PERFORMANCE ANALYSIS OF ROUTING PROTOCOLS AND ENERGY MODELS IN WSN USING QUALNET

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ABSTRACT

The wireless sensor network has importance on account of latest information technology. Micro-electrical mechanic-al system is used to evolve sensors over the last past decades. The enormous numbers of sensors are redistributed for sensing as well as accumulating data from its neighborhood through routing protocol. The leading goal of this paper is to evaluate AODV, STAR and ZRP routing protocols in WSN using Qualnet 7.1 simulator with different parameters like throughput, End to End delay and Jitter in CAP and average energy consumed in transmit, receive as well as idle mode. The simulation results show that ZRP gives better throughput, End to end delay and Jitter. Micaz energy mode consumes less energy transmit and receive mode compare to Micamotes energy mode.

Keywords : *WSN Model, AODV, ZRD, Micaz energy.*

I. INTRODUCTION

The current innovation of Micro-Electrical Mechanical System (MEMS) technology has made cellular devices more dominant, cheaper and lesser. A Wireless sensor network (WSN) composes of less expensive, small size and less power thousand of sensor nodes. In recent years WSNs have become one of the peak research areas. WSNs have several applications like environmental monitoring, surveillance and security etc. Wireless sensor networks are providing low cost solutions for numerous real world challenges [1]. Data in WSN are lost due to physical destruction of sensor nodes or lack power in sensors or blocking by an obstacle. Sensor networks are strongly dependent on battery life. Energy depletion is a principal issue for designing wireless sensor network. WSNs applications are increasing rapidly now days.

II. LITERATURE SUKRVEY

In this section related works for various routing protocols based on quality of service (QoS) have been analyzed. The authors in [2] analyzed DSR (Dynamic source routing), AODV routing protocol based on average end-to-end delay, throughput as well as the average jitter with different simulation time. They showed that DSR performs better than AODV in case of throughput as well as average jitter. Performance analysis of AODV, ZRP (Zone routing protocol) and DSDV (Destination sequenced distance vector routing) is in [3] with respect to throughput, average end to enddelay and jitter. The authors showed that AODV is more reliable protocol than DSDV and ZRP but in some scenarios DSDV performs well than AODV. Finally no one protocol is superior with respect to overall parameters. The authors in [4] analyzed DYMO (Dynamic manet on demand routing), AODV and DSR (Dynamic source routing) protocols for grid based clustered wireless sensor network with different performance parameters like power utilization in transmit mode, idle mode, receive mode as well as residual battery capacity. They showed that AODV performs better than DSR and DYMO.

III. ROUTING PROTOCOLS

The process of selecting a path to send and receive the data from origin to terminal node is called routing. The Ad hoc on demand distance vector (AODV), Source tree adaptive routing protocol (STAR) routing as well as Zone routing Protocol (ZRP) protocols have been explained in this section.

A. Adhoc On Demand Distance Vector (AODV)

This is a complete on demand approach acquisition algorithm and uses destination sequence numbers to recognize the current paths. All routing packets must have sequence numbers. This protocol is contains four messages. Route Request (RREQ) and Route Reply (RREP) messages are used for route discovery. Route Error (RERR) messages and HELLO messages are used for route maintenance. AODV takes minimum delay for connection and increases speed and accuracy.

B. Source Tree Adoptive Routing Protocol (STAR)

This protocol is based on link state algorithm. Each router keeps up a source tree, to store up favored paths to destinations. The STAR can work in two modes: the least overhead routing approach (LORA) mode or the optimum routing approach (ORA) mode but selects particular mode at once. STAR reduces control overhead and gives shortest route in LORA mode. ORA tries to revise routing tables as early as possible to update paths. STAR is perfectly suits for large scale networks dueto reduction of bandwidthfor routing updates [1]. This protocol may not suitable for highly mobile networks.

C. Zone Routing Protocol (ZRP)

ZRP combines the best features of both Table driven and on-demand routing protocol. The Zone Routing Protocol (ZRP) divides the network into zones. A zone of a node has all the nodes lying within a certain zone radius which is defined in hops. ZRP consists of two sub-protocols [3], a proactive routing i.e., the intra zone routing protocol (IARP) is used inside the zone; while the reactive routing protocol i.e., inter-zone routing protocol (IERP) is used outside the zone.

IV. SIMULATION SETUP

We have taken QUALNET network simulator to simulate the network why because it supports real time speed. And it has got more scalability, can model thousands of nodes. And it has got portability. QUALNET Network simulator is user friendly. It's a drag and drop operation provider for usage. GUI support is excellent in QUALNET. GUI is an interface through which user interacts with electronic devices. This interface uses icons, menus, and other visual display information and related user controls. Fast simulation is only supported by QUALNET.

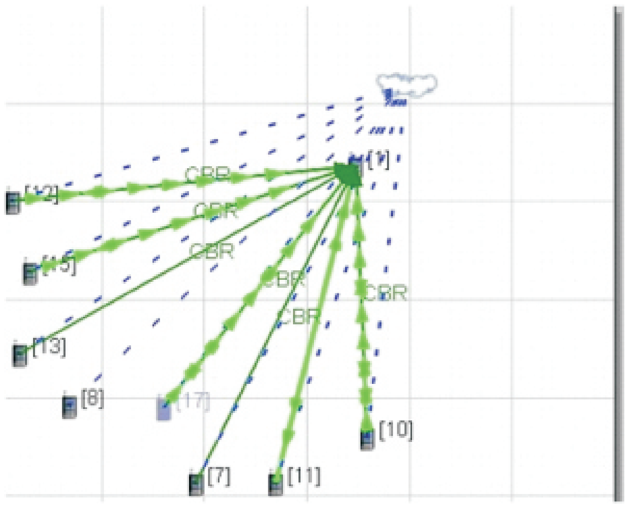

Fig.1. Qualnet animator snapshot of WSN model for AODV, STAR and ZRP routing protocols

This particular WSN area forms a clustering area approximately 2-5 kilometers. Sensor nodes are assumed to be at fixed positions within this clustered area. WSN area model 802.15.4 has been used to design reduced functional devices (RFDs) and fully functional devices (FFDs).The FFDs are classified into PAN coordinator, coordinator and devices. In this model, there are 9 static nodes are placed in terrain 800 m2. The nodes (2 to7) are RFDs and used to sense data..The coordinator node 1 gathers the collected sensing data information and forwards to the PAN coordinator 9 in as shown in Fig. 1.

TABLE I

SIMULATION PARAMETERS OF AODV, STAR AND ZRP ROUTING PROTOCOLS

Parameter	Value
Terrain Size	800× 800 m2
Number of Nodes	9
Radio Energy Model	Mica motes, Micaz
Radio Type	802.15.4
Routing Protocol	AODV, STAR,ZRP
Simulation Time	300 seconds
MAC protocol	IEEE 802.15.4
Traffic type	CBR

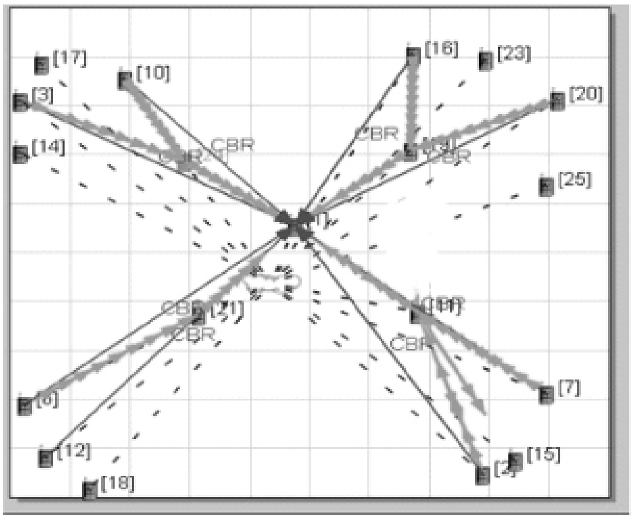

Fig.2. Qualnet animator snapshot of WSN model for AODV, STAR and ZRP routing protocols for increased cluster size

In the fig.2 the particular WSN area forms a four cluster area approximately 2-5 kilometers. Each sensor nodes sends data to coordinator (cluster head) of that particular cluster. The coordinators transfer same to the PAN co-coordinator.

TABLE 2

SIMULATION PARAMETERS OF AODV, STAR AND ZRP ROUTING PROTOCOLS FOR INCREASED CLUSTER SIZE

Parameter	Value
Terrain Size	800× 800 m2
Number of Nodes	9
Radio Energy Model	Mica motes, Micaz
Radio Type	802.15.4
Routing Protocol	AODV, STAR,ZRP
Simulation Time	300 seconds
MAC protocol	IEEE 802.15.4
Traffic type	CBR

V RESULTS AND DISCUSSION

A. Average number of signals transmitted for AODV, STAR and ZRP routing protocol

In Fig.3 average number of signals transmitted in ZRP is high and AODV and STAR is less for given WSN.

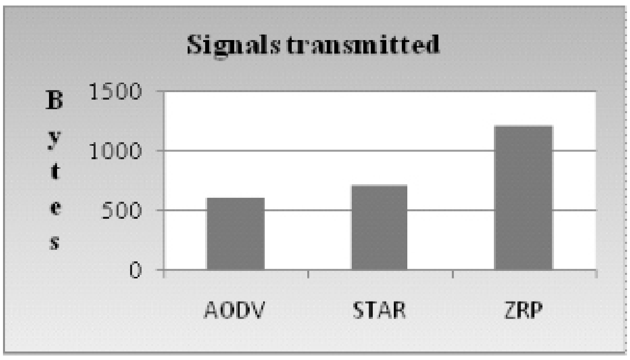

Fig.2. Qualnet animator snapshot of WSN model for AODV, STAR and ZRP routing protocols for increased cluster size

B. Average number of signals detected for AODV, STAR and ZRP routing protocols.

The average number of signals detected for ZRP is high and AODV and STAR both are less for given WSN.

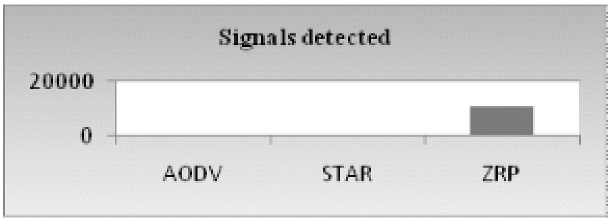

Fig.4. Average number of signals detected for AODV, STAR and ZRP routing Protocols in WSN model.

C. Throughput for AODV, STAR and ZRP routing protocols.

Throughput is the average rate of successful message delivery over a communication channel. The throughput is usually measured in bits per second (bit/sec), and sometimes in data packets per second or data packets per time slot. High throughput is always desirable in a communication system.

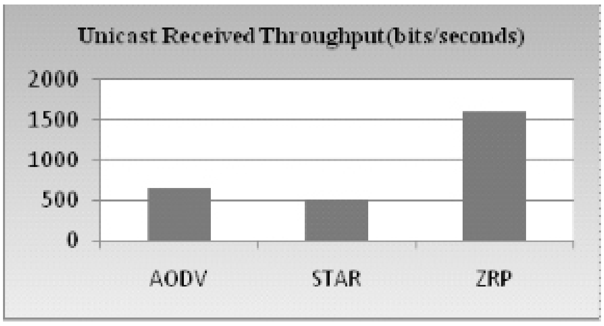

Fig.5. Throughput for AODV, STAR and ZRP routing Protocols in WSN model.

D. End to End Delay for AODV, STAR and ZRP routing protocols.

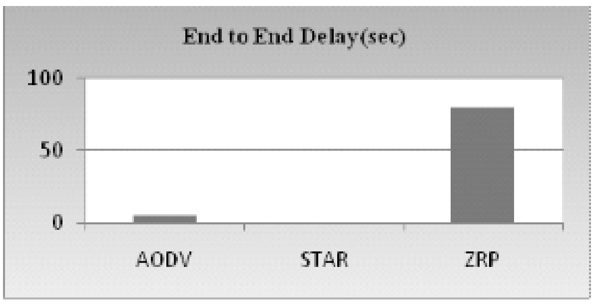

Fig.6. End to End Delay for AODV, STAR and ZRP routing Protocols in WSN model.

E. Average Unicast Jitter for AODV, STAR and ZRP routing protocols.

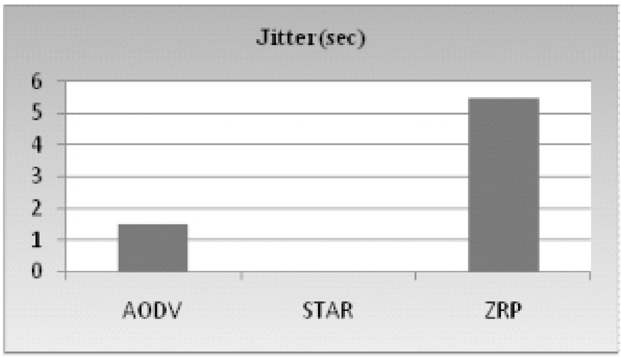

Fig.7. Average Unicast Jitter for AODV, STAR and ZRP routing Protocols in WSN model.

F. Energy consumed in transmit mode for ZRP routing protocols in Micamotes and micaz model.

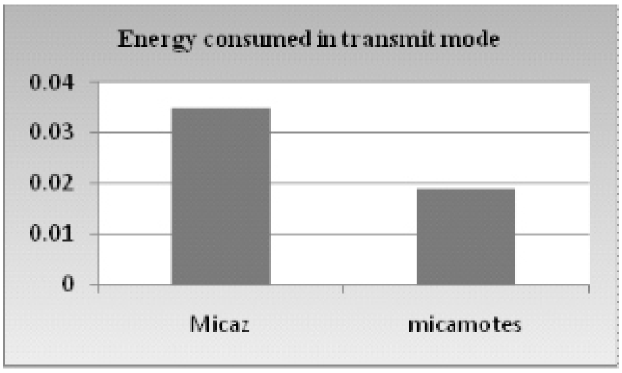

Fig.8. Average energy consumed for ZRP routing protocols in transmit mode WSN model.

G. Energy consumed in Receive mode for ZRP routing protocols in Micamotes and micaz model.

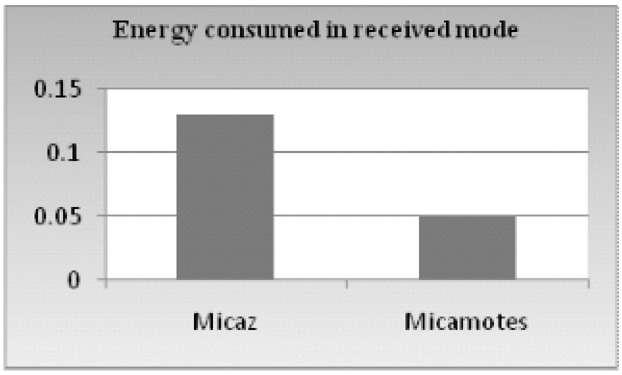

Fig.9. Average energy consumed for ZRP routing protocols in received mode WSN model

H. Energy consumed in Idle mode for ZRP routing protocols in Micamotes and micaz model.

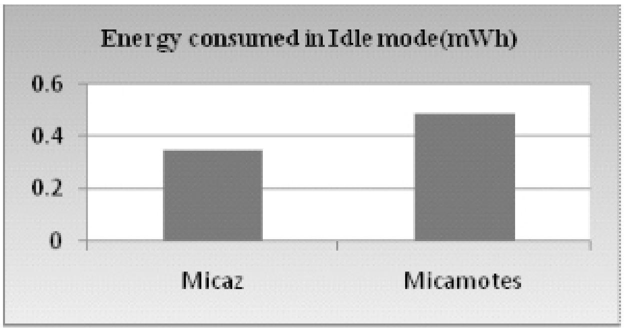

Fig.10. Average energy consumed for ZRP routing protocols in idle mode WSN model

I. Energy consumed in Sleep mode for ZRP routing protocols in Micamotes and micaz model.

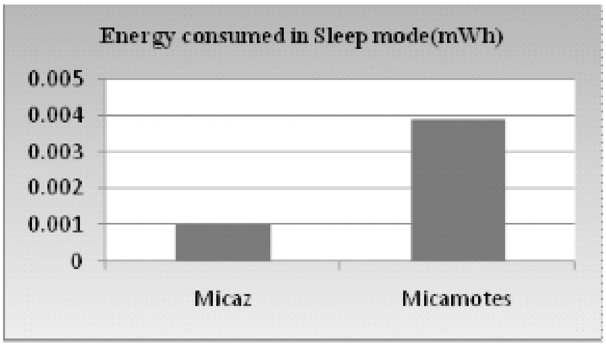

Fig.11. Average energy consumed for ZRP routing protocols in sleep mode WSN model

The energy consumed in transmit mode is Etx = Ttx × Duration. Duration is the transmission period of the packet.

The energy consumed in receive mode E rx = R rx × Duration. Duration is the receiving period of the packet.

From the fig.8 and fig.9 we can say that for the given routing protocol ZRP, the energy consumed in Mica motes is less in transmit and received mode compare to the energy consumed in Micaz mode. Whereas from the fig.10 and fig.11its clear showing that Micamotes consumes more energy in idle and sleep mode compare to Micaz mode.

V. CONCLUSION

The simulation results for WSN model exhibits that the average number of transmitted and received is high for ZRP compare to AODV and STAR. Hence ZRP gives better throughput. But in some scenario AODV performs better than STAR. By opting ZRP as the routing protocol, we also shows that Mica motesenergy model consumes less energy in transmit and received mode compare to Mica energy model. Hence for better efficiency of data reception we can choose ZRP and mica motes. This model can be also elaborate to increased cluster size and therefore ZRP performs better even if number of nodes increases. This model can be highly used in Industrial township area to sense the smoke.

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