Optimizing the Information Speed in Telemedicine Network by Increasing the Speed of Nodes

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ABSTRACT

Telemedicine has changed the way of health care. It is an indispensable tool in the hands of doctors to accelerate and facilitate the process of data interchange. Wireless networks consist of small nodes with communications capabilities. Development of wireless networks of Telemedicine system is highly demanded since these networks promise a wide range of potential applications. In this paper the researchers have proposed a new protocol based on ODMRP protocol. This protocol focuses on fairness of network and reduction of flooding overhead to increase the network of telemedicine system lifetime. The investigators have also simulated our protocol and compared its functionally to ODMRP protocol. Results showed that our protocol increases the network lifetime and speed.

Keywords

Telemedicine, Information Speed, Speed of Nodes

1. INTRODUCTION

Nowadays, with the development of new technologies of information and communication, business and procedure activities and communicate with others and access to information has been a huge change. Telemedicine as a technology has become quite common. In many countries, the importance and applications of telemedicine have understood and Telemedicine has been launched. Telemedicine has solved the need for an improved access to patient information necessitating adequate security for data and speed data transmission. Physician receives the patient's history online and pprescribes the medication required. Telemedicine progress depends on two branches of medical science and information technology since IT increases the level of health in a country beyond its geographically limitations. Numerous studies have been carried out to assist health system managers in making decisions, enabling them to evaluate the consequences produced by their choices in the efficiency of the system [1,2].

Telemedicine applications relay on the telecommunication infrastructure, which is often chosen carefully to support such application on the internet and IP-based networks provide a standardized system interface [3].

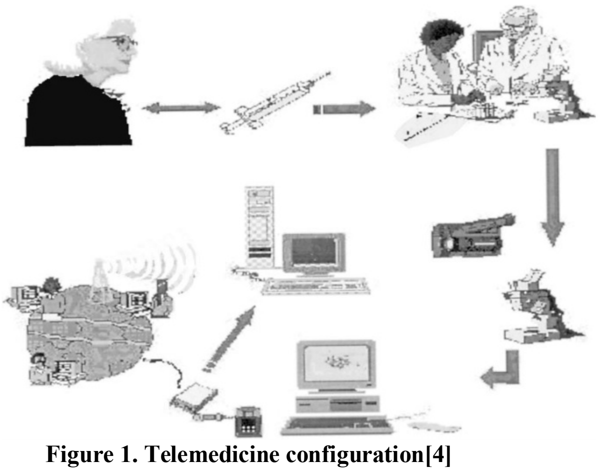

Figure 1. Telemedicine configuration[4]

In this paper, a routing protocol for wireless networks is presented. The main goal of this method is to reduce the overhead due to the SPEED network. Simulation results show that in the proposed method, speed is raised while eliminating the overhead of the nodes. Telemedicine represents a model for thinking, making decisions to improve health through information technology. In 1959,with CECIL

WHITTSON, the first practical telemedicine program was launched. The purpose of this program was mental health care as well as medical education.

Structure for telemedicine can considered as follows:

A) Creating an essential database:

- Disease diagnosis and medical services
- Service provision for research work
- Access to information by patients and physicians
- Access to raw data by the experts or medical institutions
- Access to patient information and send and receive correspondence between the patient and physician
- Establishing video conferencing between doctors or between patient and doctor
- control of Electronic hospital operations based on specific functions

B) Designing high-volume network connection for the exchange of medical information:

- Ideal Bandwidth
- Fiber optic or wireless network
- Security
- High reliability

Creating such a high volume of network, security and speed of information and availability of the essential requirements for the information is necessary. Nowadays, we tend to use wireless networks because these networks will require services for users.The most widely used of these networks is ad hac networks. ODMRP[1] protocol is the best multicast protocol of ad hoc networks.

Development of wireless networks are highly demanded since these networks promise a wide range of potential applications in Telemedicine systems. Recent advances in wireless networks have led to many new protocols specifically designed for it. Most of the attention, however, has been given to the routing protocols since they might differ depending on the application and network architecture. There has been a considerable amount of research in developing routing in these networks.

In this paper, a new protocol based on ODMRP protocol is proposed. Each node in the network helps the node to find the next best node for forwarding its packets toward nodes. The researchers have simulated our protocol and compared its functionality to ODMRP simulation for Telemedicine systems results, indicating our protocol increases the network lifetime and speed. We have proposed a telemedicine network architecture using multicast protocol of ad hoc network.

2. Related Work

There are many approaches to improve the ODMRP protocol to control their control overhead, however, the nodes have local routing system such as POOLODMRP(5), PATCHODMRP(6) PDAODMRP(7).

DCMP, another protocol is proposed to save the control overhead by classifying the sources into active and passive. In some of these protocols such as DCMP, some passive sources have forward data through their nodes.

E-ODMRP (8) reduces the packet overhead by up to a half yet keeping a packet delivery ratio comparable to the original ODMRP. E-ODMRP, which is compared favorably with other published multicast schemes.

These protocols based on ODMRP protocol previously.

In addition to the above, Mobility Prediction in protocols is:

- Mobility prediction can help determine longevity of routes and schedule refresh requests
- Mobility can be predicted, e.g., in an outdoor environment by means of GPS location information; received power based prediction also possible
- Join Queries are flooded only before predicted route disconnection time
- The scheme adapts refresh interval to mobility patterns and speeds

And route construction is:

- Similar to other on-demand routing protocols
- Consists of a query and a reply phase
- A source periodically transmits Join Query packets when it has data to send
- Join Query packets can carry data payload to eliminate route acquisition latency
- Intermediate nodes forward the packet and set up path back to the source (backward learning)
- The destination sends a Join Reply in response to a Join Query

We have simulated our protocol and compared its functionality to ODMRP simulation for Telemedicine systems. Results show that our protocol increases the network lifetime and speed of these networks.

3. Ad hoc Networks

3.1. What is Ah hoc networks?

An ad hoc network is infrastructure-less and self-organized. The network is ad hoc because it does not rely on a preexisting infrastructure, such as routers in wired networks or access points in managed (infrastructure) wireless networks. Instead, each node participates in routing by forwarding data for other nodes, so the determination of which nodes will forward data is made dynamically on the basis of network connectivity. In this network, Computers to communicate with each other must be located in the area.

Topology changes very rapidly in mobile wireless networks unlike wired networks. Protocols like DV, LS and Path Vector routing algorithms don't work well under frequent topology changes.

Tree-based protocols and mesh based protocols are two categories of multicast protocols for ad hoc networks. Tree-based protocols are more efficient than mesh-based protocols, but mesh-based schemes has no alternative path between a source and a destination. ODMRP [9,10,11], CAMP [12], NSMP [13] are mesh based schemes and AMROUTE [14] and AMRIS [15] are tree-based schemes.

3.2. ODMRP Protocol

ODMRP is an on-demand multicast routing protocol designed for ad-hoc networks. This protocol was proposed in1999 by lee. In wireless networking, On-Demand Multicast Routing Protocol is a protocol for routing multicast and unicast traffic throughout Ad-hoc wireless mesh networks. ODMRP creates routes on demand, rather than proactively

[1]On-Demand Multicast Routing Protocol

create it. Consequently, it undergoes a route acquisition delay, although it helps reduce network traffic in general. To help reduce the problem of this delay, some implementations will send the first data packet along with the route discovery packet. Since some links may be asymmetric, the path from one node to another is not necessarily the same as the reverse path of these nodes [16, 17, 18].

- **Forwarding Group**: All the nodes inside the "bubble" forward the M-cast packets via "restricted" flooding
- Multicast Tree replaced by Multicast "Mesh" Topology
- Flooding redundancy helps overcome displacements and fading
- FG nodes selected by tracing shortest paths between M-cast members

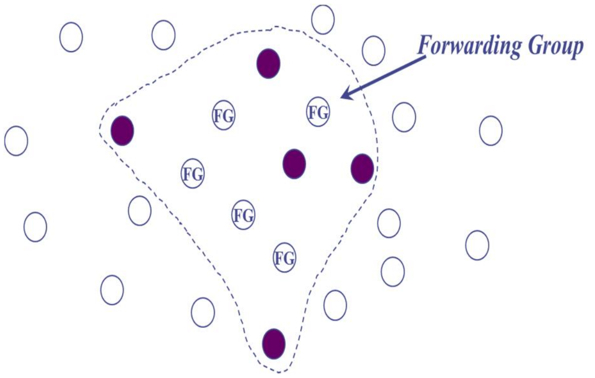

Figure2. Forwarding group in ODMRP

4. Route construction in ODMRP

- Similar to other on-demand routing protocols
- Consists of a query and a reply phase
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Table1. Route construction in ODMRP

Join Query Refresh Interval	3 Sec
Join Reply Acknowledgment Timeout	25ms
Maximum Join Reply Transmission	3

Features of ODMRP:

- Simplicity
- Low channel and storage overhead
- Usage of Up-to-date shortest routes
- Reliable construction of routes and forwarding group
- Robustness to host mobility
- Maintenance and utilization of multiple paths
- Exploitation of the broadcast nature of the wireless environment
- Unicast routing capability

5. The Proposed Protocol

In this section we introduce the proposed method. This algorithm is inspired from ODMRP protocol .ODMRP simulation protocol have been evaluated. If overhead can be reduced, Data transfer rate is higher.

The proposed protocol belongs to flat and is reactive to routing categories. Whenever a node needs to send a data packet, it takes distance into consideration as two parameters used for selecting the next node to transmit the packet to it. This selection is based on local information and there is no predefined route. We used the passive data acknowledgments after the group establishment and route construction progress. A multicast source can transmit packets to receivers via the selected routs and forwarding groups. When receiving multicast date packets, a node forwards it only if it is not a duplicate and the setting of the flag for the multicast group has not expired. In the identification phase, each node tries to identify its neighbors and to collect information about their distance to another node. Since we assumed that nodes are stationary, the distance measurement between the nodes and the destination node is once done. Then each node is calculates in terms of their average distance to the destination node. These values are used in the next phase. When a forwarding node receives a data packet, it relays the data packet then it records its source packet, multicast group address, if next node of this node is not a member of multicast group. When the node receives a data packet from its next node on path to a receiver, it sets true to delivery field in related record. A telemedicine network must be tailored specifically for the healthcare industry to deal with situations such as where mobile ambulance teams need to communicate with, accident and emergency staff, where multiple medical practitioners require simultaneous access to patient files or when specialists consult with peers in other locations. Driven by a never-ending need for cost efficiency, accuracy and reliability, medical files are increasingly being stored electronically, making telemedicine on a much wider scale much more viable. This requires a network solution that is highly flexible, reliable, scalable and future proof, one that is built to open standards and can be seamlessly integrated with all existing patient care systems. Controlled access and special protective mechanisms enable a unified network topology whist allowing different user groups to execute various required tasks. This can be easily managed by verifying hardware. The future of telemedicine is truly vast. The services and benefits from the proposed protocol also have been shown. However it is successful implementation is closely connected with an appropriate design of the telecommunications network, part essential when deploying a network and the selection of appropriate communications technologies, realistic and sustainable according to the characteristics of the context in which it is deployed.

6. Simulation Results

In this section, The proposed protocol has been compared to ODMRP protocol. In this paper, we simulated the proposed protocol by GLOMOSIM OPNET. We consider a network of nodes distributed uniformly and randomly on a 1200m*1200m region. In this simulation the IEEE 802.11 communication protocol has been used and nodes have been assumed stationary. Furthermore, the packet size is equal to 512bytes. The multicast group size is taken as 21. Bandwidth is assumed as 2Mbps. The final results are averaged over 20 simulation runs. . We have simulated our protocol and compared its functionality to ODMRP simulation for Telemedicine systems. Results show that our protocol increases the network lifetime and speed.

In the first experiment, we assumed constant number of nodes equal to 5. We have four multiple routes among nodes. We compared proposed protocol to ODMRP with packet delivery rate by increasing speed of nodes.

Packet delivery rate has been calculated using A factor which is introduced in Eq. (1)

A= the total number of packets delivered/ the total number of packets that must be delivered (1)

The result of this comparison is shown in Fig.1. As the simulation time elapses, data overhead in the proposed protocol is reduced and resistance of protocol is maintained. The packet delivery rate between proposed protocol and ODMRP is equal. Delay in packet arrival is Depending on the time between sending and receiving packets.

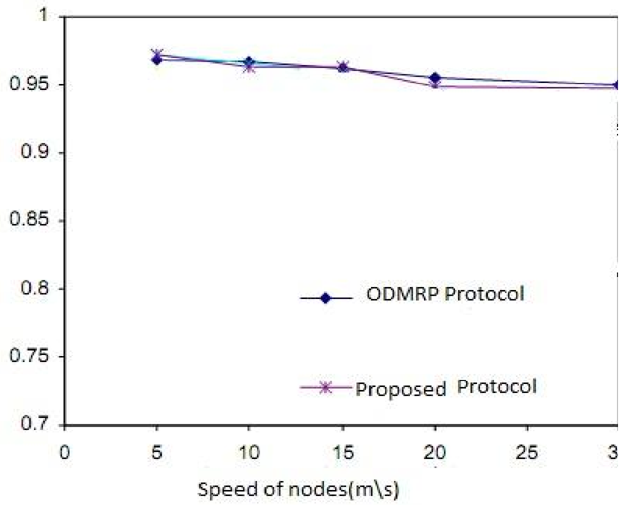

Figure3. Packet delivered Rate

In second experiment, we assumed constant number of nodes equal to 5. The researchers have four multiple routes among nodes. We compared the proposed protocol to ODMRP with delay in packet arrival with speed of nodes. As shown in Fig.2, delay in packet arrival in our protocol is better. This is because of lower repetitive data transfers.

In the proposed protocol, by increasing the speed of nodes, there will be more paths between source node and destination node. Since the traffic on each path is proportional to their nodes, more protection is done for weaker nodes and therefore, the network lifetime is increased.

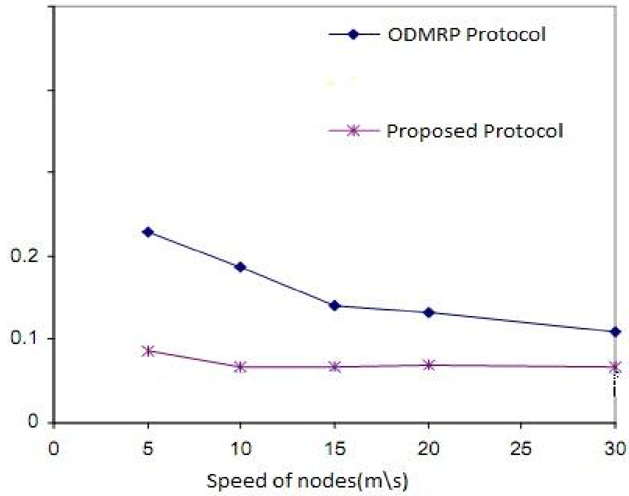

Figure 4.Delay of nodes

In the third experiment, under different number of nodes, the overhead ratio of our protocol is compared to ODMRP. In this simulation, the overhead ratio is measured based on Eq. (2)

Overhead ratio= the total number of packets sent/ the total number of packets delivered (2)

In this relation, packets delivered is the number of packets that are successfully delivered to the destinations and packets sent is the number of packets that are sent in the first phase in order to collect and update neighbors information.

Fig.3 depicts the result of this experiment. As you see in this figure, the ratio overhead in the proposed protocol is less if we increase the multiple routes. It is due to less multiple routes in our protocol and more focusing on local information to make decision of selecting the next node in routing.

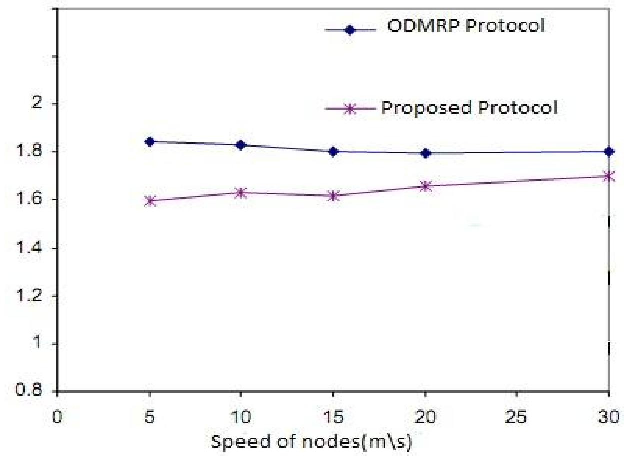

Figure 5. Data overhead

Telemedicine systems results show that our protocol increases the network lifetime and speed.

7. CONCLUSION

In this paper, a new protocol for Telemedicine systems was proposed leading to lower overhead, a delay in packet arrival, an increase in packet delivery rate, prolongation of the network in Telemedicine lifetime and optimization in the information speed. The packet delivery rate is improved at high multiple routes in the networks of Telemedicine systems. The main idea for this protocol was to increase the speed of nodes. The simulation results showed 24% reduction in overhead rate. These results were shown in the simulations and the proposed protocol was compared to ODMRP protocol.

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