ABSTRACT

With the advancement of intelligent vehicle technologies and future transportation systems, the need for reliable and real-time communication between vehicles and infrastructure has become increasingly critical. Vehicle-to-Everything (V2X) serves as a key approach to support such systems by enabling direct information exchange between vehicles (V2V), vehicles and infrastructure (V2I), vehicles and pedestrians (V2P), as well as vehicles and networks (V2N). V2X plays a significant role in ensuring connectivity across vehicles and infrastructure within intelligent transportation systems.

This study evaluates the performance of two clustering algorithms Fuzzy C-Means (FCM) and Density-Based Spatial Clustering of Applications with Noise (DBSCAN) combined with two resource allocation algorithms, namely the Greedy and Genetic algorithms, under two different scenarios. Each scenario considers the position of the Base Transceiver Station (BTS) and the method of user activity counting, either only for active users or for all users starting from the initial simulation time. The performance parameters analyzed include sumrate, average data rate, spectral efficiency, power efficiency, and fairness.

The simulation results indicate that the combination of DBSCAN and the Greedy algorithm delivers the highest performance across almost all parameters in every scenario, particularly in terms of sumrate and spectral efficiency. On the other hand, the combination of FCM and the Genetic algorithm demonstrates superior performance in fairness, indicating a more equitable distribution of resources among users. Furthermore, changing the BTS position from (750, 2250) to (5, 2995) shows a significant performance improvement, especially in scenarios that only consider active users.

The DBSCAN and Greedy algorithm combination achieved the highest values in 4 out of 5 performance metrics, with a sumrate of 66.12 Mbps, an average data rate of 0.501 Mbps, spectral efficiency of 5.044 bps/Hz, and power efficiency of 252.816 bps/mW in Scenario 2 under the active user only evaluation. Conversely, the best fairness value of 0.3996 was obtained by the FCM and Genetic algorithm combination in Scenario 1, also under the active user only scheme. These simulation results indicate that each algorithm combination has its own strengths across different performance parameters, with the DBSCAN Greedy pairing only lacking in fairness compared to others. Additionally, the comparison of the two user-counting schemes reveals that evaluating the system when all users are active yields the most optimal and consistent results across all tested metrics.

Keyword : BTS, DBSCAN, FCM, Genetika, Greedy, V2X.