Физика бойынша қолда бар ВЗЖ-на талдау жасалды. ‘Сырғанау үйкелісі коэффициентін анықтау’ және ‘Көлбеу жазықтықтың пайдалы әрекетінің коэффициентін анықтау’ зертханалық жұмыстарына арналған міндеттердің қойылымы тұжырымдалды. Интерфейсті жобалауға біртұтас амал ұсынылды және графикалық пайдаланушы интерфейсі дайындалды.

ӘДЕБИЕТТЕР ТІЗІМІ

1 Виртуалды зертханалық жұмыс физика бойынша. 7-9 сыныптар. Электронды ресурс. http://www.nd.ru/prod.asp?razd=descr&prod=virtuallab oratorytest

2 Тренажерлардың мысалдары. Электронды ресурс. http: //dl.sumdu. edu.ua/en/entrant/examples-of-simulators

3 Виртуалды зертханалық жұмыс физика. Электронды ресурс. http://www.all-fizika.com/article/index.php?id_article=110

4 Виртуалды зертханалық жұмыс. Электронды ресурс. http://www.youtube.com/watch?v=YPUA-g_GldI

5 Фрикциялық күшті өлшеудің бір әдісін көрсететін интерактивті анимация. Электронды ресурс. http://somit.ru/fisika7_30s2.htm

6 «Argus» компьютерлік зертханалық кешені. Кіру режимі - http://www.clc-argus.ru

7 Фрикциялық жетектеуші. Электронды ресурс. http: // www. planetseed.com/files/ uploadedfiles / Ғылым / Зертханалық / Air_and_Space / Friction_ Explorer / en / classes / FrictionApplet.html

8 Виртуалды фисикс зертханасы. Электронды ресурс. http: //www.dl.ket. орг / физика зертханалары /

9 «Физика» порталы ДонНТУ. Электронды ресурс. http: // info. donntu.edu.ua/el_izdan/fisik/index.html

10 «Физика» курсы. Электронды ресурс. http: // dist.donntu.edu.ua/course/view.php?id=248

РЕЗЮМЕ

Дана оценка качества доступных на сегодняшний день виртуальных лабораторий по физике. Приведена сводная таблица, содержащая классификацию рассмотренных лабораторных работ по таким признакам как режим доступа, среда исполнения, степень интерактивности и наличие преподавательского надзора за результатами выполнения работы.

RESUME

The estimation of the quality of the currently available virtual laboratories for physics is given. A summary table is presented, which includes the classification of the laboratory works examined according to such characteristics as the access mode, the execution environment, the degree of interactivity and the availability of teaching supervision over the results of the work.

UDC 004.896-027.22

Nass O.V., Doctor of Education Sciences
Yessengali K. K., Master student
Nonprofit JSC «Zhangir Khan West Kazakhstan Agrarian Technical University», Uralsk

ROBOTIC PLANT WATERING SYSTEM BASED ON THE ARDUINO MICROCONTROLLER

Аннотация

The article summarizes the experience of creating and programming a robotic device on the Arduino Uno platform. The research was carried out on the basis of the Scientific Research Institute of the «Zhangir Khan West Kazakhstan Agrarian Technical University». The main task of creating this device was to exclude the forgetfulness or inattention of users and prevent damage to the plant due to lack or excessive watering. The created device includes a soil moisture sensor that acts as a sensing

element in an automated system. Watering depends of type plant and environmental parameters and is carried out only when it is necessary the plant, herewith the exact (minimum) amount of water is used. The resulting robotic system is aimed at reducing user time for watering plants, as well as minimizing water losses.

Ключевые слова: *Arduino Microcontroller, Soil moisture sensor, water pump motor, Plant watering, Robotic watering system.*

1. Introduction

Home plants liven up any space by adding a sense of airiness and life. But plants are not only decoration the offices and the apartments. They release oxygen into the external environment, eliminate the dust of the environment, and neutralize toxic impurities in the air.

Plant owners enjoy the plants, their benefits and the feelings associated with caring about them.

Watering is the most important cultural practice and one of the labor intensive tasks in daily life. Watering systems ease the burden of getting water to plants when they need it. The major aspect of watering process is knowledge about the period when water is needed to irrigate the home plants.

However, it is difficult to do everything all right, people can forget to irrigate the plant or exceed the volume of water needed by it. This leads to different plant diseases.

Using a soil sensor, and an Arduino controlled water pump, we created a system that will never forget to do it. Instead of remembering to watering plants when the soil goes dry, people have to remember to once and a while refill the water reservoir. This prototype monitors the amount of soil moisture.

The predefined range of soil moisture is set for the defined plant type, and can be varied with soil type or crop type. In case the moisture of the soil deviates from the specified range, the watering system is turned on/off. In case of dry soil it will activate the irrigation system, pumping water for watering the plants. Wet soil stops irrigation.

The block diagram of smart irrigation system is represented on the Figure 1. It consists of a microcontroller which is the brain of the system. The moisture is connected to the input pins of the controller. The water pump and the pump motor are coupled with the output pins. If the sensors depart from the predefined range, the controller turns on the pump [1, 2].

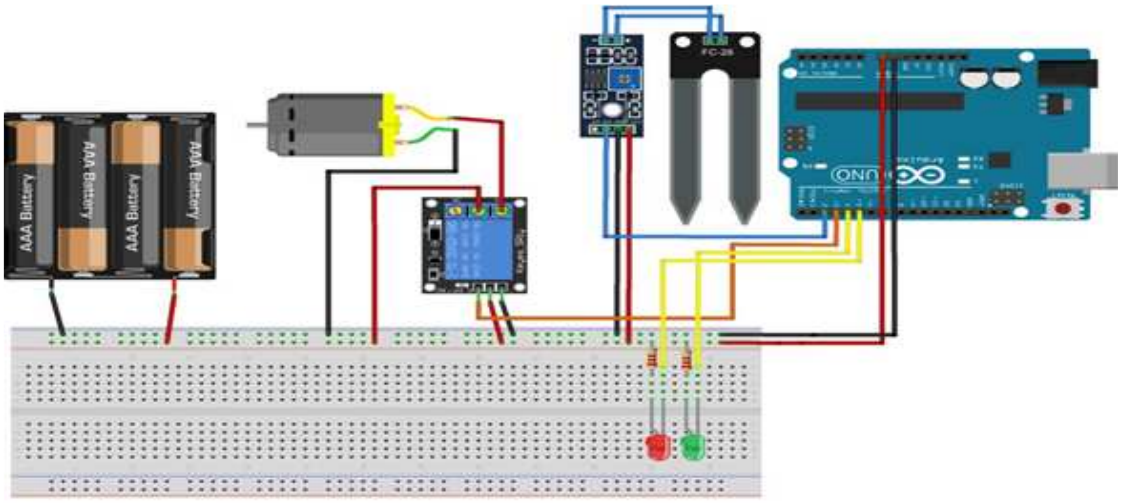

Figure 1 – Connecting devices in the robotic system

2. Components used

Arduino Microcontroller

Arduino is a hardware platform that contains a simple input-output interface and supports a development environment that implements the open programming language. Arduino Uno (Figure 2) can serve as the basis for stand-alone devices or can run under the control of software installed on the computer. Under the trademark Arduino, several boards with a microcontroller and expansion cards ("Shields") are manufactured. Arduino-compatible boards are designed in such a way that they can be expanded if necessary, adding new components to the device [3, 4].

Microcontrollers for Arduino are distinguished by the presence of a boot loader preloaded into them, with which the program is loaded into the microcontroller without the use of separate hardware programmers. The I/O ports of the microcontrollers are designed in the form of pin rulers [5].

Figure 2 – Arduino Uno ATmega328

Soil moisture Sensor

The soil moisture sensors measure the moisture level (water content) of the different plants. If the moisture level is found to be below the desired level, the moisture sensor sends the signal to the Arduino board which triggers the Water Pump to turn ON and supply the water to respective plant using the pumper. When the desired moisture level is reached, the system (Figure 3) halts on its own and the Water Pump is turned OFF [6].

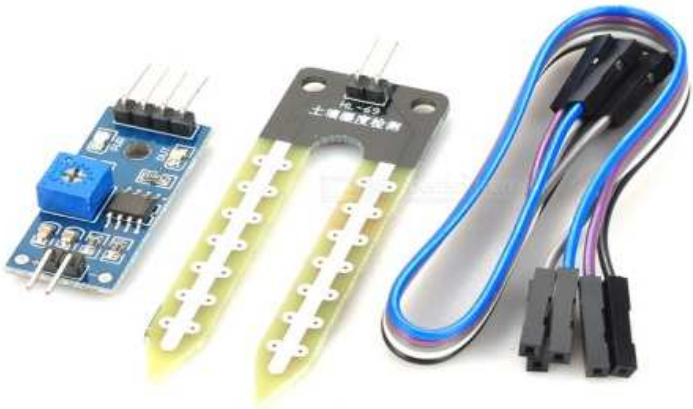

Figure 3 – YL-38 moisture sensor

Relay

The relay (Figure 4) is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal [5, 6].

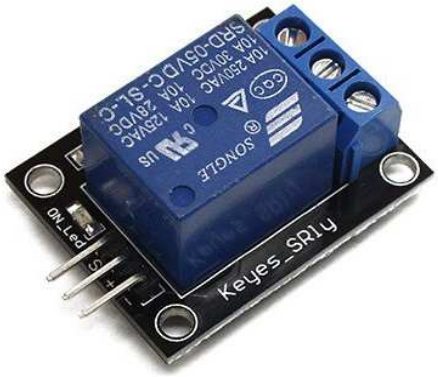

Figure 4 – Mono channel relay

Water Pump

The water pump (Figure 5) is used to artificially supply water for a particular task. It can be electronically controlled by interfacing it to a microcontroller. It can be triggered ON/OFF by sending signals as required. The process of artificially supplying water is known as pumping [6].

Figure 5 – Water pumper

Other details

Connecting leads are required to connect all components, pipe to transfer water, 12 v battery and USB charger for charging Arduino microcontroller and for pumper, breadboard for connecting circuits and pump water motor and plastic bottle used as reservoir (Figure 6).

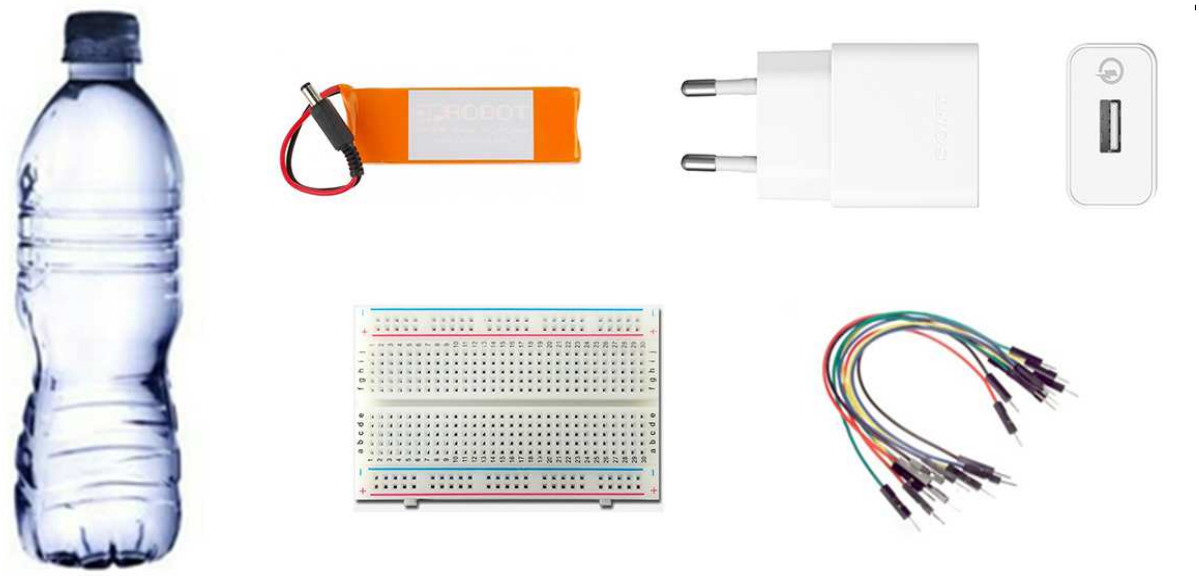

Figure 6 – Consumables robotic plant watering system

3. Connection and software

To create a device for automatic watering system for plants, take Arduino Uno and described above. Firstly, connected on the breadboard with wires moisture sensor into A1 pin, it is input, and output is water pumper which connected into A0 pin. After connection relay to battery 12v and water pump into relay (Figure 1). Then the system is programming as shown below (Figure 7).

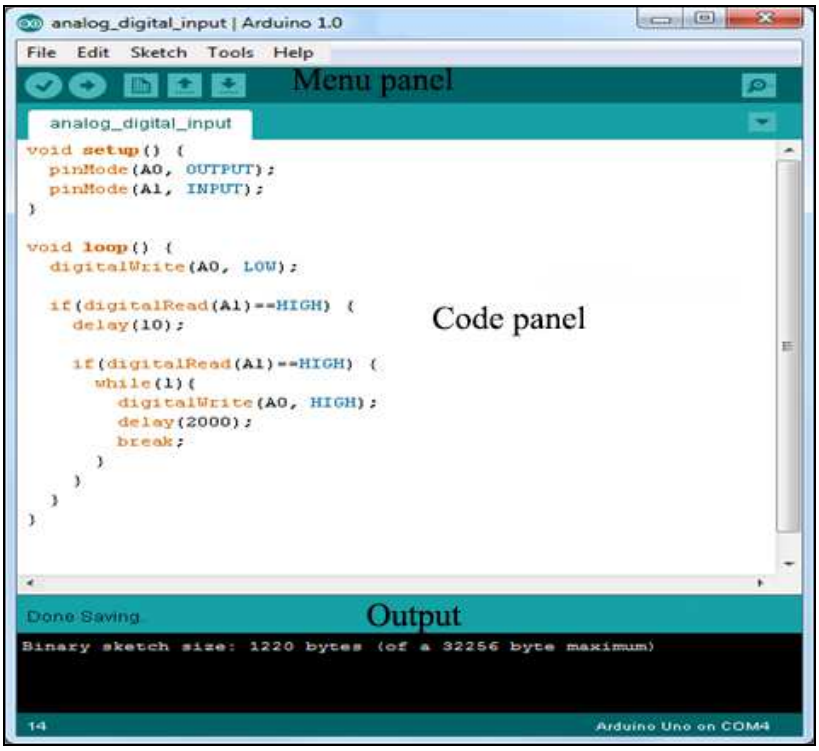

Figure 7 – Code implementation

Automatic watering system for plants has been developed by integrated features of all the hardware components used. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit (Figure 8).

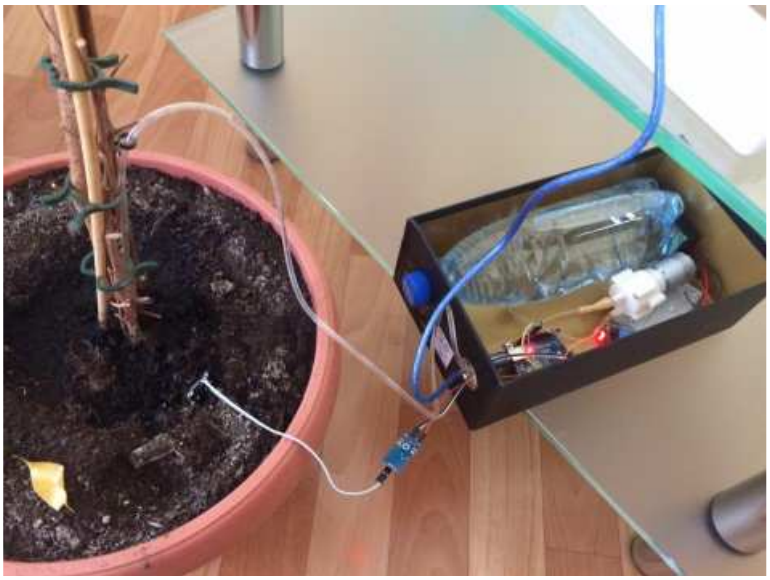

Figure 8 – System has connection with plant

The moisture sensors measure the moisture level (water content) of the different plants. If the moisture level is found to be below the desired level, the moisture sensor sends the signal to the Arduino board which triggers the Water Pump to turn ON and supply the water to respective plant using the water pump. When the desired moisture level is reached, the system halts on its own and the water pump is turned OFF.

The «Automated plant irrigation system based on Arduino Microcontroller» has been designed and was successfully tested from 20.06 to 30.08 2017 year **in automatic mode** on the basis of the Scientific Research Institute of the «Zhangir Khan West Kazakhstan Agrarian Technical University» (Figure 9).

Figure 9 – Plant before and after testing from 20.06 to 30.08 2017 year

The studies revealed the shortcomings of the obtained robotic system:

– Mildew appeared on the humidity sensor and on the inside of the lid;
– The plastic bottle for water changes shape during the water supply for irrigation (Figure 10).

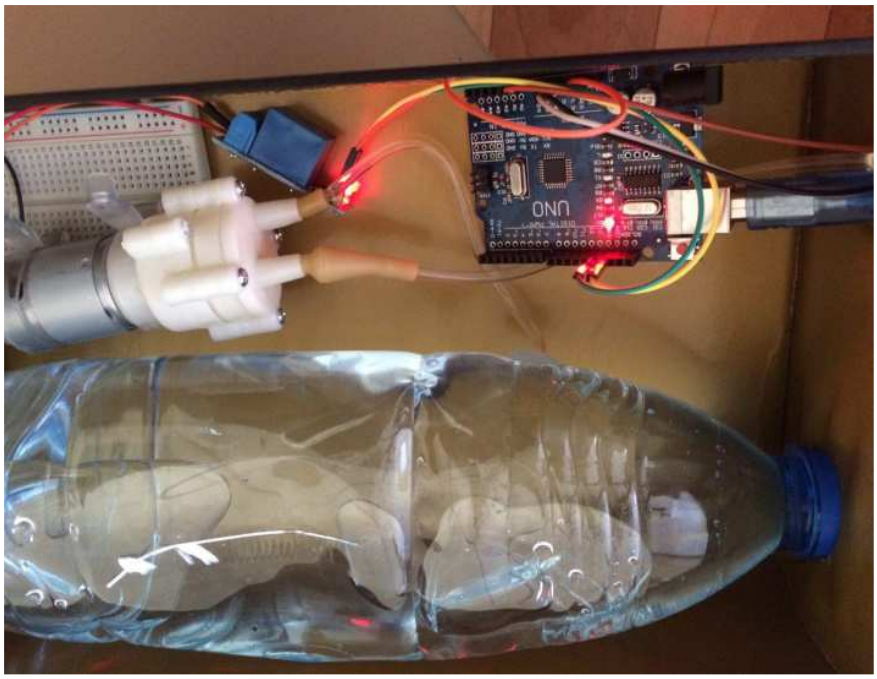

Figure 10 – Robotic plant watering system in the box

4. Conclusion

Thus, the Arduino Based Automatic Plant Watering System has been designed and tested successfully. The system has been tested to function automatically. The moisture sensors measure the moisture level (water content) of the different plants. If the moisture level is found to be below the desired level, the moisture sensor sends the signal to the Arduino board which triggers the Water Pump to turn ON and supply the water to respective plant using the water pump. When the desired moisture level is reached, the system halts on its own and the water pump is turned OFF. Thus, the functionality of the entire system has been tested thoroughly and it is said to function successfully.

The studies revealed the advantages of the Arduino humidity sensor, programmed for data reception. Determined the advantages of the robotic system obtained:

- the system can work autonomously for two weeks (without the participation of a human);
- simple to use for end user;
- efficient, economical in terms of electricity and water;
- low cost, good position in the interior.

REFERENCES

1 Massimo Banzi. Getting started with Arduino. – California: O'Reilly Media Inc., 2008. – 128 p.

2 Mike McRoberts. Arduino starters kit manual. – L.: Earthshine Design, 2009. – 105 p.

3 Jonathan Oxer, Hugh Blemings. Cool Projects for Open Source Hardware. – New York: Apress, 2009. – 445 p.

4 Michael Margolis. Arduino Cookbook. – California: O'Reilly Media Inc., 2012. – 724 p.

5 Аппаратная часть платформы Arduino. [Electronic resource]. URL: http://arduino.ru/

6 Arduino Uno Rev3. [Electronic resource]. URL: https://store.arduino.cc/arduino-uno-rev3

ТҮЙІН

Мақалада «Arduino Uno» платформасындағы робот құрылғысын жасау және бағдарламалау бойынша тәжірибесі жинақталған. Құрылғы Жәңгір хан атындағы Батыс Қазақстан аграрлық техникалық университетінің Ғылыми-зерттеу институтының базасында 20.06-ден 30.08-ге дейін сәтті сынақтан өтті. Бұл құрылғыны құрудың басты мақсаты - пайдаланушылардың ұмытып кетуін немесе ескертуін болдырмау және зауыттың зақымдануын болдырмау немесе артық суару болмауы. Құрылған құрылғы автоматтандырылған жүйеде сезімтал элемент ретінде әрекет ететін топырақтың ылғалдылық сенсорын қамтиды. Суару қондырғының түріне және қоршаған ортаның параметрлеріне байланысты және судың дәл (ең аз) мөлшерін пайдалану кезінде ғана орнату үшін қажет болғанда жүзеге асырылады. Алынған робототехникалық жүйе суару қондырғыларын пайдаланушылардың уақытын қысқартуға, сондай-ақ судың жоғалуын барынша азайтуға бағытталған.

РЕЗЮМЕ

В статье обобщается опыт создания и программирования роботизированного устройства на платформе Arduino Uno. Исследования проводились на базе Научно-исследовательского института Западно-Казахстанского аграрно-технического университета имени Жангир хана. Основная задача создания данного устройства заключалась в том, чтобы исключить забывчивость или невнимательность пользователей и предотвратить повреждения растения, связанные с недостатком или чрезмерным его поливом. Созданное устройство включает в себя датчик влажности почвы, который действует как чувствительный элемент в автоматизированной системе. Полив зависит от типа растения и параметров окружающей среды и осуществляется только тогда, когда это необходимо растению, при этом тратится точное (минимальное) количество воды. Полученная система направлена на сокращение времени пользователя на полив растений, а также минимизацию потерь воды.