DUCF: Distributed load balancing Unequal Clustering in wireless sensor networks using Fuzzy approach

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Abstract: Data gathering in Wireless Sensor Networks (WSN) consumes more energy due to large amount of data transmitted. In Direct Transmission (DT) method, each node has to transmit its generated data to the Base Station (BS) which leads to higher energy consumption and affects the lifetime of the network. Clustering is one of the efficient ways of data gathering in WSN. There are various kinds of clustering techniques, which reduces the overall energy consumption in sensor networks. Cluster Head (CH) plays a vital role in data gathering in clustered WSN. Energy consumption in CH node is comparatively higher than other non CH nodes because of its activities like data aggregation and transmission to BS node. The present day clustering algorithms in WSN use multi-hopping mechanism which cost, higher energy for the CH nodes near to BS since it routes the data from other CHs to BS. Some CH nodes may die earlier than its intended lifetime due to its overloaded work which affects the performance of the WSN. This paper contributes a new clustering algorithm, **D**istributed **U**nequal **C**lustering using **F**uzzy logic (DUCF) which elects CHs using Fuzzy approach. DUCF forms unequal clusters to balance the energy consumption among the CHs. Fuzzy Inference System (FIS) in DUCF uses the Residual energy, Node degree and Distance to BS as input variables for CH election. Chance and Size are the output fuzzy parameters in DUCF. DUCF assigns the maximum limit (Size) of a number of member nodes for a CH by considering its input fuzzy parameters. The smaller cluster size is assigned for CHs which are nearer to BS since it acts as a router for other distant CHs. DUCF ensures load balancing among the clusters by varying the cluster size of its CH nodes. DUCF uses Mamdani method for fuzzy inference and Centroid method for defuzzification. DUCF performance was compared with well known algorithms such as LEACH, CHEF and EAUCF in various network scenarios. The experimental results indicated that DUCF forms unequal clusters which ensure load balancing among clusters, which again improves the network lifetime compared with its counterparts.

Key words: Clustering **-** Energy Efficient **-** Fuzzy Logic – Distributed approach – Sensor networks-Load balancing.

1. INTRODUCTION

In the real time world, Wireless Sensor Networks (WSN) plays a vital role in environmental monitoring, traffic monitoring, disaster prevention, and National border surveillance [1]. The main activities carried over in a sensor node are sensing the required physical phenomena, computation (information processing) and communication with other nodes. Each sensor node will be having a non replaceable battery because of external hostile environmental conditions. Compared with sensing and computation, communication activities found to be consuming thousand times more energy [2] in individual sensor nodes. If the battery power of one node gets drained, the node became useless and literally called as dead node.

A wireless sensor node carries out its function in the following steps [3],