ABSTRACT

In recent decades, technology has evolved significantly, transitioning from wired PCs and basic electronic circuits to wireless interconnectivity among devices over local networks, addressing real-time problems. VLSI electronic circuit design has emerged as a crucial technology for developing efficient and dependable digital systems, necessitating capabilities such as small hardware size, high reliability, speed, and power efficiency. Rapid advances in nanometer IC fabrication technology have enabled the integration of hundreds of thousands of transistors on a single chip, posing challenges in VLSI routing optimization. Swarm intelligence-based metaheuristics, like PSO and FA, are explored to overcome these challenges, optimizing VLSI routing and reducing wirelength and delay. Similarly, modern Wireless Sensor Networks (WSNs) have become robust, affordable, and easy to monitor, laying the groundwork for IoT. However, building robust WSNs faces challenges due to diverse topologies. Conventional protocols like AODV are utilized, but they may lead to system delays and inefficient resource usage. Metaheuristics like ACO and PSO are proposed for WSN routing optimization and clustering, addressing challenges such as real-time delay and network congestion in the IoT paradigm. Fog computing controls bandwidth utilization and workload distribution, enhancing intercommunication among IoT clusters. Hybrid algorithms are tested in emulators to address WSN challenges effectively.