Location Error and Energy Consumption issues and Solution in WSN: A Survey

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Abstract-The sensor nodes are very effective to monitoring the information and also possible to work independently without any support of any authority. WSN have completely different characterized with denser levels of sensor node deployment; sever power, computation, higher undependability of device nodes and memory constraints. The harsh energy constraints of large range of densely deployed sensor nodes requires a set of network protocols to implement various network control and management functions like node localization, synchronization and network. In this paper we actually present the survey on WSN network related to location information and error issues with energy consumption factor. The less energy of sensor nodes is shows weak signal strength that means having weak Received Signal Strength (RSS). If the signal strength of nodes are reduced that means the nodes have insufficient energy. In this research we proposed the Location based RSS scheme to improve energy utilization. If the node/s having sufficient amount of energy then their signal strength is high. The Location records of sensor nodes are provides the information of location that's why routing efficiency is improves and also the energy consumption is reduced. The proposed previous method is try to improves the energy utilization and also the residual energy cost is maximum after complete simulation.

Keywords:-RSS, Routing, Location, AIES-RSS, Energy, proposed RSS, WSN,

I. INTRODUCTION

WSN (Wireless Sensor Network) consists of sensor nodes deployed in a structured or unstructured manner over a chosen area of interest. Wireless sensor networks are made of many small sensor nodes. Each node can send messages to sink through the network or controlling device. The nodes can forward messages to other nodes to perform network organization tasks and other functions [1].A typical sensor node consists of a power unit, radio, sensing unit, and a processing unit [2]. Networking these nodes presents several challenges due to device constraints, e.g. limited computational capability, energy, data storage and communication bandwidth. As sensor nodes operate on limited battery power, energy usage should be considered in WSN [3]. A node in a wireless sensor network (WSN) is a small embedded computing device that interfaces with sensors/actuators and communicates using short range wireless transmitters [2]. These sensors with different capabilities such as sensing, wireless communications and computation. These sensor nodes communicate over short distance via a wireless medium and work together to achieve some common tasks such as environment monitoring, military surveillance, and industrial process control.

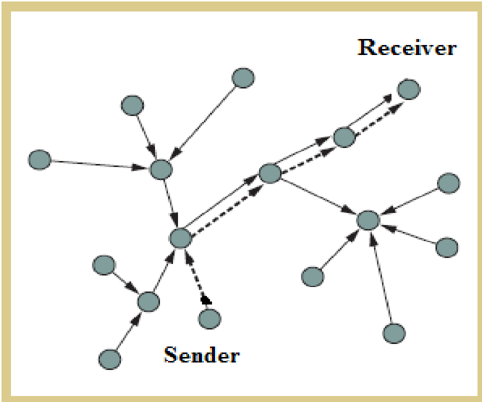

Fig.1 Wireless Sensor Network

These nodes are acts independently but cooperatively to make a logical network in which data packets are routed hop-by-hop towards collector nodes, typically called sinks or base stations. A WSN comprises a potentially large set of nodes that may be distributed over a wide geographical area, indoor or outdoor.WSN facilitate various sensing and examine services in areas of vital significance such as efficient industry manufacturing, safety and security at home, and in environmental monitoring and traffic handling. When a sensor node is depleted of energy, it will die and disconnect from the network which can significantly impact the network performance. WSN nodes lifetime depends on the number of active nodes and connectivity of the network, so energy must be used efficiently in order to maximize the network lifetime [2, 3]. The size of the network varies with the monitored environment. In WSN for indoor environments, smaller amount of nodes are required to form a network in a restricted space whereas outside environments may entail more nodes to cover a larger area. A message sending by sender in the network by being transmit from one node to another node until it not reaches its destination (multi-hop communication). Since the nodes are moving, the network topology regularly changes and so finding a delivery path to a destination is a challenging task [4].

The best example is the use of sensor networks for safety industrial applications [5]. This network may employ sensors to find the presence of dangerous materials, and also provides the early detection techniques and identifies the leaks of chemicals or biological effects prior to extreme loss which can result in public. The wireless networks uses the various routing protocol in distributed fashion, they have different path for routing, and can be maintained and healed by itself for further issues, they also resilient in an explosion or extreme inflicted loss to the industrial application, which provides public trust with critical conditioned data inside the hard constraints. The operations which are not processed due to consistently small sizes, sensor nodes are always at higher risk of being captured physically and having their compromised security in the network. The power of sensor nodes is not replaceable and the nodes consist of less battery power. Reducing the energy consumption for data transmission and security for transmitting the information through sensor nodes are very essential in wireless sensor network.

II. CHARACTERISTICS OF WSN

In comparison to common wired or even today's wireless networks, Wireless Sensor Networks (WSNs) have certain characteristics that make them unique in terms of their offered features, but also in terms of the provided targets for adversaries. For that reason, the technical and architectural characteristics of WSNs are highlighted in the following section covering, on the one hand, the constraints of single sensor nodes and, on the other hand, the constraints of the overall WSN topology. Concluding, security considerations for the network layer in WSNs resulting from these characteristics are discussed in [1, 5]. The constraints [6] are discussed below:-

A. Sensor node constraints

1) Memory limitation

The memory built into a sensor node is usually rather small (few KB). However, in general, about half of the memory is already used by the sensor's operating system. Among the most common OS for WSNs are TinyOS, Contiki, MANTIS, THINK, microC/OS-II and nano-RK. All further things, such as executable program code, buffered messages, routing tables etc. have to fit into the remaining memory.

2) Computational limitation

Also the computational power of the sensor nodes is severely constrained due to cost and energy-saving considerations. For that reason, most of the sensor nodes utilize weak processors with a clock rate of 4–8MHz such as Atmega128L or MSP430. Nevertheless, depending on the application area, in some cases, sensor nodes operate from stronger processors with a few hundred MHz, such as Strong ARM or SH4, though at the expenditure of a shorter life time of the nodes.

3) Power limitation

A sensor node has to economize with the shipped battery, i.e. the supplied energy must outlast the sensor's life. This is resulting from the fact that the sensor's battery can neither be replaced nor recharged, once deployed in a difficult to access area or hostile environment. The energy of a sensor node is consumed by mainly three essential components: the sensor unit, the communication unit and the computation unit. Because of the limited energy reserves, energy is often one of the primary metrics in WSNs routing algorithms [2]. Many operating systems for WSNs provide certain features to preserve energy.

4) Transmission range

To minimize the energy needed for communication it is very common that sensor nodes use a rather small transmission range. This results in the necessity of using multiple-hops to transfer data from a source to a destination node through a large network.

5) Physical accessibility

In comparison to wired networks, in which an attacker has to pass several physical lines of defence, such as gateways or firewalls, in WSNs an adversary can easily attack nodes because there are mostly deployed in an unprotected environment. Also additional physical threats, such as weather and radiation, can disturb the network.

B. Network constraints

1) Deployment uncertainty

Sensor nodes are normally deployed randomly and dynamically, i.e. there is no prior knowledge where the nodes will be located after their deployment and which node will be adjacent to which other nodes. However, after their deployment the sensor nodes should be self-organizing and self-configuring without further operator intervention.

2) Use of wireless links

The transfer in WSNs is not reliable because of the use of the wireless broadcast medium. In the wireless broadcast medium interferences can occur caused by environmental influences, adversaries or due to packet collisions. Furthermore, the communication between nodes is not limited on a peer-to-peer base, instead each packet is receivable for every node within the transmission range.

3) Latency

The packet-based multi-hop routing in WSNs increases the latency due to congestion in the network and the additionally required processing time. Besides, the routing process in WSNs is often causing delays: for example, if a routing algorithm uses different paths between a source and a destination to distribute the energy load, not always the shortest path is used so that additional delays are predictable.

4) Remote management

Due to the application area of sensor nodes in unattended environments, the sensor nodes have to be managed remotely after their deployment. For instance, in a military scenario, in which the sensor nodes are placed behind enemy lines for reconnaissance, no direct access will be possible after deployment.

5) Network partitions

In a randomly deployed WSN it can happen that the network is divided into several sub-networks, so called network partitions, which are not able to communicate with each other. This issue can also occur after the deployment, if certain nodes are destroyed, run out of energy or move out of range.

III. PROBLEMS IN NODE LOCALIZATION IN WSN

Problem of node localization and positioning in a sensor network is resolved if each node is provided with a GPS device. However, in the case of sensor networks, this is not a feasible possibility for variety of reasons [7] such as:

- ✓ GPS receiver and the protocols used are not designed to be energy economical or energy aware. within the case of sensor networks, energy is a scarce resource and therefore the sensor nodes is also deployed without any kind of battery being replaced for many years. Therefore, GPS devices are not appropriate for the solution of localization problem in wireless sensor networks. It is, still, attainable that beacon nodes that constitute only a fraction of the entire number of nodes are equipped with a GPS device so that these can serve as reference nodes for other nodes to resolve the matter of their position awareness using the localization algorithmic rule.
- ✓ GPS devices are rather more expensive. If these are added to each sensor node within the network somehow, price of deployment might increase to an extent thus on render the sensor network solution impracticable for a specific problem.
- ✓ One of the specified properties of detector nodes is that these ought to be of very tiny size. With the addition of GPS device, the scale of sensor nodes would become quite large that again violates one of the first requirements of a sensor node.
- ✓ GPS devices depend on satellites for their functioning. In cases or under circumstances when no satellite link is available, GPS ceases to function. In sure applications, this really is the case e.g. indoor applications and Mars exploration.
- ✓ Due to the above reasons, GPS devices are unremarkably used only in a very fraction of nodes which function reference nodes to resolve localization drawback of alternative nodes. Such nodes also are referred to as beacon nodes. As an alternative, it's attainable to avoid use of GPS altogether by positioning a couple of nodes at fixed points so that their position is understood a-priori in order that these nodes can function beacon nodes.

IV. WSN ROUTING PROTOCOLS

A Sensor Network consists of many nodes. Knowledge packets on transit normally tolerate many nodes before eventually reaching the destination. Routing is that the act of crucial the trail to be followed by a packet so as to achieve its desired destination. To do this, variety of things got to be taken into consideration. Routing protocols takes charge of this method. Quite a variety of protocols [8, 9, 10], e.g. DSDV, AODV, DSR and TORA are planned for ancient ad hoc wireless networks. However, they're not suited to the distinctive options and application needs of WSNs. the planning of routing protocols for WSNs may be a difficult task that has been within the focus of the device network analysis community within the recent past [8]. WSN routing protocols has been planned. The planned protocols show a high selection that stems from the various needs of the varied unreal application situations. First of all, links in WSNs are usually unreliable and not stable as a consequence of the low transmission power, the chip antenna style, and also the indisputable fact that the nodes are usually placed arbitrarily distributed on the base.
Moreover, link breaks is also caused by e.g. asynchronous sleep times, interference, moving obstacles, energy exhaustion, node failure or quality. Thus, the topology of the network changes often that represents a difficult downside for the routing protocol style since the device nodes also are terribly restricted in their process power and memory.

C. Classification of Routing Protocols

Broadly speaking, most of the routing protocols may be classified consistent with the network structure; as flat, gradable or location-based. Further, these protocols may also be classified consistent with operation mode; multipath-based, query-based, negotiation-based, QoS-based, and coherent-based [9]. Routing protocols that are designed for mesh and ad hoc networks are sometimes classified consistent with the method they establish routes within the network [10]. This type of classification is additionally terribly practicable for WSN routing protocols. There exist 3 totally different classes. The primary one is named proactive. Proactive protocols try and establish and maintain routes before they're required. The second class is portrayed by reactive protocols that follow the contrary approach wherever routes are solely established or computed on demand. The last cluster consists of hybrid protocols that mix the ideas of reactive and proactive route institution.

V. LITERATURE SURVEY

The number of solutions are proposed by different authors are mentioned below.

Sudha H.Thimmaiah, Dr. Mahadevan.G in [11] proposed a RSS (Received signal strength) based localization technique and also proposes an adaptive information estimation to reduce or approximate the localization error in wireless sensor network. Direction and information comes both from dimensions made between pairs of nodes and a subset of nodes that know a priori their bounds. An infrastructure self-calibration estimator calculated the unknown nodes bounds. Let consider, distributed clock synchronization in an infrastructure could be accomplished by nodes perceiving pair-wise timing offsets when just a small number of devices are synchronous.

Swagatika Bohidar Sasmita Behera Chitta Ranjan Tripathy in [12] proposed the survey of Localization error minimization i.e. one of the most important subject in WSN because the location information is typically useful for coverage, deployment, routing, location service, target tracking and rescue. Although GPS is an important tool in localization for military, civil & commercial users, the greatest disadvantages of these techniques are:-

i. High cost in terms of both hardware & power refinement,
ii. Weak performance in case of indoor or under dense foliage,
iii. Non-availability of GPS signals in confined environment prevent their use in large scale sensor networks.

RSS use a theoretical or empirical model to translate signal strength into distance.

In previous approaches can derive a high performance in terms of energy consumption, there still exist some problems; that is how to take the energy saving into the localization problem. How to balance energy consumption and localization accuracy is also a difficult problem. To solve these difficult problems they [13] proposed a multi-objective optimization algorithm that balances the tradeoff between the energy consumption and positioning accuracy. We adopt an advanced version of the Non-dominated Sorting Genetic Algorithm called NSGA-II to minimize the positioning error and effectively allocate the transmit power of the anchor nodes at the same time. The problem is formulated as multi-objective functions optimization problem with constrains of decision variables.

Navpreet kaur Sukhwinder singh Sran Lakhwinder kaur in [14] proposed the protocol that select path for routing that is based on the location and residual energy of nodes. The contribution of this paper is twofold. First, the location and residual energy of sensor nodes are considered to make the decision for the route using greedy forwarding mechanism. It jointly makes routing decisions which provide paths having good residual energy and provide positive advancement towards the sink. Secondly, The Multiple- metric path evaluation module is used to select the best possible path from the paths selected by path formation phase. It uses metrics such as residual energy of the path, second minimum residual energy of the path, bandwidth, next hop id etc. The push back module allows the path forwarding mechanism to route packets around connectivity holes. This algorithm checks for all nodes whose residual energy is nearly zero and declares them as dead nodes. It then forwards this information to path formation module.

L. Buttyán, P. Schaffer in paper [15] proposed Position based aggregator node election protocol (PANEL). Isin this scheme geographical position based algorithm is which uses location of nodes for determining the nodes aggregators. The whole network is divided into number of geographical clusters and for each cluster; a reference point is calculated in reference to the bottom left corner of cluster. Then that node is selected as CH which is closest to the reference point. Transmission can be intra-cluster or inter-cluster. Most of the data aggregation algorithms are synchronous in nature, but PANEL has the advantage to support asynchronous applications also. However the infrastructure cost of this algorithm is high due to requirement of special hardware and software for implementation on the basis of geographical knowledge of nodes.

The work [16] presents a survey with its focus on the scalability of routing protocols. It classifies them according to motivations such as control overhead reduction, energy consumption mitigation, and energy balance. The work [17] gives an exhaustive overview of intelligent routing protocols. It first defines network lifetime in three aspects. Then, it categorizes the protocols based on such algorithms as reinforcement learning, ant colony optimization, fuzzy logic, genetic algorithm, and neural networks. It also highlights the performance analysis results and applications of each surveyed routing protocol.

A. Woo and D. E. Culler in [18] proposed the concept that the application layer itself also introduces phase shifts. While jittering at the data-link layer aims to cause small transmission variations between neighboring nodes, we think, that phase shifting at a higher layer can be achieved on a larger time scale. To handle buffer based congestion (packet drops due to buffer overflow) one may employ the other two methods:-

i. Traffic control

ii. Resource control as these would help in emptying the buffers of intermediates sensor nodes.

It is possible to have more than one types of congestion occurring at the same time.

In LEAR [19], each node sends its location coordinates to its neighbors. The location information that has been used in LEAR algorithm could be extracted from devices such as Global Positioning System (GPS). Each sensor node in this geographic area begins make its routing information table based on the distances to its neighbors. As in other routing algorithms, each node makes a decision about forwarding the message to the selected candidate. If the sensor node holding the data decides not to send out it to a given applicant, the following applicant is chosen from the record and a new decision is made. A node makes a decision about the transmission path based on the location of its neighbors. Once the distance vector is constructed for each sensor node, it compares the localization of the next hop destination. The source node propagates its message to the neighbor which has the shortest distance to its location. In LEAR, sensors are deployed randomly in a clustered geographical area. Each cluster having a random number of sensor nodes based on their original locations in network. Clustering or hierarchical routing protocol are proposed to produce an efficient energy aware algorithm for sensor networks. Energy aware concepts should be taken into any design consideration. Each sensor node is driven by its battery and has very low energy resources. This puts together energy optimization principle more complex in sensor networks because it involves not only decreasing of energy consumption but also extending the life of the network as much as possible. This can be prepared by having energy awareness in every phase of design and operation. For this purpose, Enhanced Greedy Forwarding (EGF) algorithm is selected to be the core of LEAR protocol. Most of the accessible geographic routing protocols create use of greedy routing to frontward packets from source to destination in WSN.

In this paper [20] proposed the network level energy preservation protocols and algorithms. In this paper we are concern about CH selection schemes and discuss some of the associated schemes. In clustering, only CHs need to communicate with the sink node via multihop communication. The CBER employs the self organization technique for routing and clustering of WSNs. Furthermore, here a network of homogeneous sensor nodes is considered. In the proposed scheme, each node of network has to carry out the basic task of sensing the field parameters, form data packets, and converse with the cluster head. Clustering in WSN means partitioning nodes in network into different clusters. The network model considered in this paper is a hexagonal structure with source nodes and sink node. Sink sensor node is stable and permanent for each simulation network. WSN nodes are homogeneous in nature, are dispense with a inimitable identifier and have same potential. They are able to function in an active or sleeping state. Sensor nodes can use transmission power control to transform the amount of power transmitted according to the distance of the receiver. In the CBER scheme, nodes distribute information about the present energy state with simply its next hop neighbors.

This research [21] is aimed to design a new energy efficient routing protocol, namely, Position Responsive Routing Protocol (PRRP), to address the energy issues in WSN and specifically to enhance the energy efficiency in WSN. The main involvement of PRRP is the original way of selecting the cluster head (CH) in Sensor Network. In evaluates to the existing protocols such as LEACH and CELRP whereby the CHs are chosen randomly among all nodes based on their individual enduring energy, in PRRP we considered different parameters such as distance from the sink node, energy level, and the usual distance of neighboring nodes from the candidate CH node. PRRP differs from existing protocols such as LEACH and CELRP in many ways. This research assumes that nodes are aware of their geographical locations in WSNs using GPS or some other cost effective location. It is considered a randomly uniform distributed WSN where nodes are distributed randomly in a sensor field based on a grid format. The static sink is located in the center of the network. The sensor nodes in the network are divided into different groups of clusters on both side of the sink.

VI. CONCLUSION AND FUTURE WORK

Wireless Sensor (WSNs) is eminent from other wireless networks or wired network by many features. First of them is mobile nodes in WSNs can moves freely in the lack of a fixed infrastructure unit. In this survey the different issues and the main problem of energy and location is focus. The different factor are affected the WSN performance and due to these factors the precious resource energy consumption is enhanceed. The nodes are mobile and by that the link in between sender to receiver is rapidly changes i.e. the main cause of topology failure. Another one is nodes in WSNs has limited resources such as energy or power, limited bandwidth, and nodes computational power and WSNs have no trusted centralized authority. Routing protocols got to perform numerous tasks that are freelance of the route institution procedure, the network structure and also the protocol operation. The subsequent four tasks are necessary for each routing protocol so as to determine routing practicality.

Through this survey we identified that the actual location of any sensor node is not possible to find correctly, if the node is mobile. Then in future we proposed the location based energy efficient error minimization technique to improve network life time and may be reduces the location error problem. The location information of nodes is received by sender to send data at accurate position of destination. The all nodes are maintaining the location information and these nodes are also update the location information according to the change of link is network. The proper energy consumption is necessary for improve the life of nodes and also life of network.

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