

## ABSTRACT

Static itinerary planning is a commonly employed multi-hop itinerary planning method in wireless sensor networks (WSN) due to its commendable energy efficiency and ability to minimize overhead. However, this approach lacks reliability due to the possibility of inactive sensor nodes in the WSN throughout the multi-hop process. This research presents a hybrid multi-hop strategy that combines static itinerary planning with dynamic adjustment. In the event of a malfunctioning sensor during the multi-hop procedure, data transfer can persist until it reaches the sink node. Our model integrates the benefits of utilizing a genetic algorithm for static route planning and making dynamic adjustments to ensure network functionality, even in the case of node failures during data transmission. This hybrid strategy provides reliable and robust data collection by overcoming the constraints of conventional static methods, which are vulnerable to disruptions when nodes are not reachable. Furthermore, a peak detection technique is employed to specifically process the incoming vibration data produced by the bridge, thus ensuring the collection of accurate and unambiguous data for FFT analysis. The experimental results demonstrated that, despite the hybrid model's somewhat longer processing time compared to the static method, it significantly improves the network's ability to rapidly recover and maintain consistent performance. This effectively ensures uninterrupted data transmission and processing even in the event of node failures.

**Keywords:** Static itinerary planning, in-network processing, wireless sensor network(WSN), dynamic adjustment.