International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8 Issue-4, November 2019

Improving Energy Consumption of a Node in Wireless Sensor Networks

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Abstract: ***A node in a Wireless Sensor Networks (WSN) can spend its energy by sending a packet to next node and receiving a packet from other node. A node is having a more number of neighbours. It can lose its energy very quickly when compared with less number of neighbouring nodes. That is intermediate node will always be a transceiver. Most of the time, nodes in the environment spend its energy for sending a repeated data or information. For ex: If any event occurred, single event information is passed to the sink node multiple times. Due to this repeated message, a node lost its energy by sending and receiving the packet to other node. In this paper we proposed an Energy Consumption (ECON) model that will filter the repeated message and it can save the energy of a node. This model will work efficiently in clustered network. Because of this model, the total network lifetime is also increased.***

Keywords : Wireless Sensor Networks, Nodes, Energy Consumption, ECON, sink node, Cluster.

I. INTRODUCTION

Wireless Sensor Network is rapidly developing environment in the area of disaster monitoring, habitat monitoring [1]. The main objective of wireless sensor networks is to provide a data for various applications to make decisions based on the resulting data, highly reliable data collection is of great importance to the network and applications [2, 3].[6] wearable belt which monitors ECG. Generally sensor nodes sense the event from the environment and send the information to the sink node. From a sink node user can access the information. Sensors are mounted in an environment where the human being cannot able to access it. Energy is an important factor of a sensor to transmit the information in proper time. Sensors are of two types 1.event driven 2.time driven. Event driven sensors will send information to the sink node only if any event occurred Ex. Forest fire, tsunami. Time driven sensors will send the information to the sink based on timely manner, for example every one hour Climate condition is monitored. In both type, energy is an important factor of a node.

II. RELATED WORK

[4] Analysed proactive and reactive protocols which provide reliability to wireless sensor network and concluded that proactive protocols are reliable protocols. [5] Smart shirt is proposed. [7] Goodness of the data sent to the sink is measured. [8] Demonstrated where the data delivered reliably in WSN. [9] Compromised node acted as a sink hole can be finding out by the trust model evaluation. [10] Link failure and dead node is detected and eliminated from the network then shortest reliable path is calculated using primitive matrix. [11]Eliminate time delay node and dead node from the network by energy factor and time delay factor function. [12]Even though the sensors are fault tolerant but the quality of the received data should have to be guarantee. [13] Proposed EERN algorithm and introduced vigilant node, it detects compromised node which maintain task-based reliability modelling by just considering processor unit, and defines a reliability index for a task but it will not cover the system reliability perspective.[14] proposed reliability on object oriented software systems using communication variables.

III. PROPOSED MODEL

This model will save energy of a node by filtering a repeated message. This proposed model will work efficiently in clustered network rather than a flat network. Generally, in a clustered network, nodes are grouped into clusters. Each cluster has a cluster head. Each cluster head has a set of sensor nodes. Sensor nodes under the control of cluster head is treated as parent child. Sensor node monitor the environment and it send the information to the cluster head about the event occurred in an environment. Then cluster head can send the packet to the sink node. Each node in the network yields one packet per transmission cycle and the size of the packet is same. Data collection is based on broadcasting. Child nodes sense a data and send data once. If a child node has a multiple parent node then the packet received simultaneously. Successfully packet received by any one of the parent node. Using broadcasting reliability of data collection has been greatly improved compared with ECON model.

Manuscript published on November 30, 2019.
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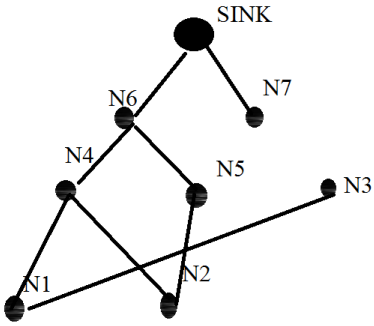

Fig-1 Sensor nodes in the monitoring environment

In the above figure, it is stated that seven nodes are scattered in the environment for monitoring the occurrence of event. In this network there is only one sink node and seven sensor nodes are there.N1 and N2 are a child node for N4 and N5. Then N4 and N5 are child node for N6.N1 is a child for N4 and N3. Nodes like N4, N5, N6 are transceivers, energy of these nodes are most of the time spend on passing the message from one node to other node. When compared with other node energy consumption of these nodes will be less than the other nodes in the network. If the energy of these nodes goes dry means Nodes like N1 and N2 are isolated. To avoid this we are proposed a model called Energy consumption model (ECON). This model can save energy by filtering the repeated messages from child node and other nodes. This can enhance the overall network life time. If the volume of data send or received by a node is reduced then the energy of a node can be saved.

A. ENERGY CONSUMPTION MODEL (ECON)

Parent node receives more than one packet from its child node, owing to similarities between the packets, parent node can generate a smaller packet using ECON model. Parent node is on the top level of the child node. If a network starts working, all nodes start sensing and enter into a transmission cycle. Data transmission starts from the bottommost child node to the topmost parent node.

Generally a parent has a one or more child; same event information is send by the child node to parent. In the same way a single child has more than one parent; same information is received by two parents. Child node and parent node are affected by sending and receiving the same event information.

pi-denote original packet generated by node

pi'-part of the data packet generated by a node with other packet using IA

Ai-data packet generated by node using ECON after node received all the packets sent from its child node.

Node - leaf node and does not receive packets

Therefore it has its original packets

A1=m1

Node v4 has child v1, v2 receive packet of all the child nodes and sum up them to produce a packet A4

A4=m4+m1'+m2'

|A4|=|m4|+|m1'|+|m2'|=|m4|+ε(|m1|+|m2|)

Node v6 has child node v4,v5 and it receives and sums the data packet of the child node in order

- It receives the data packet A4 of node V4 aggregate it then receives the data packet A5 of node v5.
  i.e, existing data packets of node v6 contains gathered packet part m1',m2'- also contained in A5.
- Node v6 deletes m1',m2' from A5 and aggregate the remaining part of A5. Finally A6 generated by node V6 is A6=m6+m1'+m2'+m3'+m4'+m5'
- Then the size of A6 is
- |A6|=|m6|+ε(|m1|+|m2|+|m3|+|m4|+|m5|)

B. DATA VOLUME

Data volume of a node is an important parameter to check a node's energy.

$$S = 1 + \sum_{i=1}^{n}[(1 - Rr).(Ch' - 1) + 1.Ar] \qquad (1)$$

Using above equation sender can filter the repeated packets from the neighbour node which it receives.

Rr- repetition rate-related to number of parent node

Ch'- data volume of node received from its child node

Ar-Aggregation rate

Node will transfer data to many parents at the same time.

$$R = \sum_{i=1}^{n}[ch(1 - (1 - Pr)^{1+rt})] \qquad (2)$$

Using the above equation receiver can filter the repeated packets from the neighbour node which it receives.

n- Number nodes in a network

Ch- denote the volume of data sent by the child to node v

Pr- Packet received rate of node

rt- Retransmit times of node.

Energy Consumption Model(ECON)

For i = no.of node n to 1

Event occurred

N=broadcast its information

If a node belongs to cluster it receives the information then

Nodes sort out IA function and apprises its information

End for

IV. IMPLEMENTATION

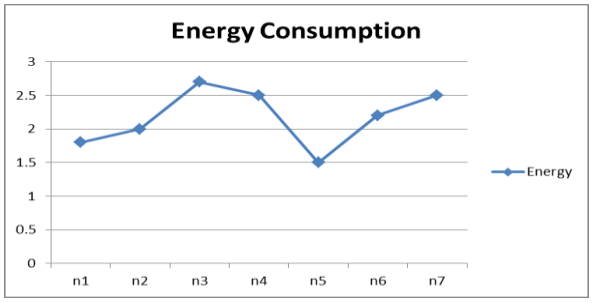

Fig-3 Energy Consumption of a node before using ECON model

In the above figure it is clearly illustrated that nodes present in the network will lost its energy. Especially intermediate nodes will lost its energy very quickly.

During data transmission intermediate nodes are act as transceivers; mostly it forwards the repeated information. So 80% of energy is wasted for forwarding the repeated information.

Table-1 Energy Consumption of a node before ECON model

Node-id	N1	N2	N3	N4	N5	N6	N7
Energy	1.8	2	2.7	2.5	1.5	2.2	2.5

Table shows the energy of each node in the network before using energy consumption model. A node which is having more neighbour will lose its energy rapidly than the nodes having less number of neighbouring nodes.

Before using this model energy consumption of a node in a network are very low. After using ECON model energy of a node will not be wasted. It will save energy of a node. Hence the network lifetime will also be increased. ECON model filters repeated information. In this paper we implemented ECON model in C++ and the value which got from that is fed into MS-Excel and we got below graph.

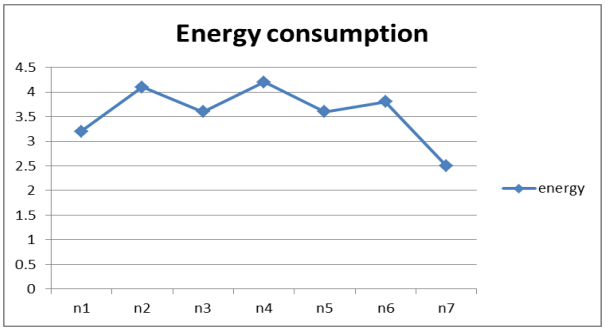

Fig-4 Energy consumption of a node after using a model

Table-2 Energy consumption of a node after ECON model

Node-id	N1	N2	N3	N4	N5	N6	N7
Energy	3.2	4.1	3.6	4.2	3.6	3.8	2.5

V. CONCLUSION

A model to save energy of a node is proposed in this paper. Sending repeated message a node can deplete its energy. Due to depletion a node can go to dead state. If a node having more number of neighbours goes to dead state means then the network will be isolated. Information sharing and message passing between nodes will be affected. It is avoided by ECON model. It filters the repeated message and saves the energy of a node. Energy of a node can be saved and dead state also reduced. ECON model improves overall network lifetime also.

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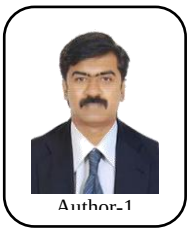

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