Advanced Science and Technology Letters
Vol.76 (CA 2014), pp.25-28
http://dx.doi.org/10.14257/astl.2014.76.07

Multiple USB Camera Control System for Reading the QR Codes Information of the Micro PCR Biochip

Seung-Cheol Lee[1], Jong-Dae Kim[2,3], Yu-Seop Kim[2,3], Hye-Jeong Song[2,3], Chan-Young Park[2,3]

[1] Dept. of Computer Engineering, Hallym University, Korea
[2] Dept. of Ubiquitous Computing, Hallym University, Korea
[3] Bio-IT Research Center, Hallym University, Korea
{ leesc4957, kimjd, yskim01, hjsong, cypark }@hallym.ac.kr

Abstract. The chip used for a micro PCR requires the correction factor of the chip temperature sensor for the precise measurement and control of temperature. The Calibration coefficient values of the temperature sensor is obtained from the chip, generated as a QR code, and attached to the chip. USB camera connected to a PC reads the QR codes, and the data from the QR codes is used to correct the measured temperature. However, multiple USB camera does not work in the one PC. We establish a system that automatically turns the USB cameras on and off by operating solid-state relay modules and a micro controller unit used in micro PCR.

Keywords: PCR, Lab-on-a-Chip, Bio Chip, quick response code, Solid-State Relay

1 Introduction

A micro PCR through Micro electro mechanical system (MEMS) features a shorter analysis time than conventional PCR and requires less sample usage, provides rapid heating and cooling rates, decreases power consumption for integrating various techniques and for operating equipment, and reduces cross-contamination and biochemical risks [1,2].

The chip for a micro PCR must have lower or no error rate between the measured temperature and actual temperature values. To that effect, it is necessary to obtain the correction factor value of a chip temperature sensor in order to correct the measured temperature value accordingly. When saving a correction factor value of the chip temperature sensor onto a chip to send it to a PC, a quick response (QR) code is used.

When several cameras are operated on a PC, only the camera first connected to the PC functions, and the others do not. This is inconvenient and delays test preparations because the user has to disconnect the link in person whenever a required camera will be in use. Therefore, we suggest a solution to this problem in camera operation by using a micro controller unit (MCU) and a solid state relay (SSR).

ISSN: 2287-1233 ASTL

2 Hardware Design

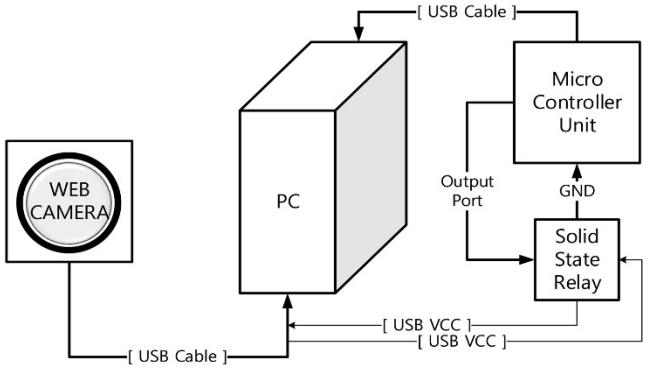

Fig. 1. Diagram on SSR and MCU Link of USB Webcam

Figure 1 shows a block diagram in which a USB camera is connected to the SSR and MCU. The USB VCC jumper wires are disconnected and the ends of the jumper wires are connected to each pin that is suitable for the SSR. An SSR cannot be used alone; it needs a medium that can send voltage signals in required situations like an MCU. The output and ground ports of the MCU are linked to each pin of the SSR. The USB camera to which both the SSR and MCU are connected controls its VCC, using the MCU output signal, and will be turned on and off by a program as needed.

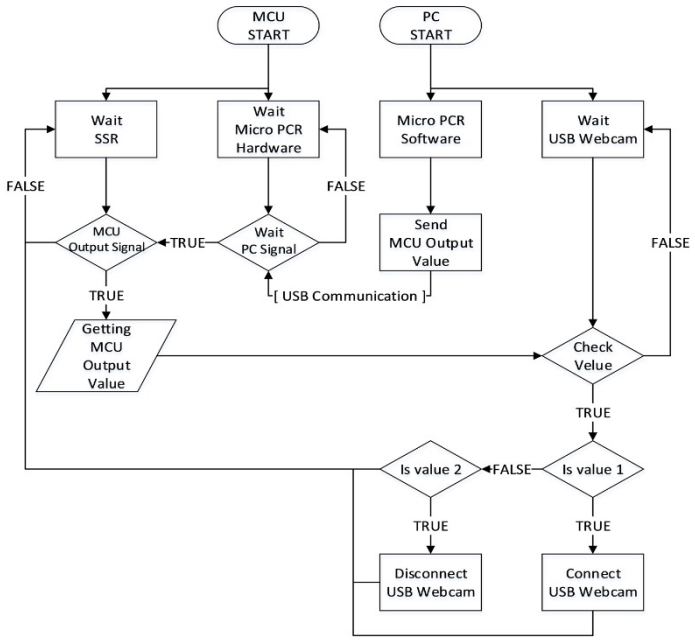

Fig. 2. USB Camera Operation Flow Diagram Using MCU and SSR Control

Figure 2 shows the flow diagram in which the MCU is operated by the command from the PC program and the MCU controls the SSR to control the USB camera. Once the program sends a command to the MCU, the MCU sends a voltage signal to the SRR. Upon receiving the signal, the SSR, as well as the VCC of the USB camera, switches on, enabling the PC to recognize the USB camera. When the SSR receives a voltage signal from the MCU again, however, it switches off. Similarly, the VCC of the USB camera switches off and the PC recognizes that the USB camera is disconnected.

3 Results

The following describes how we actually operate a micro PCR. First, we execute the PC software that operates the micro PCR.

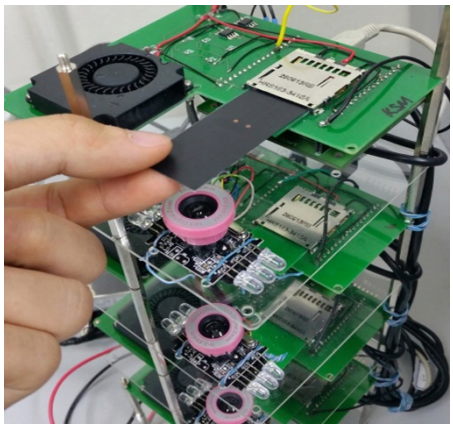

Fig. 3. Mounted Biochip

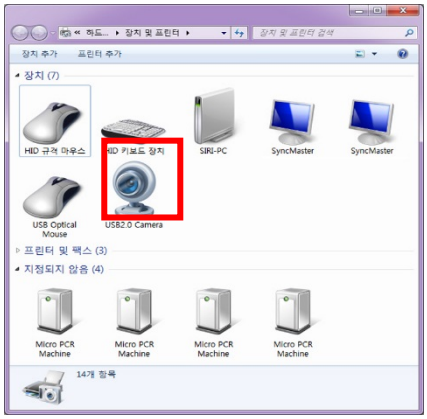

Fig. 4. PC and USB Webcam Connection

As shown in Figure 3, the software recognizes when a biochip is mounted on a micro PCR. It sends a command via software to the MCU to activate the SSR. When the SSR starts to operate, the USB webcam installed on the micro PCR also starts to operate, and as shown in Figure 4, the PC can also recognize the USB web cameras.

When the USB webcam is operated, the software shows a preview window to recognize the QR code, as shown in Figure 5, and once the QR code is recognized, the preview window is closed. The chip temperature correction factor value from the QR code is calculated with the temperature value obtained from the biochip temperature sensor, which is mounted on the micro PCR. Figure 6 shows the software that operates a micro PCR, the chip temperature correction factor value that was obtained from the corrected temperature of a biochip, and the QR code.

Fig. 5. Webcam Preview Window

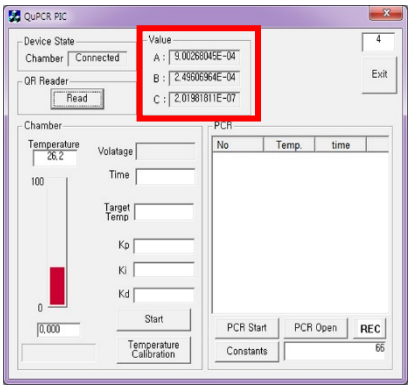

Fig. 6. QR Code Data Output

4 Conclusion

Attaching and detaching connectors to the USB ports of a PC in person will be difficult and inconvenient, as well as time-consuming, as the number of devices that need controlling increases. Thus, this paper proposed a USB device control system using MCU and SSR. Using this system, time for preparation and tasks reduces, and work comfort increases. In addition, we can use the proposed system if USB devices other than the USB camera need to be connection controlled.

Acknowledgments. The research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology (2012R1A1A2040381).

References

1. Park, B. H., Jung, J. H., Kim, Y. T., Seo, T. S., Development of a Fully Integrated Genetic Analysis Microsystem. Physics & High Technology, 3, 9 (2013).
2. Zhang, C., Xing, D., Miniaturized PCR chips for nucleic acid amplification and analysis: latest advances and future trends. Nucleic Acids Res. 35, 13 (2007)