Monitoring the dynamic characteristics of the control system in greenhouses

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ABSTRACT: The basics of managing dynamic objects for processing information on example of greenhouses. Particular attention is paid to microclimate parameters: temperature and humidity. A control algorithm has been created for information uncertainty

KEY WORDS: Monitoring and control, cloud technologies, microclimate control, controller, humidity.

I.INTRODUCTION

A greenhouse is an agricultural technology to protect plants from adverse weather conditions, while the greenhouse will be able to maintain and distribute temperature, soil moisture, sunlight and air humidity evenly at optimal levels. However, the environmental conditions inside the greenhouse will always change due to the influence of weather conditions outside the greenhouse, which are uncertain, so there is a need for monitoring so that the plants inside the greenhouse can grow optimally.

The ability to efficiently and accurately manage irrigation for greenhouse crops is of growing interest to commercial growers. Rising costs and limited labor availability create the need to create a more sophisticated management system to improve the efficiency of crop production. Modern irrigation methods must be adapted to incorporate technologies such as neural networks and closed-loop control systems. The use of a control system in a greenhouse affects the yield and environmental conditions of the greenhouse, which may be subject to changes in microclimate

II. SIGNIFICANCE OF THE SYSTEM

Improving energy efficiency through smart systems offers important industrial opportunities. In the era of industrial revolution 4.0, various types of social activities, education, agriculture and so on are always associated with the use of automated systems that are integrated with the Internet network. This era has brought many changes regarding the main purpose of using this technology - to perform optimization in the form of: increasing productivity and efficient use of available resources. Weather changing extreme conditions are one of the reasons for low productivity in agriculture, like food crops and horticulture. Unpredictable weather conditions often make it difficult to determine when to plant and harvest crops.

To control the microclimate of a greenhouse, parameters such as temperature and humidity play an important role. Humidity is the concentration of water vapor present in water. Water vapor is a gaseous form of water, usually invisible to the human eye. The DHT11 humidity sensor was selected for the experiment. Current consumption when measuring from 1 to 1.5 mA. Current consumption in standby mode is from 40 to 50 mA. Digital output signal on a single bus at 5 ms/operation. Sensitivity 0.1% for measuring temperature and humidity.
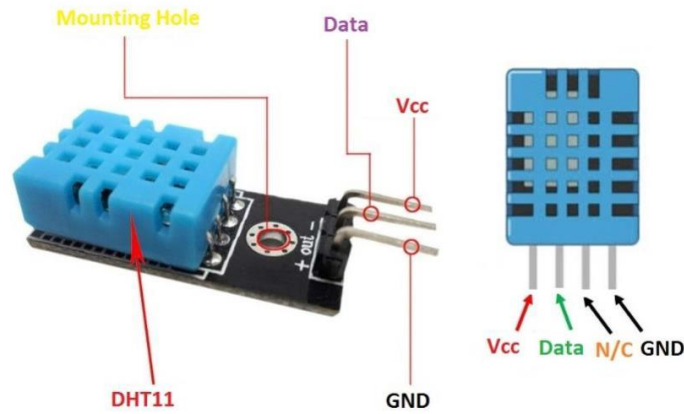
Figure 1. Temperature and humidity sensor DHT11.

This study was carried out in several stages, including:
- Analyzing the problem, analyzing the needs of the greenhouse system.
- Making tools using controller along with DHT11 sensors and capacitive soil.
- Programming using controller and humidity sensor.
- Perform testing on tools built with Internet connectivity.

The created project serves to monitor humidity in greenhouses and transmits information via the cloud to the user's smartphone Figure 2.
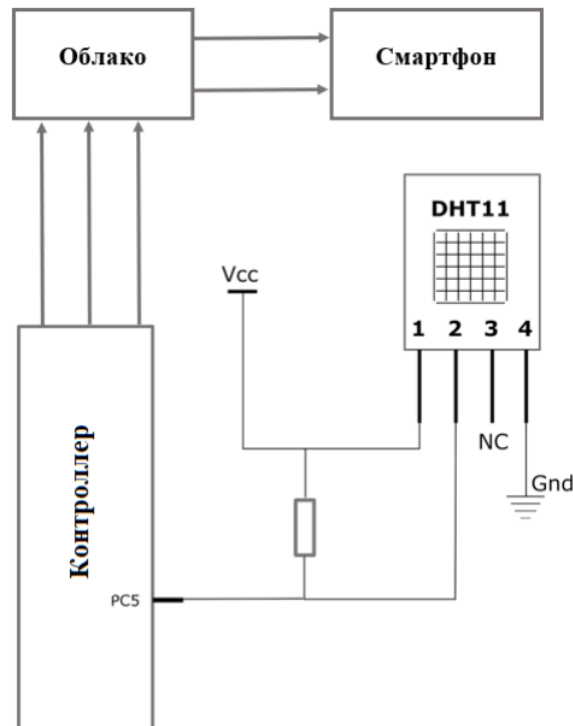

Figure 2. Scheme for monitoring humidity in a greenhouse using a "Cloud service"

All components are carefully integrated with each other and connected to a cloud server. Then a general check is carried out: the system can work normally. From the results of this general test, it is found that the program installed in the cloud, which is used as a controller, can work well and can work automatically by reading the temperature and humidity values of the greenhouse, the parameters that have been set, if the temperature and humidity values exceed the preset values. the cloud will work to ensure that the nozzle fogs so that the temperature and humidity in the greenhouse become more stable. The controller can work well so that it can regulate the temperature and humidity in the greenhouse. The cloud service will automatically transmit signals if the humidity is 50% and stops working at 80% humidity.

III. METHODOLOGY

The greenhouse system has 2 functions, namely: temperature determination and greenhouse room humidity with sensor DHT11. If the temperature in the greenhouse exceeds the maximum threshold set in the application on the Smartphone, the nozzle will spray the greenhouse until the humidity reaches the humidity parameter and the normal temperature set in the application. As for the soil moisture condition, the greenhouse will read the humidity value, if the humidity value is below 50%, then the pump will draw water through the drops until the soil moisture reaches 80%. The results of temperature and humidity values on the Smartphone will also be displayed.

In this case, the controller will control whether the DHT-11 sensor reads the value. If the humidity in the greenhouse is <60%, the nozzle will work automatically, however, if the humidity in the greenhouse is <= 85%, the nozzle will turn off.

IV. CONCLUSION AND FUTURE WORK

After testing the DHT11 sensor and cloud service in a greenhouse, the following conclusions can be drawn:

The greenhouse cloud control equipment monitoring system is made with a DHT11 sensor and has the function of reading the humidity and temperature in the room and in the greenhouse. And the controller responsible for sending data can be choose either Atmega or a ready-made Arduino board. The calculated data by the controller will be displayed in the application on the Smartphone in real time.

The equipment monitoring system for controlling temperature and humidity in greenhouses with Cloud service in its implementation involves the use of planted plants. The soil is used in different conditions, namely wet, dry and slightly damp. To test the DHT11 sensor, the sensor is installed in a greenhouse, the indoor temperature and humidity can be seen on the OLED LCD screen and the APP.

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