Patient Monitoring through Routing Protocols in Mobile Network

Arvind Tariyal, Dr. Sanjay Singh, Mr. Sudhir Jugran

Abstract— **WBAN is based on IEEE 802.15.6, allowing near field communication within 1meter range from human body. In patient monitoring, the physiological data is sensed by sensor & forward to medical professional, where the received data is compared with the original data base of a patient continuously. Mobile patient monitoring system detects the patient's situation when they are in motion & allows patient to roam around the hospital without health professional.**

For proper communication between the mobile nodes of the patient monitoring system, the IEEE standard WLAN & WPAN are to be implemented. Different routing algorithms such as AODV, DSR, DSDV, & AOMDV have been analyses in NS2 for different types of patient monitoring scenario. WPAN system is designed under IEEE 802.15.4 & provides interconnection of communicating devices. It can also serve for different purpose such as allowing the surgeon & other team members to communicate during an operation inside the operation theatre.

Index Terms— **range, nodes, routing, end-to-end delay, throughput.**

1. INTRODUCTION

Wireless Body Area Network (WBAN) is a network who employing wireless sensor technology that forms a system to continuously monitor the patient situation. Specific sensors for each physiological data are placed near the human body, but it limits the patient mobility. It is of 3 types:

1) Wireless network
2) Infrastructure network
3) Ad-hoc network

Infrastructure Network consists of a network with fixed and wired gateways. A mobile host communicates with a bridge in the network or called base station within its communication radius. The mobile unit can move geographically while it is communicating. When it goes out of range of one base station, it connects with new base station and starts communicating through it.

AD-HOC depend on pre-existing infrastructure. Wireless Ad-hoc network is made up of few to hundred numbers of nodes or device that are connected through a Radio Frequency (RF) of infrared interface & have a capability of communicating with each other by making connected in a decentralized manner [1]. Wireless Ad-hoc network is having a number of sensor node spreads over a specified area [2].

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Each node has a capability of signal processing & networking of the data. But wireless network is more susceptible to interference due to other radio frequency devices, & obstruction. Total throughput is also decreased when there are multiple connections [3]. The wireless network gives freedom to the devices, for forwarding data & takes part in communication without networking cables, which increase the mobility but decrease the range of communication

1.1 Reactive Protocols

This network maintains only the routes that are currently in use, so reducing the burden on the network when only a few of all available routes is in use at any time. These types of protocols are also called as On Demand Routing Protocols where the routes are not before defined for routing. A Source node calls for the route discovery phase to determine a new route whenever a transmission is necessary. On-demand techniques have smaller routing overheads but higher latency.

Example Protocols: DSR, AODV

1.2 Ad Hoc On-demand Distance Vector Routing (AODV) Protocol

Ad hoc On-Demand Destination Vector, (AODV) is a distance vector routing protocol that is reactive. The reactive property of the routing protocol implies that it only requests a route when it needs one and does not require that the mobile nodes maintain routes to destinations that are not communicating. AODV guarantees loop-free routes by using sequence number that indicate how new, or fresh, a route is. AODV requires each node to maintain a routing table containing one route entry for each destination that the node is communicating with. Each route entry keeps track of certain fields. Some of these fields are:

Destination IP Address**:** The IP address of the destination for which a route is supplied. Destination sequence number: The destination sequence number associated to the route. Next Hop: Either the destination itself or an intermediate node designated to forward packets to the destination. Hop Count: The number of hops from the originator IP Address to the Destination IP Address Lifetime. The Advantage of AODV is Routes are established on demand and destination sequence numbers are used to find the latest route to the destination. Least delay is there for connection setup. Disadvantages are AODV doesn't allow handling unidirectional links. Multiple Route Reply packets can lead to heavy control overhead. Periodic beaconing leads to unnecessary bandwidth consumption.

1.3 Dynamic Source Routing Protocol (DSR)

DSR based on 'on-demand theory' & supports unicast routing. It works on the source routing theory not hop by hop routing, it implies that, the source of sending packet will find out the complete sequence of the intermediate nodes by which the packet will reach up to intended terminal or node. Nodes send the packet of data to intended node, then the source will add that route sequence in the header of the transmitted packet [4]. This routing protocol is used in multi hop wireless ad- hoc network. The DSR algorithm regulates & configures the communication by two mechanisms:

i) Route discovery mechanism
ii) Route maintenance mechanism

In order to avert the memory overhead, the router maintains the list of recently used routes & route requests. Route discovery & route maintenance mechanism works completely on dem& [5]. The Route Request (RREQ) & Route Reply (RREP) message are used to perform these mechanisms.

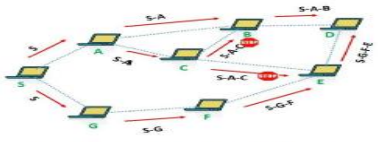

Figure 2-2: DSR Route Discovery Process RREQ Broadcast

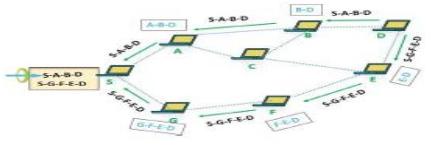

Figure 2-3: DSR Route Discovery Process RREP

1.4 Hybrid Protocols

The Hybrid protocols are the combinations of reactive and proactive protocols and takes advantages of these two protocols and as a result, routes are found quickly in the routing zone. Example Protocol: ZRP (Zone Routing Protocol)

2.2.2 Ad-Hoc On Dem& Distance Vector (AODV)

The AODV is also based on 'on-demand theory' but applicable for both unicasting & multicasting routing. It is a reactive routing protocol so it frames routing paths between the node terminals only when the request came for the same from the source terminal. Once the routing path is establish between nodes it will remain exist for it lifetime [6]. Lifetime is associated with the entry in route table, if at all a path is idle for duration, then that path is black out from route table. The AODV assigns a destination sequence number to all route entry thus it is also called as destination based routing. AODV overcomes the existing problem in DSDV routing protocol by creating the path only on dem& & thereby reduces the number of broadcast [7].

In order to find the route from source to its intended node, Source broadcast a RREQ & then in between nodes also broadcast that packet to their neighbor, this process is continued until it reaches intended node or any in between node which has a recent route information about the destination. RREQ in AODV carries the intended node address only, whereas in DSR it bears full routing data, it signifies that AODV routing algorithm, has probably lesser routing overhead. RREP in AODV, carries the intended node's IP address & destination sequence number, but unlike AODV in case of DSR routing algorithm it carries the information of the selected route, & at the same time it also carries the address of nodes coming in the selected path. Therefore AODV resolves the problem of potential overhead found in DSR [7].

Whenever any mobile terminal needs to transmit the information packet to the intended node, it broadcasts a RREQ in the network. When this RREQ message is received by the intermediate nodes, they create a reversal route towards the source node & then check for an accurate path in the route table, but if the requested route is not available.

2. LITERATURE SURVEY

In our literature survey, I have studied so many research paper and we conclude that the concept of patient monitoring system is explained in the paper "Implementation of wireless body area networks for healthcare system," [8]. The patient monitoring is implemented in "Real time monitoring of electrocardiogram through IEEE 802.15.4 network" under IEEE standard of WPAN & real time monitoring[9].

The routing is core issue for mobile patient system & the routing algorithm is discussed in the paper [10]. The performance evaluation of different routing protocol is discussed in paper "A simulation comparison among AODV, DSDV, DSR protocol with IEEE 802.11 MAC for grid topology in MANET" [11]. It states that the AODV routing is reactive On demand routing protocol. DSR routing protocols explained in paper "Optimization & implementation of DSR route protocol based on Ad hoc network" by **Zhaohua Long** et al in 2007 [3]. AODV routing protocol is not performing well in highly dynamic network, to overcome this problem a derivative of AODV routing protocol, AOMDV came into light in paper "Ad-hoc on dem& multipath distance vector routing" & described by **Marina** et al in 2006 [12].

3. SIMULATION & ANALYSIS METHOD

Network simulator (version 2) is usually known as NS2, it is a powerful simulator for studying dynamic nature of mobile wireless sensor network, and this software is used to simulation. NS2 supports simulation of a network from physical radio transmission channel to the application layer [13]. The NS2.35 simulator is used for simulation & was conducted under the Linux mint platform. In this investigation of different routing like AODV, DSR, DSDV, & AOMDV protocols to have been performed based on different parameters with increasing speed & number of nodes on the network.

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This performance parameter represents an average delay & indicate the time taken by data bits to travel from source to intended node [7]. It include all delay caused by transmission

at MAC, queuing at interface queue, processing & propagation delay. End to end delay is shown by equation (1).

Tee = Processing Delay (Tp) + Queuing Delay (Tq)+ Transmission delay (Tt) + Propagation delay (Tpr)………………………………………..………(1)

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Throughput represents the average rate of data packet received at the intended node. It is also defined as the total data packet reached at the intended node to the total time require by the bits of a data to reach the destination [6]. Higher value of throughput means routing protocol is performing better, & throughput is given by (2).

$$Throughput = \frac{N \times Ps \times 8}{Ts} \quad \text{……………………………………………………} (2)$$

Where,
N = Number of delivered packets
Ps = Packet size
Ts= Total duration of simulation

Table 3-1: Simulation Parameter Under IEEE 802.11

PARAMETER	VALUE
Radio propagation model	Propagation/ Two ray ground
Network interface type	Physical/ wireless
MAC type	MAC/802.11
Interface Queue type	Queue/Drop Tail/ Pri Queue
Link layer type	CSMA/CA
Simulation time	60 sec
Area of the network	100*100
Traffic Type	CBR

Table 3-2: Source and Destination in Ten Node Network

SOURCE NODE	DESTINATION NODE
Node (2)	Node (3)
Node (5)	Node (4)
Node (9)	Node (6)

Receiver Power & Transmitter power of this particular network is 0.4 & 0.8 watt respectively. The speed of all ten mobile nodes is varied from 10 to 50m/sec. & analysis of this network is performed for 60 seconds based on different routing protocol like AODV, DSR, DSDV, & AOMDV routing protocols.

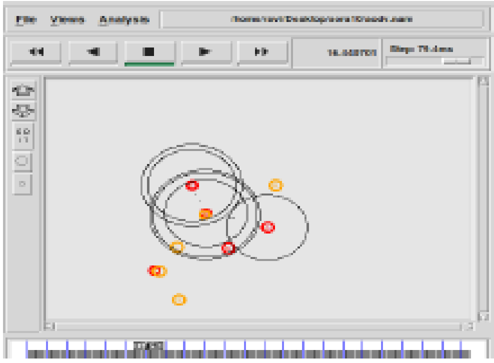

Figure3-1: Ten Node Model in NS2

Table 3-3: Source and Destination in Twenty Node Network

SOURCE NODE	DESTINATION NODE
Node (12)	Node (3)
Node (15)	Node (4)
Node (4)	Node (16)

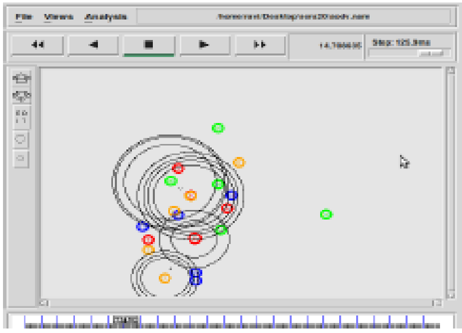

Figure 3-2: Twenty Node Model in NS2

Table 3-4: Source And Destination In Thirty Node Network

SOURCE NODE	DESTINATION NODE
12	3
25	4
24	16
3	8

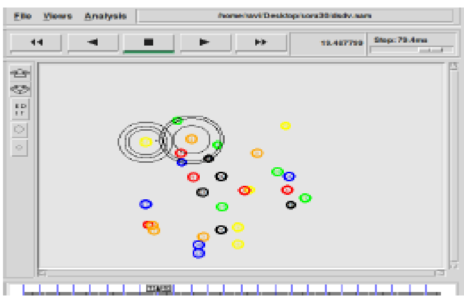

Figure 3-3: Thirty Node Model in NS2

5. CONCLUSION

NS2 is chosen as the simulation software for this study. AODV, DSR, DSDV, & AOMDV routing protocols are simulated under IEEE 802.11 MAC layer for different cases

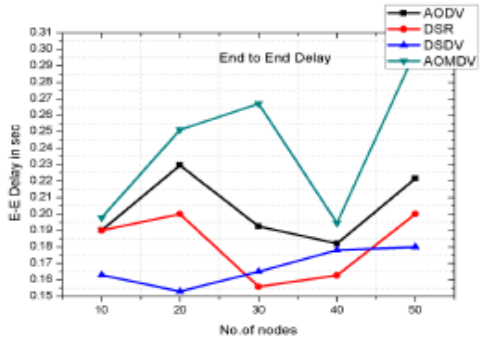

FIGURE 4-1: END TO END DELAY WITH INCREASING NUMBER OF NODES

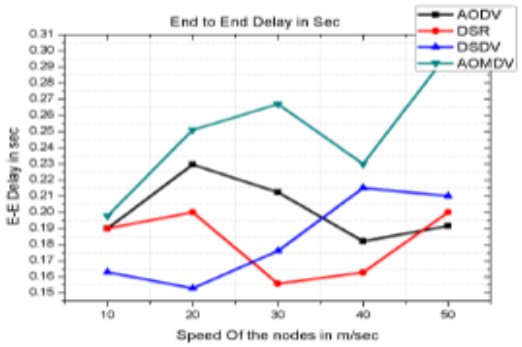

FIGURE 4-2: END TO END DELAY WITH INCREASING SPEED OF NODE

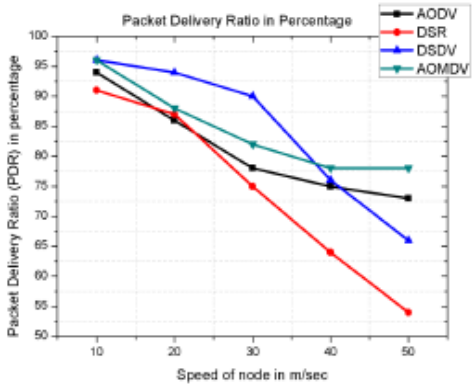

FIGURE 4-4: PDR IN PERCENTAGE WITH INCREASING SPEED OF NODE

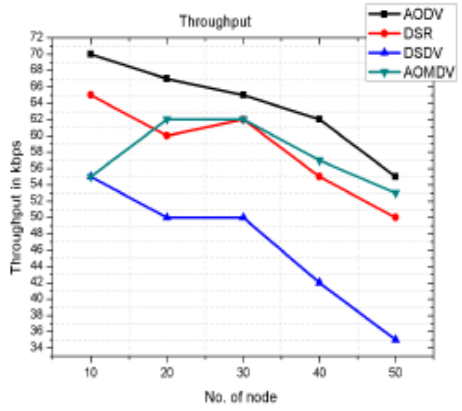

FIGURE 4-5: THROUGHPUT WITH INCREASING NUMBER OF NODES

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