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Hybrid Atypical Hierarchical Routing Protocol for Wireless Sensor Network

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Abstract: Recent advances in wireless sensor networks have led to many new protocols specifically designed for sensor networks where energy awareness is an essential consideration. Most of the attention, however, has been given to the routing protocols since they might differ depending on the application and network architecture. Since the radio transmission and reception consumes a lot of energy, one of the important issues in wireless sensor network is the inherent limited battery power within network sensor nodes. Therefore, battery power is crucial parameter in the algorithm design to increase lifespan of nodes in the network. In addition to maximizing the lifespan of sensor nodes, it is preferable to distribute the energy dissipated throughout the wireless sensor network in order to maximize overall network performance.

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I. INTRODUCTION:

A wireless sensor network is a group of specialized transducers with a communications infrastructure for monitoring and recording conditions at diverse locations. Commonly monitored parameters are temperature, humidity, pressure, wind direction and speed, illumination intensity, vibration intensity, sound intensity, power-line voltage, chemical concentrations, pollutant levels and vital body functions. A sensor network consists of multiple detection stations called sensor nodes, each of which is small, lightweight and portable. Every sensor node is equipped with a transducer, microcomputer, transceiver and power source. The transducer generates electrical signals based on sensed physical effects and phenomena. The microcomputer processes and stores the sensor output. Simulation studies compare sheer and a secure version of leach using hikes [1].The transceiver receives commands from a central computer and transmits data to that computer. The power for each sensor node is derived from a battery.

The WSN is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "motes" of genuine microscopic dimensions have yet to be created. The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth. The topology of the WSNs can vary from a simple star network to an advanced multi-hop wireless mesh network. Considering sink node, the object cluster head routing protocol is proposed, it ensure that only the object cluster head send overall data to sink node, which can balance energy depletion among the cluster heads in wsn [2].The propagation technique between the hops of the network can be routing or flooding.

Tree Based Hierarchical: At early times, specialized hierarchical routing protocols and presented a comparison survey between different clustering protocols for WSNs. Abbasi and Younis presented an influential survey on clustering algorithms for WSNs. This survey proposed a detailed taxonomy and classification of typical clustering schemes. Several aspects and characteristics of typical clustering algorithms in WSNs are discussed in regarding clustering timings, attributes, metrics, advantages and disadvantages. By considering energy efficiency presented a review on clustering algorithms for WSNs from the perspective of data routing. Some important clustering algorithms were reviewed in in which a few metrics, such as residual energy, and uniformity of CH distribution was analyzed. Their proposed approach significantly improves the life time and quality of data being delivered at the base station in sensor network [3].In the famous clustering algorithm LEACH and its descendant were discussed regarding the advantages and disadvantages. In the advantages and objectives of clustering for WSNs were outlined, and a comprehensive taxonomy of clustering methods for WSNs were presented. In particular, some prominent clustering routing protocols for WSNs were described and analyzed according to the protocol implementation stages. The successful application of fuzzy logic in WSNs is illustrated in which clustering protocols

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based on fuzzy logic are simply surveyed regarding CH election. A concise survey on neural network based clustering approaches is presented. Taxonomy of clustering algorithms and a categorizing framework are proposed which covers major factors in the selection of a suitable algorithm for big data. A comprehensive survey on clustering approaches is provided based on equality of cluster size, which provides a classification of clustering algorithms of WSNs.

Hardware Plateform:

Embedded Processor:- In a sensor node, the functionality of an embedded processor is to schedule tasks, process data and control the functionality of other hardware components. Moreover, the proposed routing protocol does not need any centralized support from a certain node which is at odds with aiming to establish a scalable routing protocol [4]. The types of embedded processors that can be used in a sensor node include Microcontroller, Digital Signal Processor (DSP), Field Programmable Gate Array (FPGA) and Application-Specific Integrated Circuit (ASIC).

Transceiver:-A transceiver is responsible for the wireless communication of a sensor node. The various choices of wireless transmission media include Radio Frequency (RF), Laser and Infrared.

Memory:-Memories in a sensor node include in-chip flash memory and RAM of a microcontroller and external flash memory.

Power Source:- In a sensor node, power is consumed by sensing, communication and data processing. More energy is required for data communication than for sensing and data processing. Power can be stored in batteries or capacitors. Batteries are the main source of power supply for sensor nodes.

Sensors:-A sensor is a hardware device that produces a measurable response signal to a change in a physical condition such as temperature, pressure and humidity. The continual analog signal sensed by the sensors is digitized by an analog-to-digital converter and sent to the embedded processor for further processing.

II. PROBLEM FORMULATION:

Hierarchical routing in wireless sensor networks (WSNs) is a very important topic that has been attracting the research community in the last decade. Typical hierarchical routing is called clustering routing, in which the network is divided into multiple clusters. Recently, some types of atypical hierarchical routing arise, including chain-based, tree-based, grid-based routing, and area-based routing. There are several survey papers that present and compare the hierarchical routing protocols from various perspectives, but a survey on atypical hierarchical routing is still missing.

This paper makes a first attempt to provide a comprehensive review on atypical hierarchical routing. We offer a classification of atypical hierarchical routing of WSNs, and give detailed analysis of different logical topologies. The most representative atypical hierarchical routing protocols are described, discussed, and qualitatively compared. In particular, the advantages and disadvantages of different atypical hierarchical routing protocols are analyzed with respect to their significant performances and application scenarios. A hybrid Chain based hierarchical technique is needed.

III. OBJECTIVE:

1. Study of Tree based hierarchical techniques.
2. Implementing Chain based Hierarchical techniques in MATLAB.
3. Improvement of Chain based Hierarchical technique by making a hybrid technique out of it. Comparison of Hybrid technique with the existing Hybrid techniques on the bases of Latency and network lifetime.

I. MATLAB™ FUNCTION DEFINITION:

A MATLAB™ function is a MATLAB™ program that performs a procedural operation and can be used as a general purpose file for operating on an input argument. Although a function accepts zero or more arguments which mean that a function does not necessarily need any arguments and can perform an operation on hard-coded data too. A function can return zero or more variables and can also generate plots, play sound, display images or videos etc.

The syntax to create a MATLAB™ function is:

$$function[output_{paramters}] = function_{name}(input_{¿})$$

Or

$$functionfunction_{name}(input_{¿})$$

Or simply

function function_name()

A function can be ended by using end statement at the end, but it is not necessarily required. Note that $output_{parameters}$ and $input_{¿}$ are optional for a MATLAB™ function but are used most often. Also note that $function_{name}$ is a string that is used to call a function. It can be anything. Also note that in MATLAB™, a function is stored in a file with same name to be

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used by other programs as a general purpose function. For example, if they have a function named **cat** the file's name where this function is stored must be *called* $cat.m$. If a file contains more than one function, the entry point function is the one with having same name as file itself.

II. INPUT AND OUTPUT PARAMETERS

$input$ ¿ And $output$ are comma separated lists of MATLAB™ variables. There is a standard in MATLAB™ programming that input variables be assumed as constant and must not be changed by any statement inside the function itself. Although, expert programmers always violate this rule since it is easier to use same variable name in the entirecode while normalizing the input variable by the function's statement itself. Although, novice should stick with the rule as it is considered good practice to assume input variable as constant and must not be changed by program itself.

Input and output variables can be scalars, vectors, matrices, string or cell or logical. Although as mentioned earlier, MATLAB™ is a loosely typed language and does not necessarily distinguish between variable types until it is required in an instruction that can be either arithmetic or logical. This is where normalization of input really helps. Once can put a vector as a parameter and the function can check if the input is vector and then can convert it to scalar and recursively operate on each piece or vice-versa.

Let's take an example. Consider the following statement:

$$y = \sin(x)$$

The statement above is simply a call to MATLAB™'s built in sine function. Now assume, if 'x' is a scalar, output 'y' will be scalar, if 'x' is row-vector, 'y' will be a row vector. If 'x' is a column vector, 'y' will be column vector etc. This feature is potentially very powerful. For example, if one needs to compute Fast Fourier Transform of a row vector, he/she definitely wants the resulting output as a row vector. Similarly, if someone wants to calculate 2D-FFT, he/she will pass a matrix (2D variable) to the input of the function and expects resultant as a 2D complex matrix with abs part as the magnitude and Imaginary part as a phase. This feature of MATLAB™ sometimes gets very confusing fornew users.

III. PLOTTING:

MATLAB™ provides many advanced plotting features for graphical representation of data. It is a major key strength of MATLAB™. The great ease and flexibility it offers make MATLAB™ superior to any other tool/software available today.

MATLAB™ provides both 2D and 3D visualization tools. One can even plot one- dimensional data on a 2D Cartesian plane. One can visualize a surface with 3D surf feature. MATLAB™ even provides nifty animation feature for advanced visualization.

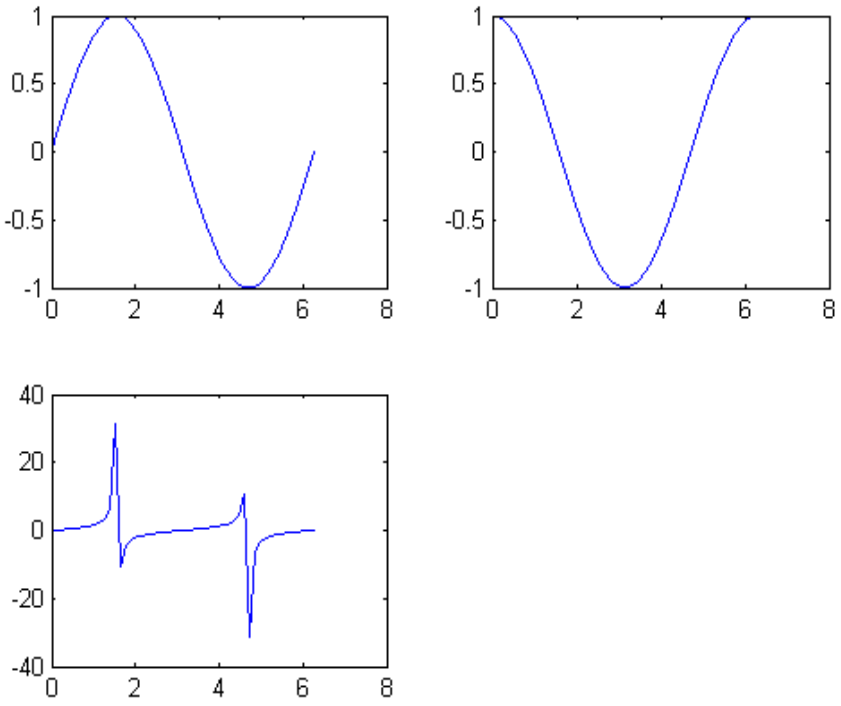

Fig. 3.4: Shows example of 2D plotting

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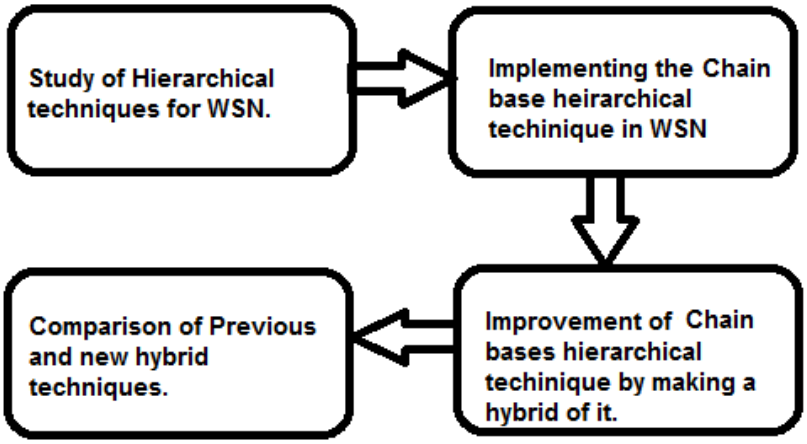
Let's see a simple example of 2D plotting function: $plot(x, y)$

This command above is MATLAB™'s 2D plotting command. It requires two parameters 'x' and 'y' in the same order. The parameters 'x' and 'y' must have same length and orientation i.e. if 'x' is a row vector, 'y' must be row vector or if 'x' is a column vector, 'y' must be column vector or vice-versa. Also, 'x' and 'y' can be scalars too. If 'x' and 'y' are matrices of order $m \times n$ then **plot** function assumes each row as one plot and plots multiple plots on same Cartesian plane.

One can also use **hold for the** statement to hold the plot and plot multiple plots on the same figure. To overwrite the current plot, use **hold off**. By default, the hold is off i.e. the plot will be overridden by next plot statement until **hold on** is used or plot is plotted in next figure.

PROPOSED METHOLOGY:



IV. RESULT

We proposed to develop and analyze the Hybrid Chain based Hierarchical Technique. The proposed technique is the combination of Chain based and Tree based routing protocol and it will remove the disadvantages of both routing schemes. The MATLAB R2013B tool is used to develop and analyze the whole proposed work as discussed in our objectives. For proper understanding the screenshots of proposed work are displayed. In a network 200 nodes are deployed randomly in area of 400x400, then selection of sink is done and four rounds of communication are performed and on the basis of these four rounds standard procedure is being followed and result for hundred rounds of communication is being generated

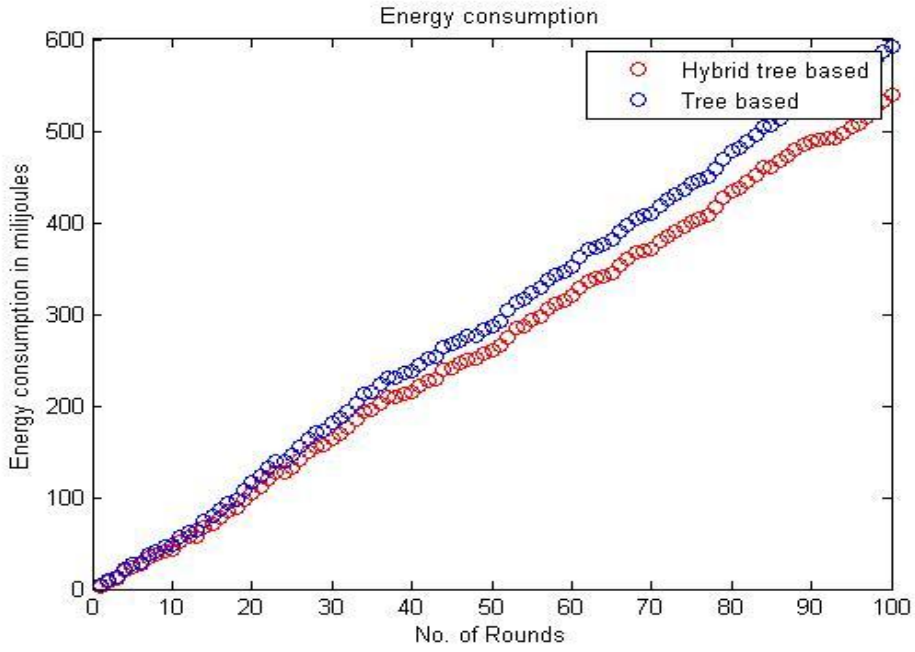


Fig. 4.9: Graph of Energy Consumption for 100 rounds of communication
(Comparison of Energy Consumption for Previous and Proposed Work

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No. of Rounds	Energy consumption	
	Proposed	Previous
10	42.54	47.4
20	105.2	116
30	164.86	181.6
40	215.52	238.2
50	260	287
60	319.64	352.4
70	371.18	408.8
80	433.84	477.4
90	488.5	538
100	538.94	592.4

Proposed Work - Hybrid Chain based Hierarchical Technique
Previous Work - Chain based Hierarchical Technique

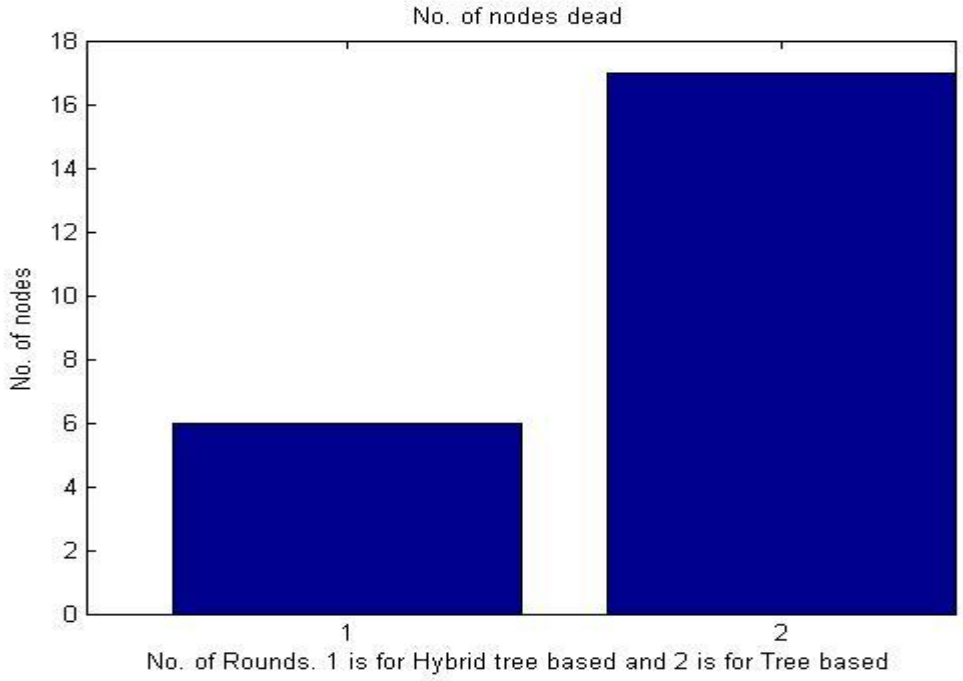

Fig. 4.10: Graph for no. of nodes Dead
(Comparison of No. of Dead Nodes for Previous and Proposed Work)

No. of Dead Nodes for Previous and Proposed Work	
Proposed	**Previous**
6	17

V. CONCLUSION:

We proposed to develop and analyze the Hybrid Chain based Hierarchical Technique, in which the combination of Chain based and Tree based routing protocol is used and it will remove the disadvantages of both routing schemes. The Chain based routing protocol have limitation that it has limited number of links capacity whereas in Tree based routing protocol the no. of links capacity is maximum due to which it has more energy consumption requirements. The proposed work is developed and analyzed by using tool called MATLAB R2013B as discussed in our objectives. The work proposed is to deploy 200 nodes randomly in area of 400x400, then selection of sink is done and four rounds of communication

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are performed and on the basis of these four rounds standard procedure is being followed and result for hundred rounds of communication is being generated.

The proposed work has minimal number of links capacity in which it is defined that how many no. of times a specific node can be used for communication, this is termed as availability. In proposed work the availability of node set to 2 times. By analyzing the results and comparison of previous work i.e. Chain based Hierarchical Technique and proposed work i.e. Hybrid Chain based Hierarchical Technique we conclude that the proposed work is better than previous work and our objectives are achieved successfully.

References

[1]. Ibriq, Jamil, And Imad Mahgoub. "A Secure Hierarchical Routing Protocol For Wireless Sensor Networks." Communication Systems, 2006. Iccs 2006. 10th Ieee Singapore International Conference On. Ieee, 2006.

[2]. Huang, Wen-Wen, Et Al. "Energy-Efficient Hierarchical Routing Protocol For Wireless Sensor Networks." Computational Intelligence And Industrial Application, 2008. Paciia'08. Pacific-Asia Workshop On. Vol. 1. Ieee, 2008.

[3]. Jan, Mian Ahmad, Et Al. "Enhancing Lifetime And Quality Of Data In Cluster-Based Hierarchical Routing Protocol For Wireless Sensor Network." High Performance Computing And Communications & 2013 Ieee International Conference On Embedded And Ubiquitous Computing (Hpcc_Euc), 2013 Ieee 10th International Conference On. Ieee, 2013.

[4]. Amini, Navid, Seyed Ghassem Miremadi, And Mahdi Fazeli. "A Hierarchical Routing Protocol For Energy Load Balancing In Wireless Sensor Networks." Electrical And Computer Engineering, 2007. Ccece 2007. Canadian Conference On. Ieee, 2007.

[5]. Cui, Xiaoyan, And Zhao Liu. "Bcee: A Balanced-Clustering, Energy-Efficient Hierarchical Routing Protocol In Wireless Sensor Networks." Network Infrastructure And Digital Content, 2009. Ic-Nidc 2009. Ieee International Conference On. Ieee, 2009.

[6]. Chen, Kuong-Ho, Jyh-Ming Huang, And Chieh-Chuan Hsiao. "Chiron: An Energy-Efficient Chain-Based Hierarchical Routing Protocol In Wireless Sensor Networks." Wireless Telecommunications Symposium, 2009. Wts 2009. Ieee, 2009.

[7]. Singh, Taranveer, Neeraj Gupta, And Jasmine Minj. "Hierarchical Cluster Based Routing Protocol With High Throughput For Wireless Sensor Networks." Signal Processing, Computing And Control (Ispcc), 2013 Ieee International Conference On. Ieee, 2013.

[8]. Nesrine, Khlifi, And Maher Ben Jemaa. "Heerp: Hierarchical Energy Efficient Routing Protocol For Wireless Sensor Networks." Communications And Information Technology (Iccit), 2012 International Conference On. Ieee, 2012.

[9]. Chan, Kevin Sean, Hossein Pishro-Nik, And Faramarz Fekri. "Analysis Of Hierarchical Algorithms For Wireless Sensor Network Routing Protocols." Wireless Communications And Networking Conference, 2005 Ieee. Vol. 3. Ieee, 2005.

[10]. Goel, Nishith, And Goodloo Aujl. "Simulation And Feasibility Analysis: Hierarchical Energy Efficient Routing Protocol (Heerp) For Wireless Sensor Network." Communications And Signal Processing (Iccsp), 2013 International Conference On. Ieee, 2013.

[11]. Sajid, M., Khan, A.H., Gull, S., Khan, K., Imran, M. and Javaid, N., 2017, June. SMPC: Singular division of Multipath Power Control tree based routing protocol for Underwater Wireless Sensor Networks. In Wireless Communications and Mobile Computing Conference (IWCMC), 2017 13th International (pp. 1641-1647). IEEE.

[12]. Long, J., Dong, M., Ota, K. and Liu, A., 2014. Achieving source location privacy and network lifetime maximization through tree-based diversionary routing in wireless sensor networks. IEEE Access, 2, pp.633-651.

[13]. Liu, Y. and Qian, K., 2016, June. A novel tree-based routing protocol in ZigBee wireless networks. In Communication Software and Networks (ICCSN), 2016 8th IEEE International Conference on (pp. 469-473). IEEE.

[14]. Ghazali, N.S., Baharun, S., Islam, A.M. and Wada, K., 2015, December. Adaptive tree-based routing for multi-channel wireless sensor network. In Advances in Electrical Engineering (ICAEE), 2015 International Conference on (pp. 186-189). IEEE.

[15]. Gotefode, K. and Kolhe, K., 2015, October. Energy efficiency in wireless sensor network using Fuzzy rule and tree based routing protocol. In Energy Systems and Applications, 2015 International Conference on (pp. 712-717). IEEE.

[16]. Roopashree, H.R. and Kanavalli, A., 2015, February. STREE: A secured tree based routing with energy efficiency in Wireless Sensor Network. In Computing and Communications Technologies (ICCCT), 2015 International Conference on (pp. 25-30). IEEE.

[17]. Juneja, P. and Jain, S., 2015, March. Tree based energy efficient routing scheme for body area network. In Computer Engineering and Applications (ICACEA), 2015 International Conference on Advances in (pp. 940-947). IEEE.

ISSN: 2454-4248
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[18]. Saranya, A., Senthilkumaran, R. and Nagarajan, G., 2015, February. Enhancing network lifetime using tree based routing protocol in wireless sensor networks. In Electronics and Communication Systems (ICECS), 2015 2nd International Conference on (pp. 1392-1396). IEEE.

[19]. Delaney, D.T., Higgs, R. and O'Hare, G.M., 2014. A stable routing framework for tree-based routing structures in WSNs. IEEE Sensors Journal, 14(10), pp.3533-3547.

[20]. Elhabyan, R.S. and Yagoub, M.C., 2013, May. Weighted tree based routing and clustering protocol for WSN. In Electrical and Computer Engineering (CCECE), 2013 26th Annual IEEE Canadian Conference on (pp. 1-6). IEEE.