

The Application of DSP in the Fire Detection

ZHENG Yanling, NING Xin, WANG Zhankui

Henan Institute of Science and Technology, Mechanical and Electrical Engineering, Xinxiang, China

Abstract: This article applies DSP to the fire detection, has made the hardware design and the main software design, unified software and hardware has carried on in the CCS the partial simulation and the experiment. Confirmed has been reasonable DSP should use in the fire to survey, but effectively reduced the difficulty which the hardware designed and enhances software the flexibility, had the certain practical significance.

Keywords: fire; DSP; CLC; TP277

1 Preamble

DSP(Digital Signal Processor)is a kind of processor for processing real-time signals. The article uses the powerful function on processing digital signals of DSP and large scale programmable devices for synchronized collection and procession of fire signals. It uses software filtering techniques of DSP to processing fire signals, which consumes less power and makes less cubage .This method is easy to realize. The article make full use the potential of DSP on detecting fire signals.

2 Hardware Design Based on DSP

We need many sensors to analysis and determinate whether the fire has happened. To realize advanced fire warning, the speed and precision of collecting data are high demanded. Collecting path should have the functions of quickly sampling multiple signals, high precision and high speed. It should realize the real-time control of the sampling path. DSP not only controls the sampling procedure and deals with the sampling data in advance.

According to the actual analysis of demanding, this design is composed of master-computer and subordinate-computer. DSP is the core processor of subordinate-computer, which finishes the collecting and pretreatment of real-time data. This article mostly introduces the design of DSP. The block-figure of the whole design is shown as Figure 1^[1].

3 Software Design Based on DSP

The functions of the software design include three independent subprograms:

1) Program for inspecting and judging: This program is the core of all programs, which is used to collecting and processing the date from multiple sensors and inspecting and judging the fire. 2) Program for display: This program performs the function of alarm and display when the fire happens.

3) Program for data communication: This program gives the sampling data and the result of judging fire to master computer for farther analysis and judgment.

The flow chart of the software design is shown as figure 2.

In fire detecting system, the signals varying with fire, such as smoke, CO and temperature are all low frequency signals, so low frequency filters are designed to filter interferential signals. The performance is as follows: Ending frequency of the pass channel is 150Hz, the ripple is 0.01, the resistance channel ripple is 0.001, sampling frequency is 5000Hz, and attenuation of resistance channel is than 50db.

The article use tool box and abundant functions provided by MATLAB to design and doing emulate previously, the I realize that through DSP

Figure 3 is FIR Amplitude-frequency characteristic of lowpass filter designed by Kaiser window. Figure 4 is zero and extreme point and unit impulse response of this filter. Figure 5 is Smog signal before and after filter the wave. Figure 6 is Temperature signal before and after filter the wave. Figure 7 is CO signal before and after filter the wave^[2].

4 Emulation Based on DSP

We used CCS software to test the effect of filter designed by us. CCS is one kind of integrated employer environment for DSP, which can be used to realize software simulation. Figure 8 is the page of loading the program of filter. Figure 9 is contrast page graph before and after filter ^[3].

After filtering the collected data with the software of DSP, we judge the fire with arithmetic of fuzzy NN and show the result of judgment on the CCS plat as figure 10.





Figure 2. Program flow chart of the system



Figure 3. Amplitude-frequency characteristic of kaiser window digit FIR lowpass



Figure 4. Zero and extreme point and unit impulse response



Figure 5. Smog signal before and after filter the wave

We know that we can judge the fire correctly with these equipments when we test the result though three kinds of different fire source. This method can judge non-fire, negative fire and fire. System can do correctly judgment when it is added interfere sauces as electro magnetism, cigarette and steam etc.





Figure 6. Temperature signal before and after filter the wave



Figure 7. CO signal before and after filter the wave

5 Summarization

This article gives a try to make full use the advantages of DSP to judge the fire, which based on other people's researches. This article uses the tools of MATLAB to analyze and process the data of different fires and test the validity of the software and hardware that we choose in this system. This article decreases the difficulty on design Technology and Application of Electronic Information



Figure 8. Filter source program increase page



Figure 9. Around filter graph contrast page

of hardware and advances the flexibility of software. It is significative to make a reasonable use of DSP in judging the fire.

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