Design of Embedded Banknote Sterilizer

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Abstract: The paper first makes an analysis of the requ irements of banknotes d isinfection, and designs a notes disinfection machine which have the functions of bank paper input auto-detection, Iiqu Remember antiseptic auto add , drying temperature detection and control, motor drive and control etc. The paper analyses the hardware and software design method ofthe Iiqu Remember antiseptic height detect and control and drying temperature detect and control. The system is to be proved stable and practical through the experhent and running.

Keywords: Atmega8, PT100, SPI, Banknote-Disinfector, Temperature control

1. Introduction

As environmental pollution and degradation, infectious virus growing, SARS and swine flu viruses in recent years to people's health and life caused great harm. As daily must with to of notes, due to in people and people Zhijian of circulation, surface attached large bacteria and the virus, notes of using is spread infectious diseases of important way, according to about sector on circulation in the of notes coupon sell dye bacteria and virus of situation survey found: notes surface sell dye bacteria and virus up to more than 10 species of more, notes Shang so more of bacteria and virus on people of health is great of hidden. For effective disinfection notes becomes an important issue, currently on the market there are some methods of sterilization on banknotes, such as ultraviolet, far infrared sterilization, but the results are not so good [1], design section of this article to automatically apply disinfectants and disinfection machine for paper drying and flattening.

2. System design

According to notes disinfection requirements analysis, to design a ATMEGA8 microcontroller as the main control chip notes disinfection machine, system consists of

banknotes into detection, temperature detection, liquid level detection detect links, including running status indicators, temperature display, automatic liquid control, output control aspects of motor control and temperature control. System block diagram in Figure 1 below.
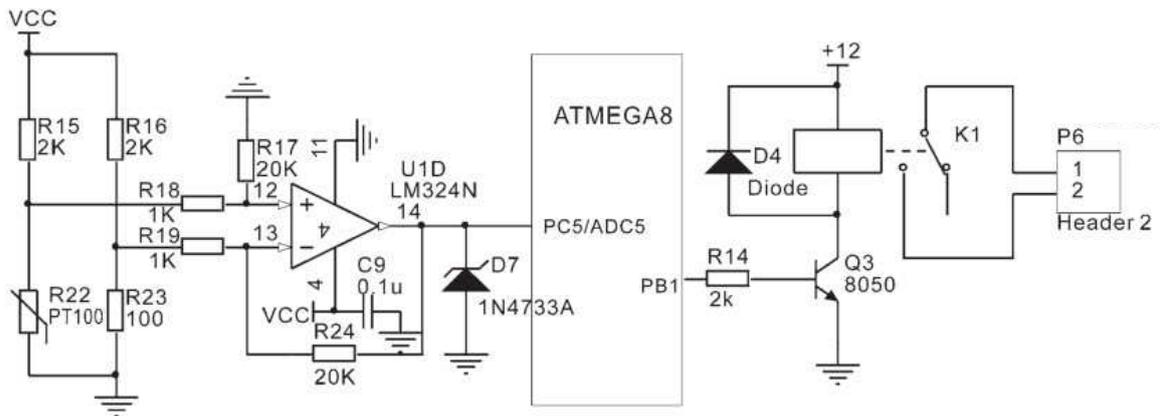
3. ATMEGA8 microcontroller

FIG. 1 System block diagram

ATMEGA8 Single chip microcomputer is ATMEL Company launches AVR Single chip machineAVR single chip microcomputer abandoned complex instructions the computer (CISC toward instruction complete course using reduced instruction set (RISC), short fetch cycle and prefetch instructions to achieve flow, so you can perform high-speed directive, up to 1MIPS/MHZ. Everywhere is ~3 PWM channels, can realize less than 16 bits, phase and frequency adjustable PWM pulse width modulation output. There are 18 different independent sources, and has a specific interrupt enable bit, improve the security of the system. Chip integrates a larger-capacity non-volatile program and data memory, working memory, storage space is sufficient to satisfy the needs and for the expansion of the system to provide the necessary guarantees. 23 programmable I/O port, can be arbitrarily defined I/O input / output direction of driving ability, can be directly driven LED high current load, and most of the I/O port for reuse, except as a general purpose digital I/O use its second function can be used as chip peripheral circuit interfaces. Three timer / counters, in addition to the usual timing and counting functions can be achieved, but also has to capture, compare, PWM outputs, more powerful features such as real-time clock counts. ADC and DAC conversion, analog input and output digital signals directly. Watch-dog circuit, once the program enters an infinite loop can be reset automatically to ensure the reliability of the system. Free,

energy saving, power off three low power mode, it is suitable for low power system requirements.

The system used in the design of probe for the detection of level of disinfectant, and according to the State-controlled tank battery valve movement, so as to realize the function of automatic liquid filling. Disinfectant liquid level detection using the principle of the probe, will install three probes into different height when when soaked in a liquid between two, less resistance between the two, when they have no liquid immersion, resistance is bigger. In the circuit of using LM 324 comparison of operational amplifier circuit to convert the liquid level changes causing resistance information voltage change, liquid-level measurement and control circuit in Figure 2 below. Water inlet is controlled by single-chip I/O through the transistor driving control solenoid valve.
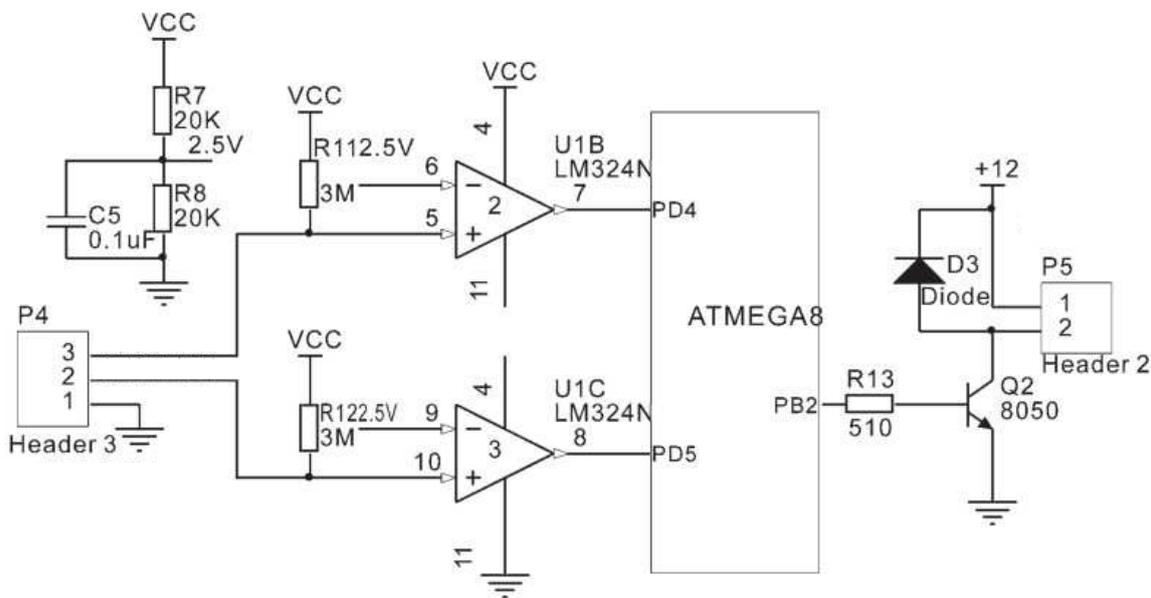

FIG. 2 Liquid level measurement and control circuit diagram

If high level-end signal is detected, stop adding liquid, if low Level ends when a signal is detected, open and fluid. Add liquid and liquid stop a difference between values, avoid fluctuation back and forth near the level at some point the frequent movement of liquid level control.

4. Temperature measurement and control

4.1 design of temperature detection circuit

Temperature detection is one of the core components of the system, directly affect the precision of temperature measurement system and select a suitable temperature

sensor and design of a high temperature detection circuit is very important. Common banknotes into detection drying temperature detection sensors are resistive temperature sensor, thermocouple sensor and integrated temperature sensor. Integrated temperature sensor as DS18B2Q measurement of precision high, but measurement of process occupied more of CPU resources, measurement temperature of range is not is wide; for resistance type temperature sensor, has General of thermistor sensor, also has precision high of platinum resistance sensor, from measurement of precision and measurement of range analysis, platinum resistance sensor has better of linear degrees and more wide of temperature measurement range, so in this system selection PT1QQ platinum resistance temperature sensor.

0-100C within thePT1QQ Platinum thermal resistance approximate linear relationship between resistance and temperature, the temperature resistance can be approximated as:

Rt Is the temperature for fC Shi PT1QQ Resistance value.

Detection circuit design is also very important in the sensor, platinum RTD sensor, using the bridge and op-amp amplifier of signal detection, temperature measurement and control circuit in Figure 3 temperature measurement and control circuit diagram Expression of the op-amp's output voltage as follows:

4.2 Temperature data acquisition and control

In this system, by PT1QQ temperature sensor temperature data, the amplified voltage signal amplifier circuit, and into single chip, the system does not use an external a/d converter, instead of using the ATM EGA8 MCU internal a/d converter,ATM EGA8 single chip has a built-in 8 Lu 1Q A^D converter, through PC parallel multiplexing ' the internal a/d converters-related settings, AD conversion in the interrupt handler to read the temperature data collected, and to count the number of temperature acquisition, Collection of temperature set temperature acquisition complete flags of the number ten. Using the software filter method, remove 1Q data of maximum and minimum values, on the middle of the 8 data averaging and data back to the calculated temperature value.

Temperature control procedures flowchart Temperature control of the system by comparing the detected temperature value and the set temperature value to determine whether to heat control and decide whether Read into the detected temperature Paper money into testing. When the detected temperature value is lower than the set temperature value, drying-lamp for heating control, red light is on, the green indicator represents the system is elevated, while closing note entered testing, even with the note into the input port, the motor does not turn. When the temperature exceeds the

set temperature value, the drying tube stops heating up, green light is on, the red indicator, the representative has reached the right temperature, reset the temperature reached the mark, and detection of paper currency allowed to enter, if there are notes entered, driving motor will run. Under the heat lamp heat nature, proportional control algorithm is used, according to the set temperature value and the difference between the current temperature values, set the corresponding heating time. Temperature control of program flow chart below.

In the temperature control system, and in 10 seconds, the heating control cycle, the heating time is proportional to the temperature difference. Current temperature is below the set temperature of 20C when using 100% heating at full speed, when the temperature in the 2QC when m with proportional heating, such as temperature differences for 1QC meters when using 50% duty heating, heat 5 seconds, stop 5 seconds, smaller temperature difference between heating Duty ratio is smaller. Through proportional control algorithm, system temperature has some overshoot during first boot after 7Q seconds control process, drying at set temperature temperature stability ± 1% range fluctuations better realize the effect of temperature, temperature curve shown in Figure 5 below. After testing and prototype operation, the system can realize the paper the actual temperature RC) Figure 5 operating temperature curve. Currency into detection and automatic hydraulic control of the disinfectant and drying features such as automatic temperature control system with high stability. Design makes full use of AVR MCU internal resources with high performance.

Acknowledgements

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