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WAYS TO USE SMART TECHNOLOGIES IN AGRICULTURE

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Abstract

The article discusses the implementation of water-saving technologies in irrigation, information on land areas and soil composition, implementation of optimal agrotechnical measures, and other scientific and innovative achievements and best practices. . The implementation of the irrigation system based on digital technologies and its efficiency in the use of water resources are shown.

INTRODUCTION

Currently, the use of digital technologies is developing rapidly in almost all spheres of human activity on a global scale. In our republic, great attention is being paid to digitalization of agriculture and development based on advanced innovations. Digital transformation of agriculture by introducing digital technologies and platform solutions to ensure technological progress in the agro-industrial complex and increase productivity in digital agricultural enterprises is considered as one of the main tasks. This, in turn, includes digital technologies in the efficient use of agricultural land and water, intensive gardening, automatic garden management technologies, automated and computerized intelligent technologies in greenhouse farms, robotics in livestock and poultry farming, serves automated and computerized technologies, storage and processing of agricultural products, implementation of digital technologies in logistics and sales centers.

The concept of "smart" agriculture is a combination of advanced technical and digital solutions (including integrated automation and robotization of production, big data processing systems, machine learning) that increase labor productivity, reduce production costs, and increase the stability of the agricultural sector. 'learning and artificial intelligence') refers to agriculture based on modern methods of agriculture and food production.

The use of digital technologies in production and management in agriculture, the creation of material and equipment supplies at the level of demand, arming them with modern digital technology, and deepening economic reforms in the agricultural sector, further increasing the sense of ownership of land and property, entrepreneurship, business , the organization of production based on new ownership and the digital economy and the development of optimal regulatory mechanisms are of great importance. According to the scientists, researches have been carried out to provide farmers with the opportunity to

remotely obtain information about saturated soil temperature, soil moisture, and plant diseases with the help of sensor devices. Through the received information, farmers can take necessary measures and activities at the same time.

It has been proven that farmers can achieve higher production efficiency through the use of the Internet of Things (IoT) through the "Smart" agricultural system. The obtained results and their analysis. Cloud technologies are also used to implement the above processes. Through the use of Internet of Things (IoT) "cloud" technologies, the data transmitted by the sensor is collected, and by evaluating the transmitted data, the necessary processes are implemented to achieve high results, and certain measurement functions are used to implement the processes. existing records.

In cooperation with the scientists of the Indian Research Institute of Mechanical and Engineering Engineering on the topic of "Use of advanced digital technologies in soil monitoring based on plant protection and automatic irrigation system" for 2021-2023 by our scientists on the above-mentioned topical issues. Research is being conducted within the framework of an ongoing international scientific project. In the project, the collection of the database, the study of the soil composition, the methods of application in large areas, as well as the automatic irrigation system were studied and tested in laboratory conditions. Currently, the research is being tested on tomato and potato crops in the experimental fields of the Tashkent State Agrarian University's Samarkand Branch Information and Consulting Center, and the algorithm of the program is being developed. Based on the data collected through the algorithms created in our research, plant health and soil analyzes were carried out as above. Cloud technologies were also used to implement the processes.

Through the use of Internet of Things (IoT) "cloud" technologies, the data transmitted by the sensor is collected, and the transmitted data is analyzed and compared. In our experiments, the process of growing crops was carried out on the basis of conventional technologies, and all observations and analyzes were carried out on the basis of generally accepted methods and recommendations.

For the purpose of comparative comparison, a separate average mixed soil sample was taken from the experimental area for agrochemical analysis of the soil and analyzed in the laboratory of the Department of Agrochemistry, Soil Science and Plant Protection, Samarkand Branch of Tashkent State Agrarian University. Soil composition in the analysis:

- ✓ Total amount of nitrogen, phosphorus and potassium;
- ✓ Nitrogen in the form of N-NO3-nitrate;
- ✓ N-NH4– ammonium nitrogen;
- ✓ Amount of compost (humus);
- ✓ Mobile phosphorus and exchangeable potassium;
- ✓ Soil environment (pH);
- ✓ Mechanical composition of the soil;
- ✓ Indicators such as soil moisture were studied.

The results of the analyzes were used in the processes of care of the crops grown on the experimental site, and the data are placed in the mobile application under development and digitized in a convenient way for farmers and farmers to use. The automatic irrigation system is built on top of the regular drip irrigation system. The standard soil moisture level for the type of planted plant is determined.

Data on soil moisture and temperature collected from sensors in the field were processed and average moisture was calculated. If the average soil moisture level in the field is below the norm, the irrigation system is automatically activated. In this part of the project, remote reading of data from the server is performed via the Internet.

SIM900A gsm module was used for this. A 5V relay is used to start and stop the irrigation system. These quilts are controlled by an Arduino Uno. The farmer will be able to monitor the data coming from all sensors and control the irrigation system through the mobile application. Below is a block diagram of the algorithm written on the Arduino Uno:

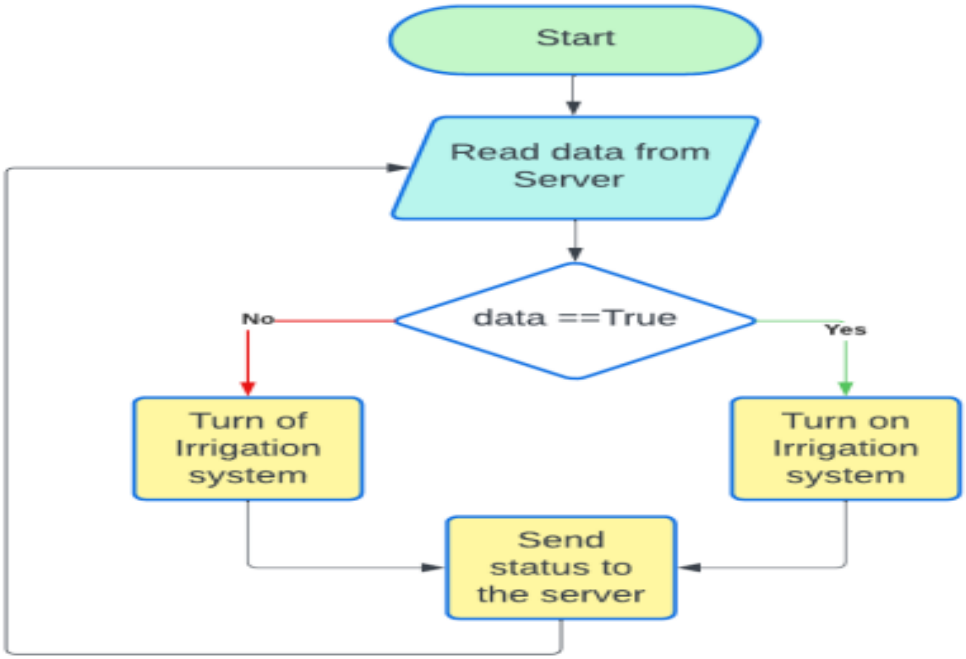

Figure 1.

Installation of irrigation systems in a small experimental field (2023)

In this method, which is proposed to be used in the project, various sensor nodes are installed in brackish areas. These nodes collect data and transmit it to a base station or server that collects data through wireless communication modules. The stored data is processed and transferred to a smartphone, tablet or laptop where the data can be displayed.

Natural parameters obtained from sensors installed in agricultural fields are measured, and the collected data are sent to the ARM microcontroller (Arduino Uno board) and Zig-Bee module through the Internet of Things (IoT) cloud system. Using a mobile device or computers, the user receives and monitors data remotely.

At the last stage, the farmer conducts the necessary actions (irrigation, resource management, crop control, etc.) based on the collected data.

Conclusions.

The proposed irrigation system consists of a microcontroller, mobile phones, a GSM module, a set of sensors and a water pump control unit. The sensor package consists of a temperature sensor, a humidity sensor, a light sensor and a rain sensor, which is used to monitor field conditions such as air temperature, soil moisture, sunlight and data such as rainfall is collected.

The mobile communication (GSM) module in the proposed irrigation system is used to send and receive messages between the microcontroller and the smartphone. The ARM microcontroller receives the data from various sensors and the data analyzed by the application installed on the smartphone and, based on this data, controls the irrigation system by turning on or off the water pump. The ARM sends information about the irrigation status to the farmer through the GSM module, and the farmer is aware of the entire irrigation status.

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