



Implementation of Graph Coloring Method for Access Point Selection in Smart Buildings

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ABSTRACT

This study investigates the optimization of Access Point (AP) selection for microcontroller-based devices within smart building infrastructures using a graph theory approach. The primary challenge in multi-story wireless networks is the topological complexity that triggers signal interference, subsequently degrading the connectivity stability of IoT devices. In this research, the network is modeled as a weighted graph, where vertices represent access points and edges represent transmission paths weighted by distance. The Welch-Powell algorithm is implemented to optimize frequency channel allocation, effectively minimizing co-channel interference between adjacent nodes. Furthermore, Dijkstra's algorithm and Traveling Salesman Problem (TSP) logic are applied to determine the most efficient communication routes. The results demonstrate that transmission distance is the most significant parameter in optimal AP selection; a distance variance of 1.2–1.7 m is proven to correlate with improved signal quality. Meanwhile, frequency channel alignment and interference management serve as crucial secondary factors in optimizing connection stability. This approach provides a mathematical framework for strategic AP placement to ensure reliable data communication for microcontroller-based devices in high-rise environments.

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1. INTRODUCTION