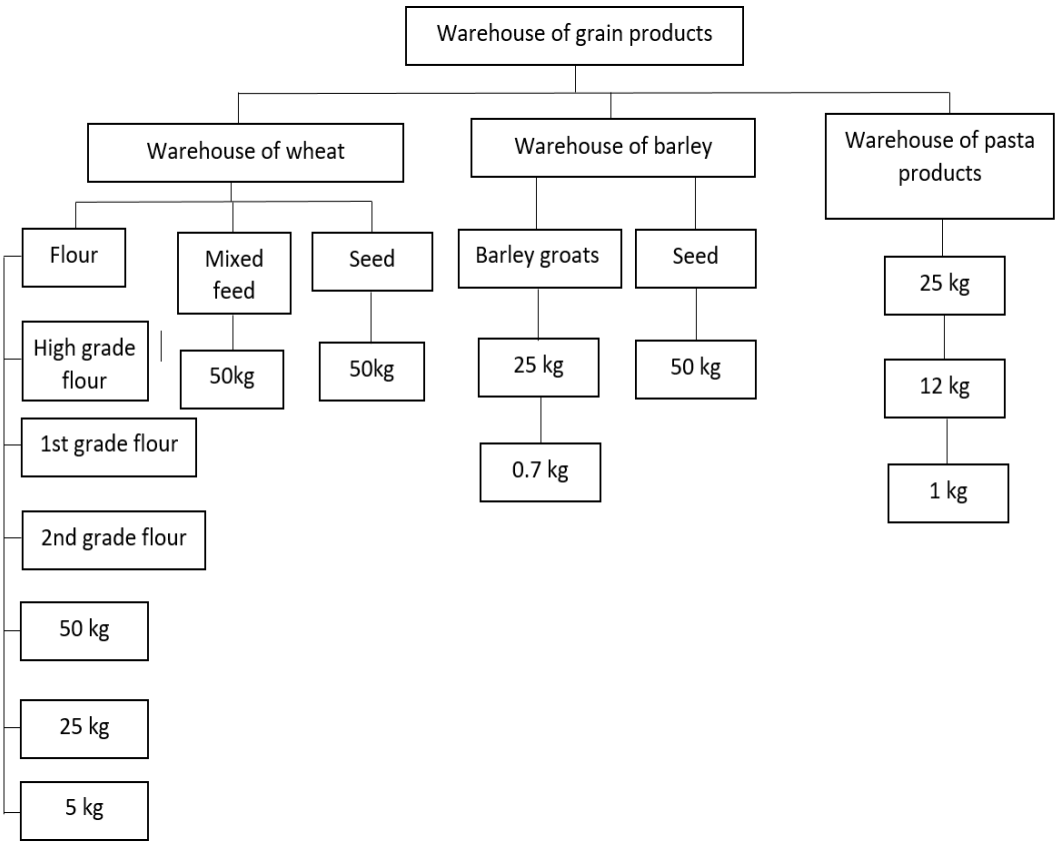

Figure 1. Classification of grain products in storage facilities.

As can be seen from Figure 1, wheat products include flour products, mixed fodder and seed grains. Flour products are also divided into varieties and packed in bags of different masses. This increases the difficulties of storage, storage and transportation of flour products. In addition, mixed fodder and seeds are also packed in bags of the appropriate size. In the warehouse of barley products, mixed fodder and seed grains for animals are packed in special bags. In the pasta storage warehouse, products are stored in bags of different sizes. It is convenient to store all products in the warehouse in a covered state, which directly facilitates their monitoring.

The project was developed for automatic monitoring of the amount of products in the grain warehouse. According to it, when grain products are placed in a warehouse, they pass through an automated, conveyor belt registration point and are recorded. At this point, scanning sensors are installed that allow you to determine what kind of product it is based on the color of the bags containing the products and the barcodes on the bags. The data is sent to the central computer through the sensors. BJ1M-DDT Counter/timer light sensor can be used to determine the color of products packed in bags (Fig. 2) [6].

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Figure 2. BJ1M-DDT Counter/timer light sensor

It is necessary to have the ability to correctly apply the light sensor to the process. Small-sized packaged products that arrive in the warehouse are taken as an item to be determined. The ability of this type of light sensors in the sorting process is somewhat limited. For this reason, we are introducing a system of recording packaged products based on barcodes in our technological process. A barcode scanner is used for this. With the help of this, information about the account of products entering and leaving the company's product warehouse is transferred to the data warehouse of the central computer in electronic form. The barcode scanner scans the products and stores them in its memory (Figure 3) [7].

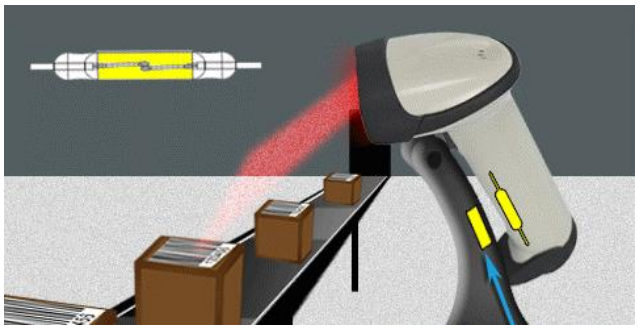

Figure 3. Products barcode scanner sensor.

In the process of sorting products with the help of a barcode scanner sensor, it is determined which type of product it is based on the barcode of the products. The barcode scanner has the following advantages:

• 100 percent control of the assembly of each product unit is provided;
• The selection process excludes the human factor;
• Possibility of integration with existing production lines, automated system of technological process management.

The process of monitoring the quantity of products in the process of placing grain products in the warehouse and transporting them from the warehouse is presented in a structural view in Fig. 4.

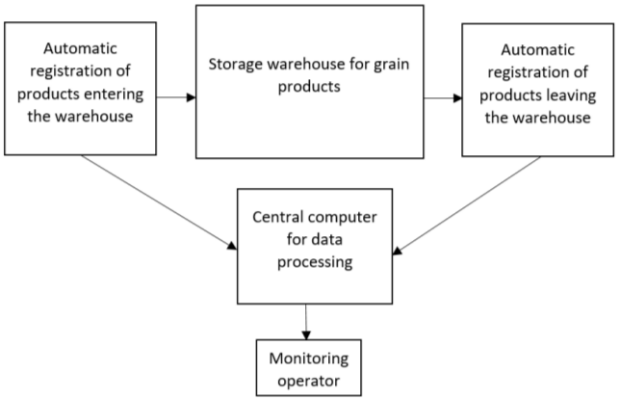

Figure 4. Structural diagram of the process of monitoring the quantity of products in the warehouse of grain products.

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As can be seen from Figure 4, grain products are automatically registered both when they are placed in the storage warehouse and when they are taken out of the storage warehouse. The recorded data is collected and processed in the central computer. Based on the collected data, information about the amount of products in the storage warehouse is monitored by the operator at any moment of time. In the central computer, these data are stored for a long time, and the data can be used at any time. It is also very useful for the enterprise [8, 9].

Results and Discussion

Based on the structure of our planned process, we can create an algorithm for the monitoring process. The algorithm clearly describes the monitoring process (Fig. 5).

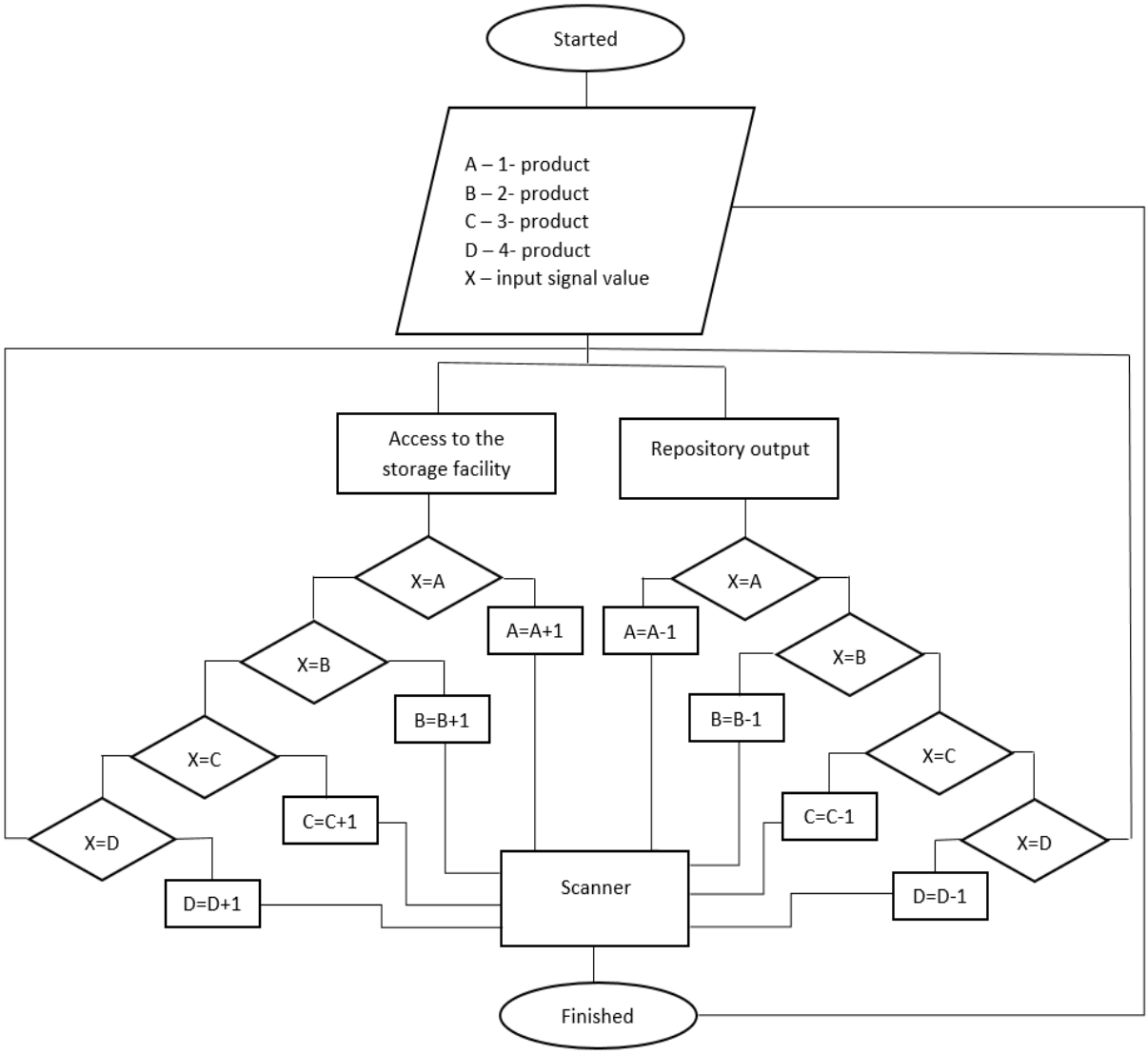

Figure 5. Algorithm for monitoring grain products.

Conditionally, four types of grain products are recorded at the entrance and exit parts of the storage warehouse. When one of the four products A, B, C, D arrives at the entrance, the product identification condition is met, the recording sensor determines which product it is and adds

one product to the number of this product tori (Fig. 5). For example, if product B arrives, the product of type B will increase by B=B+1 when the condition X=B is met. If the condition is not fulfilled, other conditions will be fulfilled and the type of product will be determined and the calculation will be performed. Product registration is also done when the products are removed from the storage warehouse. After the product type is determined by the given conditions, it is subtracted from the number of products of the suitable type based on the algorithm. In this way, accurate and complete information about the grain products taken out of the storage warehouse is stored in the automated system. Using this information, it is possible to control the number and quantity of products in the storage warehouse, up to the amount of how many products were sold.

Conclusion

Cereal products were divided into classes according to types, according to which cereal products differ from each other in terms of type and weight. Special sensitive devices were analyzed and selected to facilitate the process of separating types of grain products, placing them in the storage warehouse and removing them from the storage warehouse. As a result of the analysis, a barcode scanner device was selected for the products. The process of monitoring the grain products placed in and taken out of the storage warehouse was described through a structural scheme. Based on the structural scheme, the algorithm of the monitoring system was developed, the operation of the algorithm was established.

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