

THE IMPORTANCE OF MOBILE APPLICATIONS IN THE USE OF STANDARD WATER MEASUREMENTS

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Abstract— The article is dedicated to improving the speed and accuracy of measuring and monitoring works, with using standard water metering devices for irrigation networks, which includes the analysis of water shortages and the selection of measuring devices, the analysis of a number of shortcomings in use. It also focuses on the importance of information and communication technologies, the usage guidelines and prospects for efficient use of water metering devices in irrigation networks and increasing the efficiency of monitoring operations.

Index Terms— Water consumption, water level, water intake, water meters, stage, WUA (Water users association), farms, Java, mobile applications.

I. INTRODUCTION

The recent global climate changes made difficult of planning and fair distribution of water resources. Main reasons are: the reliability of water resources forecasting and the increasing accuracy and consistency of accounting of existing water resources. So, the main criterion of the rational water management is to improve its calculations.

In recent years, there were signed many legal documents and realized reforms which aimed water resource management and ensuring guaranteed water resources for water consumers.

In particular, the Decree of the President of the Republic of Uzbekistan dated 17.06.2019 № PF-5742 "Measures for the Effective Use of Land and Water Resources in Agriculture" should oblige new farms and water users associations to provide water management and metering devices at the water use points. This is one of the most important issues of today.

II. FORMULATION OF THE PROBLEM

In the reform of the Republic of Uzbekistan, the priority of the state policy is the development and modernization of irrigation and water management, wide introduction of innovative technologies in this sector. In all sectors main attention is paid to the wide introduction of water-saving technologies in agriculture due to the limited water resources in hot and dry climates. The actual goal of the Republic's reforms

of water management are the following important tasks: organization of uninterrupted and on timely water supply to users, based on market principles of water use, rational management of water resources and increasing the efficiency of measuring and monitoring activities [1; 2; 4;].

WUA (Water users association) and on-farm irrigation networks use standard water metering devices. It is possible to measure water consumption up to 0.0005-10 m³/sec using water conduits. The use of water trapezoidal, triangular, angular and parabolic shapes of waterways, as well as water meters, such as SANIIRI waterway, Veturi and Parshala nets, is widely used to measure water consumption in irrigation networks activities [6; 8].

III. METHOD

These measuring devices do not require a separate rating during measurements, although they meet the standard requirements and regulations, they are preferred by other methods with high accuracy.

Many research has been done on the above issues and have been achieved some results. However, it should be noted that each district, region, and farms are located in different geographical conditions, and their location, soil, relief, geology and hydrogeology and amelioration condition are different. Therefore, the possibility of establishing an effective water management system would be sufficient if the existing water management and distribution and measuring devices are installed and used properly [3; 5; 7; 9; 10].

For the determining water consumption in open irrigation channels, it is necessary to take into account several hydro-morphological parameters, as:

$$Q = f(\bar{v}, h, b, \Psi, d) \quad (1)$$

\bar{v} - mean flow velocity, m/sec;

h - flow depth, m;

b - flow width, m;

Ψ - hydraulic magnitude, mm / sec;

d - diameter of the river bed ground, mm.

Determination of the above hydro-morphological parameters in the field requires the use of separate methods and tools.

The fact that these issues are solved in the main channels and on inter-farm channels is directly related to the small number of monitoring stations.

As intra-farm channels are networked, the process of measuring water consumption is somewhat complicated by the increasing number of monitoring stations and their location under different morphological conditions.

Semi-conductor links for standard water metering devices have been developed and used extensively in the distribution of water to users. Many water meters are used to record water and measure water consumption for different conditions.

Until recent days, created a number of recommendations, tools and works by many researchers for the development of this area.

The large number and type of water management, distribution and metering devices in the internal irrigation networks reduce the speed of the process management. In particular, even though today the irrigation network is using standard metering devices in the networks, there are still some issues that need to be addressed.

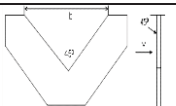
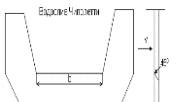
In the first stage these tasks require the introduction of information and communication technologies in the use of standard water meters. In this regard, certain results have been achieved in the implementation of modern information and communication technologies in the calculation of water resources in the networks of irrigation networks [11; 12; 13].

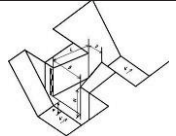
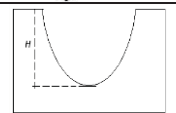
IV. RESULTS

Users can receive water from tens or hundreds of water simultaneously from inland irrigation networks. In this case, there is a need to increase speed and efficiency of the fair water distribution.

Currently, various standard water metering devices are used in irrigation networks (1- table).

If the Thomson and Chipoletti dams are installed according to current requirements, according to the water level (H) can be calculated water discharge (Q) with using the $Q=f(H)$ graphs and coordinates table, compiled according to the type and size of the conduits. Diagrams and tables to determine the flow of water through the conduits are drawn up using the water discharge formulas

Name of the water meter	Appearance	Calculation formula	Symbols
Thomson		$Q = 1.4H^{5/2}$, m ³ /sec	H- water level in the conduit threshold, cm.
Chipoletti		$Q = 1.86bH^{3/2}$, m ³ /sec	b- Width of culvert threshold, cm.

SANIIRI water measuring bar		$h/H < 0,2$ $Q = 1.72 \cdot b \cdot H^{1.5}$ m ³ /sec	b- width of the outlet of the device, cm.
Parabolic Water Conductivity		$Q = 0,576 \cdot b \cdot H^2$ m ³ /sec	H- water level in the conduit threshold cm.

Computational formulas and charts have been created to measure water consumption using these standard water metering devices. The other side of the problem is that the use of the irradiation-level formulas requires a certain amount of time and a special computing machine in natural-field conditions, while the use of small-scale graphics with these formulas can significantly reduce measurement accuracy. In addition, specialist need to have separated graphs and coordinates for each standard device when calculating water consumption.

Currently, it is possible to improve the computing process using mobile applications to simplify the process of calculating this issue which using modern information technologies will increase the speed of measurement.

For solving this issue, we created a mobile application "Hygrometry" on the android-5.0 platform written in the Java programming language based on the instructions for using standard measuring devices [14; 15].

The Hygrometry mobile app enables you to quickly and accurately calculate water consumption on all standard water metering devices in the irrigation network. Calculation time is only concerned with monitoring the water level in the system, and the results are achieved when the data is entered into the program.

The proposed "Hygrometry" mobile application is created not only for mobile phones, but also for tablets and computers. This program is written in Java programming language and can be used by all kinds of smart phones. In Fig 4 shown the instructions for using the mobile application

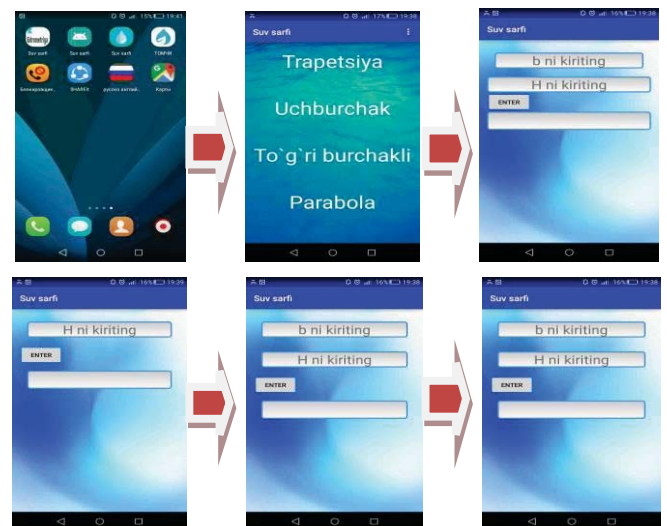


Fig 4. Mobile application schema

The proposed mobile application will allow users to perform quick measurements on measuring and monitoring devices installed on irrigation networks of WCA and farms of the Republic.

V. CONCLUSION

Application of modern information and communication technologies in the water management system, improves the efficiency of the use of metering devices and improves the efficiency of accounting for water consumption in irrigation networks. The first steps in this direction were the development of mobile application on Android 5 platform written in Java programming language. This mobile application can be used to calculate water discharge by any standard water meter today. Therefore, this mobile application is the first step in the ability to remotely manage water resources in the inland irrigation network and the development of research in this area is an urgent task today.

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