ISSN: 2278 – 1323
International Journal of Advanced Research in Computer Engineering & Technology (IJARCET)
Volume 5, Issue 4, April 2016

Energy Conservation using Data Reduction in Wireless Sensor Network

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Abstract*— WSN consist distributed sensor nodes are monitoring the physical data or environmental parameters and pass their data to the sink node. In wireless sensor network sensor nodes generate high amount of data and pass this data to sink node . To reduce amount of data transmission in wireless sensor network using data reduction techniques. Here, we proposed data reduction technique with CDC Scheme. In CDC Scheme, only one path from the source node to destination node is chosen which is shorter. The main aim of this paper is to reduce data using data reduction techniques and used proposed CDC Scheme to consume minimum energy and increase the life of sensor network.

***Index Terms*-Data reduction, Energy Minimization, network lifetime, WSN.**

I. INTRODUCTIONs

Wireless Sensor Networks consist distributed a number of autonomous sensor nodes are passing data from one or more sensor node to sink node. Sensor nodes are using a radio link through communicate with another sensor nodes and pass data to sink node(base station). In WSN sensor node are self organized and monitoring environment parameter or condition. Thus, sensor nodes controlling and monitoring application like military, health monitoring, industry etc.

WSN is some resource constraint like limited battery power, limited memory, short lifetime, low processing performance and communication bandwidth. Sensor nodes run on battery power and limited supply of energy. Replacing and charging battery power is quite impossible. This is the issue of power consumption in WSN. Another one resource constraint is a hardware limitation. The cost of WSN depends on the cost of each sensor node hardware.

Data reduction is a process reduced transmitted data from one or more sensor node to sink node in WSN. In previous papers proposed many data reduction algorithms and are found to be minimizing energy consumption in Wireless sensor network. In this paper organization as given below: In Section II given previous related work had been conducted other researcher in previous papers. In Section III describe data reduction algorithms and in Section IV given mathematic expression Next, section V given conclusion.

Manuscript received April, 2016.

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II.PREVIOUS RELATED WORK

Oliviu Ghica, Goce proposed in [2], data reduction method. Temporal and spatial distributed data reduction techniques are applied in WSN. They proposed three data reduction approaches like DPR, DDP and DDR. Doubt is a polynomial reduction algorithm, DDR and DDP is used for compute geometry.

Ting Zhuy, Ping Yiz, Yu GU proposed in [3], aggressive algorithm. This algorithm based on error inference in sensor segment. Here also given three degrees of data reduction used for to minimize energy consumption.

Premon proposed in [4,5,6] temporal and spatial correlation to communicate protocol in WSN. They use algorithms to reduce transmitted data to sink. Minimize energy consumption using this techniques.

Matos proposed in [7], Linear regression. Linear regression is used for reduce sensor nodes sensing data and collect environmental data. Linear regression performance compared to the accuracy of prediction performance.

Silva proposed in [8], Principal component analysis reduction technique. The PCA reduction method used in monitoring an air application. The PCA algorithm performance is reduced quality of data, delay and save energy. Also apply this technique in data reduction algorithm like multivariate reduction algorithm. In multivariate reduction algorithm solve prediction accuracy and energy saving problem.

Benazir Fateh, Manimaran Govindarasu proposed in [9], scheduling algorithm for minimizing energy consumption in wsn. In this paper propose data, correlation of each node used local computation and avoid similar data transmission. Also used here DVS (Dynamic voltage scaling) and (DMS) and Dynamic Modulation Scaling generates slack to save maximum energy.

Taner Cevik proposed in [10], data reduction, topology control and load balance algorithm. Spatial correlation proximity range (SCPR) parameter is used for reducing data. SCPR are statically or dynamically set in the network.

M. I. Mohammed proposed in [11], dual prediction and principle component analysis model. Dual prediction and PCA model are data reduction techniques used for improving monitoring water distribution system.

III PROPOSED WORK

In this work, our objective is to reduce data using thresholding techniques in WSN [1], which consist of Threshold Level data. In this paper our objective is to minimize energy consumption using data reduction thresholding algorithm in WSN [12]. Which consist of Threshold level, Threshold level with Controlled Duty Cycle, adaptive level and adaptive with Controlled Duty Cycle data reduction algorithms. In WSN, sensor node transmitting data from one or more sensor node to sink node (Base station). WSN sensor nodes are generating large amounts of data. Maximum energy is utilized when data transmit from sensor node to sink node. we proposed new Controlled duty cycle algorithm saves node level and network level energy. The controlled duty cycle algorithm is select the shorter path .

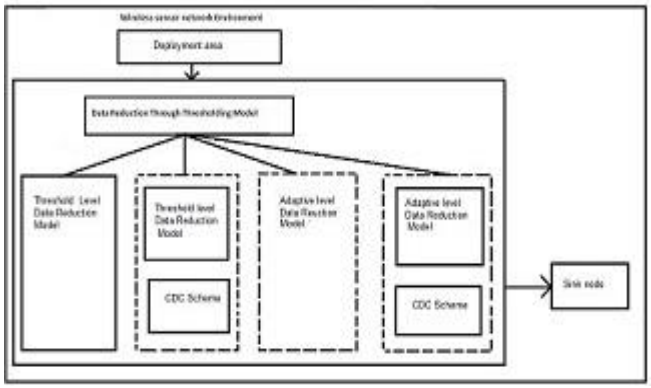

Fig. 1. System architecture.

In System architecture figure consist wireless sensor network environment, Sensor nodes are sensing data in the deployment area[12]. Then apply data reduction through thresholding algorithm on sensing, sensor nodes data and transmit this data to sink node.

Fallowing are Throttling data reduction algorithms:
1. Threshold level algorithm
2.Threshold level with CDC algorithm
3. Adaptive level algorithm
4. Adaptive level with CDC algorithm

3.1 Threshold Level Algorithm

In this algorithm firstly set the threshold value of every sensor node. The sensor node transmits only threshold exceed values to sink node (Base station). Sensor nodes are not transmitting below a threshold value. This way saves the energy to be used for avoiding unnecessary data.

Threshold Level Algorithm

- Start
- Set the threshold value of every sensor node
- Transmits-thresholds exceeding value from sensor nodes to sink node
- Calculate energy
- end

3.2.Threshold level with CDC algorithm

In this algorithm firstly set the threshold value of every sensor node. The sensor node transmits only threshold exceed values to sink node (Base station). Sensor nodes are not transmitting below a threshold value. In wireless sensor network apply Controlled duty cycle algorithm for saving node level and network level energy. The controlled duty cycle algorithm selects the shortest path using a routing protocol. If the source node wants to transmit data to sink node, then select the shortest path through intermediate nodes and transmit data through the selected shortest path. If any intermediate node energy goes below threshold level this node gives acknowledgement to the source node, then the source node will select shortest path

Threshold level with Controlled Duty Cycle Algorithm

- Start
- Set the threshold value of sensor node
- Transmits-thresholds exceeding value
- Source node select shortest path and transmit data through selected shortest path
- If energy goes below threshold of any intermediate node then source node transmit data to another shortest path.
- Calculate energy
- End

3.3 Adaptive level Algorithm

For predicting landslide are not depending on one parameter. Landslide prediction depends on rainfall, moisture, pore pressure parameter, which will to predict a landslide. In this algorithm initially not active all sensor nodes. Only one sensor will active. When one sensor node transmits threshold exceed value, then active another sensor node. Suppose rainfall sensor node transmit threshold exceed value, then activate moisture sensor node which further activate pore pressure exceeding the threshold value. This algorithm helps us to correctly guess landslide.

Adaptive Threshold Level algorithm

- Start
- Set the threshold values for each sensor node
- 1.Transmits Data when threshold gets exceeded,
  2. Activate next sensor node.
- 3. Repeat step 3 for next two sensor node
- Calculate energy
- End

3.4 Adaptive level Controlled Duty Cycle Algorithm

In this model include Adaptive level with Controlled Duty Cycle Algorithm. In this algorithm, Firstly set the threshold value of all sensor nodes. Suppose set the threshold value of

rainfall sensor node. When a rainfall sensor node transmits only threshold exceed value, then active another moisture sensor node which further activates pore pressure sensor node. The controlled duty cycle algorithm selects the shortest path using a routing protocol. If the source node wants to transmit data to sink node, then select the shortest path through intermediate nodes. If any intermediate node energy goes below threshold level the this node gives acknowledgement to it's source node, then the source node will select shortest path.

Adaptive level Controlled Duty Cycle Algorithm

- Start
- Define the threshold values for each sensor nodes
  1.Transmit Data when threshold get exceeded,
  2. Activate next sensor node.
  3. Repeat step 3 for next two sensor node
- Source node select shortest path and transmit data through selected shortest path
- If energy goes below threshold of any intermediate node then source node transmit data to another shortest path.
- Calculate energy
- End.

IV. MATHEMATICAL MODEL

4.1 Energy consumption at a single node

Single sensor node consumed energy can be obtained by using Equation (1),

$$Se = Ep + \sum_{i=1,2}^{Tn} (Bs * Tb) \quad .....(1)$$

Where
Se=Energy consumed by a sensor node
Tn=No of transmission
Ep=Energy required to process
Bs=Number of bit per sample
Tb=energy required to transmit one bit of data

4.2 Total energy consumption

The total energy consumption calculates by using an equation
(2)

$$Te = \sum_{i=1,2}^{m} Se \quad .....(2)$$

Where
Te=total energy consumed total energy by the network.
Se=sensor node consumed energy
m= m is total number of sensor node

CONCLUSION

In Wireless Sensor Network Data reduction applied through throttling techniques. It improves the life of wireless sensor network, as sensor nodes transmits only exceeding threshold data to sink node. It avoids unwanted data transmission. CDC Scheme are proposed to improve routing efficiency and save a sensor node level and network level energy and increases the network lifetime

ACKNOWLEDGMENT

I thank Prof. Sunita. S. Brave and Pramod D. Ganjewar for providing guidance and giving suggestions on the project. They gave me directions and, helped me find the solutions. I have further more to thank Prof. Sunita. S. Brave M.E. Coordinator, Department of Computer Engineering, to encourage me to go ahead and for continuous guidance. I also want to thank Prof. S. A. Jain for all his assistance and valuable guidance.

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