A Schematic Approach for Path Detection in Mobile Ad-hoc Networks

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Abstract:

In WSN, improving lifetime of each individual node plays an important role towards the lifetime of entire network. Earlier methods would take the same path from starting to ending of packet transmission. More usage of single node would affect the entire network. In this paper we propose a Ad-hoc-BAT algorithm, it takes the residual energy, travel time, Received signal strength as key parameters to prolong the lifetime. Rather than simulation, we have noted our proposed methodology in real time and obtained various outcomes. By those analyses, we observed that our proposed model renders improved lifetime and ensures good packet delivery ratios. Consideration of travel time in this paper further reduces end to end delay. Since fast and assured packet delivery with the effect of improved lifetime, our method would be more suitable for real time implementations.

Keywords: WSN, Routing Algorithms, AODV,BAT Algorithm.

I. INTRODUCTION

Mobile Ad-Hoc Network is the trending technology, glued more researchers due its complexity and necessity. Unlike infrastructure based network MANET needs the contribution of all nodes and its dedication to serve other nodes data. While at the same time securing data from various eavesdropping and various attacks also adds more complexity to the network. Moreover the contribution of node is necessitated in Ad-hoc even the packet is not intended for it. Due to these reasons, a node with more neighbors might be targeted by more number of nodes than a corner node who has less number of neighbors. Finding the best next hop is more important to survive longer in MANET. Earlier proactive protocols were used even it adds more features like fast routing, table maintenance, it lags in performance due to the bulk and frequent beacon signaling. Reactive protocols are an on demand routing in which it does not need any periodic signaling information between nodes. Later hybrid protocols were introduced with more features. Every node is main responsible for data extraction and computation. It acquires the data from the real environment and has to manipulate the data as per routing protocol. All nodes in a network have to follow a same routing protocol since each protocol proposes different packet format and manipulation. It is still difficult in giving

assurance to successful delivery of packets in MANET, after so many protocols have been introduced. All of these process required real time response real time response and concurrency between nodes.

II. RELATED WORKS

To eliminate or in order to reduce complexity in infrastructure networks, Mobile Adhoc Network (MANET) introduce in communication network, inbetween the nodes for routing purposes. Paper [1] explain concept of wireless devices which communicate on the fly for their own applications, not on base station network (nodes). For that, fly for applications [1] discussed an algorithm of multipath OLSR (Optimized Link State Routing) helps to improves communications between the number of nodes and their energy optimization of nodes, to choose alive nodes in network nearly 10 to 25% and end to end delay as QoS parameter. These optimization overheads and some other measures of routing algorithms had presented in OLSRM and OLSR (Optimization of Energy Consumption for OLSR Routing Protocol in MANET).

To enhance wireless sensor networks communication to best extent, one of important factor is energy efficiency because it related to speed and data collection between sensor nodes in network. To improve this factor, sink mobility along a constrained path is opened to unlimited communication time to observe and monitor data to collect exact sensor nodes deployed randomly. Paper [2] proposed a novel data collection scheme, through this scheme we address the issues which are related to speed to data collection and energy consumption. This scheme introduces Maximum Amount Shortest Path which increase throughput on network, as find optimizing in energy. Genetic algorithm helps to solve integer linear programming problem which helps to formulated MASP in implementation and distributed algorithm also include in two-phase protocol. This experiment results are validated through OMNET++ for both protocols and algorithm. [2] Efficient Data Collection in Wireless Sensor Networks with Path-Constrained Mobile Sinks

In WSN, single path routing protocols are forms holes in the network, nodes which are present in that single path are handle the data transmission in that network. To overcome problem in single path routing, WSN recommended multipath routing protocols in networks to increases nodes lifetime by properly handle traffic and distributing in multiple paths. In paper [3], author proposed multipath routing to spread load in different nodes and multipath search protocols discover disjoint paths between the sink and source nodes. The proposed protocols show better improvement in packet delivery, fraction, end to end delay and energy consumption as compared to EENDMRP and AOMDV. [3] Energy-Aware Node Disjoint Multipath Routing Protocol for Wireless Sensor Networks

To transfer data from one node to another node in wireless sensor network is very important due to we transfer the data with low energy efficient manner. Optimized link state routing protocol (OLSR) was proposed in [4] to fulfill the core functionality and enhancements from auxiliary functions. Message

corresponding to functions handle by nodes, not by this node which are implemented by OLSR. In OLSR, all nodes addressed by "major address" in network to forwarding data packets. In multiple interfaces major address is used to identify nodes, which is chosen. Finally, transmission power using MIMO (Multi-Input and Multi-output) is minimize.

Energy consumption is crucial issue in wireless sensor network, when we collect the data from sensor node which is placed near the sink is high. Due to energy consumption resulting leads to limit the network lifetime and network partitioning. To solve this problem, this paper proposed Shortest Path Member Assignment (SPMAS) scheme helps to improve the throughput for sensor nodes by providing the optimal assignment as well as energy efficiency. This proposed scheme implemented in different scenarios like trajectories of mobile sinks and validate for NS-2. [5] Efficient Data Collection with path Constrained Mobile sinks using Shortest Path Member Assignment Scheme in WSNs.

Today home network are the emerging area in networking with help of wireless sensors, due rapid development in the internet. Sensors are placed in consumer product, so its help to collect the data information from the recent places. Consumer product have tiny battery, which cannot replace by every time, in this situation monitoring energy consumption in product is must. For that we proposed two algorithm Energy-efficient Clustering Multi-sink algorithms (ECMA) and Energy-efficient Algorithm (MEA) to solve sink mobility problem and improve performance on network with energy efficient, same thing proposed to multiple sinks also. [6] Efficient Algorithms were suggested to improve the Performance of Wireless Sensors Network using Multi-sink and Mobile Sink.

This paper proposed Connectivity-Based Data Collection (CBDC) algorithm belongs to new data gathering algorithm used in mobile sinks for data gathering with minimize power resources, path constraints and time. The presented CBCD results are compares with LEACH-C algorithm in different levels of sensors networks, in varying mobile sinks. [7] Connectivity-Based Data Gathering with Path-Constrained Mobile Sink in Wireless Sensor Networks. In WSNs, issue like latency in data collection and speed of mobile base stations, rendezvous-based data collection approach points to data originated from sources and arrives at base stations. An approach combines in-network data caching and controlled mobility, achieve a desirable balance between data collection delay and network energy saving were discussed in paper [8].

III.METHODOLOGY

The successful delivery of packets is still unsure in Ad-hoc network. Network life time enhancement and traffic handling are important criteria. All of earlier protocols and routing methods have focused on parameters mostly in terms of residual energy, battery power. Most of them are still at simulation, implementing them in real time impacts more critics in results. In this paper, we proposed and discussed the result observed at real time implementations. We propose to merge Ad-hoc routing with BAT algorithm.

i.e., Ad-hoc-BAT algorithm offers more feature in maintaining a network stable. We add those features with wireless routing and hence provide new concepts in routing and achieving high performance of infrastructure less network. This paper focuses at multiple parameters such as number of neighbors, Travel time, Received signal strength, Congestion rate and etc.

A) Route Discovery & Selection:

Before sending data packets source node initiates route discovery process by flooding route request to all neighbor nodes. Each node further floods the request packet till the destination has been found and time to live expire this process would be continued. Route request packet consists of SoF, EoF, source address, destination address, node id as depicted in fig. S0F and EoF are denoted by eight bits '00001110' and '11110001' respectively. SoF is immediately followed by Identifier byte and node id. Here node id represents the intermediate hop which routes to destiny.

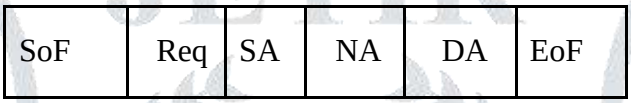

Fig 1.1 Request Packet format

Initially source node transits request packet with its own address written in SA and NA. An intermediate node left SA, DA and overwrites NA with its own address. Hence node next to it can get to know from where it is receiving packets. In reply packet every node sends set of parameters like number of neighbors to sender, received signal strength.

Reply packet is similar like request packet but packet overhead is added for additional parameters. These parameters are being a key input to the sending node in selection of next hop. Each intermediate node selects best next hops by using BAT algorithm will be discussed later in this paper.

B) Route Maintenance:

Route reply packet sent only by the intermediate node which found destination reachable to it by either direct or indirect. If the source node has received route reply packet within TTL period, then definitely there some path exists between source and destination. The data packets will be forwarded to the next hop which found earlier in route discovery process. Each node looks for regular update from its neighbor regarding its number of neighbor state, RSSI of last received packet, congestion status. Route maintenance is most important similar like route discovery.

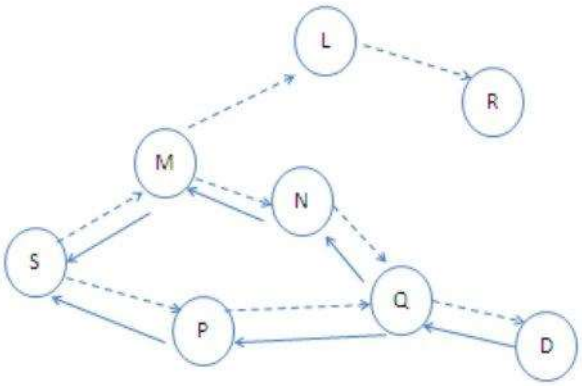

Fig2.1. Route Discovery

In fig 2.1 source node floods route request and receives reply from various path via destination is reachable. Every node frequently gets update from neighbor about their traffic handling and congestion status. Suppose N is the best next hop it carries traffic. When node N is overloaded by successive packets it would results in packet loss and poor packet delivery ratio. Node M is the sender to node N would be informed about the congestion state. Similar like pattern has to be followed in our proposed method and finally source node can get idea on which node faces the overloaded traffic problem. Hence source node selects next best hop by BAT algorithm. Each node frequently sends the details about number of packets transmitted via it.

c) Ad-hoc-*BAT Algorithm:*

Route discovery and maintenance process in WSN simply seeks path and frequently check only the presence of neighbors by beacon *hello* packets. It helps in detecting the route presence. But it does not provide any information about the neighbor. This would effect in loss and lifetime reduction. Though source node sends less number of packets to an intermediate node, the intermediate node may sense more congestion, it would affect ongoing transmission. In case a node involved in two different packet transmissions, then both route maintenance process would be thinking that the neighbor is available for its own packet transmission by seeing the beacon signal. Hence the particular node X receives data packets from both transmissions. When more number of packets were handled by a single node then its energy drains earlier and causes node to die and extend to stay out of network. Sometimes results in network portioning and it must be avoided to stay longer and improve network life time. Here by Ad-hoc-BAT algorithm based routing we conclude that apart from presence, the traffic handled by all intermediate nodes would play more in packet routing.

Ad-hoc-BAT Algorithm

1. Send Request packet wait till TTL (T_L) expire.

2. If route reply received, find the best next hop N_B. Where N_B € $\{H_{max}, RSSI_{max}\}$

3. Each node N_i finds best neighbor N_{i+1}.

4. Carry data packet at selected best route.

5. Sense number of packets carried by intermediate node N_{i+1}.

6. If traffic handled $T_h > T_l$, send congestion indication to node N_{i-1}.else continue step 5 for every certain period.

7. If T_h is high then stop sending new packets to that node and continue with step 1.

IV. HARDWARE IMPLEMENTATION

A) Transceiver Unit:

Our proposed model has been implemented in real time. Each node consists of wireless transceiver module Tarang P20 have MC1322x 32 bit Arm 7 processor internally in it. It is Zigbee based module communicates at 2.4 GHz bandwidth. It avails 16 channels in between 2.405 GHz to 2.485 GHz. Tarang P-20 is an low power device consumes less than a Watt. During idle time it consumes 0.45mA and it's transmit power is about 30dbm.

B) Communication:

The data received at wireless module has sent serially to microcontroller. This wireless module is being connected to microcontroller 16F877a an eight bit controller were used. It uses Harvard Architecture and follows reduced instruction set (RISC). It avails 8K Flash memory and 368 byte data memory. Serial interrupt handling in microcontroller were used in proper packet receiving and responding. UART (universal asynchronous receiver transmitter) wired communication was implemented between controller and wireless module in a node setup, while two different nodes talk at 2.4 GHz in wireless. Even the data has been received serially the successive packets can be identified separately by SoF and EoF bytes. From these packets a node here set to be a controller notes source id, destination id and packet identifier which intimates whether it is request, reply, Data or Ack packet. By having the collected packets, next step action were taken as per BAT algorithm coded in each node. All packet transmission has taken place in form of 0's and 1's. The controller puts its low and high symbol 0v and 5v pulses, while MC1322x puts at 0v and 3.3v respectively. These two different levels have been interpreted by implementing level converter between controller and wireless module.

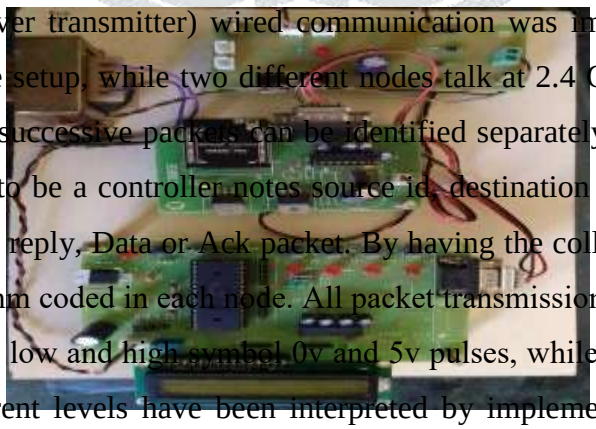

Fig2.2 Hardware implementation

V. RESULT & DISCUSSION

Real time implementation of Ad-hoc network and the verification of various algorithms are quite difficult and different than implementing in simulation. Network lifetime should be long enough to survive longer and it is affected by network parameters like traffic size, number of packets.

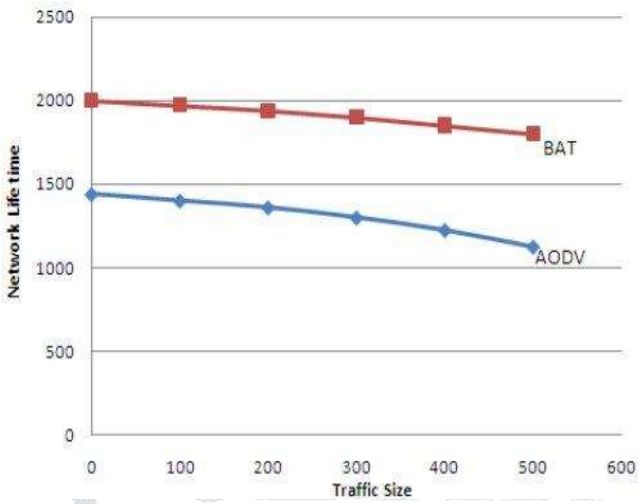

Fig.3.1 Network Lifetime comparison

Network life time is the lifetime over which no existing connected node drained out its energy in packet transmission and no node dies. Network parameters of entire network can be estimated by analyzing a single node with more number of neighbors or node which involved in more number of packet transmission.

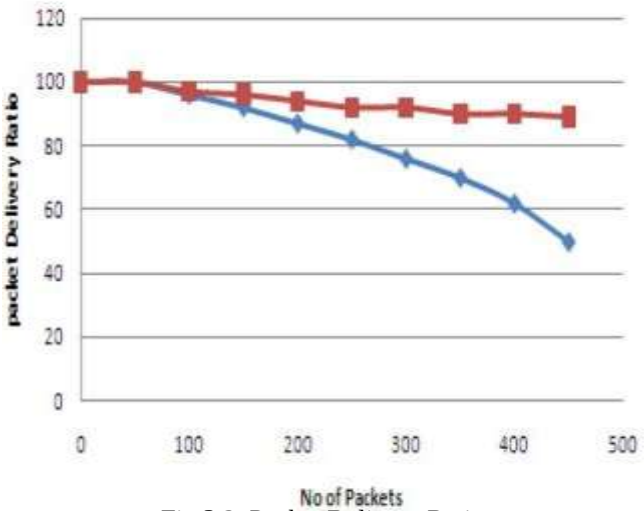

Fig.3.2. Packet Delivery Ratio

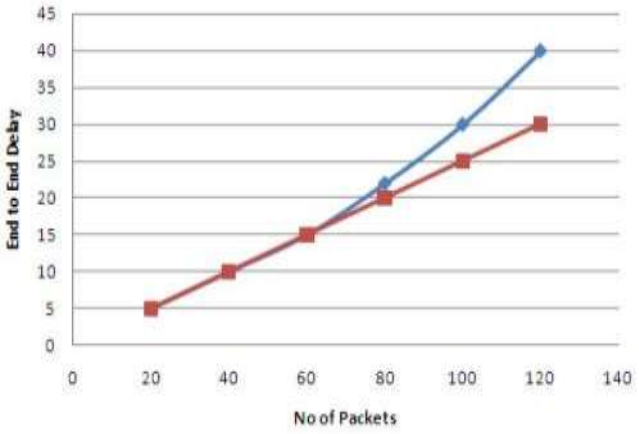

Fig.3.3. End to End Delay Vs Number of packets.

In fig3.1 Network lifetime has been analyzed by having various traffic size. i.e, numbers of bits transmitted. When the traffic size increases lifetime decreases slightly till certain point, after which it falls quickly in increasing traffic size. In earlier AODV method, when the number of packets transmitted from source increases all of them follows a same path and does not bother about the congestion. It causes poor quality in packet delivery. This paper is proposed to consider the congestion of next hop before forwarding it. Fig3.2 shows that even source transmits more number of packets it results in good packet delivery ratio, since every node seeks and selects the best next hop by Ad-hoc-BAT algorithm and hence congestion were eliminated. When congestion rate increased, it adds more delay in end to end delay and sometimes results in packet loss. It has been avoided by proper loading of intermediate node and hence delay is restrained in limit.

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