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CONTROL AND ANALYSIS OF TECHNOLOGICAL PARAMETERS IN THE "SMART GREENHOUSE" SYSTEM USING A MICROCONTROLLER

Jovliyev Sarvar Mustafo ugli
Lecturer, Karshi State Technical University, Karshi, Uzbekistan
E-mail: jovliyev19sarvar96@gmail.com
ORCID: 0000-0002-9246-3795
Science ID: MQD-0625-0016

Abstract: This article discusses the issues of automatic control of air temperature, air humidity, and soil moisture in the "Smart Greenhouse" system. The study utilized the Arduino Uno microcontroller, DHT11 and LM393 sensors, as well as relay modules to control the executive mechanisms. The operating principles of the system, the technical characteristics of the sensors, and the software algorithms are analyzed.

Keywords: smart greenhouse, Arduino Uno, DHT11, LM393, hygrometer, microcontroller, automation, relay, sensor.

Annotatsiya: Ushbu maqolada "Aqlli issiqxona" tizimida havo harorati, havo namligi va tuproq namligini avtomatik nazorat qilish masalalari ko'rib chiqiladi. Tadqiqotda Arduino Uno mikrokontrolleri, DHT11 va LM393 datchiklari hamda ijrochi mexanizmlarni boshqarish uchun rele modullaridan foydalanilgan. Tizimning ishlash tamoyillari, datchiklarning texnik xarakteristikalari va dasturiy ta'minot algoritmlari tahlil qilingan.

Kalit so'zlar: Aqlli issiqxona, Arduino Uno, DHT11, LM393, gigrometr, mikrokontroller, avtomatlashtirish, rele, datchik.

Аннотация: В данной статье рассматриваются вопросы автоматического контроля температуры воздуха, влажности воздуха и влажности почвы в системе «Умная теплица». В исследовании использовались микроконтроллер Arduino Uno, датчики DHT11 и LM393, а также релейные модули для управления исполнительными механизмами. Проанализированы принципы работы системы, технические характеристики датчиков и алгоритмы программного обеспечения.

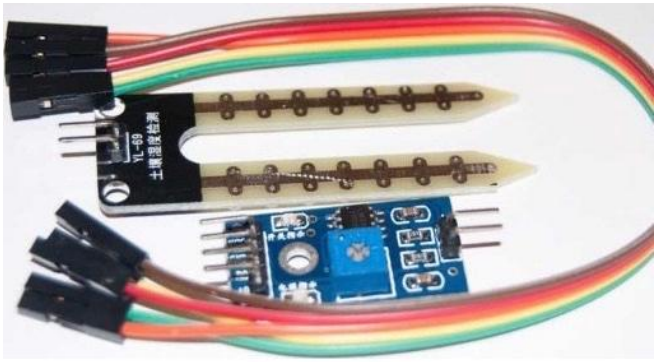
Ключевые слова: умная теплица, Arduino Uno, DHT11, LM393, гигрометр, микроконтроллер, автоматизация, реле, датчик.

Introduction: In modern agriculture, automated control of the greenhouse environment is of great importance for plant development and productivity. The "smart greenhouse" technology serves to maintain the microclimate necessary for plants, while reducing the human factor. The purpose of the research is to determine humidity and temperature indicators using sensors and create a device that automatically controls irrigation, ventilation and heating systems based on the data obtained.

Methods: The Arduino Uno microcontroller was chosen as the central control unit as part of the hardware in the study. The system consists of the following components:

LM393 hygrometer sensor: Used to measure soil moisture in analog mode. (Figure 1)

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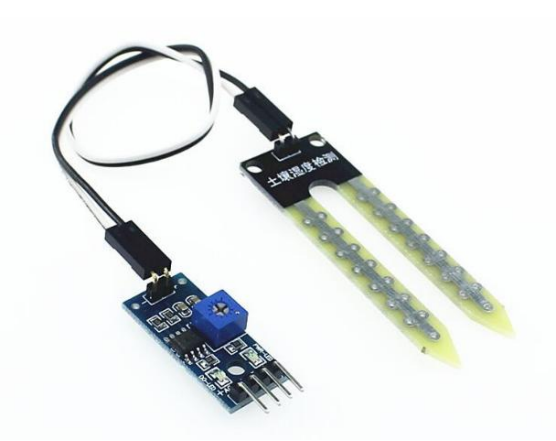
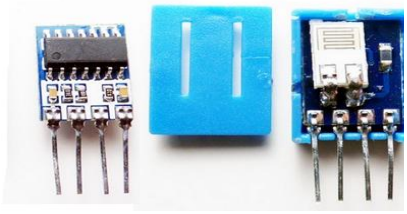
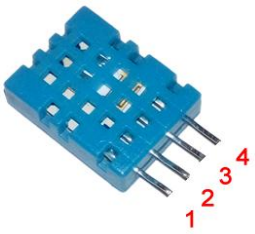


Figure 1. Hygrometer sensor

DHT11 sensor: Used to detect air temperature and humidity. (Figure 2)







1 - Vcc
2 - Data
3 - NC
2 - GND

Figure 2. **DHT11 sensor**

Relay modules (PIC AVR DSP ARM): Used to control high voltage (220V) devices such as fans, water pumps, and heaters. (Figure 3)



Figure 3. Relay PIC AVR DSP ARM

Software part: The device's operating algorithm was created in the Arduino IDE environment based on the C++ language. The sensors are connected to the analog and digital ports of the microcontroller, and the data is transmitted in real time is processed in the mode.

Results: As a result of the experiments, the following technical capabilities of the sensors were determined:

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Soil moisture (LM393): The sensor provides an output signal from 0 to 4.2 V. It was observed that the signal ranged from 0–1.46 V (digital value 0-300) when the soil was dry, 1.47–3.42 V (300-700) when it was wet, and 3.43–4.20 V (700-950) when there was a lot of water.

Air parameters (DHT11): Confirmed to measure air humidity from 20% to 95% (with an accuracy of ±5%) and temperature from 0 to 50°C (with an accuracy of ±2°C).

Control algorithm: If the soil moisture drops below 80%, the microcontroller starts the water pump via a relay. When the temperature exceeds a set point (for example, 30°C), the fan is automatically turned on, and when it drops below, the heating stove is automatically turned on.

Discussion: The research shows that the selected components (DHT11 and LM393) are inexpensive and easy to use. However, the distance plays an important role when connecting the sensors to the microcontroller: if the distance exceeds 20 meters, it is recommended to use a 5.1 kOhm resistor for the DHT11, and 10 kOhm if it is closer.

The use of relay modules ensures the safety of the system, as it allows controlling loads up to 220 V via a low-voltage (3-5 V) control signal. The main advantage of the system is the implementation of high-precision monitoring by converting analog signals into 10-bit digital values.

In **conclusion**, the developed "Smart Greenhouse" model allows for the automatic maintenance of optimal conditions for plants and can be an effective solution for the digitalization of agriculture.

References:

1. SMO Jovliev, AT Djalilov, FN Nurkulov, JB Fayziev, SA Berdiev SYNTHESIS OF ISOBUTYL METHYLOVOG EFIRA I EGO PERSPEKTIVNOST PRIMENENIYA V KACHESTVE DETONATsIONNO-USTOYCHIVOY TOPLIVNOY PRISADKI U // niversum : tekhnicheskie nauki 2025, 6 (5 (134)), 5-11
2. SMO' Jovliev, JB Fayziev, AT Djalilov KINETIC SYNTHESIS OF OCTANOPOVYShAYushchIX OXYGENATOV IIE-07: 03 I ANALYSIS IX IK-SPEKTROV // Universum: teknicheskie nauki 2025, 5 (2 (131)), 49-56
3. Jovliyev Sarvar Mustafa oglu. Checking and identifying errors in measuring instruments of different systems // Educational Research in Universal Sciences. November 2023, Volume 2, Issue 11, page 283–290
4. Jovliyev Sarvar Mustafa o'g'li. PROCESSING MEASUREMENT RESULTS // Educational Research in Universal Sciences. November 2023, Volume 2, Issue 11, page 264-269
5. ON Norboyev, SM Jovliyev. (2023). SIMULATION MODELING AND OPTIMIZATION OF CURRENT CURRENT USING THE SIMULINK PACKAGE OF MATLAB PROGRAM // Educational Research in Universal Sciences, 2(5), 870-881
6. ON Norboyev, SM Jovliyev. (2023). Description and analysis of the automation of the technological process of grain grinding // Innovations in Technology and Science Education, 2023/3/1, 2-7, 615-626
7. Jovliyev, SM o'g'li. (2023). MEASUREMENT VARIABLES AND THEIR USE IN EXPANDING THE MEASUREMENT RANGE OF INSTRUMENTS // Educational Research in Universal Sciences, 2(5), 695–700
8. Jovliyev Sarvar Mustafa o'g'li. (2022). SEVEN INSTRUMENT METHODS OF STATISTICAL METHODS FOR PRODUCT QUALITY MANAGEMENT AND ANALYSIS // EURASIAN JOURNAL OF ACADEMIC RESEARCH, 2(6), 41–45
9. Jovliyev Sarvar Mustafa oglu. (2022). USE OF CASE TECHNOLOGY IN EDUCATION IN TECHNICAL HIGHER EDUCATIONAL INSTITUTIONS // EURASIAN JOURNAL OF ACADEMIC RESEARCH, 2(5), 791–794

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ISSN: 2058-5519|Impact factor-15.9
http://houghtonstreetreview.com/index.php/hsr

10. SM Zhovliev SPECIALTY OF TECHNOLOGICAL PROCESSES AND PRODUCTION AUTOMATION–PROFESSION OF THE XXI CENTURY // ResearchJet Journal of Analysis and Inventions 2 (05), 15-19
11. Rakhimov AX, Jovliyev SM Kholbutayeva XE Radio monitoring and recognition of radio emissions radio electronic equipment // International Journal For Innovative Engineering and Management Research. -2021, April. -T.10. No. 4. -S. 506-507.
12. Mallayev AR, Sharipov GQ, Sodikov AR, Zhovliev SM Mathematical modeling of dynamics formation of hydrates at pipeline natural gas transport // International Journal For Innovative Engineering and Management Research. -2021, April. -T.10. No. 4. -S. 31-35.
13. Turaev Z.B., Yusupov R.E., Eshonkulov M.N., Jovliev S.M., Almardanov X.A., Khatamov I.A. Primenenie solnechnyx concentratorov dlya priema alternativenogo topliva cherez usstroystvo heliopyroliza // UNIVERSUM: TECHNIChESKIE NAUKI. – 2021, March. - no. 3(84). S. 8-11.