Abstract

In order to cooling an IT infrastructure and data center, our group designs a system that can determine the cooling rate based on the temperature and the human’s presence. We first build a small-scale version of the cooling system. By calibrating the PT 100 temperature sensor, we can get the actual environmental temperature and use that as the decisive factor of the motor speed by determine the PWM rate. Besides, we use infrared photoelectric sensor to detect the existence of the human. By analyzing the performance of the testing version, we conclude the things that need to be improved in the future.

Keywords---- Cooling system, PT 100 temperature sensor, motor speed, Infrared Photoelectric Sensor, Triode, PWM

Introduction

The working of IT infrastructure and data center shown in Fig.1 generates heat and increases the environmental temperature. However, the upper limit of the working temperature of a normal IC circuit is around 100. Whether the cooling system performs well affects the stability of the IT center. Therefore, a cooling system with a motor that helps the heat dissipation should be designed. Also, to save energy consumption, the speed of the motor should relate to the temperature. Considering human activities' requirements, the temperature should also be low enough to provide a good environment for humans.图片包含 建筑, 电脑, 电子, 室内

描述已自动生成

Figure 1 IT data center

Summary of Results

**Temperature Sensor Calibration**

The result of calibration is shown in Fig. 1 below. The voltage and the Temperature get from the PT 100 temperature sensor is a positive correlation. The calibration is done by adding some cold water to the hot water each time and recording the corresponding output voltage and the Temperature from the mercurial thermometer, shown in Fig.1. By MATLAB basic fitting, a yellow linear line matches the measured data effectively. The slope of the line indicates the changing rate of the Temperature per volt. Therefore, the water temperature can be calculated by multiplying the voltage output into the calibration equation eq. (1) as shown below.

Where and



**Motor Speed Control with Temperature and Human Presence**

The Infrared Photoelectric Sensor is the determinant of the speed of the motor. When The infrared photoelectric sensor detects human presence, the PWM output reaches the maximum, and the engine works at the highest rate.

When no human around, the Temperature determines the PWM output of the program. In the range of 33, the motor speed changes linearly with the Temperature, as shown in Fig.2.

**Experiment result**

1. The Human Presence detection done by the Infrared Photoelectric Sensor performs well and stable. Because the threshold value was set as a relatively large value, the distance between the block and sensor should be minimal, which does not match reality.
2. The Temperature can be measured correctly when the motor doesn't work. However, once the motor works, the temperature sensor increases immediately to about five .
3. The speed of the motor increases with the Temperature well. However, in the beginning, when the PWM rate is low, the motor vibrates but won't work.
4. The device must be recalibrated each time when using it because the calibration will change.

Discussion

Our system is only a model of the cooling system. To equip this system in reality, the problems mention above must be solved, and some improvement must be made to fit the real situation.

Problems solution.

1. The program should upgrade since the motor doesn't need to work at full speed in lower Temperatures.
2. The motor’s working will influence the temperature sensor without a possible solution. Therefore, two devices working separately and communicating the data may be the only choice to ensure good performance.
3. Because of the motor’s resistance, it will not work at low voltage. The motor speed is not linearly relating to the PWM rate. Therefore, the speed of the motor and the PWM rate should be calibrated to make sure the PWM rate can control the speed precisely.

Realistic modification methods

1. In reality, the distance between the Infrared Photoelectric Sensor is much farther than we set in the program. To measure the distance, we have to calibrate the infrared sensor and sets a proper distance.

Conclusion

By designing the computer program, our group learns how to use Labview to program the conditioning control, acquire and send the data we need to the hardware. Besides, we also learn how to use the infrared sensor to measure the distance and use the acquired data to control the speed of the motor. The PWM rate is a new concept in this course, which is useful in controlling the speed of the motor. Therefore, by designing the relationship of the PWM rate and the motor, we understand the working principles of the PWM rate and the triode function. By result analysis, the problems are listed and need to be improved in the future. The model system has some differences from reality and needs to be optimized when applying to the real situation.