

## APPLICATION OF SENSORS FOR AUTOMATION OF CONTROL PARAMETERS OF STORAGE AND SHIPMENT OF GRAIN

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Studies have shown the relevance of the automatic control of the storage and shipment of grain, which will reduce the loss of grain during transportation and storage, and also to prevent its damage in case of excess humidity.

Tasks of research work:

- determine the most important physical quantities to be measured (weight, humidity, temperature);
- select available physical quantity sensors for using with a microcontroller;
- work out the measurement, transfer to the microcontroller and display of physical quantities on the device screen;
- find out the permissible parameters (temperature and humidity) for storing grain;
- collect a mock-up of the industrial Internet of things, capable of managing the shipment of grain, the collection and transfer of the information received;
- develop algorithms and software code of the microcontroller for processing information from sensors of physical quantities, controlling the actuator of the shipment;
- explore the measurement of selected physical quantities with the help of modern sensors and a microcontroller.

As a hypothesis, we put forward the fact that using sensors of physical quantities is possible to create an affordable device for automating the monitoring of the parameters of storage and transportation of grain.

The aim of the work was to create a working prototype of this device.

In the course of our study, we determined the physical quantities that need to be measured, namely, weight, humidity, and temperature.

To measure the mass, we used a strain gauge. Strain gauge converts the mechanical deformation of the body into a change in electrical resistance.

A thermistor was chosen to measure the temperature. Thermistor - a semiconductor element that changes the resistance with temperature.

A capacitive sensor was selected for humidity measurement. Capacitive sensor - when the humidity changes, the capacitance of the capacitor changes.

In the first case, the temperature and humidity sensors are combined in one unit with a digital output.

In the second case, we reviewed the installation of a registrar module, which will prevent data loss in case of unavailability of the transmission channel or personnel fraud and accumulate work data for analysis using BigData and optimizing the process (picture 1).

The hypothesis was confirmed, a working prototype of the device was created and its directions were determined. This device, when refined for industrial purposes, will be beneficial in this area.

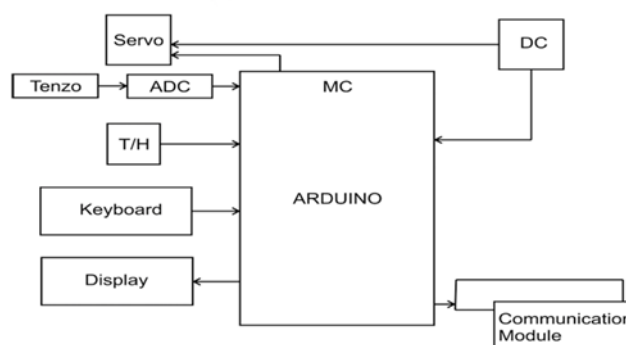


Figure 1 - installation block diagram

### References:

- <http://kipiavp.ru/pribori/termistor.html>
- <http://elektrik.info/main/automation/1083-datchiki-vl>