IMPORTANCE OF DETERMINING LIQUID LEVEL WITH THE HELP OF AN ULTRASOUND SENSOR USING AN ARDUINO MICROCONTROLLER IN AGRICULTURE

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Annotatsiya: Ushbu maqolada qishloq xo'jaligidagi eng dolzarb muammolardan biri bo'lgan suv sathini nazorat qilishning zamonaviy apparat va dasturiy ta'minoti ko'rib chiqiladi. Ushbu ishda taklif etilayotgan apparat va dasturiy ta'minot kompleksi boshqa suv sathini boshqarish tizimlaridan bir qator afzalliklari bilan farq qiladi. Ushbu tadqiqotda taklif qilingan suv sathini avtomatik monitoring qilish tizimi hisoblanadi ko'p qirrali va ulardan foydalanish oson. Ko'rib chiqilayotgan apparat va dasturiy ta'minot tizimi iqtisodiyotning turli tarmoqlarini monitoring qilish jarayonlarida qo'llanilishi mumkin.

Kalit so'zlar: Arduino, mikrokontroller, suyuqlik, sath, ultratovush, datchik, sketch, void setup, void loop, INPUT, HIGH, LOW, analog, , Nanoda, konvertor.

Аннотация: В этой статье рассматриваются современные аппаратно-программные устройства контроля уровня воды, которое является одной из наиболее актуальных проблем в сельском хозяйстве. Предлагаемый в данной работе аппаратно-программная комплекс отличается от других систем контроля уровня воды рядом преимуществ. Предложенный в данном исследовании система автоматического мониторинга уровня воды является универсален и прост в использовании. Рассматриваемую аппаратно-программную систему можно применить в процессах мониторинга различных отраслей народного хозяйство.

Ключевые слова: Arduino, микроконтроллер, жидкость, уровень, ультразвук, датчик, эскиз, настройка пустоты, цикл пустоты, ВХОД, ВЫСОКИЙ, НИЗКИЙ, аналоговый, Запись, ШИМ, Чтение, Nanoda, преобразователь.

Annotation . This article will consider modern hardware and software for water level control, which is one of the most pressing problems in agriculture. The hardware and software complex offered in this work differs from other water table management systems in a number of advantages. The automatic water level monitoring system proposed in this study is versatile and easy to use. The hardware and software system in question can be used in monitoring processes of various sectors of the economy**.**

Key words: Arduino, microcontroller ,liquid,level, ultrasonic, sensor, sketch, void setup, void loop, INPUT, HIGH, LOW, analog, Nanoda, convertor.

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. Irrigation of these cultivated areas, as well as drinking needs, is dependent on freshwater resources of rivers and

lakes. For the needs of our republic, 52-53 billion m3 of the average 116 billion m3 of water resources formed annually in the Amu Darya and Syrdarya basins in the Aral Sea region are used. In the current era, when climate change has become a global problem, it is especially necessary to use water resources economically and effectively. The reason is that in recent years, years of water shortage have been recurring frequently in Central Asian countries, in particular in Uzbekistan. For example, until the 2000s, water shortages were observed every 6-8 years, but recently this situation has been encountered every 3-4 years. As a result, in 2018, the total water deficit in Uzbekistan amounted to 3 billion m3. By 2030, this figure is likely to reach 7 billion m3, and by 2050 - 13-15 billion m3. In addition, as a result of rising air temperatures, irrigation standards for agricultural crops are expected to increase by 5 percent by 2030 and by 7-10 percent in 2050. All this sets us important tasks such as radically changing our attitude towards water resources, using efficient technologies in their use, implementing intensive irrigation methods, and most importantly, preventing land degradation and desertification.

Discussion and results: Taking into account the above issues, it is necessary to accelerate the development of water-saving technologies. Today, the government has set clear tasks for the introduction of a system of digital and geoinformation technologies in order to increase the efficiency of land relations, agricultural and water management resources management [5]. In accordance with the Decree of the President of the Republic of Uzbekistan No. PF-6079 dated October 5, 2020 "On approval of the "Digital Uzbekistan - 2030" strategy and measures for its effective implementation" and the Resolution No. PQ-4699 dated April 28, 2020 "On measures for the widespread introduction of the digital economy and e-government", as well as in order to increase the efficiency of the use of digital and geoinformation technologies in agriculture and water management, the Cabinet of Ministers has decided that the following are the priority areas for digitization of the agricultural sector of the Republic of Uzbekistan:

- introduction of technologies for online control of water resources use in reservoirs and irrigation systems;
- improvement of the water resources management system, accounting of water use and water consumption, and formation of a database;
- management and use of water resources through the implementation of modern computer technologies;
- introduction of automated management technologies in the organization of intensive gardens and the cultivation of horticultural products;
- introduction of automated, computerized intellectual technologies in greenhouse farms.

Ultrasonic level meters. The principle of operation of ultrasonic level meters is based on the reflection of sound waves from a liquid, gas (air) layer. The magnitude of the reflection of the ultrasonic pulse from the boundary surface of the air and the measured medium occurs as a result of a sharp difference in acoustic resistance. These devices have a number of advantages: for example, high accuracy, low inertia, wide range of operation, non-contact and the ability to work with aggressive liquids.

Ultrasonic level meters have a measuring range from 45 mm to several tens of meters.
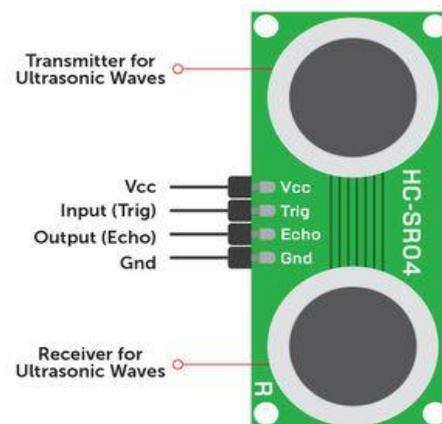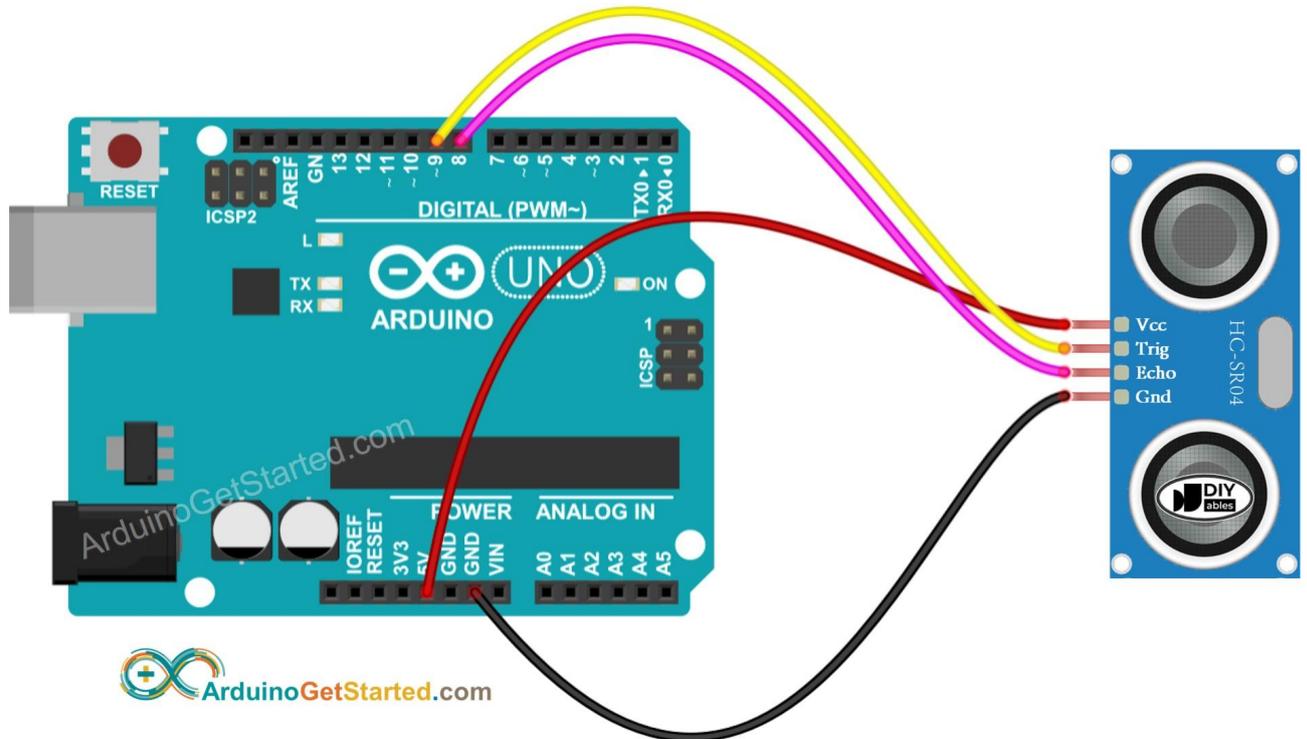
1-picture Ultrasonic sensor

Ultrasonic sensors. Sensors developed using the properties of ultrasound are sensors that convert ultrasonic signals into other energy signals (usually electrical signals. Ultrasonic reading sensors are). Ultrasonic is a mechanical wave with a vibration frequency above 20HZ. It has the characteristics of high frequency, short wavelength, small diffraction phenomenon, and especially good guidance and directional and directional scattering. Ultrasonic is especially capable of penetrating solids, such as sunlight. Ultrasonic waves encountered by impurities or interfaces will cause large reflections for the reflected shapes, and moving objects can increase the Doppler effect. Ultrasonic sensors are widely used in industry, national defense, biotibology, etc.

Arduino is a convenient platform for electronic designers and quick creation of electronic devices. The reason for the widespread use of this platform in the world is the convenience and simplicity of the programming language, as well as the openness of its architecture and programming codes. The Arduino board consists of an AtmelAVR microcontroller and hardware for programming and connecting to other circuits. Many boards have a linear voltage stabilizer of +5 V or +3.3 V. The table shows the main components of the Arduino kit and the structure of the circuit board.

2- picture: Connection Arduino and ultrasonic sensor

We will discuss the technique of programming an Arduino sketch in the Arduino IDE platform. Every sketch always has two main functions:

• void setup()

• void loop()

This is the first process that starts when the Arduino starts up.

This function is executed only once during the entire life of the program.

The setup function involves initializing each pin that you want to use for input or output in your project. Here is an example of how to write it:

```
void setup() {
  // put your setup code here, to run once:
  pinMode(2, INPUT);
  pinMode(3, OUTPUT);
}
```

In this example, we have set pin 2 as INPUT and pin 3 as OUTPUT. It also includes starting the serial monitor. The serial monitor is used to know the data being sent serially to any peripheral device.

```
void setup() {
  // put your setup code here, to run once:
  pinMode(2, INPUT);
  pinMode(3, OUTPUT);

  Serial.begin(9600);
}
```

Note: Before using any variables for programming, they must be defined in the void setup() function.

2) void loop() function

This function is considered the next important function in the sketch. The void loop() sketch runs indefinitely. Once you write code in the void loop() function, it never stops.

There are also several built-in functions in the Arduino IDE. Each built-in function is explained below:

digitalWrite() function

The digitalWrite() function takes two parameters; the first parameter is the digital pin number and the HIGH or LOW value for the digital pin. For example: digitalWrite(2, HIGH);

If the pin is set as OUTPUT with pinMode(), its voltage is set.

The corresponding value is: 5V for HIGH and 0V for LOW. Example:

```
void loop() {
  // put your main code here, to run repeatedl
  digitalWrite(3, HIGH);
  delay(1000);
  digitalWrite(3, LOW);
  delay(1000);
}
```

In the above code, digital pin 3 is turned on for 1 second and off for 1 second.

digitalRead() function

If the pin is set as INPUT, digitalWrite() turns the input pin on (HIGH) or off (LOW).

analogWrite() function

Writes an analog value (PWM waveform) to the pin. It can be used to turn on an LED at different brightness or control a motor at different speeds.

analogRead() Reads a value from the specified analog pin. The Arduino Uno board has 6 channels (8 channels in the Arduino Mini and Arduino Nano, 16 in the Arduino Mega), 10-bit analog-to-digital converters.

This means that it can represent input voltages from 0 to 5 volts to integer values between 0 and 1023. This gives a resolution of 5 volts / 1024 units, or 0.0049 volts (4.9 mV) per unit. It takes about 100 microseconds (0.0001 s) to read an analog input value, so the maximum read rate is about 10,000 times per second.

The reforms being implemented in our country to form a stable and efficient economy are already showing their results. In particular, significant achievements have been made in a short period of time in implementing deep structural changes in the economy, ensuring growth in population incomes, strengthening effective foreign trade and investment processes,

reforming agriculture, sustainably developing small business and private entrepreneurship, and strengthening the banking and financial system.

Today, in a situation where competition in the consumer market is becoming more intense

Consumer demand for product quality is increasing day by day

Therefore, one of the most important factors affecting the production of quality products is the large-scale introduction of scientific and technical achievements into production, the use of modern technologies. Practice shows that it is impossible to produce quality products with old equipment and technology, and market participants will not buy low-quality products.

Mechanization and automation of industry make it possible to improve working conditions and eliminate heavy manual labor. There is a complex of technical, organizational and economic measures for production, the implementation of which, as a result of which, the most convenient advanced technological processes in production allow for the production of high-yield, high-quality products.

The main indicators characterizing efficiency include: the cost of the product per unit of input, labor productivity, profitability, profit, payback period of additional tariff funds or the standard coefficient of efficiency.

Table 1

Technical and economic indicators of the base and projected options

Display name	Union of measurement	Variant	
		Bazis	In project
Personal number of service providers		1	0,25
Required discharge of workers	Union	IV	IV
Annual operating nominal capacity fund of the device	Hour/year		2000
Gabarite surface of a device	m^2/union	6,82	6,82
Device power	kvt	31,5	27
Cost of one baseline device	Sum	2000	2000

As can be seen from the table, it is possible to increase production based on the use of a new control system. It is also possible for one worker to service four automatic water level control units.

Capital investments for the implementation of the project.

Capital investments for the organization and implementation of the designed system include the following sections of one-time costs:

expenses for basic equipment;

expenses for the organization of an automatic control system;

- installation costs.

- We take installation costs as 10% of the cost of the device.

Table 5.2

Capital investments for comparable options

Display name	Union of measurement	Variant	
		Bazis	Loyihadagi

The number of devices calculated on the resulting production volume	union	1	1
The number of devices calculated, the price	sum	20000	22000
Automatic control system price	Sum	12000	14000
Installation costs	sum	8000	8000
Total capital investment	sum	20000	22000

Since the automation system can be installed on existing equipment, the project option increases the amount of money only due to the costs of implementing the project.

When operating a device with an automated control system, current expenses include employee wages, electricity costs, depreciation of equipment and other costs.

Salary costs consist of an hourly rate for key employees, based on working hours, additional bonuses and deductions for social insurance.

Table 5.3

Salary calculation

Displays name	Union of measurement	Variant	
		Bazis	Loyihadagi
Devices are served by the norm	person.	1	0,25
Work discharge	union	IV	IV
Hourly definition staff	Sum	50 000	60 000
Annual working time of the device	hour/year	258000	258000
Annual production main working time fund	Sum	10 000	10 000
40% amount incentive	Sum	2 500	2 500
Total annual salary	Sum	132000	158000
Social straxovka allocation (36.3%)	Sum	48312	57974
Together with the total salary and deductions to the social strakhovka.	Sum	180312	215974

It is clear that after implementing the automation system, production efficiency increases, labor costs decrease.

Let's calculate the economic efficiency of production automation.

The economic efficiency of automation can be found by the following formula:

Is =Pb (K1 *K2 -1)+I+K (5.1)

Where Pb is the price of the base product;

K1 is the coefficient of production growth when comparing the automated device with the base device (B2/B1), where B2 is the annual volume of production produced when automated, and B1 is the annual volume of base product.

К1 = B2 / B1 = 14000/12000 = 1.17.

K2 is the coefficient for calculating the change in the service life when comparing the automated system and the base system, where T2 and T1 are the service lives of the automated and base devices, respectively, and the coefficient of depreciation EP is found using (it is calculated for 0.21 years):

K2 = (1/T2 + EP) / (1/T1 + EP). (5.2)

K2 = (1/10 + 0.2) / (1/10 + 0.2) = 0.3/0.3 = 1.

Is=4274485.95 soums
We find the payback period of additional capital investments.

То'к = (К3 - К4) / (И1 - И2), (5.3)

Here К3, К4 are the total capital investments for the compared options;

И1, И2 are the annual costs for the compared options.

То'к = (22 - 2) / (215,974– 180,312) = 0.56 years.(204 days)

According to the calculations performed based on the values of the designed and base options, the payback period of the automation project for the casting machine was 204 days. This indicates the feasibility of using an automated control system.

At the same time, the current situation requires the creation of an operational control system for the technical condition of water management facilities, their timely reconstruction and modernization, as well as measures to improve design and construction and installation work in this area.

Conclusion. In order to increase the efficiency of state management in the field of water management, as well as to create an effective system for improving the condition of water management facilities:

It is no exaggeration to say that I have further strengthened my knowledge and skills on the topic "Determining the liquid level using an ultrasonic sensor using an Arduino microcontroller".

Based on the above conclusions, we would like to make the following suggestions.

1. Use modern technologies for adjusting the water level in reservoirs, namely the Arduino UNO microcontroller.

2. Implement the use of innovative technologies based on the purpose and content of the topic to achieve the effectiveness of water level management.

3. Prepare a device for use by water management personnel, enriched with new information on the selected topic using innovative technology based on what I have learned above.

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