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## Flag-Based Vehicular Clustering Scheme for Vehicular Ad-Hoc Networks

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### Abstract

Clustering schemes in vehicular networks organize vehicles into logical groups. They are vital for improving network performance, accessing the medium, and enabling efficient data dissemination. Most schemes rely on periodically broadcast hello messages to provide up-to-date information about the vehicles. However, the periodic exchange of messages overwhelms the system and reduces efficiency. This paper proposes the Flag-based Vehicular Clustering (FVC) scheme. The scheme leverages a combination of Fitness Score (FS), Link Expiration Time (LET), and clustering status flags to enable efficient cluster formation in a hybrid manner. The FVC relies on the periodic broadcast of the basic safety message in the Dedicated Short-Range Communications (DSRC) standard for exchanging the vehicle's status, FS, and joining request. Piggybacking extra information onto the existing



periodic beacon reduces the overhead of exchanging additional control messages, which is the main contribution of this work. The scheme is implemented in a hybrid manner by utilizing a Road Side Unit (RSU) to implement a clustering algorithm. This work considered the FastPAM algorithm, a fast version of the Partitioning Around Medoids (PAM) clustering algorithm, to generate a list of potential cluster heads. The FVC scheme uses the LET as the clustering metric with the FastPAM algorithm. Moreover, the Lightweight FastPAM Vehicular Clustering (LFPVC) algorithm is considered by selecting the initial cluster heads based on the FS instead of the greedy FastPAM's build stage. In the absence of the RSU, the vehicles utilize the FS with proper back-off time to self-elect the cluster head. The hybrid FVC scheme increased the cluster lifetime by 32% and reduced the control-message overhead by 63% compared to the related work. Moreover, the LFPVC algorithm achieved similar results to the FastPAM algorithm.

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## Keywords

Clustering scheme; VANET; FastPAM

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