ORGANIZATION OF AUTOMATIC SYSTEM FOR A DISCRETE IRRIGATION SYSTEM

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Abstract: *Today, along with the growing demand for water resources in agriculture, the shortage of water for crop irrigation is also increasing significantly. Therefore, we need to implement modern water-saving technologies and use them efficiently. In this article, proposals have been developed on the issues of efficient use of discrete irrigation system and improvement of land productivity and prevention of salinization of cultivated areas, efficient use of water resources and integrated management through automation of this system.*

Keywords: *discrete irrigation, automation, agriculture, water resources, smart technologies, smart economy.*

INTRODUCTION

Uzbekistan is the country with the largest irrigated area in the Central Asian region, that is, 4.3 million hectares of land are cultivated in our country today [1]. Irrigation of these fields, as well as the need for drinking water, is becoming an urgent problem every day. In addition, climate change has become a global problem at the present time, especially requiring the efficient use of water resources.

The reason is that in recent years, the Central Asian countries, in particular, Uzbekistan, have had frequent water shortage years. For example, until 2000, a water shortage was observed every 6-8 years, but in recent years, this situation has been encountered every 3-4 years. Average annual water consumption in agriculture remains high. Before 2015, the total water deficit in Uzbekistan was more than 3 billion m3—by 2030 it could reach 7 billion m3 and by 2050, 15 billion m3. In addition, the demand for access to good quality water is expected to grow, which would lead to an increase in water demand from the public utilities sector. At the same time, climate change will further exacerbate water scarcity in Uzbekistan and may increase the duration and frequency of droughts (as occurred in 2000, 2008, 2011, 2014, and 2018), causing serious problems in meeting the water needs of the economy [1]. In addition, as a result of the increase in air temperature, it is estimated that the irrigation standards of agricultural crops will increase by 5% by 2030, and by 7-10% by 2050 [2]. For all this, we need to radically change our attitude to water resources, use modern water-saving technologies in its use, apply intensive methods

in irrigation, and most importantly, prevent salinization and desertification of our lands and use water resources efficiently. need Therefore, when water-saving technologies are the need of the hour, we should apply them to our lives. Because the need for water is increasing. If at the beginning of the 1990s, the population of our country was 20.3 million people, and an average of 64 billion cubic meters of water was consumed per year in economic sectors, by 2024, the population will reach about 37 million people, and for the sectors of our economy the volume of water used is 51-53 billion cubic meters, which means that as the population increases, water resources are decreasing [3]. In order to prevent this situation, we can prevent the inevitable water shortage in the region only through the widespread use of water-saving technologies.

In particular, today the Republic of Uzbekistan is one of the countries with a high water shortage. For example, today the World Resources Institute has studied the situation of water shortages that will occur in 167 countries by 2030 and 2040. According to the results, we can see that Central Asian countries, especially Uzbekistan, are among the 33 countries that are expected to experience the greatest water shortage in 2040. [4]

Figure 1. Analysis by the World Resources Institute (WRI)

According to the report, more than 80% of the water resources of these countries are used for irrigation, livestock, industry and domestic needs.

Taking into account the above analysis, let's make some recommendations that will help reduce the negative consequences of water shortage:

1. To improve the efficiency of the use of water resources in agriculture and to improve the irrigation system for watering fields;

2. search for ways to reuse water;

3. use of water-saving technologies;

4. to improve the quality of the drainage system.

The main part. As a result of the global climate change, the sharp increase in the population, and the sharp increase in the demand for water resources due to the development of industrial sectors, the efficient use of water in agriculture is considered one of the urgent issues of today. The introduction of modern water-

saving technologies in the irrigation of agricultural crops, the improvement of methods of calculating irrigation rates and periods are receiving special attention all over the world.

In particular, in 2017-2023, water-saving technologies were introduced in our country on a total of 1.2 million hectares, that is, on 31% of agricultural arable land. However, the increasing water shortage and the growing need for water resources require a sharp increase in the efficiency of water use in agriculture.

According to the Decision of the President of the Republic of Uzbekistan on December 11, 2020 "On measures to accelerate the introduction of water-saving technologies in agriculture", drip and sprinkler irrigation in the cultivation of agricultural crops fivefold increase in the rate of introduction of plowing systems and discrete irrigation method with laser leveling, i.e. introduction of these technologies on 230 thousand hectares in 2021, and 200 thousand hectares of irrigated areas with laser leveling proposal on increasing the efficiency of water use was approved [5,6].

Therefore, based on the above issues, it is necessary to accelerate water-saving technologies. One of these cost-effective technologies is a discrete irrigation system.

Discrete (pulsar) irrigation is an irrigation system designed to deliver water under pressure to the field through a closed pipe. Discrete irrigation system is a modern automated, highly efficient complex irrigation system for supplying water to agricultural crops in our republic. It is most effective in non-saline or low-saline irrigated lands with a slope in the direction of irrigation ($0.001 \leq$ л $f \leq 0.007$) under average soil permeability. Proper use of discrete irrigation technique allows to save irrigation water (compared to conventional irrigation) by 15-20 percent and increase yield by 10-15 percent due to uniform wetting of the irrigated area [7].

The difference between discrete irrigation and other irrigation methods is that the field is evenly moistened along the length of the field and the amount of soil moisture increases. Water leakage is drastically reduced. Through this, it is possible to increase the cost of water supply to the owners and reduce the duration of irrigation. This allows us to reduce waste water consumption by 15-20% and ensures uniform wetting of the soil along the length of the fence.

Regular and timely watering of plants is a very important issue. Such irrigation can only be achieved using automated irrigation systems (Figure 2).

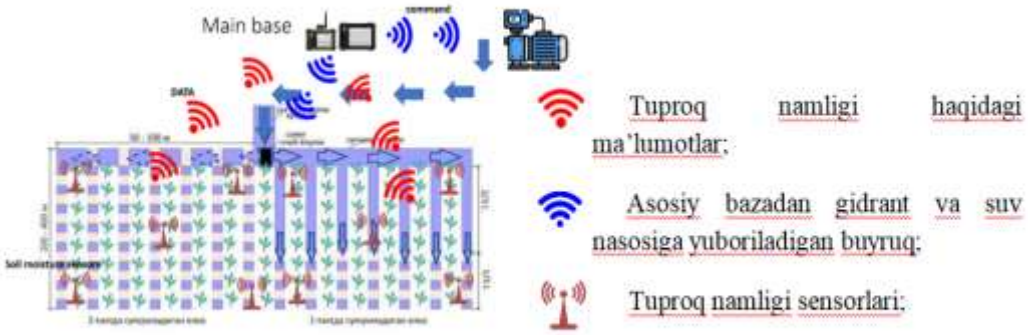

Figure 2. Scheme of automatic discrete irrigation system.

Automated discrete irrigation system (Fig. 3) has the following capabilities:

- automated remote control;
- connecting weather sensors (temperature, humidity, rain);
- displays soil moisture, air humidity and air temperature data in real time;
- when soil moisture decreases, water pumps start and water the field until the required moisture level is reached;
- the furrow is evenly moistened along its length;
- the discharge of water is sharply reduced;
- it is possible to increase the cost of water supply to the owners and reduce the duration of irrigation;
- Through ThingSpeak Server, you can monitor data from anywhere.

Advantages of the system:

- the device is developed taking into account the climate and conditions of Uzbekistan;
- availability of fast service;
- data analysis is monitored and studied through a special site;
- availability of additional remote control and monitoring function;
- remote control.

Research methods and results. The above system is designed using simple sensors and NodeMCU. The control scheme was created from a soil moisture sensor, a temperature-humidity sensor, a pump unit, a relay module, an ESP-8266 microcontroller (Fig. 3) and a program was created on the Arduino IDE platform.

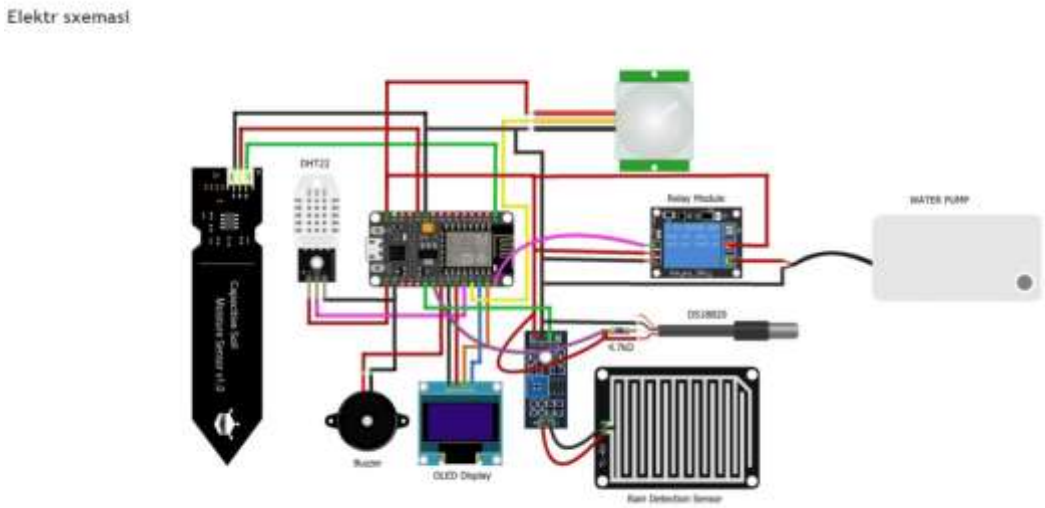

Figure 3. Microcircuit architecture for an automatic discrete irrigation system

- ESP-8266 is connected with DHT22 sensor and soil moisture sensor. It sends data to remotely control the operation of our device.
- LED is connected to NodeMCU ESP-8266 through I2C pin to display soil moisture status and water level in reservoir.
- Soil moisture sensor is connected to pin A0 of NodeMCU
- DHT22 is connected to D4 pin of NodeMCUto D4 Pin.
- The relay is connected to the pump.
- Relay is connected to NodeMCU through pin D4.
- NodeMCU's 5V pins are used to power the pump and relay.
- 3V is required for DHT22 sensor, humidity sensor and OLED display.

The generated scheme was installed on the experimental model for the purpose of obtaining experiments (Fig. 4). The main task of the system was to notify the system via the GSM system if the soil moisture falls below the norm and to start the pump for the irrigation process, and this task was fully fulfilled.

Figure 4. Experimental stand for moisture management in irrigation systems

The main task of the system is to start the water pumps and irrigate the field until the required moisture level is reached.

Conclusion. The use of an automatic discrete irrigation system is one of the most promising directions for the development and stability of agricultural production. Discrete irrigation is a new irrigation method used in agricultural practice, first of all, the field area is laser leveled before applying this system. As a result of laser leveling, the crops are supplied with the same nutrients and moisture, and the crops have a uniform fertility in the field. The convenience features of the proposed automated system include its manual and automated control, connecting the necessary sensors (temperature, humidity, rain, pressure), the ability to work according to a given schedule, receiving real-time data, and automatically starting water pumps, through ThingSpeak Server, we can include things such as monitoring data from anywhere, controlling the irrigation system. In addition, farmers will have the opportunity to control irrigation, monitor water parameters, save time and effort, and at the same time control water consumption, from any place or with a smartphone.

REFERENCES:

1. National State of the Environment Report: Uzbekistan. December 2023 https://www.iisd.org/system/files/2024-02/uzbekistan-state-of-the-environment-en.pdf
2. Climate change impacts on irrigation water requirements: Effects of mitigation, 1990-2080 (Article) https://www.researchgate.net/publication/223384056_Climate_change_impacts_on_irrigation_water_requirements_Effects_of_mitigation_1990-2080
3. The first biennial update report of the Republic of Uzbekistan. Under the UN framework convention on climate change. https://unfccc.int/sites/default/files/resource/FBURUZeng.pdf
4. https://daryo.uz/2022/12/18/dunyoning-qaysi-davlatlarida-2040-yilga-kelib-suv-tanqisligi-kuchayadi-xarita
5. Decision of the President of the Republic of Uzbekistan on December 11, 2020 “On measures to accelerate the introduction of water-saving technologies in agriculture”
6. Sh.R. Khamrayev and Sh. J. Rakhimov “Introduction of cost-effective irrigation technologies in water management” training manual, page 6
7. Recommendations on zoning of discrete surface irrigation technology (practical studies of Uzbekistan SSR). SANIIRI scientific production association, Tashkent, 1990. M.G. Horst, L.A. Baykov, V.V. Dashina, Sh.A. In Russian under the academic editorship of Ishankhojaeva, Doctor of Technical Sciences N.T. Laktaev
8. Терпигорев А. А. Механизированные технологии полива с дискретным регулированием подачи воды в борозды // МиВХ. 2004. - № 4. -С. 42-45.

9. Khudayev I.J., Avlakulov M. Irrigation of lands of Shakhrisabz district by discrete pulse method. Collection of materials of scientific and practical conference of KMII. Karshi, 1999, - c.109-110

10. Сельское хозяйство Узбекистана. № 3, 2001, с.37. 5. Худайев И.Ж. Дискретный метод полива. Экономический вестник Узбекистана. -№ 5.2001.- с.25.