Abstract

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Microthermofluidic System

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Abstract

Miniaturization of Micro-thermofluidic systems has led to tremendous attention due to their ability to be portable, automated, easy-to-operate, low power, and low-cost microdevices that are amenable to be integrated for various microfluidic-based point-of-care testing applications. The development of a micro-thermofluidic system requires the integration of multiple functions such as controller, heater, sensor, and recorder within a compact platform. Further, a precise, stable, reliable, and easy-to-use thermal management system is essential to deliver rapid data output in real-time for continuous monitoring. The spectrum of applications requiring proper temperature management with appropriate heating techniques is growing rapidly with increasingly important implications for the physical, chemical, and biotechnological sectors. Such temperature control is a critical parameter in managing many physical, chemical, and biological applications. Prominent applications of micro-devices requiring specific temperature control include nucleic acid amplification, nanoparticle synthesis, and digital microfluidics.

However, it has been observed that the existing conventional devices lack advanced technologies, consume more power, have slower processing, and are expensive. Herein, an automated, integrated, miniaturized, easy-to-use, low-cost, portable, and off-the-shelf microcontroller with IoT enabled micro-thermofluidic system has been demonstrated. The device was automated using a microcontroller, and the real-time temperature data logging facility was incorporated using Bluetooth and IoT modules leading to access and store data even in a smartphone for further analysis. The device operated at low power of 9.6 W with a temperature accuracy of ±0.5°C. Further, the proposed device offers opportunities for diversified new concepts to implement in microfluidic temperature-based point-of-care applications

Biography

Madhusudan B Kulkarni received the B.E. degree in Instrumentation Technology from B. V Bhoomaraddi College of Engineering and Technology (BVBCET), Hubballi, India, in 2013 and M.Tech degree in Biomedical Electronics and Industrial Instrumentation in 2016. Received the Gold medal award during Master's degree from Visvesvaraya Technological University, Belgaum, India. During his M.Tech, he worked on the Detection of Brain tumor using the random walk segmentation approach using MRI images. Recently, he has submitted a Ph.D. Thesis under the supervision of Prof. Sanket Goel, MEMS, Microfluidics and Nanoelectronics (MMNE) Lab, Department of Electrical and Electronics Engineering, BITS-Pilani, Hyderabad Campus, India. He worked on developing a Portable and Automated Thermal Management System for various Microfluidic platforms for point-of-care applications. He also developed a miniaturized DNA amplification system using the PCR technique for Biomedical Applications. Currently, he is working as Assistant Professor, School of Electronics and Communication Engineering at KLE Technological University, Hubballi, Karnataka, India. He holds 2 Indian Patents and has published ~15 articles in reputed international journals, 4 book chapters, and 5international/national conferences. He has received the TCS-RSP cycle-15 scholarship and international travel grant award during his Ph.D. He has also received ReSMiQ Postdoctoral fellowship award from Canada. His research interests are Microfluidics, Biosensors, Nanomaterial Synthesis, and the development of Biomedical devices for POCT

