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Survey on Transfaulty Behaviour of Nodes in Wireless Sensor Networks

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Abstract— Unattainable environments are monitored by low-power Multi-functional sensor nodes of WSN. Wireless Sensor nodes are capable of sensing, computing and communicating the happenings in the environment. Whenever an area monitored by wireless sensor networks, is exposed to radiations or electromagnetic waves, sensor nodes will be deactivated or damaged. Then nodes are temporarily isolated. This leads to the formation of the holes of dynamic nature and also functionality of WSN components will be stopped. Thus it has consider as transfaulty behavior of nodes in WSNs. This paper reviewed the existing systems in highly structured manner related with transfer of communication mode to work in radiation-prone environments and continue to communicate between sensor nodes to identify the better route to reach destination. so as to avoid work load of each node in finding route, to avoid drain of cluster head energy, and to reduce the amount of the data which will forwarded from cluster to base station for reliable data transaction during transfaulty behavior of nodes. In order to understand the factors related, here survey of several research approaches have been analysed and presented to give a best mechanisms for avoiding communication failure due to explosion of radiations in the area monitored by wireless sensor networks.

Keywords— Acoustic communication; RF communication; Wireless sensor Networks

I. INTRODUCTION

Potential Revolution in the Wireless sensor networks (WSNs) led to have different designs for hostile environments with tiny devices for sensing, computing and communicating facilities [3]. Sensor nodes are deployed to operate in the area to sense the physical environmental parameters and send that data or information to the base station through wireless communication. Wireless sensor Nodes sense the hostile environment surrounding and send the sensed data to sink through single-hop or multi-hop transmission to the base station for making further decisions. WSN usually will be affected by unexpected problems like explosion of radiation or due to electromagnetic waves. In such situation, Node outage will be created. Sensor nodes will stopping to giving its services and stopping from its usual activities. Unattainability on receiving of collected information and creating loop holes for other type of attacks on the network. Each node in a WSN will be available with low power [1], so energy source of the sensor nodes are drained. In such a situation, sensor nodes exhibits a behavior has transfaulty node. That is, transfaulty node sense its physical environment properly but fails to transfer and communicate with its neighbors in efficient way due to the failure of communication between the effected nodes [2,10-12].

When there is no communication damage in the sensor nodes of wireless sensor networks, nodes communicates its neighbor nodes through radio frequency mode. But when a problem occurs due to explosion of radiation or due to electromagnetic waves, in such a situation, nodes has to communicate in acoustic mode. Sensor nodes will be sensing and will be communicating with the neighbor and transferring the data. The removal of the transfaulty nodes from the affected system cannot be the decision and it is not so easy in remote areas. The resumption of favorable condition helps in the sensor node behaves normally. This paper, reviews of several researcher approaches to give best mechanisms for avoiding communication failure, improve the network life time, utilize the energy of nodes in efficient way, avoiding data loss in explosion of radiations in the area monitored by WSNs [4-9, 20, 22]. Also work related to review survey here is organized as follows, the section 2 about application, the section 3 is literature review of several authors' approaches, section 4 presents discussion about the literature and the section 5 gives conclusion depending on the analyzing.

II. APPLICATION

Wireless sensor network which implemented with the functionality of collecting the data about its environment such as

temperature, humidity, fire detection. These kind of functionalities are used in the applications such as habitat monitoring, forest fire detection, environment monitoring and etc. In these kind of application 'N' number of sensor nodes are randomly deployed in the network area. Each wireless sensor node is responsible to collect the information or data from its covering area. Once data about the environment is collected then they have to forward them to sink node or base station.

Table 1.Characteristics and features of sensor networks

Characteristic	**features**		
Sensors	***cost***	***low***	Hostile environment is deployed by hundreds or thousands of sensor nodes for monitor the surroundings and sense the physical environment to measure the changes. Cost of the sensor node must be reduced to low cost as possible, because requirement is more in the whole network.
	Size	***Small***	Sensor nodes are small in Size. Sensing the environment with the restricted range of distance. Because of its smaller size energy is limited hence that makes the low communication capability. e.g., micro-electro mechanical systems
		Large	radars, satellites
	Type	***Passive***	By active probing Sense the data without manipulating the environment. They are self-powered; that is, only to amplify their analog signal energy is needed. e.g., acoustic, seismic, video, IR, magnetic
		active	Require continuous energy from a power source and actively probe the environment, for example, a sonar or radar sensor, ladar.
	Composition	***Homogeneous***	same types of sensors
		heterogeneous	different types of sensors
	Dynamics	***Stationary***	Wireless Sensor nodes are static. Topology of the network does not change. e.g., Seismic sensors
		mobile	Moving nature, Physical topology of the network does changes. E.g. robot vehicles
Interest of sensing entities	***Extent***	***Distributed***	Distributed uniformly or randomly. Each node is capable of collecting, sorting, processing, aggregating and sending the data to the sink. e.g., environmental monitoring
		localized	Need to detect the presence of an object in its surrounding area within the range, movement is predicted and alert the sensors which are close to the predicted path of the target. e.g. target tracking
	Mobility	***Static***	fixed
		dynamic	Usually WSN are dynamic network. Due to battery exhaustion the sensor nodes are fail then this leads to the communication channel can be disrupted as well as the additional sensor node may be added to the network. Network topology is frequent changes Thus, the WSN nodes have to be embedded with the function of reconfiguration and self-adjustment.
	Nature	***Cooperative***	In an unattended and hostile environment Sensor nodes are deployed in an unknown fashion. The nodes are have the capability of organizing themselves. The sensor nodes have work in collaboration to adjust themselves to the distributed algorithm and form the network automatically. e.g. air traffic control
		Non-cooperative	e.g. military targets
Communication	***Networking***	***Wired***	
		wireless	
Processing Architecture		***Centralized***	central site receives sensed information from the nodes
		distributed	located at sensor or other sites
		hybrid	Consist of wireless networks and wireless sensor networks. Where transmission range and data rate are quite limited in conventional sensor network. That limitations is overcome by Such networks.
Energy Availability		***Constrained***	Energy will be used during computation, communication and storage in WSNs. In communication Sensor node consumes more energy compare to any other operation we do not have any option to recharge when the power run out. Hence, power consumption in the design phase will be consider mainly in the protocols and algorithm development.
		unconstrained	Energy availability unconstrained in large sensors
Communication mode		***Radio frequency***	Normal situation
		acoustic	When at the radio transceiver fails to work due to abnormal situation
Computational power			Limited.

III. LITERATURE SURVEY

Energy which are be radiated or transmitted in rays or waves pattern will affect the network communication. It will also be affecting the successful operations of the nodes, creates transfaulty behaviour in node and faults in sensor nodes, more energy consumption and difficulty in connectivity will be occurs in wireless sensors networks. Some of existing works, address all these problems in WSNs.

Pushpendu Kar and Sudip Misra [3] deliver the facts concerned to effectively transferring of sensed data by applying dual modes RF and acoustic in WSN. Using acoustic mode, during communication failure, establish the connectivity in network. Indicated the data extraction process and reduce information loss when radiation effect has taken, but energy usage is more during network operation because of the receptions of control messages and increase in the number of transmissions.

Steven S. McClure et al [10] proposed a mechanism its effect on the electrostatic force that is by dielectric charge trapping. In this work, found that use of GaAS MEMS devices in radiation effects. Proper design techniques may be eliminated when, if such effects is present. RSC switch configuration used to demonstrate. In space or nuclear radiation environments this type devices are recommended to use in systems prior to effects of radiation.

H.R. Shea [11] realized that communication failure will be taken between the nodes because of the affection of space radiations. The node sensing capability is affected by this. Piezoelectric sensors continue to sense the environment in the presence of radiation. In the presence of radiations erroneous data may be sensed by other sensors.
Vladimirova et al. [13] recognized that jennic motes cannot continue the work in electromagnetic interference after 2.415 GHz. Observed that radiation exposure is harmful to motes and will causes poor transmission, connectivity failure and other functionalities.

I. F. Akyildiz et al. [14] discussed that Acoustic mode communication plays a vital role in error-prone sensors, limited battery power, propagation delay limited bandwidth, impaired channel. Provide an alternative way of communication among the motes and recognized that acoustic communication can be used as an out-band communication channel in WSNs When radio transceiver fails to work.

Dini et al. [15] focused a repairing method for establishing a link between a communication failure networks by using mobile sensor nodes. Information can be send from one node of a partition to another node in partition or to base station through mobile sensor nodes. Finding proper position and considers the permanent node isolation problem but not considers the communication link failure due to temporary node isolation problem.

Senel et al. [16] using the minimum spanning tree algorithm provides spider web based method to connect communication failure network using deploying relay nodes. Discussed about isolation of node in permanent situation. They are not discussed temporary node isolation occurs by external environ-mental factors.

Liansheng Tan and Mou Wu [17] delivers the hierarchical Least-Mean-Square (HLMS) adaptive filter. Which is a workable data communication scheme. This techniques conclude the measured values both at the source and at the sink. Nodes are finally needed only to send those readings that deviate from the prediction. In this data reduction strategy data send from each node is reducing power savings. When failure of link between any two nodes presents in a WSN, then actual reading will be missing in sink and in that situation failure of the pre-diction approach will be taken place when prediction error exceeds the specified threshold.

Cesare Alippi et al. [18] Instead of considering data acquisition and processing data which Consumes less energy than energy utilization for communication techniques. Proposed an Adaptive Sampling Algorithm for sensors that estimates optimal sampling frequencies. To minimize the energy consumption of the sensors and also of radios by maintaining and considering high accuracy in collected data, it design the adaptive measurement systems.

J.Praiseline Karunya and T.Aruna [19] to achieve the balanced energy consumption among the nodes within the cluster, network configuration scheme is proposed to improve the network lifetime. Considers rotating cluster head based on adaptive cluster head rotation algorithm. In their method only remaining energy is used to elect the head node among the nodes within the cluster for the balanced energy consumption.

Mao Ye et al. [21] for periodical data gathering applications authors evaluate and proposed an energy efficient clustering

methods. A fixed number of candidate nodes will be selected and only residual energy will be consider for selection of cluster heads in the cluster head election phase.

The works discussed in the literature reveals that effects of radiations will causes failures in communication, transmission and working of nodes. Hence feasible synchronous, simple, fast and efficient mechanisms are needed.

IV. DISCUSSION

In many situations radiated energy will causes failure of network communication temporarily, that leads to the increasing of packet loss, delay in sending packets, and consume more energy. Several approaches have been offer in surveyed paper as solutions for different types of problem occurred during radiation attacks in area monitoring by WSNs. That leads to the nodes behave like transfaulty node. Despite the strengths of these techniques, some weaknesses in techniques causes fails in reduction of information loss, reducing delay time and consuming less energy to improve the life time of network.

From [10, 11, 13] realized that communication failure will be taken between the nodes due to the radiation attack. Certain level of electromagnetic waves affects working functionalities of nodes hence nodes are unable to sense and transferred the data properly.

During communication failure due to radiation attack, establish the connectivity in network by mode transferring of senor nodes from RF mode to Acoustic is achieved in better way [3]. But it is not sufficient. Energy usage is more during network operation because of the receptions of control messages and increase in the number of transmissions. Hence feasible synchronous, simple, fast and efficient mechanisms related to routing, clustering, and for data reduction mechanisms are needed to improve the life time of network.

From [14] out-band communication channel in WSNs can achieving by considering acoustic mode. In error-prone sensors, limited battery power, propagation delay, limited bandwidth, impaired channel and also radio transceiver fails to work properly.

In [15-16] focused on permanent node isolation problem but not considers the communication link failure. Due t*o temporary node isolation problem the presence of electro- magnetic or nuclear radiation is temporary. In such situation a sensor node behaves as transfaulty, when it may sense its physical surrounding correctly, but fails to communicate with its neighbours. Due to the temporary failure in communication affected by electromagnetic or nuclear radiation exposure, the sensor nodes behave normally with the resumption of favourable condition. Complete Removal of Node or Temporary Isolation of faulty nodes, using mobile sensor nodes and methods to connect communication failure will not be an efficient solution.

For data communication in efficient way will utilize the hierarchical Least-Mean-Square (HLMS) adaptive filter [17]. This data reduction strategy reducing power utilization during communication but not discussing about link failure between any two nodes occurs in a WSN. In that situation sink will missing the readings. The error exceeds the specified threshold that leads the failure of the approach.

In [18-21] for energy utilization considers communication techniques with in the cluster by considering few parameter like remaining energy to select cluster head and repetition cluster head process to avoid the work load of all nodes and cluster head present in the WSNs. For minimizes the energy consumption of the sensors and radios maintaining and considering high accuracy with less energy. Some parameters are needed to achieve this intention such as less data transmission and minimum utilization of energy of nodes during communication in error prone environment.

In summary, this survey has shown there is no specific mechanism for avoiding packet loss, less utilization of energy for improving the wireless sensor network lifetime.

V. CONCLUSION

Revolution needed in the area of wireless sensor network and wireless communication technology to give the better performance in the field of critical situation environment. When explosion of radiation or electromagnetic waves is taken

place in WSN monitoring area, which will affects the network communication and decreases the life time of network. By the several researchers work get the different views to tackle these kind of accidental events to avoid the communication failure, minimum energy utilization of the nodes to increase the network lifetime of radiation affected environment.

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