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APPLICATION OF INTELLIGENT TECHNOLOGIES IN AGRICULTURE

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Abstract
The article discusses the introduction of water-saving technologies in irrigation, information on the composition of lands and soils, the implementation of optimal agrotechnical measures and other scientific and innovative achievements, and best practices. The introduction of irrigation systems based on digital technologies in the use of water resources and their effectiveness are demonstrated.

Keywords: Android application, Drip irrigation, GSM module, Microcontroller, Smartphone and wireless sensor networks.

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 and development of agriculture based on advanced innovations. One of the main tasks is 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.

This, in turn, involves digital technologies in the efficient use of agricultural land and water, the creation of intensive gardens, technologies of automatic management of gardens, automated and computerized intelligent technologies in greenhouse farms, robotic, automated and computerized technologies in livestock and poultry farming, storage of agricultural products and serves processing processes, 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 production automation and robotics, big data processing systems, machine learning and artificial intelligence) that increase labor productivity, reduce production costs, and increase the sustainability of the agricultural sector. 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 technical 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, new ownership and digital economy. It is important to organize production and develop optimal regulatory mechanisms [1].

According to scientists, studies 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 the necessary measures and activities at the same time. It has been proven that farmers can achieve higher production efficiency through the use of Internet of Things (IoT) through a smart agricultural system.

Cloud technologies are also used to implement the above processes. Through the use of Internet of Things (IoT) "cloud" technologies, the data transmitted by sensors is collected, and by evaluating the transmitted data, the necessary processes are implemented to achieve high results, and certain measurement functions are available to apply the processes in practice (Table 1).

Table 1 Gross value added created in the Republic of Uzbekistan

Indicators	trillion soums			in % of GDP		
	2017	2020	2023	2017	2020	2023
Total GDP	**356,5**	**668,0**	**1 192,2**	**100,0**	**100,0**	**100,0**
The official economy	195,7	414,9	769,3	54,9	62,1	64,5
Unobservable economy	160,7	253,2	422,9	45,1	37,9	35,5
including:						
Informal economy	134,8	206,9	323,3	37,8	31,0	27,1
The hidden economy	25,9	46,3	99,6	7,3	6,9	8,4

With the results of the statistical assessment, statistical calculations were made for the volume of GDP of the Republic of Uzbekistan in 2023 with an additional precision of 125.6 trillion soums, and as a result, its actual volume increased from 1066.6 trillion soums to 1192.2 trillion soums. increased to soums.

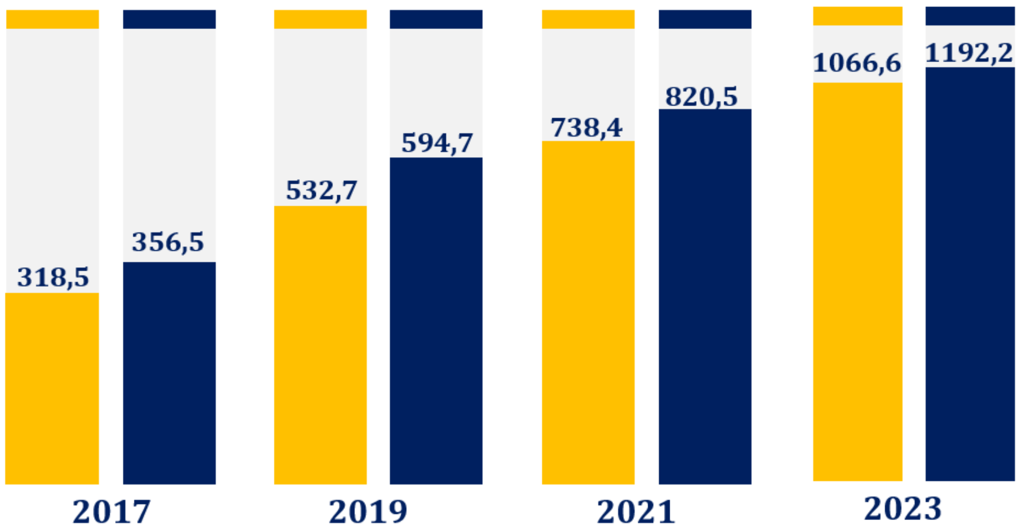

Figure 1. As a result of statistical calculations, the dynamics of changes in the volume of GDP, in trillion soums.

The volume of GDP for 2017 was additionally estimated at 7.4 billion US dollars, and it increased from 62.2 billion US dollars to 69.6 billion US dollars. For 2023, the volume of GDP of the Republic of Uzbekistan in US dollar equivalent was estimated at 10.7 billion US dollars, and it increased from 90.9 billion US dollars to 101.6 billion US dollars. Research is being carried out by our scientists within the framework of the international scientific project carried out in cooperation with the scientists of the Indian Institute of Mechanical and Engineering on the topic "Use of advanced digital technologies in soil monitoring based on plant protection and automatic irrigation system" for 2021-2023.

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 at the experimental fields of the Samarkand branch of Tashkent State Agrarian University 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 with each other. 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 nitrogen, phosphorus and potassium content;*
- *N-NO3-nitrogen in the form of nitrate;*
- *N-NH4– nitrogen in ammonium form;*
- *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 care processes 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. An automatic irrigation system is built on top of a regular drip irrigation system. The standard soil moisture level for the type of planted plant is determined. Soil moisture and temperature data collected from sensors in the field were processed to calculate average moisture. If the average soil moisture level in the field is below the norm, the irrigation system will be 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 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:

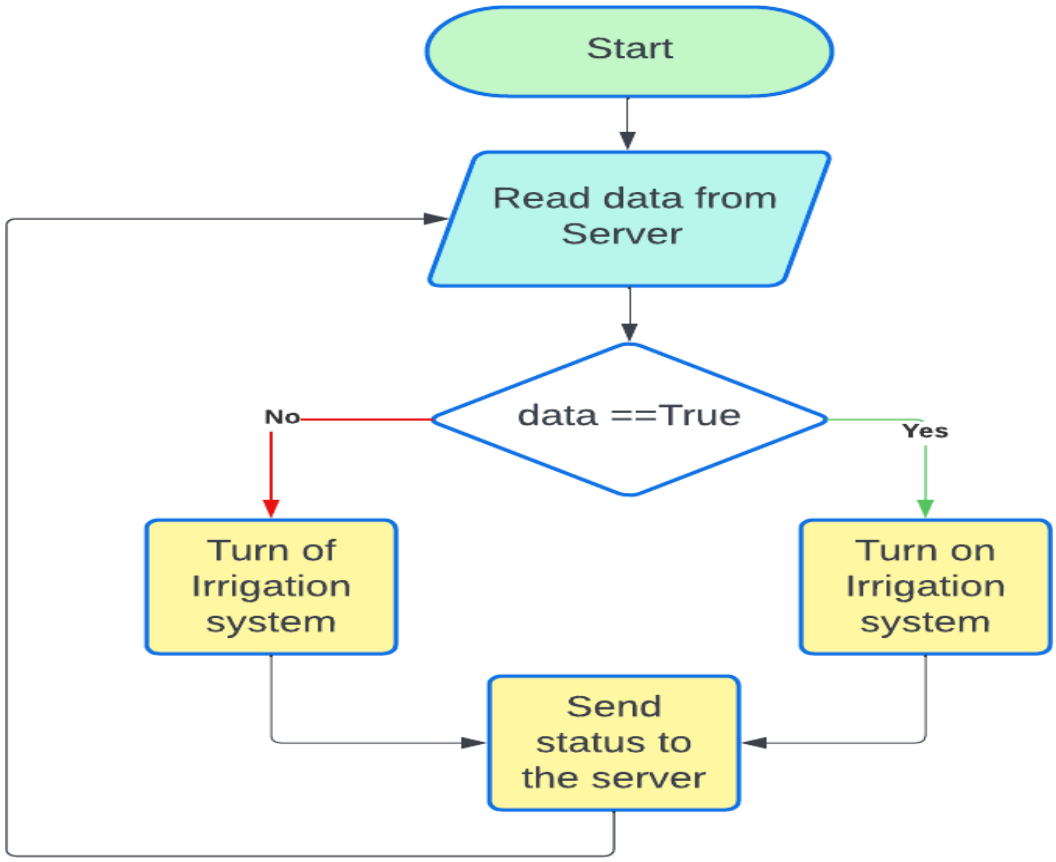

Figure 2. Installation of irrigation systems in the pilot field (2022)

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

Table 2 Social and economic development of the Republic of Uzbekistan key indicators (January-December 2023)

Indicators	Unit of measurement	January - December	Content, V %		Compared to January-December last year, in %	
			2022 year	2023 year	2022 year	2023 year
1. Gross domestic product, total	trillion sum	1,066,569.0	X	X	105.7	106.0
including:						
gross value added of industries	trillion sum	1,008,423.1	93.3	94.5	106.3	105.9
net taxes on products	trillion sum	58 145,9	6.7	5.5	97.7	107.4
2. Networks gross added value	trillion sum	1,008,423.1	100,0	100,0	106.3	105.9
Village, forest And fishing	trillion sum	245 222,5	24.9	24.3	103.6	104.1
Industry (including construction)	trillion sum	325 378,4	33.5	32.3	105.6	106.1
including:						
Industry	trillion sum	262 824,2	27.0	26.1	105.3	106.0
construction	trillion sum	62,554.2	6.5	6.2	106.6	106.4
Services	trillion sum	437 822,2	41.6	43.4	108.7	106.8
3. Kishlak, forest And fish economy	trillion sum	426264.0	100,0	100,0	103.6	104.1
Agriculture and livestock farming, hunting and services provided in these areas	trillion sum	411594.6	96.5	96.6	103.6	104.1
- Forestry	trillion sum	10399,5	2.6	2.4	101.7	102.7
- Fishing	trillion sum	4269.9	0.9	1.0	106.4	107.4
4. Industry products	trillion sum	655821.9	100,0	100,0	105.3	106.0
from which:						
mining and quarrying	trillion sum	55240,5	9.4	8.4	101.9	101,0
manufacturing industry	trillion sum	553333,4	83.2	84.4	105.4	106.7
with electricity, gas, steam give and air get rid of conditions	trillion sum	44247,7	6.8	6.7	113.5	109.7
water supply, sewerage, waste collection and removal	trillion sum	3000,3	0.6	0.5	94.7	101,0
5. Consumption goods:	trillion sum	189009,7	100,0	100,0	120.7	107.3
- food;	trillion sum	70717.5	42.4	37.4	109.6	106.2
- non-food products;	trillion sum	118292.2	57.6	62.6	128.1	107.8
that's all including light cars	trillion sum	47388,6	21.6	25.1	123.1	118.6

Indicators	Unit of measurement	January - December	Content, V %		Compared to January-December last year, in %	
			2022 year	2023 year	2022 year	2023 year
2023 year by calculation method						
6 . Investments in equity capital A:	trillion sum	352064,1	100	100	100.2	122.1
- centralized investments;	trillion sum	44806,8	15.7	12.7	81.4	99.3
- decentralized investments.	trillion sum	307257.3	84.3	87.3	104.3	126.2
7 . Construction works	trillion sum	149864.1	X	X	106.6	106.4
8. Market services rendered, total	trillion sum	470 286,5	X	X	116.3	113.7
9 . Transport:						
- cargo turnover;	trillion t-km	76.8	X	X	100.9	101.8
- passenger transportation.	trillion passengers. -km	152.7	X	X	106.9	104.2
10. Retail trade trade product appeal	trillion sum	326 160,1	X	X	110.8	109.1
11. Foreign trade turnover:	million dollar bee	62,567.4	100,0	100,0	119.8	123.9
- export	million dollar bee	24,426.2	39.1	39.0	118.4	123.8
- import	million dollar bee	38 141,2	60.9	61.0	120.6	124.0
12. Permanent population (for the average period)	thousand human	36412.4	X	X	102.1	102.1
from which:						
of working age	thousand people	20608.1	57.2	56.6	100.8	101.1
13. Average nominal wage	thousand sums	4 551,4	X	X	120.8	117.2
14. Inflation rate:						
- average monthly growth rate.	%	0.7	X	X	X	X
- compared to december last year.	%	8.8	X	X	X	X

Natural parameters obtained from sensors installed in agricultural fields are measured and the collected data are sent to an 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 (Table 2).

Conclusions and suggestions. The proposed irrigation system consists of a microcontroller, mobile phones, GSM module, a set of sensors and a water pump control unit. The sensor suite 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 precipitation. A 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 a microcontroller (GSM) module, and the farmer is aware of the entire irrigation status.

REFERENCES

1. Decision No. PQ-5009 of February 26,2021 "On measures to implement the tasks set in the strategy for the development of agriculture of the Republic of Uzbekistan for 2020-2030 in 2021".
2. Decision PQ-144 dated March 1,2022 of the President of the Republic of Uzbekistan "On measures to further improve the introduction of water-saving technologies in agriculture".
3. Ayupov R.Kh., Dzhumaniyazova M.Yu. Digital transformation of the entire economy of the Republic of Uzbekistan // Economic sciences DOI: 10.24411/2500-1000-2019-11020.
4. Mukhitdinov K. S., Jurayev F.D. Methods of Macroeconomic Modeling //International Journal of Trend in Scientific Research and Development (IJTSRD), e- ISSN. – S. 2456-6470.
5. Hasanov S. T., Khonkulov K. K., Akbarov H. U. The importance of a smart irrigation introduction system based on digital technologies in agriculture //Academic research in educational sciences. – 2022. – T. 3. – №. Speical Issue 1. – S. 89-94.
6. Lapidus L.V. Digital economy: management of electronic business and electronic commerce. - M.: INFRA-M, 2021. -381 p.
7. Khodiyev B. Yu. Digital economy in Uzbekistan // World Economy, 2022. №12.