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Microfluidic Fluid Flow Design with Arduino Relay and Temperature Controller for Processor

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Abstract— **Considering microfluidic technology, this work has been innovated to consist of monitoring, temperature control and cooling sections. The work consists of peltier a module attached to the heatsink and fan for cooling purposes. The peltier cooling is used to cool down the fluid from the water reservoir tank that will flow into the microfin CPU block. This work consists of one water reservoir tank that uses feedback system, which makes fluid will flow into the microfin (microfluidic) CPU block, and transferred back to the water reservoir tank. The temperature monitoring is monitored using the Intelligent Temperature Controller (XH-W1401) located near the system. The Arduino coding controls the relay for the on/off operation of the whole system and the water pump is for the cooling section. Overall the methodology implemented and the controller system have been successfully designed, functionally operated and tested. It is found that, the system temperature without the cooling effect reaches up to 80ºC - 100ºC while the temperature of the system with the microfluidic microfin CPU block can be reduced to 45ºC - 50ºC degree when the processor becomes too hot.**

Keywords—microfluidic; microfin; temperature controller; Arduino; cooling system

I. INTRODUCTION

There are many electronic devices in this world that uses a main processor or a microcontroller to control some specific commands of some devices. The easiest example of electronic devices that uses a processor is a laptop or a personal computer that consist of Central Processing Unit (CPU). Computer processors are designed to run at high temperatures and it is completely normal for a CPU to heat up and to actually get very warm. In fact, temperatures of over 90˚C are acceptable but not efficient. A computer's CPU works by either enabling electrical signals to pass through its microscopic transistors or by blocking them. As electricity passes through the CPU or gets blocked inside, it turns into heat energy. While the processor in a high-performance workstation may run hot due to heavy use. The processor in a regular computer that overheats is always a sign of a malfunctioning system [1].

Many electronic machines that used in factories will have to operate for at least 10 hours for manufacturing purposes. When the device operates for a long time, the processor may become hotter as times goes by. This will make the machines in factory to operate slowly when it became too hot. The processor optimum operation varies with the type of processor itself. Some of them are optimum when they operate at 40ºC-60ºC while other processors are optimum when they operate at 45ºC-55ºC. Nowadays engineers only put cooling fans or heat sinks to cool down the temperature of the processor when it becomes hot.

For this problem, the microfluidic fluid flow in a channel is a perfect choice to control the temperature of the processor when it becomes too hot. This work used a microfin copper channel as the microfluidic fluid flow to control the temperature of the processor monitored by the Intelligent Temperature Controller (XH-W1401). The flow of the fluid in a microfin copper channel is placed on the top of the processor to cool down the processor in its optimum temperature.

II. PROBLEM STATEMENT

The Central Processing Unit, or the CPU, is the vital computing unit that forms the main execution core of a computer, and is the most important element of a computer system. It is often called the 'brains' of the computer. A CPU is responsible for processing data by interpreting and executing commands from the computer's hardware and software. This CPU is also known as processor, which is the most important part in electronic devices that needs multiple actions and controllers [2].

The industry nowadays relies on processors in their factory machines to perform specific controls and actions. The processor is indeed useful in a machine but may become hot if it used for a long time. Many electronic machines that are used in factories will have to operate for at least 10 hours for manufacturing purposes. When the CPU becomes hot, it needs to be cooled for it to operate efficiently. If it is not cooled, it may become overheated slowing the machine actions. The processor optimum operation varies with the type of processor itself (some of them is optimum when they operate at 20ºC-60ºC or 10ºC-50ºC) [3].

The machines nowadays only have the cooling fan or heat sink to cool down the processor. It does not specifically maintain the temperature at specific temperature. It also does not warm the processor when it becomes too cold. The machine also will operate slowly when the processor is too cold. With the idea of the work performed, this microfluidic fluid flow design with relays and temperature control, the control for the processor in hot and cold condition can be met. This is because the work uses microfluidic fluid flow