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Telemedicine communication using MANET

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Abstract— **These Recent advances in 3G Telecommunication and computer technologies have led to the development of mobile computing environments to Telemedicine service. In mobile computing environments, users equipped with portable computers, called mobile host, can change their locations while retaining network connections by utilizing wireless communication. As Telemedicine the research fields in mobile computing environments, there has been an increasing interest in ad hoc networks constructed by only mobile hosts. In ad hoc networks, every mobile host plays the role of a router, and communicates with each other. Even if the source of ambulance and the destination of hospitals are not in the communication range of the two mobile hosts, data packets are forwarded to the destination by relaying transmission through intermediate mobile hosts. Since no special infrastructures are required, many telemedicine applications such as rescue affairs at disaster sites and inter-vehicle communication are expected to be developed in ad hoc networks. In ad hoc networks, since the network topology dynamically changes due to the movement of mobile hosts, different fundamental technologies from the conventional fixed networks are needed [1].**

Index Terms— **Telemedicine, Computer communication network, Mobile ad hoc network, Internet,**

I. INTRODUCTION

Highlight A mobile ad hoc network (MANET) is a continuously self-configuring, infrastructure-less network of mobile devices connected through internet without wire. Each Mobile device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the patient medical information required to properly route traffic. Such computer communication networks may operate by themselves or may be connected to the larger Internet. They may contain one or multiple and different transceivers between nodes. This results in a highly dynamic, autonomous topology. MANETs are a kind of wireless ad hoc network that usually has a routable networking environment on top of a Link layer ad hoc network. MANETs consist of a peer-to-peer, self-forming, self-healing network in contrast to a mesh network has a central controller (to determine, optimize, and distribute the routing table). MANETs circa 2000-2015 typically communicate at radio frequencies (30 MHz - 5 GHz). Some MANETs are restricted to a local area of wireless devices (such as a group of laptop computers), while others may be connected to the Internet. For example, A VANET (Vehicular Ad Hoc Network), is a type of MANET that allows Mobile Telemedicine Ambulance vehicles to communicate with roadside equipment. While the vehicles may not have a direct Internet connection, the wireless roadside equipment may be connected to the Internet, allowing patient data from the vehicles to be sent over the Hospital network through Internet. The vehicle data may be used to measure traffic conditions or keep track of trucking fleets. Because of the dynamic nature of MANETs, they are typically not very secure, so it is important to be cautious what data is sent over a MANET. [2-5]

The field of wireless and mobile communications has experienced an unprecedented Growth during the past decade. Current second-generation (2G) cellular systems have reached a high penetration rate, enabling worldwide mobile connectivity. Mobile users can use their cellular phone to call to Specialist doctors and sent patient details to their email and browse the Internet for live status of patient using two way communications. Recently, 2G cellular networks are evolving to 3G, offering higher data rates, an increasing number of devices such as laptops, personal digital assistants (PDAs), pocket PCs, tablet PCs, smart phones, MP3 players, digital cameras, etc.are provided with short-range wireless interfaces. This evolution is driving a new alternative way for mobile communication, in which mobile devices form a self creating, self organizing and self-administering wireless network, called a *mobile ad hoc network*. This paper discusses the mobile telemedicine how to communicate the patient data transfer to hospital using MANET through internet.[6-10]

II. TELEMEDICINE SERVICE USING MANET

A. Telemedicine data replica allocation for improving data accessibility

In ad hoc networks, there are many applications in Telemedicine which mobile hosts access data items held by other hosts. Here, if a network partition occurs due to the

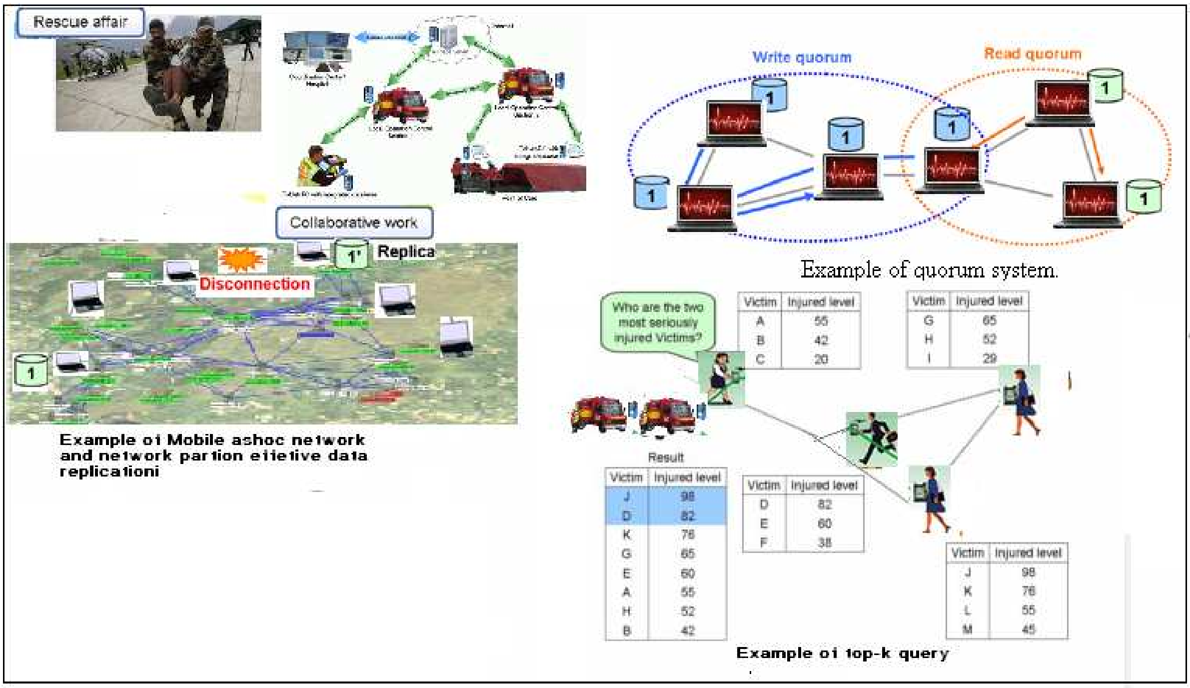

Figure 1. *Telemedicine Mobile Ad hoc network*

movement of mobile hosts, data in two separated networks becomes inaccessible to each other. Thus, data accessibility in ad hoc networks becomes lower than that in the conventional fixed networks (Fig. 1). A key solution is to replicate data items on mobile hosts that are not the owners of the data items. We proposed three replica allocation methods for improving data accessibility. In these methods, each mobile host periodically allocates replicas considering the access frequency of each data item and the network topology. We extended these methods considering the correlation among data items and the stability of radio links. We assumed an environment where mobility and access characteristics of mobile hosts have the locality and proposed a method that locally relocates replicas just before a network division occurs.[6-10].

B. Telemedicine consistency Management among Replicas

In an environment where data updates occurs, it is difficult to keep the consistency among replicas in the entire network. To solve this problem, consistency management among replicas based on a dynamic quorum system is a promising approach. In a dynamic quorum system, quorums are constructed of replicas, where every pair of read and write quorums have an intersection. Data accesses and updates are performed to all replicas in a quorum (Fig.1). In Mobile telemedicine research, mobile hosts holding replicas are grouped into quorums and manages the consistency among replicas. We have classified consistency levels according to application requirements and proposed methods to realize them. The methods which keeps the strict consistency construct quorums by considering the number of mobile hosts in a quorum or the locations of the regions.[8-13].

C. Telemedicine K Nearest Neighbors (kNN) query processing

In mobile ad hoc networks, a location-based service (LBS) is a typical application. In an LBS, it is common that a node issues queries to search the information on a specific location in real time which is held by mobile nodes. In such a case, it is effective to process the queries as k Nearest Neighbor (kNN) queries, which search the information on the k nearest neighbors (kNNs) from the specified location. Figure 2 shows an application example of performing a kNN query where an event organizer distributes coupons or some time-service information to kNNs from a specific location on the event site. If the query-issuing node receives replies from all nodes, it produces a large amount of unnecessary traffic. Moreover, if a static query propagation tree is constructed and a link in the tree is disconnected, the query-issuing node cannot acquire the information of some kNNs. Therefore, we have proposed kNN query processing methods for reducing traffic and also keeping high accuracy of the query result in mobile ad hoc networks.

D. Telemedicine Module description

Network Formation**:** In this module we form the network. The network contains number of nodes and one base station. We can construct a topology to provide communication paths for wireless network. Here the node will give the own details such as Node ID and port number through which the transmission is done and similarly give the known nodes details such as Node ID IP address and port number which are neighbors to given node.

Rebroadcast Delay**:** In this module we find the uncovered neighbor set and calculate the rebroadcast delay. The UnCovered Neighbors set U(ni) of node ni as follows:

$$U(n_i) = N(n_i) - [N(n_i) \cap N(s)] - \{s\}$$

where N(s) and N(ni) are the neighbors sets of node s and ni, respectively. s is the node which sends an RREQ packet to node ni.

The rebroadcast delay can be calculated as,

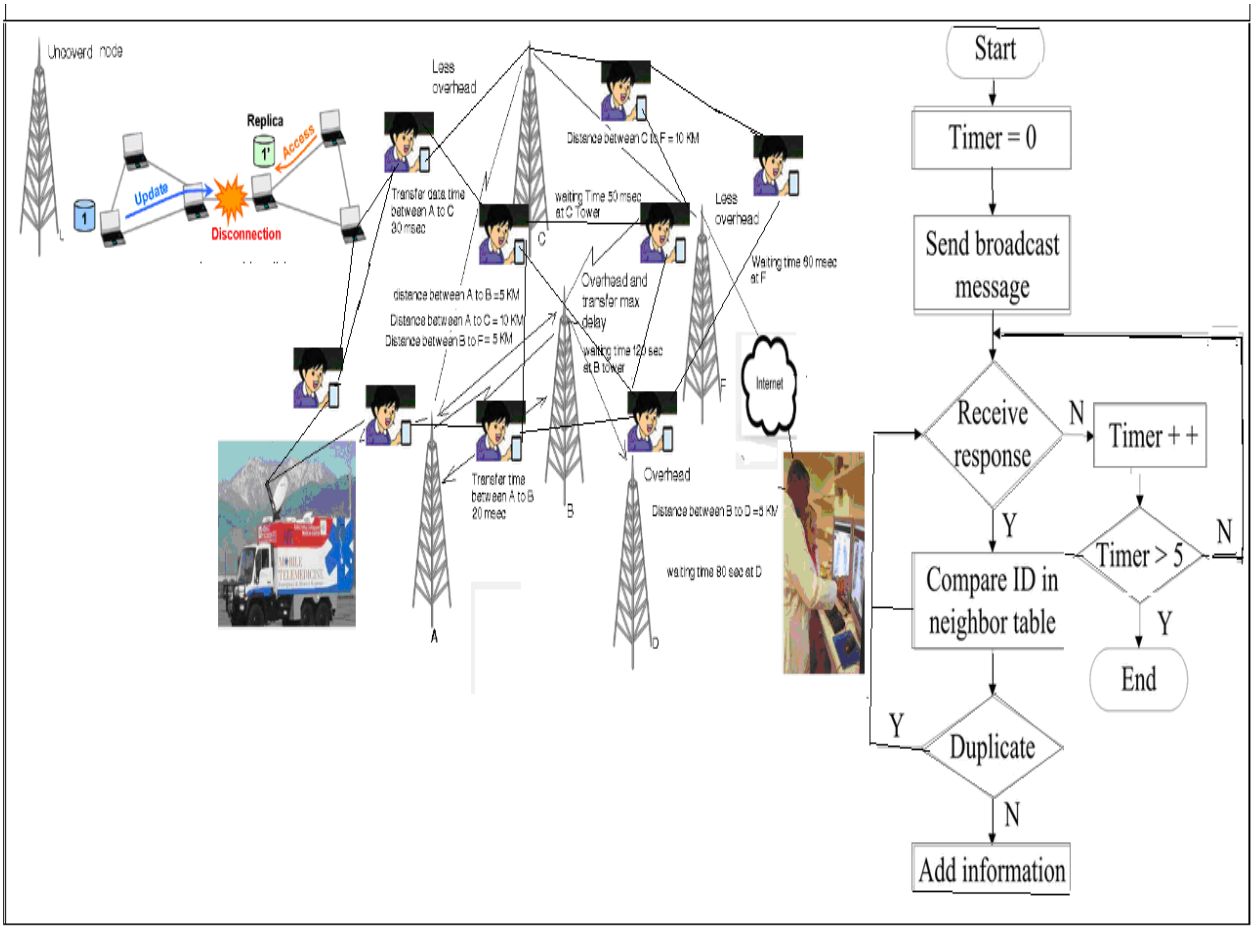

Figure 2. *Nearest Neighbor queries*

$$T_p(ni) = \frac{|N(s) \cap N(ni)|}{|N(s)|}$$

$$T_d(ni) = MaxDlay * T_p(ni)$$

$T_p(ni)$ is the delay ratio of node ni, and Max Delay is a small constant delay.

Rebroadcast Probability**:** The rebroadcast probability can be computed as follows:

$P_{re}(n_i)=F_c(n_i).R_a(n_i)$

Where $R_a(n_i)$ is the additional coverage ratio of node n_i

$F_c(n_i)$ is the connectivity factor .

NCPR: Neighbour Coverage-based Probabilistic Rebroadcast algorithm used for reducing routing overhead in route discovery.

E. Neighboring routing algorithm

Step 1: compute overhead – On
Step 2: Compute Max transmission delay – Td (ni)
Step 3: Compute the waiting time – Tw(ni)
Step 4: if On> max and if Td (ni)>max and if (Tw(ni) > max
Step 5: compute covered neighbors set of nodes C (c,x)
Step 6: compute uncovered neighbors set ( ) U (ni, Rs.id)
Step 7: U(ni) = N(ni) – [N(ni) ∩ N(s)] – {s}
Step 8: compute the re broad cast delay Td (ni)
Step 9: compute rebroadcast delay Tp(ni) = | 1-[N(S) ∩ N(ni)] | / | N(S) |
Step 10: Td (ni)= max delay* Tp(ni)
Step 11: Set a Timer (ni, Rs.id) according to Td (ni)
Step 12 end if
Step 13: if ni receives a new RREQ from S then C (ni, Rs.id)
Step 14: Compute shortest distance of covered neighbors set of nodes
Step 15: Compute neighbors set of nodes of max overhead and waiting time.
Step 16 if compare C (ni, Rs.id), C (nj, Rs.id)
Step 17: if new neighbors overhead and waiting time are less
Step 18: discard to new neighbors nodes of j
Step 19: discard (RREQj)
Step 20: broad cast (RREQs),

$P_{re}(n_i)=F_c(n_i).R_a(n_i)$

F. Replica management considering dataupdate

In a real environment, since it is more likely that data items are updated, mobile hosts may access old replicas that have been updated (Fig.2).[9 to 13]. Accesses to old replicas are invalid and cause useless data accesses and rollbacks. We assumed an environment where data items are updated and proposed replica allocation methods which consider read/write patterns or data update intervals. In addition, we are considering the follwing topics:

- Cache invalidation by broadcasting invalidation reports in order to reduce the number of accesses to old replicas.
- Update data dissemination to update old replicas efficiently for improving data accessibility.
- Log dissemination to efficiently verify the validity of tentative accesses to replicas.

Figure 3. *Decreasing battery and boost power by solar battery and avoid data loss*.

G. Replica management Considering power consumption

In ad hoc networks, since it is more likely that battery capacities of mobile hosts are limited, mobile hosts at the center of the network and holding data items (replicas) frequently accessed by other hosts need to transmit them many times and consume much power than other hosts (Fig. 3). In this case, mobile hosts cannot access data items held by the mobile hosts that exhaust their batteries and leave the network, and thus, data accessibility becomes lower. We have studied on data management considering power consumption to not only improve data availability but also prolong the lifetime of mobile hosts. We have also proposed replica allocation methods for not only improving data accessibility but also balancing the power consumption among mobile hosts. In these methods, each mobile host replicates data items frequently accessed by itself and its nearby hosts. As a result, these methods can balance the numbers of data accesses performed on data items held by each host. In addition, we have proposed the following data access methods:

- To prevent mobile hosts from exhausting their batteries, each mobile host selects the path on which mobile hosts has much remaining battery power and uses it for data transmission.
- To maintain data availability and prolong the lifetime of mobile hosts for reducing data traffic, each mobile host collects multiple requests for data items and transmits the requested data items by multicast. [8-13] [16].

H. Routing and Management of TopologyInformation

As mobile ad hoc networks are characterized by a multi-hop network topology that can change frequently due to mobility, efficient routing protocols are needed to establish communication paths between nodes, without causing excessive control traffic overhead or computational burden on the power constrained devices6. A large number of solutions have already been proposed, some of them being subject to standardization within the IETF. A number of proposed solutions attempt to have an up-to-date route to all other nodes at all times. To this end, these protocols exchange routing control information periodically and on topological changes. These protocols, which are called *proactive* routing protocols, are typically modified versions of traditional link state or distance vector routing protocols encountered in wired networks, adapted to the specific requirements of the dynamic mobile ad hoc network environment. Most of the time, it is not necessary to have an up-to-date route to all other nodes. Therefore, *reactive* routing protocols only set up routes to nodes they communicate with and these routes are kept alive as long as they are needed. Combinations of proactive and reactive protocols, where nearby routes (for example, maximum two hops) are kept up-to-date proactively, while far-away routes are set up reactively, are also possible and fall in the category of *hybrid* routing protocols. A completely different approach is taken by the *location-based* routing protocols, where packet forwarding is based on the location of a node's communication partner. Location information services provide nodes with the location of the others, so packets can be forwarded in the direction of the destination. Figure 2 provides an overview in terms of routing table content of the proposed solutions provides an extensive overview of routing protocol research. Simulation studies have revealed that the performance of routing protocols in terms of throughput, packet loss, delay and control overhead strongly depends on the network conditions such as traffic load, mobility, density and the number of nodes8.Ongoing research at Ghent University therefore investigates the possibility of developing protocols capable of dynamically In an ad hoc networks, the network topology changes dynamically due to the movement of mobile hosts. Thus, many applications which use topology information are proposed. However, most of them generate control packets on the application layer to grasp the information on the network topology. Therefore, the control traffic increases in the whole networks, and thus, several problems such as the deterioration of throughput and the increase of energy consumption occur. On the other hand, a huge amount of routing protocols are proposed in ad hoc networks. In these protocols, each mobile host maintains the routing graph which includes the information on routes between mobile hosts. We propose a topology generation method to decrease the control traffic on application layer by using the routing table (Fig. 4) [18].

A. Telemedicine Patient data sharing in inter-vehicle network

Recently, there are many approaches to Intelligent Transport Systems (ITS) which integrate roads, vehicles, Ambulance and users to solve various traffic problems. As part of ITS, an thus, data availability becomes low. We propose a data dissemination method to share data items

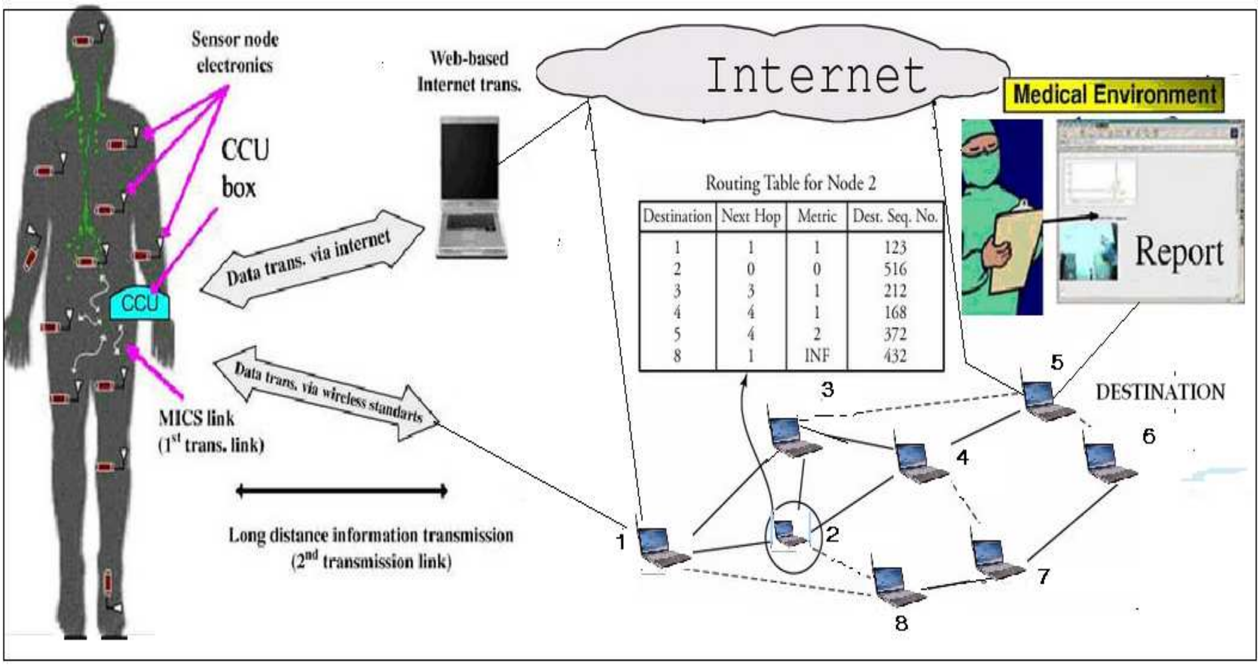

Figure 4. *Routing table of MANET*

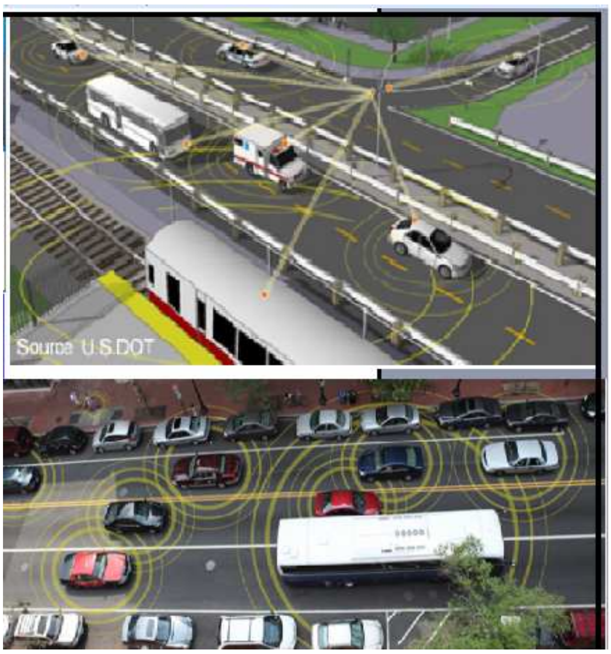

Figure 5 *Data sharing by inter-vehicle communications*

interest is increasing in traffic information delivery systems by which a user can receive traffic information about accidents and congestions via a car navigation device. In conventional systems, it is usually difficult for users to acquire fresh information due to the delay for collecting and delivering the information.

To solve this problem, it is effective that vehicles equipped with sensors gather information from the surrounding environment and share it with other vehicles using inter-vehicle communication However, in inter-vehicle communication, a vehicle cannot acquire a data item if it does not connect with another vehicle holding the data item, and among vehicles, which increases the opportunity for vehicles to acquire more fresh data items that the users request. Our research group assume that inter-vehicle communications will be implemented in communication technologies similar to adhoc networks.[14][17].Data sharing by inter-vehicle communications as shown in Figure 5.

B. Top- k query processing

In mobile ad hoc networks, since the 3G Mobile communication bandwidth is enough for data transmission , it is important to acquire only necessary data items to reduce data traffic. A possible and promising solution is that each mobile node retrieves data items using a top-k query, in which data items are ordered by the score of a particular attribute and the mobile node that retrieves data items (the query-issuing node) acquires ones with the k highest scores (top-k result). In Figure 1, we show an application example of a rescue effort at a disaster site where the communication infrastructure, e.g. Internet, has been broken down. Each rescuer can search for several victims with serious injuries to evacuate them with a limited number of ambulances. Here, if each rescuer transmits the information on the two most injured victims in his/her responsible region, the query-issuing rescuer acquires information on more victims than necessary. In addition, if the radio link between portable computers of rescuers in the bottom-right and top-left corners is disconnected, the query-issuing rescuer cannot acquire information on victims managed by the rescuer in the bottom-right corner. We have studied on message processing methods for top-k query to reducing network traffic and to keeping an accuracy of top-k result. In these methods, each mobile node estimates data items with the k highest scores and only transmits those data items. However, in these methods, queries are forwarded by flooding so many nodes send top-k queries and replies which are not related to acquire the result. Hence, we have studied routing methods for top-k query processing.[19].

Table 1 Telemedicine MANET .Application.

Telemedicine Mobile Adhoc network Applications	
Application	**Mobile Telemedicine service**
Tactical networks	Telemedicine communication and Operation
Emergency services	Remote sensing Real time operation in ambulance tele surgery Video Telephoney Emergency military healthcare suporting and communication of Specialist Doctors and nurses
Commercial and civilian environments	Vehicular services: road or accident guidance. transmission of Hospital networks to Emergency care Hospital Telemedicne centre
Home networking	Mobile Telemedicine System for Home Care and Patient Monitoring
Tele Education	• Universities and campus settings • Virtual classrooms • Ad hoc communications during meetings or lectures
Sensor networks	• Home applications: smart sensors and actuators embedded in consumer electronics • Body area networks (BAN) • Data tracking of environmental conditions, animal movements, chemical/biological detection
Coverage extension	• Extending cellular network access • Linking up with the Internet, intranets, etc.
Context aware services	contextual information regarding the patient's environment (e.g., location, data transmission device and underlying network conditions, etc.) is represented through an ontologicalknowledge base model. Rule-based evaluation determines proper content (i.e.,biosignals, medical video and audio) coding and transmission of medical data, in order to optimize the telemedicine process

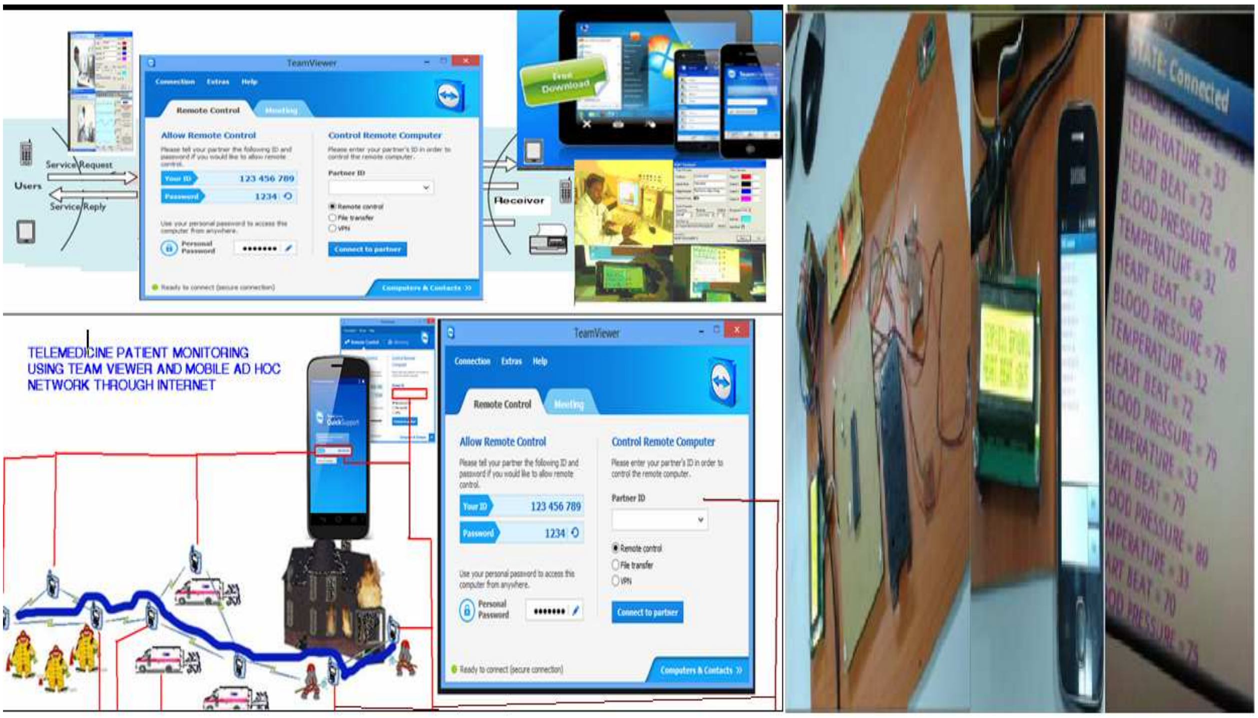

***Figure 6**. Internet connectivity of Telemedicine .*

III. INTERNET TELEMEDICINE CONNECTIVITY MOBILE DEVICES USING MOBILE AD HOC NETWORK.

Provide technical remote support to mobile devices from any Windows or Mac computer Whether it's a single tablet or a deployed fleet of smart phones, Team viewer mobile device support connect to Android and iOS (iPad/iPhone/iPod Touch) mobile devices through the Team viewer for Quick support application for monitoring Patient details. Support mobile devices remotely, all from the convenience of Telemedicine workstation. Internet connectivity of Telemedicine patient monitoring as shown in Figure 6. Telemedicine MANET .Application as shown in Table 1.

IV. Conclusion

This paper is explained about of Telemedicine service using computer communication with Mobile ad hoc network. The patient data transmission from source to destination when the data may be loss or disconnected by uncovered node of mobile ad hoc network. This paper explains how to overcome from loss of data transmission from uncovered node and find out covered node of neighbor's node. In Telemedicine service is essential of emergency transmission of data from Ambulance to specialist doctors in hospital but some node are not able to covered by mobile ad hoc network. The important patient data maybe loss to transmit to doctors and we need to with out data loss. My paper help to overcome the data loss and find out what node has problem for uncovered and transmit to covered node of neighbors node using NRSA algorithm.

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