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Energy comparative analysis of diverse routing protocols in MANET for healthcare environment: Survey paper

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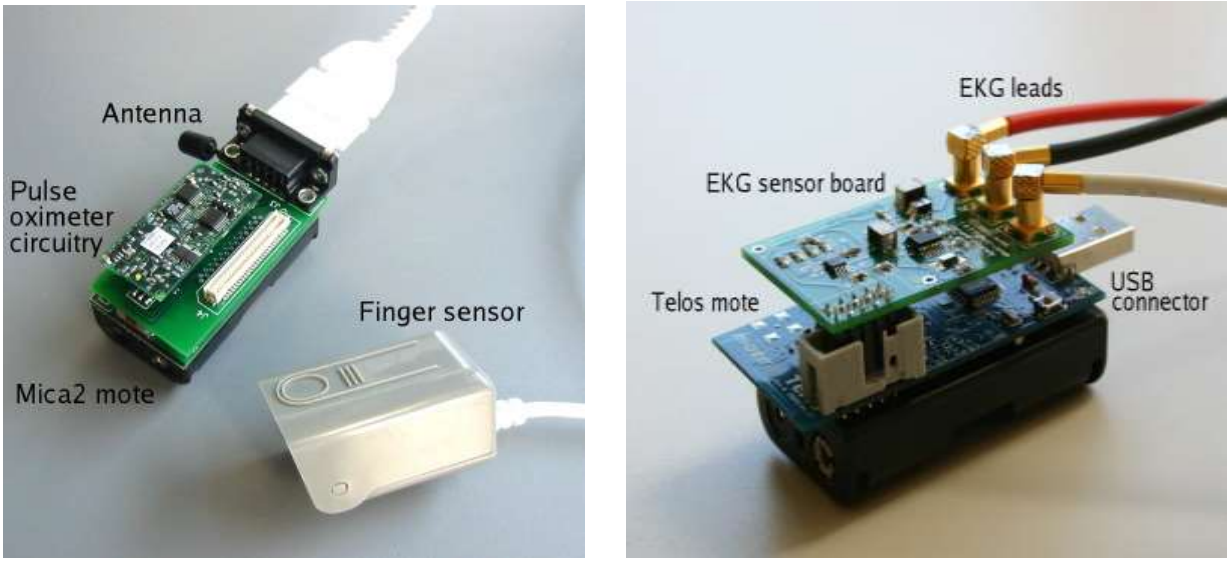
ABSTRACT

Nowadays, wireless networks play a vital role in diverse filed due to a huge area of application. An ad-hoc network is a mull over as a fragmentation type of wireless network. MANET is a category of the ad-hoc network where nodes are high octane. The MANET is made up of a number of mobile nodes that can connect to each other over multi-hop wireless links on an ad-hoc basis. Adhoc mobile networks have diverse routing protocols of a different class. After research, we came to a conclusion that every protocol having some advantageous and limitation and every protocol cannot be deployed in every circumstance for underwater WSN there is a different class of protocols. In this review paper a deep analysis carried out on proactive (table driven), reactive (on demand) and hybrid protocol. Further our main backbone is to know about those protocols which take minimum energy in the healthcare system. The reference article having three protocols of different category DSR, DSDV, and AODV. Today advance and unorthodox applications for healthcare environments based on a wireless network are being flourished in the private enterprise. The prominent wireless networks are growing an elementary part of every single field of life. Our research work will be carried out in NS2.

Keywords—*DSR, DSDV, Healthcare, MANET, Node, AODV*

1. INTRODUCTION

With the momentum of time breakthrough applications of healthcare, environments have been invented for ad-hoc networks. The potential to intensify healthcare telemetry with wearable dwarf wireless sensors would have an extraordinary jolt on diverse ways of medical practice. The efficiency of small transferrable wireless instruments plays a crucial role in the healthcare environment and to assist indispensable support to patients [1-2]. In these day's advanced wireless healthcare monitors/ instruments are easily available in the market at an economical price as compared to some time back, for example, blood pressure monitors, pulse Oximeters maternal uterine and fatal heart rate monitors, Wireless ECG System and EKGs (Electrocardiographs). During disaster recovery or a group of casualty, the doctor fixes small sensors on each patient and monitors the results using Laptop and PDAs. Figure 1 and Figure 2 represent wireless instruments which are used for healthcare purpose.



(a) **(b)**

Fig. 1: (a) Pulse Oxi-meter (b) EKG

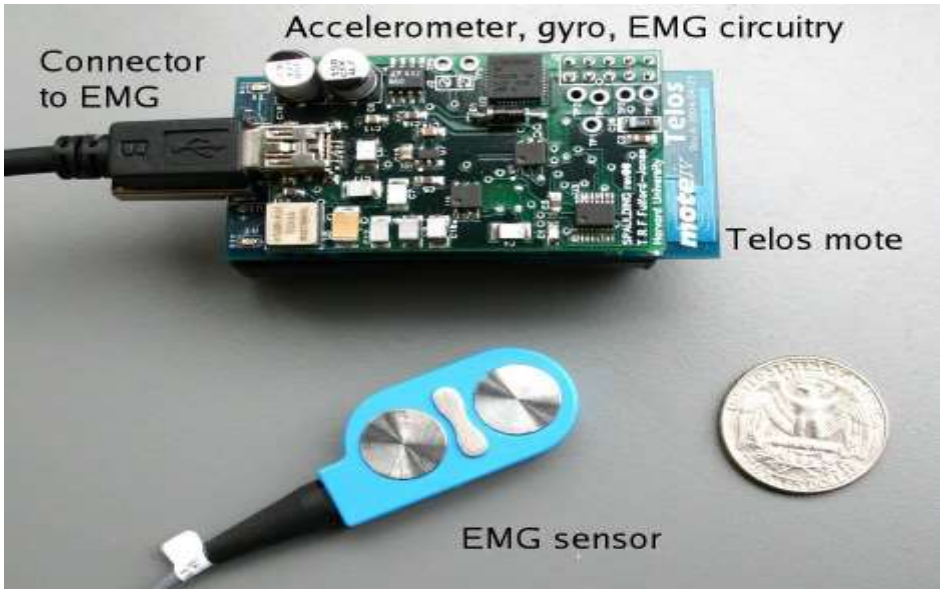


Fig. 2: Motion capture and EMG

2. RELATED WORK

F. Giroire et al: Traffic load of the routers only has a small influence on their energy consumption. Therefore power consumption in networks is strongly related to the number of active network elements, such as interfaces, line cards, and base chassis. The goal thus is to find a routing that minimizes the number of active network elements used when routing. In this paper, we consider a simple architecture where a connection between two routers is represented as a link joining two network interfaces. When a connection is not used, both network interfaces can be turned on. Therefore, in order to reduce power consumption, the goal is to find the routing that minimizes the number of used links while satisfying all the demands. We proposed a heuristic algorithm for this problem and we also proved some negative results about basic greedy and probabilistic algorithms [9]. N. A. Pantazis et al: Wireless Sensor Networks have their own unique nature of distributed resources and dynamic topology. This introduces very special requirements that should be met by the proposed routing protocols for the WSNs. A Wireless Sensor Network routing protocol is a standard which controls the number of nodes that come to an agreement about the way to route packets between all the computing devices in mobile wireless networks. Today, wireless networks are becoming popular and many routing protocols have been proposed in the literature. Considering these protocols we made a survey on the WSNs energy-efficient routing techniques which are used for Healthcare Communication Systems concerning especially the Flat Networks Protocols that have been developed in recent years. Then, as related work, we discuss each of the routing protocols belonging to this category and conclude with a comparison of them [11]. I. Noorzaie: With recent developments in the wireless networks field, new and innovative medical applications based on this technology are being developed in the research as well as commercial sectors. This trend has just started and we predict wireless networks are going to become an integral part of medical solutions due to its benefits in cutting down healthcare costs and increasing accessibility for patients as well as healthcare professionals. In this survey paper, we give some background on applications of wireless networks in the medical field and discuss the issues and challenges. We have also tried to identify some of the standards in use. Another contribution due to this paper is the identification of innovative medical applications of wireless networks developed or currently being developed in the research and business sectors. In the end, we also talk about the future trends in this field [14]. P. Ber Gamo, Alessandra: In this paper, distributed power control is proposed as a means to improve the energy efficiency of routing algorithms in ad hoc networks. Each node in the network estimates the power necessary to reach its own neighbors, and this power estimate is used both for tuning the transmit power (thereby reducing interference and energy consumption) and as the link cost for minimum energy routing. With reference to classic routing algorithms, such as Dijkstra and Link State, as well as more recently proposed ad hoc routing schemes, such as AODV, we demonstrate by extensive simulations that in many cases of interest our scheme provides substantial transmit energy savings while introducing limited degradation in terms of throughput and delay [12].

3. ROUTING PROTOCOL

Due to the dynamic nature of MANETs, designing communications and networking protocols for these networks is a challenging process. One of the most important aspects of the communication process is the design of the routing protocols which are used to establish and maintain multi-hop routes to allow the data communication between nodes. A considerable amount of research has been done in this area, and many multi-hop routing protocols have been developed. Most of these protocols such as the DSDV, DSR, AODV, and others establish and maintain routes on the best-effort basis [3]. While this might be sufficient for a certain class of MANET applications, it is not adequate for the support of more demanding applications such as multimedia audio and video. In the base paper, three protocols are used which are DSDV, DSR, and AODV. A brief summary of these protocols is below explained after studying various research paper.

3.1 Destination-Sequenced Distance Vector (DSDV)

One of the first routing protocols for MANETs is Destination Sequenced Distance Vector (DSDV) [6], which can be called an adaptation of the Bellman-Ford Distance Vector protocol for MANETs. Packets are transmitted between the nodes in the network by using the routing tables which are stored at each node of the network. Each node's routing table lists all available destinations, next hop node and the number of hops to reach there. Each routing table entry is tagged with a sequence number which is

generated by the destination node. In AODV, the sequence number serves the purpose of avoiding loops in the route and to indicate their freshness. To maintain the consistency of routing tables in a dynamically varying topology, each node periodically transmits updates in addition to transmitting updates when significantly new information is available. Thus DSDV is a proactive protocol. Route advertisements are sent by broadcast or multicast. In order to reduce the amount of information carried by these advertisements, two types of packets are defined [6]. One carries all the available routing information, and is called “full dump". The other type carries only information changed since the last full dump and is called the “incremental". Full dumps are transmitted infrequently when no movement of mobile hosts is occurring. When node movements become frequent and the size of the incremental approaches the size of a network protocol data unit (NPDU), then a full dump can be scheduled. To further reduce the traffic, the advertisement of the routes which may not have stabilized yet is delayed. When a mobile host receives new routing information, that information is compared to the information already available from previous routing information packets. Any route with a more recent sequence number is used. Routes with older sequence numbers are discarded. A route with a sequence number equal to an existing route is chosen if it has a better metric such as smaller number of hops. When a link to the next hop of a route is broken, any route through that next hop is immediately assigned an infinite metric and an updated sequence number. The modifications are immediately broadcast in a routing information packet.

3.2 Adhoc On-demand Distance Vector (AODV) Routing

Adhoc On-demand Distance Vector (AODV) is the currently most popular routing protocol for MANETs. In this protocol, a node discovers a route on demand, i.e., only when it is needed and caches it. Network-wide flooding is used to discover the routes. This protocol requires that nodes maintain local connectivity information by sending periodic local (1-hop) broadcast messages known as hello messages. Through these hello messages a node becomes aware of its neighbors or nodes in its radio range. When a source node wants to send a message to a destination node and a route to the destination is not available in the cache, it initiates a path discovery process by broadcasting a route request (RREQ) packet. When a node receives an RREQ packet it checks whether it has received the same packet before, if it has then it discards the packet. The node then determines whether it has a route to the destination node in its cache. If it cannot satisfy the route request of the source then it rebroadcasts the packet after setting up a reverse path to the source. To set up a reverse path, a node records the address of the neighbor from which it received the first copy of RREQ as the next hop to the source. Eventually, an RREQ arrives at a node (possibly the destination itself) that possesses a current route to the destination. Then node uncast a route reply (RREP) packet back to the source [7]. As the RREP travels back to the source, each node along the path sets up a forward pointer to the node from which the RREP was received as the next hop to the destination and updates its timeout information for the route entries to the source and destination.

3.3 Dynamic Source Routing (DSR)

Dynamic Source Routing (DSR) is another reactive routing protocol and is similar to AODV in operation. The main difference between AODV and DSR is that DSR performs source routing, while AODV uses next-hop information stored in the nodes of the route. Source routing is a routing technique in which the sender of a packet determines the complete sequence of nodes through which to forward the packet; the sender explicitly lists this route in the packet's header, identifying each forwarding hop by the address of the next node to which to transmit the packet on its way to the destination node. The route discovery process in DSR is similar to AODV. When a node wants to send a packet to another host it checks its route cache for a route to the destination. If the route is not available in the cache then the node broadcasts a route request packet containing the identity of the destination [10]. In addition to the address of the source and destination, each request packet contains a route record, which is accumulated a record of the sequence of hops taken by the route request packet as it propagates through the ad-hoc network during route discovery. When a packet reaches a node that does not contain the route to the destination, it appends its address to the route record in the request packet and rebroadcasts the request further [5]. When a packet reaches a host (including can also be the destination) that has a route to the destination, the host appends the route to the accumulated route record in the packet and sends a route reply. In order to return the route reply packet to the initiator of the route request packet, the node must have a route to the initiator. If it has a route entry for the initiator in its route cache then the route reply packet is unicast to the initiator. Otherwise, the node can reverse the route in the route record of the route request packet, and use this route to send the route reply packet. This, however, requires the wireless links to work equally well in both directions, i.e., the wireless links must be bidirectional. If this condition is not true, then the host can piggyback the route reply packet on a route request packet targeted at the initiator of the original route discovery.

4. MANET APPLICATION AND CHARACTERISTICS

ATTACKS This subsection presents the challenges, which are briefly shown in Table and it discusses the important characteristics that need to be considered when MANETs are designed and deployed.

Fig. 3: Characteristics and complexities of mobile ad hoc networks

4.1 Some of the characteristics of MANETs explained below:

4.1.1 Autonomous and Infrastructure-less: The network is considered as an autonomous system comprised of interlinked nodes without any infrastructure or centralized administration. Serving as an independent router, every node in the system generates and forwards messages to other nodes outside of their transmission range [8].

4.1.2 Mobility: Devices in MANETs generally contain no physical boundaries, and their locations remain changeable depending on occurring movements. The varying movements of participating nodes mean that the network topology is highly dynamic. Thus, intercommunication patterns between nodes are unpredictable. As an unwelcome consequence, frequent path breaks are experienced by on-going communication sessions. Broadcasting and routing protocols for MANETs should thereby ensure high mobility management efficiency.

4.1.3 Energy Consumption: MANET mobile devices usually outsource energy from batteries. Batteries, in turn, have relatively constrained power, and are also highly prone to non-rechargeable batteries. Moreover, activities like wireless signal transmission, reception, retransmission, and beaconing operations all reduce battery power. Finally, MANET nodes consume extra energy whenever packets are forwarded to their neighbors; as such, nodes jointly function as an end system and a router [4].

4.1.4 Heterogeneity: MANET applications are designed to cover large spaces. Therefore, the number of performing nodes in a system may range from a small group to tens of thousands. Node mobility also varies according to need and/or the environment, from static sensor nodes to mobility nodes. MANETs typically restrict the speeds considered (unlike Vehicular Ad-hoc Networks (VANETs). Moreover, as dissimilar nodes adapt to their respective functions, their sizes, memories, computational abilities and battery powers also differ. This heterogeneity in the network, node mobility and node features cause a variety of topology dynamics, which then influence the performance and design of MANET protocols.

4.1.5 Network Security: MANETs are not as heavily equipped as their wired counterparts when it comes to security. They are susceptible to information attacks and physical threats; especially the physically unprotected nodes used for shared broadcast wireless channels. Moreover, the distributed and deconstructed nature of MANETs keeps the system reliant on individual security solutions. These solutions are outsourced from each mobile node, as centralized security control is difficult to operate.

4.2 Applications of MANETS

During the last two decades, there has been a tremendous growth in the use of MANETs, not only due to the development in the technology but also due to the many advantages they have over infrastructure (access point) wireless networks and wired networks [4], [8]. Here is a list of major applications of MANETs which multi-hop communication and/or dynamic routing is implementing:

- Military communication, operations
- Search and rescue operations, as well as disaster recovery, e.g. early retrieval and transmission of patient data (record, status, diagnosis) from/to the hospital
- Automated battlefields
- Home applications: smart sensor nodes and actuators can be buried in appliances to allow the end user to manage home devices locally and remotely
- Environmental applications include tracking the movements of animals (e.g. birds), Chemical/biological detection, precision agriculture, etc.
- Tracking data highly correlated in time and space, e.g. remote sensors for weather earth activities
- Replacement of a fixed infrastructure in case of earthquakes, hurricanes, fire, etc.

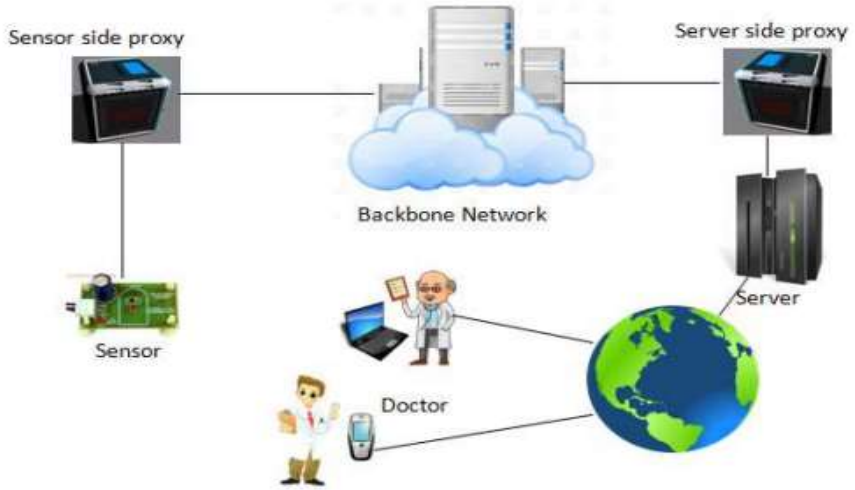


Fig. 4: Ad Hoc Sensor Network based Remote Patient Monitoring System

5. CONCLUSION

With the momentum of time new technology coming rapidly in the market in various filed. In recent time technology in the medical filed also booming with great momentum. In this review paper, we studied various routing protocol like proactive, reactive and hybrid protocol deeply. MANET has so many application in diverse filed and also in healthcare. As there are many challenges to implement MANET effectively. Our dissertation work will be base upon to diminish energy consumption in a

wireless network (WN). The reference article having three protocols of different category DSR, DSDV, and AODV. First of all, we studied these protocols in detailed using various research article of high quality. According to reference paper, DSR protocol has minimum energy consumption and also other networking parameters as compared to other protocol. In recent time energy efficient routing protocol are tremendously growing in a healthcare environment. Each node having scare quantity of energy, therefore, this amount must be utilized efficiently to get apex result. Besides this, we also studied MANET various application in diverse filed and challenges in every aspect.

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