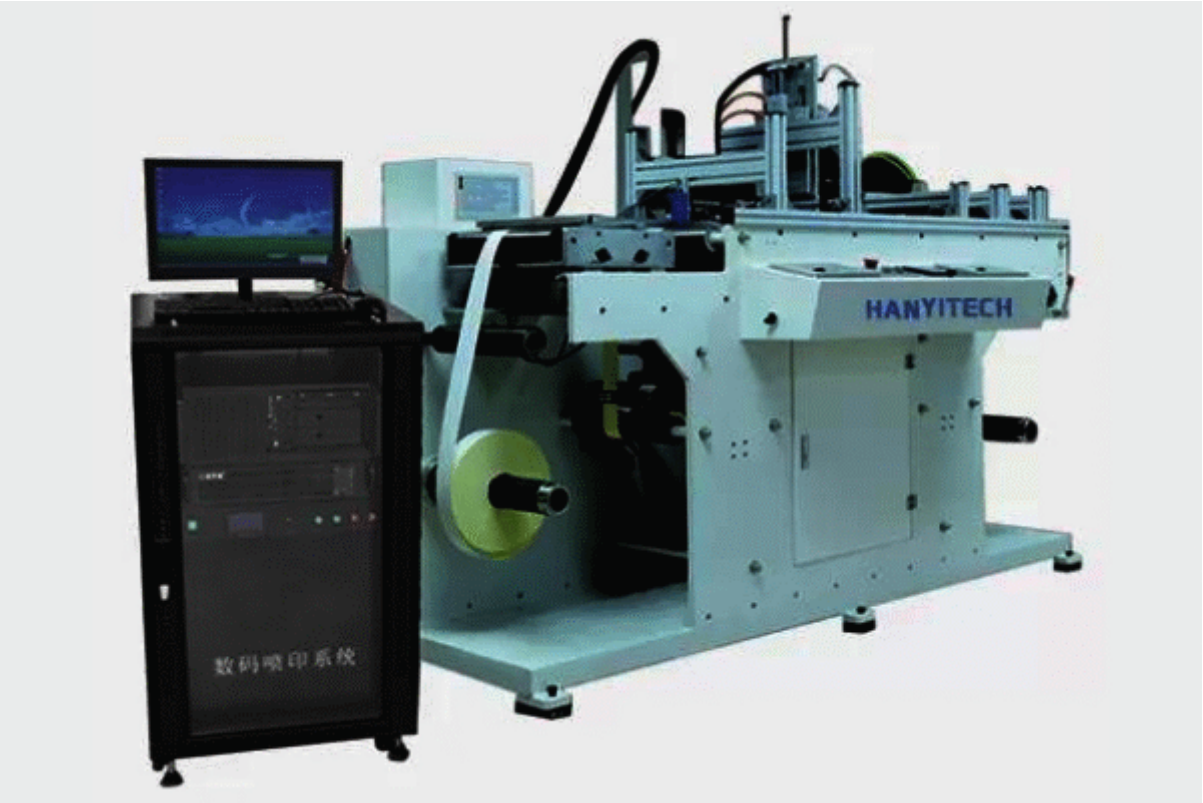
The Development Trend of Laser Marking Machine Its Control System Design

подробное описание :

1. The creation and development of laser marking machines

In 1958, the birth of the laser was considered a great invention of the 20th century. Nowadays, laser technology has been developed even more rapidly, and its applications are extremely wide, including industry, light industry, production manufacturing, mining, energy, aerospace and aviation, and medi According to theoretical research and specific applications, laser technology can be divided into 2 ma categories, one is laser manufacturing technology, and the second is laser application technology. La marking (coding) technology belongs to a kind of laser application technology. The so-called marking means the production of signs on the product's surface, such as the manufacturer, manufacturing da life, contact number, etc... Before the emergence of laser marking technology, the common use of ink technology. Not only was it slow and inefficient, but there was also pollution, and the mark was not c After laser marking technology was created, it gradually replaced the traditional ink marking technolo marking technology is fast and accurate and has the advantage of safety and non-pollution. As the ap of laser marking technology becomes more and more widespread, the development of laser marking technology itself is also becoming more and more rapid. The trend is to combine it with automatic co control, marking speed and accuracy can be better controlled.

We illustrate this with an example of an embedded laser marking machine control with the S7-200. Th machine is the current hotspot and frontier of research in laser marking technology. The embedded l marking machine combines a variety of the latest emerging technologies, of which there are three co technologies: laser technology, embedded technology, and EDA technology.
The embedded laser marking machine has portability advantages, fast marking speed, high integratio price, and high marking quality.



2. Laser marking machine control system design

A machine should be designed according to the principle that the user determines the performance a structure. A laser marking machine is no exception. According to the laser marking machine, work ne determine the laser marking machine should have easy to carry, marking speed, high integration, low high marking quality performance. Generally speaking, the main structure of the laser marking mach consists of the laser system, power supply system, control system, scanning vibrating mirror system, transmission mechanism. In the above structure, the control system is at the core. The control syster is good or bad to determine whether the embedded laser marking machine can meet the work perfo

We take the design of the laser marking machine control system as an example. The essence of the c system is information processing, embedded laser marking main machine processor using ARM microprocessor, auxiliary processor using field programmable gate array FPGA, the benefits of this ch the main processor using ARM program as the main tool for information processing. Its main functio edit the initial control signal, generate marking data. The main processor functions are controlling ma speed, reading and writing marking line objects, controlling marking position, and calculating compen standard data. The ARM processor has powerful functions with various interfaces and strong informa processing and data transmission capabilities during execution. Although its processing power is som insufficient for high-speed data, other processors only have a limited number of I/O. Compared with the data processing speed of the FPGA is faster, positioning and timing capabilities are more accurate

interface is more versatile and scalable. The X and Y axis deflection mirrors are the main control obje
embedded laser marking machine system. In addition, detecting the speed and position information
marked object when the system is running is also very important. The whole system is mainly compo
the laser marking machine as the core control system, with the help of FPGA as the core control syste
power generation and transmission system, high-speed scanning detector system, transmission devi
measurement system to complete the specific work procedures.
Embedded laser marking machine, while gathering the respective advantages of ARM and FPGA, ARM
FPGA parallel processing events, high-speed processing data, can achieve precise time control functio
the cost performance is also very high. Therefore, embedded laser marking machine has become the
mainstream direction of marking machine development.

3. Composition of the control system of the embedded laser marking machine

The main equipment of the embedded laser marking machine control system is as follows.

(1) Processor: The processor of the embedded laser marking machine control system is divided into 2
parts: the main processor and the assistance processor. ARM is the core component of the control sy
most important function is responsible for marking data and generating initial control signals. In addi
processor is also responsible for timely reading out the object of the marking line, controlling the ma
speed and position information, timely calculation of compensation standard data, and other functio
achieve. Assist processor FPGA: FPGA as ARM's main processor on the system bus connected to the A
external storage method is the control system of the auxiliary processor.
The FPGA receives and interprets through D/A conversion, generates control signals, and enhances th
processing circuit through the driver while attaching some external interrupt request signals, which e
form control commands to control the servo system driver and laser scanning vibrator laser marking
addition, the auxiliary processor FPGA is also responsible for handling key events, reading the matrix
keyboard key values, processing the photoelectric detection signals and emergency stop requests, ar
notifying the main processor.

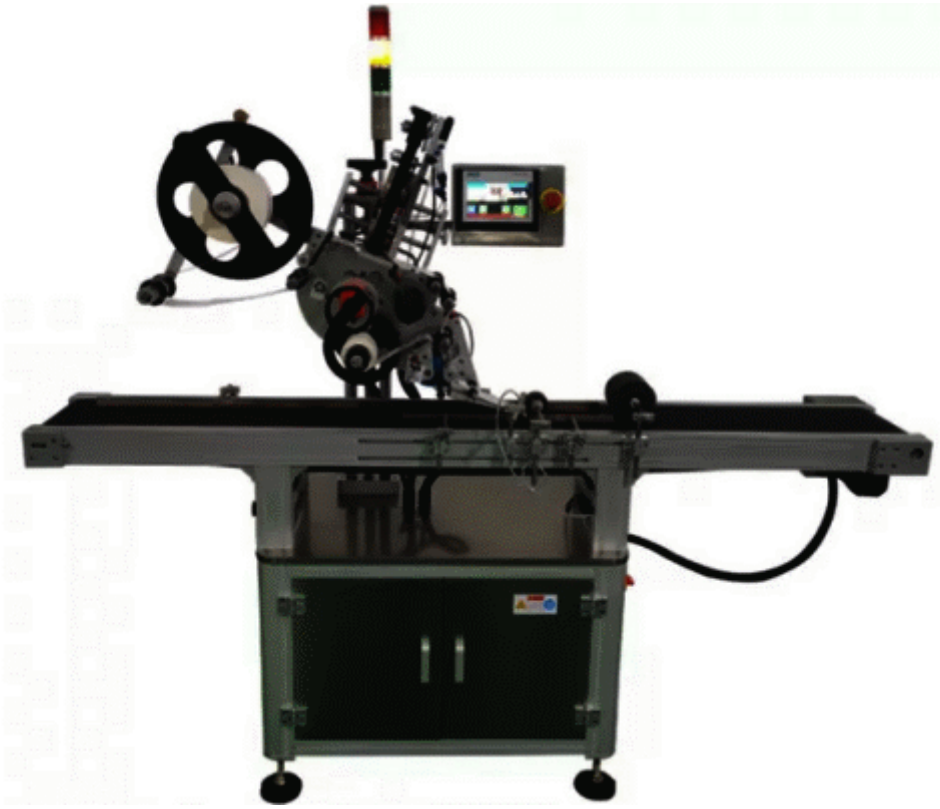
(2) USB interface: USB is the storage device of the laser marking machine, which enables the copying,
and transferring functions of the marking files. Compared to the general laser marking machine, the
interface of the embedded laser marking machine has better versatility and expansion performance,
can store multiple types of files and automatically identify the content of duplicate content, thus savi
storage space.

(3) LCD and touch keyboard: LCD is the output device of the LCD to present various operation inform the system, embedded laser marking machine adopts touch keyboard, thus combining keyboard and into one.

(4) Laser and Scanning Vibrating Mirror System: The laser's high energy can be concentrated in the m area of the marking object, which requires deflected reflection by a vibrating mirror to cause physical chemical changes in the marking area. And using the X and Y axes in the high-speed vibrating mirror scanning system, the vibrating mirror deflects the laser beam, enabling fast and precise positioning a movement of the laser beam.

(5) Transmission mechanism and speed measurement device: The operation of the marking producti requires a stable movement speed. The embedded laser marking machine can accurately measure th marking speed of the laser beam through a real-time speed measurement device and feedback to th controller, which then outputs this data after compensating for the marking position.

(6) Safety grading procedure: When designing a laser marking machine control system, safety perfor very important. In the event of misuse or virus invasion, the laser marking machine may not work, or control system may collapse. In contrast, the embedded laser marking machine improves the securit control system by setting up a system security detection program that can detect the system's securi time. The security of the control system of the embedded laser marking machine is divided into 3 lev first level is the security level, under which the control system can perform any operation without any restrictions. The second level is the protection level. The control system is in a safe and protected sta only basic operations such as editing, saving, and copying can be performed. The third level is the em protection level. Under this level, the control system is installed with an emergency stop switch to pe emergency shutdown operation while saving the current file to prevent the system from crashing.



4. Main processor circuit design

The main processor is the core part of the laser marking machine controller system. The main proces
function is dependent on the circuit to complete. Therefore, the main processor circuit design is cruc
laser marking machine control system. The laser marking machine control system's main processor c
divided into three types: storage, power, and reset.

(1) SDRAM memory circuit

Because SDRAM has high data transfer rate and high integration, it has become the most commonly
main memory for embedded systems. SDRAM is usually designed to select two HY57V561620 chips a
main memory of the system.

SDRAM memory circuit using a 3.3V power supply, 2 SDRAM and ARM for expansion mode connectio
introduced to the LDATA000-LDATA031 full 32-bit data bus. Due to the SDRAM chip line and column a
line of each part of the address pins (A8 ~ A0) being multiplexed, the response to the location of the
processing to the line address is 9, the column address is 13. Therefore The total number of bits of th
address signal is 22, and the main memory capacity of the controller system is 4M x 16bit x 4 blocks x
= 64Mb.

(2) NAND Flash memory circuit

In the embedded laser marking machine control system, a large amount of information is not allowe

lost, so non-volatile memory needs to be used to store the information. At present, non-volatile stora
devices, mainly NAND flash memory and NOR flash memory 2 kinds, because the NAND flash memor
capacity, relatively low price, read and write speed, is the common non-volatile storage device solve t
information. Therefore, the design of a NAND flash chip K9F1208UOM was chosen as a non-volatile m
with a capacity of 64 μm. The ARM processor K9F1208UOM chip uses a 3.3 V power supply, and the s
lines DATA7-DATA0 can be used both to transfer data and connect to the low 8-bit data bus and can b
to send address and control information. The symbols for the other chip functions are ready/output
control command latch CLE (I), with the input signal type in brackets, O for the output signal type, and
input signal type.

(3) Power supply circuit

The design of the controller system requires a variety of power supplies, including 12VDC, 5VDC, 3.3V
1.8VDC for the main processor circuit part. In addition to an emergency backup battery, the battery p
also sufficient to support the real-time clock operation when there is an unexpected power failure. 12
required for the LCD backlight power supply, and +SVDC, +3.3VDC, and +1.8VDC for other circuit part
+1.8VDC. To avoid the hassle of multiple power inputs, the main processor circuitry has only ++12VDC
+SVDC as the only two power inputs, with the rest being obtained by stepping down the +SVDC. Most
main processor circuit devices require 3.3VDC, which is supplied to the different module circuits by st
down the +SVDC through several AMS1117-3.3 chips.

(4) Reset circuit

The reset circuit design is an important part of the ARM system circuit. Using the ARM system, often n
enter the reset state.

The RC reset circuit is the simplest ARM system reset circuit. After the system is powered on, the low-
capacitor is at both ends and reset low after 2 inverters. The capacitor is charged by 8304, and the vo
both ends is gradually approached after the capacitor rises. The system is in the reset state when the
U302A input threshold voltage is not met. Reset is high when the voltage at both ends of the capacito
the U302A threshold voltage is reached. Then the normal operation state of the system is entered.

5. Conclusion

In summary, the embedded laser marking machine is the product of the combination of laser techno
computer automation technology, is a new type of laser marking machine with embedded technology
technology, and EDA technology as the core technology. The embedded laser marking machine is ma
composed of a laser system, control system, power supply system, scanning mirror system, transmis

mechanism, etc. This paper focuses on the overall design of the embedded laser marking machine co and its component composition. Embedded laser marking machine has the advantages of fast markin ease in carrying, high integration, low price, and high marking quality, so it has become the mainstrea direction of marking machine technology development.