WIRELESS NANOSENSOR NETWORK: A REVIEW

[1] Pooja Kataria, [2]Dr. Kanika Sharma
[1]M.E Scholar, [2]Assistant Professor
[1] Electronics & Communication Department,
[1]National Institute of Technical Teacher Training and Research(NITTTR), Chandigarh-160019, India.

Abstract : A Wireless sensor network is an arrangement of wireless devices which can pass the information collected by a watched field through remote associations. The information is sent by various center points, and along a gateway, the data is related with various frameworks like remote Ethernet. Remote nanosensor systems (WNSNs) are substitution ages of detecting component systems found in nano scale, that is supposed to be made inside the returning times of years. Each nanonode is inside the shift of a little too few nano meters in measure. The property of nanoscale in nanonodes that opens the energizing the new applications inside to detecting space. Wireless nanosensor is made by different components for the communication. This paper gives a deep review of wireless nanosensor networks which is build on electromagnetic communication. The network architecture for interrelationship of nano devices is presented. The modeling of the network represented in all required layers and also channel modeling represented in terms of terahertz band is reviewed in deep. There are also some research challenges in wireless nanosensor networks, which are important for the next development of the networking parameter.

Index Terms **- TS-OOK modulation, wireless nanosensor networks, energy harvesting.**

I. INTRODUCTION

Remote nanosensor systems (WNSNs) are substitution ages of detecting component systems found in nano scale, which are suppose to be made inside the next coming years. Each nanonode is inside the shift to a little too few nano meters in measure. The nanoscale characteristic of nanonodes accessible to energizing the new applications inside to detecting space. For instance, nanosensors may locate substance mixes at the atomic level or the nearness of different irresistible specialists, as infections or unsafe microorganism. [6]

Nanosensors can gather supportive information which should be making outward of their detecting surroundings for capacity and additional procedure. In elective words, they'll get the opportunity to convey between themselves in like manner like hubs inside the little and full scale space. Among all feasible correspondence routes among nanonodes, thinks about demonstrate that attractive fascination correspondence inside the 0.1-10.0 rate (THz) band could be a auspicious methodology for correspondence in WNSNs, in activity inside the rate band will encourage nanosensors expend a short vitality though giving property at the nanoscale. A graphene based nano-reception apparatus has been contemplated in light of the fact that the nanoscale handset for transmit and get beats inside the rate band. [7].

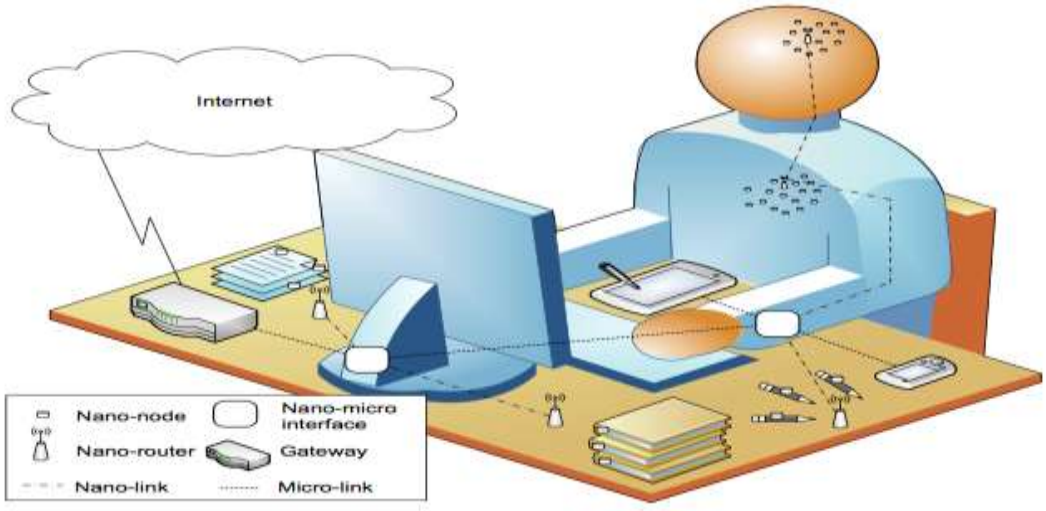

fig. wireless nanosensor network

II. ARCHUTECTURE OF NANONODE

Wireless nanosensor is made by different components for the communication. These components are: nano nodes, nano Router, nano micro interface, gateways [8].

(i) Nano nodes

Nano hubs are little gadgets with constrained vitality, computational and capacity abilities. They are places into an objective territory for detecting and assembling the data from the environment. The extent of the WNSN is characterized by these nano hubs with the goal that they catch all relative data shape goal region. The execution of WNSN is given by the quantity of nano hubs which are utilized as a part of systems.

(ii) Nano router

The measure of Nano switch is bigger than that of nano hubs and has more assets then the last one. Nano switch can likewise control the conduct of nano hubs by trading extremely basic control orders. They gather and process the data from nano hubs and send data to nano-miniaturized scale interface through nano-joins.

(iii) Nano-micro interface

These can gather the data originating from nano switch to illuminate it to the miniaturized scale, and the other way around. Nano small scale interfaces gadgets can impart in the nano scale utilizing the nano correspondence strategy to utilize the correspondence worldview in ordinary interchanges arrange.

(iv) Gateway

Portals are those gadgets which empowers remote control of whole framework over the web. These are gadgets which gather the data from nano organizes and give these data to the remotely put screen along the web. Nano hubs, nano switch and nano smaller scale interface are might be immobile or mobile as per the applications.

III. LITERATURE REVIEW

Massimiliano Pierobon et al. proposed the routing structure for the wireless nanosensor networks, to optimization of the energy harvesting to the suitable for the operation of the wireless nanosensor networks however, at the same time the throughput of the overall network is increasing. This framework is based on the Medium Access Control (MAC) Protocol for the combine throughput and lifetime optimization in wireless nanosensor networks. The paper conclude the evaluation for the multi-hop routing framework, the key parameter of this paper is to reduce energy consumption , the capacity of the network and the delay of each nanosensor of the wireless nanosensor networks.

Vishrant Rupani et al. has reviewed the wnsns which are basic building blocks of the electromagnetic communication. The author introduced the architecture for interconnection of nanodevices, modeling of the network in all the possible layer. The channel modeling is present in terms of the THz band. The author conclude that the energy is finite in the nanodevice ,therefore short weight channel codes are used to decrease the interface power and energy consumption therefore, network lifetime is increases.

Ayoub Oikhar et al. introduced the mechanism of flooding algorithm for routing in wireless nanosensor networks and then they compared with the counter-based and probabilistic based broadcasting mechanism. A new term is proposed in this paper called MANETs. This is the category of ad-hoc network in which location can be change and configured as itself on the circle. As MANETs are mobile in nature, therefore they use wireless connections so that they can connect various networks. The conclusion of this research paper was that the investigation from the range of transmission affects the performance of the EM-based broadcasting mechanism for nano communication.

Pedtem Johari et al. was proposed the link capacity maximization problem in wireless nanosensor networks given by that the devices and communications are independence in wireless nanosensor networks. In this paper the optimal data is in pocket size that maximize the link efficiency and initialized to holding devices, channel, link and physical layer particularities of WNSNs. The outcomes are presented to observe the effect on the packet size for the various error control techniques. The conclusion of this paper was to optimal packet size maximum to the link throughput in WNSNs that was observed for some various error control techniques, which includes EPC, FEC and ARQ. The analysis captured the particularities of THz band, nanodevice and their capacities of energy harvesting and data transmission.

Long Jun Huang et al. proposed the energy optimization algorithm for the communication in WNSNs and also introduced an energy model for the consumption of energy. In this the transmitter and receiver are presented the energy consumption. Since the receiver and transmitter are presented on the basis of optimal code-word length and optimal source-word length. Also a coding algorithm is presented is developed for the optimizations of energy problems and efficient energy coding scheme. The EOC will

compare with and AWD. The conclusion was that the code-word length of EOC which was greater than the source-word length, that was totally disimilar form NME and the result is better in terms of energy efficiency.

Amrita Afsharinejad et al. have discussed for the first THz band for the path loss model for a plant monitoring. A simplified plant structure model and also probability model for the successful transmission between the nanosensor and micro sensor. A receiver is install on the plant stem for interchange the information between nano sensor and micro sensor. Also the author addressed in order to the path loss model for THz communication. This paper concludes that the border for the path loss of the reference value , that depends upon the shape of the plant and the transmission structure, that can be use for the detection of threshold at the receiver.

Kai kai Chi et al. is focused on WNSNs use on off keying modulation which is used to minimize the energy transmission with respect to the minimization of average codeword weight. In this the author gives a integer non linear programming problem to build a prefix code which have small ACW in the condition of average codeword length therefore, transmission energy consumption is minimum will collect the large throughput than the preset value. Two cost effective algorithm that is known as binary tree based length decreasing (BT-LD) algorithm and binary tree based weight decreasing (BT-WD) were given to establishe a low ACW prefix free codes. The results of paper was when the preset threshold of average codeword length is small the 20% of energy consumption is reduced.

Kaikai Chi et al. are focused on an ON-OFF keying (OOK) modulator. By using this modulator the transmission energy is reduced when an actual low-weights with the low average codeword weight (AWC) source symbols with the various higher bits. To resolve this problem author design a code name as Fixed length Minimum-Communication-Energy (F-MCE) and variable-length minimum-communication-energy (V-MCE) code that were capable to reduced the energy consumption on the transmitter and receiver side in between the ends of two nodes in OOK based WNSNs. The result shows the MCE coding scheme which are efficient to overcome the overall energy consumption in wireless communication for WNSNs. The parameters which are depending on the amount of energy consumption per single bit transmission, symbol length, and energy consumption per bit demodulation, the gains of energy storing differ from few dozen of percent.

Eisa Zarepour et al. discussed about wireless nanoscale sensor networks which operates in terahertz band range from 0.1-10 THz. Energy efficiency, reliability and simplicity is the basic parameter to build a communication protocol network for WNSNs. A carrierless pulse based modulation is adopted because of its simplicity and energy efficiency. The author compare the four carrierless modulations, PPM, PAM, BPSK, and OOK in terms of WNSNs operates in THz band. Also find BPSK which is additionally typical in the terms of decoding logic on the receiver side. The conclusion was the OOK is a simple technique and the reliability performance is small when they compare it with BPSK. BPSK has larger energy efficiency and higher performance but to achieve these it needs complex transceiver rather than other schemes.

Hoa Tran-Dang et al. gives two ranging algorithm, which is based on hop counting method by which the author can estimate the location of each and every nanosensor and also find the distance between the nodes in the network. To transfer the information packet in all nodes and to count the number of hopes between the two nodes in a network, the flooding mechanism can b used. A second algorithm, which is based on cluster to reduce the problem of duplication of information packets and waste of energy consumption. The result of this paper is that if we calculate the dimension of a square then the counter counts the number of hops by counting the number of nodes placed between the two corners of the square.

Sefat Noor Orni et al. proposed cluster based single hop routing algorithm with an energy harvesting model. The proposed model also include two other algorithms: one is to form a cluster and another is to transmit the data from nanosensor to nano routers. The main goal was this paper to invite a decentralize a hop cluster based routing algorithm which is designed with energy harvesting model by improvising prevailing mechanism. The conclusion was the paper that an en efficient energy harvesting algorithm and also develop a routing algorithm for the energy harvesting.

Josep Miquel jornet et al. introduced an energy model for self- powered nanosensor motes. The purpose was this model to define a relation between the energy harvesting process and the energy consumption. Energy harvesting process is recognize in piezoelectric nano generator which develop a model for reproduce the experimental data. The motes in the communication are operating in terahertz band (0.1-10 THz). An energy model was presented for capturing the dynamic behavior of total network traffic and the multiuser interface. The result was the author develops a framework to explore the influence of the packet size and retransmission policy from one end to other packet delay and the throughput of WNSNs.

Murat Kocaoglu and Ozgur B.Akan proposed a modulation technique and a minimum energy scheme (MEC) to get efficient energy in WNSNs. For minimizing the energy MEC maintains a suitable code distance which helps to provide reliability to the network. If the source set number is smaller than the inverse of the symbol error probability then the codewords can be decoded ideally for large code distance with the help of MEC which is shown analytically. The OOK modulation is used to generate the minimum average codeword energy. By using the properties of THz channel they proposed multi carrier scheme for wireless nanosensor communications. The outcomes of the paper were around MEC which satisfies a mimimum Hamming distance for reliability.

Shahram Mohrekesh and Michele C.Weigle introduced the different parameter of energy consumption in pulse-based wnsns which converts the energy harvesting to the supply energy. The author calculate the effects of repetition, packet size and code weight on the optimization problems. This model validate the ideal energy consumption design in theWNSNs. The outcome of this paper gives the optimum energy consumptions when the QoS requirements are complete which are delay and transmission reliability.

Josep Miqel Jornet and Ian F. Akyildz proposed a mechanism for reduce then interference in the Pulse-based nanonetworks. It wass shown by choosing an appropriate the weights of the code, rather than using the channel codes for detecting and correcting the transmission errors. The performance scheme provides reduction in overall interface and information rate in terms of both analytically and numerically. The terahertz band is used for the pulse based communication. A statistically model which provide impulsive interface generated by a Poisson field of nanomechanics operate on TS-OOK modulation. The outcomes of the paper was that, when the low weight channel code are used then overall interface should be reduced.

Ian F. Akyildiz et al. provides a deep knowledge of terahertz Band (0.1-10 THz) communication, which is the basic technology for boost up speed of wireless communication. The device designed and developed for challenges in THz band are reviewed. There are so many challenges in the paper like, capacity analysis, modulation scheme, propagation modeling and physical and link layer solution. Terahertz band is new boundary in the area of research. Terahertz band also validates the different networking schemes at the nanoscale level, such as wireless nanosensor networks. The outcomes of the paper were terahertz band technology from the device perspective.

IV. RESEARCH CHALLENGES IN WNSNs

Here are various challenges in wireless nanosensor networks and given below:

- The big challenge to the researchers is the communication between nano devices and it may be reduce to adopting the good communication strategy, channel type and routing technique.
- Nanosensor has less amount of energy, therefore energy harvesting and consumption is big concern in WNSNs.
- Since the number of nanonodes differs, PLR (Packet Loss Ratio) and packet delay have individual performance. So the size of the network is also affecting the network efficiency.

V. CONCLUSION

The area of applied science is in previous stage of analysis. There is great distance to travel for analysis in numerous area of applied science. Energy is proscribed for the nanodevice thus for low weight channel codes are accustomed scale back the interference power and energy consumption, thus period of the network is will increase. Thanks to energy parameters and size of the network it's useful to acquire communication strategy that's supported short pulses and therefore the info capacity of the network for each single user and multi user are offers the thought of the capability of the network. There are various analysis challenges before researchers which incorporate with size of the network, channel modeling, efficient MAC protocol and routing algorithmic rule, energy harvest and consumption. These challenges before the researchers require a attentive analysis and analysis of the network for different applications altogether areas.

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