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When Managing CNC Machines a Selection of Microcontrollers

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Abstract. The article considers the analysis of a microcontroller for controlling CNC machines and the rationale for its choice. The controller processor receives data from two input registers, performs a logical operation, and stores the result in an output register. All this takes one executable cycle.

Key words: Arduino Nan, Arduino software, interface, chip, nanoplatform reset, microcontroller, register, industrial computer.

In many industries, an industrial computer (IC) is used as a control system for the operation of CNC machines, which performs the role of reading processing parameters and trajectories of the working mechanism from a program written in G-code. and take them to the car. However, this computer is very expensive and takes up a decent amount of space, if the executable program does not involve frequent changes and editing of parameters and trajectories, you can use a very cheap and compact control panel on a microcontroller that can read the program. from memory and convert them into machine instructions for the production of final products. In order to choose the right microcontroller that meets all the requirements, we will get acquainted with the reason for its appearance, the history of its creation and the prayer line currently available on the market.

First, let's look at the very concept of "microcontroller". A microcontroller can be defined as a miniature computer based on a single microcircuit, connected to a processor, a number of auxiliary elements, such as RAM, EPROM, a timer, and current and others. The microcontroller is designed to perform any predefined task.

- MegaAVR - the most popular line, which has a sufficient amount of internal memory (up to 256 KB), many additional peripherals and is used for tasks of medium and high complexity.
- XmegaAVR is used for complex business applications that require a large amount of memory and high performance.

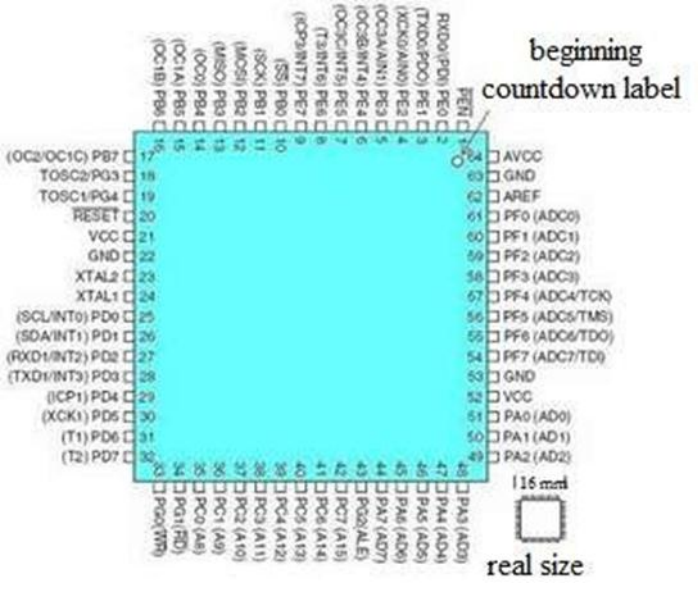
Table 1. Analysis of the technical characteristics of microcontrollers

Series name	Series name	Series name	Series name
TinyAVR 6-32	6-32	0.5 – 8 KB	Small size
MegaAVR	28-00	4-256 KB	Peripherals
Xmegaaur	44-00	16-384 KB	Interrupt system

1. Family features

Firstly, the microcontrollers of this series are fast. The microcontroller's processor executes many instructions in one cycle. AVR microcontrollers are about 4 times faster than PICs. In addition, they consume significantly less energy and can operate in several energy-saving modes.

Many AVR controllers are 8-bit, although there is also a 32-bit version of the AVR32 controllers. In addition, as mentioned above, AVRs are RISC microcontrollers. The RISC (Reduced Instruction Set Computers) architecture means that the set of instructions that the device's processor can execute is truncated, but at the same time, this architecture provides a speed advantage. An analogue of the RISC architecture is the CISC architecture (Complex Instruction Set Computers).



Rice. 1. Bit version of AVR32 controllers.

An 8-bit controller means that it is capable of transmitting and receiving 8-bit data. The provided I/O registers are also 8-bit.

The controller architecture is based on registers. This means that the controller uses registers.

The controller processor receives data from two input registers, performs a logical operation, and stores the result in an output register. All this takes one executable cycle.

2. Programs for microcontrollers

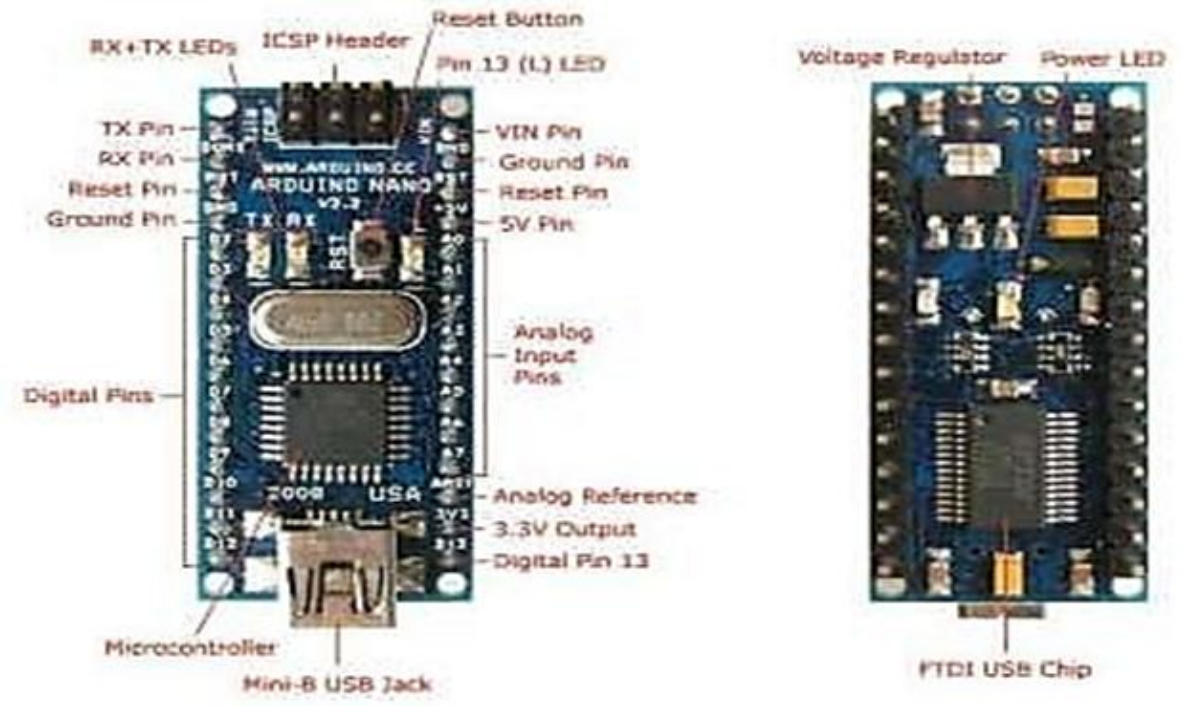
As mentioned above, a microcontroller is like a PC, and it follows that, like a PC, an AVR can also execute any program, even if only one at a time. The microcontroller program can

be stored in the internal memory of the controller and is a set of elementary commands that select data and perform certain operations with them. In some cases, this means reading the input, checking its status, and outputting the corresponding output values. Sometimes it may be necessary to modify data and perform operations on it, as well as transfer data to some external peripheral device, such as an indicator or a serial port.

For such simple tasks, sets of elementary commands are used, each of which has an analogue in a language more accessible to human perception. Therefore, the most common way to write controller programs is to write them in machine instruction language.

The FTDI FT232RL is only powered if the platform itself is USB powered. Thus, when operating from an external source, there will be no 3.3 V voltage generated by the FTDI chip, and the RX and TX LEDs blink only when there is a signal on pins 0 and 1.

Inputs and outputs



Rice. 3. Microcontroller outputs

Each of the 14 digital outputs can be configured as input or output using the pinMode(), digitalWrite() and digitalRead() functions. The pins only work at 5V. Each pin has a resistor (disabled by default) 10-40kΩ and can carry up to 30mA. Some contacts have certain functions:

- Serial bus: 0 (RX) and 1 (TX). Pins are used to receive and transmit data.
- External interrupt: 2 and 3. These pins can be used to trigger an interrupt on the lowest value or the highest value.

Rising edge, falling edge, or when the value changes.

- PDM: 3, 5, 6, 9, 10 and 11. Each of the pins provides PDM with up to 8 bits of resolution using the AnalogWrite() function.

- SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). SPI communication is done through these pins. The Nano platform has 8 analog inputs, each with a resolution of 10 bits. By default, the pins have a measurement range of up to 5 V from zero, although it is possible to change the upper value using the AnalogReference() function. Some contacts have certain functions:
- I2C: A4 (SDA) and A5 (SCL). Through the pins, I2C (TWI) communication can be carried out. Additional pair of platform pins:
- AREF. Required for analog inputs. Used with AnalogReference().
- Reload. Reboot the microcontroller. Typically used to connect a reset button on expansion boards that prevents access to the button on the board itself.

The Arduino Nano platform contains many devices for communicating with a computer, other Arduino devices, or microcontrollers. The ATmega328 has a TTL (5V) UART serial interface via the RX and TX pins. A chip installed on the board routes this interface through USB, and the drivers provide a program on the computer with a virtual COM port. The Serial Monitor of the Arduino software allows you to send and receive text data when connected. The RX and TX LEDs on the platform will indicate TX and RX communications.

ATmega328 supports I2C (TWI) and SPI interfaces. Arduino has a Wire library for easy use of the I2C bus.

We came to the conclusion that our machine can be controlled both from a PC and using an independent control panel based on the Arduino Nan universal platform.

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