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SELECTION OF A MICROCONTROLLER FOR A MEASURING COMPLEX

To create a measuring complex for clonal micropropagation of plants, the choice of a microcontroller begins with defining the system goals and measurement parameters. In this work, we will focus on the problem of measuring humidity in the range of 80–100%. It is important to consider the accuracy, range of operating conditions, autonomy and power consumption. The requirements for the number of interfaces (I2C, SPI, UART) and ADC channels depend on the number of sensors and their polling frequency.

The optimal choice of a microcontroller involves finding a balance between performance, cost and the number of supported interfaces. At the same time, it is advisable to break down the tasks of the measuring complex into narrower and more specialized subtasks, each of which can be implemented on a separate microcontroller. For example, to measure humidity in the range of 80–100%, a separate microcontroller can be used as part of the complex, dedicated exclusively to this task. This approach ensures more accurate and stable data processing. A separate microcontroller recalculates the values that were received from the sensor, implements filtering and pre-processing algorithms, and then transmits the processed information to the main control level. Transmission can be carried out both wirelessly and via wired interfaces, e.g. using the Modbus RTU protocol over the RS-485 interface.

Taking into account modern requirements for measuring systems, the ESP32-C3 looks like an ideal choice for implementing data collection, processing and transmission tasks. Firstly, it combines compactness, low power consumption and sufficient computing power to perform application logic and pre-filter measurements. Secondly, its main advantage is the presence of a built-in Wi-Fi (IEEE 802.11b/g/n) and Bluetooth Low Energy (BLE) 5.0 module, which makes it easy to implement wireless data exchange with both local devices and the user, without additional modems and external interfaces. In addition, the ESP32-C3 is built on the RISC-V architecture, making it promising in terms of open standards and long-term support. At the same time, it maintains compatibility with the rich ESP-IDF and Arduino ecosystem, which simplifies development and integration into existing solutions. In terms of hardware resources, the ESP32-C3 provides a sufficient number of interfaces (1× I2C, 3× SPI, 2× UART). Combined with a low cost (from 2 to 4 USD), this makes the ESP32-C3 a rational choice for creating reliable and modern IoT nodes.