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Microcontrollers and Their Application

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ANNOTATION: The article provides information about microcontrollers. Requirements for microcontrollers are given the concepts of its connection and control. There is also information about different microcontrollers and their differences and advantages

KEYWORDS: microcontroller, registers, control unit, arithmetic logic unit, analog, LED display, MSC-51, Atmel AVR, microchip PIC, ADC, LCD display.

Microcontroller is a small computer, so to speak. It has its own central processor (registers, control unit and arithmetic logic unit), memory and other peripheral i / U ports, timers, interrupt control devices, pulse generators and even analog converters. It is impossible to list them all. It is not possible to list all the programs of microcontrollers.

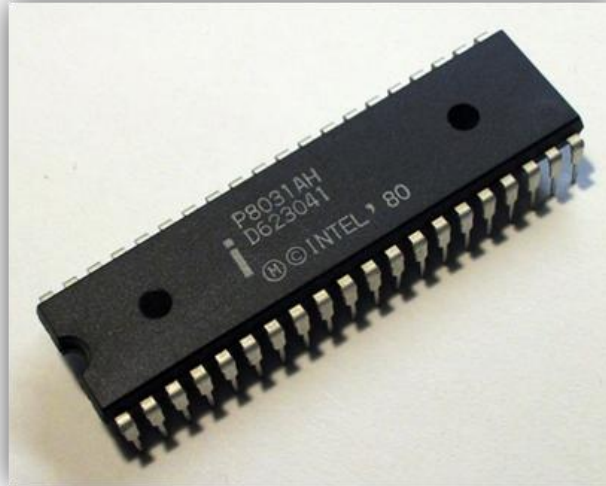
However, if you simplify everything significantly, then the main function of microcontroller is to “shake the legs”. That's it. it has multiple pins (6 to several tens depending on the model) and on these pins it can be set to 1 (high voltage level, e.g. + 5 volts) or 0 (low voltage level, approximately 0.1 volts) . the software algorithm is firmly embedded in its memory. The microcontroller can also detect the signal status at the feet (for this they must be configured for input) - high voltage or low (zero or single). Modern microcontrollers also have an analog converter almost everywhere - something like a voltmeter that allows you to not only monitor 0 or 1 at the input, but also measure the voltage exactly from 0 to the reference (usually equal to the reference supply voltage).) and represents it as a number from 0 to 1024 (or 255 depending on the ADC power).

From it you can make a smart home, brains for home robots, a smart aquarium control system or just a beautiful LED display with working text. Among the electronic components, the MK is one of the most versatile devices. For example, in the development of the next device, I prefer not to bother with breaking various electronic circuits, but to connect all inputs and outputs to the microcontroller and program all the logic of the work. It saves both time and money dramatically, which means the money is square.

There are many, many microcontrollers. Almost every self-respecting company in the production of radio components produces its own manager. However, there is an order in this variety. MK is divided into families, I won't count them all, but I will only describe the simplest eight-bit families.

CPU REQUIREMENTS

MSC-51 The most widespread and advanced MSC-51, the oldest, came from the Intel 8051 and is now manufactured by many firms. Sometimes briefly called C51 ... This is different from many other 8-bit architectures and other 8-bit CISC architecture. That's it. Sometimes very complex actions can be performed with a single command, but commands are executed in many clock cycles (usually 12 or 24 hour cycles, depending on the type of command), with different lengths, and many of them, for all occasions. Among the architectural controllers are dinosaurs such as the MSC-51, AT89C51minimal peripherals, small memory and poor performance, and products such as multi-meat mincemeat on board with silicone labs, huge RAM boxes, and permanent memory. , USB from UARTA, which consists of simple interfaces, and CAN also get a brutally fast core, up to 100 million operations per second.



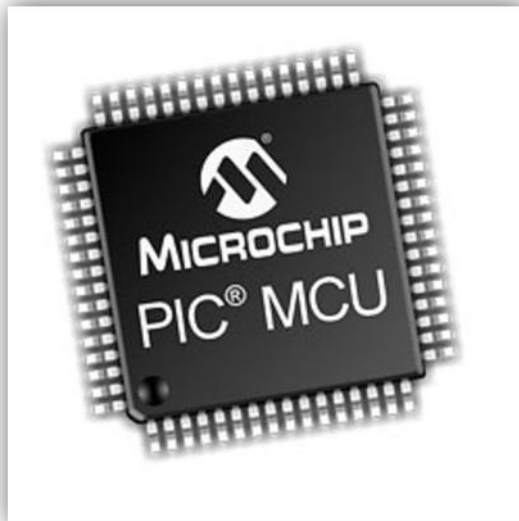
As for me personally, I love the C51 architecture for a very nice installer, this post is very interesting. Gigabyte of code has already been written for this architecture, all imaginable and unimaginable algorithms have been created.

Atmel AVR My second favorite family is Atmel from AVR ... Usually Atmel produces and MSC-51 controllers, but they still focus on AVR ... These controllers already have 8-bit RISC architecture and run a single command in the loop, but unlike the classic o The RISC cores have a very extensive command system, but are not as convenient as in the C51, which is why I don't like them.



But AVR's are always equipped like war and ATmega, which is simply surrounded by various peripherals, especially subfamily controllers ... And they are very easy to flash, you don't need any specialized programmer or other sophisticated equipment for that. Only five wires and a computer LPT port. The ease of learning has allowed this controller to sink into the hearts of many radio amateurs around the world.

Microchip PIC. The other 8-bit RISC microcontroller is distinguished by a very corrupt command system, consisting of only a few dozen commands. Each command is executed in a four-hour cycle. There are a number of advantages, first of all it is low power consumption and fast start.



The average PIC controller does not have as many accessories as the AVR, but the modifications themselves are so many that PIC Controllers can always get a crystal with a peripheral that is fully compatible for the task, neither more nor less. The enabled PICBolta traditionally produces the car's on-board computer and many home alarms.

MICROCONTROLLER CONNECTION

The following diagram is a simplified method of connecting AVR microcontrollers. AVR is a family of eight-bit microcontrollers from Atmel. The year of development is 1996.

In a friendly way, you should add a few more external elements to the scheme.

The wire shown by the dotted line in the diagram does not need to be used if the microcontroller is powered from an external source.

Output AREF ADC is used as input for reference voltage - where ADC is the calculated voltage. An internal 2.56V reference can be used or an AVCC voltage can be used.

ADC (Analog to Digital Converter) is an electronic device that converts voltage to binary digital code

It is recommended to connect a capacitor to the AREF pin, which increases the quality of the ADC voltage and thus allows the ADC to be measured correctly. A capacitor and a junction are installed between the AVCC and the GND, and a ceramic capacitor with a power of 100 nF between the GND and the VCC to attenuate the short noise pulses generated by the operation of the chip (corrosion of the contacts) closer to the pins).

Another 47 mF capacitor is installed between the GND and the VCC to attenuate the possible voltage.

MICROCONTROLLER CONTROL

AVR microcontrollers are equipped with Harvard architecture. Each of the memory fields is located in its own address field. In controllers, data memory is implemented using registry, permanent, and random access memory.

The registry memory contains 32 general-purpose registers attached to the file, as well as service registers for input and output. Both the first and the second are located in the RAM area, but not part of it.

The IN rVV field (input and output registers) contains various service registers - cases, microcontroller control, etc., as well as registers responsible for the management of peripheral devices included in the microcontroller. In fact, managing these registers is a way to control microcontrollers.

MICROCONTROLLER DEVICES

AVR microcontrollers are easy to use, low power consumption and have a high level of integration.



Typically, these microcontrollers can be used in a variety of devices, including general purpose systems, public address systems, LCD displays, and limited area boards.

They are also used for battery level gauges, authentication, automotive electronics, protection against short circuits and overheating, and more. In addition to industrial purposes, the microcontroller can be used to create the following devices (and is often used by beginners):

- ◆ Atmega168 based temperature recorder;
- ◆ Kitchen counter on Attiny2313;
- ◆ Thermometer;
- ◆ 50 Gts frequency network frequency measuring instrument;
- ◆ LED brake light controller on Attiny2313;
- ◆ LED lamps and lights that affect temperature or sound;
- ◆ Electronic or touch switches.

Note that different microcontroller models are used for different devices. Thus, 32-bit AVR UC3 microcontrollers (as well as XMEGA, megaAVR, tinyAVR, etc.) are suitable for general purpose systems designed for picoPower, QTouch, EEPROM technologies, event processing systems and self-programming.

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