

Abstract

Compact Camera Fluorescence Detector for Real-Time PCR Devices Using a Parallel Light Lens [†]

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Abstract: Molecular diagnosis evaluates changes in molecules occurring in cells through numerical and imaging. The expression of genes and disease genes are studied to present directions for the prevention and treatment of infectious diseases. Real-time polymerase chain reaction is a technology that amplifies the amount of a small-target genetic material. Real-time PCR (Polymerase Chain Reaction) detection technology based on fluorescence measurement detects DNA amplification and measures fluorescence brightness. Existing real-time PCR systems require complex configurations and many optical components. As a result, the size of the optical system device is large, and there are limitations in cost and assembly. In addition, imaging devices, such as large and expensive high-performance cameras, are required to measure fluorescence. Recently, due to the continuous development of cameras for smartphones, many cameras with a small size and good performance are being developed. In this paper, we propose a low-cost compact fluorescence detection device using a parallel light lens. The proposed system has a simple optical structure, and the cost of the system can be reduced and miniaturized. This system has the same field of view using a fresnel lens. In addition, a small and inexpensive CMOS (Complementary Metal–Oxide Semiconductor) camera (Arducam, Nanjing, China) and LED were placed in the same direction to the greatest extent possible in the center of the fresnel lens. For an accurate analysis, an image processing method was used to compensate. As a result of comparative experiments using double distilled water (DDW) and a reference fluorescence solution (FAM), the proposed system confirmed that stable fluorescence detection was possible.

Keywords: real-time PCR; fresnel lens; fluorescence detection; open platform camera; image processing



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