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A Survey on Hybrid Routing Protocols for Central Monitory Console In Medical Sciences

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ABSTRACT

Medical Sensor Nodes (MSN) are integrated modules that works on sensing nodes integrated with sensors can be used as an effective tool for data acquiring regardless their deployment. EERP (Energy – Efficient – Routing – Protocol) in hybrid clustering routing protocol could be used rather than other protocols like the Data Centric, Location Based etc., has an eloquent percussion on the comprehensive endurance of the sensing network in field of medical sciences. This paper targets on various existing protocols in MSN, which are indulged in routing data across network and addressing the best protocol that solve issues of Energy dissipation in MSN. In hybrid clustered, data routing across – medical sensors are segregated into a topology called as clusters. Each cluster will have a CH (Cluster Head) which takes care on each and every node that are in cluster and routes the data only from the CH, where it results in reducing power dissipation.

KEY WORDS: Clusters, Central Monitory Console, Energy Efficiency, Proactive, Reactive, Base Station, Medical Sensor Networks.

1. INTRODUCTION

MSN's are integrated modules that works on sensing nodes integrated with sensors be used as an effective tool for data acquiring from the patient's body. MSN are low-powered sensing nodes that operates in from the patient's body in the place of deployment. These sensors are finite in resources like, computation capacity, low performance in communication and battery. In MSN, sensors are distributed in an area of the requirement that are used in acquiring the information. These nodes will be communicating directly (or) using transitional nodes which thus forms a network, (Ravi Tej, 2017) the information that was sensed by nodes will be transmitted to a control centre that is centralized called Base Station (BS) / or Central Monitory Console (CMC).

The CMC is positioned way from nodes in networks so that these nodes have to communicate through the CHs to reach data to CMC. Only the nodes with the higher computation – power reaches BS directly. To route the information, from sensor to CMC, they require appropriate mechanism called the routing protocols. These protocols will help in routing sensed information from the patient to nodes, this also look after the information until it reaches the CMC. Based on the function and application of target type, various protocols for routing were proposed. These protocols for routing are categorized on their deployment, efficiency, and function of the protocol which can perform a given task for a targeted application. Every node in network will have a two basic functions called Proactive and Reactive. In proactive, whenever the sensors sense the data, it transmits data in periodic manner to CMC. In reactive the scenario is different, whenever the sensors sense the data it transmits data to CMC or it may react to the sudden changes in sensed attributes. For the applications like time-critical, reactive is more reliable than proactive. TEEN protocol is an example of reactive routing. If there are abrupt changes in sensed attributes beyond a value of predetermined threshold, nodes in network immediately reacts to the changes. Hybrid routing is another classified routing technique which integrates proactive & reactive routing advantages. In hybrid routing, the nodes first compute's the available routes to reach CMC and enhances routes if necessary. APTEEN (Adaptive Periodic TEEN) a protocol belong to family of hybrid routing be classified into flat and direct communication that depends on node functionality.

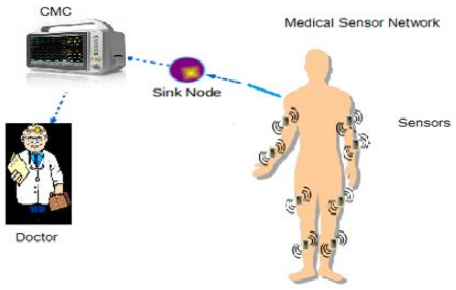

Figure.1. Architecture for MSN

In flat communication, every individual node plays typically the same role. These sensors collaborate to accomplish a task. It isn't feasible to assign global identifier to each node as the nodes are in huge number, when the nodes require to transmit data, initially they search for a route which leads to (Radhika Rani, 2017) CMC. In Direct-communication data that was sensed by nodes can transfer to BS directly using the direct communication protocol.

This can be implicated in huge networks, as the capacity (energy) of sensors may reduce where the scalability is low. Nodes in network are divided as clusters that have identical attributes and functionalities. Clusters in network contain individual CH that communicates precisely to CMC. Cluster heads will communicate directly to correspondent cluster heads but not to the nodes by which efficiency can be increased.

Characteristics:

Network Characteristics: MSN are the multifunctional sensor nodes consist of low - cost, low – power nodes which are deployed in required environment. These are capable of sensing and processing of data and communicate through a wireless channel which tends to carry out task. The following are the few characteristics that are unique in MSN:

Deployment: In MSN sensors are generally deployed in way, that it reaches the requirement. Nodes in network are application depended, their work is sensing and gathering data and transmitting it to CMC. So, a proper care to be taken while deploying the nodes.

Power/Energy: Sensors in MSN are battery powered. In most instances, these work in a strident environment that may pose challenges to recharge the batteries or to replace them.

Storage & computation constraints: As these sensors depend on battery for computation and routing, this power may not support for some high-end applications. To mend these issues, an Energy – Efficient – Protocol for routing has to be deployed.

Application-Specific: Node deployment relay on application type that is being used, this may vary with changes in requirement because no protocol will justify the requirements for entire applications. Unreliability: The failure of sensors may occur or get damaged as they are operated without any attendance in hostile environments. So, view of this issue a legitimate mechanism should follow with proper implementation of network with the self-evolving mechanism.

Changes in Topology: Energy depletion and transmission failures might be some reasons for the failure in the MSN, this is due to topological changes in network. If network is not a well-designed, the nodes will have to insist more in order transmit data due to which there will be a high consumption of energy.

Design Objectives of Network: The networks performance and capability depend on design of network. To achieve goals in MSN, design of network is an extensive task. Design objectives of networks are as follows:

Node Size: The primary design objectives in these types of networks is to reduce node size which ultimately provides the efficiency to network. If there is an increase in size it is difficult to embed in the body and maintain such a one network that accumulated with a many nodes. To get – over this, an efficient and miniature form with high sensing and computation capability sensors are to be used.

Node Cost: Reduction of node cost is another aspect to be considered in designing a network. If network is large it requires a huge number of the sensor to be deployed. So, this increases the cost and complexity in the network. In order to overcome this issue, the design of the network should be in such a way that the number of nodes should be less and the results should be numerous.

Less utilization of power: Power – consumption is another constraint in designing a protocol for a MSN. As the nodes are battery powered, they may drain out at a point of time. These batteries cannot be charged frequently which is a difficult task. This can be conquered by deploying a proper protocol provides a great function with less consumption of energy.

Self – Configurability: Nodes in network are deployed usually in an ad-hoc fashion without any proper architecture. They should be organized themselves to get communicated among themselves which is called as the self-configurable function/adaptability. Nodes in network should have information in regard to all the corresponding nodes so that, they evolve as a network by exchanging beacon packets with each other.

Reliability: Reliability is primary constraint that is to be appropriated while designing a routing protocol for MSN. Whatever the data that was sensed by nodes it is to be delivered to CMC without any loss are duplication. This issue can be resolved with reduction of errors by providing a control and correction mechanisms that takes care of reliability.

QoS - Support: Every network will be having some (QoS) requirements like reduction of packet loss, delivery and latency. Design of a new protocol is to be in a way that takes care of flaws and provides the required support in design of network.

Design Challenges: The protocol design for MSN poses many challenges. The protocol that is designing should overcome all the following challenges.

Limited Energy: Battery powered sensors have a limited power to perform their operations. This is considerable challenging in designing protocols and architecture for MSN with respect to hardware and software. So the protocol should be designed in a way, that it should consume less power and provide a greater throughput.

Hardware Resources: Sensors are limited in processing & storage capacity which shows an impact on computation of the nodes. So to achieve the best with resources available, proper design should be adapted.

Node Deployment: Nodes in MSN are large number which may be in hundreds (or) even more. In such cases, deployment is generally dependent on the application as mostly nodes are scattered randomly at an intended area or may be deployed massively in a region. These nodes have a self-organizing mechanism which helps in communicating before they initiate their task & there should be proper survey on each node and their arrangement because all nodes cannot serve requirements of everything.

Environment Constraints: In general MSN operates in a hostile region, which is the reason for the failure of most networks topology. This may alter frequently because of various reasons like the failure of nodes, damages in the intermediate nodes, node disruption or energy depletion. Despite of these, nodes are connected via a wireless channel, which some – times may cause noise, errors in transmission etc. Other reasons like disrupted frequency due to channel fading or signal attenuation.

Diversified Applications: Design of networks in MSN is an application specific. Nodes consist a range of diverse applications which varies significantly on requirements. All the protocols cannot satisfy entire application needs. There are diversified protocols that are to be implemented to meet requirements.

Network Architecture: MSN consists of sensors which are deployed in region of interest. These vary from minimum to maximum. Nodes in network forms as clusters with self-evolution and each cluster will have an individual cluster head (CH). These CH will be connected to a centralized system called the CMC, Fig.2. These CMC forward the commands to CH that are in sensing region which works together for a common task. Meanwhile, the sink or CMC serves as gateway to outside networks, like the Internet.

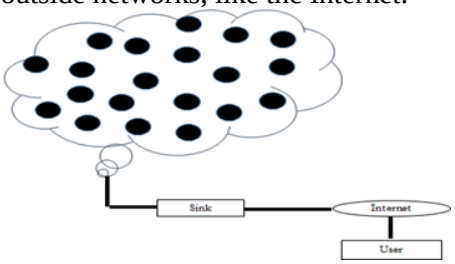

Figure.2. Internal Architecture of Sensor Network

Data routing to sink follows a communication mechanism called the single-hop a long-distance transmission mechanism that leads to a single-hop network architecture, Fig.3. In terms of Power constraint, the long distance transmission is a costly affair. The energy that is utilized for communication is higher than that of a computation and sensing. Furthermore, the energy that is utilized for the transmission purpose, overlooks the maximum amount of energy consumed. Exponentially with the increase of transmission distance, there will be an increase in energy consumption. Therefore, it is required to reduce the traffic and the transmission distance to prolong network lifetime which increase saving energy.

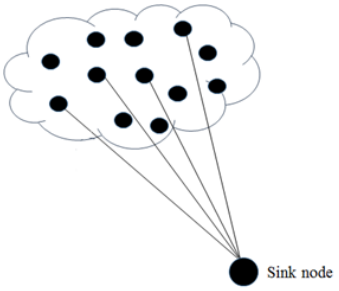

Figure.3. Single - hop network architecture

Lifetime of network can be prolonged, if nodes work efficiently and the amount of traffic that nodes are holding to be controlled. The transmission distance be reduced for individual nodes by implementing the multi-hop short-distance communication. Mostly nodes in network are deployed in order that neighbour nodes are close to one another that makes it feasible to use a short distance communication. In a multi-hop communication, transmission takes place while the nodes come close over a period. This is where transmission takes place between CMC/Sink by utilizing the intermediate nodes. Different protocols for routing are proposed whichever be deployed to overcome various issues in the MSN.

Routing Protocols:

LEACH (Low – Energy – Adaptive – Clustering – Hierarchy): in (Heinzelman, 2000) stated an adaptive – clustering – protocol based on technique called randomization. This technique helps in distributing energy to nodes exist in cluster of a network. There are few assumptions that are made in LEACH protocol. a) Routing the data in LEACH assumes that it has adequate power in nodes across the network, where all nodes routes with same amount of power that helps to reach the CMC. b) Supports different MAC protocols and look after the individual node to inherit computation power. c) Nodes have a correlated data that are located corresponding to each other. Basing on

LEACH, CMC is fixed which is far from the nodes. This may vary as the size of network changes. LEACH Fig.4, is a homogeneous energy constrained protocol. Nodes in network are prorated to clusters. Each cluster will be having a CH which sinks data from nodes in that cluster and route data to CMC. This protocol at random attains the high-energy cluster-head so that the resources are equally shared among the nodes. Data fusion a compression technique where data is routed from the CH to CMC which reduces the dissipation of energy and enhances the networks lifetime.

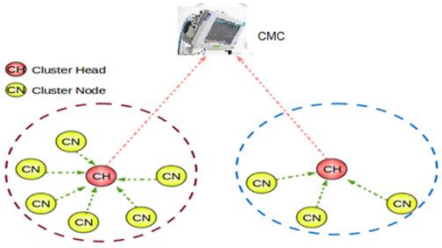

Figure.4. Leach Protocol

TEEN (Threshold – Sensitive-Energy – Efficient – Sensor – Network): Manjeswar (2001), stated a Cluster-Head hierarchical routing derived from LEACH protocol. This protocol can be used in critical time applications. The following are the two assumptions in TEEN: It is assumed that nodes in cluster and the CMC are having the same amount of initial energy. The CMC has a potential to route the data over the nodes which sense the path continuously to see that there will not be any loss of data while transmission. TEEN comprises of simple nodes with CH's as first-level and second-level. This adapts the strategy of LEACH which helps in forming clusters. In first level of CHs are formed at lower level and second level is formed near to CMC. CH routes data of two types to neighbours which are called as Hard-Threshold (HT) and Soft-Threshold (ST). In hard threshold, if Threshold value is minimum and the attributes sensed are in range of interest, while soft threshold (ST) on the other hand transmits data if threshold value ranges from minimum to maximum, a small changes in value of attribute will not allow data to get transmitted in the soft threshold.

APTEEN (Adaptive Threshold TEEN): Manjeswar (2002), stated an advancement to TEEN that has the DNA of TEEN. APTEEN was implemented as an advancement in hybrid networks which capture the data periodically and reacts to time - critical events. APTEEN supports following parameters: Analyses of historical values. a) Contains an overview of current networks. b) Monitors persistent events over time period. The CH in APTEEN broadcast the following parameters in each round when it is decided: a) Attributes to be maintained by an individual node. b) Thresholds to be followed to route the data. c) Scheduling time - slots for the nodes (TDMA). d) Time counter is the time between any two succeeding reports that are sent by a node which is maximum. Nodes in APTEEN will be ideal over a period of times when nodes has data by no means to transmit. This help nodes to reduce energy consumption. APTEEN belongs to a hybrid routing protocol, it emulates a proactive or a reactive network threshold value dependent and time count. The nodes senses their surroundings continuously and then stores sensed data for transmission. If nodes in cluster comes closer then they start exchanging the data. a) The APTEEN does not focus on Prior mechanisms like the contentions in link and mobility - factor. b) Mobility causes the link failure which is the major drawback in MSN's can be overlooked by APTEEN. c) Use a selective and prioritize forwarder list algorithm to handle node - mobility factor.

PEGASIS (Power – Efficient – Gathering – Sensor – Information – System): Stephanie Lindsey (2002), stated that PEGASIS the nodes will have information about the corresponding nodes. Each node is capable in transmitting data to CMC. This also assumes that nodes in network contain the same chunk of energy and these may stop their function at a time as they are with the same amount of energy. A greedy algorithm is used in constructing chains. Chain creation starts at nodes which are far from CMC. Individual nodes transmits & receives the data that is carried by the closest nodes of their neighbours. Closer nodes are located by measuring distance from the corresponding nodes by using signal strength. A node (leader) from the chain will be chosen & transmits aggregated data to CMC from that (leader) node. Nodes which are closer forms as chains and forms path to CMC. PEGASIS outperforms the LEACH protocol by eliminating dynamics of cluster overhead and cluster information which minimizes the distances and limits number of transmissions. Each sensor requires information of entire network so that PEGASIS takes care of entire network.

SPIN (Sensor – Protocols – for – Information – via – Negotiation): Martorosyan (2008), stated that it belongs to adaptive routing. This protocol uses a resource-adaptive and negotiation data algorithm. SPIN belongs to Data – centric – protocol for routing as the hierarchical routing which assumes that nodes in network will be as CMC. Nodes with the Close proximity will be having similar data. Major idea behind the SPIN protocol is it names the data packets with a high- level descriptors. Nodes in network assumes that CMC as a centralized station and the information will be broadcasted to nodes by CMC. The users can request any node and get the appropriate information. Before transmission, the exchange of data is done between the nodes (Meta - Data - Negotiation) by broadcasting an

advertisement so that this reduces the transmission of redundant data. Once data is received, nodes broadcasts advertisement packet to neighbour nodes and interested nodes get the data by a request message.

Spin don't specify the format of meta-data as it is application dependent. Problem of flooding is solved by Spin which helps in achieving the energy efficiency. Three messages are used by the spin to communicate: they are Advertisement, Request, and Data. Data is the actual message. Request to request for data, Advertisement for advertising a new data. The advantage of the spin protocol is that it addresses changes in topology of network, thus provides an energy saving mechanism to the meta-data negotiation and reduces the flooding. SPINs mechanism called as the advertisement of the data which doesn't guarantees delivery of data.

4. CONCLUSION

MAPTEEN protocol still contains some drawbacks like the node mobility factor, which creates the disruption in network. This leads to retransmission and causes congestion in the network as the retransmission and the congestion are interdependent. If this problem of retransmission persists, nodes in patient's body have to consume to power which results in high radiating frequency that effects the health. To over come these issues a dynamic node mobility mechanism and WTCP can be implemented in future work as a project for the protocol so that there might be a chance of overcoming issues in MSN.

REFERENCES

Design of a Secure System for Reading Patient's Data Using Medical Sensor Networks. Radhika Rani Chintala, Madava Rama Narasinga Rao, Somu Venkateswarlu published in Journal of Chemical and Pharmaceutical Sciences, 10 (1), 2017, 673- 679.

Hamid Barati, Ali Movaghar, Ali Barati and Arash azizi mazresh, A Review of Coverage and Routing for Wireless Sensor Networks, world Academy of Science,Engineering and technology, 2008, 37.

Heinzelman W, Chandrakasan A and Balakrishnan H, Energy–Efficient Communication Protocol for Wireless Micro sensor Networks, in Proceeding of the 33rd Annual Hawaii International Conference on System Sciences (HICSS), Big Island, USA, 2000, 3005-3014.

Kulik J, Rabiner W, Balakrishnan H, Adaptive protocols for information dissemination in wireless sensor networks, in, Proceedings of the 5th Annual ACM/IEEE International Conference on Mobile Computing and Networking (MobiCom_99), Seattle, WA, 1999.

Manjeswar and Agrawal D.P, APTEEN, A Hybrid Protocol for Efficient Routing and Comprehensive Information Retrieval in Wireless Sensor Networks, 2nd International Workshop on Parallel and Distributed Computing Issues in Wireless Networks and Mobile Computing, 2002, 195-202.

Manjeswar and Agrawal D.P, TEEN, A Protocol for Enhanced Efficiency in Wireless Sensor Networks, 1st International Workshop on Parallel and Distributed Computing Issues in Wireless Networks and Mobile Computing, 2001, 189.

Martorosyan A, Boukerche and Richard, Nelem Pazzi W, A Taxonomy of Cluster-based Routing Protocols for Wireless Sensor Networks, Paradise Research Laboratory, University of Ottawa, Canada, 2008.

Qiangfeng Jiang, Manivannan D, Routing Protocols for Sensor networks, IEEE, 2004.

Stephanie Lindsey and Cauligi Raghavendra S, PEGASIS, Power Efficient gathering in sensor information systems. In Proceedings of IEEE Aerospace Conference, 2002.