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Cost-effective automatization of experiment

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Automation of a physical experiment is an important part of its preparation. Quite often, it is required to remotely control equipment that is in radiation hazardous conditions, control various parameters of the experimental setup, and monitor the temperature and humidity of the air in the experimental room.
To date, electronics has reached great heights. Microcontrollers costing less than 2 USD with built-in WI-FI have appeared, which makes it possible to create very cheap devices for remote control and monitoring. The high performance of these microcontrollers and a large amount of internal memory significantly reduce the requirements for the quality of the executable code, which, together with a large number of ready-made libraries for various peripheral devices, significantly speeds up the development of appliances.
To automate the experiments carried out within the framework of the TANGRA[1] project, a number of devices based on the ESP8266[2] microcontroller were created: a manipulator for moving various objects, a liquid nitrogen amount control system for the dewars of germanium detectors, and sensors for monitoring the parameters of the environment in the experimental room. The process of creating these devices, the features of their circuitry and the experience we gained when using these devices will be discussed in this report.

1. Fedorov N. A., Grozdanov D. N., Kopatch Yu. N. et al., EPJ A 57 (2021) 194.
2. https://www.espressif.com/sites/default/files/documentation/0a-esp8266ex_datasheet_en.pdf

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