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Congestion Control in WBAN in the Field of Heterogeneous Network

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Abstract: The Wireless Sensor Network (WSN) technology plays a significant role in the present day applications considering energy, security, routing, load balancing, optimization etc. The application of Wireless Body Area Network (WBAN) in recent times has significantly increased the potential of remote healthcare monitoring systems. However, the issues considering the congestion control and the performance of WBAN with respect to energy is still persistent. This paper intends to develop a heterogeneous WBAN network in order to perform congestion control and evaluate the energy efficiency. The control parameters such as distance and the traffic load were also computed which resulted in a more robust analysis on congestion control. Graphs of Cumulative Distribution Function (CDF) vs. traffic load and Probability Density function (PDF) vs. traffic load were given which shows an improved rate in the flow of traffic with respect to congestion control. Evaluation with respect to energy consumption with respect to WBAN nodes is also performed.

Keywords: WSN, WBAN, congestion control, energy efficiency.

I. INTRODUCTION

Usage of wireless communication system is increasingly adopted in every sector of commercial applications. The adoptions of sensors are also increasingly used in healthcare sector, which is termed as wireless body area network. Although, Wireless Body Area Network (WBAN) bears resembles with conventional wireless sensor network but it differs from wireless sensor network with respect to data rate, latency, and mobility factor. The present project discuss about a problem related to congestion control with respect to wireless body area network. There has been enough research work being carried out in sensor network pertaining to various problems of energy, security, routing, load balancing, optimization etc. However, there is a less amount of research work being evident on the literatures associated with wireless body area network. Although, there are various congestion detection and avoidance protocols in conventional wireless sensor network, it is still an unsolved question about their applicability on wireless body area network. As a result the wireless body area network has been slowly progressing towards a more civilian- based application where one such application is the remote healthcare monitoring system. The nodes are mobile in WBN compared to WSN where they are stationary.

The wireless sensor network is defined as network constituting number of devices which is represented in the form of nodes. This network consists of a monitor or a controller which is represented as a sink, the data is transferred to the sink by what is known as multiple hops. Many such networks could be connected to other networks through what is known as a gateway. These nodes could be stationary or moving, heterogeneous or homogeneous.

The wireless body area network is defined as network of devices of contact with the human body which is used for the monitoring of the physiological data. The application of WBAN in recent times has significantly increased the potential of remote healthcare monitoring systems. The Wireless Sensor Actuator Network (WSAN) from which the WBAN was originally derived was initially used in military applications, which later on evolved into more commercial applications. The WBAN has significantly increased the potentiality of the remote healthcare monitoring systems.

The work in has evaluated the congestion effect on Healthcare System Performance. Due to the “many-to-one” nature of the traffic patterns in healthcare system architecture, congestion at the sink bottleneck node can occur when the Point of Care (PoC) nodes traffic increases with respect to the sink capacity. So, it is a focal issue for health care application to design an appropriate sink capacity allocation strategy addressing reliability and timely delivery without failure.

A considerable amount of survey has been conducted with respect to WBAN network such as [1] [2] [3] [4] and [5]. However the issue with respect to congestion control and energy efficiency still persists which is significantly shown in the above works.

The rest of the chapter is organized as follows, the second chapter mentions the review of literature performed with respect to WSN and WBAN related to system architectures, techniques applied, design considerations, applications and issues involved. The third chapter explains about the proposed system architecture along with the methodology. Consecutive chapter constitutes obtained simulation results and conclusion along with future scope.

II. LITERATURE SURVEY AND RELATED WORKS

Ullah et al. [1] performs a review on the key aspects concerning the WBAN with respect to numerous applications. They also present a WBAN infrastructure that provides solutions to on-demand, emergency, and normal traffic. This review signifies the need for new solutions with respect to power efficiency towards in body and on body sensor networks.

Thomas D. Lagkas and George Eleftherakis [2] present an overview of the wireless sensor networks which is based on the data communication networks. Considering the practicality and usability of the of sensor networks in healthcare services and environmental monitoring, they present an approach towards the realization of cooperative Healthcare and Environmental monitoring systems. The outcome of the review infers that the concept of wireless sensor network in an integrated cooperative architecture is capable of widely providing distributed services with respect to sensed data.

J Y Khan et al. [3] perform a comparative analysis on the various techniques involved in the WBAN concept. This work presents WBAN techniques with respect to medical applications. They examine The WBAN design issues with particular emphasis on the MAC protocol designs and profiles considering the power consumption of WBAN. Experimental results demonstrate that a MAC protocol plays a critical role in determination of power consumption along with reliability of transmissions and throughput of a network. Upon considering three classes of MAC protocols for patient monitoring applications, they inferred that a flexible and reliable monitoring system could be developed by considering the CSMA/CA architecture.

N. Kumar et al. [4] presents a review on various wearable and implanted body area network sensors which provides continuous monitoring of the patients. These medical sensors are designed for the purpose of collection of physiological data and transmit the corresponding data to the respective base station.

J. Y Khan et al. [5] performed examination on the performance metrics concerning IEEE802.15.4/Zigbee MAC based on the WBAN operating in the different patient monitoring systems. Using the OPNET based simulation model the performance of remote patient monitoring system could be inferred. The design issue considered in this paper was when WBAN was directly connected to the main hospital via a service node, this service node would transmit data in short packets which in turn reduces the transmission efficiency and would increase transmission delay.

S. Ullah et al. [6] conducts a comprehensive survey on the concepts and applications of WBAN, They also discuss the fundamental mechanisms, WBAN architecture, wireless implant communication, low power MAC and routing protocols. A comprehensive study of WBAN technologies at physical, MAC and network layers are also discussed, useful solutions were derived for each layer. Many WBAN applications were highlighted.

Mark A Perillo and W. B Heinzelman [7] had conducted a survey of various wireless network protocols, some of the protocols were Resource Aware Routing, Data centric Routing protocol, geographic routing protocol, clustering for Data Aggregation which involves low energy adaptive Clustering Hierarchy (LEACH) and Hybrid Energy-Efficient Distributed Clustering (HEED). Protocols for QoS management are also included. Some of the issues presented in their work include factors such as translation of data-specific QoS parameters into meaningful protocol parameters, integration of protocols with hardware, reliability, sensor nodes supporting multiple applications at the same time, Security concerns and integration with other networks to mention a few.

J. Y Khan and M. H Yuce [8] shows the significance on the use of WBAN for medical applications. The WBAN network design techniques involve protocols such as MAC protocols for WBAN, Scheduled TDMA MAC Protocol, Polling MAC protocol, Random Access MAC protocol, IEEE802.15.4 MAC protocol. Different factors involving the measure of the WBAN network design include reliability, power efficiency, scalability, priority based services, etc.

J. Ahmed and Fareeha Zafar [9] conducted a review on the BAN technology and wireless medical monitoring. The main objective of the work in [] was to reduce the load at hospitals by using the medical implant communication system (MICS) and Wireless medical telemetry system (WMTS). They inferred that the technology could provide a more economical, easier and quick respondent history of patient. However many challenges were also highlighted system design, configuration, customization, seamless integration to name a few.

Sabato Manfredi [10] performs the evaluation with respect to performance health care monitoring system over Heterogeneous Wireless Networks. The work in has focused mainly in the congestion control which occurs mainly due to the uncontrolled increase of traffic with respect to the network capacity, As a result it affects the reliability of the transmission of information at any network. The work in has proposed a new method which improves the performance of the system in terms of reliability and efficiency of the system.

C. Buratti et al. [11] conducts an overview based wireless sensor technology and its evolution with respect to its application and protocol design. The work in [] presents an overview in WSN technologies, its applications and standards, features in WSNs design and evolutions. Also the trends and possible evolutions are also discussed.

III. PROPOSED METHODOLGY

The purpose of the proposed system is to develop a WBAN model with respect to congestion control analysis. The block diagram for the system architecture is shown in Fig 1. Initially the WBAN network is initialized and the number of nodes along with the cluster heads is defined. The network is deployed along with the intrinsic

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communication between the defined cluster head. With respect to assigning mobility to each node, the speed of the node is defined along with the number of iteration to be performed. The respective communication is established. The control parameters with respect to WBAN network are defined. The traffic load with respect to congestion control is evaluated and also the energy consumption is also evaluated. Finally three graphs with respect to Traffic load Vs PDF, Power consumption Vs PDF and power consumption Vs CDF are plotted.

The implementation procedure is given as follows,

1. First the user enters the number of nodes which would be deployed into the heterogeneous network concerning the WBAN. The user then defines the number of cluster heads in the overall network, the network is then deployed with nodes and cluster heads. The clustering is then performed and the intrinsic communication network is established.
2. The speed of the node with respect to its mobility could be controlled with the user input. The iteration of each cycle for the WBAN network is also given as an input control parameter.
3. The control parameters with respect to the WBAN network are given as follows, first the distance metric is computed with respect to two nodes and the distance between the node and the cluster head. Consequently the orientation of the node with respect to its angle of direction is computed. The orientation is computed for the purpose of prediction of the node when generated randomly. Finally the minimum and maximum value for the respective node is computed to define the bounding region for the random node mobility.
4. The traffic load is evaluated with respect to congestion control by computing the density function of the same. The Cumulative Distribution Function (CDF) is computed concerning the traffic load with respect to congestion control. Consequently the probability density function is computed with respect to congestion control. The energy consumption is computed with respect to cumulative distribution function along with the computation of the probability density function (pdf). Graphs are plotted considering the traffic load, CDF, power consumption and pdf.

IV. SIMULATION RESULTS

This chapter deals with the simulated results obtained from the implementation of the project with respect to proposed WBAN network model. The obtained graphs are shown in Fig 2, Fig 3, Fig 4, Fig 5, Fig 6, Fig 8 and Fig 9.

1. Database

1.1. Input parameters

The input parameters considered in this project is shown in table 1. All the input parameters considered in this project are only for the purpose of the node mobility in the WBAN network model.

Table 1: Input parameter for the WBAN initialization

Sl. no	Input parameter	Value	Remark
1.	Number of nodes	100	Creates number of nodes in the overall region
2.	Number of cluster head	10	Creates number of cluster head in each WBAN network
3.	Node speed	0.2	Controls the speed of the node with respect to its mobility in WBAN area
4.	Number of iteration	1000	Indicates the simulation time or the number of cycles the node should consider with respect to its mobility

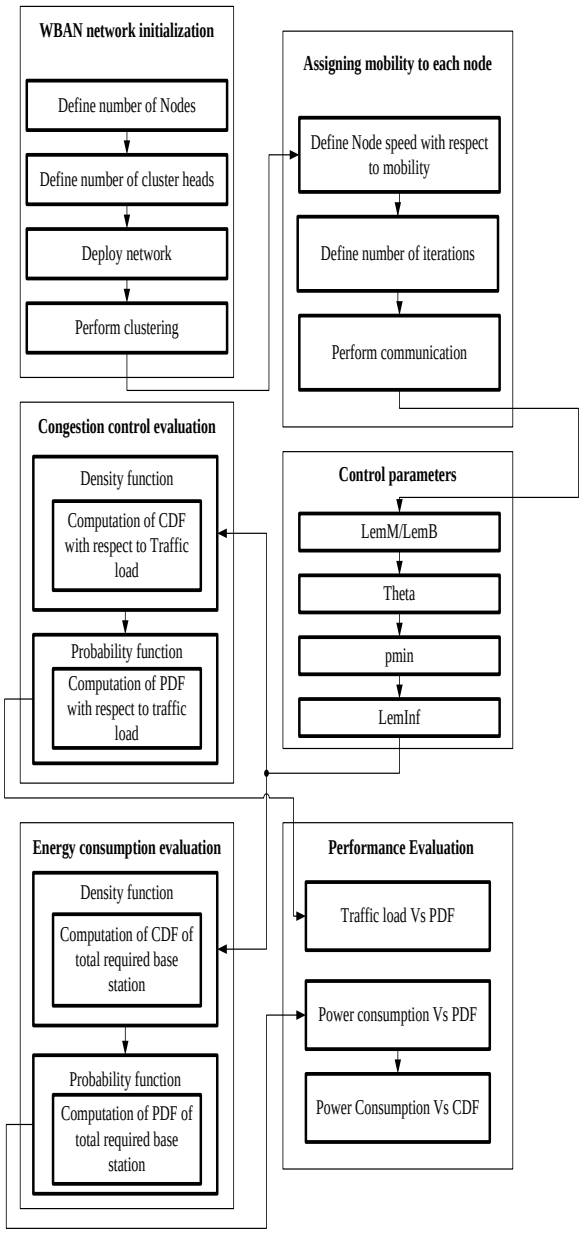

Fig 1: Proposed methodology

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1.2. Control parameters

The control parameters considered in this project is shown in table 2. All the control parameters considered in this project are only for the purpose of the node mobility in the WBAN network model.

Table 2: Control parameters for WBAN system

Sl. no	Control parameter	Value	Remark
1.	Distance metrics	15	Computes the distance between the node of concern and the cluster head
2.	theta	1.8	Computes the load distribution between the nodes
3.	pmin	1.1	Computes the minimum traffic rate
4.	Maximum range value	10e-10	Computes the maximum traffic rate

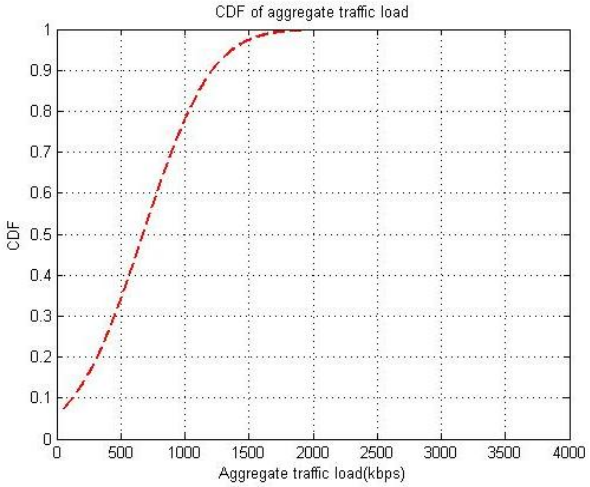

Fig 2: Plot of Aggregate traffic vs. CDF

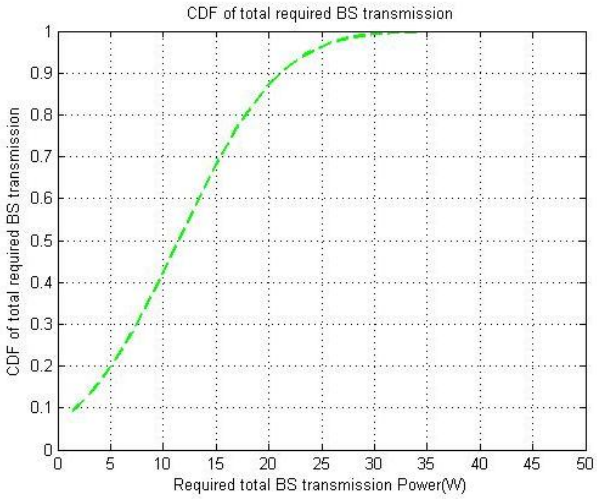

Fig 3: Plot of total required base station vs. CDF with respect to transmission power

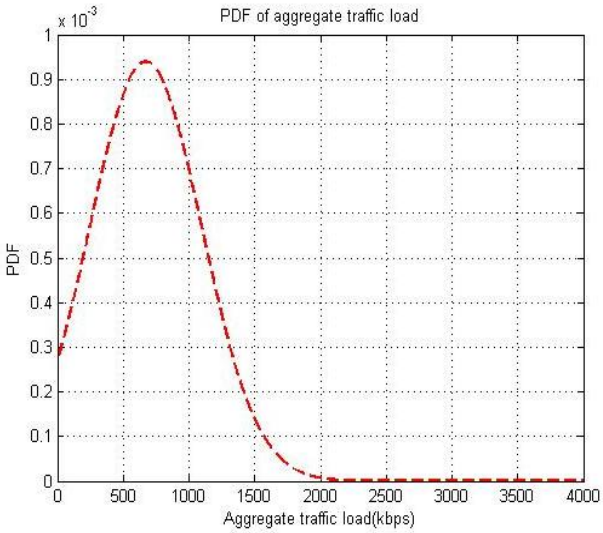

Fig 4: Plot of Aggregate traffic vs. PDF

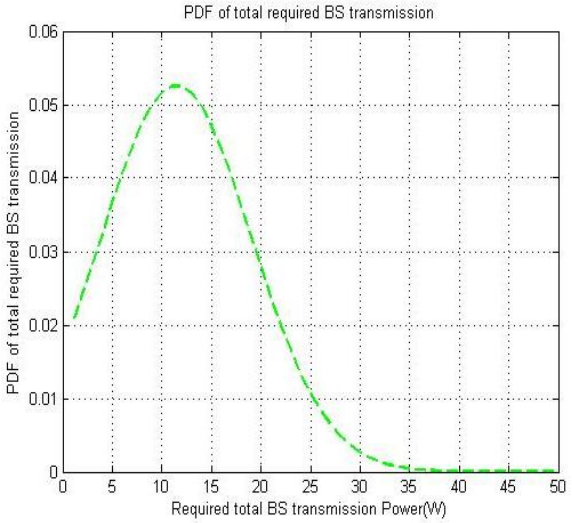

Fig 5: Plot of total required base station vs. PDF with respect to transmission power

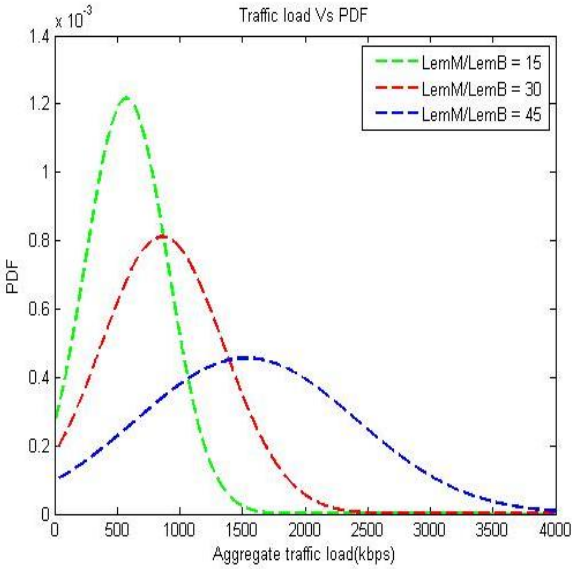

Fig 6: Plot of Traffic load vs. PDF

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The simulation result WBAN system with respect to congestion control is shown in Fig.7.

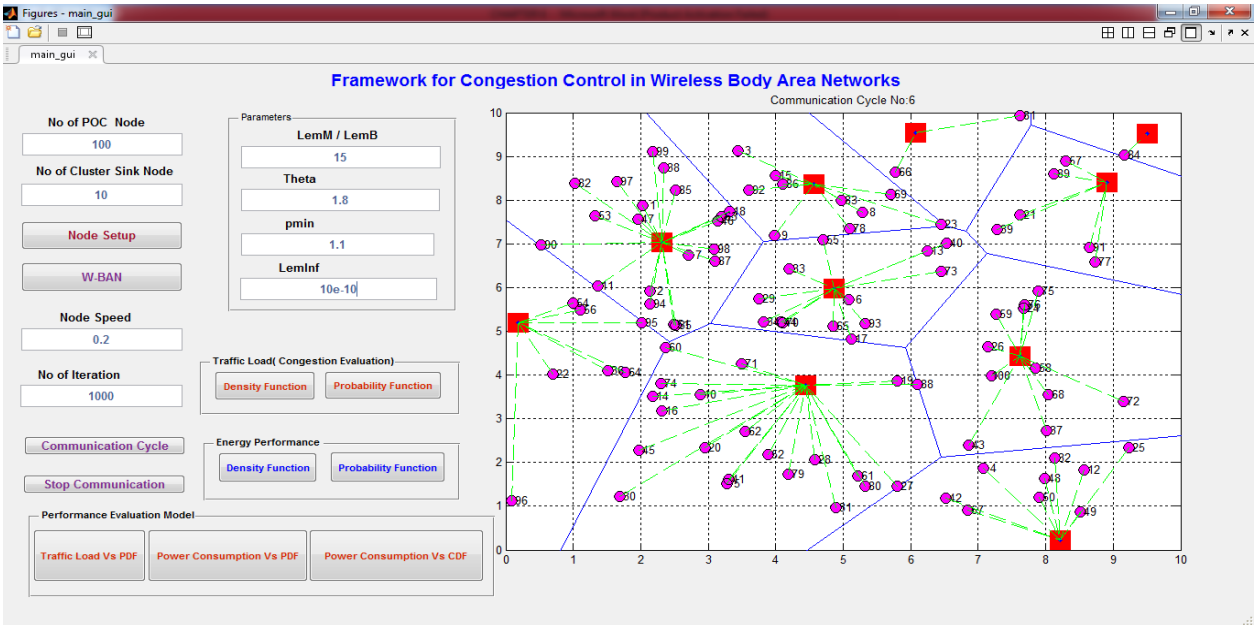

Fig 7: The simulation result WBAN system with respect to congestion control

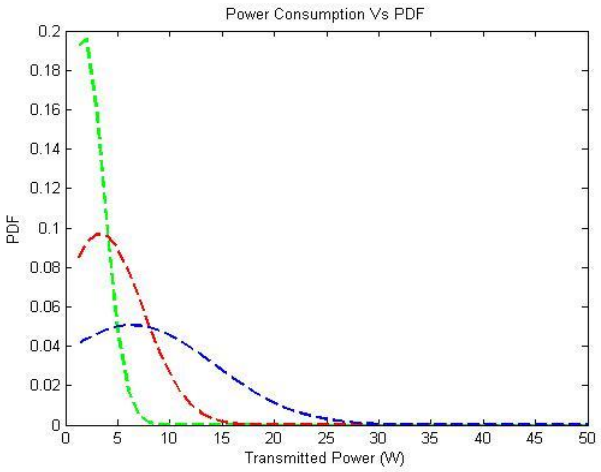

Fig 8: Plot of power consumption vs. PDF

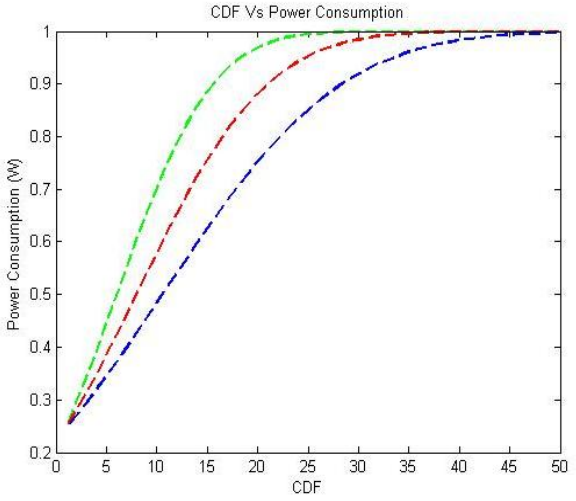

Fig 9: Plot of CDF vs. power consumption

V. CONCLUSION

From the conducted experiment, we have successfully built the WBAN network model in a heterogeneous condition. The input parameters such as number of nodes and number of cluster heads were given along with the option of controlling the speed and the iteration of the nodes. The control parameters such as distance and the traffic load were also computed which resulted in a more robust analysis on congestion control. Graphs of CDF Vs traffic load and PDF Vs traffic load were given which shows an improved rate in the flow of traffic with respect to congestion control. Evaluation with respect to energy consumption with respect to WBAN nodes is also performed. The work presented here involves WBAN network under ideal condition. This work could be extended towards a mobility based node movement based on priority with respect to different circumstances.

REFERENCES

[1] Khan, Jamil Y., and Mehmet R. Yuce. "Wireless body area network (WBAN) for medical applications." New Developments in Biomedical Engineering. INTECH (2010).

[2] Thomas D. Lagkas and George Eleftherakis,"An Overview of Wireless Sensor Networks: Towards the Realization of Cooperative Healthcare and Environmental Monitoring", Copyright © 2014. 23 page.

[3] Khan J Y, Yuce MR, Bulger G and Harding B,"Wirless Body Area Netowrk (WBAN) design techniques and performance evaluation", Journal of Med. System 2012, Vol. 6, Pg. no.1441-57.

[4] Darwish A, Hassanien A E, "Wearable and implatable wirless sensor network solutions for healthcare monitoring", Sensors (Basel)-2011, Vol.11, Pg.no.5561-95.

[5] Khan, J.Y.; Yuce, M.R.; Karami, Farbood, "Performance evaluation of a Wireless Body Area sensor network for remote patient monitoring," in Engineering in Medicine and Biology Society, 2008. EMBS 2008. 30th Annual International Conference of the IEEE, vol., no., pp.1266-1269, 20-25 Aug. 2008.

DOI 10.17148/IJARCCE.2016.5522

[6] Sana Ullah , Henry Higgins , Bart Braem , Benoit Latre , Chris Blondia , Ingrid Moerman, Shahnaz Saleem , Ziaur Rahman , Kyung Sup Kwak, "A Comprehensive Survey of Wireless Body Area Networks", Journal of Medical Systems, v.36 n.3, p.1065-1094, June 2012

[7] Perillo, Mark A., and Wendi B. Heinzelman. "Wireless sensor network protocols." Algorithms and Protocols for Wireless and Mobile Networks, Eds. A. Boukerche et al., CRC Hall Publishers (2004).

[8] J.Y.Khan and M.R.Yuce,"Wireless Body Area Network (WBAN) for Medical Applications",New Developments in Biomedical Engineering,Domenico Campolo(Ed),InTech.

[9] J.Ahmad and fareeha Zafar,"Review of Body Area Network Technology & Wireless Medical Monitoring"International Journal of Information and communication Technology Research,2012.

[10] Khan, Jamil Y., and Mehmet R. Yuce. "Wireless body area network (WBAN) for medical applications." New Developments in Biomedical Engineering. INTECH (2010).

[11] C. Buratti; Andrea Conti, Davide Dardari and Roberto Verdone, "An Overview onWireless Sensor Networks Technology and Evolution", Molecular Diversity Preservation International, Basel, Switzerland.

BIOGRAPHIES

Srinidhi C received is BE in Electronics and communication at EWIT, Bengaluru. He is final year Mtech student in Computer Networks and Engineering at EWIT, Bengaluru. His current area of research in Wireless Networking, Neural Networks and Simulation of Communication Systems.

Mangala C N received the B.E. Degree in Computer Science and Engineering from NCET, Bengaluru, VTU University in 2006 and got M. Tech Degree in Computer Science and Engineering from RVCE, Bengaluru, India. She is currently working has Assistant Professor in Dept. of CSE, EWIT Bengaluru India. Her area of interest includes Image processing, Data mining and Big Data.

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