Proceedings of International Scientific-Practical Conference «Sustainable Development Goals: Youth Policy and Innovative Technologies», February 15-16, 2023, Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan

DESIGN OF THE AUTOMATIC GREENHOUSE CONTROLLER USING A PIC18F4550 MICROCONTROLLER

Perman Ezizgulyyevich Hojagulyyev[1*], Suleyman Malikmyradovich Nokerov[2], Arslan Tirkeshovich Tirkeshov[3], Aravind Pitchai Venkataraman[4]

[1,2,3]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*
[4]*Department of Electrical and Computer Engineering, Mattu University, Mettu, Ethiopia.*

[*]Corresponding author

DoI: https://doi.org/10.5281/zenodo.7782911

In order to facilitate human labor in the agricultural sector in our country, agricultural machinery is automated on the equipment of leading world technologies. Given the importance of greenhouses for the development of agriculture, research, and design work were carried out to create a greenhouse control system. PIC microcontrollers are now widely used to develop high-performance and low-cost greenhouse control systems. In this context, the PIC18F4550 microcontroller was selected to develop the greenhouse automation control system considering the advantage of its introduction into production [1] and its high operating speed and efficiency [2]. In smart greenhouses, various subsystems (heating, lighting, photovoltaic, etc.) are controlled and managed. Smart greenhouses are designed to increase production and ensure environmental sustainability [3].

A number of research works have been studied on the greenhouse control system. The electrical circuit (figure 1) of the system was designed using the Proteus EDA software and its functionality was verified by circuit simulation.

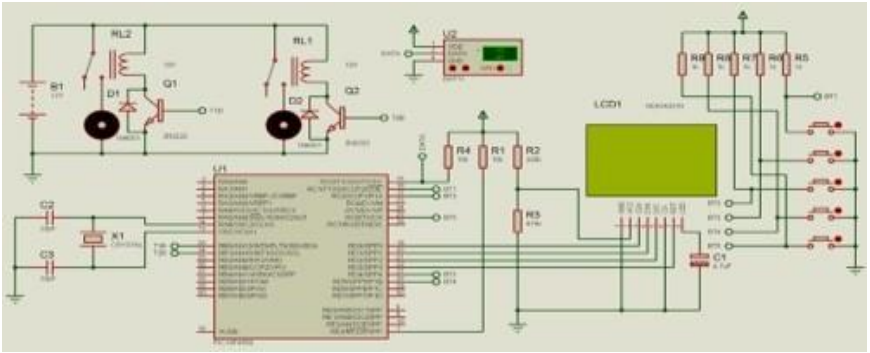

Figure 1. Electric circuit of greenhouse control system in Proteus program

Our selection of microcontrollers has 40 I/O systems, allowing us to increase the number of sensors and actuators that can be connected to the control system. Its memory is larger than other models, which allows it to accommodate complex program code that includes multiple functions. The Nokia 3310 display was used for the display of commands. The 4 relays act as a bridge between the microcontroller to ensure that the commands to the actuators work properly. A DHT 11 temperature and humidity sensor were connected to a device for measuring temperature and humidity in a greenhouse. There are 5 buttons for user control and control settings. Then using this program was the designed printed circuit board. According to the PCB in the program, a printed circuit board was made and the components necessary for the circuit board were placed on it. A control program was loaded into the microcontroller

to make the board fully functional, using the Pickit 3 programmer. The main program of the system, the display library for the correct display of text and images on the display, and the library for the DHT 11 sensor are written in C language, and for addressing the ports of the microcontroller the program code is written in Assembly language. The developed control system has opportunities for implementation in automated greenhouses.

REFERENCES

[1]. P. Hojagulyev, A.P. Venkataraman, “Modern automation methods of greenhouses,” Abstracts of papers of the International scientific conference “Science, technology and innovation in the period of the Revival of the new epoch of the Powerful state”, June 12-13, 2022, pp. 197-199

[2]. Suleyman Nokerov, Rovshen Ishangulyyev, Perman Hojagulyyev, Dr. Aravind Pitchai Venkataraman, and Khalid Ali Khan. 2022. Technology Development of Automated Contactless Hand Sanitizer Dispenser System with IR Sensor and Based on A PIC Microcontroller. In International Conference on Computer Systems and Technologies 2022 (CompSysTech ’22), June 17, 18, 2022, University of Ruse, Ruse, Bulgaria. ACM, New York, NY, USA, 6 pages. https://doi.org/10.1145/3546118.3546131

[3]. G. Cecchetti and A. L. Ruscelli, "Monitoring and Automation for Sustainable Smart Greenhouses," 2022 IEEE International Conference on Smart Computing (SMARTCOMP), Helsinki, Finland, 2022, pp. 381-386, doi: 10.1109/SMARTCOMP55677.2022.00084