Energy Efficiency through Prediction in Wireless Sensor Networks

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ABSTRACT

In wireless sensor network researchers have been taken huge interest because WSN have established into numerous area such as: environment, military, habitat, home automation etc. Even though wireless sensor network is widely used in many applications and schemes but still WSN is hampered by limited energy. Prediction technique is designed to provide stability of the energy in the network. This paper presents use of prediction technique that can manage limited energy resource and also improves the network life time. Adhoc On Demand Distance Vector routing protocol and proposed work are taken consider for performance evaluation and NS3 network simulator is taken consider for simulation.

Keywords-

Wireless sensor network, Prediction, Energy consumption, Performance parameter

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I. Introduction

Wireless sensor network nothing but thousands of tiny sensor network comes together to carry out some task. Wireless sensor networks are most widely used network in almost all sectors. Wireless communication has supported the improvement of multifunctional low coat, low power sensor nodes. WSN technology propose several benefits over conventional working explanations, for example low budget, scalability, consistency, correctness, flexibility and comfort of placement that empower their usage in a extensive range of varied claims[1]. But energy consumption turns into a main problem for WSN, because of low battery power. One of the greatest significant restrictions on sensor nodes is to intake very low energy. Sensor nodes have restricted, mostly inimitable energy sources [2]. Moreover nodes are installed in acute territory also in huge amount, so it is problematic to change or renew the energy resource [3]. The cost of repeated placement and node rearrangement is also frequently more. So that, an effective approach is required to reduce network energy intake and lengthen the network lifespan [4].

In WSN, routing is more essential assignment that is to be controlled sensibly; routing method is required for distribution the data among the source nodes and the destination node, therefore to start the communication [5]. Broadcasting of bulk data and handling the data needs more energy [6] besides the absence of energy resourceful methods a node would loss its battery within a short period of time [7]. In the WSN maximum energy used for data package routing movement [8]. So an energy competent routing procedure is much needed to minimise the energy consumption as well as provides the reliable data transmission and also gradually expand the network life. This sort of presentation defines the proper arrangement of standards and protocol to be applied [9]. Using energy prediction techniques proposed work presenting an energy efficient routing protocol. Prediction technique manages limited energy resources and improves the network lifetime.

II. Literature Review-

Author [10] proposed different data reduction strategies have been developed in demand to decrease the energy depletion in mobile wireless sensor network. This work considers the data prediction models for WSN which are based on time slot. Moving Average (MA), Autoregressive (AR), Autoregressive Moving Average (ARMA) these time series technique are used. Author [11] this work presented prediction built clustering algorithm for target tracing in WSN. Planned algorithms used from a new chaser sensing node collection system. Planned system reflects together power and distance constraint for choosing tracer sensing nodes. Author [12] proposed a novel heterogeneous sensor networks

scheme with heterogeneity of observed things and energy heterogeneity of each node is projected, in terms to create many normal practice of network energy and lengthen the lifespan of the network. This work presents an energy well-organized prediction clustering system. Author [13] proposed an innovative geographic routing procedure for competently and dependably promoting data packs from a stationary data source to a mobile destination node by passing to a multi hop wireless senor network. The source forecasts the position of the mobile sink node. Author [14] proposed work to forecast the energy usage by sensor node direct to develop the Energy Map of a wireless sensor network. Residual obtainable power in every amount of the system is termed as Energy Map and may possibly support in improves the lifespan of the system.

III. Proposed Methodology

Proposed method is designed to propose a novel energy competent routing procedure. To overcome the energy concerns in wireless sensor network and explicitly to increase the energy efficiency of WSN, also expands the network life span. This work undertakes that sensor nodes remain spread in the range. Every single node likely knows its own position as well as its neighbour and the destination. This work assumes entire nodes have equivalent extreme communication range and equal quantity of primary energy.

A. Energy Prediction

Energy prediction can predict the future behavior of the node in terms of energy. It is a statement about an uncertain event which might be occurs due to low energy of a node. Wireless sensor networks are having restricted energy resource. These restricted energy resource restrict the network presentation and performance. Energy prediction can help to increase the network performance and also prolong the network lifespan. Energy prediction provides path stability to the network; path stability can improve network performance and saves the energy also. WifiRadio energy model is provided by network simulator Ns3. The energy model of the sensor node can support to enlarge the system performance. The well-defined energy model can contribute to well assessment of remaining energy in every node.

EM = RE / IE

(1)

EM = Energy Measure, IE = Initial Energy, RE = Remaining Energy

$$RemaningEnergy = \int_{i=0}^{N} RemaningEnergy[i] = \mathrm{IE(i)Energy\_Consumption}(i)$$

(2)

Using prediction techniques it is easy to find out each nodes remaining energy. High remaining nodes get selected for routing which can provides path stability as well as lengthen the network lifetime. Selecting maximum remaining energy node can minimizes path failure because of energy drain also reduces packet drop ratio and control overhead of the network.

Algorithm:

Energy Threshold – En_Th,
Current Remaining Energy - RE
Energy Node Validity – En_NV
Nodes - N
Each n € N
Start
Step1: Nodes Initialize
Step2: Discovery of Neighbouring nodes
Step3: Selection of energy efficient node
If RE > En_Th
En_NV[n] = valid;
Else
En_NV[n] = invalid;
Step4: Valid node selected
Step5: Else repeat the steps 2, 3 and 4 till the last node.
End

IV. PERFORMANCE ANALYSIS OF ROUTING PROTOCOL

Simulation Methodology

Simulation supports to recognise the conduct and presentation of the network and its procedure. Numerous network simulators are accessible for mobile wireless sensor networks; NS3-Network Simulator3 is considering for this simulation. In this setup node 0 is sink node and all other nodes are source node. Here 100 wireless nodes are creating wireless sensor network, deployed in (500m*500m) space for 40s simulated time. Random way point mobility model is taken consider for mobility of nodes. WifiRadioEnergyModel is used to check energy consumption of each and every node in the network.

Simulation Parameter

Parameters are used for simulation to check performance analysis of mobile wireless sensor networks.

Table 1. Parameters consider for simulation

Parameters	Values
Network Simulator	NS3
Protocol Studied	AODV, M-AODV
Network Type	Mobile
Node movement model	Random waypoint
Energy model	WifiRadioEnergy model
Packet Size	1
Simulation Time	100ms
Connection	UDP
Type	
Simulation area	500*500m
Number of Nodes	100
Pause Time	0 sec
Nodes Speed	20ms

V. RESULT ANALYSIS

In this work simulation is work out on mobile wireless sensor network considering above parameters and performance metrics. Routing protocol used for this work are Ad hoc On-Demand Distance Vector (AODV) and proposed modified Ad hoc On Demand Distance Vector (M-AODV)

1.1 Energy Prediction

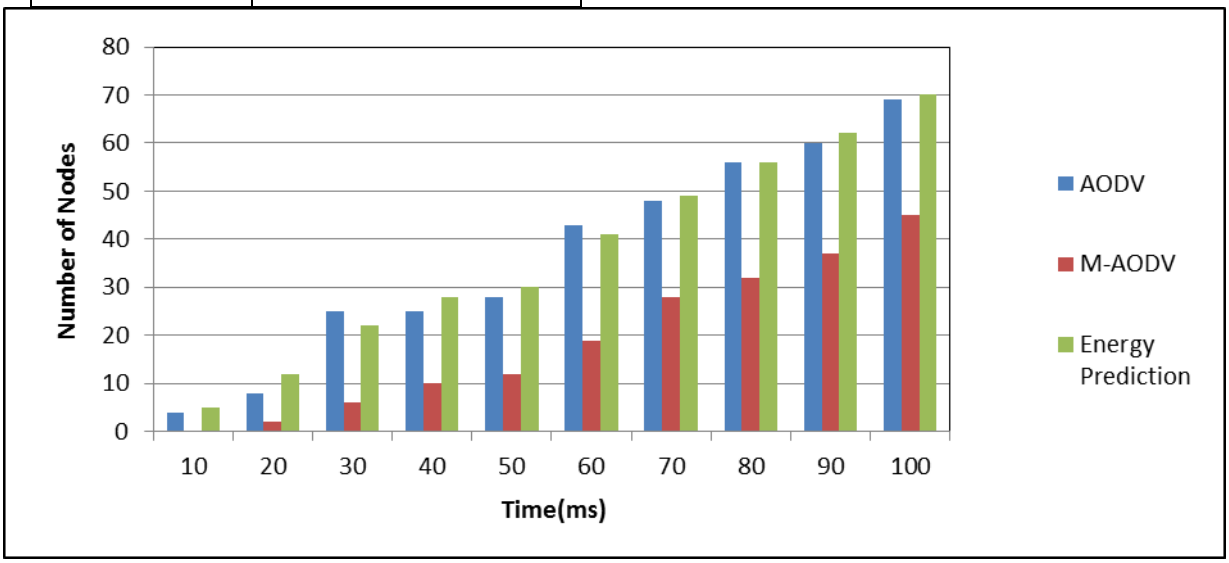

Fig: 1 Energy prediction graph

Energy prediction can predict how long the particular node can work, it gives each nodes remaining energy. The above graph shows comparison between AODV and proposed modified M-AODV. Because of energy prediction techniques are used in proposed work which efficiently used the remaining energy of nodes. Prediction can help to select determined expiration time of node for packet routing to provide path stability.

1.2 Dead node Prediction

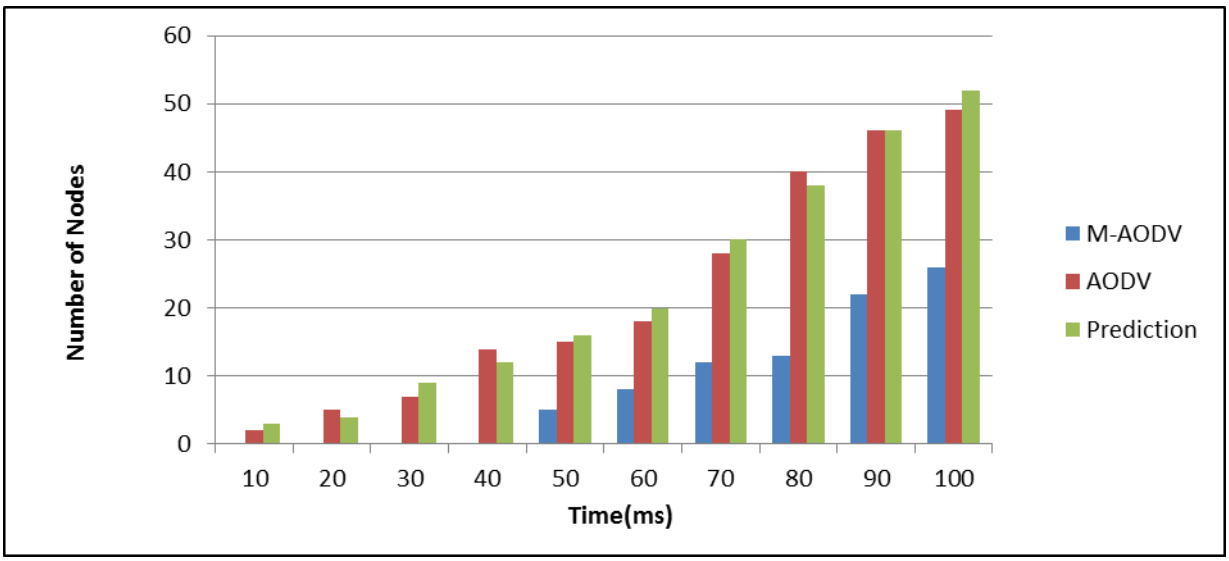

Fig 2: Dead node prediction graph

The above graph shows that proposed protocol M-AODV have very less count of dead node than AODV protocol. Proposed work uses the prediction technique which select nodes which having high remaining energy.

1.3 Packet Drop Prediction

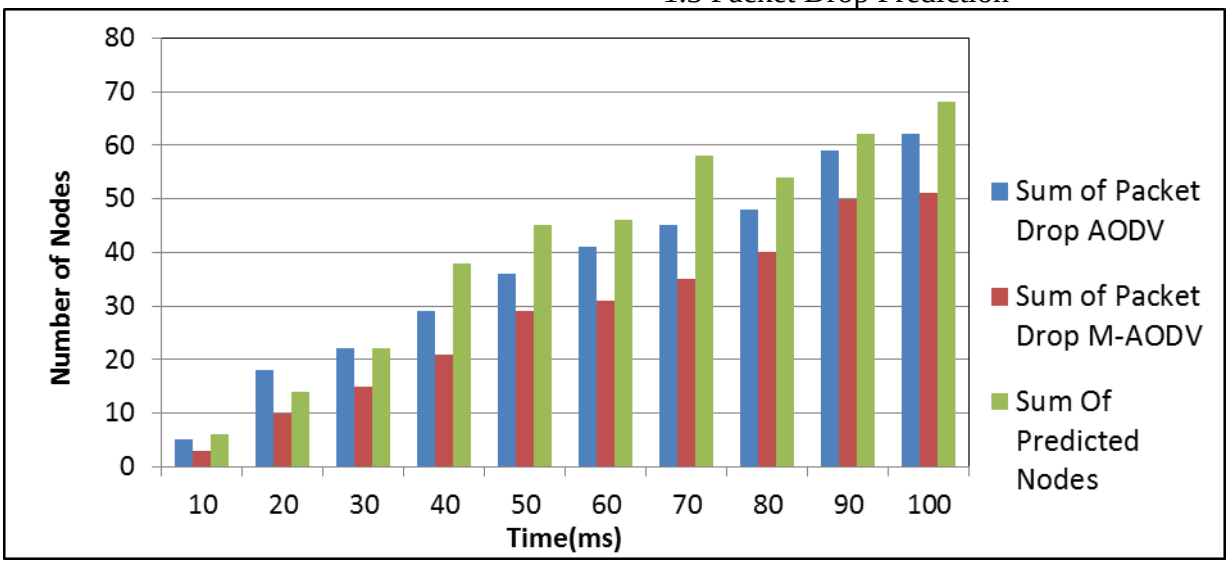

Fig: 3 Packet drop ratio graph

Packet drop ratio of projected work is less than AODV protocol. Energy prediction offers path stability to proposed M-AODV protocol which minimizes packet drop ratio. Packets sent for drained node also get drop. Packet drop ratio is less in proposed work because prediction technique provides each nodes reaming energy. Only high remaining energy nodes get select for routing. Prediction also minimizes network overhead.

1.4 Network Lifetime

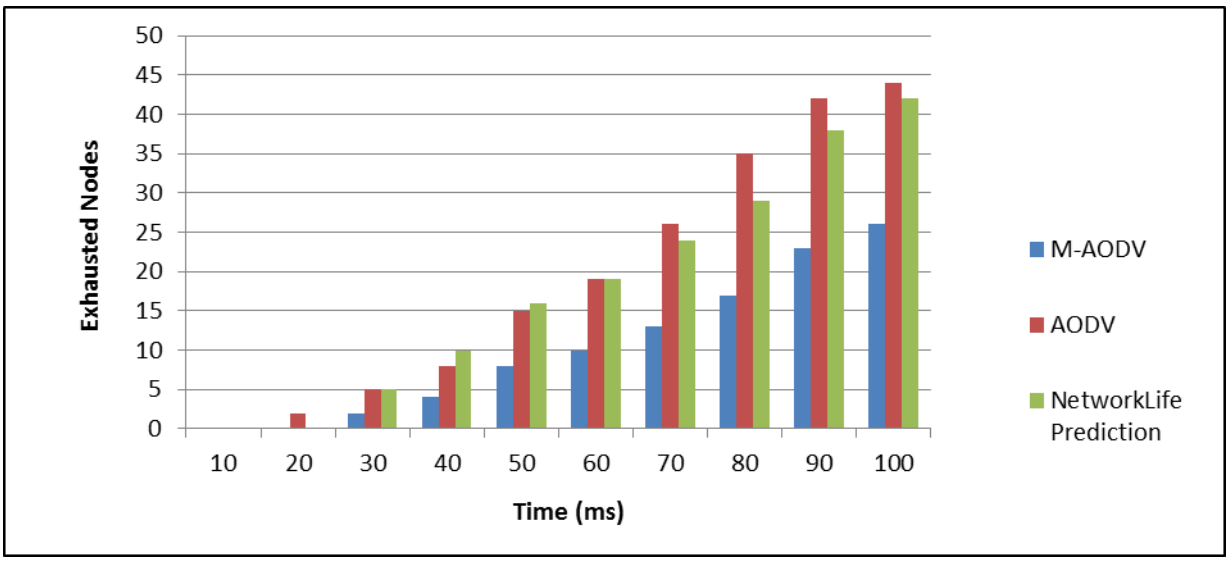

Fig: 4 Network Lifetime graph

Once node get fail network needs to do new path discovery this process unnecessary consumes network energy which also affect network lifetime. Predication techniques provide each nodes remaining energy so only high remaining nodes get select for routing. In above graph proposed work M-AODV shows very less count of exhausted nodes than AODV protocol.

VI. Conclusion

In this work prediction technique has been projected to expand wireless sensor network presentation. Prediction is the effective and powerful method to choose the stable path. Path damage because of node's energy ditch is avoided. Prediction technique deals with routing path stability estimate by predicting nodes remaining energy. Path damage because of nodes energy ditch is escaped, which help to decrease packet drop rate and also decreses network overhead. Energy prediction is the utmost productive approach to lengthen the lifespan of wireless sensor network. Result of presentation analysis of proposed M-AODV and AODV shows clearly that proposed work shows greater performance than AODV. This proposed energy prediction has enhanced the performance, functionality and lengthen the lifespan of wireless sensor network.

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