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SOFTWARE DETECTION OF THERMALLY HOT ELEMENTS IN AN ELECTRONIC DEVICE

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Software Detection of Thermally Hot Elements in an Electronic Device

Abstract: A software technique determines hot elements of an electronic device and controls their power consumption to reduce temperature, without the use of individual thermal sensors for the elements.

This disclosure relates to the field of thermal management of electronic devices.

A technique is disclosed that uses software to detect a hot element in an electronic device and then perform thermal control on the hot element, without using a thermal sensor to detect the hot element.

Excessive heat generated within an electronic device can impair the device's performance, or even damage or destroy the device. Some devices use one or more thermal sensors to detect the temperature of elements such as the CPU, memory, Nvme SSD, WLAN, dGPU, and the like. But adding thermal sensors to an electronic device increases the cost of the device, and this cost can be significant if it is desired to monitor the temperature of a large number of individual elements within the device. Furthermore, the thermal sensors take up space on the PC board and/or within the volume of the device enclosure, a situation that is exacerbated when the electronic device is thin and small.

According to the present disclosure, a software thermal detection and control technique may be invoked if a skin temperature of the electronic device exceeds a limit. This condition may be determined using a single temperature sensor, such as a skin temperature sensor, of the entire device. If the temperature limit is exceeded, the technique first assesses the current workload of the electronic device in order to determine the hot element(s). For example, if the electronic device is a notebook computer, and the workload is due to gaming, the hot elements may be determined as the CPU, GPU and memory. Or, if the workload is due to web browsing, the hot elements may be determined as the CPU, NIC and SSD. If the workload of the electronic device is unknown, a trial-and-error method can be used to identify the suspected hot element.

Next, power control is performed on those element(s) which are determined to be hot. This can involve reducing the load on the element from a high level to a lower level in a manner that is specific to the particular element.

Finally, the total power consumption of the electronic device is measured after power control for the element has been performed. This may be done directly (i.e. using a power measurement means of the device) or indirectly (e.g. via a decrease in the skin temperature, measured at a subsequent time that accounts for the thermal mass of the device). If the element on which power control is performed was indeed the hot element, then the device's total power consumption will be decreased. If the total power consumption is not decreased, then the element controlled was not the hot one, and the power control method is repeated for another element until the hot one is identified.

The disclosed technique advantageously detects hot element(s) of an electronic device and performs thermal control on these elements, without including thermal sensors for the individual elements. This saves the cost and space that would otherwise be dedicated to these sensors. In addition, the temperature of some elements, such as for example memory or SSD, can be difficult to read via a thermal sensor, and thus the disclosed technique may be the only viable option.

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