SCHOOL LABORATORY STAND FOR STUDYING THE BASICS OF ELECTRONICS AND ROBOTICS BASED ON ARDUINO UNO TRENER

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ABSTRACT: The article presents the developed school laboratory stand - ARDUINO UNO TRAINER for studying the basics of electronics and robotics. The article considers the project activity in the educational process using this stand, which contributes to the development of the student's key competencies, as well as ensures the connection of the educational process with practical activities. The laboratory stand based on ARDUINO UNO TRENER gives students the opportunity to master the basic techniques of designing and programming controlled electronic devices and gain the necessary knowledge and skills for further self-realization in the field of engineering, invention, information technology and programming.

KEY WORDS: ARDUINO UNO TRENER, controller, electronics, laboratory stand, programming, robotics

Today it is impossible to imagine our life without information technology and industrial robots are increasingly used in enterprises. Preparing students for this current field begins at school, which begins with training in robotics. Robotics - the basics of mathematics, physics, computer science, technology, engineering, etc. In this regard, it is very important to conduct all types of training in school robotics [1].

The world of electronics and robotics today is full of simple and very convenient solutions that allow you to create very interesting projects. Currently, the only option for artificial intelligence design is the Arduino platform.

Arduino is an electronic board and the basis of the project - the basic equipment on which you can write code for the controller in a specialized programming language. Strictly speaking, this is the C++ language, which is complemented by some libraries and with the help of a written program you can organize the joint operation of these devices.

It is a simple automation and robotics system for non-professional users, it allows you to connect many different devices to it and use them in a special Arduino programming environment, which has a simpler architecture than computers. The low price, flexible system and variety of large number of boards have made them popular in hobbyist and hobbyist projects [2-3].

Fig.1. ARDUINO UNO TRAINER

A laboratory bench for studying sensors based on the integrated platform ARDUINO UNO TRENER is an ideal tool for anyone learning to program (Fig. 1.).

Whether you're in elementary school or a university teacher, you can learn to program with Arduino.

The lab will teach you the eight most commonly used inputs and outputs in the Arduino environment. You can master these functions using ArduBlock, as well as using the Arduino development environment without support for graphics "blocks".

Capabilities of the laboratory bench for studying sensors based on the integrated ARDUINO platform:

1. Studying the LED.
2. Controlling an LED using Arduino.
3. A pushbutton switch connected to an Arduino to control an LED.
4. Adjust the brightness of the LED using a potentiometer.
5. Using the LCD display.
6. Light sensor.
7. Adjust the brightness of the LED using a potentiometer.
8. Exploring the three primary colors of RGB LEDs.
9. Using a potentiometer to control an RGB LED.
10. Using Arduino to control an RGB LED.
11. Using Arduino to create sound using a speaker.
12. Electronic keyboard Arduino.
13. Studying the buzzer.

14.   Studying the infrared sensor.

15.   Welcome doorbell

16.   Studying the microphone.

17.   Studying the Temperature Sensor

18.   Ultrasonic Sensor Study

19.   Ultrasonic distance measurement to obstacles

20.   Using PWM to control a DC motor

As an example, we will give a topic for studying LED and LED control using Arduino.

A light-emitting diode (LED) is a semiconductor device that emits light when current passes through it. Electrons in a semiconductor recombine with electron holes, releasing energy in the form of photons. The color of light (corresponding to the energy of the photons) is determined by the energy required for the electrons to cross the band gap of the semiconductor. White light is produced by using multiple semiconductors or a layer of light-emitting phosphor on a semiconductor device.

LED is widely used in indoor and outdoor LED lighting, LED displays, traffic lights, automobile headlights, display backlighting, lighting, fiber optic communication and so on.

Light-emitting diode has the advantages of high efficiency, long service life, not easy to damage, fast response speed, high reliability compared with traditional light source.

LEDs have also led to new types of displays and sensors, while their high switching speeds are useful in advanced communications technologies with applications as varied as aviation lighting, garlands, strip lights, car headlights, advertising, general lighting, traffic signals, flashes cameras, backlit wallpaper, horticultural grow lights and medical devices.

LEDs are converters of electricity into light. They work in the opposite direction than photodiodes, which convert light into electricity.

To turn on the LED, you can use a DuPont wire to connect the LED to the power pin of the ARDUINO UNO TRENER. Connect power and the LED will light up.

A typical red LED typically requires a forward voltage of no more than 1.5V. If the voltage at the anode is less than 1V at the cathode, no current will flow and the LED will not emit light. When the voltage at the anode and cathode significantly exceeds 1.5V, the LED may burn out, resulting in a short circuit (the current will be very high). Therefore, it is necessary to use a resistor to limit the current, otherwise the LED may burn out. Typically, the maximum continuous LED current is 25mA. Since the LEDs in ARDUINO UNO TRENER are connected to a current limiting resistor, directly connecting the 5V wire will not damage the LED.

Before we start experimenting with LEDs, you'll need to take a moment to install

the software and understand the basic principles of how it works.

Arduino digital pins can output a high (5V) or low (0V) signal. In the current experiment, if the LED terminal is connected to the negative pole of the power supply GND, the LED will not pass current and will not emit light. By controlling the Arduino pins to output high or low levels with a program, you can control the LED to turn on and off. This is equivalent to connecting the LED terminal to the positive and negative power supply.

Before we start programming, let's first understand the Arduino program. The most basic Arduino program consists of setup() and loop().

Setup: The code in the void setup() function is executed only once at power up or power reset. It is used to initialize variables, set the output/input type of pins, and set up the serial port.

Loop: The code in a void loop function will be executed repeatedly, usually a program function is implemented here.

Arduino program code area:

```
void setup()
{
//ledl
pinMode(13, OUTPUT); //connect pin 13 to output
}
void loop()
{
digitalWrite(13, HIGH); // connect pin 13 to HIGH
delay(1000);        //      wait      1      second
digitalWrite(13, LOW); // connect pin 13 to LOW
delay(1000); // wait 1 second

}
```

Select the port number at the bottom of the current software window. At this time, the LED on the board will be configured according to our program, turn on for one second, and then turn off for one second, continuously repeating the cycle.

The controller operates according to the program and the execution process is as follows.

Pin code digital output mode:

digitalWrite() - The digitalWrite() function is designed to set the output voltage at the pin to HIGH.

This function has no return value, there are two parameters pin and value, the pin parameter specifies which pin should be set and the value parameter specifies the output voltage (high and low level).
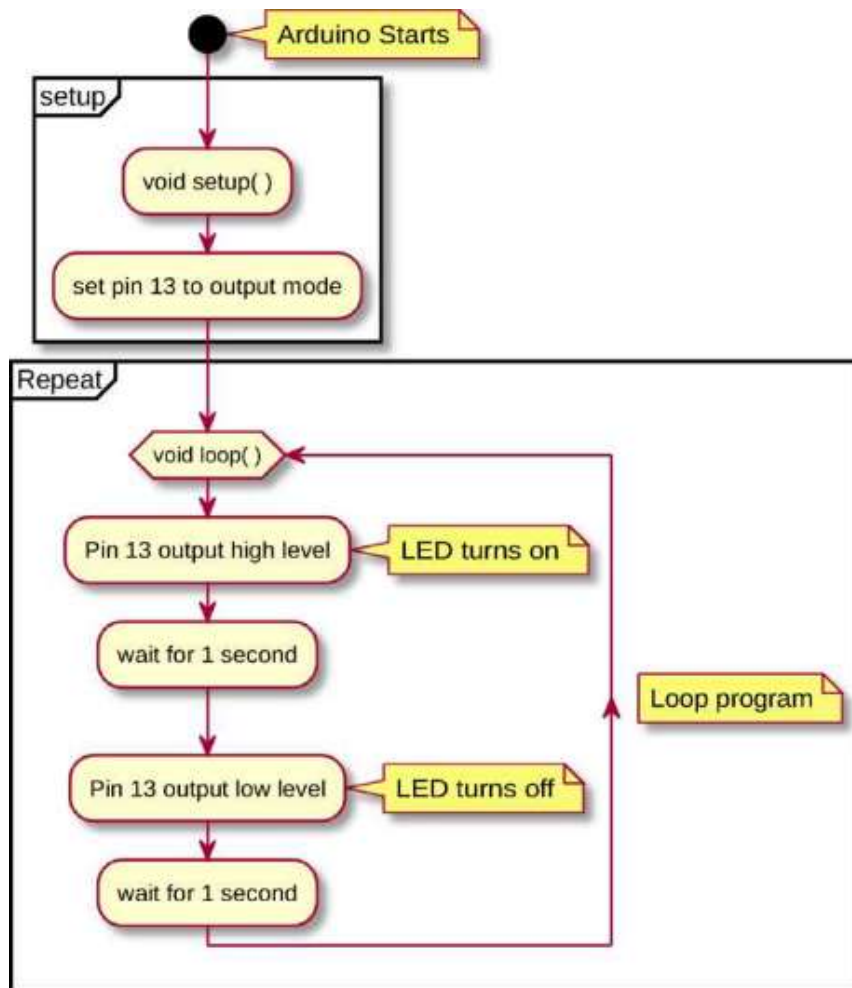
Fig. 2. Program execution process

Before using digitalWrite(pin, value), use pinMode to set the output mode.

When an Arduino digital pin is set to output mode, it can only output data in two states: HIGH or LOW. This output is usually called a digital output (for these two states it is sometimes called binary output). These states are commonly referred to as HIGH and LOW levels. A high level is equivalent to the message "there is voltage!", a low level means "there is no voltage on this pin!".

When you drive a pin high using the digitalWrite() command, you are connecting the pin to the positive power supply inside the chip. Measure the voltage between the contact and the negative pole of the power source and the voltmeter will show 5V.

When you set the pin to LOW, the pin is connected to the negative power terminal, again measure the voltage between the pin and the negative power terminal, the voltmeter will show 0V.

Project activities used in the educational process contribute to the development of the student's key competencies, and also provide a connection between the educational process and practical activities. Creative, independent completion of practical tasks and assignments in the form of a description of a task or assignment is a task that allows students to independently choose ways to solve it [4-7].

A laboratory stand based on ARDUINO UNO TRENER gives students the opportunity to master the basic techniques of designing and programming controlled electronic devices and gain the necessary knowledge and skills for further self-realization in the field of engineering, invention, information technology and programming.

REFERENCES

1. Kaloev M.A., Titova A.A., Lataeva A.V. The use of microcomputers and microcontrollers in training // New information technologies in automated systems. 2016. No. 19. URL: https://cyberleninka.ru/article/n/ispolzovanie-mikrokompyuterov-i-mikrokontrollerov-v-obuchenii (date of access: 05/01/2024).

2. Nugmanova, S. and Erbolat, M. 2021. USE OF MICROCONTROLLERS IN TEACHING SCHOOLCHILDREN. Bulletin of Abai KazNPU, Series "Physical and Mathematical Sciences". 69, 1 (Jun 2021), 387–392.

3. Samylkina N.N., Kalinin I.A. THE INFLUENCE OF EDUCATIONAL ROBOTICS ON THE CONTENT OF A BASIC SCHOOL COMPUTER SCIENCE COURSE. Computer science at school. 2017;(8):16-21.

4. Ganiev A.A. LABORATORY STAND ON SOLAR ELEMENTS FOR STUDYING OHM'S AND KIRCHHOFF'S LAWS // Universum: technical sciences: electron. scientific magazine 2022. 3(96). URL: https://7universum.com/ru/tech/archive/item/13302 (access date: 10/14/2023).

5. Ganiev A.A., Zikrillaev N.F. DEVELOPMENT AND CREATION OF LABORATORY STANDS IN SOLAR ELEMENT PHYSICS // Universum: psychology and education: electron. scientific magazine 2022. 6(96). URL: https://7universum.com/ru/psy/archive/item/13662 (access date: 10/14/2023).

6. Ganiyev A.A., Qurbonova U.X., Aliyev B.U. Fizikani o'qitishda innovatsion texnologiyalardan foydalanish "Physics va elektronikaning dolzarb muammolari" Mavzusidagi Republic of Ilmiy-Amaly Anzhumani Tashkent, 2023, November 3-4

7. Xalmurat M. Iliyev, Zafar B. Khudoynazarov, Bobir O. Isakov, Mirahmat X. Madjitov, Abduvokhid A. Ganiyev ELECTRODIFUSION OF MANGANESE ATOMS IN SILICON. EAST EUROPEAN JOURNAL OF PHYSICS. 2. 384-387 (2024)