

Energy Saving using Token Bucket in Sensing Network

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ABSTRACT: Wireless network in this modern era is more popular because of its efficiency, availability and convenience. As a consequence, congestion increases day by day. In this paper, we have proposed a method for lesser energy consumption and to set equilibrium in traffic with the help of BEEM and Token bucket procedure due their major advantages in wireless environment. So the main objective is to maintain load with BEEM and to control congestion such as average rate, maintain burst size with the help of token bucket algorithm, where wireless environment is of heterogeneous and cluster type. All simulation results are obtained by using MATLAB software.

KEYWORDS: Wireless, Sensor, BEEM, Protocol, Token, Energy, HEED.

I.INTRODUCTION

A Wireless Sensor network is a set of sensors, deployed in a sensor field to monitor specific characterization of the environment to measure those characteristic and collect the data related to the phenomena in which sensors are small devices with limited resources such as limited battery power, low memory, little computing capability, very low data rates, low bandwidth processing, variable link quality[1]. There is a balanced energy efficient multihop protocol which is mainly used in sensing networks. There are two perspectives that is longevity and balanced sensor distribution which leads from HEED and LEACH . It can guarantee the network coverage for a longer time, compared with HEED and LEACH. In BEEM nodes can communicate symmetrically. All the nodes are deployed randomly and placed at fixed location[2]. VivekKatiyar et al.[4] proposed and analyzed a new energy efficient clustering protocol (FZ-LEACH) that eliminates the above problem by forming Far-Zone. The simulation results and analysis shown that proposed FZ-LEACH algorithm outperforms LEACH in terms of energy consumption and network lifetime. Reetika Munjal, et al [5]studied the problems with LEACH protocol and presented an improved ideas to select the cluster head node. The main problem with the LEACH lies in the random selection of cluster heads. Shuo Shi et al. [6] used the simulated annealing algorithm to find the optimal solution with better position to reduce the energy loss of cluster heads. Thu Ngo Quynh [7] proposed a new hierarchical routing protocol (called EL-LEACH: Energy and Load balance LEACH) which achieved energy efficiency and load balance. Their simulation result shown that their new scheme EL-LEACH achieves better energy consumption, load balance and network life time than other well known LEACH protocols. Heinzelman, W. et . al.[10] presented the algorithms for adapting clusters and rotating cluster head positions to evenly distribute the energy load among all the nodes, and techniques to enable distributed signal processing to save communication resources. Babaie, S. [11] proposed algorithm adjusts the threshold of each node gradually according to the number of live and dead nodes in each round, so more nodes could have the opportunity to be CHs. Simulation results demonstrated that the proposed algorithm was having higher efficiency and can achieve better network lifetime and energy consumption. Guisheng Yin et. al.[12] proposed a method ased on the hierarchical network architecture, the process of forwarding packets between the source nodes in the target region and the base station. Sun J. et al.[13] had taken nodes' residual energy into consideration during the process of

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cluster heads being elected. The constraint threshold of distance was used to optimize cluster scheme. Furthermore, it was also constructed the routing tree based on cluster heads' weight.

II.TOKEN BUCKET ALGORITHM

M.M. Islam [8] presented an extended Stable Election Protocol (SEP) algorithm for cluster head selection in a hierarchically clustered heterogeneous network to reorganize the network topology and energy efficiently. This was not able to work with BEEM protocol. So token bucket is integrated with BEEM [3] that allows the output rate to vary, depending on the size of the burst. Lu, Y., Zhang et. al[9] proposed a method to change the node's threshold function to prolong the network's lifetime and realize the balance of energy in network. The simulation results indicate that the new protocol can prolong network's life time and balance energy consumption of nodes. But this method is quite similar with leaky bucket method but this technique focus on coming packets size and having queue to hold token until next second. Token is a unit or fixed number of bytes or single packet of fixed Size. We assume a token = a unit byte. The figure 1 represent procedure and need of this method step by step.

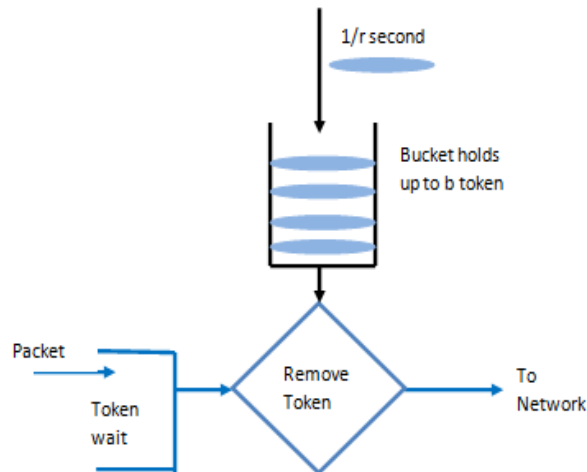


Figure 1: Token Bucket Algorithm

The token bucket algorithm can be conceptually understood as follows:

- A token is added to the bucket every $1/r$ second.
- The bucket can hold at the most b tokens. If a token arrives when the bucket is full, it is discarded.
- When a packet (network layer PDU) of n bytes arrives, n tokens are removed from the bucket, and the packet is sent to the network.
- If fewer than n tokens are available, no tokens are removed from the bucket, and the packet is considered to be non-conformant.

In this article we will study proposed method in 3rd section and then there are simulation results to prove our best outcome in 4th section. During 5th section, we have compared our results with BEEM without Token method. Hence, Conclusion and future trend are presented at the last section.

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III. PROPOSED METHOD

We have proposed a method for lesser energy consumption and to set equilibrium in traffic with the help of BEEM and Token bucket procedure due their major advantages in wireless environment.

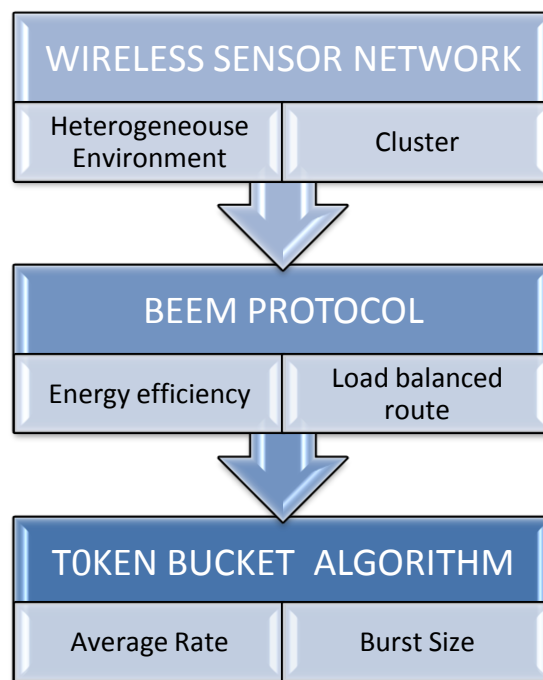


Figure 2: Proposed Method

- Wireless sensor network is of two types: Homogenous and heterogeneous. In our proposed method heterogeneous type is used where all nodes work independently in a cluster.
- Energy efficiency and to balance load are two main goals which are controlled by using BEEM.
- Token bucket is used to average rate and burst size in case of heavy traffic

IV. SIMULATION RESULTS AND DISCUSSION

In this article we have observed that BEEM protocol in wireless network stands with dynamite performance. Where BEEM is responsible for load balance and token bucket helps to control congestion in path.

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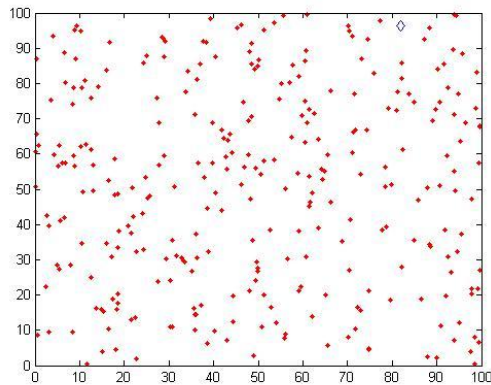


Figure 3: Dead nodes

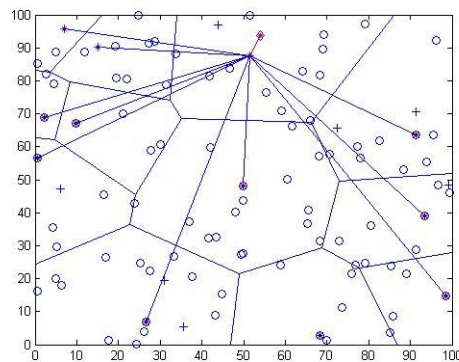


Figure 4 : Current scenario

This figure 3 and 4 are showing all dead nodes and 100*100 sensor area is taken into consideration. Where red small diamonds are representing dead nodes, big diamond shows mobile sink, circle is for nodes which are with token, plus sign represents advance nodes, blue and purple circle shows cluster head , star is to represent root cluster head which has global token.

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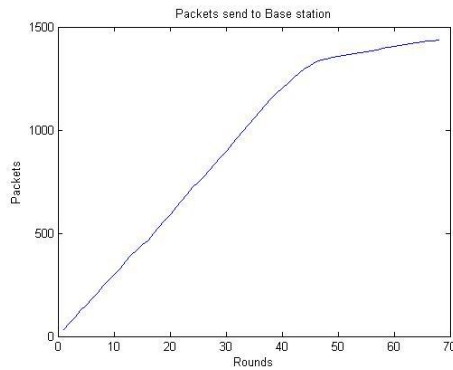


Figure 5 : Packets send to base station

In this figure 5, maximum 1400 packets are sent to base station during 67 rounds. It means that at every round 10 packets are increasing.

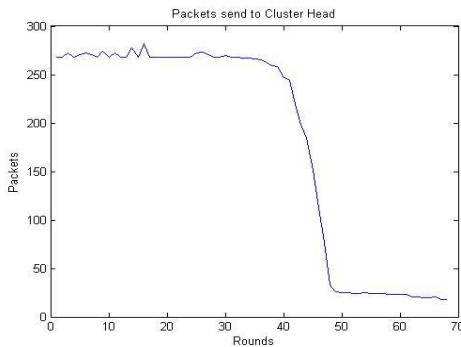


Figure 6: Packets send to cluster head

This figure 6 shows that 260 packets are sent to cluster head till 68 rounds where in 40 rounds, packets are full and after that they are deploying at high speed.

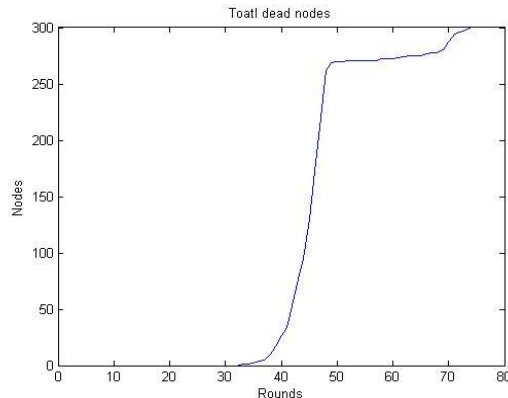


Figure 7 : Total Dead nodes

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In figure 7, First dead note is happened in 32 rounds and last dead note is at 74 rounds.

V. COMPARATIVE ANALYSIS

From previous work , it is evident that BEEM cannot work efficiently without Token as shown in figure 8. Furthermore when it is integrated with token method, its performance increased. In figure 9, we can see that in more load and congestion, this method create balance in network.

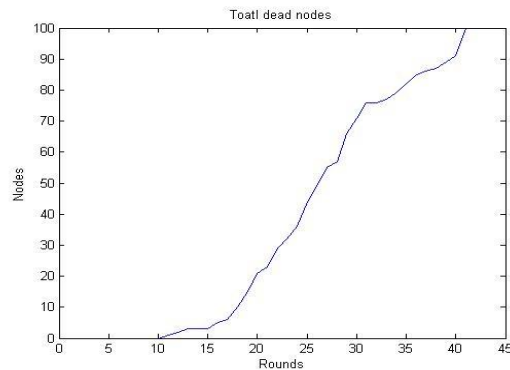


Figure 8 : BEEM without Token Bucket Algorithm

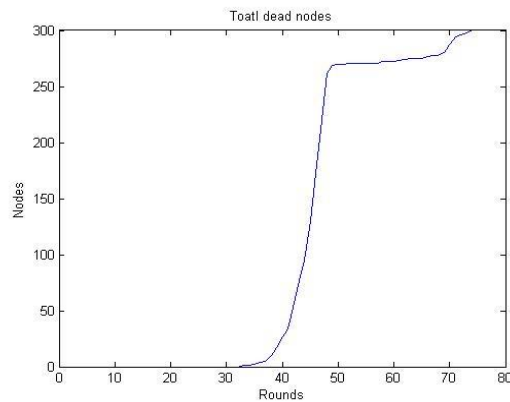


Figure 9 : BEEM with Token Bucket Algorithm

VI.CONCLUSION AND FUTURE TREND

It can be concluded at the end that our proposed method in wireless network performs very well. It is evident from simulation results and comparison, our work proven to be best than working without token in terms of energy consumption, congestion control and load balance. When it is integrated with token method, its performance increased. Packets sent to either base station or cluster head, increased in every round. Thus in future, more parametric analysis can be added to show better domino effect of this practice.

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