ABSTRACT

Indoor air quality control is the primary focus of this study through the development of a prototype air purifier utilizing zeolite-based filtration and a Metal-Organic Framework (MOF)-based sensor. This research evaluates the system's efficiency in reducing CO_2 concentration using zeolite filtration and characterizes the MOF sensor's performance in detecting CO_2 gas. The experiments were conducted by injecting CO_2 into a test chamber while monitoring CO_2 levels before and after filtration. The results indicate that the zeolite filter achieved a CO_2 adsorption efficiency of 64% under enclosed conditions. The developed MOF sensor detected CO_2 within a range of 400–5000 ppm, with an average deviation of 41.78 ppm compared to a standard analyzer. The designed signal conditioning system successfully converted nano-scale current into milli-volt level voltage, enabling microcontroller processing. Optimization was implemented by integrating fuzzy logic control for fan speed adjustment based on CO_2 concentration, along with OLED display integration and Micro SD Card storage, achieving <5% data loss due to the application of a Real-Time Operating System (RTOS) in the hardware system. The findings of this study serve as a foundation for further development of a more efficient CO_2-reducing air purifier that can be integrated into IoT-based smart systems.

Keywords: *Air Purifier, CO_2, Filter, MOF, Sensor, Zeolite*