OPTIMASI KERANGKA KERJA METODE SIDIK JARI PADA TEKNIK PEMOSISIAN OBJEK DALAM RUANG BERBASIS WI-FI LEWAT PENERAPAN KLASTERISASI *HYBRID* DBSCAN-K MEANS DAN *IMPROVED* WKNN

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INTISARI

Dalam beberapa tahun terakhir, perkembangan teknik pemosisian dalam ruang menjadi topik penting dalam penelitian komunikasi jaringan nirkabel. Salah satu fokus penelitian tersebut diantaranya pengembangan metode pemosisian berbasis sidik jari (*fingerprint method*). Sejumlah peneliti telah mengusulkan optimasi kerangka kerja sidik jari lewat upaya pembentukan klaster pada pengolahan data mentah guna mengurangi kompleksitas komputasi serta meningkatkan akurasi pemosisian. Sejumlah kerangka tersebut meliputi kerangka berbasis klasterisasi K-means dan klasterisasi *Density Based Spatial Clustering of Applications with Noise* (DBSCAN). Klasterisasi K-means mampu secara valid memprediksi data baru lewat pencocokan jarak spasial berbasis *centroid*, namun buruk dalam menyeleksi *outlier*. Sementara klasterisasi DBSCAN baik dalam menangani *outlier* namun tidak cukup valid dalam memprediksi data baru. Hal ini dikarenakan kehadiran data baru dalam klaster DBSCAN mampu mengubah entitas definitif dari titik-titik tetangganya. Atas dasar itu diusulkan sebuah kerangka optimasi yang berfokus pada tiga bagian meliputi, optimasi tahap *offline*, optimasi model induk, dan optimasi tahap *online*. Optimasi tahap *offline* dilakukan lewat penerapan *hybrid* DBSCAN-K-means dalam proses pembentukan klaster, optimasi model induk dilakukan lewat pendekatan model berbasis jarak Manhattan, serta optimasi tahap *online* dilakukan lewat penerapan *Improved Weighted K Nearest Neighbors* (I-WKNN) sebagai strategi pencocokan data baru terkategori *outlier* pada fase prediktif. Kerangka optimasi kemudian dibandingkan dengan sejumlah kerangka *state-of-art* diantaranya, *K Nearest Neighbors* K-means (KNN-K-means), *K Nearest Neighbors* DBSCAN (KNN-DBSCAN), dan *K Nearest Neighbors Handling Fingerprint Sparsity For Complex Environment* (KNN-HFSCE). Hasil penelitian menunjukan kerangka optimasi usulan mampu menurunkan nilai rerata RMSE pemosisian masing-masing sebesar 17.97%, 14.03%, 9.36% pada uji diagonal kiri, serta 16.86%, 19.99%, 16.09% pada uji diagonal kanan untuk seluruh skenario lingkungan yang diujikan.

Kata kunci: Teknik Pemosisian Dalam Ruang, Kerangka Metode Sidik Jari, Penanganan *Outlier*, Klasterisasi DBSCAN, *Improved-WKNN*.

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FRAMEWORK OPTIMIZATION OF FINGERPRINT METHOD FOR WI-FI BASED INDOOR POSITIONING TECNHIQUE THROUGH IMPLEMENTATION OF DBSCAN-K MEANS HYBRID CLUSTERING AND IMPROVED WKNN

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ABSTRACT

In recent years, indoor positioning techniques have become an important research topic on wireless network communication. One of these focuses is the development of a fingerprint-based method. Many researchers have proposed an optimized fingerprint framework using clusters generation to process raw data to reduce computational complexity and improve positioning accuracy. Some of these frameworks include the K-means clustering-based framework and Density-Based Spatial Clustering of Applications with Noise (DBSCAN) clustering-based framework. K-means clustering has an excellent approximation to predict new data via centroid-based spatial distance matching; however, lacking at outliers data selection. In contrast, DBSCAN clustering is good at handling outliers data but fails to provide valid approximation at predicting new data. This failure is because new data in the DBSCAN cluster can change the definitive entity from its neighbor's points. The author proposes a new optimized fingerprint framework that mainly focuses on three parts of optimization, including offline, baseline model, and online optimizations. Furthermore, the differences between them are:

1. Optimization is carried out through the application of hybrid DBSCAN- K-means clustering in the cluster formation process.

2. Baseline model optimization is carried out through the Manhattan distance model-based approach.

3. Online optimization is carried out by applying Improved Weighted K Nearest Neighbors (I-WKNN) as a strategy for matching new data categorized outlier in the online prediction phase.

The optimized framework was later compared with some state-of-art frameworks, including K Nearest Neighbors K-means (KNN-K-means), K Nearest Neighbors DBSCAN (KNN-DBSCAN), and K Nearest Neighbors Handling Fingerprint Sparsity For Complex Environment (KNN-HFSCE). Hence, the results show that the proposed framework can persistently reduce average RMSE positioning error by 17.97%, 14.03%, 9.36%, respectively, on left diagonal testing, as well as 16.86%, 19.99%, 16.09%, respectively, on the right diagonal testing for the entire experimental test-bed scenarios.

Keywords: Indoor Positioning Technique, Fingerprint Method, Outlier Handling, DBSCAN Clustering, Improved WKNN.

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