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Power-Efficient Gathering in Sensor Information Systems Protocol to Improve Lifetime of WSN

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ABSTRACT: In this paper, a novel method of combining PEGASIS, clustering and genetic algorithm to minimize transmission distance was proposed. A variable weight CH selection based on distance and energy for better load balancing was adopted. A new version of PEGASIS is adapted for 3D networks and variants of it were also proposed. Simulations in MATLAB have shown the superiority and adequacy of our proposed protocols in terms of FND. This is illustrated by PEG-GA Vertical Clustering having improvements in FND over PEGASIS for base station inside and outside the network respectively. These very high percentages of improvement result from the very poor performance in 3D networks of the greedy algorithm used by PEGASIS and these percentages show the need for our proposed protocols. Residual energy, load balancing and delay performance were also shown to be superior. Wireless Sensor Networks have been subject to much research in the last two decades. WSNs are often deployed in remote environments making replacement of batteries not feasible. Low energy consumption being of prime requisite led to the development of energy-efficient routing protocols.

KEYWORDS: PEGASIS, LEACH, Wireless Sensor Networks (WSN), Genetic Algorithms (GA), FND.

I. INTRODUCTION

Wireless Sensor Network contains hundreds of thousands of low-cost sensor nodes. A sensor node has constraints like storage, energy, limited processing and transmitting capability [1]. Routing technique plays a vital role in the wireless sensor network. It is extremely difficult to assign the global ids for a large umber of deployed sensor nodes. Thus, traditional protocols may not be applicable for WSN. Unlike conventional wireless communication networks (MANET, cellular network, etc.), WSN has inherent characteristics. It is highly dynamic network and specific to the application, and additionally it has limited energy, storage, and processing capability. These characteristics make it a very challenging task to develop a routing protocol [2–3]. In most of the scenarios, multiple sources are required to send their data to a particular base station. The nodes near to the sink depleted more energy and hence eventually die. This causes partitioning of the network; consequently, the lifetime of the network gets to reduce. The main constraint of the sensor node is energy [1, 4]. The sensors are battery-powered computing devices. It’s hard to replace the batteries in many applications. Therefore, WSN requires an energy-efficient routing protocol. Due to dense deployment, the sensor nodes generate the redundant data, and the base station may receive multiple copies of the same data. Therefore, it unnecessarily consumes the energy of the sensor nodes. WSN does not have any fixed infrastructure and is highly dynamic [6].

II. SYSTEM MODEL & ALGORITHM

The GA is an iterative process. To find new solutions which may yield a better solution, GA operators are applied on chromosomes at each iteration. The simplest GA operators are [2]:

I. Selection this involves favoring the selection of solutions having better fitness.
II. Crossover this is similar to the reproduction process which takes place in evolution. It involves taking more than one solution and combining them to produce a new solution.
III. Mutation this entails modifying a portion of the solution and it helps to ensure diversity in a population [1]. It consist of the following:

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i) Swap operation two nodes are selected at random in the solution and their positions are swapped. For instance, considering positions 2 and 5
a → b → c → d → e → f becomes a → e → c → d → b → f
and widely used in WSN literature [1]. Hence, comparisons to previous protocols are made easier and fairer. Transmitter and receiver circuits need energy to be run. The latter is a function of the number of bits (k) only [1]. ETx=Rx−elec ¼ Eelec3 k (1) where Eelec is the energy expended per bit to run the transmitter or receiver. The transmission energy used by the amplifiers is a function of both

ii) Flip operation Part of the solution is flipped randomly as illustrated below:
a → b → c → d → e → f becomes a → e → d → c → b → f
after flipping at positions 2 and 5

iii) Slide operation Part of the solution is selected randomly and it is 'slid' across to modify the solution. For illustration, the part of the solution from position 2 to 5 is considered.
a → b → c → d → e → f becomes a → c → d → e → b → f

An open source code was used to implement the GA for chain building Kirk [2]. It makes use of selection and mutation. The steps in the GA algorithm are outlined below.

III. FLOW CHART

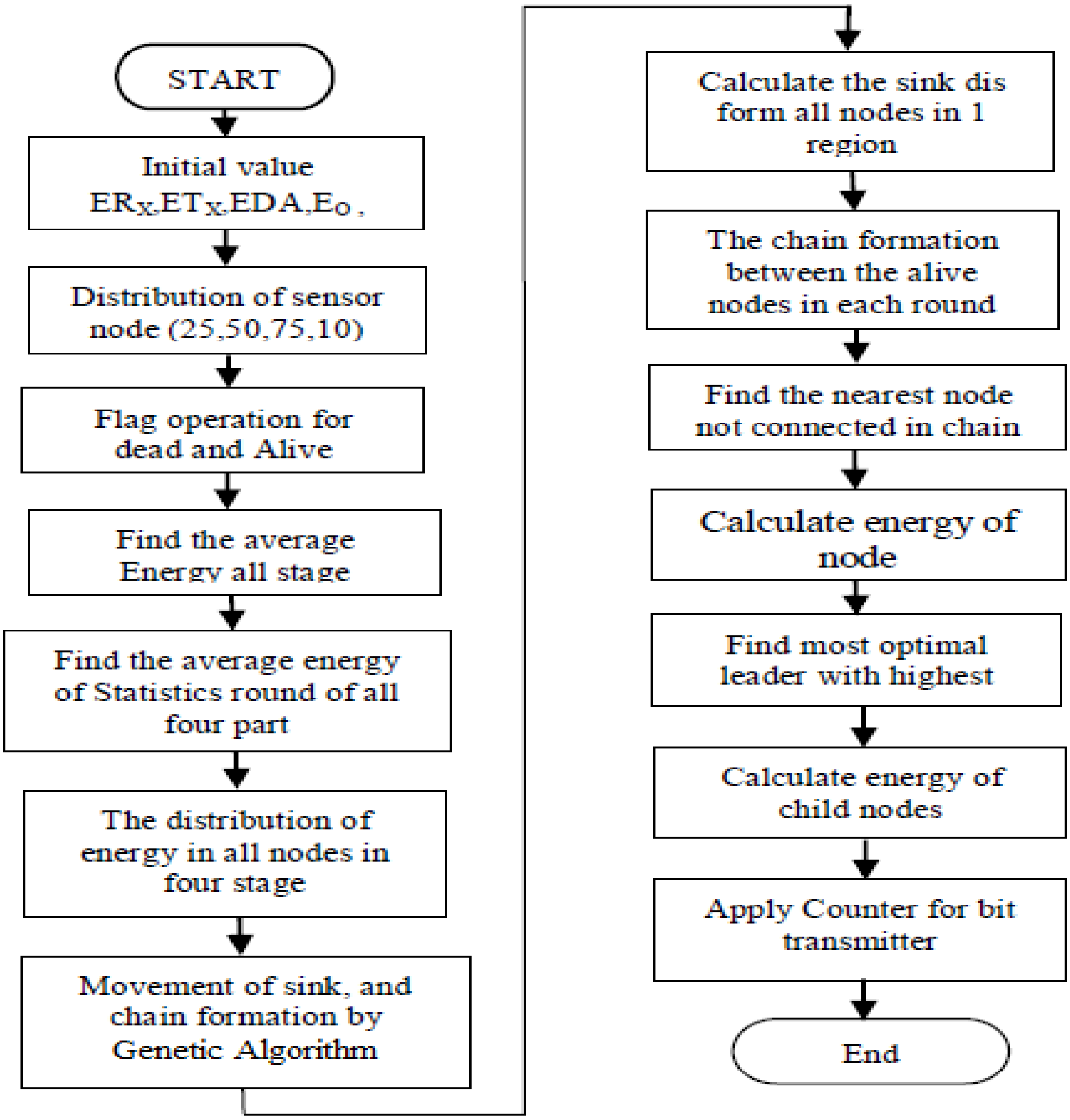

Fig. 1: Flow diagram of proposed energy efficient Pegasus Scheme

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IV. SIMULATION RESULT

In order to evaluate the performance of our proposed EPEGASIS algorithm, we use Matlab simulator to conduct the experiment. Matlab 2014a has been used for the simulation of PEGASIS code.

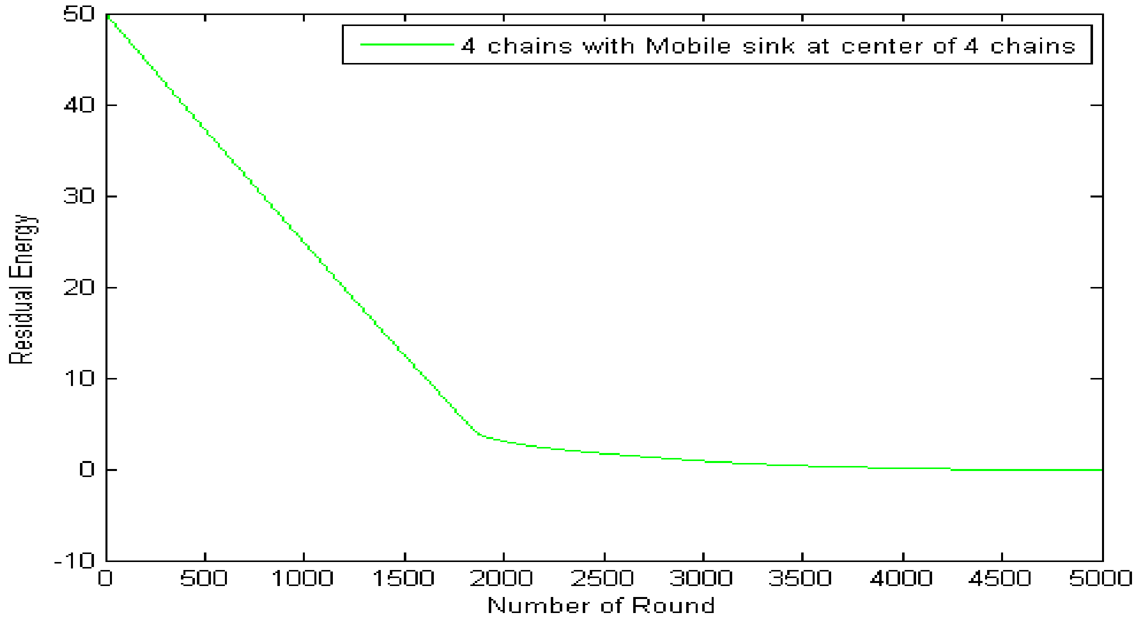

Fig. 2: Residual energy Vs Number of rounds

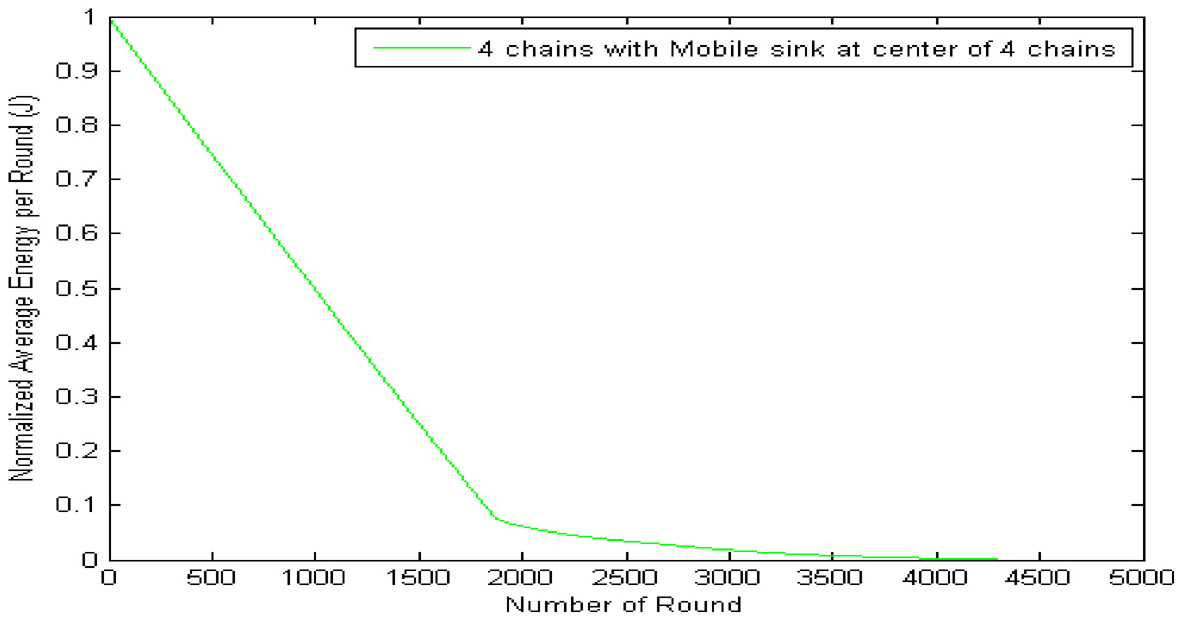

Fig. 3: Normalized Average energy per round graph

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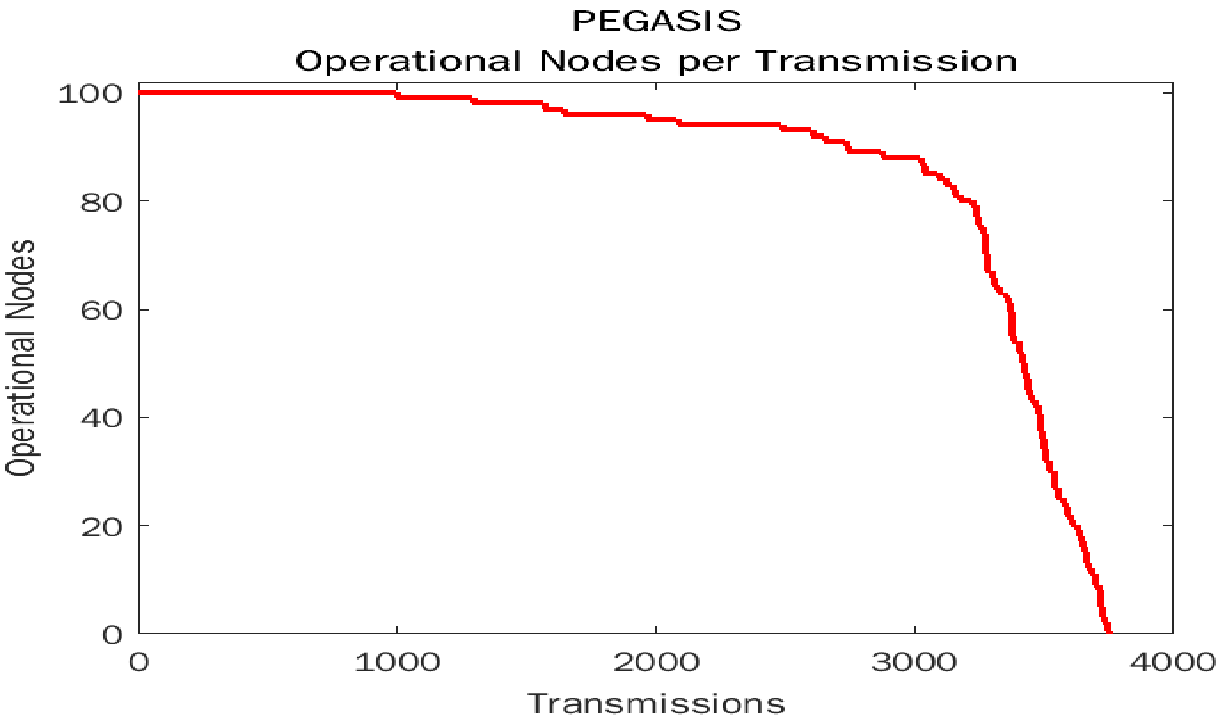

Fig. 4: Operational nodes per transmission v/s number of transmission for PEGASIS protocol

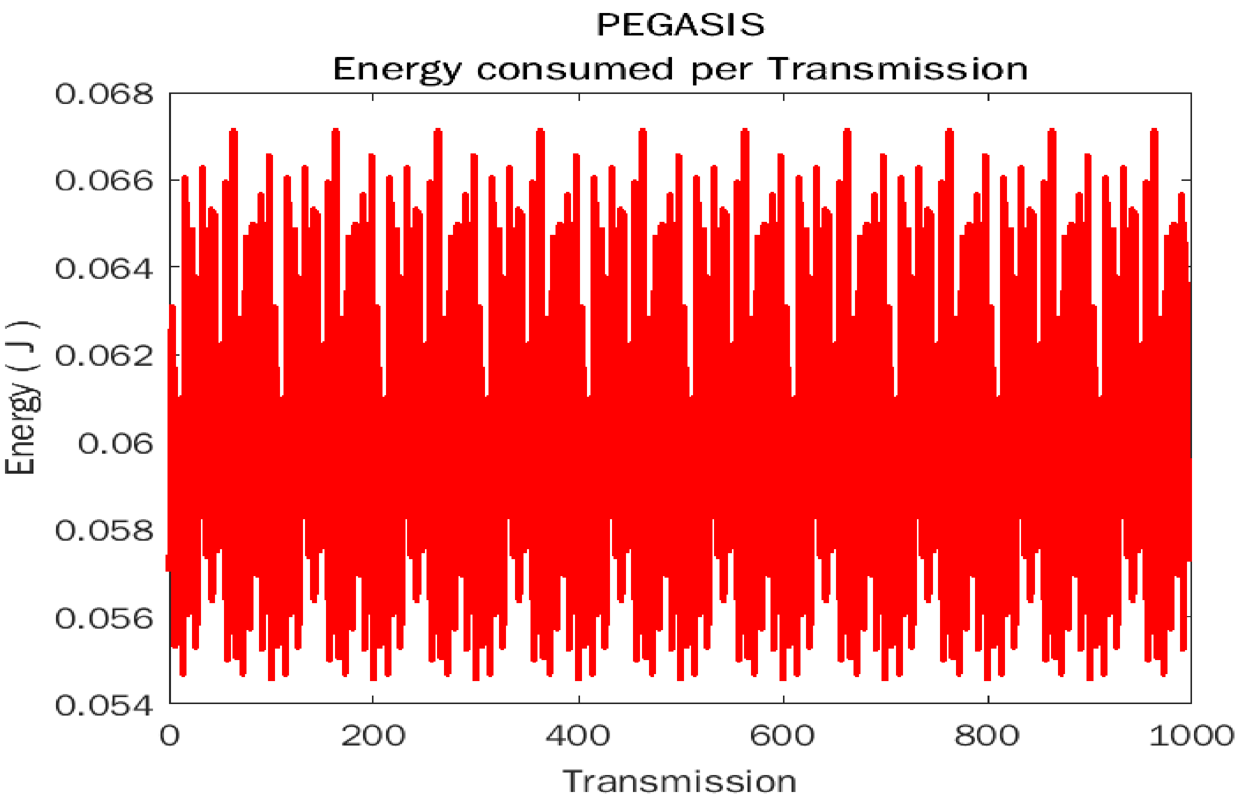

Fig. 5: Energy consumed per transmission v/s Number of transmissions.

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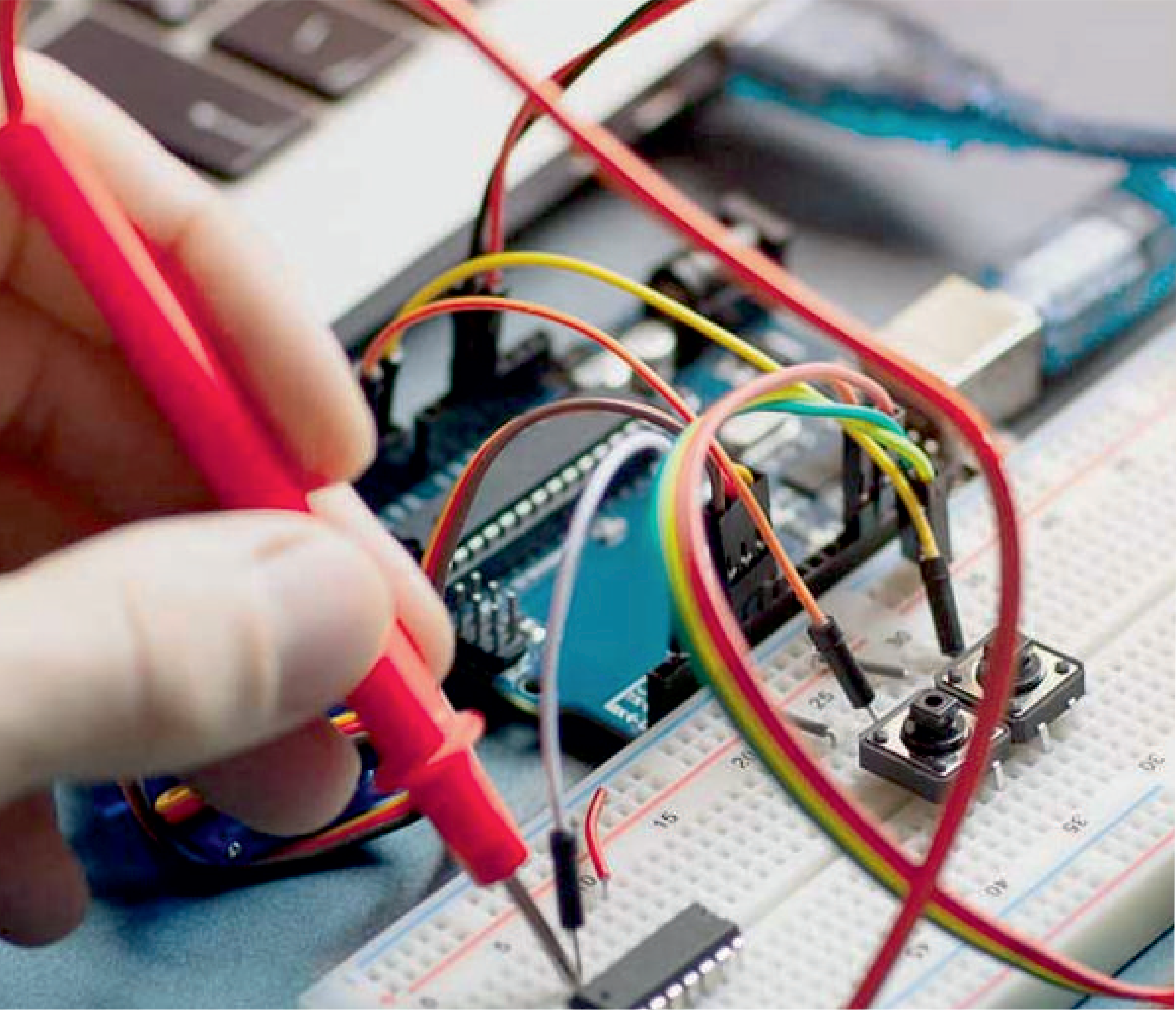
V. CONCLUSION

We have discussed the design tradeoff between energy conserving and quality of service support, results when protocols are tested on the assumption factors like latency, scalability, energy awareness, synchronization, etc. necessary for a wireless sensor network. Contention-based protocols like SMAC, TMAC and TEEM, they use a single radio and change the radio state periodically in order to make the nodes energy efficient. STEM is also a contention-based protocol, but uses two radios (data and wake-up radio) to make the nodes energy efficient. It allows the nodes to wake up the data radio when there is a need to process data; otherwise it stays in sleep state. In contention based protocols transmission suffers from collision and delay because each node is allowed to access the shared medium. Contention-free protocols like DEMAC, PACT and LMAC, they provide collision free communication. Each node has pre-assigned time slots to transmit the data but each node has to listen to the time slots of its neighbors in order to synchronize. This may increase the energy consumption. Contention-free protocols suffer with clock drift problems and require tight synchronization.

REFERENCES

[1] T. Li, F. Ruan, Z. Fan, J. Wang, J.-U. Kim, An improved PEGASIS routing protocol based on neural network and ant colony algorithm, Int. J. Future Gener. Commun. Networking 8 (2015) 149–160.
[2] M. Al Ameen, S.R. Islam, K. Kwak, Energy saving mechanisms for mac-protocols in wireless sensor networks, Int. J. Distrib. Sens. Netw. 6 (2010) 163413.
[3] M. Al Ameen, S.R. Islam, K. Kwak, Energy saving mechanisms for mac-protocols in wireless sensor networks, Int. J. Distrib. Sens. Netw. 6 (2010) 163413.
[4] X. Liu, J. Shi, I. Engineering, Clustering routing algorithms in wireless sensor networks: an overview, KSII Trans. Internet Inf. Syst. 6 (2012) 1735–1755.
[5] W. Guo, W. Zhang, G. Lu, PEGASIS protocol in wireless sensor network based on an improved ant colony algorithm, 2nd International Workshop on Education Technology and Computer Science ETCS 2010 (3) (2010) 64–67.
[6] S. Lindsey, C.S. Raghavendra, PEGASIS: power-efficient gathering in sensor information systems, IEEE Aerospace Conference Proceedings 3 (2002) 1125–1130.



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