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DIGITALIZATION TECHNOLOGIES IN PLANT PROTECTION OF THE REPUBLIC OF UZBEKISTAN AND MOBILE APPLICATIONS FOR THEIR SOLUTION

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Abstract. The article discusses trends in the development of digital technologies in the Republic of Uzbekistan. It also provides descriptions and examples of the application of the developed mobile applications for smartphones such as ANDROID in agricultural production, including in the field of plant protection. The scientific and organizational tasks of their application are outlined, descriptions of the use of six developed mobile applications for phones of the ANDROID type are given, which contribute to the identification of types of harmful organisms in agricultural crops and the organization of protective measures.

Keywords. Plant protection, digital technology, mobile application, monitoring, forecast, diagnostics, coding, information and advisory system.

抽象的。 本文讨论了乌兹别克斯坦共和国数字技术发展的趋势。 **它**还提供了针对智能手机（例如 ANDROID）**开**发的移动应用程序在农业生产（包括植物保护领域）中的应用的描述和示例。 **概述了其**应用的科学和组织任务，描述了六款已开发的用于 ANDROID 类型手机的移动应用程序的使用，这有助于识别农作物中有害生物的类型和组织保护措施。

关键词。 **植物保**护、数字技术、移动应用、监测、预测、诊断、编码、信息和咨询系统。

The 21st century has been recognized around the world as the age of information technology. During the last 20 years of this century, certain achievements have been made in the field of information technology, and at the same time new terms have entered our lives. One of them is "digitization" technologies. Digitization refers to the digitalization of various sectors, including the economy, medicine, education, science, and public administration.

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From year to year, these digitization technologies are developing rapidly and their application is expanding. Digitization technology is a discrete system based on coding (digitizing) data collection that can quickly solve problems that need to be solved.

The use of modern information technologies in agriculture of the Republic of Uzbekistan, including the protection of plants from pests and diseases, remains a modern requirement. Currently, farms that cultivate cotton and grain in large areas of the country have been replaced by cultivation based on low-volume technologies using farms and clusters. This, in turn, will reduce the cost of growing cotton and grain, reduce the cost of fertilizers, and bring irrigation systems to an alternative level. That is why it is important to create and introduce phytomonitoring bases in cotton and grain cultivation. One of the main tasks of phytomonitoring is to know and analyze the condition of crops, to identify the causes of developmental delays. Timely receipt of such information allows to make clarifications and changes in the technology of cotton and grain cultivation, to determine the impact of certain factors and to create optimal conditions for crop development. And this work cannot be done without automated computer systems, without the use of digitization technology.

The solution of the above problems is based on the transition to "digits", ie the development of digitization technology, digitization of the stages of process coding, diagnosis, forecasting, optimal decision-making.

Digital coding - The development of automated systems for solving plant protection problems (especially forecasting) requires the collection, analysis and processing of large amounts of data. In order to obtain such information quickly and in a timely manner, it is important to encode it. In addition, the use of coded information reduces the work of remote transmission of this information and reduces the cost of them by several times.

Digital diagnosis is the determination of the degree of damage to plants from pests, diseases and weeds using a variety of sensors. The data obtained are analyzed by computer and diagnosed according to the degree of damage. This diagnostic system works online. The basis of the digital diagnostic system is automated databases and knowledge, with the help of which accurate and rapid diagnoses of the development of pests are made.

Digital monitoring is an automated phytosanitary monitoring of the condition of plants and the impact of biotic and abiotic factors affecting it, the identification of indicators of their development phases (development phases, varieties, weather data, agro-technological and economic indicators, etc.) and their collection in a database in coded digital forms. Such monitoring is carried out regularly or at certain times. According to the results of phytosanitary, agroecological, economic and economic monitoring, the development of plants and their damaged organisms is assessed, and forecasts of their condition are developed.

Optimal decision-making is the analysis of the condition of plants and their infected organisms based on the results of digital diagnosis and monitoring and on the conducted agrotechnical and protective measures, optimal decisions are made on their strategy and tactics.

Digitization technology has its own scientific and industrial directions in all areas, including agriculture and plant protection. The first application of this technology in the field of plant protection in the Republic of Uzbekistan

can be seen in the following examples of mobile applications [1-5].

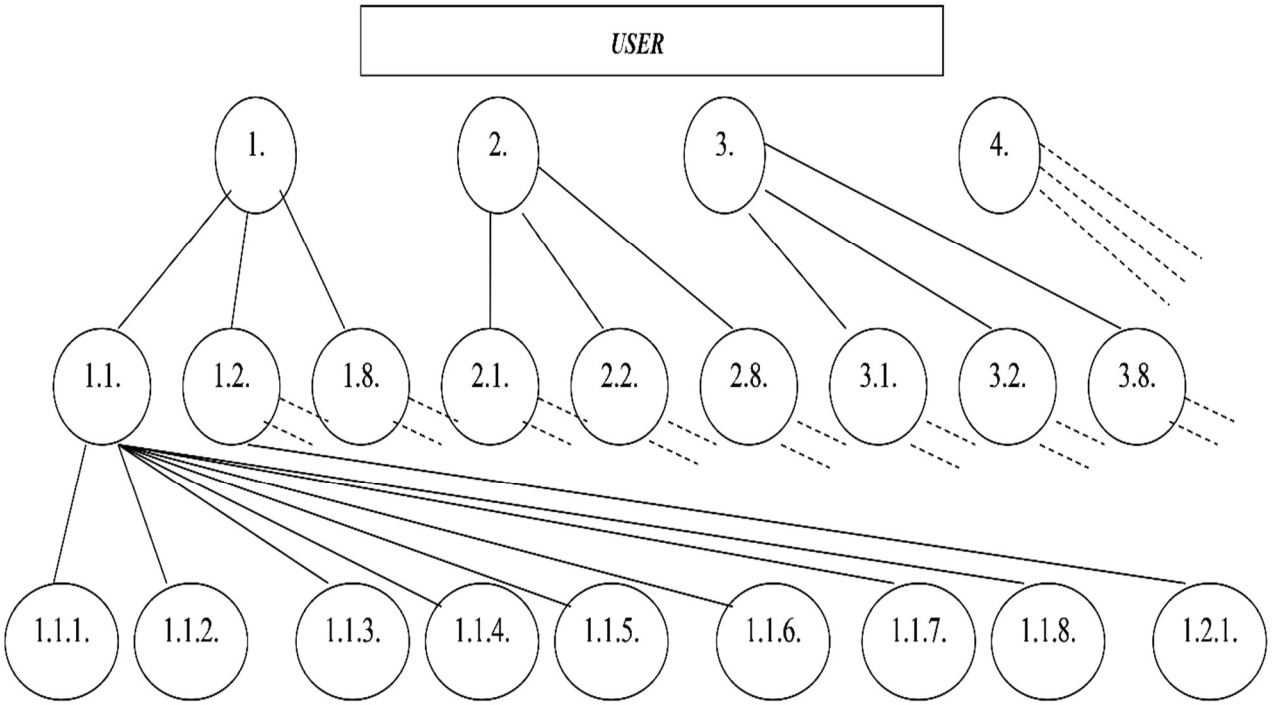
Employees of the Laboratory of Diagnosis, Forecasting and Application of Information Technologies of the Research Institute of Plant Protection of the Republic of Uzbekistan have developed mobile applications (8) for ANDROID-type mobile phones to address industry-specific issues. Below is a description of their characteristics, functions and capabilities.

An application of the information and consulting system "Plant Protection" for Android mobile phones has been developed, which is officially registered with the Intellectual Property Agency of the Republic of Uzbekistan and received a certificate (No. GDU 04019). Also, a diploma of the "New Intellect-2017" competition was issued for the mobile application, which was held on April 26, 2017 in honor of the International Day of Intellectual Property.

The mobile application is intended for employees of farms and cluster farms, agricultural specialists, students studying in this field, masters, doctoral students, researchers, professors and teachers[2,8].

This app includes complete information about the main pests and diseases of agricultural crops, i.e. their definition, survival, damage, control measures, enriched with color pictures. In the "gallery" section of the program there are samples of pictures of pests or diseases on each subject, and under the picture opens a series of pictures with the help of an indicator button, if to click the "Open Data" button below it, the subject information for the selected image will open automatically. In other words, by looking at pictures of pests and diseases, it is possible to obtain information about it[2,6].

The system includes a feature that constantly displays information about the development and spread of harmful objects (cotton, grain, vegetables, pests and diseases of horticultural crops) on the screen, which works using the selected method of communication. The information retrieval system serves as a communication base. From it, the available options queries to the users are entered in digitized form. Each number in it corresponds to an option selection. A multi-window “menu” was used to provide information on pests and diseases of each crop type (Figure 2). For example, if the user selects number 1, window 2 opens, and if he selects number 1,2, window 3 opens, and so on. Thus, the user will be able to get the information he needs. The search for information in the system is performed using the "search" tree shown in Figure 1. For example, if the user is interested in information about the bioecological properties of the cotton bollworm, its damage and control, then the "fall" from the search tree is carried out according to the scheme 1 - 1.1 - 1.1.2 (Figure 1).



Signs in the first "branch":

1. Cotton Pests and Diseases
1.1. Cotton moth
1.2. Autumn moth
1.3. Aphis gossypii and thrips
1.4. Useful entomophages
1.5. Root rot
1.6. Angular leaf spot
1.7. Wilt

1.1.1 Description
1.1.2 Damage
1.1.3 Development and dissemination
1.1.4 Lifestyle
1.1.5 Natural pests
1.1.6 Control measures
1.1.7 Economics

Figure 1. Information search "tree"

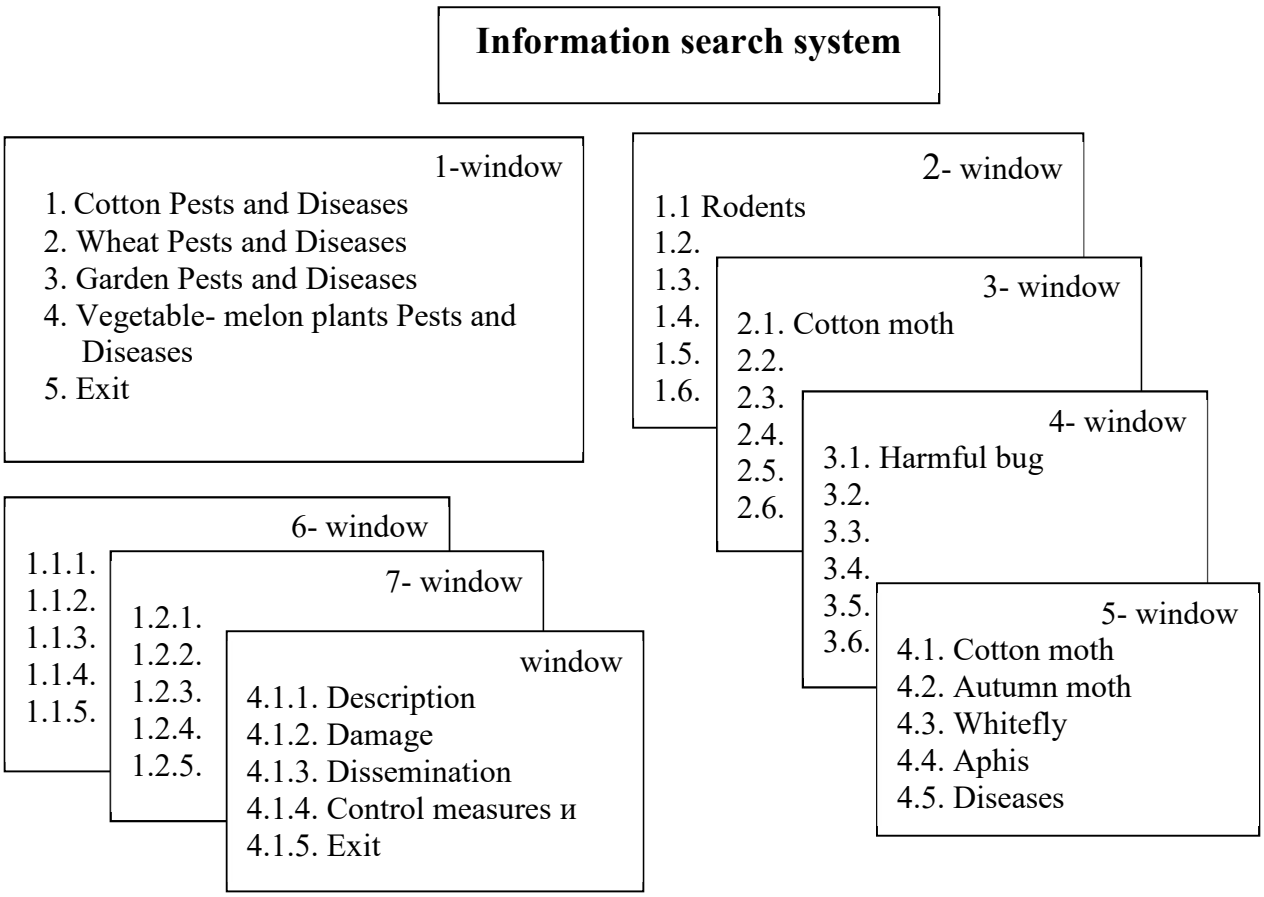


Figure 2. Information menu

The second mobile application is the "Grasshopper" information-consulting system, which is also developed as an application for Android-type mobile phones. This application is also officially registered with the Intellectual Property Agency of the Republic of Uzbekistan and received a certificate (No. GDU 05283). Also, this mobile application was awarded a diploma in the competition "New Intellect-2017", which was held on April 26, 2017 on the occasion of "International Intellectual Property Day".

This application is intended for specialists of plant protection and grasshopper control expeditions of the republic, employees of farms and cluster farms, students of higher educational institutions and universities in the field of agriculture, professors, teachers, doctoral students and researchers[1,3,4,5].

This mobile application contains detailed information on Tettigonia and grasshoppers found in the territory of the Republic of Uzbekistan and possible control measures against them. In addition, the application allows to determine the species of grasshoppers based on the image. The procedure for searching, retrieving information and making recommendations is done in the view in the first appendix.

All three applications, which allow to determine the development dates of the next "Turnip moth", "Eurygaster integriceps" and "Apple worm", are officially registered in the Intellectual Property Agency of the Republic of Uzbekistan and received certificates (№ GSU 05150, 05283, 05284). With the help of these applications it is possible to determine the developmental periods of cotton budworm, aagrotis segetum, eurygaster integriceps and apple wormduring the growing season on the basis of the sum of useful temperatures.

The scheme for calculating the time of emergence of the cotton budworm works in the following order. After entering the region and district code in the mobile application, the application created for this region will open. Average daily air temperatures will be entered into the program table. The effective sum of temperatures (EST) is automatically calculated and summed based on the weather data entered in the table in Microsoft Excel. When the sum of the effective temperatures reaches 50 degrees, the process of laying eggs in the cotton budworm. Therefore, when it is time to lay eggs, that is, when the total effective temperature is 50 degrees, the program will send an SMS to users indicating "the time of oviposition (month, day), field trichogram, the distribution of lacewing (month, day) and the order of a bioproduct"[2,4,6].

A block diagram of this process is shown in Figure 3. As calculations continue, when the sum of useful temperatures is 250 degrees, a text "SMS" will be sent with the content "Date of appearance of 4-year-old larvae (month, day), period of distribution of bracon in the field (month, day), as well as the need to order a biological product ". If the sum of useful temperatures is 350 degrees, an SMS is sent with the text "The time of appearance of 6-year-old larvae (month, day), the time of distribution of the bracon in the field (day), the need to order a biological product", and the calculation ends when the sum of the useful temperature is 550 degrees, then there is from this date the next generation of the pest begins. Determining the developmental periods of the remaining pests is carried out in a similar way.

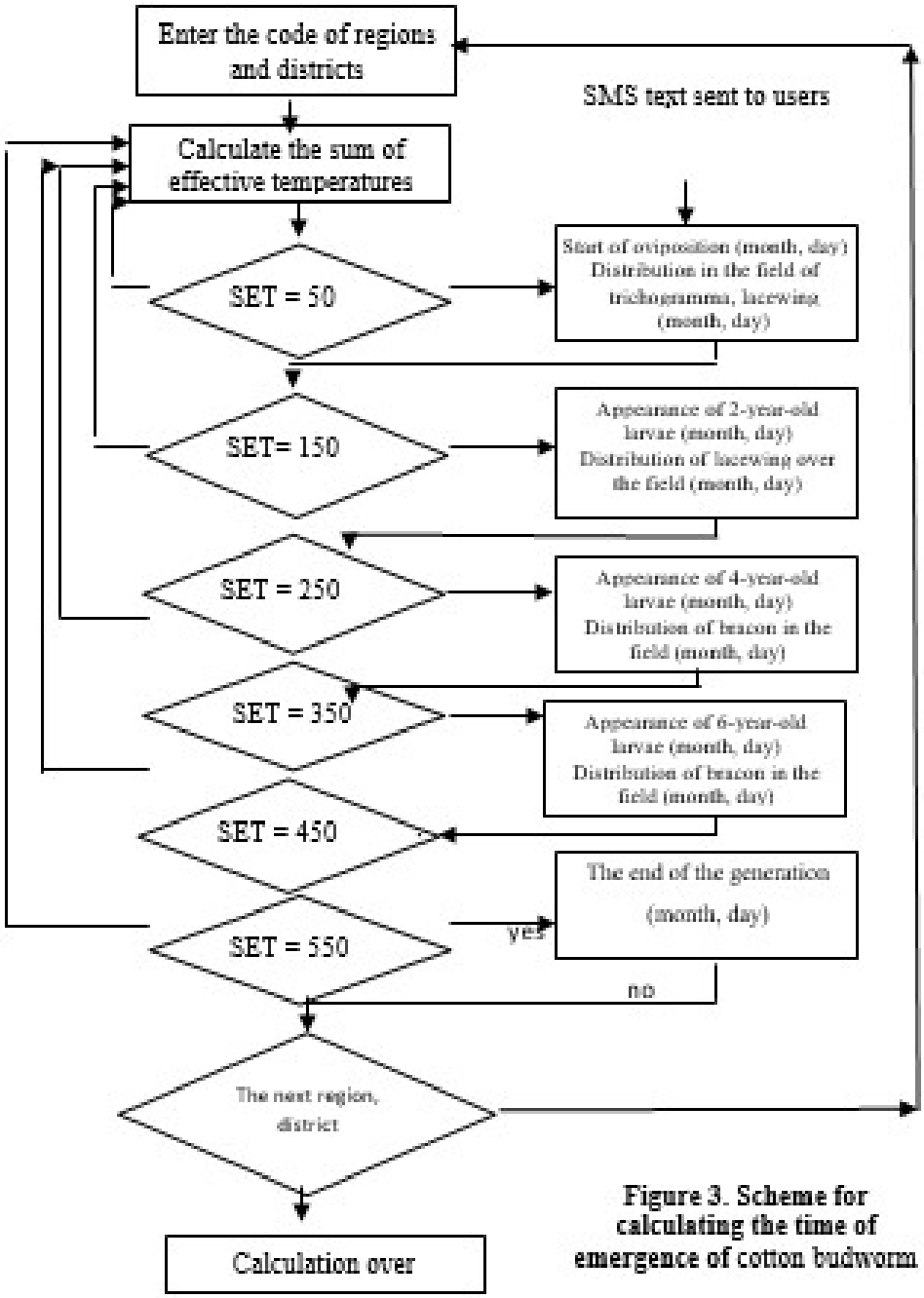


Figure 3. Scheme for calculating the time of emergence of cotton budworm

The latest mobile app is a wheat stripe rust detection mobile app that allows you to determine if a wheat leaf is affected by rust by looking at the image. It is also possible to determine the degree of damage of grain by brown and stem rust using this application[2,4,5,8].

Currently, the laboratory has developed applications for mobile phones to determine the developmental stages and damage levels of Myiopardalis pardalina moth pests. These applications included information on melon varieties, planting schemes and cultivation technologies, and changes in leaves as a result of nutrient deficiencies[1,3,7].

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